AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

16 Antimicrobial stewardship in community and residential aged care

Antimicrobial Stewardship in Australian Health Care

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Contents

Acronyms and Abbreviations

Abbreviation	Definition
AC NAPS	Aged Care National Antimicrobial Prescribing Survey
AMR	antimicrobial resistance
AMS	antimicrobial stewardship
APAS	Australian passive AMR surveillance
AURA	Antimicrobial Use and Resistance in Australia
CDI	*Clostridioides difficile* infection (previously referred to as *Clostridium difficile*)
COPD	chronic obstructive pulmonary disease
GNB	gram negative bacteria
GP	general practitioner
IPC	infection prevention and control
MAC	Medication Advisory Committee
MCS	Microscopy, Culture and Sensitivity
MDR	Multidrug resistant
MRSA	methicillin-resistant *Staphylococcus aureus*
MSU	mid stream urine
NAPS	National Antimicrobial Prescribing Survey
NPS MedicineWise	National Prescribing Service
NSQHS	National Safety and Quality Health Service
PBS	Pharmaceutical Benefits Scheme
PHN	Primary Health Network
QUM	quality use of medicines
RACF	Residential aged care facility
RMMR	Resident medication management review
RPBS	Repatriation Pharmaceutical Benefits Scheme
UTI	urinary tract infection
VICNISS	Victorian Healthcare Associated Infection Surveillance System
VRE	Vancomycin resistant Enterococci

Key Points

- Older people are more vulnerable to infections than younger adults, and may not have typical signs and symptoms of infection.
- People who receive aged care services are known to experience higher rates of infection than other older people, and also have higher overall rates of antimicrobial use, compared with the general population.
- The most commonly recorded reasons for use of antimicrobials in aged care services are for prophylaxis, or to treat cystitis; skin, soft tissue or mucosal infections; pneumonia; tinea; and, non-surgical wound infections. A number of these conditions can be managed without the use of antimicrobials.
- Inappropriate antimicrobial use can cause harms to the individual and the community.
- Inappropriate use of antimicrobials for residents of aged care homes, prolonged duration of antimicrobial prescription and widespread prophylactic use has been demonstrated for many years, through the Aged Care National Antimicrobial Prescribing Survey.
- People receiving aged care services have multiple risk factors that may lead to the emergence of antimicrobial resistance. Antimicrobial stewardship (AMS) is important to reduce antimicrobial resistance and improve infectious disease outcomes.
- Leadership and governance, policies and prescribing guidelines, monitoring and surveillance, education and training, audit and feedback are all key components of AMS programs in aged care.
- AMS initiatives address infections and associated risk factors, particularly those that contribute to the infectious diseases burden and high rates of antimicrobial use.
- Strategies for preventing and managing infections need to be tailored to local circumstances, including the local microbiology and prevalence of infectious diseases; nature of the aged care setting; and, individual characteristics of the people the organisation provides care for.
- It is important for staff and visitors to stay at home when they are feeling unwell, so as not to potentially give an infection to residents or other staff.
- Recipients of aged care services and carers, should be actively engaged in AMS by the aged care home.
- The Australian Aged Care Quality Standards require providers of aged care services to demonstrate actions to minimise infection-related risks to consumers, the workforce and the broader community. This includes implementing practices to promote appropriate prescribing and use, to support optimal care and reduce the risk of increasing resistance to antibiotics and have a clinical governance framework around AMS.

16.1 Introduction

Australia's National Antimicrobial Resistance Strategy describes priority actions to address the growing public health impact of antimicrobial resistance (AMR).[1] Antimicrobial stewardship (AMS) is a key component of the national strategy.

Antimicrobial Stewardship in Australian Health Care (the Antimicrobial Stewardship Book) was published in 2018 by the Australian Commission on Safety and Quality in Health Care to provide an overarching resource for AMS programs in Australia. The Antimicrobial Stewardship Book is available at www.safetyandquality.gov.au/our-work/healthcare-associated-infection/antimicrobial-stewardship/book/.

As additional chapters of the Antimicrobial Stewardship Book are developed on specific topics to support and advance AMS in Australia, these are published as supplements to the Antimicrobial Stewardship Book.

Antimicrobial Stewardship in community and residential aged care is the latest addition to the Antimicrobial Stewardship Book. This chapter:

- describes antimicrobial use and resistance in aged care services (encompassing residential and community aged care);
- identifies resources to support appropriate prescribing of antimicrobials; and
- provides practical strategies that can be implemented within aged care services to improve AMS.

16.1.1 Aged care services in Australia

The aged care system in Australia comprises a spectrum of subsidised services ranging from provision of basic supports to enable people to remain independent at home, through to full-time care in a residential aged care service (referred to as aged care homes in this Chapter).

The aim of the aged care system is to promote the wellbeing and independence of older people (and their carers), by enabling them to stay in their own homes, or by supporting their care needs in residential care.[2] Aged care is provided in people's homes, in the community, and in aged care homes. The objective of aged care is to deliver high-quality care to meet the individual's needs.[3]

Although most aged care services are provided to people in their homes, of Australians aged 65 years and over, 7% receive residential aged care each year. This equated to 270,500 people nationally in 2019.[4]

There is no minimum age to be eligible to receive government-subsidised aged care services in Australia; rather, access is determined by assessed needs.[4] Although the age of 65 years is often considered a threshold to be an 'older person', nearly 19,000 people under the age of 65 years use an aged care service each year. Of these, 34% receive permanent residential aged care, which is decreasing over time.[4]

The scope of the term 'older' is extended in Aboriginal and Torres Strait Islander peoples to include people aged 50 to 64 years, reflecting generally higher care needs at younger ages relative to other Australians. Approximately 9,600 Aboriginal and Torres Strait Islander peoples aged 50 to 64 years use aged care services each year, of which 6% use residential aged care.[4]

There are 2,695 residential aged care providers in Australia including government, not for profit and private providers. The aged care sector is set to expand to match the growing older Australian population. Although most of the government funded growth in aged care is in the residential care segment, the home care segment is growing rapidly, reflecting consumers' expressed preference for remaining at home for as long as possible.[5]

16.1.2 Infectious disease and ageing

Older people are more vulnerable to infections than younger adults. [6]

Physiological changes occur with ageing that affect the immune system. This is referred to as "immunosenescence" and is an age-related dysfunction of the immune system.[6] Changes to immune responses with ageing are associated with an increased risk of severe infections and reduced protective effects of some vaccines, including influenza, hepatitis B and pneumococcal vaccines.[7] However, it is important for older people to be immunised in line with national evidence-based guidelines to minimise the risk of vaccine preventable infection; more recently this involved vaccination for COVID-19.

Ageing also affects organ systems that can contribute to increased vulnerability to infections. For example, bladder prolapse in women and prostatic disease in men increase urinary stasis and subsequent risk of urinary infections. Blunting of the cough reflex can reduce protection of the airways and increases risk of respiratory tract infections. Chronic kidney disease affects bioavailability and excretion of some antimicrobials. Loss of subcutaneous tissue, reduced dermal collagen and reduced dermal blood flow increase susceptibility to skin infections and impair wound healing.[7]

Malnutrition in older people may contribute to increased susceptibility to infections. [8] Malnutrition may be due to a combination of socioeconomic, psychological and biological factors.[8]

Older people are more likely to have chronic diseases that increase risk of infections, including type 2 diabetes, chronic obstructive pulmonary disease, stroke and cancer. [9] Hospitalisation occurs more frequently in older people, with associated risks of acquiring infections in hospital.

