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Optimising antimicrobial stewardship in Australian primary care

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Key Messages

The emergence of antimicrobial resistant infections poses one of the most significant health threats of our time. Continued inappropriate or overuse of antimicrobials, increases the speed of the development of antimicrobial resistance (AMR) and may render currently treatable infections life-threatening in the near future. In Australia, antimicrobials continue to be inappropriately and overprescribed in primary care. Given that 80% of antibiotics are consumed within primary care, embracing the concept of antimicrobial stewardship (AMS) in primary care will play an important role in improving the appropriate use of antibiotics and reducing the risk of antimicrobial resistance.

AMS processes have been well established in Australian hospitals through clinicians responsible for the design and implementation of AMS programs. Such expertise is important for the provision of AMS education and support to the primary care sector.

Practical and systemic barriers to AMS implementation in primary care include patient demand for antibiotics, diagnostic uncertainty, and limited AMS training. Both general practice and community pharmacy must be empowered to harness tools for better prescribing such as point-of-care testing and clinical decision support tools. Similarly, reducing systemic and regulatory barriers to AMS such as inadequate and poorly enforced prescription guidelines, lack of AMS program funding, and consideration of scope of practice for GPs and pharmacists will be essential to embedding AMS in primary care.

Comprehensive data on prescribing trends is integral to assessing prescribing habits, informing policy priorities, and affecting solutions. However, current data platforms are suboptimal. New data collection platforms and improvements to current systems can enable real time monitoring, routine prescription reviews, and collaborative model of care between GPs and community pharmacists.

Interprofessional collaboration is a well-established strategy for improving care in a range of settings, including for AMS in secondary and tertiary care. Such collaborative care models must be extended to primary care between GPs and community pharmacists for effective AMS implementation. Primary care providers indicate a willingness to collaborate, but establishing a framework for collaborative care models in primary care will require investment from a breadth of stakeholders.

The suite of reforms needed for a comprehensive program of AMS in primary care will require the co-design, development, and implementation of a GP-pharmacist collaborative antimicrobial stewardship framework. This will require engagement and consultations among stakeholders and professional bodies, underpinned by a clear governance framework to establish the proposed structure and function of a wholistic program. Establishing effective processes for further embedding and evaluating evidence-based policy will be necessary for establishing a learning health system which can drive continued improvements to AMS over the long term.

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Executive Summary

Compared to national guideline recommendations, antimicrobial use in Australia continues to be overprescribed in the community, with 30-50% of antibiotic prescriptions within primary care being inappropriate either in choice, dose, or duration.

Overuse and inappropriate use of antimicrobials contributes to an increasing number of adverse effects, re-consultations, medicalisation of self-limiting conditions, increasing treatment costs, and a risk of developing multidrug-resistant infections. This is compounded by barriers to optimising antimicrobial use, including patient demand, diagnostic uncertainty regarding the cause of infection, and limited resources and training for primary care providers.

Given that 80% of antibiotics are consumed within primary care, primary care must be a priority setting for fostering the establishment and implementation of antimicrobial stewardship (AMS) programs. AMS programs consist of multicomponent and multifaceted strategies and policies to optimise antimicrobial use. Doctor-pharmacist collaborative care models are central to effective implementation.

While doctor-pharmacist collaborative care models already exist to promote AMS programs in secondary and tertiary care settings, several barriers must be addressed before AMS programs can be incorporated into primary care, including:

- the development of a national AMS implementation framework,
- improving access to primary-care-specific AMS resources,
- the composition of the interprofessional care team, and
- defining the roles of general practitioners (GPs) and pharmacists for routine AMS
- establishing supportive system structures.

Furthermore, implementation and expansion of AMS programs will require effective engagement and collaboration between GPs and community pharmacists. For this to be achieved, GPs and pharmacists must be involved in the development of the national governance framework to implement evidence-based strategies. Complex primary health system structure and limited funding impedes the development of AMS framework in primary care.

This issues brief explores the need for a national AMS implementation framework and the GP-pharmacist collaborative models of care required to improve AMS in primary care. Recommendations are made to address gaps in current health systems structures and policies that will support GP-pharmacist collaboration for AMS and to tackle antimicrobial resistance (AMR) in primary care.

Background

Antimicrobials are medicines that act to kill bacteria, viruses, fungi, and parasites. When antimicrobials are ineffective at killing these microbes, the phenomenon is called antimicrobial resistance (AMR). Injudicious prescribing and suboptimal use of antimicrobials are the main causative drivers of AMR (McCullough et al., 2017).

Across the world, an estimated 5 million people die with AMR infections and 1.3 million people died in 2019 as a direct result of AMR (Murray et al., 2022).

AMR produces disastrous impacts on healthcare costs and gross domestic product (GDP) (Shrestha et al., 2018; Dadgostar, 2019). High costs are associated with expensive and intensive treatments and escalation in resource utilisation which are direct monetary effects of AMR on health care (Chokshi et al., 2019).

The global impact of AMR

In the United States, AMR costs over $20 billion in health care expenditure and over $35 billion of productivity loss annually (Dadgostar, 2019).

Global annual AMR costs could exceed $1 trillion by 2050 (Chokshi et al., 2019).

The World Bank estimates in a high-impact scenario that global GDP loss due to AMR could reach 3.8% annually by 2050 (World Bank 2017).

In 2021, over 1000 AMR associated deaths occurred in Australia, with an estimated loss of 27,705 quality-adjusted life years due to the five most common AMR pathogens[1] (Wozniak et al., 2019); and around $5.8 million is spent per year for treating infections caused by resistant bacteria[2].

Increased and inappropriate antimicrobial prescribing

In Australia, 80-90% of antibiotic prescriptions occur in primary care, where approximately 30–50% of prescriptions are inappropriate either in choice, dose, or duration (ACSQHC, 2021).

Australia has been ranked seventh highest compared with European countries in community use of antibiotics (ACSQHC, 2021); with the consumption rate much higher than some European countries including the Netherlands, Sweden Belgium, and Austria (ACSQHC, 2021). For example, Australian general practitioners (GPs) prescribe antibiotics up to nine times more frequently than therapeutic guidelines particularly for respiratory infections (McCullough, 2017). 81.5% of Australian patients with acute bronchitis and 80.1% of patients with acute sinusitis continue to be prescribed antimicrobials despite no evidence for its benefit (ACSQHC, 2021).

In 2021, the Antimicrobial Use and Resistance in Australia (AURA) report found that 40.3% of the Australian population had at least one antibiotic dispensed in 2019 (ACSQHC, 2021). This rate of use is far higher than in most European countries and Canada.

[1] *E. coli; K. pneumoniae; S. aureus; P.aeruginosa; E. facium*

[2] antibiotic-resistant *E.coli*

This high level of use occurs despite a lack of evidence for its benefit.

Prescribers in Australia may also order antimicrobial prescriptions privately for indications that are not subsidised by the Pharmaceutical Benefits Scheme (PBS) or Repatriation Pharmaceutical Benefits Scheme (RPBS). They may also prescribe a quantity that exceeds the PBS/RPBS limit. In Australia, private prescriptions of broad-spectrum antibiotics[3,4] increased by around 40% between 2010 -2019 (ACSQHC, 2021). For example, average monthly private prescriptions of the broad-spectrum antibiotic azithromycin increased from 423 in 2010 to 1,424 in 2019 (ACSQHC, 2021).

Inappropriate use of antimicrobials, particularly broad-spectrum antimicrobials, is associated with an increasing burden of adverse effects, re-consultations, increased treatment costs, and a risk of developing multidrug-resistant infections in patients (Bjerrum et al., 2004); and in combination with higher use of these antimicrobials, have increased the potential incidence of AMR within the primary care community (Edelstein et al., 2017).

Antimicrobial Stewardship (AMS) Programs

AMS is a collaborative, multifaceted, and multidisciplinary program or approach that engages healthcare leaders, doctors, pharmacists, microbiologists, nurses, infectious disease specialists, and IT experts to improve patient treatment outcomes and safety by reducing development of AMR (Majumder et al., 2020).

The core aim of the AMS program (Figure 1) is to ensure that a patient is taking the right antibiotic, at right time, with right dose, right dosage form (e.g., tablet or injection) and for the right duration.

