



2 Establishing and sustaining an antimicrobial stewardship program

Antimicrobial Stewardship in Australian Health Care

2018

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Acronyms and abbreviations

Abbreviation	Definition
AMR	antimicrobial resistance
AMS	antimicrobial stewardship
AURA	Antimicrobial Use and Resistance in Australia
FTE	full-time equivalent
ID	infectious diseases
IT	information technology
LHD	Local Health District
LHN	Local Hospital Network
NAPS	National Antimicrobial Prescribing Survey
NAUSP	National Antimicrobial Utilisation Surveillance Program
NSQHS Standards	National Safety and Quality Health Service Standards
QI	quality improvement

Key points

- Overall accountability for antimicrobial management lies at the highest level of each health service organisation, and with the clinicians responsible for delivering services efficiently and effectively.
- The National Safety and Quality Health Service Clinical Governance Standard identifies management requirements for ensuring that the antimicrobial stewardship (AMS) program is appropriately supported and implemented, and that outcomes are evaluated.
- The preferred model for AMS in most settings involves a multidisciplinary AMS team that has the responsibility and resources for implementing a program to improve antimicrobial prescribing.
- Effective implementation of an AMS program within a health service organisation requires a good safety culture and uses an appropriate quality improvement process.
- Specific implementation strategies and interventions need to be relevant to the local context and individual circumstances.
- A successful AMS program will incorporate ongoing data collection, analysis and actionable feedback to clinicians, as these elements have been shown to improve prescriber behaviour.
- To be sustainable over time, an AMS program should use a quality improvement framework that incorporates audit and actionable feedback; teams are more likely to be effective if they have access to education and training in AMS, and effective quality improvement processes.

2.1 Introduction

Antimicrobial stewardship (AMS) is a systematic approach by a health service organisation to:

- Promote and optimise appropriate antimicrobial use, and improve patient outcomes
- Reduce and contain antimicrobial resistance (AMR)
- Reduce healthcare costs.

AMS programs contain a range of strategies to reduce unnecessary antimicrobial use and promote the use of appropriate antimicrobials in line with prescribing guidelines.

Changing antimicrobial prescribing behaviour is complex and requires sustained support. No single approach will deliver optimal antimicrobial prescribing in every context. Strategies need to be customised for the individual health service, and consider the local environment and available resources. Using local information and data to better understand the local safety culture and readiness to implement or improve a program will maximise the chance of success.

This chapter suggests approaches to establishing, improving and sustaining an AMS program. It discusses the establishment of appropriate governance for an AMS program and the steps involved in the development of an AMS program plan.

This chapter will be of use to anyone involved in establishing an AMS program: clinicians from all disciplines, health managers and health service executives. Although much of the published experience to date is hospital based, the same principles can be applied to primary health and other settings.

Issues that are especially relevant for certain settings – rural and remote hospitals, private hospitals and aged care – are tagged as R, P and AC, respectively, throughout the text.



2.2 Essential elements of antimicrobial stewardship programs

Successful AMS programs comprise a range of strategies, structures and governance, appropriate to local circumstances, to support their

implementation. The requirements and strategies considered essential to meet the goals and objectives for AMS in Australian human healthcare settings are summarised in Box 2.1. They are applicable to all healthcare settings: metropolitan, rural and remote hospitals; private hospitals; aged care; community health services; general practice; and dental practice.

Box 2.1: Essential elements and strategies for antimicrobial stewardship programs

Structure and governance

Overall accountability for antimicrobial stewardship (AMS) is defined by an organisation's corporate and clinical governance. Managers and senior clinicians are responsible for the AMS program, including:

- Ensuring that AMS resides within the organisation's quality improvement and patient safety governance structure
- Establishing a multidisciplinary AMS team that includes, at least, a lead doctor and pharmacist
- Providing the necessary human, financial and information technology* resources for AMS activities
- Ensuring ongoing education and training for prescribers, pharmacists, nurses, midwives and consumers about AMS, antimicrobial resistance and optimal antimicrobial use.

Essential strategies

The essential strategies that sit within the AMS governance structure are:

- Implementing clinical guidelines† consistent with *Therapeutic Guidelines: Antibiotic* that take into account local microbiology and antimicrobial susceptibility patterns
- Implementing formulary‡ restriction and approval systems that include restricting broad-spectrum and later-generation antimicrobials to patients in whom their use is clinically justified

- Reviewing antimicrobial prescribing, with intervention and direct feedback to the prescriber
- Implementing point-of-care interventions (including directed therapy, intravenous-to-oral switching and dose optimisation)
- Ensuring that the clinical microbiology service
 - provides guidance and support for optimal specimen collection
 - targets reporting of clinically meaningful pathogens and their susceptibilities
 - uses selective reporting of susceptibility testing results
 - generates location-specific antimicrobial susceptibility reports (antibiograms) annually
- Monitoring antimicrobial use and outcomes, and reporting to clinicians and management.

* Information technology examples include electronic prescribing with clinical decision support, online approval systems for restricted agents, post-prescription alert systems and antimicrobial use surveillance systems.

† Guidelines include clinical pathways and care bundles.

‡ Refers to institutional formularies; in the community, the Pharmaceutical Benefits Scheme and the Repatriation Pharmaceutical Benefits Scheme act as the formulary.

2.3 Structure and governance

AMS programs should work within the organisation's safety and quality improvement program. Governance requires both executive and clinical leadership.

2.3.1 Safety and quality improvement

Appropriate antimicrobial use is an essential component of patient safety, and requires close oversight and guidance.^{1,2} The inclusion of the Preventing and Controlling Healthcare-Associated Infection Standard in the National Safety and Quality Health Service (NSQHS) Standards signifies the importance of AMS in patient safety. This standard requires that 'the health service organisation implements systems for the safe and appropriate prescribing and use of antimicrobials as part of an antimicrobial stewardship program' (see Section 1.3 in Chapter 1: 'Evidence for antimicrobial stewardship').

An organisation's AMS program is most effective and best supported when it resides within the patient safety and quality improvement governance structure, and is incorporated into the organisation's safety and quality strategic plan.^{1,3-5} By embedding the program within a safety and quality framework, AMS is framed as an issue of safe and high-quality patient care. Safety is addressed through promoting care that avoids preventable harm, and quality of care is pursued through continuous measurement, evaluation and striving to improve. This moves antimicrobial prescribing and use from an issue that might be considered to be pertinent to only microbiologists and infectious diseases physicians to one that is owned by all involved in the prescribing pathway. Promoting a safe culture can further influence the effectiveness of patient safety practices, such as AMS.⁶ Executive and clinical leaders can promote a safety culture by demonstrating their own commitment to safety and providing resources to help teams to improve.⁶⁻⁸ Regarding AMS, they can help the workforce focus on improved patient safety and outcomes, and best clinical management as the goal of AMS (see also Factors influencing antimicrobial prescribing behaviour).

The Comprehensive Unit-Based Safety Program (CUSP) is an example of a patient safety model that combines best practices and the science of safety, and promotes a safety culture (see Safety culture)

as the basis for improving practice.^{7,9} Steps in implementing the CUSP model have been included in a CUSP toolkit, developed by the Agency for Healthcare Research and Quality. This framework has been successfully applied to reducing central line-associated bloodstream infections^{7,9} and catheter-associated urinary tract infections.^{6,10} It could be applied to AMS activities targeted at reducing suboptimal antimicrobial use.

2.3.2 Governance

The NSQHS Clinical Governance Standard describes governance as the set of relationships and responsibilities established by a health service organisation between its governing body, executive, clinicians, patients and consumers to deliver safe and high-quality health care. It aims to ensure that the community and health service organisations can be confident that systems are in place to deliver safe and high-quality health care, and continuously improve services.

Clinical governance is an integrated component of the corporate governance of health service organisations, ensuring that everyone – from frontline clinicians to managers and members of governing bodies, such as boards – is accountable to patients and the community for assuring the delivery of health services that are safe, effective, high quality and continuously improving.

The Clinical Governance Standard requires that accountability for the AMS program must lie with the highest level of corporate and clinical governance and management within the organisation.¹¹

Hospital and community health service AMS programs should have clearly defined operational and reporting lines to the health service executive, the director of clinical governance, the patient safety and quality improvement committee, the infection prevention and control committee, and the drug and therapeutics committee.^{3,4,12} Figure 2.1 is an example of a governance structure for a hospital AMS program. It is important to consider the specific governance arrangements for a hospital or health service and their effect on local AMS programs, as different governance arrangements may be required depending on local structures and resources.

The structure described in Figure 2.1 could be extended to networked AMS programs organised at the Local Hospital Network (LHN) or Local Health District (LHD) level, or to a private hospital group.^{13,14} LHNs and LHDs need to formalise the



workforce members responsible for AMS at the facility and network-wide levels, clarifying where resources are to be shared. These arrangements may also extend to inter- and intra-LHN/LHD networks, providing oversight to rural and remote services. Similarly, arrangements may be extended to include Primary Health Network linkages with LHNs and LHDs.

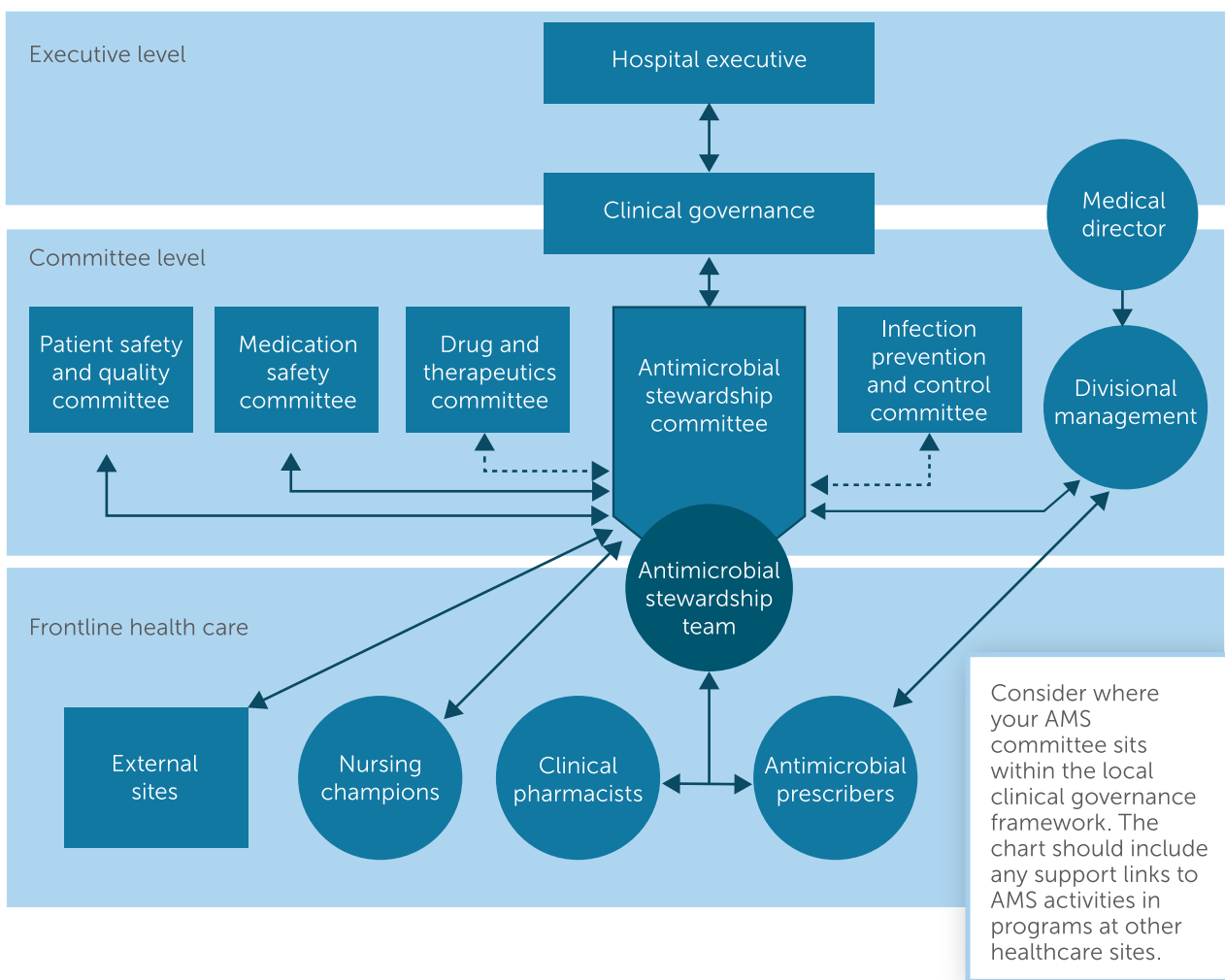
At the state and territory level, AMS is considered to be best supported within the safety and quality improvement governance arrangements for each

state or territory, and should be included within that state's or territory's strategic quality improvement plan. Most state and territory health departments have an established governance structure for AMS. This may include an AMS advisory committee or AMS network, with representation from LHNs and LHDs.