Cognitive decline may also occur with ageing. People with cognitive decline may have more difficulty in maintaining hygiene (hand hygiene, showering, bathing), contributing to increased infection risk.[6] Cognitive decline, together with reduced sense of taste and smell with ageing, may contribute to inappropriate storage, cooking or consumption of food, with associated risk of infection.[10]

Polypharmacy is also more common, increasing the risk of drug interactions and adverse reactions when antimicrobials are prescribed. Some medications can also increase infection risk, such as immune suppressants, corticosteroids and proton pump inhibitors.[6,9]

16.1.3 Presentation of infections in older people

Infection can be more difficult to recognise in older people who may present with non-specific or atypical signs and symptoms of infection. [11]

Typical signs and symptoms in particular, fever may not be present. A blunted fever response may occur in older people compared with younger adults with severe infections.[12,13] Widespread use of paracetamol for persistent pain management may further blunt febrile response.

A variety of non-specific signs and symptoms of infection may occur in older people. Older people with infection may present with fatigue, drowsiness or social withdrawal, confusion, falls and / or decreased oral intake. They may also experience exacerbation of an underlying chronic illness, such as worsening glycaemic control with diabetes. These changes may be the only indication that infection is present. [7,11,12]

Being alert for such presentations is particularly important when caring for older people with cognitive impairment as they may be unable to accurately communicate their symptoms.[7] Infectious such as urinary tract infections or patient's with urinary catheterisation can predispose older patients to develop delirium. See the Commission's Delirium Clinical Care Standard for more information.

16.1.4 Infectious diseases and aged care services

Older people who reside in aged care homes experience a higher burden of infections than their peers.[14] There are many reasons for this, including their generally advanced age; poorer functional and health status; multiple comorbidities and compromised immune status; greater use of invasive devices in aged care homes (e.g. urinary catheters); cognitive impairment; and, a close living environment.[15]

Residents live closer to one another than in their own homes, and share equipment and facilities including toilet, dining, recreation and therapeutic facilities where infectious disease transmission may occur. They may share bathroom and toilet facilities, and also have frequent close physical contact with staff, which increases risk of transmission of infectious diseases.[16] Facility settings are therefore at increased risk of infection outbreaks occurring e.g. influenza, norovirus, scabies.

Infections are among the most common causes of hospitalisation of residents of aged care homes. Up to 25% of all hospitalisations from aged care homes are for infections, most commonly respiratory, urinary tract, gastrointestinal and skin infections.[17]

The often-limited on-site diagnostic capability and medical support in aged care homes can result in frequent transfer of aged-care residents to acute-care hospitals for medical assessment and care.[18]

Hospitals and aged care homes have frequent transfers for many clinical problems, not only infections, where services are not able to be provided at the aged care home. This presents opportunities for the spread of drug-resistant organisms, including Methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), multidrug-resistant (MDR) gram-negative organisms and other organisms, such as *Clostridioides difficile,* from one setting to the other. During hospitalisation, older people may acquire pathogens and, upon transfer to an aged care home, may become a source of transmission of infection to others.[19]

16.2 Antimicrobial use and aged care services

The burden of infection in older people is associated with a need for higher antimicrobial use. [20] The exact prevalence of infection and antimicrobial use in people receiving community-based aged care services is largely unknown.

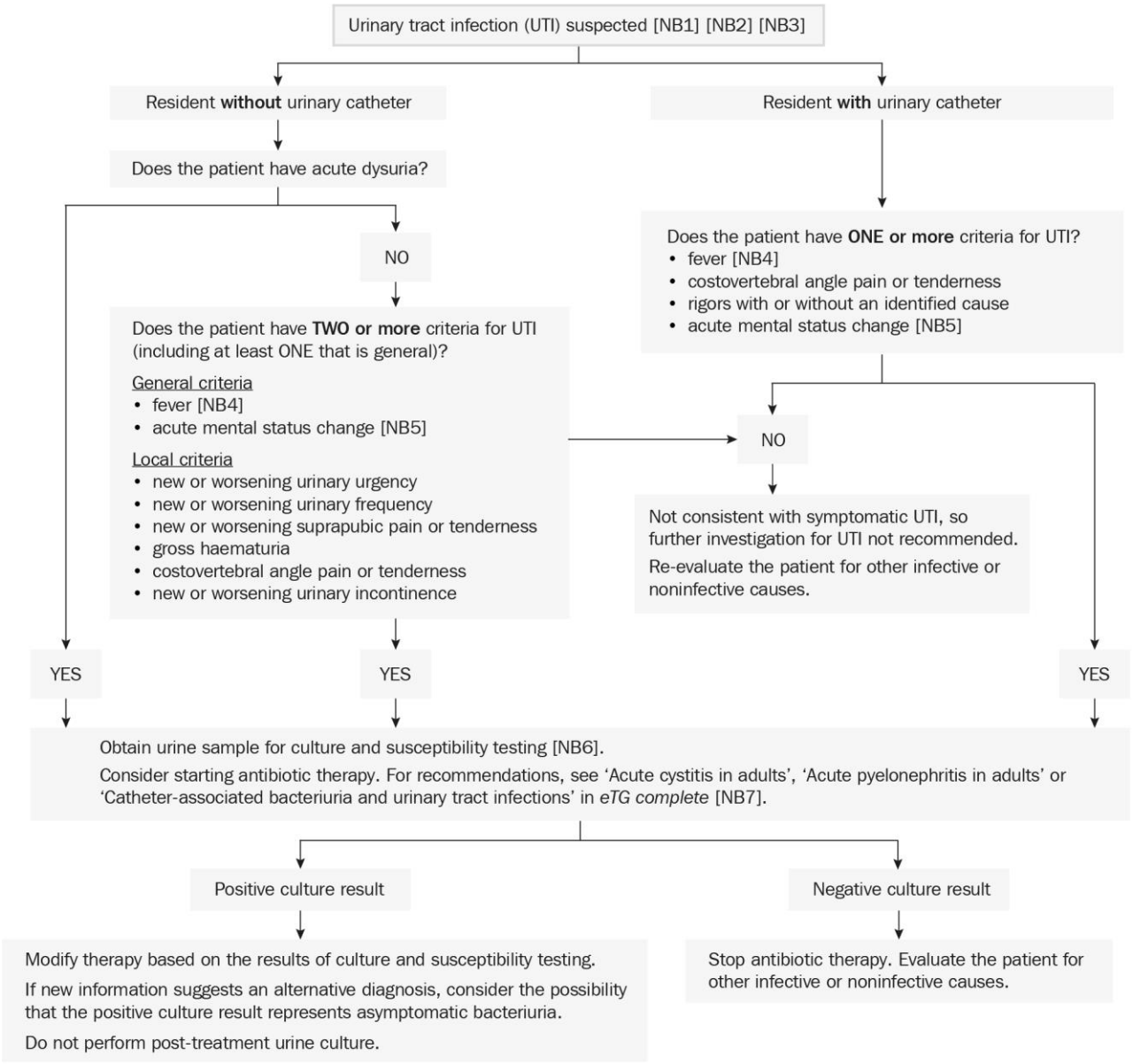
Approximately 3% of residents of aged care homes in Australia have infection at any point in

time and between 8% and 9% are receiving antimicrobials.[20, 21] Excluding topical and antiviral prescriptions, 6% of residents at any point in time are receiving antimicrobials and between 50% and 80% of aged care residents receive at least one course of antimicrobials annually.[20-22]

Inappropriate use of antimicrobials in aged care homes is a well-documented issue. Inappropriate use includes[23]:

- Prescribing antimicrobials for conditions that do not require antimicrobials (e.g. asymptomatic bacteriuria – see Figure 1).
- Prescribing antimicrobials for unconfirmed infections.
- Prescribing antimicrobials for undifferentiated illness (e.g. delirium without infective cause being identified)
- Failure to review and adjust antimicrobial prescriptions based on microbiological results.
- Prolonged duration of antimicrobial prescription.
- Widespread use of topical antimicrobial and "when required" (prn) prescribing.
- Poor documentation of indication, duration and review or stop date of antimicrobials.