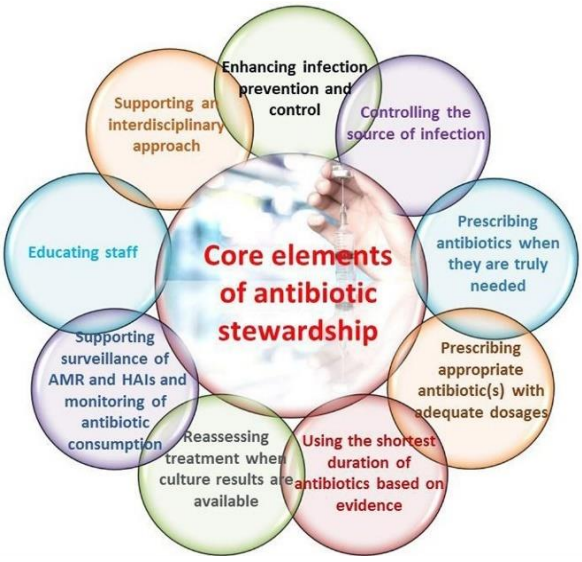

Figure 1. The core elements of AMS programs (Majumder et al., 2020)

In Australia, evidence- based AMS programs are well accepted, but implementation is irregular and not sustained. The progress of AMS depends on individual commitment, organisational leadership, interprofessional collaboration, availability of evidence-based resources and funding support (Majumder et al., 2020).

[3] Azithromycin: antibiotic used to treat certain bacterial infections, such as bronchitis; pneumonia; sexually transmitted diseases (STD); and infections of the ears, lungs, sinuses, skin, throat, and reproductive organs (healthdirect.gov.au)

[4] Ciproflaxin: antibiotic used to treat bone and joint infections, intra-abdominal infections, certain types of infectious diarrhea, respiratory tract infections, skin infections, typhoid fever, and urinary tract infections (healthdirect.gov.au)

AMS implementation in Australia

For the most part, implementation of AMS programs in Australia are limited to the hospital and post-acute care environment (Cairns et al., 2015; Bishop et al., 2018), where we are considered international leaders in establishing AMS programs in this setting (Mendelson et al., 2019).

AMS processes and structures have been established in hospitals to meet the AMS criterion within Standard 3 of the National Safety and Quality Health Service (NSQHS) Standards (Clinical Excellence Commission, 2019), including a Progress & Planning Tool designed to support periodic assessment. This is complemented by evidence-based Australian therapeutic guidelines and the broad availability of resources. This suite includes information on antimicrobial prescribing, antimicrobial formulary restrictions, routine review of antimicrobial prescription, surveillance of antimicrobial use data and AMR, and evaluation of program performance.

In hospitals, AMS roles for pharmacists have been developed and they routinely support implementation of AMS programs (Weier et al., 2018); and dedicated collaboration, communication and co-ordination between physicians and pharmacists has been shown to contribute to the success of AMS programs in this setting (Trubiano et al., 2017; Broom et al., 2015; Cotta et al., 2015; Ourghanlian et al., 2020).

AMS has been incorporated as accreditation criteria for hospitals since 2013 (Jones et al., 2020). In primary care however, the policy framework and governance structure to support the establishment and implementation of AMS remains undeveloped (ACSQHC, 2017).

Given that 80% of antibiotics are consumed within primary care, primary care must be a priority setting for fostering the establishment and implementation of AMS programs.

AMS Framework for primary care

To improve implementation of AMS programs in primary care, a framework for general practice-community pharmacist collaboration has been developed by researchers at Deakin, Monash and Melbourne Universities (Figure 2; Saha et al., 2022).

The GP/pharmacist antimicrobial stewardship (GPPAS) model framework, also known as the Framework, demonstrates three broad level of support to foster implementation of AMS programs in primary care in Australia:

- Personal and Interpersonal level,
- Resource and organisational level and
- Environment and Policy level.

However, a number of barriers hinder the widespread adoption of the framework (Table 1).

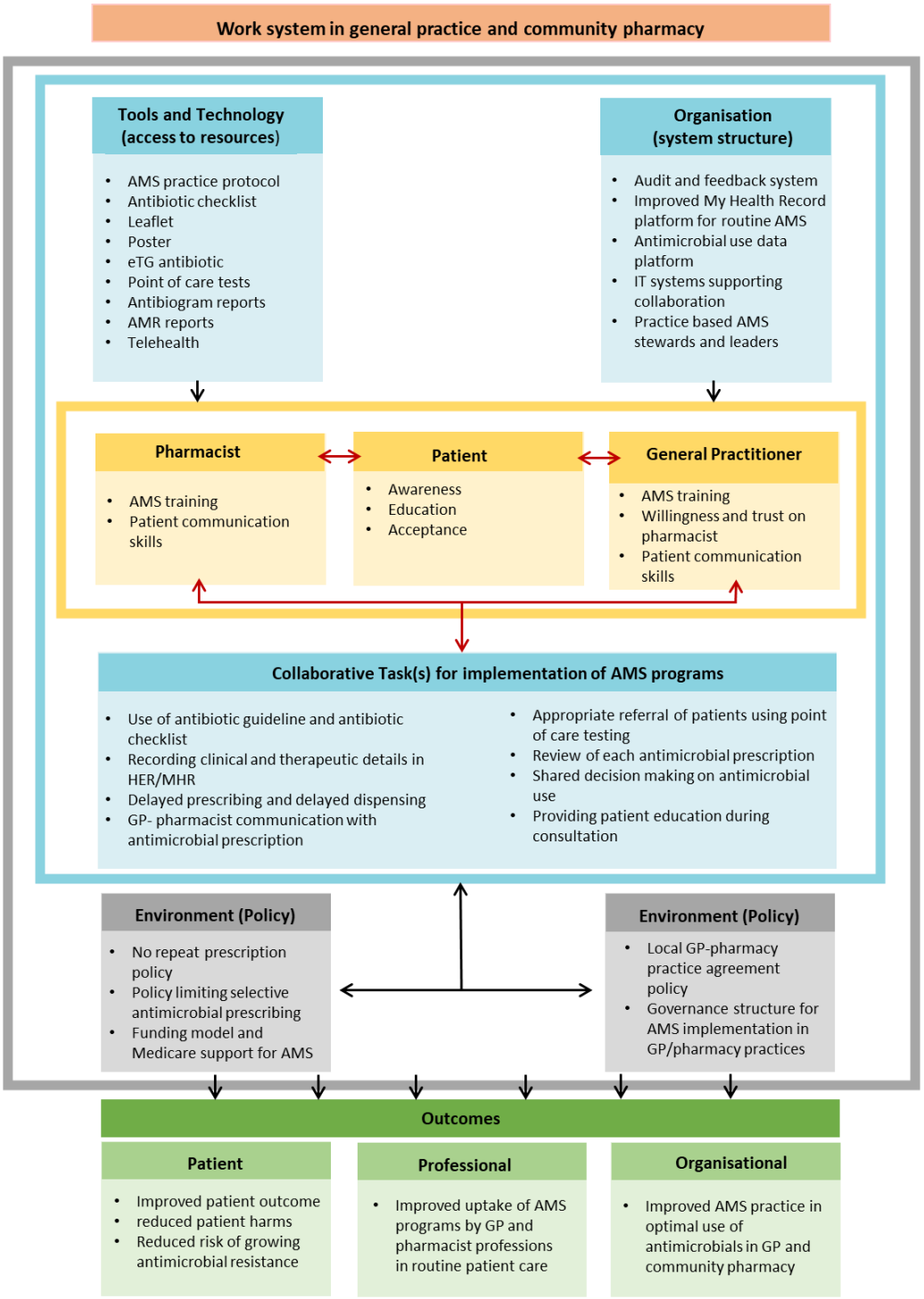

Figure 2. GPPAS implementation model framework to optimise antimicrobial use in primary care in Australia (Adapted from Saha et al., 2022).