Table 2.1 provides options for governance arrangements for different types of health service organisations (see also [Resources](#)).



Figure 2.1: Example of a governance structure for a hospital antimicrobial stewardship program



AMS = antimicrobial stewardship
Source: Adapted from Clinical Excellence Commission, 2017¹⁵

Table 2.1: Options for governance arrangements in different health service organisations

Possible governance arrangements	Program element	
	Executive leadership	Governance arrangements, structure and lines of communication
Health service organisation*	Network, district, management group or executive sponsorship and support for AMS program	<ul style="list-style-type: none"> • Director of AMS program • Multidisciplinary AMS committee • AMS is part of the safety and quality plan • Links to committees responsible for drugs and therapeutics, and infection prevention and control • Reports to chief executive and governance units
Principal Referral Hospital, Acute Group A Hospital, public or private†	Local executive sponsorship and support for AMS program	<ul style="list-style-type: none"> • Director of AMS program (infectious diseases physician, clinical microbiologist or pharmacist) • Multidisciplinary AMS committee • AMS is part of the safety and quality plan • Links to committees responsible for drugs and therapeutics, and infection prevention and control • Reports to the chief executive and governance units • Multidisciplinary AMS team
Acute Group B Hospital, Acute Group C Hospital, public or private‡	Local executive sponsorship and support for AMS program	<ul style="list-style-type: none"> • AMS program lead is a pharmacist (where possible, may be local or network/district pharmacist), with input from local or network/district infectious diseases physician or clinical microbiologist • If no pharmacist is available, coordinated by a medical clinician or senior nurse with dedicated time for AMS • AMS is part of the safety and quality plan • Links to committees responsible for drugs and therapeutics, and infection prevention and control • Reports to the chief executive and governance units • Multidisciplinary AMS team
Acute Group D Hospital/ multi-purpose service, public or private#	Local executive sponsorship and support for AMS program	<ul style="list-style-type: none"> • AMS program lead is the facility manager, who coordinates with input from local or network/district pharmacist, infectious diseases physician or clinical microbiologist • AMS is part of the safety and quality plan • Links to committees responsible for drugs and therapeutics, and infection prevention and control • Reports to an organisational governance group • Multidisciplinary AMS team
Same Day Hospital, public or private	Owner and management support for AMS program	<ul style="list-style-type: none"> • Coordinated by the facility manager, with support from specialist visiting clinicians or pharmacist, where available • AMS is part of the safety and quality plan • Links to committees responsible for drugs and therapeutics, and infection prevention and control • Reports to an organisational governance group

AMS = antimicrobial stewardship

* For example, Local Hospital Network or Local Health District, private hospital group

† For example, large urban hospital or tertiary facility

‡ For example, rural/district hospital

For example, small hospital/multi-purpose service, hospital with fewer than 50 beds

2.3.3 Executive leadership

The success of the AMS program depends on the support and leadership of the executive, senior management and the senior clinical workforce.^{1,3,11,16}

An organisation's executive or governing body can show its support and leadership for the AMS program by:

- Prioritising and promoting AMS as a strategic safety and quality goal of the organisation
- Ensuring that the clinical governance framework, and quality improvement systems and processes relating to AMS within the organisation are robust, and that AMS is incorporated into strategic planning
- Identifying an executive sponsor to participate in the AMS committee and program
- Supporting AMS and communicating to the workforce and other leaders why appropriate antimicrobial use is a priority
- Providing appropriate resources for the AMS team and committee, and supporting them to operate within the clinical governance framework
- Scheduling time to review progress and provide advice
- Supporting the AMS team and committee in promoting accountable clinical practice across the organisation
- Ensuring that clinicians (prescribers, pharmacists, nurses and midwives) receive appropriate orientation on the AMS program at the start of their employment in the organisation, and ongoing education and training regarding AMS
- Ensuring that consumers receive appropriate information regarding AMS.

Table 2.2 provides examples of how leaders can show commitment to AMS in different healthcare settings. The [SA Health Antimicrobial Stewardship Policy Directive](#) provides an example of the roles and responsibilities that are expected of the chief executive and LHN chief executive officers in supporting the implementation of AMS in public hospitals in South Australia.¹³

2.3.4 Clinical leadership

Engaging senior clinicians to champion and support the AMS program is a key factor for successful AMS.^{20,21} The aim of developing clinical leadership in AMS is to promote a culture of optimal antimicrobial use within the organisation. Both executive and clinical leadership are needed to

champion the AMS effort. Specific change ideas include^{22,23}:

- Identifying clinical champions to be thought leaders about AMS
- Enabling clinical champions to work with the executive to ensure that the executive understands the rationale and goals for AMS programs, in order to provide sufficient executive support
- Engaging a clinical champion and central team to improve the focus of AMS in the current process of care
- Using clinical champions to bring disciplines together to improve communication and collaboration about improving antimicrobial use, including (as appropriate to the setting)
 - infectious diseases physicians and clinical microbiologists
 - other specialist clinicians (for example, intensive care, emergency department, respiratory)
 - surgeons
 - junior prescribers
 - pharmacists
 - infection control practitioners
 - nurses and midwives.

Networked AMS programs often require designated leadership and resources to support rural and remote facilities. If available, an infectious diseases physician or a clinical microbiologist is well placed to lead the AMS program. If these experts are not available, a general practitioner, general physician or surgeon should be supported to lead and manage the program. A pharmacist is a valuable resource to an AMS program and can coordinate hospital AMS programs in settings that have limited access to infectious diseases physicians.^{24,25} In hospitals without an on-site pharmacist, this role may be performed by a regional or network pharmacist. Mentorship from a specialist AMS pharmacist (for example, from an established program at a different hospital or the LHN/LHD AMS service) and access to further AMS training are likely to assist a general pharmacist taking on this role. Alternatively, an infection control practitioner, nurse or midwife, with the necessary support and training, could be appointed to coordinate AMS activities (see Chapter 12: '[Role of nurses, midwives and infection control practitioners in antimicrobial stewardship](#)').

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Table 2.2: Examples of leadership commitment to antimicrobial stewardship in different health service organisations

Hospital and community health services	Aged care homes	Primary care practice (general, dental)
<p>Leadership support is critical to the success of AMS programs and can include:</p> <ul style="list-style-type: none"> • Issuing formal statements that the facility supports efforts to improve and monitor antimicrobial use • Including AMS-related duties in job descriptions and annual performance reviews • Ensuring that workforce members from relevant departments are given enough time to contribute to AMS activities • Supporting training and education • Ensuring participation from the many groups that can support AMS activities. <p>Financial support increases the capacity and impact of a stewardship program. Effective programs will often show savings in both antimicrobial expenditures and indirect costs over time.</p>	<p>Facility leadership, including owners and administrators, as well as regional and national leaders if the facility is part of a larger corporation, can show their support for AMS by:</p> <ul style="list-style-type: none"> • Writing statements in support of improving antimicrobial use, to be shared with the workforce, residents and families • Including AMS-related duties in position descriptions for the medical director, clinical nurse leads and consultant pharmacists • Communicating to the nursing workforce and prescribing clinicians the facility's expectations about antimicrobial use, and the monitoring and enforcement of AMS policies • Creating a positive culture, through messaging, education and celebrating improvement, that promotes AMS. 	<p>Community practice leaders can promote appropriate antimicrobial prescribing by:</p> <ul style="list-style-type: none"> • Identifying a clear lead to direct AMS activities within a facility • Including AMS-related duties in position descriptions or job evaluation criteria for medical directors, nursing or midwifery leadership positions and practice management personnel • Communicating with all workforce members (including administrative, nursing and midwifery, allied health and medical) to set patient expectations by using consistent messages when communicating with patients about the indications for antimicrobials.

AMS = antimicrobial stewardship

Source: Adapted from Centers for Disease Control and Prevention¹⁷⁻¹⁹

2.4 Antimicrobial stewardship committee and team

Although overall accountability for AMS lies with the highest level of governance in a health service organisation, the responsibility for implementing the program, and effectively and efficiently managing available resources lies with a multidisciplinary AMS committee and the local AMS team.^{1,3,26} The terms 'AMS committee' and 'AMS team' are often used interchangeably; however, they describe different entities. The AMS committee provides oversight and advice, whereas the AMS team is concerned with implementation.

The NSW Clinical Excellence Commission's *Antimicrobial Stewardship Teams & Committees fact sheet* informs the establishment of effective AMS committees and teams, including their composition and roles.

2.4.1 Antimicrobial stewardship committee

In the Australian setting, the term 'AMS committee' describes a multidisciplinary committee whose primary role is to direct and support the AMS program within the health service organisation and to oversee the effective implementation and ongoing function of the program. This may be at an individual hospital or practice level, or at an LHN, an LHD or a Primary Health Network level.

The AMS committee should sit within the existing clinical governance structure, and have links with the quality improvement (QI) system. Cross-membership with the drug and therapeutics, medication safety, and infection prevention and control committees is recommended.

Committee membership

Multidisciplinary committees are best suited to guide and advise on the changes required for an effective AMS program.²⁷ Therefore, although committee membership should include those with professional expertise in the safe use of antimicrobials, different professions and individuals – with diverse perspectives, skills and responsibilities for AMS – should be included. Membership of the

committee will vary, depending on the resources available and the practice setting (see Table 2.3). Involving prescribers, pharmacists, nurses, midwives, administrators, infection control practitioners, information systems experts, microbiologists and infectious diseases physicians in a committee that effectively incorporates their views and expertise will support meaningful program interventions.²²

Organisations should consider including one or more consumers on the AMS committee to help to promote activities that better consider consumer needs (see also Chapter 7: [‘Involving consumers in antimicrobial stewardship’](#)).