Figure 1 Assessment and treatment of aged-care facility residents with suspected urinary tract infection



NB1: Do not investigate or treat cloudy or malodorous urine in aged-care facility residents who do not have other signs or symptoms of UTI.
NB2: Consider whether an alternative diagnosis is likely. Consider both infective (eg pneumonia) and noninfective (eg medication-related adverse events) causes.
NB3: Establish whether an advance care plan is in place as it may influence assessment and management (eg whether investigations are performed or antibiotics are given).
NB4: Fever is defined as a temperature higher than 38°C or an increase of more than 1.5°C above baseline temperature.
NB5: Acute mental status changes include new change in level of consciousness, periods of altered perception, disorganised speech and lethargy.
NB6: If the resident has an indwelling urinary catheter, see *eTG complete* for a guide to collecting urine samples in patients with indwelling urinary catheters.
NB7: The duration of therapy does not need to be modified for this patient group and should always be stated on the prescription.

Source: Reproduced with permission from Assessment of UTI and bacteriuria in aged-care facility residents [published 2019 Apr]. In: eTG Complete [digital]. Melbourne: Therapeutic Guidelines Limited, 2021 Mar. https://www.tg.org.au - see *eTG Complete* online for further information and other references included in this figure

The most common clinical indications given for prescriptions are cystitis; skin, soft tissue and mucosal infections; pneumonia; tinea; and, non-surgical wound infections.[21] Some of these conditions can be prevented by managing hydration and providing good basic hygiene care. Non-pharmacological management is a key consideration for these conditions.[21]

Cefalexin, topical clotrimazole, amoxicillin–clavulanic acid, trimethoprim and doxycycline are the most commonly prescribed antimicrobials.[21,24,30] Narrower spectrum agents than cefalexin and amoxicillin–clavulanic acid are recommended for many infections as they are less likely to promote antimicrobial resistance.[21]

Prescription of prophylactic antimicrobials is common – approximately 20% of prescriptions are for prophylaxis.[21] This is concerning as antimicrobials are rarely recommended for prophylaxis.

Almost one-third (30.4%) of all prescriptions are for topical antimicrobials, which also account for more than 90% of prn prescriptions, most commonly clotrimazole (74.1%).[21] The prn prescribing and use of clotrimazole is concerning; use should be limited to recommended treatment courses and clinical review. Failure to document clinical indication, treatment courses and consider non-pharmacological management may lead to inappropriate duration and unnecessary use of antifungal therapy, either topically or systemically. This may contribute to the development of antimicrobial resistance. It also causes delays in diagnosing and appropriate management of non-fungal skin conditions.[21]

16.2.1 Antimicrobial resistance

Antimicrobial-resistant organisms and their resistance genes can spread readily between people. This can happen in the community, primary care services, hospitals and aged care homes. The spread of these organisms can significantly affect the community, patients, health services and the health system. Therefore, it is critical that resistant organisms with the highest risk of causing harm to humans are identified and monitored through enhanced surveillance and managed appropriately.[23]

People receiving aged care services may have frequent and / or prolonged hospitalisations; prolonged or frequent use of antimicrobials; the presence of wounds, ulcers or pressure injuries that are prone to infection; and, invasive medical devices in situ, which increases their risk of acquiring resistant organisms.[25,26] Further, people residing in aged care homes are a source of transmission of MDR infections to other areas of the community.[22,23]

MRSA, VRE and MDR gram-negative bacteria (GNB) such as *Escherichia coli* cause infections in recipients of aged care.[25] Data from the Australian Passive AMR Surveillance (APAS) system show the proportion of methicillin resistance in *S. aureus* isolates is higher in aged care homes than in other settings and increased from 25% in 2006 to 32% in 2017.[23] The prevalence of colonisation with multidrug-resistant GNB among aged-care residents is higher than the prevalence of MRSA and VRE.[25]

Awareness of the emerging trends of various MDR organisms is important to inform empirical antimicrobial prescribing recommendations in this high-risk population. Prescribers must therefore keep up to date with current guidelines.

16.3 Antimicrobial stewardship

AMS in aged care is required to address the growing problem of antimicrobial resistance in aged care settings. AMS in aged care requires a collaborative effort across health and aged care professionals and consumers.

Effective AMS strategies both reduce the risk of infections occurring, whilst simultaneously identifying and managing infections appropriately. AMS balances the need to:

- Detect serious infections and institute appropriate management in a timely manner (in the context of the person's goals and wishes); and
- Avoid unnecessary antimicrobial use.

The Australian Aged Care Quality Standards reflect the importance of AMS and require aged services organisations to demonstrate actions to minimise infection-related risks to consumers, the workforce and the broader community.[27]

Standard 3 requirement (3)(g)

Minimisation of infection-related risk through implementing:

·standard and transmission-based precautions to prevent and control infection

·practices to promote appropriate antibiotic prescribing and use to support optimal care and reduce the risk of increasing resistance to antibiotics.

Standard 8 requirement (3)(e)

Effective organisation wide systems are required for preventing, managing and controlling infections and antimicrobial resistance.

A clinical governance framework should include, but is not limited to, antimicrobial stewardship.

16.4 Antimicrobial stewardship program strategies

Effective infection prevention and control measures incorporate AMS interventions to improve infectious disease outcomes for recipients of aged care services.[19] There are a range of infection control resources included in the resources section of this chapter, which can assist providers with AMS. Strategies for AMS that have been successfully applied in a range of settings are also described at Chapter 3 of this book.

There is less evidence to guide the implementation of AMS strategies in aged care services compared with hospitals. However, the same principles for implementing AMS, discussed in other chapters, can considered by aged services organisations. Each aged service home will need to assess the barriers and enablers for establishing good AMS practice in their services and embedding it in their organisational and clinical governance structures. Using an AMS Gap analysis tool may assist the organisation to identify areas for AMS improvement (see Resources). This work may also be undertaken by the overarching organisation, available for implementation in individual aged care home.

AMS is more challenging in aged care homes compared with acute hospitals. In aged care homes there are logistical challenges with provision and availability of medical care and pharmacy support, and with accessing external infectious diseases expertise and diagnostic facilities. Nursing staff have a significant role in infection management and AMS and need to be supported by the aged care home and be provided access to appropriate resources (e.g., Therapeutic Guidelines: Antibiotic and the Australian Medicines Handbook).[28,29]

16.4.1 Program governance

Accountability for antimicrobial use within aged services organisations should sit at the highest level of management, which takes responsibility for ensuring that an AMS program is developed and implemented, and its outcomes are evaluated.

