REDUCING ANTIBIOTIC RESISTANCE 2012-2017

Evaluation Report

September 2018

Independent, not-for-profit and evidence based, NPS MedicineWise enables better decisions about medicines and medical tests. NPS MedicineWise receives funding from the Australian Government Department of Health.

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Contents

EXECUTIVE SUMMARY

The NPS MedicineWise Reducing Antibiotic Resistance (RAR) program ran from 2012 to 2017 and included interventions for health professionals and consumers. A major visiting program took place in 2012-13, and other health professional and consumer activities took place across the five-year period. The overarching goal of the program was to reduce inappropriate prescribing of antibiotics for specified conditions, including upper respiratory tract infections (URTI).

Antibiotic prescribing in Australia was reduced from 2012 to 2017

The overarching goal of the program was to reduce antibiotic usage by 25% over the course of the five-year program. The program was successful in reducing antibiotic prescribing in Australia from 2012-2017, based on analysis of Pharmaceutical Benefits Scheme (PBS) data, as well Organisation for Economic Cooperation and Development (OECD) data.

PBS data was used to assess changes in prescribing of J01 class antibiotics, as well as a subclass of those commonly prescribed for URTI. Prescribing patterns using PBS data were analysed separately for GPs and other health professionals:

- Between 2012 and 2017, an estimated reduction of 18.4% of all antibiotics prescribed by GPs and dispensed under the PBS was found, confirming that most of the decline in overall usage of antibiotics was driven by a decline in usage arising from GP prescribing

An analysis of PBS concessional data for dispensed prescriptions for antibiotics commonly prescribed by GPs for upper respiratory tract infections (URTI) between 2012 and 2017, using Bayesian hierarchical time series analysis, calculated the relative change in dispensing when the program was implemented, compared to what would have been expected if the program was not run.

- By June 2017, the estimated overall reduction since 2012 in the number of selected antibiotic GP prescriptions dispensed to concessional beneficiaries on the PBS was **24.8%**
- During the 2016-17 financial year, there were three months where an average reduction in prescribing greater than 25% was achieved. The reductions were achieved in July 2016 (26.9%), February 2017 (25.1%) and April 2017 (28.5%)

OECD data was used to compare Australian antibiotic defined daily doses per 1000 inhabitants per day (DDDs) to other similar countries.

- Australia's antibiotic DDDs reduced from 23.7 in 2012 to 18.4 in 2016, bringing Australia in line with prescribing levels in Norway (18.6 in 2016) and the United Kingdom (18.7 in 2016)

Changes in GP knowledge, attitudes, and practice

GP knowledge, attitudes and practice related to antibiotic resistance, and use of antibiotics in treatment of URTI changed during the program.

Improvements in GP knowledge and attitudes and practices detected by a survey of Australian GPs included:

- Knowledge that antibiotic resistance can occur after single use of an antibiotic, increasing from 32% in 2011 to 46% in 2017 (+14%, $p<0.001$)
- Knowledge that prescribing an antibiotic unlikely to benefit the patient can increase resistance increasing, from 94% in 2011 to 97% in 2017 (+3%, $p=0.042$)
- Acknowledgement that antibiotic resistance is an issue in communities served by their practice, increasing from 55% in 2011 to 61% in 2017 (+6%, $p=0.027$)
- The proportion of GPs who consider antibiotic resistance when prescribing antibiotics to their patients, increasing from 82% in 2011 to 95% in 2017 (+13%, $p<0.001$)

- The proportion of GPs who did not prescribe antibiotics to meet patient expectations, increasing from 62% in 2011 to 78% in 2017 (+16%, p<0.001)
- The proportion of GPs who discussed the issue of antibiotic resistance with their patients, increasing from 50% in 2011 to 64% in 2017 (+14%, p<0.001)

Consumer awareness of antibiotic resistance has increased

Consumer activity has been a constant component of the program, with two major advertising bursts in 2012 and 2015. Gains were made in consumer knowledge of antibiotics, but for further impact in this area sustained campaign effort is required. An ongoing process of research has identified insights about consumer knowledge and attitudes, and our increased understanding has influenced an evolving communications strategy.

- Consumer awareness of the term 'antibiotic resistance' has increased during the campaign from 70% in 2014 to 74% in 2017
- 44% of consumers indicating that antibiotics do no kill viruses in both 2014 and 2017
- More consumers believe that antibiotic resistance is affecting them now, from 11% in 2015 to 25% in 2017
- Changing consumer attitudes and beliefs and ongoing campaign work are a contributing factor to reducing unnecessary demand for antibiotics and needs to be conducted in parallel with GP education programs

Recommendations based on evaluation findings

- Address both consumer and health professional factors that drive demand for inappropriate use of antibiotics:
  - Investigate ways to improve GP communication skills with patients, especially about patient expectations of having an antibiotic prescribed
  - Develop a range of real-life case-based scenarios that demonstrate different GP strategies for managing the consultation safely, reducing the likelihood of inappropriate antibiotic prescriptions
  - Develop better mechanisms to ensure ready access to consumer materials and self-management resources at the point of consultation
  - Continue to provide information for consumers to raise awareness of antibiotic resistance in order to reduce patient demand for antibiotics for URTI in consultations with GPs
  - Maximise consumer campaign impact by addressing issues identified in research and maintaining a consistent level of campaign investment.
- Encourage use of shared decision-making strategies to reduce unnecessary antibiotic prescribing using resources NPS MedicineWise has available to support these conversations
- Inappropriate use of broad spectrum agents such as amoxicillin and clavulanic acid should be targeted by future programs
- Continue to provide educational programs to address levels of GP knowledge of:
  - the current and increasing impact of antibiotic resistance for individuals, including those within their immediate community
  - the potential impact of a single course of antibiotics on resistance for individual patients
- Conduct evaluations of program outcomes and impact to inform further program direction and content

BACKGROUND

Reducing Antibiotic Resistance (RAR) 2012-2017 was a five-year NPS MedicineWise program that aimed to reduce inappropriate prescribing of antibiotics by addressing both health professional and consumer audiences.

The *Design Statement Reducing Antibiotic Resistance 2012-2017* identified that gaps in both consumer and health professional knowledge were contributing to the development of antimicrobial resistance in the community and primary care settings. The design statement documented the importance of finding a different angle in each year of the program to capture the interest of health professional audiences, and in different years program content has focussed on URTI, urinary tract infections (UTI), and skin infections. Most activities in the program were aimed at health professionals. Two consumer focussed campaigns took place each year.

Program goal

The overarching goal of the Reducing Antibiotic Resistance program was to implement a coordinated five-year initiative to reduce antimicrobial resistance by reducing inappropriate use of antibiotics.

The overall target of the five year initiative was to reduce antibiotic usage by 25% over 5 years (from 24 to 19 DDDs based on 5% per annum) which at the time was to achieve concordance with international best practice and Australian Commission on Safety and Quality in Health Care (ACSQHC) recommended benchmarks.

Program activities

Health professionals

A summary of products offered to GPs as part of the 5-year program is outlined below. A national educational visiting program was offered in 2012. Some MedicineInsight practices had small group discussions 2016.

TABLE 1: OVERVIEW OF RAR 2012-2017 PRODUCTS AND ACTIVITIES

Program/product	Activity	GPs
Antibiotic Resistance and Respiratory Tract Infections 2012/13 (Feb 2012)	Case study	1,127
	Clinical audit	1,442
	Interactive Workshop	31
	One-to-one visit	5,118
	Small group case based meeting	4,081
	Webinar	75
	Clinical audit	787
	All activities	*10,296*
PBS feedback: Antibiotic prescribing for URTIs (Feb 2012)	PBS feedback	≈25,000
Antibiotics – Reducing Antibiotic Resistance (2014/2015)	Case study	842
	Clinical audit	1,398
	eLearning	256
	All activities	*2,495*

Program/product	Activity	GPs
PBS feedback: Antibiotic prescribing for URTIs (Apr 2015)	PBS feedback	24,222
PBS feedback: General antibiotic prescribing (Nov 2015)	PBS feedback	28,526
MedicineInsight visit: Antibiotics Practice Report (2016)	Small group case based meeting	255
Antibiotics resource kit (Aug 2016)	Educational materials (1,680 practices)	-
Respiratory tract infection action plan (Mar 2016)	Action plan/management pad	-
National Case Study: Otitis media (2016)	Case study	304
Antibiotics resource kit (July 2016)	Educational materials (635 practices)	-
MBS practice review: Testing in older people: urine MCS testing (May 2017)	MBS feedback	29,943
Educational materials distributed with Chief Medical Officer's letter (June-December 2017)	Distributed with Behavioural Economics and Research Team (BERT) letter	2,630

In addition to the products aimed at health professionals, each year of the RAR program two national campaigns were implemented; the Winter Campaign, as well as the Australian activities for *World Antibiotic Awareness Week*. These campaigns were designed to reach both consumers and health professionals.

