

# Implementation Challenges in Antimicrobial Stewardship

**Professor Karin Thursky**

Director, National Centre for Antimicrobial Stewardship, Department of Infectious Diseases, University of Melbourne

Director, Royal Melbourne Hospital Guidance Group

Director, Centre for Health Services Research in Cancer, Peter MacCallum Cancer Centre

Implementation Stream Lead, National Centre for Infections in Cancer, Peter MacCallum Cancer Centre



*Declarations:  
No conflicts of interest  
Melbourne Health owns Guidance  
and NAPS IP*

195 Countries *should* have National Action Plans for AMR



Overall global average score of 51.7 out of 100 for AMS implementation and governance

Patel et al. Measuring the global response to antimicrobial resistance, 2020–21: a systematic governance analysis of 114 countries. Lancet ID 2023

A very small workforce of antimicrobial stewardship experts (ID physicians, specialist pharmacists, specialist nurses, microbiologists)



Doctors



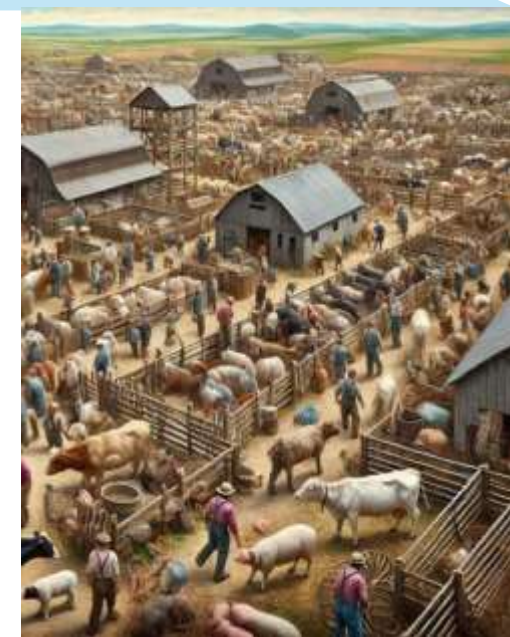
Patients and carers



Nurses



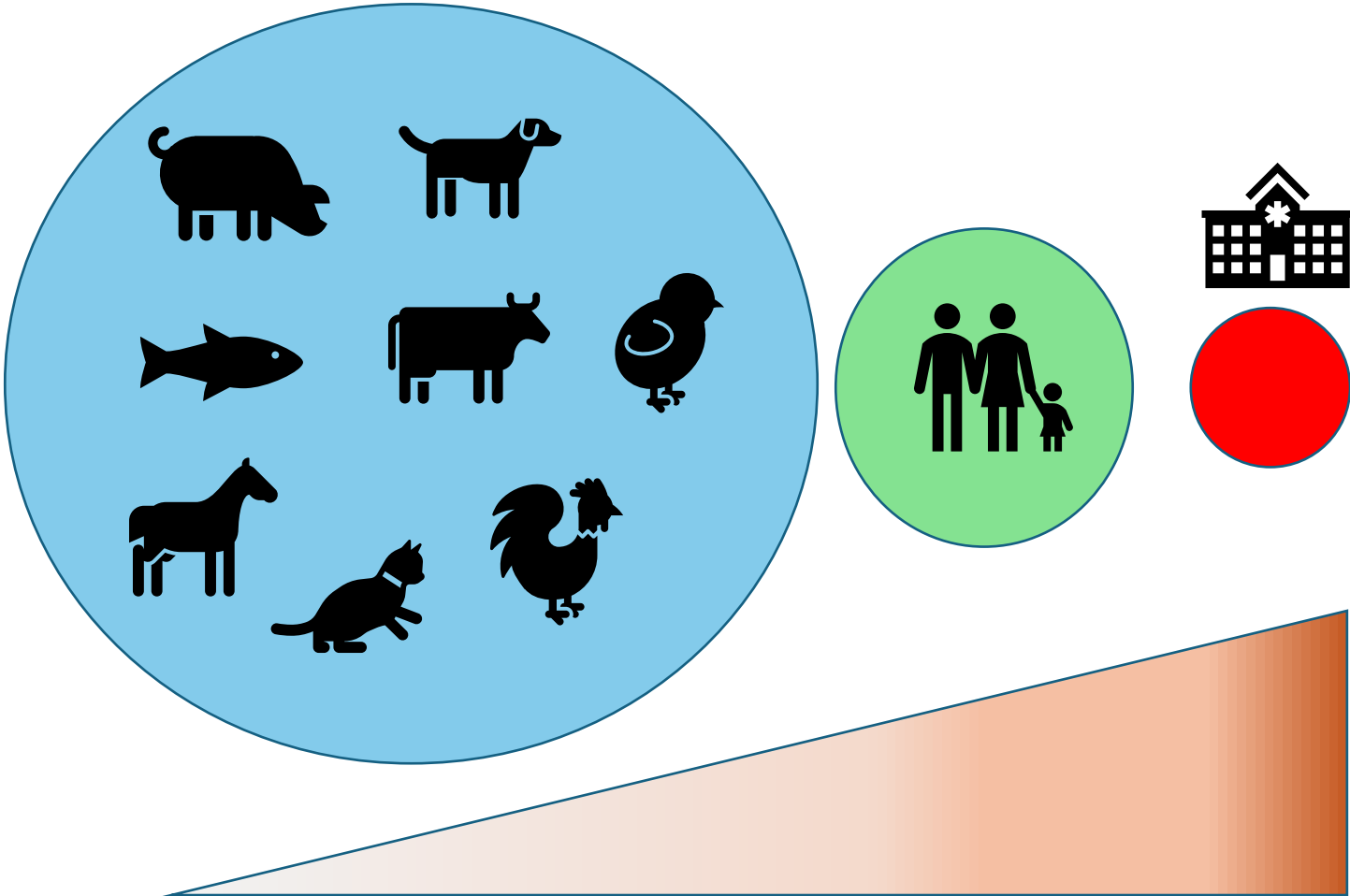
Pharmacists



Farmers, vets

Billions of users and prescribers

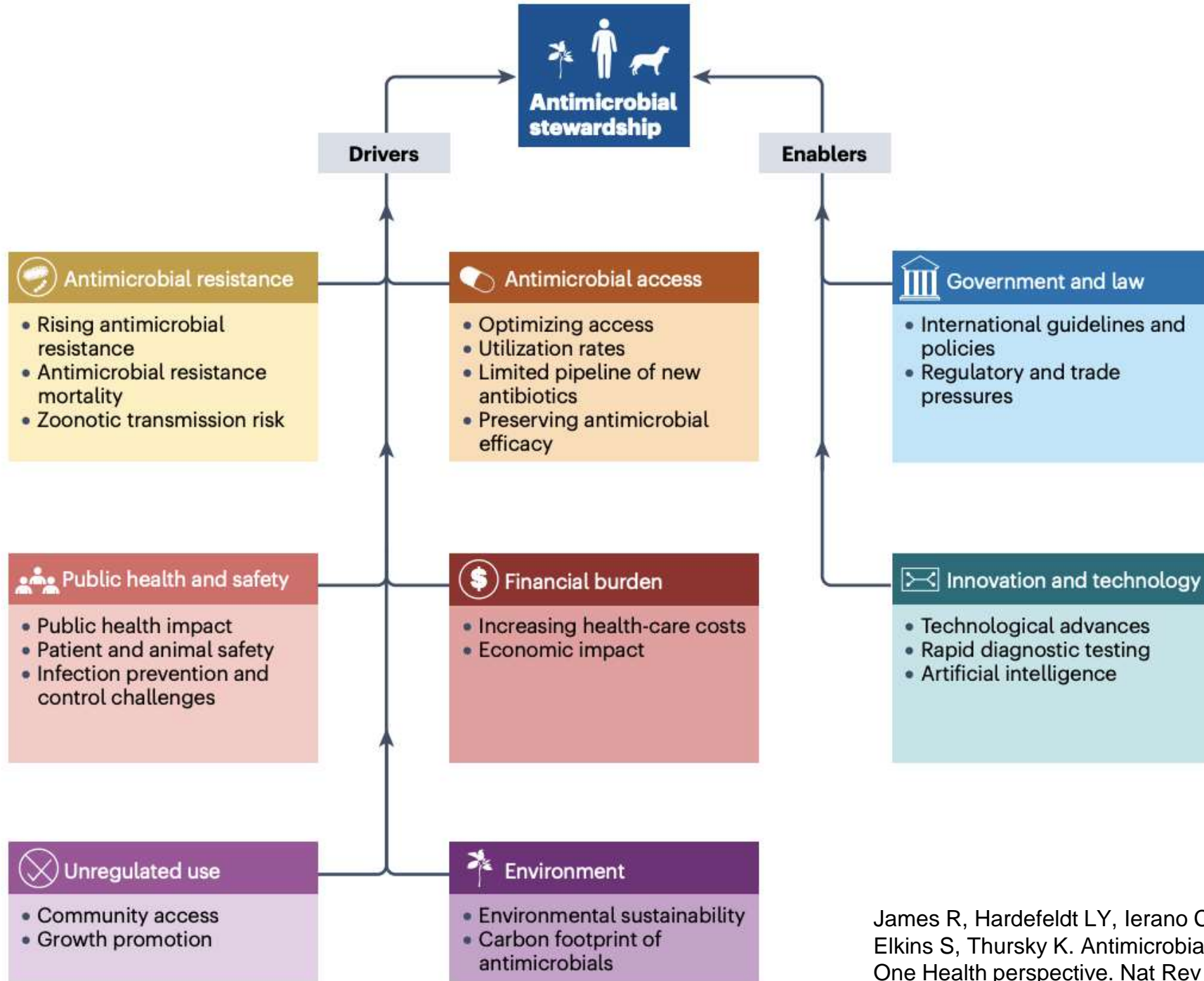
# Where, who, why and how are our antimicrobials being used?



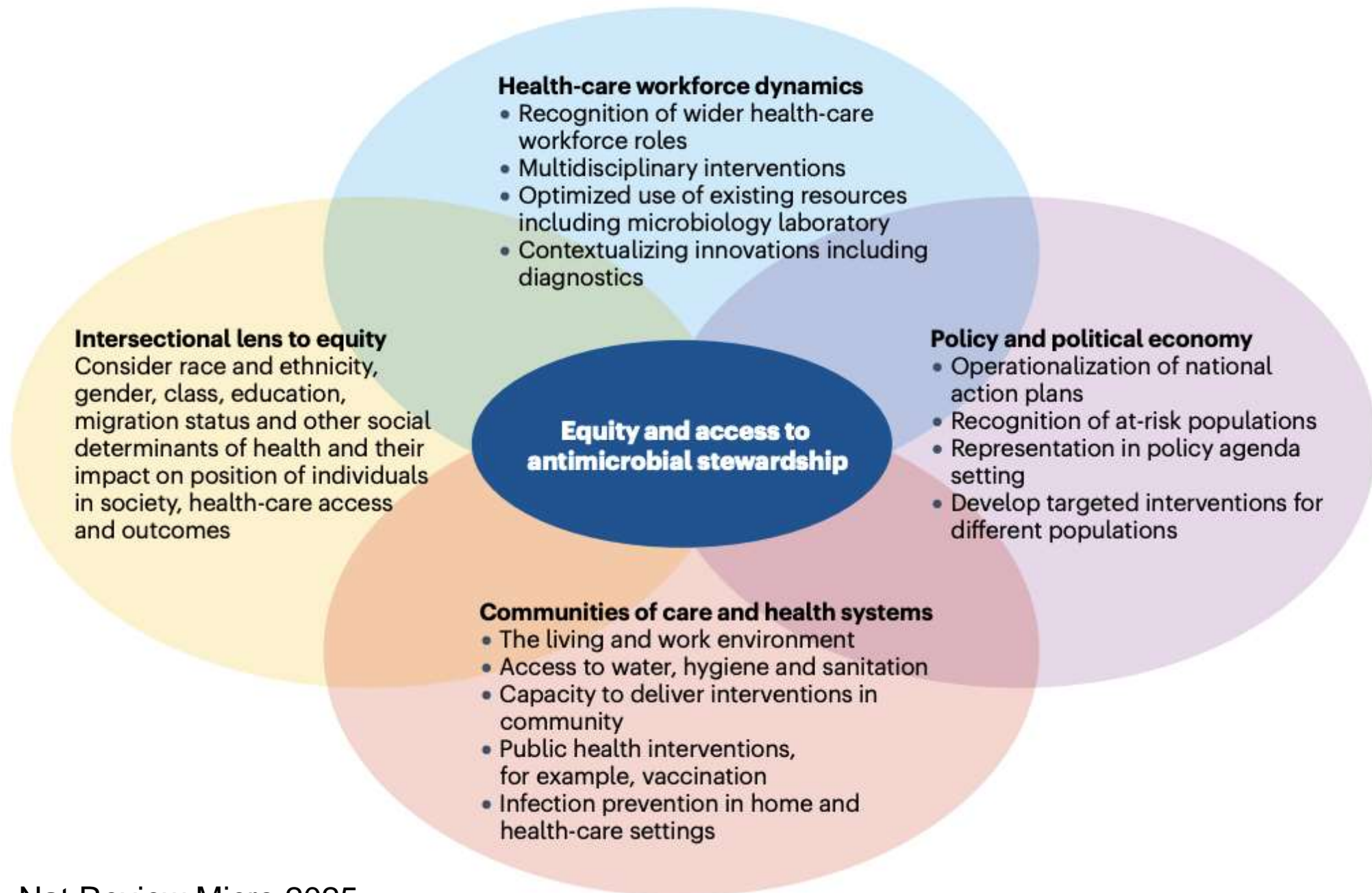
80% antimicrobials are being used in the animal sector