Governance bodies are also accountable for development of AMS policies, procedures and standard processes, and with integrating AMS with the aged service's quality and patient safety functions.

The role of the governance and executive leaders in AMS programs is discussed further in Chapter 2.

16.4.2 The AMS team

A successful AMS program requires a multi-disciplinary team approach, where relevant team members contribute to AMS within their scope of practice and responsibilities. AMS team members provide valuable leadership in implementing AMS activities within the organisation, and in monitoring and reporting on success. Team members need a clear understanding of their AMS roles, which is communicated to other staff.

In smaller aged service organisations, the size and make-up of the team may be modest. In other organisations, team membership may be broad. Managers, registered nurses, enrolled nurses,

personal carers, general practitioners (GP), pharmacists, geriatricians, other visiting health professionals and recipients of care may form part of the AMS team.

Nurses are key to AMS in aged care homes – nurses are a constant in patient care, advocate for patients, and work collaboratively with other aged care and healthcare professionals. All Australian government-funded aged care homes are now required to also have a dedicated IPC nurse lead onsite.*

General practitioners (GPs) provide most medical care to people receiving aged care services. Working together with GPs who provide care within aged services organisations is important to identify and manage infections appropriately across the care team. It is acknowledged that engaging GPs in AMS may be challenging as they are usually visiting service providers, not remunerated for AMS activities, and are generally not employed directly by the aged services organisation. Primary Health Networks (PHNs) maybe also be a potential source of support.

Pharmacists perform resident medication management reviews (RMMRs) and receive Australian Government funding to provide Quality Use of Medicines (QUM) services, which may involve activities relating to antimicrobial stewardship, such as clinical governance, education and training, and clinical audits.

- RMMRs are a service provided by a pharmacist to an eligible person residing in an eligible Australian Government-funded aged care home with the intended purpose of identifying, resolving, and preventing medication-related problems. A Pharmacist accredited to provide RMMR services will conduct a RMMR for a Patient when requested to do so by the Patient's Referring Medical Practitioner. RMMRs can support the quality use of antimicrobials and minimise risk of adverse events associated with antimicrobial use. Pharmacists can identify antimicrobials with no clearly recorded indication, prolonged use, no end date recorded and inappropriate prn prescribing.
- QUM services, which are facility-focused, complement resident-focused services such as RMMRs. Further information about the Program can be found on the Pharmacy Programs Administrator website: www.ppaonline.com.au.

Pharmacists also advise on appropriate dose delivery forms for people with difficulty swallowing. These activities will assist aged care homes to meet and maintain medication management accreditation standards, to comply with regulatory requirements, and the development of, and reporting on, quality indicators and other quality measures.[30] More information about the role of the pharmacist in aged-care settings is in Chapter 11.

Frequent and regular communication between AMS team members about AMS priorities, results of testing and surveillance and the use of guidelines relevant to AMS is a key feature of effective AMS. Innovative ways of communicating across the team may be required as team members may be within or outside the organisation and can come from various health or aged services professional roles.

Access to specialist providers with a role in AMS can be challenging for aged care providers. Accessing microbiologists and infectious disease physicians can be particularly challenging, but this advice may be required from time to time. Understanding local availability of these services, including how to access them, is a consideration for AMS planning.

16.4.3 Policies and prescribing guidelines

AMS policies and prescribing guidelines are an important component of any aged service's infection prevention and control program. Organisation-wide antimicrobial stewardship policies and procedures can promote safe and effective use of antimicrobials for residents.

AMS policies and procedures are based on evidence-based guidelines for the management of infections. Antimicrobial prescribing guidelines for older people may be different to the population as a whole as there may be a lower threshold for antimicrobial use in older people.[28,29] Easy access to organisational policies and prescribing guidelines for staff and visiting health professionals is therefore important to facilitate AMS.

In hospitals, the availability of an organisational policy and formulary has supported AMS clinical champions to translate evidence into practice. While the structure and function of aged care services are different that the acute sector, there may be aspects of this approach that are adaptable to aged care settings.

Organisations may consider implementing policies promoting the use of the national residential medication chart, available at https://www.safetyandquality.gov.au/our-

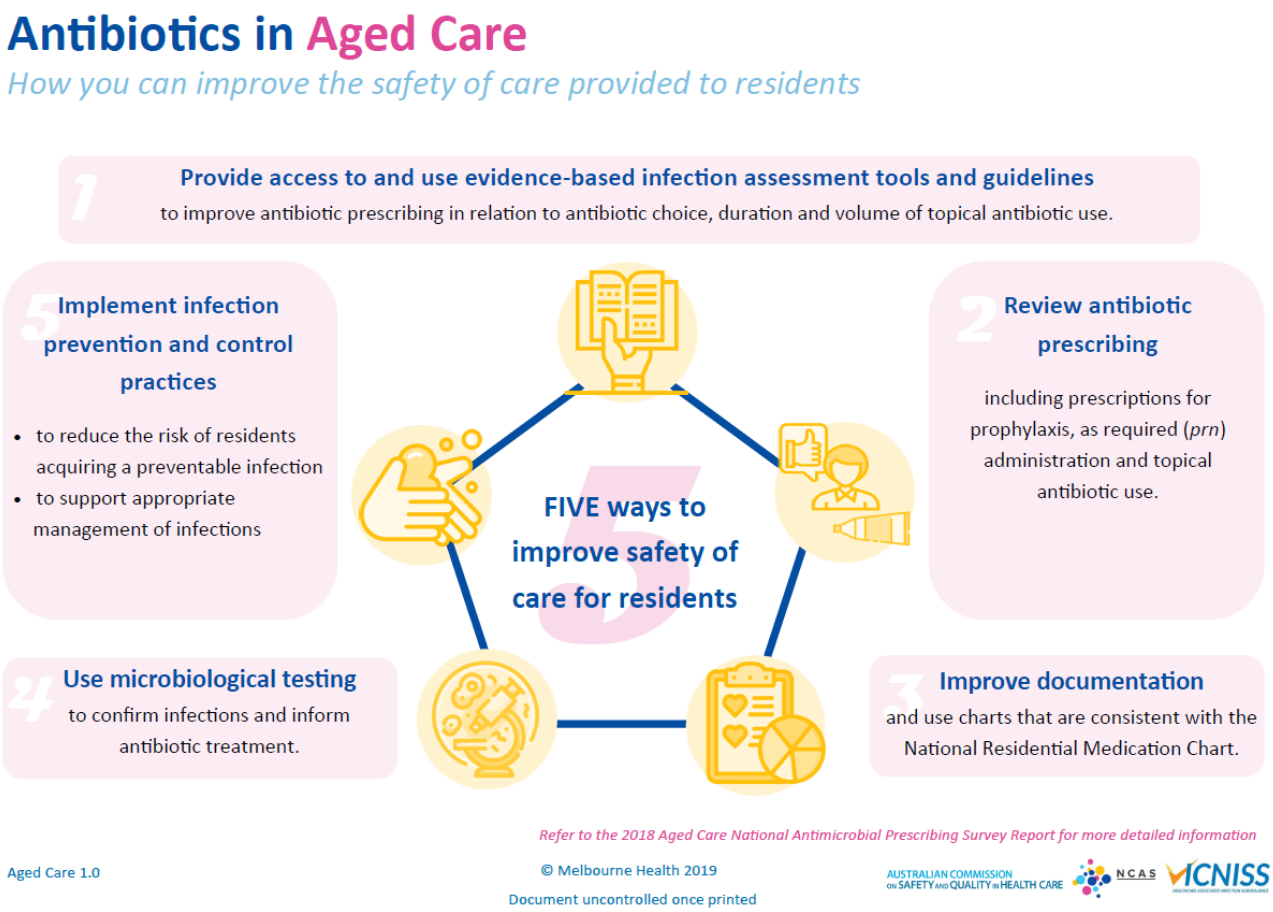
* https://www.agedcarequality.gov.au/sites/default/files/media/final_a4_ipc_fact_sheet.pdf

work/medication-safety/national-residential-medication-chart. The chart was developed for use in aged care homes to improve medication safety for residents. This resource minimises the administrative burden of prescribers, aged care staff, and pharmacists when ordering, administering and supplying medicines.