Consumers

Consumer activity has remained a constant component of the RAR 2012-17 program. Annual winter campaigns timed to coincide with higher levels of demand for upper respiratory tract infections have been the mainstay of communications targeting consumers. While campaigns have been run each year of the 5-year program, there have been two major advertising bursts at the start of the program (2012) and in year 4 (2015).

The aim of our work with consumers has been to raise the profile of antibiotic resistance and to reduce unnecessary demand for antibiotics for upper respiratory tract infections (cold and flu viruses) by addressing a range of knowledge and beliefs.

Throughout the duration of the program an on-going process of evaluation and market research (through qualitative research, message testing and campaign analysis) has identified drivers of consumer behaviour and unnecessary demand or expectation. This knowledge has led to an evolution of our campaign messaging about antibiotics and a change in emphasis for ongoing evaluation.

The scope of knowledge and belief areas addressed and communicated through the program is extensive and has included themes such as:

- The role of antibiotics in treating bacteria, not viruses
- Misapprehension that antibiotics can work for viruses like the cold and flu
- Knowledge that bacteria are becoming resistant to antibiotics
- Misapprehension that antibiotics can speed up recovery for upper respiratory tract infections
- Knowledge that antibiotic resistant bacteria can be passed on to others
- The prevalence of antibiotic resistance in our society and that it is occurring and affecting people now
- Symptom type and duration for URTI
- Good hygiene to prevent the spread of germs

Each year the campaign included slightly different themes, and varying levels of media exposure depending on budget available.

TABLE 2: SUMMARY OF WINTER CAMPAIGNS FROM 2012 TO 2017

Year	Campaign Highlights
2012	**Significant media burst:** "Resistance Fighter" launch campaign to raise awareness for the category and to demonstrate how it is possible to recover from cold and flu viruses without antibiotics. ▪ Total spend of $1.3 million. Media split included; TV; magazines, digital advertising and social media. 30 second and 15 second versions of a TVC were broadcast in April and May, and a further two weeks in July and August. Celebrity endorsement through Channel 7's Mel Doyle and in program segmenting ▪ The TV campaign reached over 8.73 million Australians. ▪ Magazine advertorials reached 6.1 million and served 50 million digital impressions. ▪ Over 35,000 online "pledges' to use antibiotics appropriately made by Australians. ▪ Media coverage increased by 200% compared to the previous year
2013	A $272,000 spend on activities to reinforce the previous campaign's message using a mixture of outdoor advertising in and digital media. ▪ First annual antibiotic awareness week promoted in November 2013 ▪ Range of social media assets and films exploring different messaging created
2014	A $196,000 spend and further insights about consumer knowledge led to tactical changes in strategy ▪ These included social media advertising, digital panels in selected medical centres; and a small regional outdoor campaign and the development of new messaging through social media as well as native content in online publications such as Mamamia
2015	**Significant media burst:** The campaign featured x2 TVCs and creatives. The first focussed on how using antibiotics for cold and flu impacts on their effectiveness and the second on how antibiotic resistant bacteria can be passed on to others. ▪ Total spend of $1.75 million was split across digital, television, and out of home ▪ The opportunity to see these was 4.4 million people for the first campaign and 3 million people for the second campaign ▪ The outdoor component was potentially seen by 8.2 million people ▪ The digital component served 47.3 million impressions ▪ A significant and high profile PR campaign in conjunction with the Tropfest Film competition ▪ A further 10,000 pledges made and 9,000 interactions with a speed of recovery digital race game

Year	Campaign Highlights
2016	A $127,533 spend on campaign activities. ▪ A range of consumer messaging addressing different concepts tested online following extensive qualitative research exercise with 5.7 million impressions served Additional tactical components included a campaign aimed at child care centres
2017	The total campaign spend was $171,833 ▪ "What every Parent Should Know About" Campaign to educate parents on the usual duration of childhood Respiratory Tract Infection and raise awareness that antibiotics are generally not recommended for these symptoms ▪ Campaign served 18.8 million impressions through six different publishers ▪ Geo targeted campaign in Dandenong – an area of high prescribing ▪ Fitness First

EVALUATION METHODS

Purpose of the evaluation

The purpose of this evaluation is to assess whether the program has made an impact on GPs and consumers during its five-year implementation period, and whether it has contributed to its key objective of reducing inappropriate antibiotic prescribing in Australia.

Types of evaluation

To assess the program's impact on its key audiences, a variety of data sources has been used to conduct process evaluation, impact evaluation, and outcome evaluation.

The evaluation includes:

- **Process evaluation** - information about participation, reach, satisfaction, and perceived value.
- **Impact evaluation** - changes in awareness, knowledge, attitudes, beliefs, and behaviours.
- **Outcome evaluation** - assessment of whether the program has contributed to savings on the PBS, and/or influenced changes to rates of antibiotic prescribing in Australia.

Key evaluation questions

The key evaluation questions over the 5 year program were:

- Was the program successful in significantly reducing antibiotics prescribing in Australia?
- Did the program change GP knowledge, attitudes, and practice related to prescribing antibiotics for URTI?
- Did the program change consumer knowledge, awareness, and attitudes to use of antibiotics?
- Did the program change consumer knowledge of antibiotic resistance?
- Was uptake of program elements as expected, or did some products perform better/worse than expected?
- Did products developed for RAR achieve their respective participation and/or download targets? (includes resources, health professional participation, implementation of campaigns)

Data sources

The data collection period was from 1 January 2012 until 30 June 2017 unless otherwise specified.

Process evaluation

Three process evaluation reports about the RAR program were completed in 2014, 2016, and 2017. Key findings from those reports are summarised in this report. The existing reports that were reviewed included monitoring of:

- **Participation data:** The number of health professionals who participated in the program interventions
- **Product delivery information:** When program components were produced an implemented, and whether there were barriers to implementation
- **Distribution and order data:** HP and consumer access to hard copy and electronic resources associated with the program
- **Campaign Data:** Review of existing reports to assess key metrics for the Winter Campaign and Antibiotics Awareness Week

Impact evaluation

The data sources in this section provided information about knowledge, attitudes, and practice among GPs and consumers

GPs

- **Reducing Antibiotic Resistance 2012-2017 GP Survey:** A pre survey was sent to a sample of Australian GPs in November 2011 to assess their knowledge, attitudes, and practice related to antibiotic prescribing. A revised questionnaire was distributed to a sample of Australian GPs in October 2017, to assess for changes in selected measures before and after the RAR program.
- **Clinical e-Audit:** The first NPS MedicineWise online clinical e-audit was developed for the RAR program in 2012. Changes to indicators were made in 2015 to reflect changes to guidelines, so data in the current report reflects analysis of the updated version of the audit, including data gathered from 1,632 GPs from 1 June 2015 to 15 February 2018. This section assessed GPs self-reported changes on key indicators related to URTI in patient interactions.
- **MedicineInsight data:** MedicineInsight data was used to evaluate the impact of resource kits sent to GP practices in July 2016. Prescribing in practices that received the kit was compared to prescribing in control practices.

Consumers

Surveys have been conducted to gather information about consumer knowledge, attitudes, and beliefs to track changes in them over time. Those referenced in this report include:

- **National Consumer Survey:** National Consumer surveys were conducted in 2012, 2014, 2015 and 2017 and the results of these surveys have been used to track how consumer knowledge, awareness, and attitudes related to antibiotic use and antibiotic resistance have changed over this period.
- **Consumer Campaign Assessment (2013):** Online consumer surveys were conducted as part of the campaign at two points, in April 2013 (n=1,002) and June 2013 (n=1,000).
- **Online communications tracking surveys (2011 and 2012):** Two online communications tracking surveys were conducted in December 2011 (n=1,013) and June 2012 (n=1,019) as part of tracking the NPS MedicineWise brand. As part of these surveys initial questions about antibiotics were included

One additional survey, recently conducted to explore parents' knowledge of URTI was conducted, and may be used as a benchmark for future results:

- **2017 Antibiotics Survey:** A cross-sectional survey of parents with children aged 14 years or below was conducted online in July 2017. The purpose of the survey was to provide baseline data about parents' knowledge and behaviour in relation to symptoms of upper respiratory tract infections in their children.

Outcome evaluation

- **Drug utilisation evaluation:** This section assesses changes in defined daily doses per thousand inhabitants using PBS data provided by the Department of Human Services (DHS), as well as prescribing data reported by the OECD.
- **PBS cost savings:** A summary of cost savings figures calculated as part of savings reports provided to the Department of Health.

CHANGES IN ANTIBIOTIC USE IN AUSTRALIA

This section addresses the evaluation question, **Was the program successful in significantly reducing antibiotics prescribing in Australia?** It specifically addresses changes in antibiotic prescribing and dispensing across the program period.