Table 2.3: Suggested antimicrobial stewardship committee and team arrangements for health service organisations

Suggested committee and team arrangements	Program elements	
	AMS committee	AMS team
Health service organisation*	<p>Multidisciplinary AMS committee comprising:</p> <ul style="list-style-type: none"> • The director of the AMS program • A member of the executive • A pharmacist(s) • An infectious diseases physician or a clinical microbiologist • Medical specialists • Surgeons • Infection control practitioners • Nurses and midwives • Representatives from network or district facilities • A consumer representative 	Not applicable
Principal Referral Hospital, Acute Group A Hospital, public or private†	<p>Multidisciplinary AMS committee comprising:</p> <ul style="list-style-type: none"> • The director of the AMS program • A member of the executive • An AMS pharmacist • An infectious diseases physician or a clinical microbiologist • Infection control practitioners • Nurses and midwives • Prescribing clinicians from key departments, including intensive care • Possibly pharmacy manager(s), information systems expert, consumer, other relevant representatives from AMS team 	<p>Multidisciplinary AMS team comprising:</p> <ul style="list-style-type: none"> • An infectious diseases physician or a clinical microbiologist • A pharmacist with allocated time for AMS <p>May also include:</p> <ul style="list-style-type: none"> • Infection control practitioners • Prescribing clinicians from key departments (e.g. intensive care) • Nurses and midwives

Suggested committee and team arrangements	Program elements	
	AMS committee	AMS team
Acute Group B Hospital, Acute Group C Hospital, public or private [§]	<p>Functions may be performed by an:</p> <ul style="list-style-type: none"> AMS committee at level of Local Hospital Network / Local Health District or private hospital group <p>OR</p> <ul style="list-style-type: none"> AMS team <p>OR</p> <ul style="list-style-type: none"> Existing committee, such as safety and quality, or drug and therapeutics 	<p>Multidisciplinary AMS team comprising:</p> <ul style="list-style-type: none"> An on-site or a Local Hospital Network / Local Health District pharmacist with allocated time for AMS A prescribing clinician, nurse or midwife, as appropriate Input from an infectious diseases physician or a clinical microbiologist
Acute Group D Hospital/multi-purpose service, public or private [#]	<p>Functions may be performed by an:</p> <ul style="list-style-type: none"> AMS committee at level of Local Hospital Network / Local Health District or private hospital group <p>OR</p> <ul style="list-style-type: none"> AMS team <p>OR</p> <ul style="list-style-type: none"> Existing committee, such as safety and quality, or drug and therapeutics 	<p>Multidisciplinary AMS team (may be on site or Local Hospital Network / Local Health District) comprising:</p> <ul style="list-style-type: none"> A pharmacist with allocated time for AMS A prescribing clinician, nurse or midwife Input from an infectious diseases physician or a clinical microbiologist
Same Day Hospital, public or private	<p>Functions performed by:</p> <ul style="list-style-type: none"> An AMS team <p>OR</p> <ul style="list-style-type: none"> A facility management committee 	<p>Facility manager, nurse, midwife, and visiting medical officer (surgeon or anaesthetic representative) or pharmacist (where available)</p>

AMS = antimicrobial stewardship

* For example, Local Hospital Network or Local Health District, private hospital group

† For example, large urban hospital or tertiary facility

§ For example, rural/district hospital

For example, small hospital/multi-purpose service, hospital with less than 50 beds

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Larger health service organisations may have enough resources for a dedicated AMS committee, but this may not be feasible for smaller, and rural and remote organisations. In that case, AMS committee functions could be incorporated into an already functioning committee, such as the drug and therapeutics, infection prevention and control, medication safety, safety and quality, or practice management committee. For smaller health service organisations, membership of the committee will depend on the available workforce and may involve members who have regional roles (for example, an LHN AMS pharmacist) or members from a

larger organisation in the LHN/LHD. Off-site AMS specialists may be asked to provide expert advice to meetings by teleconference. As for all organisations, the more members and variety of specialties involved – including infectious diseases physicians, pharmacists, and nurses and midwives – the more robust and sustainable the program will be.

For LHNs or LHDs, the main membership of the networked AMS committee should include representation from executive, medical, surgical, pharmacy, and nursing and midwifery stakeholders, and from different hospitals and multi-purpose services in the network.^{13,14}

Committee role

In general, the AMS committee is responsible for:

- Developing, designing and updating the organisation's AMS program
- Overseeing the ongoing implementation and development of the AMS program
- Reviewing local datasets regularly to identify trends, improvements and opportunities for change
- Evaluating and reporting on the progress and effectiveness of the AMS program.

Example terms of reference for AMS committees are available within the NSW Clinical Excellence Commission's [AMS Implementation Toolkit](#).

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LHNs or LHDs may establish an AMS committee responsible for the development and ongoing evaluation of a regional AMS program. Responsibilities of an LHN AMS committee may include¹³:

- Providing governance for the use of antimicrobials, as per the committee terms of reference
- Providing leadership for the LHN to meet the requirements of the [NSQHS Preventing and Controlling Healthcare-Associated Infection Standard](#)
- Working collaboratively with other LHN committees – including drug and therapeutics, and infection prevention and control – on formulary management and AMS issues
- Reviewing, approving and promoting LHN guidelines on antimicrobial use or endorsing statewide guidelines for use in LHN facilities
- Coordinating actions in response to reports on antimicrobial use and AMR
- Providing leadership for the education of the LHN clinical workforce and consumers on AMS
- Providing representation on the statewide AMS advisory group and other relevant committees.

2.4.2 Antimicrobial stewardship team

In the Australian setting, the term 'AMS team' describes a group of clinicians who are the 'effector arm' of the AMS program and the 'face of AMS' within the organisation. The composition of this team will depend on local needs.

Team membership

The AMS program model based on a multidisciplinary AMS team approach with a clinical microbiologist or infectious diseases physician and a clinical pharmacist (with infectious diseases training) as main team members is optimal.^{1,3,27-29} This approach can be adapted to different healthcare settings, and can be effective in the absence of clinicians with specialist infectious diseases training. See Table 2.3 for the suggested composition of AMS teams in different healthcare facilities.

Where on-site infectious diseases physicians or clinical microbiologists are not available, the AMS team should be led by an interested clinician with a clinical pharmacist, if available. In these circumstances, health service organisations should establish formal mechanisms to access specialist advice to support the local AMS team. This may be achieved through clinical networks within or across LHNs or LHDs, or through arrangements with the private sector. These arrangements should be formalised to ensure continuity of advice and service delivery. Small hospitals and other healthcare settings without an on-site pharmacist needing to seek advice from a clinical pharmacist may be able to do so from another hospital in their LHN/LHD or a community pharmacy service. Innovative programs have been developed in these settings using formalised networks and telehealth facilities.

The local AMS team may need to recruit support from other workforce members where appropriate (for example, data collectors for audits, or reviewers for guideline development or revision). This can be facilitated by the AMS committee or health service executive and should be considered when planning the program. Teams should also consider involving colleagues from different clinical disciplines when developing AMS interventions. This will help to engage a broader range of prescribers and other clinicians in AMS activities.

It is important that there is sufficient time for the AMS team members to undertake these tasks.

Team roles

To carry out their roles effectively, team members need to be clear about their roles, responsibilities and time commitment. Depending on the setting, AMS team roles and functions may include:

- Providing antimicrobial support to a specific clinical unit or service when guidelines are developed or reviewed

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- Implementing guidelines, including auditing prescribers' compliance and providing feedback to them
- Developing, reviewing and maintaining formulary restriction and approval systems (including electronic systems)
- Reviewing patients who have been prescribed restricted antimicrobials
- Monitoring the performance of antimicrobial prescribing by collecting and reporting unit-, ward- or practice-specific data, including appropriateness of antimicrobial use
- Liaising with the clinical microbiology service regarding AMS
- Conducting workforce education and training
- Advising on the design and implementation of information technology (IT) systems to support AMS (for example, electronic clinical decision support systems).

Professional development

AMS professionals engaged in building, leading or evaluating AMS programs require specific knowledge and skills. These include an understanding of the rationale for AMS, the types of stewardship strategies that an AMS program may consider, and the approaches for measuring the processes and outcomes of an AMS program. Guidance on these skills and knowledge has been published and may assist team members.³⁰ (Links to guidance on skills and knowledge required for AMS professionals are provided in [Resources](#); see also Chapter 5: '[Antimicrobial stewardship education for clinicians](#)').

AMS committee and team members are encouraged to learn about, and incorporate findings from, general QI activities in health care, and to seek further information and training in QI and change management processes, as required. It is important to consider involving others who can contribute this expertise, such as workforce members from the organisation's QI and patient safety team, or from state, territory or LHN/LHD safety and quality units.

2.5 Antimicrobial stewardship program plan

When the governance structure (with executive commitment), the AMS committee and the multidisciplinary AMS team have been established, the next step is to plan the AMS program. The program

will differ according to the healthcare setting and available resources. Clinician involvement is critical.³¹ A QI approach to planning and implementing the program is recommended. QI incorporates behaviour change strategies of sustainable self-measurement by clinicians or clinical teams. It involves ongoing data collection and analysis, together with the provision of actionable feedback, which has been shown to improve prescriber behaviour.³²⁻³⁴ Evaluating the impact of the intervention helps teams to decide whether implementation strategies are effective or if different approaches are needed, and enables unintended consequences to be identified (see Chapter 6: '[Measuring performance and evaluating antimicrobial stewardship programs](#)'). This approach can be applied to any healthcare setting.

Steps in designing, implementing or improving an AMS program include:

- Assessing readiness to implement an AMS program
- Reviewing existing policies and guidelines
- Reviewing local data on antimicrobial use and AMR
- Determining priority areas for AMS activities
- Identifying effective interventions
- Defining measurable goals and outcomes
- Documenting and implementing the AMS plan
- Educating the workforce
- Developing and implementing a communication plan.

2.5.1 Assessing readiness to implement an antimicrobial stewardship program or intervention

An organisation's readiness to implement an AMS program or specific AMS interventions should consider various factors needed for a successful program, including:

- Structures and processes required for the AMS program
- Resources to support the program
- An understanding of the context in which the AMS program is being implemented, including the organisational culture, safety culture and local influences on prescribing behaviour.

Structures and processes required for an antimicrobial stewardship program

An assessment of the key structures and processes required to establish and maintain an AMS program

should be completed by the AMS committee or team:

- Before implementing a program, to provide baseline information for a gap analysis
- At regular intervals after implementation, to help AMS teams to measure their progress and identify areas for improvement.

The self-assessment will help to decide the local factors influencing antimicrobial prescribing and use; the level of executive support or commitment to the program; and available human, financial and IT resources. External advice is often helpful in undertaking a comprehensive self-assessment process.

A number of assessment tools are available for hospitals and community services to decide what structural requirements and processes are in place to support AMS in their organisation (see Box 2.2 for examples and Chapter 6: [‘Measuring performance and evaluating antimicrobial stewardship programs’](#)).

Resources to support the antimicrobial stewardship program

It is important to assess the resources that are required and currently available or accessible to implement and promote AMS within the organisation. These include the capacity of the workforce to undertake the AMS program, such as access to clinical microbiology, infectious diseases and pharmacy expertise; available policies and guidelines; current audits and data collection processes (that may help support AMS); IT (see Chapter 4: [‘Information technology to support antimicrobial stewardship’](#)); and education systems (see Chapter 5: [‘Antimicrobial stewardship education for clinicians’](#)). This information can be collected as part of the assessment using the tools listed in Box 2.2.

Resourcing needed for successful AMS programs may include^{9,25}:

- Management and workforce
 - dedicated clinician and pharmacist time for participation in AMS activities
 - access to clinical microbiology, infectious diseases and pharmacy expertise
 - resources to provide appropriate orientation to new clinical workforce and ongoing education to the existing workforce regarding the AMS program and AMS strategies
 - a clinical lead for AMS
 - clinical champions
 - an appropriately qualified and trained workforce

Box 2.2: Antimicrobial stewardship self-assessment tools and links

Hospitals

- NSW Clinical Excellence Commission: [Antimicrobial Stewardship Progress and Planning Tool](#)³⁵
- South Australia (SA) Health Antimicrobial Stewardship Program: [Self-evaluation Toolkit](#)³⁶
- Centers for Disease Control and Prevention: [Checklist for Core Elements of Hospital Antibiotic Stewardship Programs](#)¹⁷
- Transatlantic Taskforce on Antimicrobial Resistance: [Core and supplementary structure indicators for hospital AMS programs](#)³⁷

Aged care homes

- Centers for Disease Control and Prevention: [Core Elements of Antibiotic Stewardship for Nursing Homes Checklist](#)¹⁹

Primary care and general practice

- Centers for Disease Control and Prevention: [Core Elements of Outpatient Antibiotic Stewardship Checklist](#)¹⁸
- Royal College of General Practitioners: [TARGET Antibiotic Toolkit Self-Assessment Checklist](#)³⁸

- IT
 - clinical decision support
 - clinical surveillance systems
- Data analysis and reporting
 - local data collection
 - systems to provide timely data for decision-making.

Few countries have established the human resource requirements for AMS teams but, where they have been established, they are only for hospitals. Several countries have estimated around four full-time equivalent (FTE) workforce members per 1,000 beds for a hospital AMS program. The team



should comprise physicians (ideally with infectious diseases training), pharmacists and microbiologists. The European Centre for Disease Prevention and Control recommends two to six FTE workforce members per 1,000 beds.³⁹ However, comparability of international estimates is limited because of the different methods used to estimate bed capacity, varying primary activities for AMS teams and the way services are delivered in the different healthcare systems.⁴⁰

Resources should be readily available to the workforce to support appropriate antimicrobial prescribing. Examples include this publication, state and territory guidelines, the latest version of *Therapeutic Guidelines: Antibiotic*⁴¹, relevant websites and information from other groups, information about access to therapeutic advisory groups, and LHN or LHD resources (see [Resources](#)). In a community or primary care setting, the material available from [NPS MedicineWise](#) will be especially valuable.