Table 1. Major issues that prevent implementing AMS strategies and optimise antimicrobial use by GPs and community pharmacists (Saha et al., 2020; Saha et al., 2021a)

	Key barriers to AMS implementation in primary care	
Barrier	**General Practice**	**Community Pharmacy**
Personal	**Patient Level**	
	• expectations around access to prescriptions • poor health literacy, including a lack of awareness regarding the risk of antibiotic use, • late presentation with severe symptoms, and the desire for a quick recovery.	• requirement to establish trust and confidence in the advice of a pharmacist • openness to collaborative support between pharmacists and patients.
	GP level	
	• perception of pharmacists as a dispenser lacking adequate knowledge for collaboration, experienced GPs with established prescribing practices, and inertia to change.	• lack of collaboration to discuss antimicrobial issues with pharmacists, and openness for consideration of pharmacist recommendations.
	Pharmacist level	
	• perception of financial conflict of interest with pharmacists providing antimicrobial prescriptions	• limited education and training on AMS and management of infections. • lack of visibility to a patient's clinical records for AMS action.
Tools and technology	• absence of protocols that defines AMS tasks in practice. • lack of access to electronic Therapeutic Guidelines (eTG). • lack of IT facilities related to decision support tools. • limited point-of-care diagnostic testing facilities.	• lack of protocols and guidelines to guide AMS activities. • "My Health Record" patient records system not integrated with patient's clinical indication. • lack of GP-pharmacist structures for timely communication. • eTG not integrated with dispensing software. • AMS patient education resources are not available. • absence of codes on prescriptions notifying of indications behind script. • GuildCare pharmacy software does not have record keeping system for AMS interventions. • lack of digital AMS tools for rural pharmacy.
Organisation	• lack of access to infectious disease physicians, pharmacists, and microbiological services. • legal system for delayed prescribing.	• lack of AMS training to better understand and undertake AMS activities.

	• delayed access to diagnostic reports (e.g., antibiotic sensitivity, culture test). • lack of provision of AMS training. • no monitoring of AMS-related activities.	• lack of mandatory continuous professional development (CPD) program for pharmacists regarding AMS. • lack of GP-pharmacist practice agreements for AMS. • lack of AMS supports from professional organisations • lack of AMS collaborative initiatives between GP and professional pharmacist groups
Task	• time constraints hinder completion of AMS tasks.	• time and personnel constraints hinder patient counselling, prescription reviews and communication with GPs.
Physical environment	• lack of AMR/AMS information leaflets for educating patients.	• lack of AMR/AMS information leaflets for educating patients, including when better to not dispense. • lack of timely access to concise, up-to-date information (e.g., dosage guidelines, antibiotic resistance reports). • lack of reference guide and tools for ensuring antimicrobial guideline adherence.
External environment	• lack of AMS incentives. • lack of funding models for AMS implementation. • extended validity of repeat antimicrobial prescriptions.	• default repeat prescription of antimicrobials. • PBS restrictions around indications. • lack of funding models for AMS service implementation, including compensation for any loss of income. • large antimicrobial pack size.

Interprofessional collaboration

Interdisciplinary health care teams have been shown to improve patient experiences and health outcomes across a variety of settings; and collaborative models between general practice and community pharmacy have been established to improve quality use of medications in primary care.

For example, the general practice pharmacist (GPP) model (Dey et al., 2011) has established pharmacists into general practice to deliver services to both patients and practitioners, including medication reviews, medication safety initiatives and education, particularly as it relates to chronic disease management (Shaw, 2020; Tan et al., 2014).

In another example, The Home Medicine Review Program assists people to better understand and manage their medicines through a medication review conducted by a pharmacist in collaboration with a GP within the home (Chen, 2016).

In Australia, however, a GPP collaborative model of care for AMS has yet to be established; and fostering collaboration between the two professions will be critical for the development and implementation of AMS in primary care (Rizvi 2023; Saha et al., 2021a).

Both Australian and international studies have long recognised that AMS interventions delivered through interprofessional teams consisting of a doctor and a pharmacist can improve antibiotic prescribing practices (Saha et al., 2019; Ashiru-Oredope, 2016; Ashiru-Oredope et al., 2012; Colligan et al., 2015; Dryden et al., 2011; Liaskou et al., 2018; Nathwani and Christi 2007); with a collaborative model shown to be effective at reducing antibiotic prescribing (12%) and improving adherence to antibiotic prescribing guidelines (16%) (Saha et al., 2019). However, these models, implemented in hospitals, may be unrealistic in primary care due to divergence of routine practices between providers, a distant interprofessional working environment, organisational structures, and differing patterns of antimicrobial use.

In primary care, the collaboration, co-ordination and communication of GPs and community pharmacists will be central to implementing AMS strategies that mirror the AMS approach seen in hospitals. Yet a survey of general practice and community pharmacy perspectives on interprofessional collaboration for AMS has identified interprofessional trust as the most significant barrier to AMS implementation in primary care (Saha et al., 2021a; Sudeshika et al., 2022).

A number of factors support the development of interprofessional trust, including collaboration and communication.

Collaboration between tertiary, secondary and primary care

There are growing number of AMS clinicians and experts including infectious disease physicians and AMS pharmacists who lead AMS programs in hospitals across Australia. This includes telehealth services to support regional and rural areas.

AMS clinicians have prime responsibility to help design AMS programs and are well positioned to train GPs and community pharmacists about AMS activities and become

a linkage for AMS support between hospital and primary care GPs and community pharmacists. Nevertheless, the delegation and exchange of AMS knowledge and experience from infectious disease physicians and AMS pharmacists to GPs and community pharmacists is lacking.

In Australia, the rate of hospital readmission for patients with surgical site infections, urinary tract infections, gastrointestinal infections and respiratory tract infections is increasing (Mitchell et al., 2017). Annually there are 250,000 medicines-related hospital admissions in Australia, costing $1.4 billion. 50% of these events are considered preventable (PSA, 2019).

Community pharmacist led transition care interventions including interviews with patients, medication review and communication with hospital pharmacists, can reduce hospital readmissions and medication related adverse effects including antibiotics (Luder et al., 2015; Bach et al., 2019).

However, a lack of access to and poor communication with hospital-based AMS experts discourages GPs and community pharmacists to seek expert advice for safe antimicrobial use and infectious disease management (Saha et al., 2022; Mercuro et al., 2020).

In parallel, hospital discharged infectious disease patients involving multiple medications, including antimicrobials, are not followed and supported by co-ordination care models involving hospital-community pharmacist collaboration and liaison with GPs.

Building relationships and networks between hospital and community pharmacy practice will be critical for developing AMS in primary care.

GPs access to hospital infectious disease experts

- France has been running a telephone support service for GPs to access infectious diseases experts for guidance on antibiotic therapy (Wang et al., 2015). The Regional Functional Unit of Infectious Diseases was created in 2012 in Corsica, financing provided by regional health agency (ARS). The unit provided Corsican GPs with telephone advice during weekdays and participates in various antibiotic therapy training sessions as part of post-graduate courses (Gernigon et al., 2014)
- Sweden has a scheme where clinical experts work with GP prescribers and provide antibiotic audit and feedback information to promote guideline adherence (Mölstad et al., 2017).

Commonwealth and state funds should be directed to support GPs and community pharmacists to be able to provide full cycle of care for patients who have transitioned from hospitals and for those patients who optimal antibiotic use through GP-pharmacist collaboration. infectious disease functional units could be established in high prescribing regions, which are supported by hospital and regional health agencies to provide necessary training and advice to GPs during weekdays.

GP-pharmacy collaborative practice agreements for AMS

In Australia, there is no formal GP-pharmacy practice agreement, either locally or nationally, and no collaborative care model to support efficient patient referrals and optimal antimicrobial use and management (Saha et al., 2021a). This impedes the collaboration and communication required between GPs and pharmacists to implement AMS programs (Saha et al., 2021b).

There are, however, a growing number of successful trials with significant outcomes in the USA, the UK and European countries which have demonstrated implementation of AMS programs utilising GP-pharmacist collaborative practice agreements (Klepser et al., 2015; Klepser et al., 2016a).

International GP-pharmacy practice agreements for antibiotic stewardship

Many states in the USA have established local GP-pharmacy practice agreements to allow community pharmacists using C-reactive protein (CRP) and rapid antigen testing (RAT) screening and treatment services to optimise antibiotic use in patients with respiratory tract infections (e.g., Bronchitis, Pharyngitis, Influenza) (Herbin et al., 2020; Hohmeier et al., 2022; Klepser et al., 2015; Klepser et al., 2016c).

In the Netherlands, a local GP-pharmacy practice agreement has been developed to conduct a regular GP-pharmacist group meeting to discuss antibiotic pharmacotherapy, set objectives for reducing antibiotic use, discuss clinical cases and antibiotic audit reports to identify improvement areas and future collaboration (Welschen et al., 2004).

In Spain, a GP-community pharmacy collaborative practice tool has been validated to perform GP-pharmacist collaborative medication review including antibiotic prescription review in clinical practice (Sanchez-Molina et al., 2022). This clinical service requires close collaboration between GPs and community pharmacists helping to detect and resolve drug related problems and to optimise patient therapeutic outcomes.