Program target/objectives

The program ran over a five-year period with the specific aim of reducing antibiotic dispensing by 25% by the end of 2017. This target was chosen to bring Australia's use of antimicrobials in-line with the average of Organisation for Economic Cooperation and Development (OECD) countries and with the recommended benchmarks of the Australian Commission on Safety and Quality in Health Care (ACSQHC).

The program aimed to do this by reducing inappropriate prescribing by health professionals of nominated antibiotics for target conditions.

Key Findings

There has been a significant reduction in prescribing of antibiotics overall, including those typically prescribed for upper respiratory tract infections (URTI) following the NPS MedicineWise Reducing Antibiotic Resistance program.

- Between 2012 and 2017 analysis of PBS data shows a decline in GP prescribing of both systemic antibiotics and those specifically used for URTI. Non-GP prescribing over the same period showed a slight increase.
- By June 2017, the estimated overall reduction in the number of antibiotic prescriptions dispensed to concessional beneficiaries on the PBS was **24.8%** compared to the volume that would have been expected without the NPS MedicineWise program.
- In an analysis of concessional PBS data, there were three months during the 2016-17 financial year where an average reduction in prescribing for antibiotics commonly prescribed for URTI greater than 25% was achieved. The reductions were achieved in July 2016 (26.9%), Feb 2017 (25.1%), and April 2017 (28.5%).
- According to OECD data, the annual Australian defined daily doses per thousand inhabitants per day (DDDs) for all antibiotics decreased from 23.7 in 2012 to 18.5 in 2013, and to 18.4 in 2016.

Changes in defined daily doses

Trends in drug utilisation have been investigated to identify changes in antibiotic use measured in defined daily doses per thousand inhabitants per day (DDDs). This measure was calculated for specified antibiotics on an annual basis.

Trends in PBS Data

Estimates of antimicrobial usage have been undertaken by NPS MedicineWise using PBS data provided by the Department of Human Services and measured in DDDs between 2012 and 2017.

This data reflects all dispensed prescriptions for antibiotics in the J01 class, including under co-payment scripts. An additional analysis was undertaken for J01 class medicines typically used in the treatment of upper respiratory tract infections (URTI). The full list of PBS item codes included in this analysis are provided in Appendix A.

This data provides an estimate of change in antibiotic dispensing over time, with the rate for all health professionals dropping by an estimated 18.4% between 2012 and 2017 (Figure 1).

Data has also been broken down to compare general practitioners to other health professionals. This distinction is made as NPS MedicineWise programs have concentrated only on GPs. The second and third panel of Figure 1 partitions usage arising from general practitioners from that arising from other health practitioners.

General practitioners comprise the majority of usage, accounting for between 20 and 16 DDDs between 2012 and 2017 (Figure 1 – middle panel). Other health practitioners accounted for around 3 DDDs over the same time. Moreover, the decline in overall usage was driven by a decline in usage arising from GPs; with usage arising from GPs declining between 2012 and 2017 whilst usage arising from other health professionals increased slightly (Figure 1 – middle and lower panels).

Usage of antibiotics typically used to treat respiratory tract infections paralleled the usage trends of all antibiotics in the J01 group (Figure 1 – all panels).

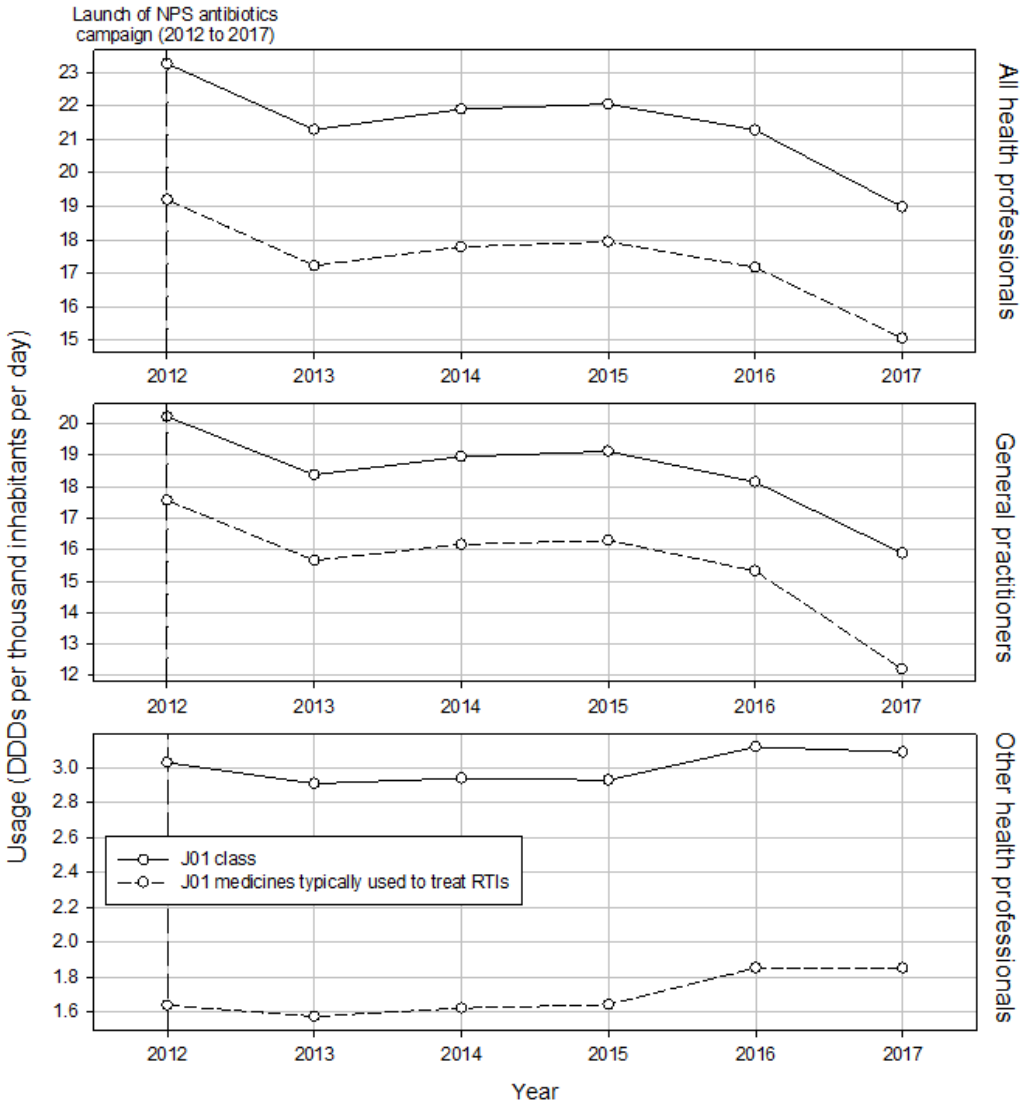

Figure 1: **ANTIMICROBIAL USAGE (IN DEFINED DAILY DOSES PER 1000 INHABITANTS PER DAY) IN AUSTRALIA (UPPER PANEL) PARTITIONED BETWEEN GENERAL PRACTITIONERS (MIDDLE PANEL) AND OTHER HEALTH PROFESSIONALS (LOWER PANEL) AND BETWEEN ALL ANTIMICROBIALS IN THE J01 CLASS (SOLID LINES) AND ANTIMICROBIALS TYPICALLY USED IN THE TREATMENT OF RESPIRATORY TRACT INFECTIONS (DASHED LINES). THE VERTICAL DASHED LINE INDICATES THE LAUNCH OF THE 2012 NPS ANTIBIOTICS PROGRAM.**

Volume changes in antibiotics commonly prescribed for URTI

Calculations related to reductions in PBS prescribing to concessional patients for specified antibiotics commonly prescribed for URTI has also been undertaken as part of NPS MedicineWise annual savings reports to the Department of Health. Information in this section is summarised from savings reports produced by NPS MedicineWise, for submission to the Department of Health. This includes the 2016, 2017, and 2018 savings reports. These are different to the analysis above in that they reflect data from only the concessional patient group.

Prescription data for the concessional patient group was used as it represents a complete dataset for URTI and UTI antibiotics as before 2012 we did not have access to under co-payment data for general beneficiaries. Data was supplied by the DHS. A Bayesian structural time series model was used to forecast a series of antibiotic dispensing volumes expected to have occurred if the interventions had not taken place. These were compared with the volumes that were actually observed to estimate the intervention effect. The estimated change in the dispensing volume following the sequence of interventions was calculated from the monthly differences between the observed and expected antibiotic dispensing volumes. The methods used in this study are described in Wu et. al's 2018 paper, *Relationship between antimicrobial-resistance programs and antibiotic dispensing for upper respiratory tract infection: An analysis of Australian data between 2004 and 2015.*[1]

By June 2017, the estimated overall reduction in the number of antibiotic scripts dispensed to concessional beneficiaries since 2012 was 24.8% compared to the volume that would have been expected without the NPS MedicineWise program.