80% of human use is in the community

Most data and the highest quality data is from the hospital sector



James R, Hardefeldt LY, Ierano C, Charani E, Dowson L, Elkins S, Thursky K. Antimicrobial stewardship from a One Health perspective. Nat Rev Microbiol. 2025

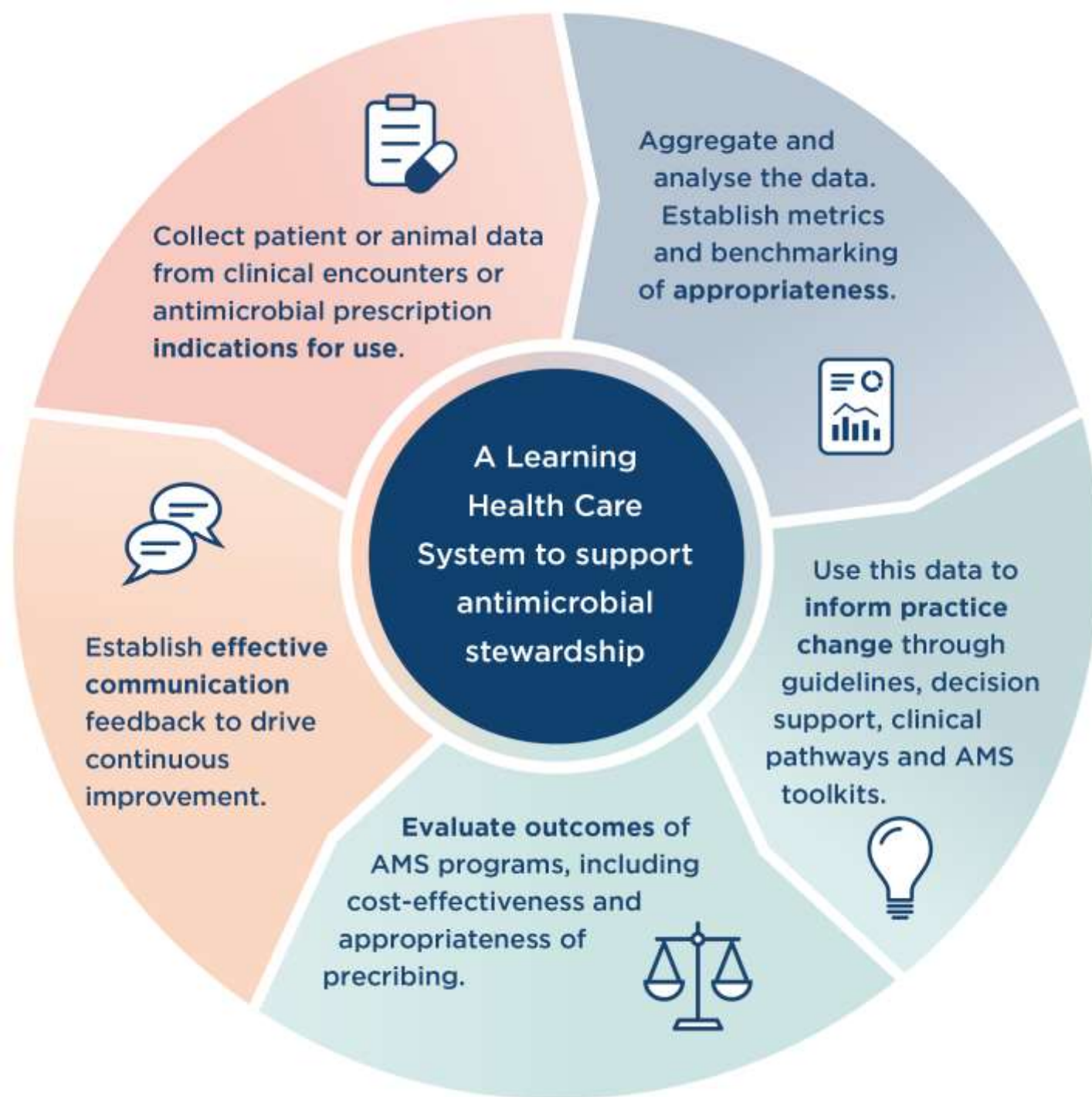


Setting	Hospital 	Aged Care 	Primary Care 	Animal Health 
<b>Structural Measures</b>				
Policy	Dark Blue	Dark Teal	Light Teal	Dark Teal
Accountability & Leadership	Dark Teal	Medium Teal	Light Teal	Lightest Teal
Expertise	Medium Teal	Medium Teal	Lightest Teal	Lightest Teal
Educational Resources & Training	Medium Teal	Dark Teal	Medium Teal	Dark Teal
Classification systems (e.g., WHO AWaRe classification <sup>19</sup> )	Light Teal	Lightest Teal	Lightest Teal	Lightest Teal
<b>Process Measures</b>				
Access to guidelines & toolkits	Medium Teal	Medium Teal	Dark Teal	Dark Teal
Access to decision support systems	Dark Teal	Lightest Teal	Medium Teal	Lightest Teal
Prospective audit & feedback	Dark Blue	Dark Teal	Medium Teal	Light Teal
Formulary restriction requirements	Lightest Teal	Lightest Teal	Lightest Teal	Lightest Teal
• pre-authorisation	Dark Teal	Lightest Teal	Lightest Teal	Lightest Teal
• promoting antibiotic alternatives	Lightest Teal	Lightest Teal	Lightest Teal	Medium Teal
Post-prescription review interventions	Lightest Teal	Lightest Teal	Lightest Teal	Lightest Teal
• Intravenous to oral conversion	Dark Teal	Lightest Teal	Lightest Teal	Lightest Teal