AMS program resources may be shared across other safety and quality programs. If more resources are required to establish or improve an AMS program, it may be useful to develop a business case for consideration by the executive. The business case should outline the goals of the program, define the components of the program, qualitatively and quantitatively describe the costs and benefits of the components, and define the indicators that will be used to measure the effects of the program before and after implementation.⁴² (See [Resources](#) for links

to guidance for the development of a business case in hospital settings.)

Establishing and sustaining an AMS program in smaller facilities and in private hospitals where resources may be limited may require more innovative approaches, especially where there are no on-site doctors or pharmacy services, and arrangements for expert consultations vary. In these cases, having formalised networked arrangements in place will promote reliable and sustainable access to AMS essentials. Establishing an LHN/LHD or regional AMS program led by a multidisciplinary AMS committee is a model that has been adopted in some Australian states and territories to oversee, coordinate and support AMS activities across all facilities in the health network. (See also Chapter 4: '[Information technology to support antimicrobial stewardship](#)'.) Rural, remote and private hospitals may be able to access off-site services, such as expert clinical microbiologists from a diagnostic laboratory or infectious diseases physicians from a larger public hospital, through telehealth strategies (see Chapter 4: '[Information technology to support antimicrobial stewardship](#)'). Case study 2.1 provides an example of the resources available through an LHN AMS network to support AMS in a small hospital.

Local context

Understanding the organisational context, culture and workplace norms, including local prescribing rules and behaviours, is critical to successfully establishing an AMS program. A 'one size fits all'

Case study 2.1: Local Hospital Network support for antimicrobial stewardship (AMS) in a small hospital

Hospital A is a 17-bed public hospital that is part of a Local Hospital Network (LHN). The LHN also includes a Principal Referral Hospital in a major city with on-site specialist services, including:

- An infectious diseases unit and a microbiology laboratory
- Four smaller public acute hospitals with on-site general surgeons and general physicians

- Three very small mixed subacute and non-acute hospitals served by visiting general practitioners.

The successful LHN AMS program for Hospital A has seven key features.

Antimicrobial stewardship committee

An LHN AMS committee has been established and holds monthly meetings at the Principal Referral Hospital. Representatives from the networked hospitals attend these meetings, and those at the more remote hospitals attend by videoconference.

Antimicrobial stewardship service

The AMS service at the Principal Referral Hospital is provided by three infectious diseases physicians, who have appointments in AMS and work in the service for a month at a time on a rotating roster. There are also two full-time clinical microbiologists associated with the microbiology laboratory. An AMS pharmacist is employed full time to oversee the program for the LHN.

Expert antimicrobial stewardship clinician support

The network AMS pharmacist visits Hospital A at least quarterly to familiarise themselves with the local AMS issues, understand the local environment and build rapport with the workforce. Although the infectious diseases physicians may not be able to attend every meeting, attendance is ensured at least once per year.

Clinical champions

General practitioners at the smaller hospitals have been nominated as local AMS clinical champions and deal with the daily running of the AMS program. A generalist pharmacist also visits Hospital A for four hours twice a week and assists with local issues, including setting up the hospital formulary and some post-prescription reviews. Both the general practitioners and the generalist pharmacist at Hospital A have sought extra training in AMS by attending short courses, and they are supported through a system of mentorship from the networked infectious diseases physicians and AMS pharmacist. They are encouraged to phone the AMS team at the Principal Referral Hospital to discuss any issues and seek antimicrobial prescribing advice.

Antimicrobial policy and guidelines

Guidelines, policies and procedures are developed by the LHN AMS committee. They are available to all hospitals in the LHN and are customised to suit the local context of the individual hospitals.

Education

The AMS team at the Principal Referral Hospital is responsible for delivering education on antimicrobial use to the workforce across the entire network, using online conferencing.

Information technology

Hospitals in the LHN have a common information technology system that allows access to any results or investigations for patients from all sites. The hospitals also have an electronic approval system for pre-prescription approval of restricted medicines, which is on a multi-site platform. The AMS team can view the approvals at each of the sites within the LHN and phone to discuss cases with prescribers, if necessary. They can also recommend formal consultation with the infectious diseases service, if appropriate. This is usually a telephone consult but is sometimes part of a weekly formal infectious diseases ward round conducted using telehealth. Within the LHN, Hospital A had the fastest uptake of the electronic approval system, even though it was one of the least resourced services. This was because Hospital A had a highly enthusiastic and respected local champion and a workforce that was keen to have a successful program. There was also some friendly rivalry among the smaller hospitals within the LHN.

approach is not appropriate and does not sufficiently recognise that each setting has unique elements to be considered, such as enablers and barriers for appropriate antimicrobial prescribing and use. These enablers and barriers can affect the success of the implementation and should be considered when planning the implementation strategy.⁴³ Information on the effect of context on quality improvement is available from [The Health Foundation](#).

Tools have been developed that can help organisations to assess and better understand the local context and ways in which this will influence improvement efforts. For example, the [Model for Understanding Success in Quality \(MUSIQ\)](#) has helped teams to identify aspects of context that are weak in their setting and consider what can be done to modify those aspects.⁴⁴

Organisational culture

Different cultural factors, encompassing how the organisation operates and communicates, may influence the success of an AMS program. Cultural factors that may support successful AMS include^{9,24}:

- Management and workforce
 - endorsement and recognition from management, leading to appropriate leadership and resourcing of the AMS program
 - engagement of clinical leaders
 - institutional buy-in
 - awareness of, or practical access to, antimicrobial prescribing guidelines and resources
- Communication
 - collaborative styles of communication
 - direct styles of communication
 - good organisational networks supporting formal communication processes
- Relationships
 - respectful and trusting
 - collegial and collaborative
 - multidisciplinary engagement
- Conflict management
 - leadership support
 - direct communication with those who resist change.

Safety culture

Establishing and maintaining a safety culture is a specific aspect of organisational culture that can influence the effectiveness of patient safety practices.⁶ Increasingly, health service organisations are undertaking safety culture (or safety climate) surveys to inform implementation of improvement strategies. Although a survey is not an essential prerequisite for implementing an AMS program, gaining an understanding of the local safety culture will help teams to identify stewardship strategies that are more likely to succeed.

The AMS team may be able to use recent safety climate surveys or assessments, including surveys that measure workforce perceptions about the organisation's safety culture (see [Resources](#)), to assess the local safety culture. Working with patient safety and quality committees or departments within an organisation or network will enable the AMS committee or team to decide what activities may already be occurring regarding assessing, creating and promoting a safe workplace culture. These activities might be able to support implementation of AMS.

Factors influencing antimicrobial prescribing behaviour

Determinants of antimicrobial prescribing behaviour have been identified through Australian and international research.^{45,46} An awareness and understanding of these factors, and how they might relate to the local context, can help AMS teams to tailor interventions to change antimicrobial prescribing behaviour in their workplace⁴⁵ (see also Chapter 5: '[Antimicrobial stewardship education for clinicians](#)').

Table 2.4 lists the determinants of antimicrobial prescribing behaviour and some practical steps for AMS teams to follow to target some of the determinants, if they are an issue. It is important to consider the drivers behind behaviour, and to target interventions and messages accordingly.

2.5.2 Reviewing existing policies and prescribing guidelines

Local policies and prescribing guidelines, based on evidence-based guidelines, such as *Therapeutic Guidelines: Antibiotic*⁴¹, are the basic structure on which AMS programs are built. It is therefore important to regularly review them, especially as part of the AMS planning process.

Antimicrobial stewardship policy

All health service organisations should have an AMS policy. An AMS policy establishes AMS as a safety and quality priority, gives authority to the AMS team and disseminates the key concepts of AMS. The AMS policy should be:

- Developed by the AMS team and AMS committee, and include a review date
- Approved by the drug and therapeutics or medication management committee
- Endorsed by the health service organisation executive
- Regularly reviewed and audited for compliance
- Readily available to all clinicians
- Used as the basis for AMS education programs.

Table 2.4: Determinants of antimicrobial prescribing behaviour and actions to influence them

Determinants of antimicrobial prescribing behaviour ⁴⁵⁻⁵⁰	Practical steps for antimicrobial stewardship teams to influence prescribing among hospital clinicians ⁴⁶
Decision-making autonomy – clinicians may rely on professional judgement rather than evidence-based guidelines	<ul style="list-style-type: none"> Engage senior clinicians in guideline development, with regular microbiological review, to support adherence
Limitations of local evidence-based policies – clinicians may deem local policies to be not always applicable to the individual patient	<ul style="list-style-type: none"> Work with senior clinicians to align the evidence base, local guidelines and consultant preferences, considering local resistance patterns
Etiquette – clinicians may be reluctant to scrutinise and criticise other clinicians' prescribing practices	<ul style="list-style-type: none"> Use effective clinical leadership to influence practice
Culture of hierarchy – junior clinicians' prescribing decisions are influenced by senior workforce members	<ul style="list-style-type: none"> Make guidelines readily available to junior clinicians Focus on adherence to guidelines and when to deviate when teaching clinicians
Antimicrobial resistance awareness – clinicians may not consider antimicrobial resistance to be relevant to their clinical decisions	<ul style="list-style-type: none"> Provide training to all clinicians, including those trained overseas, that increases their awareness about antimicrobial resistance and overuse, the need to prescribe judiciously and current antimicrobial information
Knowledge about antimicrobials, including antimicrobial spectrum and appropriate clinical use – clinicians may not be aware of current antimicrobial information	<ul style="list-style-type: none"> Promote prescribing guidelines
Diagnostic uncertainty – clinicians may be afraid of clinical failure or of overlooking something that is of more concern than downstream complications of antimicrobial resistance	<ul style="list-style-type: none"> Educate clinicians to perform appropriate diagnostic work-ups before starting treatment – especially the correct use of microbiology and imaging
Expectations of patients, families and carers – clinicians may be influenced by patients' expectations for antimicrobials (perceived and actual)	<ul style="list-style-type: none"> Engage with consumers, and use patient information about antimicrobial resistance and shared decision-making tools to change both patients' and clinicians' expectations

At a minimum, the AMS policy should:

- Nominate a person and their position within the organisation who has executive responsibility for the policy's content, and for implementing and monitoring it, and will be involved in future AMS activities
- Incorporate the principles of the Antimicrobial Stewardship Clinical Care Standard⁵¹, including the need for clinicians to prescribe antimicrobials guided by the latest version of *Therapeutic Guidelines: Antibiotic*⁴¹ wherever possible, with specific mention of how evidence-based practice recommendations for antimicrobial prescribing are to be applied locally
- Include a list of restricted antimicrobials, and outline the procedure for obtaining approval for use of those agents and a process for managing unapproved requests
- Provide information on how to access expert advice
- Refer to the health service organisation's policy on liaising with the pharmaceutical industry
- Outline how compliance with the policy will be audited and fed back to prescribers and the AMS committee or governance bodies.

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The AMS policy may be developed and monitored at the LHN, LHD, hospital group, individual facility or practice level, depending on the governance arrangements.

The policy should be regularly reviewed and revised, and this process can be a useful way to gain multidisciplinary input and engagement. However, AMS teams should try to avoid prolonged policy development to the exclusion of other activities. This may slow progress in developing and testing systems to directly influence antimicrobial prescribing.

Examples of Australian AMS policies for hospitals include:

- NSW Clinical Excellence Commission's *Sample Antimicrobial Stewardship Policy: for a Local Health District or Network*¹⁴
- SA Health's *Antimicrobial Stewardship Policy Directive*.¹³

Prescribing guidelines

Most healthcare settings will not need to develop local guidelines. However, existing ones will need to be implemented and promoted (for example, *Therapeutic Guidelines: Antibiotic*⁴¹, or guidelines developed or endorsed by the LHN/LHD AMS committee). (See Chapter 3: '[Strategies and tools for antimicrobial stewardship](#)'). The [NPS MedicineWise website](#) provides several resources to help to implement guidelines in primary and community care settings.