There were three months where an average reduction in prescribing greater than 25% was achieved. The reductions were achieved in July 2016 (26.9%), Feb 2017 (25.1%), and April 2017 (28.5%).

The timing of this reduction corresponds to peak GP participation in the 2012 academic detailing activities.

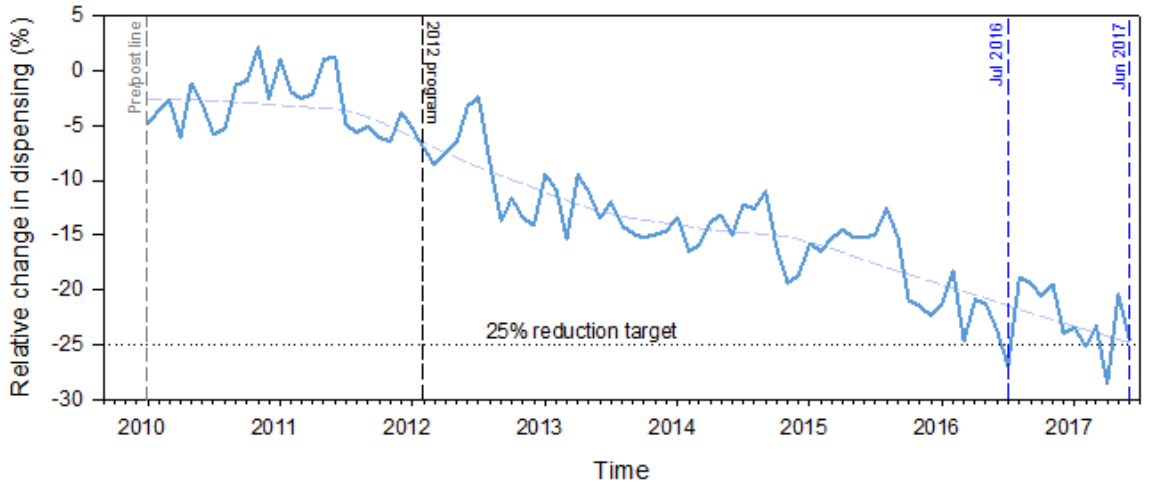

Figure 2: **CHANGE IN PRESCRIBING BY MONTH BETWEEN JANUARY 2010 AND JUNE 2017 RELATIVE TO ESTIMATED DISPENSING WITHOUT NPS INTERVENTION. GREY VERTICAL LINE INDICATES THE START OF THE NPS MEDICINEWISE 5-YEAR SET OF PROGRAMS.**

Savings

It is estimated that the sustained effort of NPS MedicineWise to combat antibiotic resistance via various programs has reduced expenditure on antibiotics by $70.2 million for the period July 2012-June 2017. Savings reports for each year can be provided on request.

Other analysis of antimicrobial usage – AURA and OECD

Comparing different analyses of antimicrobial use is complex due to the variation in data sources, inclusion dates, application of ATC codes, inclusion of non-systemic antimicrobials and approaches to extracting data.

Two other sources report on the use of antimicrobials in Australia. The Antimicrobial Use and Resistance in Australia (AURA) reports were first published in 2016, with a further report issued in 2017. The AURA reports use a number of data sources to analyse antimicrobial usage in hospitals and the community. The Organisation for Economic Cooperation and Development (OECD) publishes Australian antimicrobial usage data for comparison with other countries using data obtained from the PBS and RPBS.

Antimicrobial Use and Resistance in Australia (AURA) reports

AURA reporting derives volume of antimicrobial use from the PBS, RPBS, and DUSC database. The 2017 report includes data through the 2015 calendar year. It includes antimicrobials prescribed by general practitioners, specialists, and approved non-medical prescribers in the community, as well as prescriptions written in public hospitals for outpatients and patients on discharge (for all states/territories excluding NSW and ACT).

The AURA report indicated that in 2015, 44.7% of the Australian population had at least one antimicrobial dispense under the PBS/RPBS, with an overall rate of 25.4 DDDs.[2] The 2014 AURA report indicated an overall rate of 23.8 DDDs.[3] These rates are higher than the NPS MedicineWise figures (which just evaluates PBS data) for 2015 (22.1 DDDs) and 2014 (21.9 DDDs), though the direction of change for the analysis is the same. The NPS MedicineWise analysis extends to 2017, when more positive changes are seen, with a reduction to 19.0 DDDs for all health professionals.

While the analysis presented in the AURA report using data through 2015 indicates higher levels of antimicrobial use than the NPS MedicineWise analysis, it also highlights data from additional sources that indicate positive change.

In the AURA 2017 report, data from the MedicineInsight program found that the rate of antimicrobial prescriptions per 100 GP consultations has shown a small decline from 2010 to 2015. Furthermore, findings from the Report on Government Services 2016, vol. E: Health, indicates that the proportion of presentations of URTI for which systemic antimicrobials were prescribed by GPs decreased 30.2% over the five-year period from April 2010 to March 2015.[4] Commentary in AURA specifically highlights that this change may be in response to the NPS MedicineWise RAR program.

OECD data

Data published by the OECD includes all J01 class antibiotics (antibiotics for systemic use). These annual DDD figures vary from NPS MedicineWise analysis as it includes prescriptions dispensed under the Repatriation PBS data set.[5]

In the five years prior to the launch of NPS MedicineWise's five-year antibiotics campaign (2007-2011), antimicrobial usage among the Australian population for all antibiotics was relatively stable, averaging 24.2 DDDs (Figure 3).

In 2012, antibiotic usage dropped by 2.1% relative to this five-year average. In 2013, usage dropped by 23.6% relative to the five-year average. This drop remained stable thereafter, reaching a drop of 23.9% by 2016 (Figure 3).

The drop in Australia's estimated DDDs between 2012 and 2013 corresponds with a change in OECD methodology. OECD data is based on prescriptions submitted for payment on the PBS/RPBS. Prior to 2012, dispensing data for general beneficiaries (under co-payment threshold) was not included in PBS

data and instead was estimated based on pharmacy surveys. Survey data also collected information about private antibiotic prescriptions. From April 2012 under co-payment data was included in the PBS data collection and survey data ceased in March (for under co-payment patients) and August (for private prescriptions) These changes in PBS data inclusions should have also affected other estimates, yet AURA figures do not show the same large and rapid decline in the 2012-13 period.

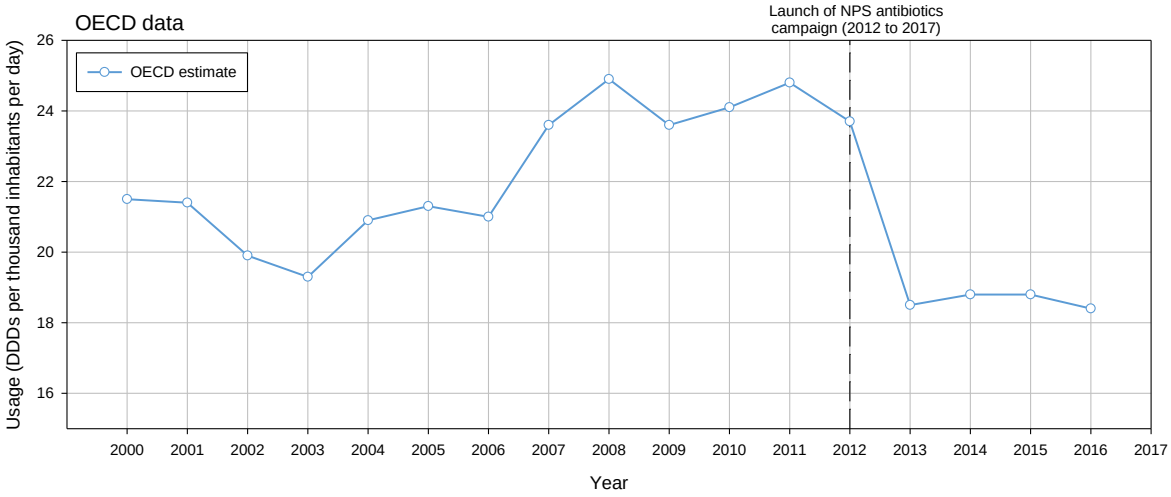

Figure 3: **ANTIMICROBIAL USAGE (IN DEFINED DAILY DOSES PER 1000 INHABITANTS PER DAY) IN AUSTRALIA BETWEEN 2000 AND 2017 AS ESTIMATED BY THE ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD).**

OECD data for Australia have been compared with six similar countries, which were selected for inclusion in the *AURA 2016: first Australian report on antimicrobial use and resistance in human health.* report In the AURA 2016 report, community antimicrobial use in Australia was compared to other countries selected due to readily accessible and comparable data. Out of these countries (England, Canada, Norway, Denmark, Sweden, and the Netherlands), the DDD per 1000 inhabitants per day for Australia were the highest prior to 2013.