In Belgium, Medical-Pharmaceutical Concertation has been implemented to promote conversations between GPs and community pharmacists with a focus on pharmacotherapy, including antibiotic pharmacotherapy. (Damiaens et al., 2021).

In Switzerland, a GP-pharmacist interprofessional ‘quality circle’ (QC) approach has shown potential to reduce antibiotic prescribing by GPs in private practice (Plüss-Suard et al., 2020). QCs are based on open exchange of experiences, new knowledge acquirement and implementation. Regarding antibiotic use, QCs analyse antibiotic prescription, benchmark prescribing, disseminate good clinical practice recommendations, develop consensus treatment strategy for common infections with conservative use of antibiotics and its application and revision in 1 to 2 years to integrate new evidence. (Niquille et al., 2010; Mombelli et al., 2016; Suttels et al., 2022). The importance of group dynamics motivated the conception of QCs in European primary care (Elango et al., 2018).

In Australia, GP-pharmacy practice agreements and implementation of antibiotic stewardship programs should be built and fostered.

Research and incentives

Despite Australia's national One Health research agenda for improving antimicrobial stewardship in primary care, poor GP-pharmacy intersectoral collaboration and information sharing between research institutes and professional and policy organisations has resulted in limited coordination between the various AMS research funding streams in Australia (AMA, 2023).

Additionally, siloed research has resulted in an understanding gap of what incentives and mechanisms are needed to support GPs and community pharmacists to improve antimicrobial stewardship in routine patient care and how to develop a cost-effective incentives mechanism for AMS in primary care.

AMS delivery in primary care

AMS training

Antimicrobial stewardship education and training programs for GPs and community pharmacists is a core component of the Australia's National Antimicrobial Resistance Strategy (Department of Health and Department of Agriculture, Water and the Environment, 2020) but is not widely implemented.

In a survey of GPs and community pharmacists, 45% of 386 GPs and 70% of 613 community pharmacists strongly believed in the need for adequate AMS education (Saha et al., 2021a). More than 80% of surveyed GPs and community pharmacists had indicated their willingness to participate in future AMS education and training programs (Saha et al., 2020; Saha et al., 2021a). This positive sentiment should be capitalised.

AMS training should be developed and implemented across primary care, with education and training programs delivered through registration with medical and pharmacy professional colleges. The National Centre for Antimicrobial Stewardship (NCAS) could be a liaison point for professional colleges and PHNs for AMS training resources.

At the local level, PHNs could support practice-based AMS training program in general practice and community pharmacies. The medical and pharmacy colleges should be working with universities to develop the national AMS curriculum for future generation GPs and community pharmacists (Courtenay et al., 2018).

The now defunct NPS MedicineWise previously developed AMS education materials for GPs and pharmacists, including antimicrobial modules and a range of AMS education programs (NPS MedicineWise); with the 2012-2013 educational visiting program focused on antibiotics involving more than 9200 GPs (NPS MedicineWise, 2018). The visiting program focussed on previously identified barriers to change, and delivery was tailored to the needs of individual GPs.

Evaluation of the program which included auditing and feedback alongside academic detailing and other interventions, was estimated to have led to an 18.4% reduction in antibiotics prescribed by GPs and dispensed by pharmacists under the PBS between 2012 and 2017 (NPS MedicineWise, 2018).

In 2023, the function of NPS MedicineWise transferred to the Australian Commission on Safety and Quality in Healthcare (ACSQHC) as part of the redesign of the Quality Use of Diagnostics, Therapeutics and Pathology program and the Australian Department of Health and Aged Care.

Pharmacist prescribing

Addressing the misuse of antibiotics in the community will require improving the utilisation of community pharmacists' skills in antibiotic prescribing for uncomplicated infections (Figure 3); and will require consideration of scope of practice.

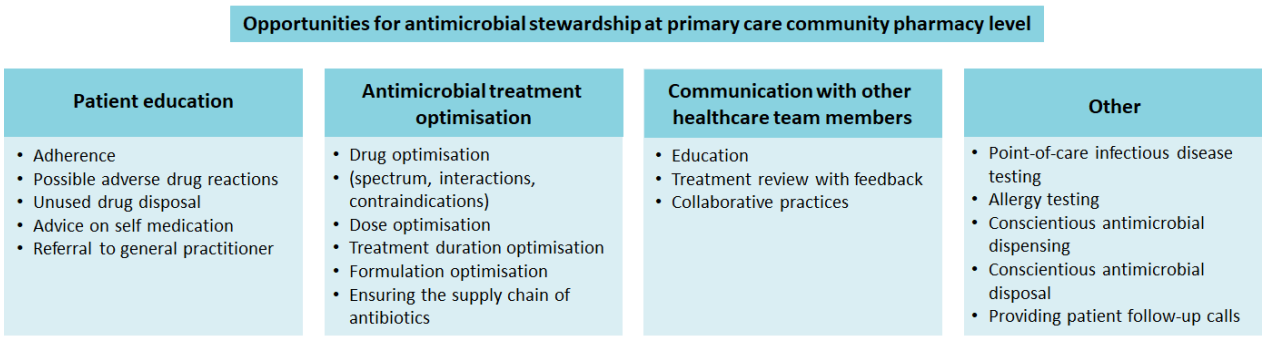

Figure 3. Opportunities for community pharmacists to improve antimicrobial stewardship in primary care (Bishop et al., 2019; Essack and Pignatari, 2013; Essack et al., 2018; Essilini et al., 2021; Rusic et al., 2021; Saha et al., 2022).

Access to selected antibiotics, via strict AMS protocols, would enable community pharmacists to effectively treat a range of infections without contributing to AMR (Paudyal et al., 2022).

The role of the pharmacist and pharmacy services in antimicrobial stewardship has yet to be defined (ACSQHC, 2018). Redefining community pharmacists' scope of practice to include additional AMS activities could improve guideline adherence and reduce inappropriate dose and duration of antibiotic therapy.

Australian studies have shown promise for pharmacists to be able to operate with an expanded scope. For example, pharmacist prescribing programs for uncomplicated UTIs have now been implemented in QLD[5] (Nissen et al., 2022) and trials around pharmacists prescribing for certain conditions, such as skin ailments, ear infections, and hormonal contraception are also under way in NSW (NSW Health, 2022).

Evidence is also growing in support of the implementation of collaborative doctor-pharmacist prescribing models in particular. For example, doctor-pharmacist collaborative prescribing for HIV infections (Hale 2016).

In order to scale up such programs, pharmacists need access to appropriate training, decision support tools and protocols (Eudaley et al., 2019). Diagnostic training and patient consultation training will also be critical.

The introduction of pharmacy prescribing programs would be in line with international evidence, practice and policies in France (Piraux et al., 2021), the USA (Sanchez et al., 2016), Canada (Beahm et al., 2018) and the UK (Peiffer-Smadja et al., 2020).

[5] Pharmacy prescribing programs for uncomplicated UTIs have now been expanded to NSW, ACT and VIC.

Delayed antibiotic prescribing and dispensing

Delayed prescribing is an AMS strategy that involves a prescriber offering an antibiotic prescription but with advice not to fill the prescription for a certain period, or unless the symptoms get worse.

The duration of delay for prescriptions can range widely, from 1 to 7 days.

Routine use of this strategy has proven effective at reducing antibiotic use, and is cost-effective, clinically safe, noncompromising in terms of patient satisfaction (McNulty et al., 2015).

Delayed prescribing has been reported to be helpful to educate and empower patients to build a more effective clinician-patient relationship (Spurling et al., 2017; Dallas et al., 2020).

A survey of Australian GPs has found that more than 70 % of 385 practitioners implement a delayed prescribing strategy[6] (Saha et al., 2020).

To gain the AMS benefits of delayed prescribing, prescribed antibiotics should also be delayed dispensed. Yet, an Australian study has found that 40% of community pharmacists dispensed delayed prescribed antibiotics to patients within 24 hours of a GP visit (Avent et al., 2018). This means that although GPs have issued delayed antibiotic prescriptions, patients and pharmacists are not treating them as such.

Reasons for immediate dispensing have not been identified but dispensing of delayed scripts may occur due to:

- a lack of information on scripts that helps pharmacists identify that they are dealing with a delayed prescription,
- a GP-patient conversation about the delayed prescription where information is not passed on to the pharmacist.

It has been reported that pharmacists would, in fact, support GPs and the public to implement delayed prescribing -despite not having previously heard of the strategy (Sargent et al., 2017). Support for pharmacist to carry out this important AMS strategy should be provided. This could include the development of guidelines that direct community pharmacists to identify delayed prescriptions, support to communicate with patients if they insist urgent dispensing of delayed prescription and withholding dispensing for a recommended period in order to achieve the desired benefits of reducing antibiotic use in primary care.