As part of the assessment process, AMS teams should ascertain what guidelines are currently available within the organisation and assess whether they:

- Are consistent and evidence based
- Reflect agreed best practice (that is, are consistent with *Therapeutic Guidelines: Antibiotic*⁴¹)
- Reflect the *Antimicrobial Stewardship Clinical Care Standard*⁵¹
- Have appropriate engagement and endorsement from units or services
- Have a regular audit and feedback process in place
- Are readily accessible by prescribers
- Have a review date to allow the content to be regularly reviewed.

Guideline development needs to be accompanied by a carefully planned implementation process that includes a program of audit and feedback.

2.5.3 Reviewing local data on antimicrobial use and resistance

AMS programs need to be tailored to the clinical setting. Local factors such as patient characteristics and needs, common indications for antimicrobial therapy, use of particular classes of antimicrobials, use of costly agents, and AMR patterns can be used to guide the focus of the program.

Understanding local antimicrobial use and AMR patterns within the specific clinical setting will help to identify priority areas for improvement. For example, in a primary care setting where the main role for antimicrobials is for urinary tract infections, skin and soft-tissue infections, and selected respiratory tract infections, patterns of use of common first- and second-line oral antimicrobials and resistance rates in *Escherichia coli*, *Staphylococcus aureus*, *Haemophilus influenzae* and *Streptococcus pneumoniae* are of most importance. This situation is different from tertiary cancer care, where a focus on broad-spectrum antimicrobials and antifungals, and resistance patterns in a wider range of pathogens is more relevant. Microbiologists, clinicians, clinical pharmacists, and infection control practitioners can assist in interpreting the data.

Health service organisations, aged care homes and other health organisations and providers can participate in different programs that can provide baseline and regular data and information to assess AMS performance (see also Chapter 6: '[Measuring performance and evaluating antimicrobial stewardship programs](#)'). Table 2.5 describes data sources for these programs, many of which form part of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System. In addition to supporting AMS teams to identify areas of focus, baseline data are useful for evaluating improvements in practice.

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Table 2.5: Examples of sources of information on antimicrobial use and resistance

Data	Data sources		
	Hospital sector	Aged care homes	Community and primary care
Quantity of antimicrobial use	<ul style="list-style-type: none"> National Antimicrobial Utilisation Surveillance Program (A, L+N) Hospital pharmacy department dispensing reports (L) 	<ul style="list-style-type: none"> NPS MedicineWise aged care home reports on antimicrobial use in urinary tract infections (L) 	<ul style="list-style-type: none"> NPS MedicineWise feedback on PBS/RPBS prescribing (L) Australian Atlas of Healthcare Variation⁵² (N)
Prevalence of antimicrobial use	<ul style="list-style-type: none"> National Antimicrobial Prescribing Survey (A, L+N) 	<ul style="list-style-type: none"> Aged Care National Antimicrobial Prescribing Survey (A, L+N) 	<ul style="list-style-type: none"> NPS MedicineWise MedicineInsight program (A, N)
Quality of antimicrobial use	<ul style="list-style-type: none"> National Antimicrobial Prescribing Survey (A, L+N) 	<ul style="list-style-type: none"> Aged Care National Antimicrobial Prescribing Survey (A, L+N) 	<ul style="list-style-type: none"> NPS MedicineWise MedicineInsight program (A, N)
Antimicrobial expenditure	<ul style="list-style-type: none"> Hospital pharmacy department dispensing reports (L) 	<ul style="list-style-type: none"> None available 	<ul style="list-style-type: none"> None available
Antimicrobial susceptibility patterns or antibiograms	<ul style="list-style-type: none"> Microbiology laboratory Australian Passive AMR Surveillance System (A, L+N) 	<ul style="list-style-type: none"> Microbiology laboratory Australian Passive AMR Surveillance System (A, L+N) 	<ul style="list-style-type: none"> Microbiology laboratory (L) Australian Passive AMR Surveillance System (A, L+N)
Infection surveillance data	<ul style="list-style-type: none"> Infection prevention and control audits (L) 	<ul style="list-style-type: none"> Aged Care National Antimicrobial Prescribing Survey (A, L+N) 	<ul style="list-style-type: none"> None available

AMR = antimicrobial resistance; AURA = Antimicrobial Use and Resistance in Australia; PBS = Pharmaceutical Benefits Scheme; RPBS = Repatriation Pharmaceutical Benefits Scheme

Note: A = AURA program participant; L = local data; N = national data; L+N = participation generates local and national data

2.5.4 Determining priority areas for antimicrobial stewardship activities

A gap analysis and risk assessment of the information gathered from the self-assessment, the review of policies and prescribing guidelines, and the data available on antimicrobial use and AMR will help the AMS team to identify:

- Elements of the AMS program that are missing or need improvement
- Areas that should be improved
- Priorities for action.

Risk assessments review the likelihood of occurrence and the size of the likely impact. The AMS risk assessment could consider, for example, whether activities should be focused on particular

antimicrobial agents or particular clinical conditions, or whether a broader perspective is needed. In the hospital setting, if existing infrastructure and resources are limited, AMS teams may want to start by targeting specific medicines that have suboptimal local use. Pharmacy costing data, comparative use rates or a baseline audit of the appropriateness of antimicrobial use obtained through AURA, the National Antimicrobial Prescribing Survey (NAPS) and the National Antimicrobial Utilisation Surveillance Program (NAUSP) will guide local priorities. For example, reserve agents such as intravenous quinolones, carbapenems and aztreonam could be targeted, as could third-generation cephalosporins. High-risk agents (for example, aminoglycosides) could be included for safety reasons.

Efforts to improve antimicrobial prescribing for specific clinical conditions (for example, community-acquired pneumonia, asymptomatic bacteriuria, skin and soft-tissue infections) has been shown to be effective, as has targeting patients infected with key pathogens (for example, *S. aureus* bacteraemia, gram-negative bacteraemia, candidaemia).^{53,54} This approach relies on the AMS team being able to identify patients whose therapy requires review (for example, febrile neutropenic patients).

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Surgical prophylaxis in hospitals is another area that could be prioritised for attention. Data from the annual NAPS reports show that two out of five prescriptions for surgical prophylaxis are inappropriate.⁵⁵ This is of particular importance for private hospitals, which provide around 65% of all elective surgical procedures in Australia, including 75% of orthopaedic knee operations and 70% of major eye operations.^{56,57} Results from a study into the appropriateness of antimicrobial prescribing in three large Australian private hospitals in 2013 showed that prescriptions for treatment of infection were generally judged to be appropriate (80% appropriate), whereas the appropriateness of prescribing for surgical prophylaxis was much more problematic (only 40% appropriate).⁵⁸ The Australian Commission on Safety and Quality in Health Care (the Commission) has issued guidance regarding surgical prophylaxis and will be working with the Royal Australasian College of Surgeons to further support local AMS programs.

By targeting problem areas, the benefits of the program are likely to be demonstrated quickly, which can help build momentum for future initiatives.

2.5.5 Identifying effective interventions

Essential strategies for successful AMS programs are listed in Box 2.1. The strategies are complementary and some are interdependent – for example, collecting antimicrobial prescribing data to feed back to prescribers in an education session. AMS programs therefore need to comprise a range of interventions and strategies, especially those that have been shown to influence prescribing behaviour, such as restrictive, persuasive and enablement strategies. (See Chapter 3: ‘[Strategies and tools for antimicrobial stewardship](#)’.)

AMS teams will need to determine which AMS strategies to test, and how they should be implemented in their local context. AMS teams

looking to implement or review an AMS program may find it helpful to contact different hospitals or practices to learn how their AMS programs have been developed, what strategies have been selected and what lessons were learned during their implementation. For strategies to be adopted and accepted by prescribers, they need to fit within the clinical workflow, and their implementation should be carefully planned and endorsed by the executive. Different strategies are discussed in Chapter 3: ‘[Strategies and tools for antimicrobial stewardship](#)’, including options for implementation in different settings.

Driver diagrams

A driver diagram is a useful approach to determine which interventions to include in the AMS program.

A driver diagram organises information on proposed activities so the relationships between the aim of the improvement project and the changes to be tested and implemented are clear. A driver diagram is typically set out using columns and comprises:

- An aim statement – the project goal or vision
- Primary drivers – high-level factors that you need to influence to achieve the aim
- Secondary drivers – specific factors or interventions that are needed to achieve the primary drivers; these are targeted areas for specific changes or interventions
- Change ideas – well-defined change concepts or interventions to consider for the secondary drivers, and what exactly will be done and how it will be done.

The Institute of Healthcare Improvement and Centers for Disease Control developed an AMS driver diagram²⁰ that has been adopted by the NSW Clinical Excellence Commission.⁵⁹ The AMS driver diagram in Figure 2.2 describes these processes.

If a driver diagram is considered an appropriate tool, it may be accompanied by a change package that outlines specific interventions that act positively on those drivers. As well as helping teams to identify factors that need to be considered to achieve program goals, the driver diagram can be used to communicate the change strategy and guide the development of a measurement framework.

Driver diagrams can be developed and used for specific AMS problems (for example, to reduce inappropriate antimicrobial use in urinary tract infections) and may be developed for use in other settings.

Once the strategies and specific interventions have been identified in the driver diagram, they should be endorsed by the AMS committee and included in the original and ongoing AMS program plans (see [Documenting and implementing the antimicrobial stewardship plan](#)).

2.5.6 Defining measurable goals and outcomes

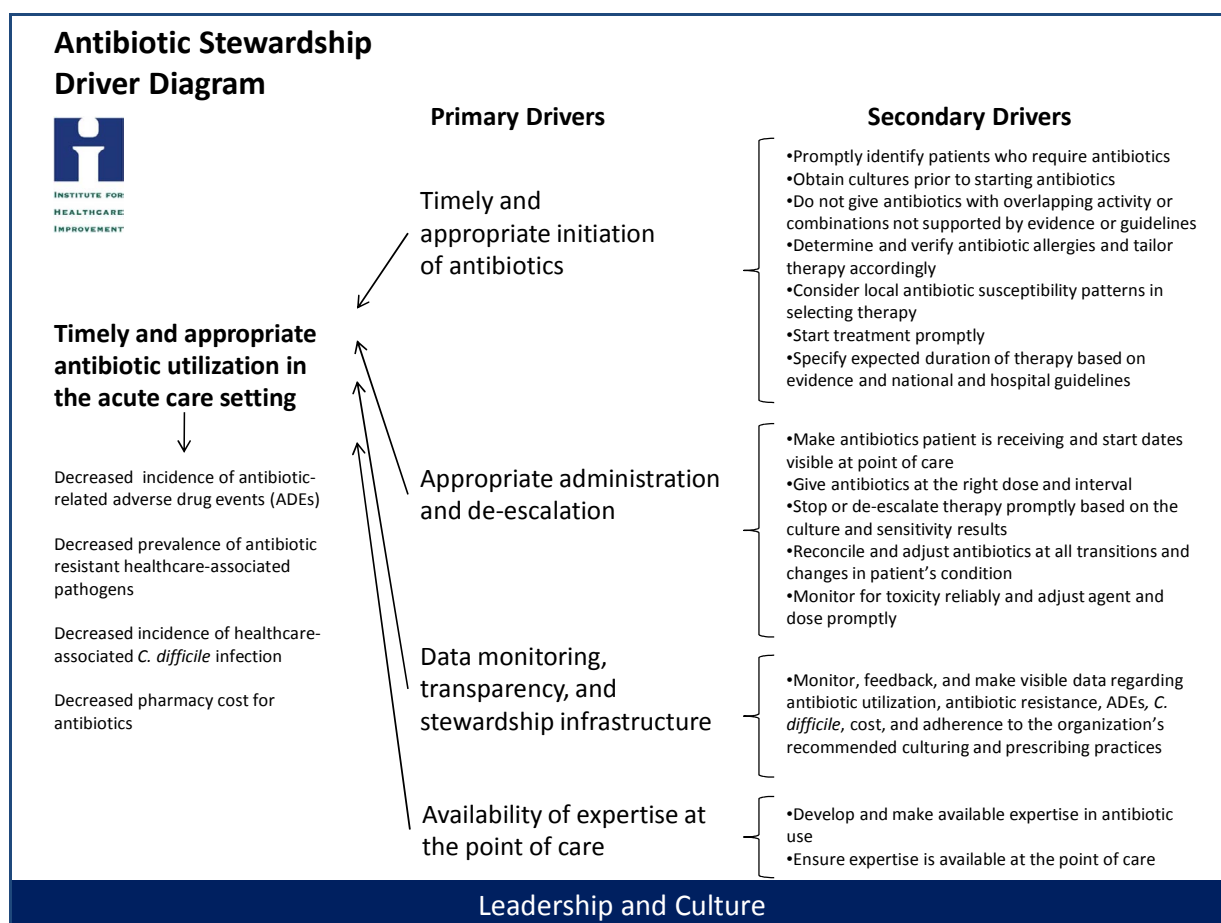
To demonstrate and enable improvements resulting from AMS interventions, the AMS team should ensure that goals and outcomes are measurable and clearly defined. When initiating a program, the goals should be targeted, small and well defined (for example, reduced use of one or a few antimicrobials, rather than a larger goal of decreasing use of all agents or decreasing AMR rates).⁶⁰ As the program progresses and achievements accrue, the goals and outcomes can be expanded.