• De-escalation of therapy	Medium Teal	Lightest Teal	Lightest Teal	Lightest Teal
• Dose optimization	Medium Teal	Lightest Teal	Lightest Teal	Lightest Teal
Antibiotic time-outs or stop orders	Light Teal	Lightest Teal	Lightest Teal	Lightest Teal
Antibiotic cycling or rotation	Light Teal	Lightest Teal	Lightest Teal	Lightest Teal
Rapid diagnostic testing	Light Teal	Lightest Teal	Lightest Teal	Lightest Teal
Delayed prescribing or watchful waiting	Lightest Teal	Lightest Teal	Dark Teal	Lightest Teal
<b>Outcome Measures</b>				
Reduced antimicrobial consumption	Dark Blue	Dark Teal	Dark Teal	Dark Teal
Decreased rates of AMR	Light Teal	Medium Teal	Lightest Teal	Dark Teal
Improved clinical outcomes	Medium Teal	Medium Teal	Lightest Teal	Lightest Teal
Reduced Clostridioides difficile infections	Dark Teal	Medium Teal	Lightest Teal	Lightest Teal
Cost savings	Dark Blue	Light Teal	Medium Teal	Lightest Teal



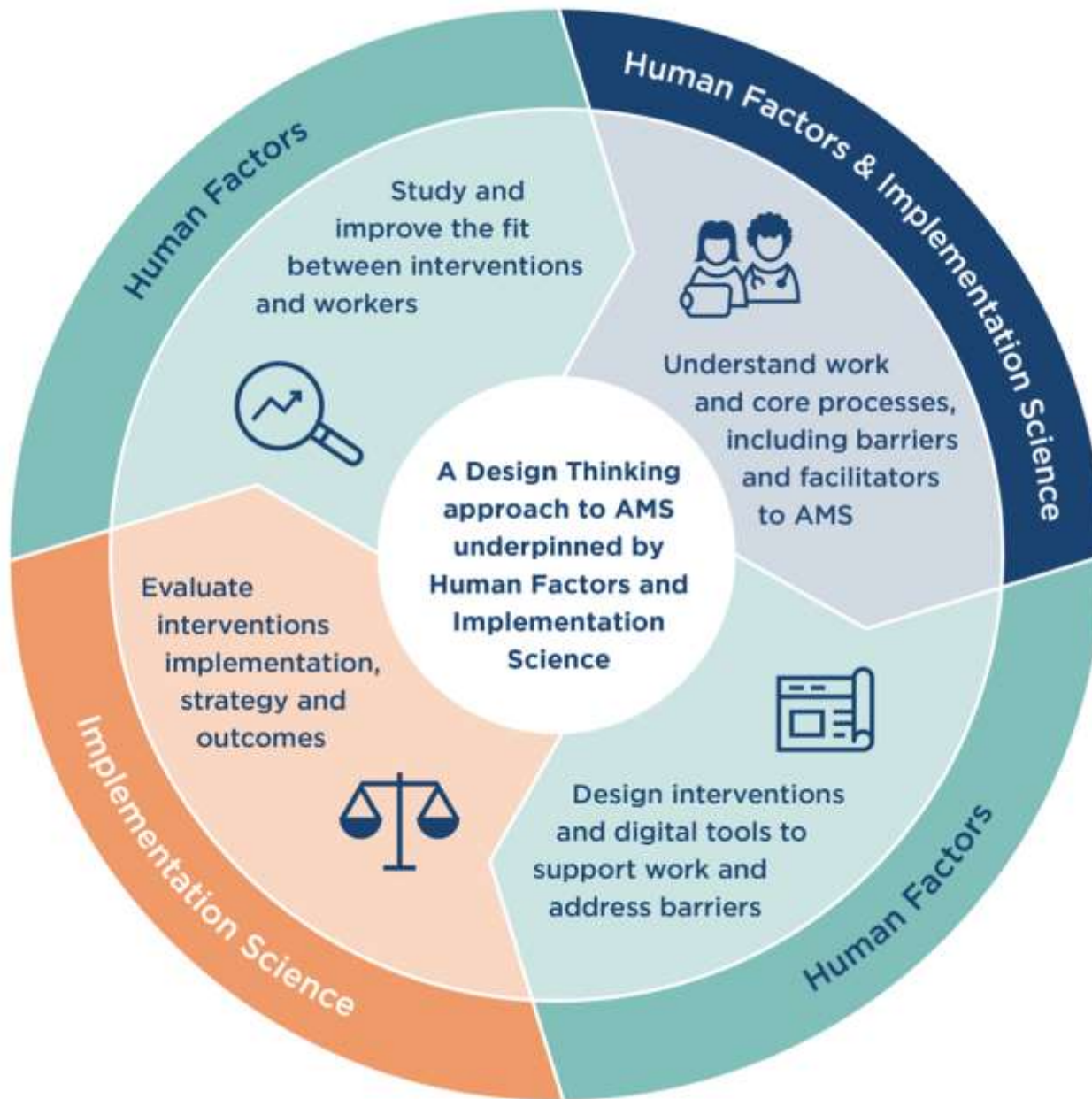
# Current Evidence for AMS Interventions

James et al. Nat Review Micro 2025



## The Learning Health Community

AMS /AMR experts  
 Data analytics  
 Data scientists  
 Human factors experts  
 Clinical informaticists  
 Epidemiologists  
 Implementation scientists  
 Health economists  
 Social scientists  
 Communications experts  
 Patients and consumers  
 Management and executive  
 Policy makers



How do we ensure that our AMS processes are fit for purpose?