A policy guided local GP-pharmacist partnership model will be critical to effectively implementing delayed prescribing strategies (Saha et al., 2022).

Limiting repeat prescriptions

Longer duration of antimicrobial use accelerates the development of AMR (Pouwels et al., 2019; Holmes et al., 2016). In this regard, limiting repeat prescriptions of antibiotics can reduce inappropriate courses of antibiotics and use of the repeat script.

On 1 April 2020 the Australian Department of Health and Aged Care introduced a no repeat policy intervention aimed at increasing the

[6] always implement(52.3%); often implement(20%)

quality use of four antibiotics.[7] Compared to the previous year, this policy change resulted in improvements in the appropriate supply of original antibiotic prescriptions (1.8%) and improvements in the supply of appropriate repeat antibiotic prescriptions (3.8%; Contreras et al., 2023). However, data from 2021-2023 is unavailable and it is unclear if improvements have been sustained.

Patient education tools

Public awareness and understanding of AMR and appropriate use of antimicrobials remain a challenge in Australia (Alejandro et al., 2022; Bosley et al., 2018; Anderson et al., 2020; Bakhit et al., 2019; Davis et al., 2020; De Barro 2020; OUTBREAK 2020).

- 92% of Australian adults do not know the difference between a viral and bacterial infection.
- 25 % of Australians do not know what AMR is.
- 20 % of Australians believe that antibiotics can be used to treat the common cold.

This lack of awareness leads patients to inappropriately use antimicrobials, retain unused antibiotics or prescriptions for future self-medication (Lum et al., 2017), and put unnecessary pressure on GPs to prescribe antimicrobials; contributing to high prescribing rates in Australia (Lum et al., 2018).

Routine use of patient education leaflets, for example an "antibiotic checklist", has been proven effective to address gaps in patient awareness (Ashiru-Oredope et al., 2020). The use of leaflets by community pharmacists has been shown to:

- improve management of self-limiting infections by community pharmacists through shared decision making,
- improve patient awareness on safe use of antibiotics,
- reduce patient referral to GPs and
- enable community pharmacists to diagnose and treat self-limiting infections.

In the UK, the "TARGET TYI-RTI leaflet" tool was adapted for community pharmacy teams to share with patients who are seeking advice regarding self-limiting respiratory infections (Ashiru-Oredope, 2016). The leaflet was associated with increased likelihood of providing self-care advice to patient and decreased GP referrals (Ashiru-Oredope et al., 2020). Pharmacy staff were positively motivated and felt capable of managing self-limiting infections.

In Australia, it has been reported that the majority of community pharmacists and GPs provide patient education and counselling without using any patient education leaflets (Saha et al., 2021a). However, the National Centre for Antimicrobial Stewardship and the University of Melbourne have developed a validated patient education leaflets for common infections. Where appropriate, these resources could be promoted to GPs and community pharmacists for sharing with patients during routine patient consultations, and also contribute to a national campaign on antibiotic awareness.

[7] Amoxicillin, Amoxicillin–Clavulanic acid, Cefalexin and Roxithromycin.

Routine review of antimicrobial prescriptions

Routine review of each antimicrobial prescription by community pharmacists to ensure prescribed antibiotic, its dose and duration are guidelines compliant is an important step to avoid inappropriate use of antibiotics. However, this activity has been hampered by a lack of training, time, access to antibiotic guidelines and timely access to diagnostic reports.

An Australian study has found that more than half of prescription durations exceeded guideline recommendations (Neels et al., 2020; Sangwan et al., 2023).

Antibiotic pack sizes

Antibiotic pack sizes can have an impact on appropriate antibiotic use (McGuire, 2019; Rusic et al., 2019). For example, in Australia antibiotics used to treat uncomplicated urinary tract infections in non-pregnant women are made available in pack sizes containing more tablets than a required for the recommended course of treatment (TGL, 2019). This practice does not promote good AMS and has the potential for:

- prescribing antibiotics for longer duration,
- using more tablets than needed by patient,
- and risk of using leftover antibiotics by patients in future occasion by themselves.

Where there is international consensus on dose and treatment duration the Therapeutic Goods Administration (TGA) should consider working with manufacturers to align those antibiotic pack sizes with indication.

Paracetamol

Each year in Australia, around 225 people are hospitalised and 50 Australians die from paracetamol overdose, with rates of intentional overdose highest among adolescents and young adults (TGA, 2022). In 2023, the Therapeutic Goods Administration made the decision to reduce paracetamol pack sizes with the explicit aim to reduce harm from intentional overdose.

Restrictions will see the maximum pack size of paracetamol available for sale in supermarkets limited to 16 tablets or capsules (down from 20). While the maximum pack size available in pharmacies without the supervision of a pharmacist will be limited to 50 tablets or capsules (down from 100).

Point-of-care diagnostic resources

In primary care, diagnostic uncertainty regarding the cause of patient's infection will often trigger a clinician's decision to prescribe antibiotics and is a major cause of unnecessary antibiotic use (Magin et al., 2022). The presentation of an illness with indistinguishable symptoms, or concerns about missing a serious infection are also known to influence a prescriber to adopt a default position of prescribing antibiotics (Magin 2022).

The use of point-of-care testing (POCT) programs in primary care are a potential strategy which can be used to overcome such uncertainties and guide optimal antibiotic prescribing decisions (Bissonnette and Bergeron, 2010); however such programs are not widely used in Australia.

Point-of-care testing (POCT)

POCT is defined as the use of a quick diagnostic test during patient consultation, with a prompt result which can be used for clinical management, referrals, triage, and treatment decisions. By facilitating improved medical decision-making, POCT may reduce inappropriate antibiotic choice and prevent poor outcomes. POCT is used in programs including:

C-reactive protein (CRP) testing program

- CRP testing programs can successfully differentiate bacterial respiratory infections from viral infections within five minutes (Cooke, 2016). CRP testing programs in primary care have been shown to be clinically effective and cost effective (Holmes et al., 2018; Huang et al., 2013; Hughes, 2016; NICE, 2016), with cost-effectiveness analyses finding a ten-fold cost saving from reducing inappropriate antibiotic prescribing in Sweden and Norway (Oppong et al., 2013).

Rapid Antigen Testing (RAT) program

- RATs can reliably identify bacteria (e.g., pharyngitis and bronchitis) in patients within five to fifteen minutes (Pelucchi et al., 2012; McIsaac et al., 2004).

Penicillin allergy testing program

- Penicillin allergy testing safely assesses if patient is allergic to penicillin antibiotic. In UK primary care, the use of the test was well tolerated (Sundquist et al., 2017). This test has ability to significantly reduce broad spectrum antibiotic use. While diagnostic testing is more readily available in hospitals, no such testing exists in primary care (Trubiano et al., 2020) in Australia. Community pharmacy could be a feasible setting for implementation of point-of care penicillin allergy testing in Australia.

In the United States, POCT programs have been shown to reduce unnecessary and inappropriate antibiotic use by supporting clinician's decisions for antimicrobial treatment and appropriate patient referral between GPs and pharmacists (Klepser et al., 2016a). The routine use of POCTs by GPs has increased in several European countries, the UK, and the USA where it is now viewed as a tool to cost-effectively optimise antibiotic use (Martínez-González et al., 2020; Ward, 2018).

International outcomes of CRP testing in GP settings

In a UK study, three types of POCTs (TTP; FebriDx; CRP) used for acute respiratory infections significantly reduced annual health care costs and reduced antibiotic related adverse effects by 75%-79% (Schneider et al., 2020):

- TPP: 54% annual cost savings of £17.9 million ($33 million AUD).
- FebriDx: 27% annual cost savings of £8.9 million ($16.4 million AUD).
- CRP POCT: 11% annual cost savings of £3.6 million ($6.6 million AUD).

In Norway and Sweden, CRP testing has been found to be cost-effective (cost per quality-adjusted life year (QALY)). If patients are willing to pay for the test at minimum there will be 70% probability that the CRP test will be cost-effective in acute cough and lower respiratory tract infections in primary care (Oppong et al., 2013).

In a Danish study, GPs who used the CRP test were less likely to prescribe antibiotics for sinusitis than those who did not (59% compared to 78%) (Bjerrum et al., 2004).