In 2012, the OECD estimate for Australian antibiotic DDDs is 23.7, also the highest of the seven countries. By 2016, the Australian DDD level is at 18.4, which is slightly lower than Norway (18.6) and the United Kingdom (18.7). The DDD per 1000 inhabitants per day for these comparator countries have remained stable unlike Australia (Figure 2).

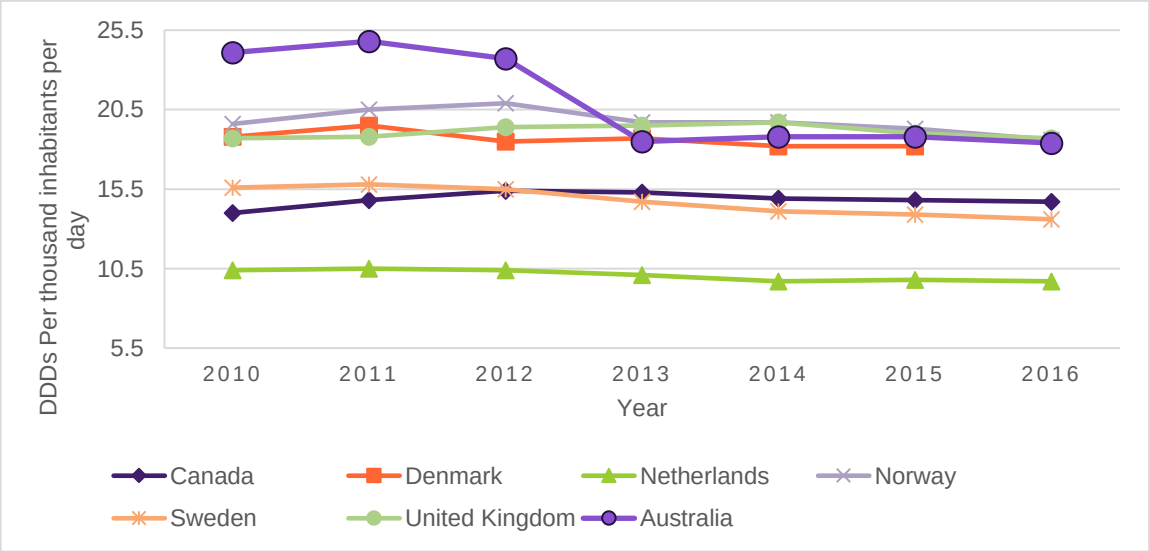

Figure 4: **OECD ESTIMATES OF DEFINED DAILY DOSES PER 1,000 INHABITANTS FOR COUNTRIES IDENTIFIED AS SIMILAR TO AUSTRALIA, BY YEAR**

CHANGES IN GP KNOWLEDGE, ATTITUDES, AND PRACTICE

This section addresses the evaluation question, **Did the program change GP knowledge, attitudes, and practice related to prescribing antibiotics for URTI?** Changes to GP knowledge, attitudes, and are measured as they are expected to decrease inappropriate prescribing of antibiotics for target conditions.

Key findings

There have been positive changes in GP knowledge and attitudes related to the concept of antibiotic resistance in 2017 compared to 2011.

- 14% more GPs are aware that resistance can occur after single use of an antibiotic (32% vs 46%, $p < 0.001$)
- 3% more GPs recognize that prescribing an antibiotic that is unlikely to benefit the patient can increase resistance (94% vs 97%, $p = 0.042$)
- 6% more GPs acknowledge resistance as an issue in the community served by their practice (55% vs 61%, $p = 0.027$)

There have been positive changes to GP practice during consultations with patients presenting with URTI in 2017 compared to 2011, including:

- 13% more GPs report that they consider antibiotic resistance when prescribing (82% vs 95%, $p < 0.001$)
- 16% more GPs report that they do not prescribe antibiotics to meet their patient expectations (62% vs 78%, $p < 0.001$)
- 14% more GPs report that they discuss the issue of antibiotic resistance with patients (50% vs 64%, $p < 0.001$)

GPs who participated in the clinical e-audit reported practice that was more in line with guidelines during the second phase of the audit:

- For the six indicators with an activity that was not recommended, all demonstrated a statistically significant decrease in the proportion of patients meeting the indicator ($p < 0.05$). The greatest change was observed for an indicator related to acute sore throat / pharyngitis / tonsillitis (49.7% decrease).
- Among twelve indicators for activities that are recommended; all demonstrated statistically significant increases in the proportion of patients for whom GP actions meet the indicators ($p < 0.05$). The greatest increase was seen for a general indicator about use of recommended antibiotic, dose, frequency, and duration when therapy is recommended (64.8% increase).

Using MedicineInsight data it was determined that a practice kit distributed to MedicineInsight practices was found to be associated with a reduction in prescribing at those practices:

- Prescribing rates of practices receiving print materials in the kit were 2.9% lower than non-intervention practices for all antibiotics ($p = 0.02$)

RAR 5 Year GP Survey

The primary data sources are two surveys conducted by NPS MedicineWise in November 2011 and October 2017. Ten questions repeated verbatim across the 2011 and 2017 surveys addressed GP knowledge and attitudes about antibiotic resistance, as well as about GP practice in consultation for URTI. This area was selected as a focus of the survey as the RAR program 2012-17 had a focus on URTI as an area of high antibiotic prescribing which far exceeds prescribing recommended by antibiotic guidelines. Full details of the survey and findings are available in Reducing Antibiotic Resistance 2012-17 GP Survey Report.

In both 2011 and 2017, the questionnaires were distributed by mail to a random sample of GPs in the NPS MedicineWise contact database. In 2011, a response rate of 47% resulting in 666 completed surveys and in 2017 513, a 27% response rate.

TABLE 3: SURVEY RESPONSE RATES

Group	Initial Sample	Exclusions*	Completed	Response rate
2011 Survey	1,570	152	666	47%
2017 Survey	2,000	128	513	27%

GP knowledge about antibiotic resistance has increased

There was an increase in the proportion of GPs selecting the desired response for three statements about antibiotic resistance.

TABLE 4: PROPORTION OF GPS SELECTING DESIRED RESPONSES TO STATEMENTS ABOUT ANTIBIOTIC RESISTANCE

Statement (Desired Response)	GPs selecting desired response		
	2011 % (n)	2017 % (n)	Significant difference
Prescribing an antibiotic that is unlikely to benefit the patient (Factor selected)	94 (625)	97 (475)	**+3%, p = 0.042**
Antibiotic resistance, lasting up to 12 months, may occur after single use of antibiotic (Agree/Strongly Agree)	32 (210)	46 (232)	**+14%, p < 0.001**
Antibiotic resistance is a problem in the community served by my practice (Agree/Strongly Agree)	55 (364)	61 (312)	**+6%, p = 0.027**

Increased knowledge that prescribing an antibiotic is unlikely to benefit the patient and increases resistance

From 2011 to 2017, there was an increase in the proportion of GPs who correctly selected ‘prescribing an antibiotic that is unlikely to benefit the patient’ as an action that can increase antibiotic resistance (94% vs 97%, p = 0.042). The proportion of GPs selecting this factor was already high in 2011.

Increased knowledge that resistance can occur after single use of an antibiotic

The proportion of GPs who strongly agree or agree that antibiotic resistance, lasting up to 12 months, may occur after single use of an antibiotic increased by 14% from 2011 to 2017 (32% vs 46%, p < 0.001).

Evidence for this statement comes from a systematic review by Costelloe et al which showed that patients receiving antibiotics for infections of the respiratory or urinary tract in primary care develop resistance to that antibiotic. The risk of resistance is greatest in the months following the antibiotic course, but resistance can still be detected in some patients up to a year later.[6] This result demonstrates that GPs are becoming more aware of the potential impact of antibiotic resistance on the individual following a single course of antibiotics.

Knowledge about the potential impact of an antibiotic course on resistance in an individual patient is likely to reduce antibiotic prescribing, particularly when the antibiotic is likely to provide only a small or negligible benefit to the condition being treated.

Increased belief that resistance is a problem in the community

The proportion of GPs who strongly agree or agree that antibiotic resistance is a problem in the community served by their practice increased by 6% from 2011 to 2017 (55% vs 61%, p = 0.027). This result is in line with surveillance of antimicrobial resistance in Australia, which has shown significant and increasing levels of antimicrobial resistance such as vancomycin-resistant enterococci, community-acquired methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum beta lactamase (ESBL) producing *Escherichia coli.*[7]

GP Practice

The survey also explored GP practice during consultations about a URTI. Positive changes have occurred in how GPs approach consultations with patients and discuss antibiotic resistance with them. GPs in 2017 were more likely to consider antibiotic resistance when prescribing compared to 2011 (+13% p < 0.001). GPs in 2017 were also more likely to indicate that they rarely or never prescribe antibiotics to meet patient expectations (+16%, p < 0.001).