The AMS team should coordinate the collection and analysis of key measures to assess the effectiveness of the AMS strategies implemented, including antimicrobial use and AMR. A balanced set of measures should be agreed and include^{12,61}:

- Structural measures – Are the right elements in place?
- Process measures – Are the systems performing as planned?
- Outcome measures – What is the result?
- Balancing measures (to monitor unintended consequences) – Are the changes causing new problems?

The measures need to be sustainable, and the measurement framework should be included in the AMS plan (see Chapter 6: [‘Measuring performance and evaluating antimicrobial stewardship programs’](#)).

Figure 2.2: Example of a driver diagram for hospital-based antimicrobial stewardship



Source: Centers for Disease Control and Prevention²⁰

2.5.7 Documenting and implementing the antimicrobial stewardship plan

Documentation of the plan for the program is important to ensure that everyone – executive, management and clinicians – are ‘on the same page’. The documentation should include the results of the assessment and planning steps (local context, resources, policy, and antimicrobial use and AMR); the priority areas for AMS; and the interventions that will be implemented. One way to document the plan is to develop a [driver diagram](#) to identify the interventions that will be used, and then add the resources needed and the timing planned for each intervention.

It is important to obtain executive agreement to establish the AMS program and implement it within assigned resources. Documentation of the plan is essential for this step.

In most cases, a period of testing will be needed before the new strategies are introduced or the program is fully implemented, and this should be built into the plan. Testing new processes allows unforeseen problems to be resolved, and interventions evaluated and refined before full implementation into widespread day-to-day operations. Including different individuals and perspectives in both the planning and testing phases will help reduce resistance to change.⁶²

In general, testing should follow a QI audit sequence such as plan–do–study–act cycles. Examples of QI models are available from the Institute for Healthcare Improvement’s [Model for improvement](#). (See also [Resources](#) for examples of AMS toolkits from organisations that use a QI approach to implementation.)

When the AMS team and committee are satisfied that the improved practice or behaviour is established, steps can be taken to spread the intervention to other parts of the organisation (see [Resources](#) for tools to support the spread of AMS interventions).

2.5.8 Educating the workforce

Education is an essential component of any AMS program. It should include consumers and clinicians from all healthcare settings who are involved in the antimicrobial medication management pathway. Education provides the foundation of knowledge and understanding that will increase acceptance of

AMS strategies, and improve the appropriateness of prescribing and antimicrobial use.

For clinicians, AMS education should start during undergraduate training and continue throughout their careers. Local education programs should include local AMS recommendations. Programs that are multifaceted and include one or more active educational activities are more likely to be successful in changing clinicians’ behaviour.

Raising awareness of AMR may be of particular importance for some organisations to overcome workforce perceptions that AMR is not an issue in their facility. For example, a 2014 survey of 330 private hospital visiting medical officers, nurses, midwives and pharmacists revealed a prevalent perception that AMR was more of a problem in other hospitals than in the surveyed private hospital, and only 36% of respondents believed that AMR affected care of their patients.¹⁷ Studies have revealed similar findings in other acute settings and in the community.^{63–65}

Smaller facilities, including rural and remote hospitals, private facilities and aged care homes, may need to draw on communication and education resources available in larger organisations. Advances in technology have made education more accessible to those working outside metropolitan areas. Clinicians can access education on AMS through webinars, online training modules, video lectures, and education activities organised by professional organisations and state or territory AMS networks or committees. Infectious diseases physicians, an AMS pharmacist, or the microbiology workforce from a larger hospital or the LHN/LHD can also be engaged to provide outreach education in person or by online tools.

Educational activities provided by an organisation need to be assessed, and an evaluation process should be built into the program.⁶⁶ Records of AMS education provided, along with records of attendance and certificates of online training modules completed, should be maintained by the organisation. Hospitals, LHNs or LHDs may have existing systems or structures, such as education and QI departments, to assist with this. As well as measures of participation, the evaluation process could also include measures of effectiveness such as pre-knowledge tests and competency assessments. (See Chapter 5: ‘[Antimicrobial stewardship education for clinicians](#)’.) To encourage uptake among senior clinicians, continuing AMS education could be part of visiting medical officer accreditation for admitting rights at a hospital. Education for



consumers is discussed in Chapter 7: '[Involving consumers in antimicrobial stewardship](#)'.

2.5.9 Developing and implementing a communication plan

Robust communication is critical to raise awareness of the AMS program and initiatives, engage stakeholders and disseminate results. Communicating why change is required, providing information on how the change will occur, and reporting ongoing progress to affected individuals and groups will minimise resistance to change. The communication plan should consider:

1. Raising awareness and promoting the AMS program and its specific initiatives or elements
Communication about the AMS program should be clear and concise, outline the goals and benefits of the program, and contain key clinical messages.⁶⁶ The [Antimicrobial Stewardship Clinical Care Standard](#)⁵¹ and supporting documentation are useful resources for communicating clinical messages (see also [Resources](#)).
2. Issuing AMS program updates
Key antimicrobial outcomes should be reported at least quarterly to the executive, directorates and specific clinical areas, and an annual report that summarises data on antimicrobial use and QI initiatives should be published.³⁷ Organisational laboratory susceptibility data (in the form of antibiograms) should also be reported to the AMS committee at least annually.
3. Providing feedback on antimicrobial prescribing and program outcomes, including improvements over time
Communicating and learning from data are important⁶⁶, and any unexplained deviation from accepted prescribing practices should be promptly reported back to prescribers. Initially, presenting locally derived, meaningful data to small groups of clinicians in face-to-face meetings (for example, at departmental or practice meetings) is likely to be more successful than emailing out formal reports. However, different strategies are likely to be necessary to disseminate all data. Organisation-wide measures of the quality of prescribing should be regularly reported to prescriber groups, and patient safety and quality groups in the organisation (see Chapter 6: '[Measuring performance and evaluating antimicrobial stewardship programs](#)').

Antibiotic Awareness Week, held each year during the second week of November, is a good time to

communicate with clinicians in the organisation or practice about the local AMS program, and provide feedback on local activities and achievements (more information on Antibiotic Awareness Week is available from the [Commission](#) and [NPS MedicineWise](#) websites; see also [Resources](#)).

2.6 Sustaining the antimicrobial stewardship program

The AMS program is expected to evolve over time, depending on the results of QI testing, evaluation and ongoing monitoring, any change in the complexity of service provision, and the availability of new diagnostic tools and IT systems.

Maintaining an AMS program can be challenging, but continuous planning and evaluation with feedback to clinicians will support sustained improvements (see Chapter 6: '[Measuring performance and evaluating antimicrobial stewardship programs](#)'). Ongoing education is critical to the engagement of clinicians and others involved in AMS initiatives (see Chapter 5: '[Antimicrobial stewardship education for clinicians](#)'). Programs need to communicate successes with the use of process and outcome data, and be ready to respond to changing circumstances. It is likely that programs will need to change as new challenges are identified, and goals and achievements are realised.

Using a QI framework will support sustainability. Once a practice has become established or behaviour change has occurred, attention needs to be refocused on consolidating improved prescribing practices and behaviours. Several measurement cycles might be needed to identify whether changes to clinical practice have been embedded in the organisation. If it becomes evident that practice change has not been sustained, strategies may need to be refined or retested.

Examples of how different health service organisations have approached implementing and sustaining an AMS program are provided in [Resources](#).

Examples of successful and sustained AMS programs that have incorporated some of the above strategies are provided in [Appendix A](#).

Resources

Governance of antimicrobial stewardship

- An example of the roles and responsibilities that are expected of the chief executive and LHN/LHD chief executive officers: [SA Health Antimicrobial Stewardship Policy Directive](#)

Antimicrobial stewardship committee and team

- Advice on establishing effective AMS committees and teams, including their composition and roles: NSW Clinical Excellence Commission's [Antimicrobial Stewardship Teams & Committees: Fact sheet](#)
- Example terms of reference for AMS committees: NSW Clinical Excellence Commission's [AMS Implementation Toolkit](#)
- Cosgrove SE, Hermsen ED, Rybak MJ, File TM, Parker SK, Barlam TF. [Guidance for the knowledge and skills required for antimicrobial stewardship leaders](#). *Infect Control Hosp Epidemiol* 2014;35:1444–51.

Antimicrobial stewardship program plan

- Information on the effect of context on QI: [The Health Foundation](#)
- A tool to identify weak aspects of context and consider what can be done to modify those aspects: [Model for Understanding Success in Quality \(MUSIQ\)](#)
- AMS self-assessment tools and links
 - NSW Clinical Excellence Commission: [Antimicrobial Stewardship Progress & Planning Tool](#)
 - SA Health: [Antimicrobial Stewardship Program Self-evaluation Toolkit](#)
 - Centers for Disease Control and Prevention: [Checklist for Core Elements of Hospital Antibiotic Stewardship Programs](#)
 - Centers for Disease Control and Prevention: [Core Elements of Antibiotic Stewardship for Nursing Homes Checklist](#)
 - Centers for Disease Control and Prevention: [Core Elements of Outpatient Antibiotic Stewardship Checklist](#)

- Core and supplementary structure indicators for hospital AMS programs: [Transatlantic Taskforce on Antimicrobial Resistance](#)
- National Institute for Health and Care Excellence: [Antimicrobial stewardship: systems and processes for effective antimicrobial medicine use](#)
- Royal College of General Practitioners: [TARGET Antibiotics Toolkit Self-Assessment Checklist](#)
- Agency for Healthcare Research and Quality: examples of [patient safety culture surveys](#) for different healthcare settings
- Examples of Australian AMS policies
 - NSW Clinical Excellence Commission: [Sample Antimicrobial Stewardship Policy: for a Local Health District or Network](#)
 - SA Health: [Antimicrobial Stewardship Policy Directive](#)
- Resources to support AMS: [NPS MedicineWise](#)
- Public Health Ontario: [selecting antimicrobial stewardship strategies](#)
- Barlam TF, Cosgrove SE, Abbo LM, MacDougall C, Schuetz AN, Septimus EJ, et al. [Implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America](#). *Clin Infect Dis* 2016;62:1197–202.
- Resources for Antibiotic Awareness Week: the [Commission](#) and [NPS MedicineWise](#)

Business case resources

- Public Health Ontario: [How to Make a Business Case for an Antimicrobial Stewardship Program](#)
- Society for Healthcare Epidemiology of America: [Antimicrobial Stewardship Program Proposal Sample](#)
- Sinai Health System – University Health Network: [spreadsheet for start-up costs and projections](#)
- Making a business case for antimicrobial stewardship: Tamma PD, Cosgrove SE. [Antimicrobial stewardship](#). *Infect Dis Clin North Am* 2011;25:245–60.