A meta-analysis combining 13 studies worldwide showed that use of the CRP significantly reduced immediate antibiotic prescribing by 13.2% in respiratory tract infections (Martínez-González et al., 2020).

In Australia, the Royal Australian College of General Practitioners (RACGP) has developed standards for use of POCT in general practice and require training of GPs on their use (RACGP, 2021). However, POCT is not readily available in Australian general practice and the rate of POCT use by GPs is less than 20% (Saha et al., 2020). This indicates that there are substantial potential prescriptive and financial benefits which are not being realised.

The low uptake of POCT in general practice has been attributed to the fact that Medicare does not cover the costs of patient screening using POCT (Services Australia, 2022). The introduction and use of POCT including CRP and RATs in the general practice setting should be supported by Government. This should be underpinned by continuous evaluation to help determine cost-effective and best approach in terms of consideration of the Medicare Benefits Schedule (MBS) and patient eligibility.

RATs and antibiotic treatment of sore throat

Only 20% of pharyngitis (sore throat) infections are estimated to be caused by bacteria, requiring antibiotic treatment. However, according to a Canadian study, up to 70% of these infections are inappropriately treated with antibiotics (Papastergiou et al., 2018).

This inappropriate prescribing has been attributed to a lack of access to POCT (RATs) to detect bacterial pharyngitis and bronchitis (Cohen-Poradosu and Kasper, 2007). Meta-analysis has found RATs highly reliable for accurate diagnosis of pharyngitis and streamlining management of sore throats in primary care (Lean et al., 2014).

In Australia, a study on school children in the remote Kimberley region similarly found the use of RATs for pharyngitis diagnosis as both highly practical and feasible in remote settings (Pickering et al., 2020).

Point-of-care testing in community pharmacy

The use of CRP and RATs can reduce unnecessary antibiotic use in pharyngitis, bronchitis, and influenza cases. Implementation of POCT services in community pharmacy could enhance confidence in infectious disease treatment and management and reduce unnecessary GP visits and antibiotic prescriptions (Cooke et al., 2020; Klepser et al., 2016a; Klepser et al., 2017; Mantzourani et al., 2023; Mantzourani et al., 2022; Wakeman 2018).

In the USA, several states already allow community pharmacists to perform POCTs[8] under their state's pharmacy practice act, and by establishing a collaborative GP-CP practice agreement (Klepser et al., 2016b; Klepser et al., 2017; Cooke et al., 2020) and obtaining a "Clinical Laboratory Improvement Amendments (CLIA) Certificate of Waiver" service (Kehrer and James, 2016). This has fostered an expanded scope for community pharmacists in clinical and antimicrobial stewardship roles in patient care (Buss et al., 2019; Klepser et al., 2016b).

In Australia, a feasibility study (Sim et al., 2021) with 5 pilot community pharmacies that provided POCT services to 131 patients found that after CRP testing, over 50% of participants had their perceptions changed regarding their need for antibiotics, with only 14% subsequently intending to seek a GP prescription. The study also found that patient satisfaction was high, with 93% of participants reported that they would utilise the service again.

The clinical effectiveness, cost effectiveness, and feasibility of various POCT services in community pharmacy in Australia is still to be determined. GP and pharmacist collaborative practice agreements, capacity building training and clinical guidelines for community pharmacists, are needed to facilitate POCT implementation in community pharmacy and improve diagnostic AMS.

[8] POCT services have been made available for bronchitis, pharyngitis, and influenza management (Gubbins et al., 2014; Klepser et al., 2016c).

Data infrastructure support for AMS programs

Data platforms for antimicrobial use in primary care

Judicious use of antimicrobials is a core objective of Australia's National Antimicrobial Resistance Strategy – 2020 and beyond (Department of Health and Department of Agriculture, Water and the Environment, 2020). However, significant barriers achieving this this goal remain. In part, this is due to the lack of information about how and why antibiotics are being used. Such data is critical to informing the wider efforts to drive improvements in AMS in primary care.

Accurate data on antibiotic prescribing by Australian GPs will be required for AMS program development. The Pharmaceutical Benefits Scheme (PBS)/Repatriation Pharmaceutical Benefits Scheme and the MedicineInsight program are available sources of data that could be used to inform wider efforts to drive improvements in AMR: However, these are not without limitations.

For example, PBS data lacks the clinical information required to inform better AMS choices. Up to 25% of PBS prescriptions are from non-GP providers are absent; and data on private prescriptions, outside of PBS restrictions, are also not included (Department of Health, 2015). This limits the usability of PBS data to inform AMS strategy in primary care.

Internationally, the development of electronic databases that can capture diverse data, and segregate by variables such as type of practitioner, and region have improved the quality of information available for AMS development. For example, The Health Improvement Network (THIN) database in the UK distinguishes antibiotic prescribing between different roles of clinicians, including locums, salaried GPs, partners, and registrars (Borek et al., 2022). This has allowed the NHS to robustly monitor antibiotic prescribing practices; compare prescribing practices among peers, and to identify and mitigate any inappropriate prescribing. In addition, it has enabled the establishment of prescribing benchmarking and identified targets for reduction of prescribing (NHS Business service authority, 2023).

In Australia, a similar digital data platform should be established for improving antibiotic stewardship in primary care. This could include the reasons for a patient's antibiotic use, appropriate diagnoses, patient referrals, interprofessional input, patient follow up and clinical and therapeutic outcomes. Data could then be used to inform the development stewardship metrics and indicators (Productivity Commission, 2017).

Trustworthy clinical and therapeutic patient data is an important enabler of GP-community pharmacy interprofessional engagement and are integral to improve quality of antibiotic care. This is activity is hindered when data is not linked with the patient journey. Linkage of health care datasets in a single platform needs significant development in Australia.

Electronic medical records and GP-pharmacist collaboration

A range of clinical software for recording prescribing is used in Australian general practice and yet ongoing issues of interoperability have limited the meaningful use of electronic medical records (EMRs) in AMS analysis (Liaw et al., 2011). For example, nearly half of antibiotic prescriptions in Australia, as well as the UK, are issued without a record of diagnostic indicators (Saha et al., 2020; Sun and Gulliford, 2019; Dolk 2018). The use free text fields in practice software has also made data collection and analysis more difficult and complex.

The My Health Record (MHR) has been a significant development in Australia to bridge the gap between GPs and pharmacists' communication in patient care; and yet the quality of data contained within records is inadequate for AMS use. As a result, pharmacist use of the platform for AMS has been limited. (Saha et al., 2021a).

GPs have cited time constraints as a reason for nonreporting, including reporting on clinical indications for antibiotic prescriptions (Saha et al., 2021a),. Consequently, pharmacists, as part of a collaborative AMS approach, are unable to appropriately assess scripts and discuss potential issues with the prescriber (Saha et al., 2021a).

Improved access to patient clinical and therapeutic data by pharmacists should be a core component of effective AMS in Australia and will be essential to empowering both GPs and pharmacists to coordinate better AMR and patient outcomes.

This will require robust and comprehensive in the MHR for antibiotic prescription. Policy incentives which facilitate consistent and comprehensive clinical indications reporting for antibiotic prescriptions in primary care are also needed. This mechanism has already been established for critical data collection activities. For example, SafeScript for high-risk medicines (Paola, 2020).

Practice-based antimicrobial audit and feedback programs

Antibiotic auditing and feedback within general practice is critical to improving the appropriate choice, dose, duration, and guideline compliance of antibiotic prescription (Elouafkaoui et al., 2016; Choi et al., 2021).

In Australia, a real-time prescription monitoring system (RTPM) has been established in primary care to audit the prescribing and dispensing of controlled medicines with the aim of reducing their misuse. A similar audit mechanism for antimicrobial prescriptions has yet to be established.

In this regard, practice-based audits and a national antibiotic prescribing (NAP) survey in general practice would help identify the evidence practice gaps and quality improvement strategies to optimise antibiotic use in primary care. This strategy must also consider support for the AMS workforce, and incentives for routine audit and feedback.

Pen-CS CAT4, a clinical auditing tool, is increasingly used by general practice to drive data-driven quality improvement and could be a potential source of data for use in AMS.

A data driven 'learning healthcare system'

Understanding the quantity of inappropriate prescribing as well as the clinical reasons for prescribing antibiotics in primary care lacking. Such data is necessary to identify areas for quality improvement, as well as providing the opportunity for feedback to prescribers, dispensers, and users to improve judicious use of antimicrobials (Thursky et al., 2021; Hallsworth et al., 2016).