Antimicrobial usage needs to minimise associated harms. Allergies, side-effects e.g., nausea, diarrhoea, candidiasis, the cost of medications and risk of resistant infections all have adverse consequences for the older person. A range of strategies can be put into place to improve their safety (Figure 2). It is essential organisational policies and procedures include careful documentation of allergies to antimicrobial preparations.

Other aspects of antimicrobial prescribing that can be considered for inclusion in policies and guidelines are summarised in Table 16.1.

Figure 2. Antibiotics in Aged Care



Source: VICNISS

Table 16.1 Antimicrobial prescribing in aged-care homes: areas of concern[16] [*]

Area of potential antimicrobial misuse	Evidence or reason	Changes to be considered
Antimicrobial prescribing without microbiological investigation	Inappropriate empirical antimicrobial prescribing can be associated with poorer clinical outcomes and may increase risk of mortality in some cases.[16] Likely causative pathogens should be investigated, especially for symptomatic urinary tract infection, to guide empirical antimicrobial therapy. This supports use of antimicrobials that are most appropriate for the resident's infection and are most narrow-spectrum.	The 'wait and see' approach to guide prescribing is a reasonable approach for recipients of care who are not acutely unwell or unstable. If it is determined that symptoms are of sufficient intensity or individual patient context that a delay of 2–3 days while waiting for culture results is not appropriate, empirical antimicrobial therapy should be initiated. Treatment must follow informed consent, and requires shared decision-making with the older person and their carer, if required. Every effort should be made to obtain specimens for laboratory examination and culture. Just because someone usually wears continence aids does not mean that a specimen cannot be collected with individualised strategies. Prescribers should review recent antimicrobial susceptibility results, if available, to guide empirical prescribing.
Prolonged duration of antimicrobial treatment	Unnecessarily prolonged antimicrobial treatments increase the risks of antimicrobial resistance and side effects. Antimicrobial courses of ≤7 days are as effective as longer treatment for most common bacterial infections. Normally, a ≤5-day course of antimicrobial(s) is sufficient for uncomplicated urinary tract infections and respiratory tract infections, including pneumonia. Topical antifungal courses of ≤14 days are as effective as longer treatment for common fungal skin conditions.	Prescribers should have access to evidence-based antimicrobial treatment guidelines appropriate for aged care, (see the resources section of this Chapter), with recommendations about appropriate dosages and duration of therapy. All antimicrobial treatment plans should be properly documented in the antimicrobial ordering form, with clear treatment indications and planned duration of treatment or stop date. Prescribers should plan to review antimicrobial(s) prescribed after 2–3 days of treatment to follow-up clinical response, side effects and microbiology results which allows

[*] Guidelines may not apply to all recipients of aged care services (e.g. people receiving immunosuppressive medications, cancer treatments). Clinical judgement will determine individual patient assessment and management. Specialist input may be required.

Area of potential antimicrobial misuse	Evidence or reason	Changes to be considered
		for change to directed rather than empirical prescribing. Avoid chronic use of highly renal dependent drugs.
Broad-spectrum or parenteral antimicrobial treatment for older people with advanced dementia or end-stage of illness	Some studies indicate that antimicrobial therapy is futile (does not prolong survival or reduce discomfort) for the end stages of life; other studies report that antimicrobials do relieve discomfort for some dying patients. There is a lack of evidence to show superiority of parenteral antimicrobial therapy in this group of patients.	Aggressive antimicrobial therapy for pneumonia in recipients of care with advanced dementia is contentious and may be best guided by ongoing clinical assessment of potential benefits, Advance Care Directives and practice guidance. It is important to discuss and document wishes and goals of treatment with the older person and / or their substitute decision makers.
Antimicrobial therapy based on clinical appearance of urine, positive urine dipstick finding, asymptomatic bacteriuria or minimally symptomatic urinary tract infections	Evidence from randomised controlled trials does not support treating asymptomatic bacteriuria in older people in aged care homes. Asymptomatic bacteriuria is widespread among aged-care residents, particularly those with chronic indwelling urinary catheters.§ However, antimicrobial therapy does not prevent recurrent bacteriuria or symptomatic infection.	Urinalysis and/or collection of urine cultures should not routinely occur from asymptomatic patients. For patients who have minimal symptoms it is generally safe to watch and wait, without antimicrobials. In chronically catheterised patients, the indwelling catheter should be changed before starting the antimicrobial, and a fresh urine specimen should be collected from the newly placed catheter. Discontinuation of catheter use where possible, good resident hygiene and proper aseptic technique in changing catheters are keys to preventing urinary tract infections and other urinary complications.† Bacteria grow in urine sitting in catheter bags and hence fresh samples need to be taken.
Widespread use of prophylactic antimicrobials for urinary tract infections	Prolonged antimicrobial use, in the absence of infection risk, will select for resistant organisms and increase risk of adverse drug events from antimicrobials.	Other actions (e.g. increased hygiene, good hydration) should be considered.
Widespread prescribing of quinolones as empirical	Historical use of quinolones in aged care was widespread, mainly due to their excellent bioavailability, long half-life and broad-spectrum activities. However, quinolones have a	Quinolones should be avoided as first-line empirical therapy unless the patient is known to have a multidrug-resistant organism in

† The *Australian Guidelines for the Prevention and Control of Infection in Healthcare.* (2019). Canberra: National Health and Medical Research Council are included in the resources section of this Chapter and provide further guidance on best practice management.

§ Lim CJ, Stuart RL, Kong DC. Antibiotic use in residential aged care facilities. Aust Fam Physician. 2015 Apr;44(4):192-6.