There was no change in recommending symptomatic management alone. There was a 13% decrease in GPs who always or often prescribe a narrow spectrum antibiotic when required (p < 0.001).

TABLE 5: IN YOUR CONSULTATIONS FOR PATIENTS PRESENTING WITH A URTI, PLEASE INDICATE HOW FREQUENTLY THE FOLLOWING OCCUR:

Situation (desired response)	GPs selecting desired response		
	2011 % (n)	2017 % (n)	Significant difference
You consider the issue of antibiotic resistance when prescribing (Always/Often)	82% (543)	95% (475)	**+13%, p < 0.001**
You prescribe antibiotics in order to meet your patient's expectations (Rarely/Never)	62% (410)	78% (389)	**+16%, p < 0.001**
You recommend symptomatic management alone (Always/Often)	90% (602)	93% (471)	None
You prescribe a narrow spectrum antibiotic when required and available (Always/Often)	72% (465)	59% (296)	**-13%, p < 0.001**

More GPs now consider the issue of antibiotic resistance when prescribing

A higher proportion of GPs in 2017 compared to 2011 considered the issue of antibiotic resistance when prescribing for patients with an URTI.

In addition to the overall proportion of GPs selecting a desired response increasing (82% vs 94%, $p < 0.001$), the proportion of GPs in the sample who indicate that they “always” consider antibiotic resistance when prescribing antibiotics for URTI has increased from 33% in 2011 to 70% in 2017 ($p < 0.05$) (Figure 5).

This indicates that GPs are more frequently considering antibiotic resistance when prescribing antibiotics. By doing so, they are taking into consideration some of the risks of antibiotics for their patients and for the community and may be less likely to prescribe them as a result.

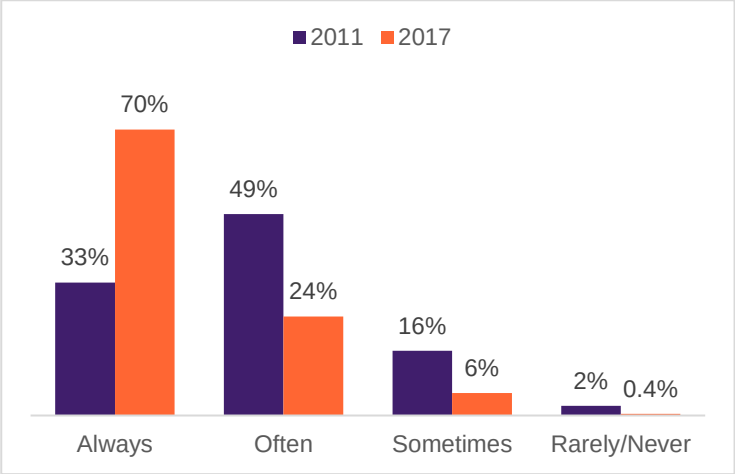

Figure 5: **PERCENTAGE GPS WHO CONSIDER THE ISSUE OF ANTIBIOTIC RESISTANCE WHEN PRESCRIBING, 2011 AND 2017**

Fewer GPs report prescribing antibiotics to meet patient expectations

It was hoped that fewer GPs never or rarely prescribe antibiotics to meet patient expectations as this can lead to inappropriate antibiotic prescribing and contributes to antibiotic resistance.

From 2011 to 2017, the proportion of GPs who report that they ‘rarely’ or ‘never’ prescribe antibiotics in order to meet patient expectations increased from 62% to 78% ($p < 0.001$).

In addition to the overall increase in the proportion of GPs who selected the desired response in 2017, the proportion of GPs in the sample who indicate that they “never” take this action increased from 13% in 2011 to 23% in 2017 ($p < 0.05$). This represents a positive change in GP practice when consulting with patients with an URTI.

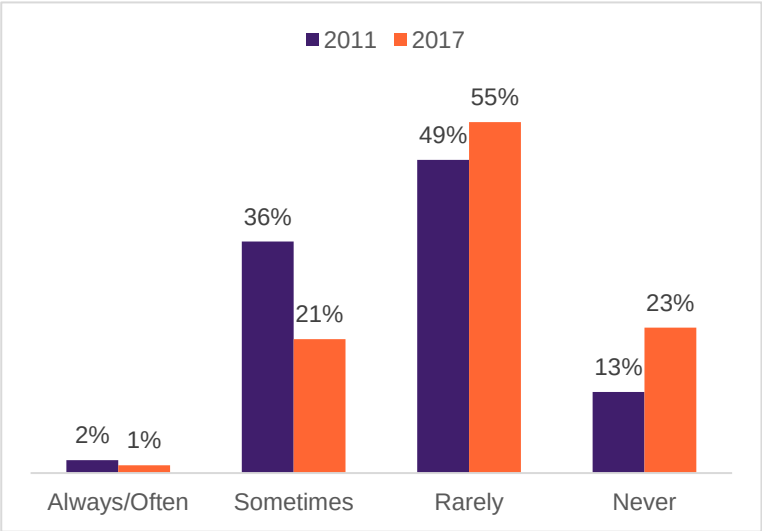

Figure 6: **PERCENTAGE GPS WHO PRESCRIBE ANTIBIOTICS IN ORDER TO MEET PATIENT EXPECTATIONS, 2011 AND 2017**

Slight changes in GP recommendations of symptomatic management alone

The desired response for this question would be for GPs to 'always' or 'often' recommend symptomatic management alone, as for most cases of URTI antibiotics are not usually indicated. Symptomatic management may include use of over-the-counter medicines such as analgesics or decongestants or non-pharmacological management such as rest and fluids.

The proportion of GPs who report that they 'always' recommend symptomatic management of URTIs alone has increased from 13% in 2011 to 22% in 2017 ($p < 0.05$).

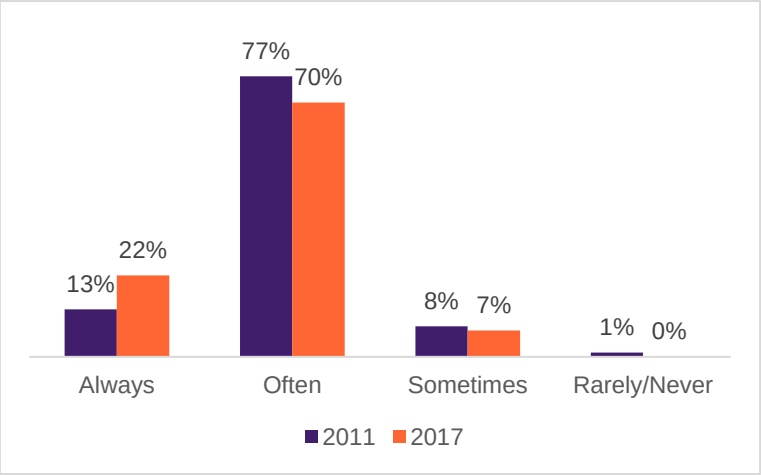

Figure 7: **PERCENTAGE GPS WHO RECOMMEND SYMPTOMATIC MANAGEMENT ALONE FOR URTI, 2011 AND 2017**

Decrease in GPs who prescribe a narrow spectrum antibiotic when required and available

In the survey, GPs were asked if they would prescribe a narrow spectrum antibiotic in a situation where one was required and available. The proportion of GPs who always or often prescribe a narrow spectrum antibiotic when required decreased from 72% in 2011 to 59% 2017 ($p < 0.001$) (Table 5).

It is unclear why this change away from the desired responses has occurred for this question, when many other indicators around interaction with patients have demonstrated positive changes.

It is possible that GPs are seeing increasing resistance and therefore ruling out the possibility of using the most narrow spectrum agent. It is also possible that they are indicating that they try not to prescribe at all, and so in trying not to prescribe at all, this action is taken less frequently. Prescribing of broad-spectrum antibiotics is a concern with antibiotic usage reports indicating amoxicillin and clavulanic acid is increasingly being prescribed, including in URTI when it is unlikely to be indicated.[8] Broad-spectrum antibiotics may drive antibiotic resistance by selecting for a greater range of resistant organisms.

Patient conversations

In 2017, 64% of GPs reported 'always' or 'often' discussing the issue of antibiotic resistance with patients presenting with URTI compared to 50% in 2011 ($p < 0.001$). For two other measures regarding patient expectations and adherence to antibiotics, no difference was detected.