A learning system approach, developed by the National Centre for Antimicrobial Stewardship (Figure 5) emphasises the need for data that allows practitioners and pharmacists to understand patterns of local antibiotic prescribing, dispensing and consumption.

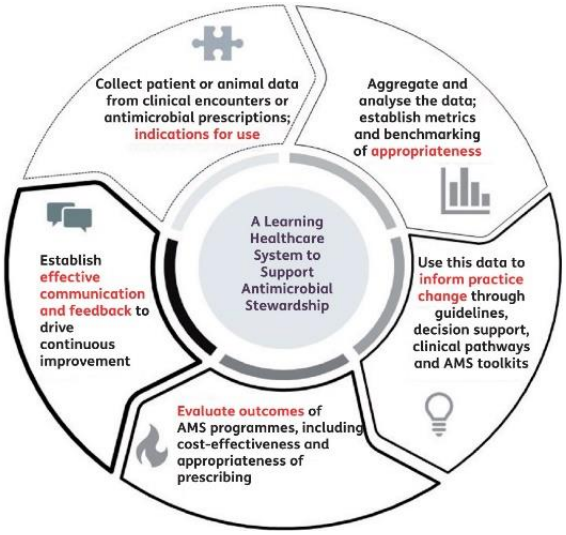

Figure 4. A data driven 'learning healthcare system' approach to improve antimicrobial stewardship in primary care (Thursky et al., 2021).

Data collection

A national antibiotic prescribing (NAP) survey (Australian Government, 2022) and practice-based antimicrobial prescribing audits in general practice could be performed to collect data to embed strategies to optimise antimicrobial use in primary care.

A pilot survey tool (Cuningham et al., 2020) has been developed and evaluated to perform antimicrobial audits in a remote GP context in Australia. This validated tool can be widely used and promoted to use across GP practices in Australia. NCAS and ACSQHC should lead and regularly collect both quantitative and qualitative data related to antimicrobial use at local and national level to guide stewardship targets in primary care.

Data analysis and benchmarking

Data should be analysed to assess appropriateness, guideline compliance in terms of choice, dose, and duration; along with rate of prescribing to identify evidence practice gaps, establish metrics, and set benchmarking for future improvement. Establishment of metrics and setting benchmarking at practice, local community and the national level is fundamental for any future quality improvement.

Data to inform practice change

The quantitative and qualitative outcomes of aggregated data will guide development of antibiotic local antibiotic guidelines, review national antibiotic guidelines, generate clinical decision support tools specific to particular antimicrobials and clinical indications, and aid development of antimicrobial stewardship tools. One of the greatest advantages of using this data is to provide prescriber and practice-targeted education and feedback programs which are currently lacking. This is instrumental to improve appropriate choice, dose, duration, and guideline compliance of antibiotic prescriptions (Elouafkaoui et al., 2016; Choi et al., 2021). Within AMS programs, audit and feedback provides critical interaction between the antimicrobial stewards and

prescribers in order to tailor specific antibiotic therapy for each patient.

In addition, a peer comparison letter from a respected authority can substantially and sustainably impact on antibiotic prescribing by GPs and can be a powerful behavioural tool when it is used for individual GP-level feedback.

In other countries, the use of educational letters comprising of antibiotic prescribing graphical reports of peer GPs has been shown to reduce prescription rates around 10%, (Department of Health and Department of Agriculture, Water and the Environment, 2021). This equated to a reduction of 126, 000 antibiotic scripts over a six-month period. It was estimated that 280, 000 antibiotic prescriptions would not be filled if all high-prescribing GPs were sent the letter. However, there is no future strategy for widely sending further letters to GPs (Department of Health and Department of Agriculture, Water and the Environment, 2021). This strategy should be reviewed for further implementation.

In addition, comprehensive antimicrobial use data from My Health Records would be critical to the development and enhancement of a GP-community pharmacists' collaborative platform for routine AMS activities in future.

Program evaluation

It is important to evaluate data driven AMS programs and their impact on improving appropriateness of prescribing, cost-effectiveness, and receptiveness to the program among clinicians for future development. Development of a monitoring and evaluation framework for program evaluation will be warranted.

Continuous improvements

GP practice-level prescribing data and program evaluation should underpin iterative development and updates to AMS practice and decision making, in a process which promotes evidence-based prescribing.

Comprehensive "My Health Records" with detailed inputs of clinical information including clinical reasons for prescribing antibiotics, diagnostic information, and antibiotic dose and duration from GPs and community pharmacists is instrumental for GP-pharmacist collaborative care and patient safety (Saha et al., 2020; Thursky 2021).

Establishment of an effective antimicrobial audit-feedback programme in primary care would drive continuous improvement.

Clinical decision support tools (CDSS)

In Australia, administrative challenges and technical issues to integrate CDSS tools into GP and community pharmacy practice software persist. The current electronic medical record systems do not provide CDSS support to assist antibiotic prescribing decisions by GPs (Biezen et al., 2021; Robertson et al., 2011).

Pilot studies have found that the CDSS tool was well accepted by GPs in Australia, however some key features of CDSS need to fit into the clinical workflow (Biezen et al., 2021; Robertson et al., 2011).

Clinical decision support systems (CDSS)
Clinical decision support systems (CDSS) are a digital health technology that provide clinicians with point-of-care information. CDSSs tools are computerized alerts and reminders which have been designed to support clinicians improving decisions regarding antibiotic choice, dose, and duration.

Benefits of CDSS for antibiotic stewardship include optimising the prescribing process by auditing decisions and providing real-time feedback, as well as increasing with antibiotic prescribing guidelines and reducing the risk of unnecessary and inappropriate prescribing of specific antibiotics (Biezen et al., 2021; Calloway et al., 2013).

While the outcomes of using CDSS by clinicians include reduction in antibiotic usage (Calloway et al., 2013), reduction in broad-spectrum antibiotic use (Schulz et al., 2013; Litvin et al., 2013), reduction in adverse events (Evans et al., 1998; Pestotnik et al., 1996), decreased mortality (Pestotnik et al., 1996), increase in pharmacy interventions (Evan et al., 1998), and decreased healthcare costs (Calloway et al., 2013; Paul et al., 2006).

Barriers and enablers to CDSS adoption for improved antibiotic prescribing include time constraints and patient preference (Laka et al., 2021) as well as a "whole of practice" approach to adoption involving enthusiastic GPs, practice staff, and a defined champion GP.

Determining the optimal CDSS features and characteristics for the Australian setting will be critical to triggering higher CDSS use by primary care prescribers to improve antibiotic prescribing.

Standardised evaluation of currently available CDSSs suitable for use in primary could help optimise current tools, improve the adoption and sustainability of CDSSs for antibiotic prescribing in future.

CDSSs in optimising antibiotic use in primary care in the United States and France

- A systematic review from the United States found marginal to moderate improvements of antibiotic prescribing behaviours of GPs while used CDSS in routine patient care (Holstiege et al., 2014).
- While a study of Community pharmacists found that they were overwhelmingly supportive of using CDSS tools to evaluate patients and promote antibiotic stewardship but noted that resolving communication barriers with GPs would ease implementation of CDSSs in community pharmacy settings (Sayood et al., 2021).

In France, two CDSSs (Antibioclic and AntibioHelp®) were particularly suitable for use in primary care settings which are mostly accessible via smartphone applications and online websites (Jeanmougin et al., 2012; Tsopra et al., 2019). More than 90% of the CDSSs displayed recommendations for antibiotic selection, prioritization, dosage, duration, route of administration, and alternative antibiotics in case of allergy (Durand et al., 2022).

Governance for AMS in primary care

Clinical governance for AMS in primary care

Internationally, an expanded role for community pharmacists as enablers of AMS is well accepted. In Canada, the United States, New Zealand and the United Kingdom (Goode et al., 2019; Law et al., 2012; Zhou et al., 2019), pharmacists are already working within various prescribing models to support AMS, including collaborative, supplementary and independent pharmacist prescribing (Tonna et al., 2007; Wu et al., 2021).

In Australian primary care, AMS governance at the national and local level is absent; and implementing governance structures will require significant developments to ensure leadership, engagement, and accountability for AMS stakeholders in primary care is. Without clear governance, issues of poorly implemented AMS programs will continue.

To date, top-down approaches have proven ineffective for improving the delivery of AMS programs in primary care, (Hawes et al., 2020).

Therefore, taking a bottom-up approach to local and national governance structures will be critical enablers at the community level to foster AMS implementation and GP–community pharmacist collaboration in AMS, as well as being able to reduce barriers to implementation.