Area of potential antimicrobial misuse	Evidence or reason	Changes to be considered
treatment for urinary tract infections	significant side-effect profile, particularly in older people.[29] High rates of quinolone-resistant gram-negative organisms, including *E. coli* have been reported in aged care homes with high quinolone use. Private prescriptions for quinolones are not captured in PBS data.	the urine that is susceptible to a quinolone and there are no alternative options available.
Widespread antimicrobial prescribing for upper respiratory tract infections or acute bronchitis without confirmed bacterial infections	Cough in an older person may frequently result from causes that are not infection related. For example, chronic obstructive pulmonary disease (COPD), chronic bronchitis, bronchospasm, medication side-effect etc. Upper respiratory tract infections in aged care homes are usually caused by viral pathogens, and empirical antimicrobial treatment is seldom necessary (unless symptoms are prolonged or the patient has underlying lung disease). Specific antimicrobial treatment to target *Pseudomonas* isolates from the respiratory tract (which frequently represent colonisation) is not always necessary.	Differentiate between viral and bacterial respiratory tract infections to reduce inappropriate antimicrobial use. If an outbreak is suspected, timely nose and throat swab testing, notification of medical personnel and instituting enhanced infection prevention and control measures is critical. Check vaccination status and ensure vaccinations are up to date.
Routine antimicrobial treatment for gastroenteritis	Antimicrobials are not routinely recommended for treating gastroenteritis because most cases are caused by viruses rather than bacteria. Consider *Clostridioides difficile* infection (CDI) as a differential diagnosis, especially if the person has had recent or current antibiotic exposure. Diarrhoea in older people frequently has a non-infection-related cause (e.g. medication side effect, constipation with overflow).	Consider enhanced infection prevention and control measures for managing the older person. Microbiology testing to identify pathogen (e.g. stool MCS, *C. difficile*, viral testing). Antimicrobials are recommended (1) empirically for severe gastroenteritis (2) when a specific bacterium has been identified in a stool sample and patient not clinically improving.[25]
Targeted treatment against organisms isolated from chronic ulcers or skin lesions	Infection should be diagnosed on clinical grounds - do not use swabs to diagnose infection as all wounds and ulcers will contain bacteria. Swabs should be used to identify the pathogen where there is clinical suspicion of infection that requires antimicrobials. Growth of organisms from a skin swab may represent either colonisation or infection. If the ulcer or skin lesion does not appear infected, antimicrobials (systemic or topical) are not indicated. They do not improve wound healing and may expose the resident to unnecessary antimicrobial adverse effects and increase risk of colonisation with MDR organisms.	For non-infected ulcers or skin lesions, active ulcer dressing and other management strategies are indicated. This may include assessment and management of pain and underlying causes (e.g. pressure injury, nutritional deficiency, poor glycaemic control, oedema, circulatory issues). Some people will require referral to a wound consultant. For infected ulcers or skin lesions, systemic antimicrobial therapy may be required for people with cellulitis, deep soft tissue or bone infection.

16.4.4 Monitoring and surveillance

Monitoring for resistant organisms and antimicrobial sensitivities can help clinicians make more appropriate empirical antimicrobial choices. When antimicrobials are prescribed, ongoing monitoring from all clinicians involved in care for optimal safety and efficacy of the prescription is essential.

The Aged Care Quality and Safety Commission's Standard 3 (Requirement 3(g)) requires aged care homes to assess the risk of and take steps to prevent, detect and control the spread of infections, and to minimise the development and spread of resistant organisms. The Standard encourages organisations to use data to monitor infections as part of their infection prevention and control program. Assessors will look for evidence from aged care providers to determine whether this requirement is met.

Methods and systems of infection surveillance vary between organisations. The Aged Care National Antimicrobial Prescribing Survey (AC NAPS) is one standardised audit tool that can be used to monitor the prevalence of infections, antimicrobial use in aged care homes and multi-purpose services.[20,23]

Although participation in AC NAPS is voluntary, the number of aged care homes participating in 2020 has grown to 568 residential aged care services (510 aged care homes and 58 multi-purpose services). Since 2017 all aged care homes operated by the Victorian Government have been required to participate in AC NAPS as part of the Victorian Nosocomial Infections Surveillance System (VICNISS) Infection Control Indicator Program.[20,23]

Participation in AC NAPS or other auditing activities supports facilities to identify areas for improvement in antimicrobial use, preventing infections and helping reduce antimicrobial resistance. Participation also helps improve safety and quality of care for residents and assists the demonstration of compliance with the Australian Aged Care Quality Standards.[20,23] AC NAPS provides resources and support for facilities to help perform the survey and online education is available.

An example of the AC NAPS criteria for infections is provided at Figure 3.

Figure 3. AC NAPS criteria for infection

System criteria; *Complete for all residents with any signs and / or symptoms of a suspected or confirmed infection on the **survey day** or in the **2 days prior**. Multiple system criteria are possible*

Urinary tract

❒ Acute pain on urination
❒ Acute pain, swelling or tenderness of the testes, epididymis or prostate
❒ Back pain or tenderness (new onset)
❒ Blood in urine
❒ Frequency (new or marked increase)
❒ Incontinence (new or marked increase)
❒ Low blood pressure with no alternate site of infection (new onset)
❒ Pus discharging from the urethra or around a catheter
❒ Suprapubic pain (new onset)
❒ Urgency (new or marked increase)
❒ Urinary retention

❒ **Other** signs +/or symptoms not listed above

Urinary catheter
❒ none
❒ intermittent *(in and out)*
❒ indwelling
❒ suprapubic
❒ external
❒ nephrostomy tube

Urine dipstick
❒ not performed ❒ performed; *date / /*
Nitrite
❒ negative ❒ positive ❒ not recorded
Leucocyte esterase
❒ negative ❒ 1+ ❒ 2+ ❒ 3+ ❒ not recorded

Urine specimen *in the **6 days prior** to **3 days after** the **survey day***
❒ not collected ❒ collected: *date / /*
❒ final report attached

Respiratory tract

❒ Chest wall pain
❒ Chest X-ray (recent, normal)
❒ Chest X-ray showing pneumonia or new infiltrate (recent)
❒ Cough (new or increased)
❒ Headache or eye pain (new)
❒ Hoarseness
❒ Loss of appetite
❒ Lung abnormalities (new or increased)
❒ Malaise
❒ Myalgia or muscle pain
❒ Oxygen saturation < 94% on room air or a reduction of > 3% from baseline
❒ Pain on swallowing
❒ Respiratory rate ≥ 25 breaths per minute
❒ Runny nose or sneezing
❒ Sore throat
❒ Sputum (new or increased)
❒ Stuffy nose
❒ Swollen or tender neck glands

❒ **Other** signs +/or symptoms not listed above

Sputum specimen *in the **6 days prior** to **3 days after** the **survey day***
❒ not collected ❒ collected: *date / /*
❒ final report attached

Respiratory virus test *in the **2 days prior** to **3 days after** the **survey day***
❒ not collected ❒ collected: *date / /*
❒ final report attached

Skin or soft tissue

❒ Heat
❒ Pus present at wound, skin or soft tissue site
❒ Redness
❒ Serous discharge
❒ Swelling
❒ Tenderness or pain

Rash
❒ rash or lesions characteristic of a fungal skin infection
❒ maculopapular rash and/or itching rash
❒ vesicular rash

Doctor or laboratory confirmation for
❒ fungal skin infection
❒ herpes simplex or zoster
❒ scabies

❒ Linkage to laboratory confirmed case of scabies

❒ **Other** signs +/or symptoms not listed above

Swab *in the **6 days prior** to **3 days after** the **survey day***
❒ not collected ❒ collected: *date / /*
❒ final report attached

Oral

❒ Doctor or dental provider confirmation
❒ Presence of raised white patches or plaques in mouth

❒ **Other** signs +/or symptoms not listed above

Eye

❒ Itching or pain > 24 hours
❒ New or increased conjunctival redness
❒ Pus from one/both eyes present for >24 hrs

❒ **Other** signs +/or symptoms not listed above

Source: NCAS

16.4.5 Audit and feedback

Clinicians can audit their prescribing practices to monitor whether their prescribing patterns are consistent with their peers and with evidence-based guidelines and protocols. Aged care providers may also rely on audit and feedback to monitor and improve the use of antimicrobials in their service. This may be via committees such as their Medication Advisory Committee or IPC team.

Audit and feedback of prescribing practices have been shown to reduce inappropriate antimicrobial prescribing in other settings.[31] For example results from the AC NAPS is useful data for providers to communicate to prescribers.