# The National Antimicrobial Prescribing Survey

**NAPS** National Antimicrobial Prescribing Survey

## Welcome to the National Antimicrobial Prescribing Survey (NAPS)

Thank you for showing interest in the NAPS program

The NAPS program is coordinated by a multi-disciplinary team at the [National Centre for Antimicrobial Stewardship](#) and is delivered by the [Royal Melbourne Hospital](#) 2013 and has helped thousands of health care facilities globally assess the quality of their antimicrobial prescribing practices.

Multi-factor authentication is required to sign-up for an account, log-in and to make changes to your account details. Please refer to our cheatsheet to guide you through the process.

The recommended internet browsers are Google Chrome and Microsoft Edge. If you experience issues with loading our website, we suggest [clearing your browser](#).

## Current audit tools

Click on the following for more information on specific surveys

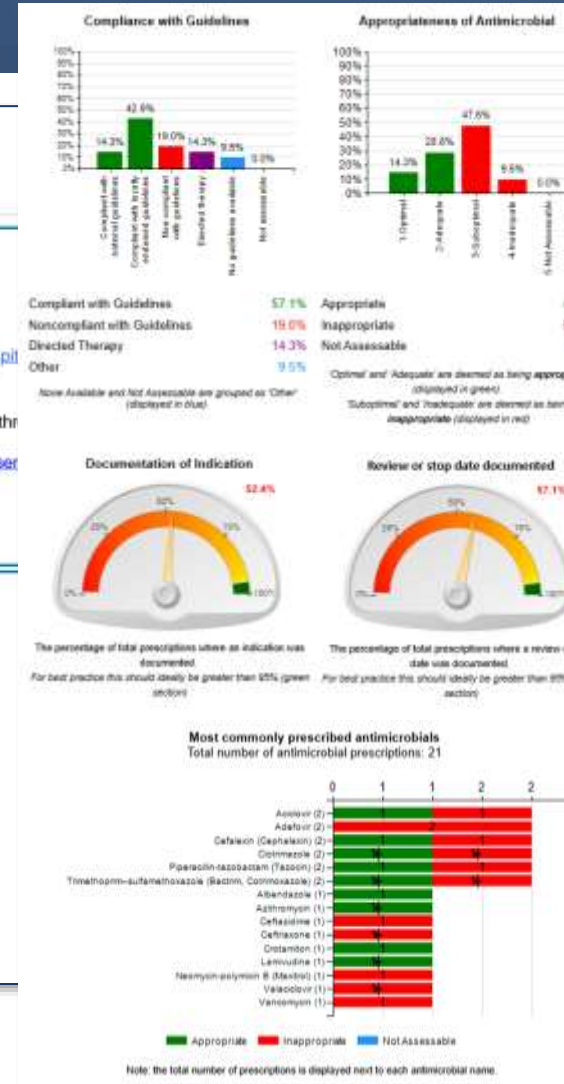


## Reports

All reports for the [Hospital NAPS](#), [Surgical NAPS](#) and [Aged Care NAPS](#) are publicly available. [Click here](#) to view.

## Contact us

If you are experiencing any problems registering, or have any questions about the NAPS, please [Contact us](#) for assistance.



**2023**

**AGED CARE NAPS**

**National Antimicrobial Prescribing Survey 2023**

**Chronic Obstructive Pulmonary Disease**

Results of the 2023 Aged Care National Antimicrobial Prescribing Survey

Chronic Obstructive Pulmonary Disease (COPD) is a long-term condition that affects the lungs and makes it difficult to breathe. It is caused by damage to the airways and lung tissue, often due to smoking or long-term exposure to air pollution. COPD is a leading cause of disability and death in Australia. The 2023 Aged Care National Antimicrobial Prescribing Survey (NAPS) provides insights into the use of antimicrobials in aged care facilities, highlighting areas for improvement and best practices.

**Introduction**

Chronic Obstructive Pulmonary Disease (COPD) is a long-term condition that affects the lungs and makes it difficult to breathe. It is caused by damage to the airways and lung tissue, often due to smoking or long-term exposure to air pollution. COPD is a leading cause of disability and death in Australia. The 2023 Aged Care National Antimicrobial Prescribing Survey (NAPS) provides insights into the use of antimicrobials in aged care facilities, highlighting areas for improvement and best practices.

**Recommended Management of COPD**

Antibiotics are only indicated if there are signs or symptoms of bacterial infection. Long-term antibiotic therapy may be indicated for patients with severe COPD and for recurrent exacerbations requiring hospitalization despite regular inhaled therapy. Low-dose macrolides can be used as part of an ongoing maintenance plan. Before the benefits of antibiotic therapy exceed their overall risk. Antibiotics, including oral antibiotics, are not recommended for the treatment of exacerbations of COPD.

**Chronic Obstructive Pulmonary Disease (COPD)**

COPD is a long-term condition that affects the lungs and makes it difficult to breathe. It is caused by damage to the airways and lung tissue, often due to smoking or long-term exposure to air pollution. COPD is a leading cause of disability and death in Australia. The 2023 Aged Care National Antimicrobial Prescribing Survey (NAPS) provides insights into the use of antimicrobials in aged care facilities, highlighting areas for improvement and best practices.

**Introduction**

Chronic Obstructive Pulmonary Disease (COPD) is a long-term condition that affects the lungs and makes it difficult to breathe. It is caused by damage to the airways and lung tissue, often due to smoking or long-term exposure to air pollution. COPD is a leading cause of disability and death in Australia. The 2023 Aged Care National Antimicrobial Prescribing Survey (NAPS) provides insights into the use of antimicrobials in aged care facilities, highlighting areas for improvement and best practices.

**Recommended Management of COPD**

Antibiotics are only indicated if there are signs or symptoms of bacterial infection. Long-term antibiotic therapy may be indicated for patients with severe COPD and for recurrent exacerbations requiring hospitalization despite regular inhaled therapy. Low-dose macrolides can be used as part of an ongoing maintenance plan. Before the benefits of antibiotic therapy exceed their overall risk. Antibiotics, including oral antibiotics, are not recommended for the treatment of exacerbations of COPD.

# NAPS Program – Reasons for Success



User centred design led by AMS clinician experts



Standardised and validated audits, structured appropriateness assessment eLearning packages

Online data entry portals and automated reports



Proven transferability with programs operating in over 750 hospitals and 1,000 aged care homes and 13 countries



Accreditation compliance



# 2026 and Beyond...



Home Audits About Publications

## National Antimicrobial Prescribing Surveillance Program

Improving antimicrobial prescribing through data-driven insights.