The governance structure should define and update leadership roles and accountability for establishing AMS programs in Australian general practice and community pharmacy, similar to the AMS program embedded into hospitals.

A proposed governance structure to implement AMS programs in general practice and community pharmacy has been developed (Figure 4). Having a national governance structure for implementing AMS programs in primary care must be a policy priority.

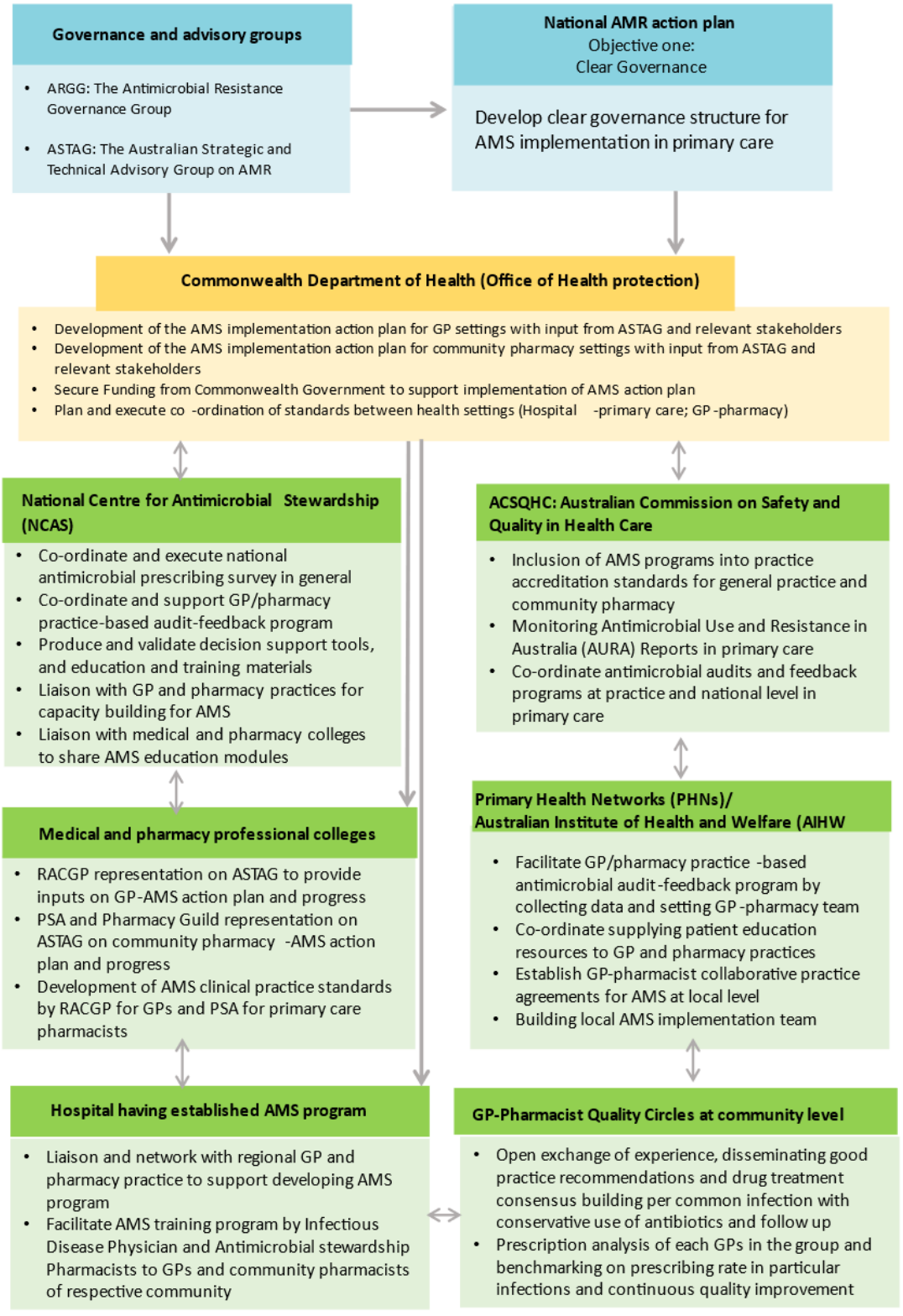

Figure 5. Governance structure to foster implementation of GPPAS framework to optimise antimicrobial use in primary care (Adapted from Saha et al., 2022; Hawes, 2020).

Conclusion and Recommendations

Growing antimicrobial resistance in the community potentially caused by overuse and inappropriate use of antimicrobials is a serious public health threat. The economic and health care burden justify sustainable development in the intersectoral collaboration between general practice and community pharmacy to optimise antimicrobial use. The solutions proposed in this issues brief will position Australia as a global leader in establishing GP-pharmacist collaborative antimicrobial stewardship program in primary care to address antimicrobial resistance and related threats.

Recommendation 1: Models of care to support best practice AMS

Commonwealth and state and territory funds should be directed to support GPs and community pharmacists to be able to provide a full cycle of care for patients who have transitioned from hospitals.

Infectious disease functional units could be established in high prescribing regions, which are supported by hospital and regional health agencies to provide necessary training and advice to GPs.

Recommendation 2: GP-community pharmacy practice agreements

GP-pharmacy practice agreements and implementation of antibiotic stewardship programs should be built and fostered. This could be led by PHNs and supported by professional medical and pharmacy organisations.

Recommendation 3: AMS training

AMS training should be developed by ACSQHC in collaboration with stakeholders, and implemented across primary care, with education and training programs informed by AMS expertise found in hospitals and delivered through registration with medical and pharmacy professional colleges.

At a local level, PHNs could support practice based AMS training programs in general practice and community pharmacies.

Medical and Pharmacy Colleges should work with universities to develop a national AMS curriculum for general practice and community pharmacy.

Recommendation 4: Collaborative GP-pharmacist prescribing models.

Collaborative GP-pharmacist prescribing models should be implemented in primary care. Pharmacists should be given access to appropriate training, decision support tools and protocols, as well as diagnostic training and patient consultation training. The introduction of pharmacy prescribing programs would be in line with international evidence, practice and policies.

Recommendation 5: Guidelines to support delayed prescribing strategies.

Guidelines that direct community pharmacists to identify and implement delayed prescriptions and that support communication with patients should be developed. A policy guided local GP-pharmacist partnership model will be critical to effectively implementing delayed prescribing strategies.

Recommendation 6: Point-of-care testing for microbial infection

The introduction and use of POCT in general practice for microbial infections should be supported by government. This should be underpinned by continuous evaluation to help determine cost-effectiveness and best approach in terms of consideration of the MBS and patient eligibility. GP and community pharmacy practice agreements should underpin POCT implementation in community pharmacy for improving diagnostic AMS.

Recommendation 7: A digital platform to support AMS in primary care

The government should support the development of a digital platform that monitors antibiotic prescribing practices in primary care. This could be modelled from the NHS Health Improvement Network database and data could then be used to inform the development of AMS metrics and indicators.

Recommendation 8: Program evaluation

An effective antimicrobial audit and feedback program should be established in primary care to drive continuous improvement in AMS.

The collection of both qualitative and quantitative data related to antimicrobial use at both the national and local level will be critical to guiding stewardship targets in primary care and already validated survey tools could be adopted to scale.

Recommendation 9: Audit and feedback through real-time monitoring for antibiotic prescribing

A real-time prescription monitoring system should be established in primary care to audit the prescribing and dispensing of antimicrobial prescriptions. The mechanisms that have been established to audit the use of controlled medicines could be adapted to include this approach.

Practice based audits and a national antibiotic prescribing survey in general practice would help identify the evidence practice gaps and quality improvement strategies to optimise antibiotic use in primary care.

Support for the AMS workforce and incentives for routine audit and feedback must be considered.

Recommendation 10: Clinical decision support tools for antibiotic prescribing

The use of clinical decision support tools by primary care prescribers is critical to improving antibiotic prescribing; and the development of a standardised evaluation of currently available tools will be critical for improving their adoption and sustainability in AMS programs moving forward.

Recommendation 11: GP-Community pharmacy governance framework for AMS

A national clinical governance structure to implement AMS programs in primary care has been developed and its implementation should be supported by government (Figure 4). This will be critical to ensuring that responsibility and accountability for the best possible AMS practices in primary care is placed with GPs and community pharmacists who will operationalise AMS decisions. Effectiveness of the framework as part of AMS quality and risk management should be developed.

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