TABLE 6: PERCENTAGE GPS BY FREQUENCY DISCUSSING ISSUES WITH PATIENTS WITH URTI, 2011 AND 2017

Issue (desired response)	GPs selecting desired response 2011 % (n)	2017 % (n)	Significant difference
The issue of antibiotic resistance (Always/Often)	50 (334)	64 (325)	**+14%, p < 0.001**
Their expectations of having an antibiotic prescribed (Always/often)	79 (528)	77 (390)	No difference
Adherence to the antibiotic regimen if prescribed (Always/Often)	88 (582)	88 (441)	No difference

More GPs discuss the issue of antibiotic resistance

Within the group who report discussing antibiotic resistance with patients, the proportion who indicate they 'always' take this action in the 2017 group is significantly higher than in 2011 (9% vs 25%, p <0.05). This is a positive finding as discussing the risks versus benefits of antibiotics is likely to reduce antibiotic prescribing as part of a shared decision-making approach.

Most GPs reported discussing expectations of having an antibiotic prescribed with patients although there was no change in the proportion between 2011 and 2017. Eliciting patient expectations for antibiotics is important since GPs have been shown to overestimate a patient's desire for antibiotics which may lead to higher antibiotic prescribing.[9]

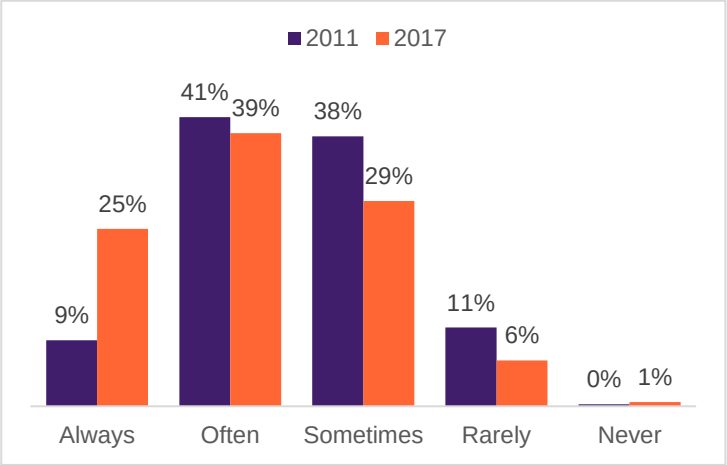

Figure 8: PERCENTAGE GPS BY FREQUENCY OF DISCUSSING THE ISSUE OF ANTIBIOTIC RESISTANCE WITH PATIENTS, 2011 AND 2017

Clinical e-Audit results

The Clinical e-Audit requires GPs to complete two phases of reviewing and recording management of 10 patients in their practice. As part of the activity, GPs reflect on changes that have been implemented for individual patients and reflect on how their clinical indicator results compare with aggregate results of their peers.

The first NPS MedicineWise online clinical e-audit was developed for the RAR program in 2012. Data provided by participants in the e-Audit from 2012-13 were analysed and reported on in the Antibiotic Resistance and Respiratory Tract Infections 2012/13 Final Evaluation Report.

Changes to the indicators were made in 2015 to reflect changes to guidelines, so the e-Audit's launch to mid- 2015 cannot be directly compared to the results of the current version of the audit. This report reflects analysis of the second version of the audit, with data gathered from 1 June 2015 to 15 February 2018. 1,632 GPs participated in the current version of the audit, which examined 18 key indicators related to the use of antibiotics in their practice.

GPs report changes in their management of patients presenting with URTI in the second phase of the clinical e-audit

The clinical audit data were analysed to identify statistically significant differences in the number of patients meeting each of the indicators in the initial and review phases. For each indicator, a generalised linear model with a Poisson distribution, log link function and an offset (logarithm of the number of patients assessed) was used to estimate the percentage change in the number of patients meeting the indicator. The analysis was conducted using the GENMOD procedure in SAS v. 9.3. The number of GPs analysed for each indicator is presented in the table below.

The 'relative change' column represents the percent change in the proportion of patients meeting the indicator from the initial phase to the review phase.

For the six indicators that outline an activity that was not recommended, all demonstrated a statistically significant decrease in the proportion of patients meeting the indicator ($p < 0.05$). The greatest change was observed for an indicator related to use of an antibiotic in acute sore throat / pharyngitis / tonsillitis (49.7% decrease).

The remaining twelve indicators outline activities that are recommended. All demonstrated statistically significant increases in the proportion of patients for whom GP actions meet the indicators ($p < 0.05$). The greatest increase was seen for a general indicator about use of recommended antibiotic, dose, frequency, and duration when therapy is recommended (64.8% increase).

TABLE 7: PERCENTAGE PATIENTS MEETING CLINICAL INDICATORS AT INITIAL AND REVIEW PHASES

	Clinical indicators	Initial phase % (n)	Review phase % (n)	Relative change (%)
Patient education				
1.	Discussed beliefs and expectations regarding treatment	91.6 (16,328)	95.4 (15,458)	**+4.2** **p < 0.0001***
2.	Provided advice on symptomatic management	97.7 (16,328)	98.7 (15,458)	**+1.0** **p < 0.0001***
Antibiotic use				

	Clinical indicators	Initial phase % (n)	Review phase % (n)	Relative change (%)
3.	Use of a recommended antibiotic, dose, frequency and duration when antibiotic therapy is recommended	29.2 (3,547)	48.1 (2,955)	**+64.8** **p < 0.0001***
4.	Use of an antibiotic where there is no recommendation for antibiotic therapy **(not recommended)**	23.0 (12,781)	13.1 (12,503)	**-43.0** **p < 0.0001***
Common cold / acute viral rhinitis (non-specific URTI)				
5.	Use of an antibiotic **(not recommended)**	6.5 (6,859)	3.9 (7,100)	**-40.0** **p < 0.0001***
Acute bronchitis				
6.	Use of an antibiotic **(not recommended)**	60.2 (2,703)	41.5 (2,260)	**-31.1** **p < 0.0001***
Acute bacterial rhinosinusitis				
7.	Use of a recommended antibiotic where an antibiotic is recommended	53.8 (1,213)	70.2 (1,031)	**+30.4** **p < 0.0001***
8.	Use of a recommended dose and frequency where recommended antibiotic is prescribed	79.8 (656)	85.3 (728)	**+6.9** **p = 0.0077***
9.	Use of recommended duration of therapy where recommended antibiotic is prescribed	53.9 (656)	76.6 (728)	**+42.0** **p < 0.0001***
10.	Use of an antibiotic where there is no recommendation for antibiotic use **(not recommended)**	49.7 (488)	26.5 (508)	**-46.6** **p < 0.0001***
Acute sore throat / pharyngitis / tonsillitis				
11.	Use of a recommended antibiotic where an antibiotic is recommended	64.4 (1,351)	74.4 (1,120)	**+15.4** **p < 0.0001***
12.	Use of a recommended dose and frequency where recommended antibiotic is prescribed	51.1 (867)	67.4 (867)	**+31.7** **p < 0.0001***
13.	Use of recommended duration of therapy where recommended antibiotic is prescribed	82.2 (867)	90.2 (867)	**+9.7** **p < 0.0001***
14.	Use of an antibiotic where there is no recommendation for antibiotic use **(not recommended)**	17.1 (2,066)	8.6 (2,025)	**-49.7** **p < 0.0001***
Acute otitis media (AOM)				
15.	Use of a recommended antibiotic where an antibiotic is recommended	76.4 (983)	83.5 (804)	**+9.3** **p = 0.0003***
16.	Use of a recommended dose and frequency where recommended antibiotic is prescribed	51.9 (751)	63.7 (671)	**+22.7** **p < 0.0001***

	Clinical indicators	Initial phase % (n)	Review phase % (n)	Relative change (%)
17.	Use of recommended duration of therapy where recommended antibiotic is prescribed	66.2 (751)	82.9 (671)	**+25.3 p < 0.0001***
18.	Use of an antibiotic where there is no recommendation for antibiotic use **(not recommended)**	42.3 (665)	23.6 (610)	**-44.2 p < 0.0001***

* Statistically significant at the p < 0.05 level

The percentage of patients who met each of the clinical indicators varied at baseline and the clinical audit intervention was successful in prompting significant changes in GP practice for all of the indicators analysed. These results indicate that there has been a change in GP clinical decisions following participation in the audit.

GP reflections on their practice

In addition to documenting patient cases, GPs who completed the audit were asked about changes made to five aspects of their practice. The figures below include responses from both GPs and GP registrars who completed the evaluation questions.

TABLE 8: SELF-REPORTED CHANGES TO PRACTICE AMONG GPS COMPLETING THE CLINICAL AUDIT

	I have changed my practice: % (n)	I intend to change my practice: % (n)	No change necessary (current practice reinforced): % (n)	Not sure: % (n)
Identifying patients for whom an antibiotic is recommended	41 (641)	18 (274)	40 (627)	1 (16)
Using a recommended agent, where an antibiotic is appropriate, at optimal dose, frequency and duration	36 (557)	25 (390)	38 (585)	2 (26)
Establishing patient beliefs and expectations about management options	32 (495)	20 (316)	47 (725)	1 (22)
Promoting symptomatic management and discussing the benefits and harms of antibiotics	33 (507)	18 (282)	49 (756)	1 (13)
Identifying patients for whom imaging is recommended in rhinosinusitis	20 (304)	23 (362)	49 (771)	8 (121)

The area of practice where the highest proportion of GPs reported change was “using a recommended agent, where an antibiotic is appropriate, at optimal dose, frequency and duration”, with 61% of respondents (n=947) indicating that they have changed, or intend to change, their practice. This was closely followed by “identifying patients for whom an antibiotic is recommended,” with 59% of respondents (n=915) indicating change or intended change.