Validated, standardised audits that fit clinical workflows



Instant reports with actionable insights to drive improvement

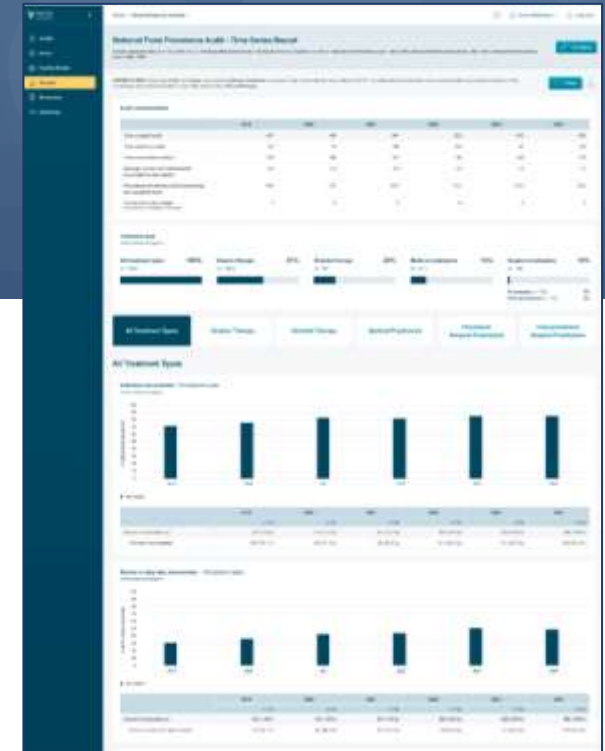
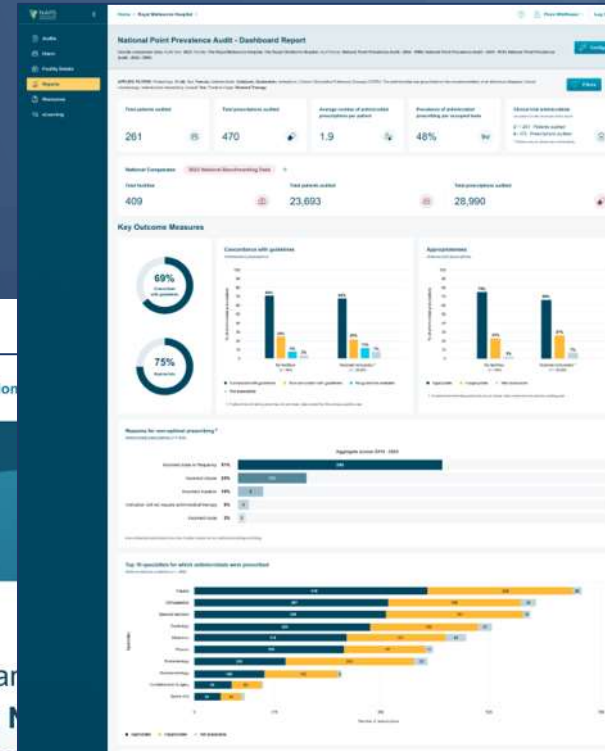


Secure cloud-based storage with multi-factor authentication

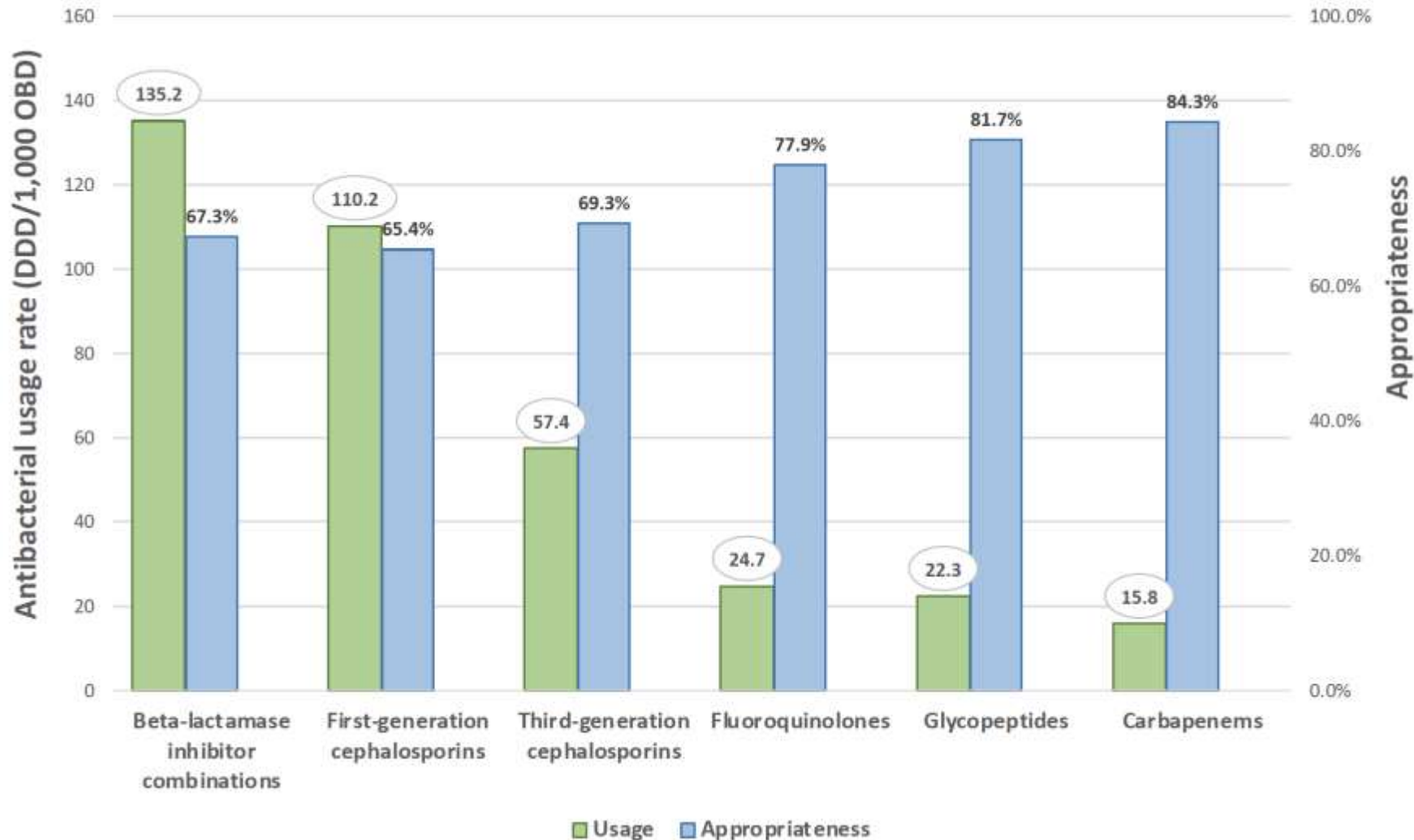
Are you an  
Hospital  
Improvement NAPS?