Implementation toolkits

- NSW Clinical Excellence Commission: AMS Implementation Toolkit
- Nathwani D, Sneddon J: *A Practical Guide to Antimicrobial Stewardship in Hospitals*
- EQulP Program (Education, Quality, Infection Prevention, Training, and Professional Development): *Jump Start Stewardship: Implementing antimicrobial stewardship in a small, rural hospital*
- National Quality Forum: *National Quality Partners Playbook: Antimicrobial stewardship in acute care*
- Agency for Health Research and Quality: Toolkit for Reduction of *Clostridium difficile* through Antimicrobial Stewardship
- Agency for Health Research and Quality: Toolkits for AMS interventions in aged care homes – Implement, monitor, and sustain an antimicrobial stewardship program

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Appendix A: Examples of successful and sustained antimicrobial stewardship programs

Case study A1: A successful and sustained Australian antimicrobial stewardship program in one Australian hospital, 2012–2016

Setting

Large metropolitan hospital of 380 beds.

Team

- Dedicated infectious diseases (ID) physician, increasing from 0.2 full-time equivalent (FTE) to 0.5 FTE over time as program expanded
- ID team with registrar
- Dedicated pharmacist (0.2 FTE)
- Considerable input from pharmacy dispensary and clinical teams (for example, education, prescribing and formulary reviews, safety and quality).

Resources

Supportive ID team; pharmacy service, including clinical pharmacists; clinical microbiology service, and infection prevention and control service; executive support; and access to advice and essential electronic prescribing guidelines (local or *Therapeutic Guidelines: Antibiotic*).

Strategies

The core strategies developed to implement the antimicrobial stewardship (AMS) program are listed below.

2012

- Implemented a formal antimicrobial restrictions procedure and ID approval system, incorporating phone-based ID approval codes
- Developed and implemented a local antimicrobial formulary and restriction policy, and a gentamicin procedure.

2013

- Established an AMS advisory committee, chaired by the Executive Director of Medical Services, to help establish the AMS program and show support from the hospital executive
- Established an annual quality improvement plan for AMS
- Started contributing data to the National Antimicrobial Utilisation Surveillance Program, with review of those data by the AMS committee
- Developed and implemented local guidelines, starting with a febrile neutropenia guideline
- Started annual point prevalence surveys, with feedback to clinicians, using the National Antimicrobial Prescribing Survey (NAPS) method (see Figures A1–A3)
- Started participating in annual Antibiotic Awareness Week, using national presentation from the Australian Commission on Safety and Quality in Health Care as a basis, and incorporating local data that highlighted areas that were doing well and those requiring attention (including annual NAPS data and key improvement areas); data discussed at medical grand rounds
- AMS committee developed and started annual review of local antibiograms
- Initiated regular clinical reviews of guidelines and prescribing to validate processes
- Started clinical education using multiple modalities, including structured education from the ID, AMS and clinical pharmacy teams, as well as on-the-spot ward education from ward pharmacists.

2014

- Started accreditation against the National Safety and Quality Health Service (NSQHS) Preventing and Controlling Healthcare-Associated Infection Standard
- Developed and implemented local AMS clinical procedures, as well as more widespread guidelines, such as
 - community-acquired pneumonia guideline
 - paediatric empirical quick reference guide
 - *Staphylococcus aureus* bacteraemia guideline
 - vancomycin guideline
 - intravenous-to-oral switching guideline
 - hospital-acquired pneumonia guideline(These guidelines are maintained locally based on usage and risk; some are informed and updated based on available statewide policy, such as for vancomycin)
- Expanded program to incorporate medical AMS education during orientation and developed an AMS intranet page
- Following a review of Hospital in the Home services, established improved procedures for antibiotic infusor devices for those services, incorporating
 - specific ID approval codes
 - implementation of a discharge approval sheet
 - initiation of active ID review at weekly Hospital in the Home infusor clinics
 - improved ordering and review processes in pharmacy.

2015

- Marked the launch of the statewide formulary, incorporating a comprehensive anti-infective formulary with local implementation
- Developed a procedure for post-exposure prophylaxis after non-occupational exposure to HIV
- Consolidated and further refined processes (for example, responding to

antimicrobial shortages and reviewing antimicrobials stored in clinical areas)

- Provided letters to the Division of Surgery, highlighting improvements in surgical prophylaxis.

2016

- Tabled reports on antimicrobial incidents, infection control and antimicrobial resistances at meetings of the AMS committee for review.

Review of AMS committee membership

The AMS committee was firmly established in the organisational structure, enabling a change in the committee chair from executive leader to ID/clinical microbiology consultant. The AMS committee receives oversight from, and reports to, the relevant drug and therapeutics committee (DTC), which in turn reports to the Local Hospital Network (LHN) Clinical Governance Committee. The AMS committee makes recommendations to the DTC, and sends updates to the LHN committee about the NSQHS Preventing and Controlling Healthcare-Associated Infection Standard regarding AMS actions.

Executive leadership for the Preventing and Controlling Healthcare-Associated Infection Standard was determined to be no longer essential, although links are maintained.

AMS committee members include:

- ID/clinical microbiology consultant (chair)
- DTC chairperson or representative
- ID physicians and clinical microbiologists
- Consultant physicians from other LHN campuses
- Pharmacy directors and senior pharmacists from different campuses and departments
- Infection prevention and control representative.

The AMS program has been expanded into other areas of the LHN, where it contributes to statewide processes and policy development, such as the review of antimicrobial formulary applications and guidelines.

Monitoring, review and feedback

Based on surveillance, intervention and feedback, the following improvements in prescribing were seen:

- Reduced duration of ciprofloxacin for procedural prophylaxis during prostatic biopsy following correspondence from pharmacy (2014)
- Audit and review of ceftriaxone use in the intensive care unit following National Antimicrobial Utilisation Surveillance Program (NAUSP) data review (2014)
- Intervention and reduction in inappropriate norfloxacin use following NAUSP data review (2014)
- Vancomycin use and education to clinicians (2015)
- Gentamicin audit showed ID approval requirement at 72 hours is working and improving patient safety with input from ID (2016).

Results of AMS activities

- AMS committee activities: appropriateness of antimicrobial prescribing improved from 69% in 2013 to 87% in 2015, and this was sustained in 2016 (Figure A1)
- The percentage of surgical prophylaxis given for more than 24 hours decreased from more than 30% in 2014 to less than 20% in 2016 (Figure A2)
- Targeted intervention (management of chronic obstructive pulmonary disease): appropriateness increased from 14% in 2015 to 90% in 2016 using education and awareness strategies (Figure A3)
- Improved governance and procedures relating to antimicrobial infusors: significant reductions in antimicrobial use and post-implementation cost savings of around \$45,000.

Figure A1: Appropriateness of antimicrobial prescribing at the hospital, using National Antimicrobial Prescribing Survey methods, 2013–2016

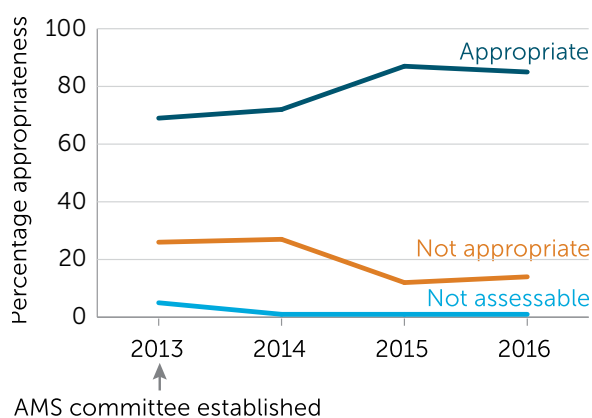


Figure A2: Percentage of surgical prophylaxis given for more than 24 hours, 2013–2016

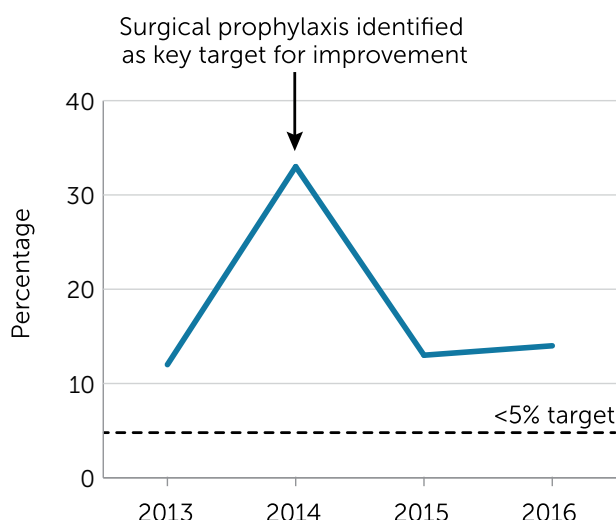
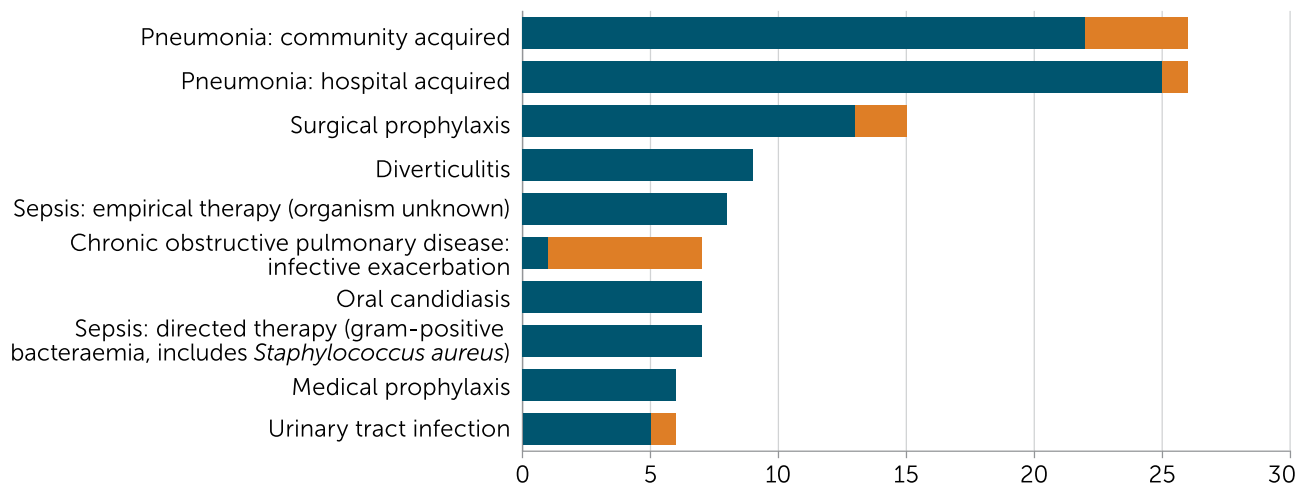
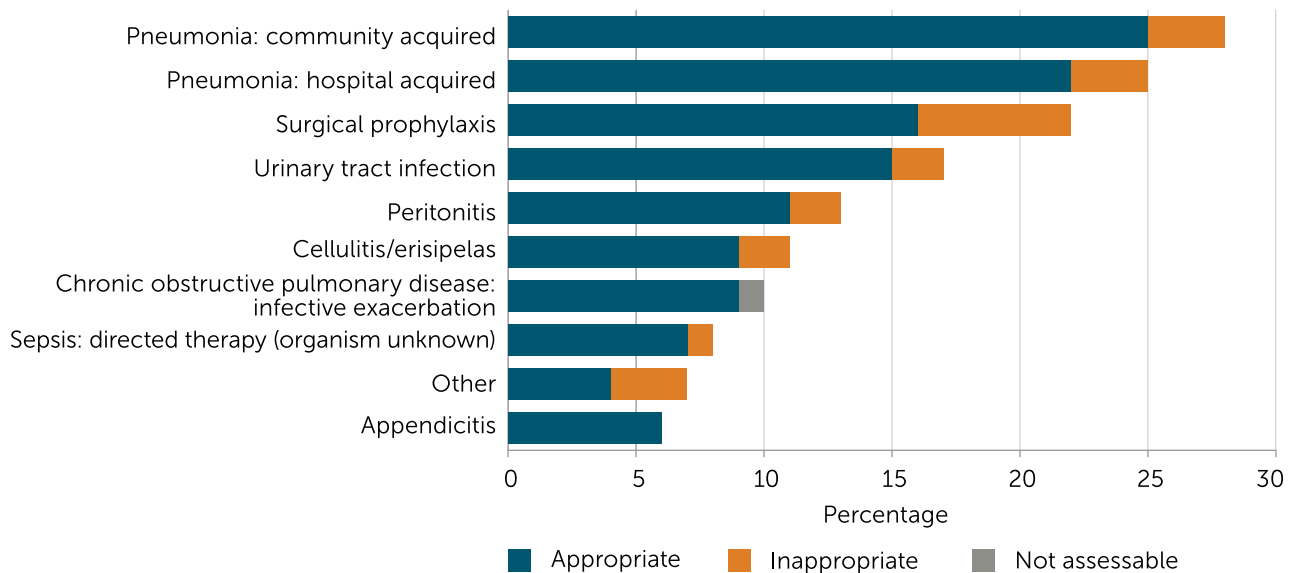


Figure A3: Most common indications for antimicrobial prescribing in the hospital, using National Antimicrobial Prescribing Survey methods, 2015 and 2016

2015



2016



Note: The total numbers of antimicrobial prescriptions were 199 in 2015 and 208 in 2016.