Data can sometimes also be obtained from continuous monitoring systems through measurement of antimicrobial ordering or dispensing software.[32]

AC NAPS data, described in Section 16.4.4, can also support AMS audit and feedback activities within aged care homes.

The Australian Commission on Safety and Quality in Health Care will continue to identify opportunities for engagement with the Aged Care Quality and Safety Commission, and aged care homes to improve surveillance and strategies for enhanced prescribing and use of antimicrobials.

Antimicrobial stewardship in aged care homes – a case study.

On one day each year between 2016 and 2019, the Sunshine Coast Hospital and Health Service AMS team conducted a point prevalence audit within one aged care home to describe patterns of antimicrobial use.

The team comprised of an AMS Pharmacist and AMS Clinical Nurse. The AC NAPS Antimicrobial and Infection collection tools were used to conduct the audit, capturing:

- Antimicrobials prescribed including duration and dosing data.
- Mode of prescription.
- Indications for prescription.
- Documented adverse drug reactions to antimicrobials.
- Specimens collected and microbiology results.

Audit results demonstrated treatment regimens for urinary tract infections were appropriate according to the results of microbiology testing. However, use of antifungal medications for skin rashes was identified to be a problem.

Antifungal resistance may increase mortality in vulnerable groups, including residents of aged care homes.

Audit results were therefore presented to managers and staff of the aged care home and strategies were put in place to reduce the unnecessary use of antifungal agents, including:

- Specifying recommended timeframes for clinical assessment of residents by prescribers.
- Clearly documenting a treatment plan for all new antimicrobial prescriptions.
- Introducing a nursing practice pathway for excoriated skin as standard practice.

16.4.6 Education and training

Although a successful AMS program requires team members to undertake designated roles in AMS, all staff in aged care services have a role to play in AMS. AMS education can be tailored to the needs of staff working in different aged care roles and help to foster a culture of quality and safety. It is important for staff to be aware of infectious diseases relevant to the older people they care for and to know how about organisational policies for diagnosis, treatment and referral. [32]

Staff education and training can incorporate recognition and management of infections, antimicrobials used for specific types of common infections and their complications. Training may also include a focus on recognising and acting on possible outbreak situations, infection prevention and control interventions and the importance of accurate and descriptive documentation.

Multi-faceted education, using a range of education modalities, is the most successful approach to reducing unnecessary and inappropriate prescribing.[32] Educational materials could be made available at the point of care – on posters, pre-printed forms and electronic systems.

Aged care homes should also provide general education to recipients of care, and families, on how to prevent the spread of infection through correct hand hygiene practices and cough etiquette, requirements for transmission-based precautions where relevant to the resident's care needs and the role and limitations of antimicrobials in managing infections.

Where recipients of care cannot understand or remember how to manage simple hygiene practices, staff should be guided in how to remind and assist them.

The IPC lead has specialised education and training needs. Courses are available through the Australasian College for Infection Prevention and Control and various universities.

Additional strategies to support AMS education are described in Chapter 6.

16.4.7 Preventing and managing infections

Infection prevention and control aims to reduce the risk of residents acquiring preventable infections. Infectious agents can be easily transmitted during care and come primarily from interaction with other people – residents, carers, clinicians and visitors. The prompt identification of individuals presenting with, or with risk factors for, infection and putting in place appropriate measures to prevent the spread of infection is important to reduce risk of transmission of infection to recipients of care.

Facilities should ensure comprehensive infection prevention and control policies are in place and staff are familiar with policy requirements and comply with them. The Australian Guidelines for the Prevention and Control of Infections in Health Care (2019) (see resources) can be used to develop policies and protocols in aged care.

A comprehensive approach to infection prevention and control includes effective cleaning practices; hand hygiene; monitoring for infection and responding in a timely way; limiting visiting and interaction where infection is known; appropriate use of personal protective equipment; safe handling of waste and linen; safe cleaning of shared equipment to minimise infection risks; and staff and visitor education. The Commission has a number of e-learning modules for Infection Prevention and Control, with a number suitable for the aged care workforce. (See Resources)

Resources are available from the Australian Commission on Safety and Quality in Health Care, the Australian Government Department of Aged Care and the Aged Care Quality and Safety Commission and are described in the Resources section of this Chapter.

When implementing and supporting an AMS program in aged care homes, resourcing should be reviewed to identify enablers and barriers, and strategies to overcome barriers. Generally, barriers can be categorised into those related to the resident cohort, the complex physical environment, organisational workflow, and culture (Table 16.2).[33]

In addition to strategies indicated above, other activities to prevent infections in aged care homes include:

- Ensuring resident immunisations are up to date.
- Promoting good nutritional status and optimising fluid intake.
- Minimising the use of invasive devices where possible (e.g., urinary catheters) and removing these when no longer required.
- Assisting residents with activities such as good hand hygiene, and general hygiene where this cannot be achieved independently.
- Staff maintaining the recommended healthcare worker immunisations and provider organisations maintaining a record of staff and visiting clinicians' vaccinations.
- Facilities requiring visitors to be immunised in certain circumstances as a requirement of attendance at the facility.

- Providing easy access to facilities to promote regular hand washing with soap and water or use an alcohol-based hand rub by staff, visiting clinicians and visitors generally.
- Encouraging visiting clinicians and staff to report if they are experiencing symptoms related to possible infection (diarrhoea, vomiting, fever, sore throat or jaundice) or infected skin lesions, and to not attend the workplace if unwell.
- Aged care homes implementing procedures to exclude visitors from the facility who are experiencing symptoms related to possible infection. Lessons learned during the COVID-19 period may be helpful in this regard.

As general practitioners are the primary medical care providers, aged care homes should promote systems of care and collaborative arrangements to provide residents with access to safe, timely and comprehensive medical management of infections. A person centred approach that fosters trust, establishes mutual respect to share decisions and plan care should be the cornerstone.

Residents (and their support people or substitute decision-makers where requested or required) should participate in decisions regarding managing infections and receiving antimicrobials.

Early detection of infection can help prevent transmission to other recipients of care, staff and visitors. When an infection is suspected, appropriate actions and a diagnosis should be sought immediately.

Organisational policies and guidelines should support the collection of clinical and diagnostic evidence to confirm the presence, source and type of infection. Any assessment findings, including signs and symptoms of infection, should be documented and communicated in a timely and effective manner to the appropriate members of the care team and in the clinical record.

The Antimicrobial Stewardship Clinical Care Standard, developed by the Australian Commission on Safety and Quality in Health Care supports AMS across all settings. It includes quality statements to ensure the appropriate use of antimicrobials, covering aspects such as diagnosis, treatment, documentation and review. This standard should be used to inform the care of recipients of aged care services.

Microbiological investigation, as recommended by the standard should guide the antimicrobials prescribed and ongoing care. In the case of telephone order of antimicrobials, the off-site medical doctors should be responsible for visiting and reviewing the patients in a timely manner. Where indicated and desired, care recipients should have timely access to the hospital system to manage serious or complex infection.