These audits have been redeveloped as the **National Point Prevalence Audit** and **Focused Prescribing Audit** and you will need to create a new account to access them and your previous data.

Create an account



# Combining antimicrobial consumption and appropriateness data

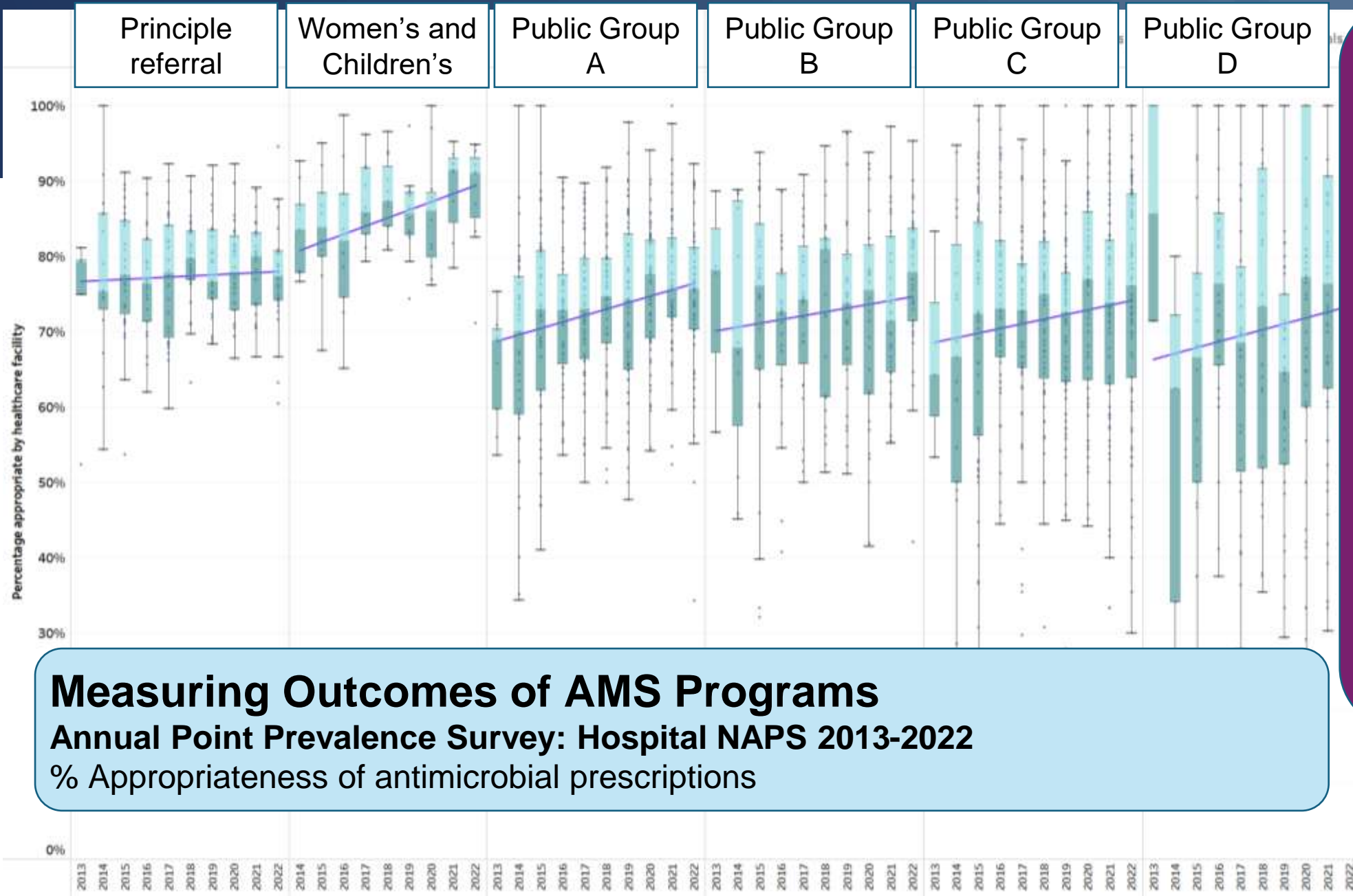


Data from the Australian NAPS and NAUSP program

181 facilities contributed data to both programs in 2022

*Indication level appropriateness*





“NAPS has validated clinician concerns about antimicrobial prescribing, ... assisted in gaining awareness of antimicrobial resistance [and] created an open dialogue between the health care team, including doctors, microbiologists, pathologists, pharmacists and nursing.”

Remote hospital pharmacist

**Measuring Outcomes of AMS Programs**  
**Annual Point Prevalence Survey: Hospital NAPS 2013-2022**  
 % Appropriateness of antimicrobial prescriptions

# Real World Data

Aggregation and triangulation of data from multiple sources

Local, regional and population level

Understand trends, patterns and drivers for AMR and AMU

Examples:

- Clinical and laboratory
- Quantitative and Qualitative
- Human and animal (and environmental)

- Data quality and accuracy
- Data privacy and security
- Integration and interoperability
- Bias and fairness
- Ethical and regulatory issues



## Data for action: The Reality



Here is the futuristic depiction of antimicrobial stewardship in 2025, showcasing a high-tech hospital environment with healthcare professionals collaborating through holographic displays and advanced digital tools. Let me know if you'd like any adjustments or additional details!