Case study A2: Implementation and sustainability of an Australian antimicrobial stewardship program in one Australian hospital, 2003–2017

Setting

Tertiary referral hospital with approximately 500 beds.

Team

Dedicated 1.0 full-time equivalent (FTE) infectious diseases (ID) pharmacist with 0.2 FTE ID physician.

Resources

Supportive ID team, pharmacy service, clinical microbiology service, and infection prevention and control service.

Strategies

The core strategies developed to implement the antimicrobial stewardship (AMS) program are listed below.

2003

- Introduced a paper-based 'monitored antibiotic authority form' for all third-generation cephalosporins and intravenous β -lactam/ β -lactam inhibitors prescribed.

2005

- Started contributing data to the National Antimicrobial Utilisation Surveillance Program.

2007

- Established hospital antibiotic stewardship group to develop a formal AMS program
- Started formal ID–adult intensive care unit (ICU) clinical liaison (including twice-weekly clinical liaison rounds).

2008

- Started formal ID–haematology clinical liaison (including weekly clinical liaison rounds)

- Developed successful business case for a dedicated ID pharmacist (1.0 FTE) position on basis of escalating antimicrobial use and costs, and concerns about antimicrobial resistance because of a hospital outbreak of vancomycin-resistant enterococci
- Established hospital AMS committee
- Endorsed antimicrobial restriction policy with three categories of antimicrobials: category A (unrestricted), category B (restricted) and category C (highly restricted).

2009

- Formally launched the AMS program
- Implemented electronic clinical decision support system to enable implementation of the antimicrobial restriction policy
- Started daily AMS rounds (weekdays only) to review selected patients taking restricted antimicrobials.

2010

- Started formal ID–neonatal/paediatric ICU clinical liaison (including weekly clinical liaison rounds)
- Developed guidelines for aminoglycosides and vancomycin
- Started collaborative work with surgical units and anaesthetists to develop local surgical antibiotic prophylaxis guidelines consistent with *Therapeutic Guidelines: Antibiotic* to assist with local implementation, together with auditing and feedback processes

- Conducted first whole-of-hospital point prevalence antimicrobial use survey (pilot site using the European Surveillance of Antimicrobial Consumption Network methodology); since 2010, these surveys have been conducted at least annually, targeting clinical syndromes or clinical units/services, with participation in the National Antimicrobial Prescribing Survey and with feedback provided to the relevant units/services.

2011

- Developed guidelines relating to antimicrobial use to assist local implementation, including for febrile neutropenia in haematology–oncology patients, and management of *Staphylococcus aureus* bacteraemia, endocarditis and prosthetic joint infection.

2012

- Engaged with stakeholders (including the emergency department) in response to inappropriate antimicrobial use in the treatment of community-acquired pneumonia to develop and implement a local community-acquired pneumonia guideline with an associated clinical pathway, together with an agreed audit and feedback process.

2013

- Joined a statewide AMS network that was established to support AMS programs across the state
- Provided support to regional acute hospitals without a dedicated ID service to help establish their AMS programs, and provided ongoing clinical support and AMS committee membership
- Replaced the antimicrobial restriction policy with an antimicrobial use protocol that specifies that antimicrobials are to be prescribed in line with *Therapeutic Guidelines: Antibiotic*, as well as prescribing criteria and antimicrobial restrictions
- Developed an online state medicines formulary for the state health service

with a comprehensive antimicrobial component

- Formally launched the adult sepsis pathway in the emergency department with an accompanying empirical antibiotic therapy guideline
- Started reporting an annual cumulative antibiogram.

2014

- Changed the hospital AMS committee to a regional AMS committee, expanded to involve primary health, oral health and mental health services
- Engaged with the general surgical unit in response to inappropriate antimicrobial use in the treatment of intra-abdominal infections to develop and implement a local antibiotic therapy guideline for intra-abdominal infections, and engaged with the general surgical clinical pharmacist to provide ongoing support to the junior clinical workforce to ensure adherence to the guideline.

2015

- Aligned auditing of surgical antibiotic prophylaxis with surgical site surveillance for key surgical procedures, with reporting to surgical units and external reporting to the Australian Council on Healthcare Services (Figure A4)
- Started annual antimicrobial use surveys in the rural inpatient facilities in the state, facilitated through the state infection prevention and control unit
- Started formal engagement of general practitioner liaison officers and general practitioner prescribers within the rural inpatient facilities.

2016

- Started formal ID–renal clinical liaison (including weekly clinic and regular meetings).

2017

- Helped establish an overarching state health service AMS committee to provide formal governance for AMS across the health service, which includes acute public hospitals, rural inpatient facilities, oral health services and mental health services
- Started planning statewide consistency for guideline development, and auditing/feedback and reporting processes

- Started planning a proposed relaunch of the AMS program for 2018.

Examples of AMS program outcome measurements

AMS outcome measurements are shown in Table A1 and Figures A4 and A5.

Figure A4: Surgical antimicrobial prophylaxis (SAP) data for coronary artery bypass graft procedures according to Australian Council on Healthcare Service criteria

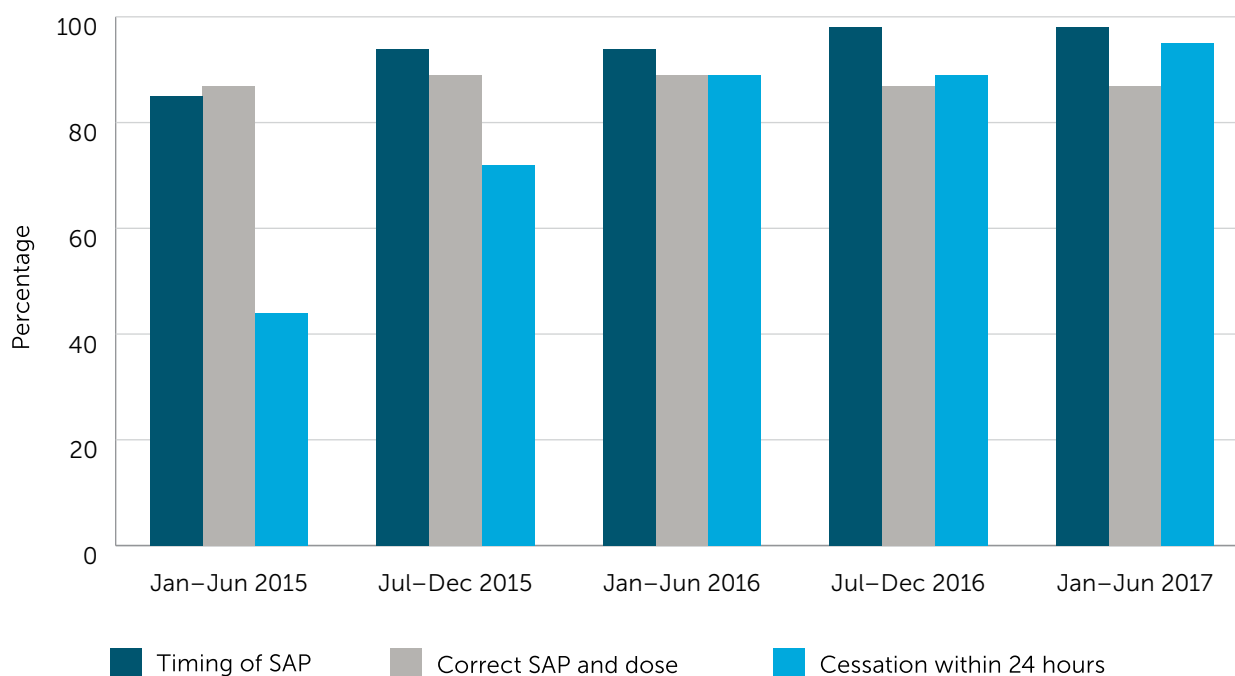


Figure A5: Total combined cost of antibacterial agents per occupied bed day (OBD)

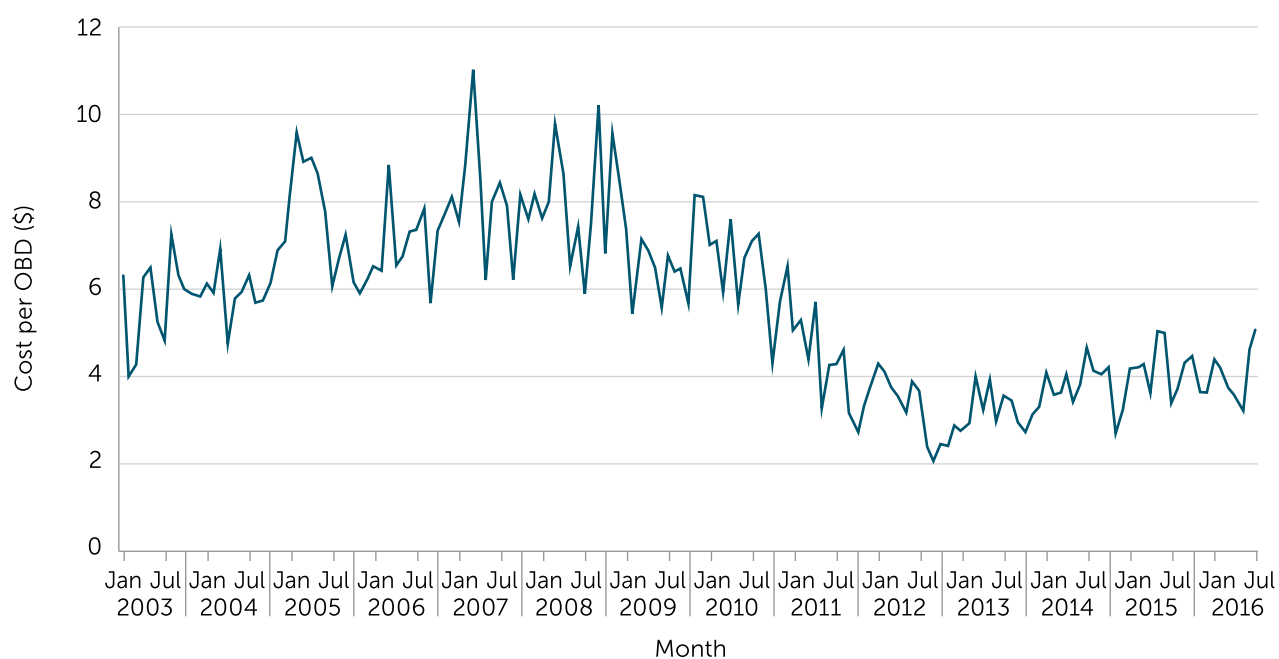


Table A1: Appropriateness of antimicrobial use: whole-of-hospital antimicrobial use data from the National Antimicrobial Prescribing Survey, 2015

Criteria	Percentage
Percentage of inpatients on antimicrobials	38
Percentage appropriateness (where appropriateness was assessable)	82
Percentage documented indication	80