Table 16.2 Barriers to AMS interventions in the aged-care setting

Factors	Components	Potential implications
Workflow related	Nurse-driven infection management	Lack of executive support for AMS.
		Lack of clinical buy-in from other clinicians.
	Logistical barriers associated with off-site medical doctors	Phone ordering of antimicrobials.
		Difficulty ensuring timely on-site review of residents.
		Care of residents by doctors with no established therapeutic relationship with the patient.
	Absence of on-site pharmacist support	Access to antimicrobials after hours may be an issue. Pharmacists also provide valuable clinical support.
	Prescription and dispensing process	Where medication charts are rolled over in rewriting, there is a greater chance that antimicrobials will be continued, rather than dispensed in limited quantity.
	Lack of antimicrobial prescribing policy	Choices of antimicrobial regimens are based on resident, family or nursing staff requests and doctors' preferences, not necessarily following guidelines.
		More difficult for nurses to challenge medical prescribing practices.
	Challenges with use of diagnostic services	Pathology and radiology investigations are less commonly requested. Mobile pathology and radiology can be used as an alternative.
Culture related	Frailty	Early antimicrobial initiation is preferred 'in case' recipients of care deteriorate.
	Atypical symptoms of infections	Infections cannot be confirmed in some cases, potentially leading to over diagnosis and overtreatment with antimicrobials.
	Cognitive impairment	Difficulty in establishing symptoms, leading to delayed antimicrobial treatment.
	Urinary incontinence	Midstream urine cultures challenging to collect, leading to lack of microbiological data to guide antimicrobial therapy. Failure to try strategies to collect MSU as default.
	Family and organisational pressure to prescribe antimicrobials	Unrealistic expectation for antimicrobial(s) even for minor symptoms.
		Failure to understand the harms caused by antimicrobials, especially when not offset by any benefit.
		Overuse of antimicrobial(s) for end-stage illness or to prolong life where this conflicts with the goals and wishes of the resident.

16.5 Conclusions

Community and residential aged care services care for a vulnerable population who are at greater risk of infections and of acquiring multidrug-resistant organisms. Antimicrobial use in recipients of aged care is common, and inappropriate antimicrobial use has been identified and described in the literature as being both widespread and concerning. Therefore, there is an urgent need to implement effective, sustainable infection prevention and control and AMS programs in all Australian aged care services.

Challenges for the sector in implementing AMS, and strategies for aged services organisations to consider in implementing AMS, have been described in this chapter.

As with all settings, AMS programs in aged care need to be tailored to the specific context of the service and the people receiving care. Bringing together partners in AMS in the aged care setting can be difficult because of complex funding and governance in aged care.

Leadership within the aged care service is essential across organisational boundaries to reduce infectious disease burden, harms from inappropriate antimicrobial use and to reduce AMR.

A range of antimicrobial stewardship resources have been described in this chapter that organisations may find useful in developing organisational AMS programs.

Resources

- Aged Care Quality and Safety Commission.
    a. Quality Standards. Standard 3. Available at: https://www.agedcarequality.gov.au/providers/standards
    b. Infection control monitoring checklist. Available at: https://www.agedcarequality.gov.au/media/88322
- Australian Commission on Safety and Quality in Health Care.
    a. Antimicrobial stewardship in aged care. ACSQHC website. Available at: https://www.safetyandquality.gov.au/our-work/antimicrobial-stewardship/antimicrobial-stewardship-aged-care
    b. Asymptomatic Bacteriuria Factsheet. Available at: https://www.safetyandquality.gov.au/publications-and-resources/resource-library/fact-sheet-asymptomatic-bacteriuria-2020
    c. Australian Passive Antimicrobial Resistance Surveillance (APAS) First report: multi-resistant organisms - https://www.safetyandquality.gov.au/publications-and-resources/resource-library/australian-passive-antimicrobial-resistance-surveillance-apas-first-report-multi-resistant-organisms
    d. AMS Clinical care standard. Available at: https://www.safetyandquality.gov.au/our-work/clinical-care-standards/antimicrobial-stewardship-clinical-care-standard
    e. Infection Prevention and Control eLearning Modules. Available at: https://www.safetyandquality.gov.au/our-work/infection-prevention-and-control/infection-prevention-and-control-elearning-modules
    f. Surveillance in residential aged care. Available at: https://www.safetyandquality.gov.au/our-work/antimicrobial-resistance/antimicrobial-use-and-resistance-australia-surveillance-system-aura/antimicrobial-prescribing-australian-residential-aged-care
    g. Consumer brochure: Do I really need antibiotics? Available at: https://www.safetyandquality.gov.au/publications-and-resources/resource-library/consumer-brochure-do-i-really-need-antibiotics
    h. Consumer brochure: Antimicrobials and older people in aged care homes - what you should know. Available at: https://www.safetyandquality.gov.au/our-work/antimicrobial-stewardship/antimicrobial-stewardship-aged-care
    i. Topical antifungals in aged care. Available at: https://www.safetyandquality.gov.au/publications-and-resources/resource-library/fact-sheet-topical-antifungals-aged-care
    j. Delirium Clinical Care Standard. Available at: https://www.safetyandquality.gov.au/our-work/clinical-care-standards/delirium-clinical-care-standard
- Australian College for Infection Prevention and Control. Position Statement – The Role of the ICP in Antimicrobial Stewardship. Available at: https://www.acipc.org.au/news-and-links/
- Australian Government Department of Health.
    a. Aged Care. Available at: https://www.health.gov.au/health-topics/aged-care
    b. Infection prevention and control leads. Available at: https://www.health.gov.au/initiatives-and-programs/infection-prevention-and-control-leads
    c. COVID-19 infection control training. Available at: https://www.health.gov.au/resources/apps-and-tools/covid-19-infection-control-training
    d. Quality Use of Medicines (QUM). Available at: https://www1.health.gov.au/internet/main/publishing.nsf/Content/nmp-quality.htm
- Australian Guidelines for the Prevention and Control of Infection in Healthcare (2019). Available at: https://www.nhmrc.gov.au/about-us/publications/australian-guidelines-

prevention-and-control-infection-healthcare-2019

- Australian Medicines Handbook Aged Care Companion. Available at: https://agedcare.amh.net.au/
- Australian Technical Advisory Group on Immunisation (ATAGI). Australian Immunisation Handbook, Australian Government Department of Health, Canberra, 2018. Available at: immunisationhandbook.health.gov.au.
- National Centre for Antimicrobial Stewardship (NCAS).
  a. Website https://www.naps.org.au/Default.aspx
  b. Microbiology fact sheets. Available at: https://www.ncas-australia.org/education
- National Health and Medical Research Council. Australian Guidelines for the Prevention and Control of Infection in Healthcare. (2019). Canberra. Available at: https://www.nhmrc.gov.au/about-us/publications/australian-guidelines-prevention-and-control-infection-healthcare-2019
- National Quality Partners Playbook™: Antibiotic Stewardship in Post-Acute and Long-Term Care. Available at: https://store.qualityforum.org/collections/antibiotic-stewardship
- National Prescribing Service (NPS) MedicineWise
  a. NPS MedicineWise / Commission Antimicrobial prescribing modules. Available at: https://learn.nps.org.au/mod/page/view.php?id=4282
  b. NPS MedicineWise. Urinary tract infections in residential aged-care facilities. Available at: https://learn.nps.org.au/mod/page/view.php?id=6026
- Older Persons Advocacy Network. Medication: It's your choice. It's your right. Available at: https://opan.org.au/yourchoice/
- Pharmacy Programs Administrator. Residential Medication Management Review and Quality Use of Medicines. Available at: https://www.ppaonline.com.au/programs/medication-management-programs/residential-medication-management-review-and-quality-use-of-medicines
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