# What is the role of artificial intelligence for AMS?

## Artificial Intelligence

Computer systems capable of activities normally associated with cognitive effort

### Machine Learning

Training machines to recognize patterns using labelled (supervised) or unlabelled (unsupervised) data

### Deep Learning

Subfield of machine learning using layered neural networks to learn from vast amounts of data

### Generative AI

Subfield of deep learning that relates to the generation of new data (text, audio, video, images)

# Machine Learning can support AMS



## **Antibiotic Selection & Optimization**

Appropriate antibiotics based on patient history, infection type, and local resistance patterns.

## **Prediction of Antimicrobial Resistance (AMR):**

Guide targeted therapy and reduce empirical overuse of broad-spectrum antibiotics.

## **Early Diagnosis & Risk Stratification:**

Early identification of infections requiring intervention (e.g sepsis and HAI)

## **Clinical Decision Support Systems (CDSS):**

Assist AMS teams in real-time decision-making, ensuring better adherence to guidelines.

**Accuracy across 2 meta-analyses: 74-97%**

## **Comparative Performance with Clinician Judgment**

Perform **equal to or better than human experts** in identifying optimal antimicrobial therapies.

## **Ethical and Implementation Challenges:**

Concerns about transparency, interpretability, and clinician trust in AI recommendations.

## **Bias and Data Limitations:**

Potential overfitting in ML models due to biased datasets, often collected from high-income settings.

**Limited external validation**



# What is the role of generative AI in AMS?

One query to ChatGPT uses approximately as much electricity as could light one light bulb for about 20 minutes.

## The ideal situation

1. Enhance clinical decision making
2. Democratisation of expertise
3. Diagnostic support tools
4. Reduce cognitive load and burden of documentation
5. Support personalized medicine
6. Medical education (including multilingual)

**No clear pathway to implement and integrate generative AI in AMS**

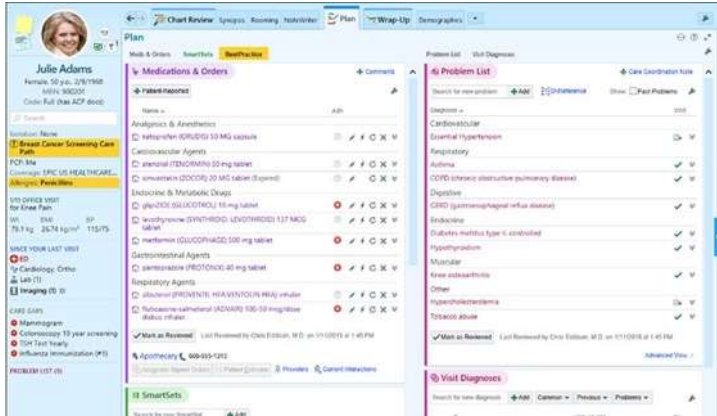
Reddy et al. Imp Sci 2024  
Sabbiah. Nature Medicine 2023

	Parrot	ChatGPT
		
Learns random sentences from random people	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Talks like a person but doesn't really understand what it's saying	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Occasionally speaks absolute non sense	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Is a cute little bird	<input checked="" type="checkbox"/>	<input type="checkbox"/>

r/ProgrammerHumor

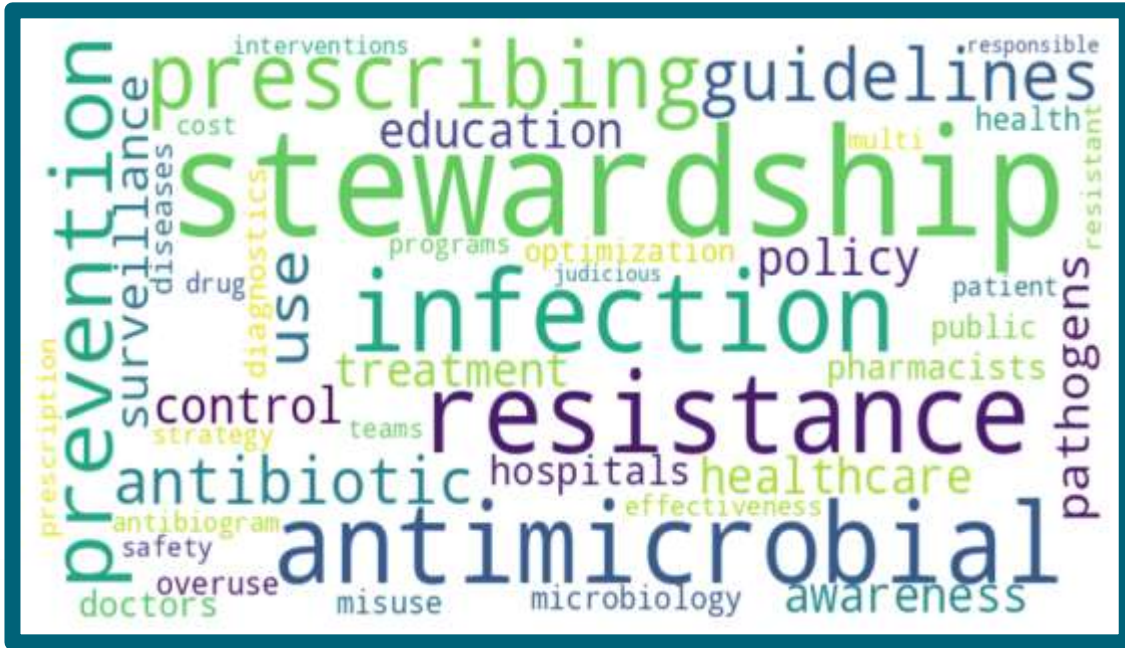
# The NCAS Data Science Initiative

An MRFF Research Data Infrastructure Grant



Natural language processing and machine learning  
Automation of assessments  
Human and animal  
Community and hospitals

# Is it time to reframe antimicrobial stewardship?



AMR-related health terms -esp “AMR” and “Antimicrobial resistance” are unsuitable for public health communication, as they score consistently **low on both memorability and risk association**

Practitioners place saving life in the immediate sense as the highest priority. Any risk of an untreated infection is intolerable and motivates the use of antimicrobials.

We need to consider **moral injury as an unintended consequence**

Krockow, Nature Communications Medicine 2023

Davis et al, 2024. Risk individualisation and moral injury in the treatment of infection as impediments to the tackling of antimicrobial resistance. *Health, Risk & Society*