Barriers to achieving best practice

GPs and GP registrars who participated in the e-audit were asked to identify the greatest barriers in implementing best practice in their prescribing of antibiotics. Their responses provide further

information about how NPS MedicineWise can better support GPs with products and programs related to antibiotics. From a pre-specified list, respondents (n=1,558) selected barriers outlined in the able below:

TABLE 9: REPORTED BARRIERS TO ACHIEVING BEST PRACTICE IN THE MANAGEMENT OF RESPIRATORY TRACT INFECTIONS

	Respondents selecting barrier in 2015-18, % (n)	Respondents selecting barrier in 2012-13, % (n)
Patient/carer expectations for antibiotics	85% (1,327)	84% (736)
Non-adherence to symptomatic management	41% (646)	43% (371)
Challenging differential diagnoses	41% (632)	37% (318)
Limited time for patient/carer discussion	31% (485)	31% (268)
Non-adherence to medicine(s)	24% (368)	22% (192)
Limited access to follow up or after-hours medical care	18% (284)	16% (143)
Convenience of dosing regimen	18% (273)	19% (163)
Adverse effects of antibiotics	15% (239)	15% (133)
Other	4% (58)	4% (34)

Patient/carer expectations for antibiotics was the most frequent response, with 85% of respondents (n=1,327) choosing this barrier. This barrier was selected by twice as many respondents as any other barrier; the next most selected response, “non-adherence to symptomatic management” was selected by just 41% of respondents (n=646).

For the version of the Clinical e-Audit analysed in the Antibiotic Resistance and Respiratory Tract Infections 2012/13 Final Evaluation Report, a similar question was asked of respondents (n=872). In the 2013 survey, containing data through October 2013, 84% of respondents (n=736) also selected the response regarding patient/carer expectations as the most frequently mentioned barrier.

Ranked by frequency of responses, the order of the barriers indicated by the current group of respondents is similar to the 2012-13 responses. There is only one change to the order, where “limited access to follow up or after hours medical care” is mentioned more frequently than “convenience of dosing regimen.”

This indicates the challenges GPs are facing are consistent over time and that dealing with patient/carer expectations for antibiotics is still a significant challenge for GPs that NPS MedicineWise programs should continue to address.

Practice information and resource kit

Distribution of a practice information and resource kit led to changes in antibiotic prescribing at MedicineInsight practices

The 2016 practice kit was comprised of a: RTI Action plan (symptomatic management) pad: commitment to reducing antibiotic resistance statement; poster; and coughs, colds & flu brochure and tent card. The 2016 practice kit was distributed to a total of 1,680 practices, including 294 MedicineInsight practices. TONIC Health Media delivered 91 of the kits for MedicineInsight practices and all other kits were sent by Australia Post, addressed to the practice manager.

Impact of the kits

Following distribution of the 2016 kit, an evaluation was conducted to determine prescribing changes at MedicineInsight practices. The analysis found that there was a statistically significant reduction in the monthly number of all antibiotics prescribed per practice following the delivery of print materials alone ($p = 0.02$). On average, the prescribing rates of practices receiving print material alone were 2.9% lower than non-intervention practices between August and December 2016 (CI95 = -0.5%, -5.3%). The analysis also looked at the TONIC Health Media advertising on an in-practice television broadcast system, but that intervention component did not demonstrate any significant impact.

When analysis was restricted to specific conditions related to URTI, there was a marginal reduction in the monthly number of antibiotics prescribed per practice following the delivery of print materials alone ($p = 0.107$). On average, the prescribing rates of practices receiving print material alone were 5.7% lower than non-intervention practices between August and December 2016 (CI95 = -12.2%, +1.3%).

CONSUMER KNOWLEDGE AND ATTITUDES

This section assesses whether the RAR 2012-17 program contributed to changed consumer knowledge, awareness and attitudes towards antibiotics. It addresses the evaluation questions: **Did the program change consumer knowledge, awareness and attitude to antibiotics?** and **Did the program change consumer knowledge of antibiotic resistance?**

Changing consumer attitudes and beliefs and ongoing campaign work contribute to reducing unnecessary demand for antibiotics and needs to take place in parallel with GP education.

Antibiotic resistance is a highly complex concept to both communicate and for consumers to grasp. Ongoing research and evaluation has identified multiple gaps in knowledge and beliefs linked to behaviour and unnecessary demand of antibiotics. These findings have in turn necessitated an evolution in campaign messaging and the introduction of new indicators during the program cycle.

Key findings

Consumers are increasingly aware of the dangers posed by antibiotic resistance and its threat to public health. At the same time, there is still an opportunity to improve their understanding of how their behaviours contribute to this threat to public health.

- Consumers in 2017 reported an increase in awareness of the term 'antibiotic resistance' following a focus on that issue in the 2016 winter campaign (70% in 2014 vs 74% in 2017, $p < 0.05$).
- The proportion of consumers who report awareness that bacteria is becoming resistant to antibiotics has increased from 50% in 2011 to 72% in 2013.
- In 2014 and 2017, 44% of consumers correctly indicated that antibiotics do not kill viruses.
- In 2017, 40% of consumers indicated that they believed that antibiotics do not help people recover faster from colds and flu.
- More consumers believe that antibiotic resistance is affecting them now (11% in 2015 vs 25% in 2017)
- Our understanding of consumer behaviours expectations has increased enabling more effective program design

Changes in consumer knowledge, attitudes, and practice

The information about consumer responses in this section is summarised from three *National Consumer Survey* reports, written in 2014[10], 2015[11], and 2017.[12] It also includes data from surveys of consumers conducted as part of campaign planning in 2013[13], and NPS MedicineWise online communications tracking in 2012[14] and 2011[15]

Consumer knowledge that antibiotics kill bacteria has increased

The launch of the program coincided with a significant improvement in the number of people who understood that bacteria is becoming resistant to antibiotics, from 50% in 2011 to 72% in 2013.

Over time there has also been an increase in the proportion of people who understand that antibiotics kill bacteria - from 70% in 2014 to 74% in 2017.

Messaging about bacteria has been a significant area of focus for the campaign and has been used to articulate antibiotic resistance. These improvements correlate with an increase in the awareness for the term antibiotic resistance from 70% in 2014 to 74% in 2017.

Consumer knowledge that antibiotics do not kill viruses has not changed

While a substantial proportion of consumers understand that antibiotics kill bacteria, their level of understanding about the lack of effectiveness of antibiotics for viruses is lower

In 2011 39% of people agreed with the statement “I should not take antibiotics to get rid of viruses.’ This increased to 43% in 2012 at the peak of the launch campaign but then fell to 40% in 2013.

In 2014 and 2017, 44% of people disagreed with the statement ‘antibiotics kill viruses.’

Impact of of antibiotic misuse

Consumer qualitative research exercsises indicated that some consumers had no idea of how their own actions and behaviours involving antibiotic misuse could have an adverse impact. The outcomes of the research were an understanding that consumers were not aware that when people take antibiotics for cold and flu they risk developing antibiotic resistant bacteria and passing this on to others, .Some consumers also (incorrectly) believed that when people take antibiotics for cold and flu the antibiotics help them recover faster.

New measures in consumer surveys were introduced to reflect a change in our messaging and campaign focus. Benchmarks for these measurements were taken at the peak of significant campaign activity, so it was not possible to measure a true baseline before campaign materials were launched. As measurements were taken at the height of campaign activity, this may be why agreement with the desired answers did not improve in subsequent measurements.

- Consumers who correctly answered that people who take antibiotics for cold and flu risk passing on antibiotic resistant bacteria to others declined over time, from 35% in 2015 to 28% in 2017 ($p < 0.05$).
- Consumer belief that antibiotics help with faster recovery from cold and flu (which is not a desired response) has remained constant, with 38% disagreeing in 2015, and 40% disagreeing in 2017.

Awareness of the term antibiotic resistance has increased

Consumer research identified that some people believed that misusing antibiotics did not really matter or affect their lives and that this was a problem that would be resolved in the future. In campaign materials from 2012 to 2017, the term ‘antibiotic resistance’ has consistently been mentioned, and the issue of antibiotic resistance has also been highlighted in Australian news media.

The proportion of consumers who indicated they had heard of the term “antibiotic resistance” increased from 70% in 2014 to 74% in 2017 ($p < 0.05$), indicating that consumer awareness of the term has increased during the course of the RAR program.

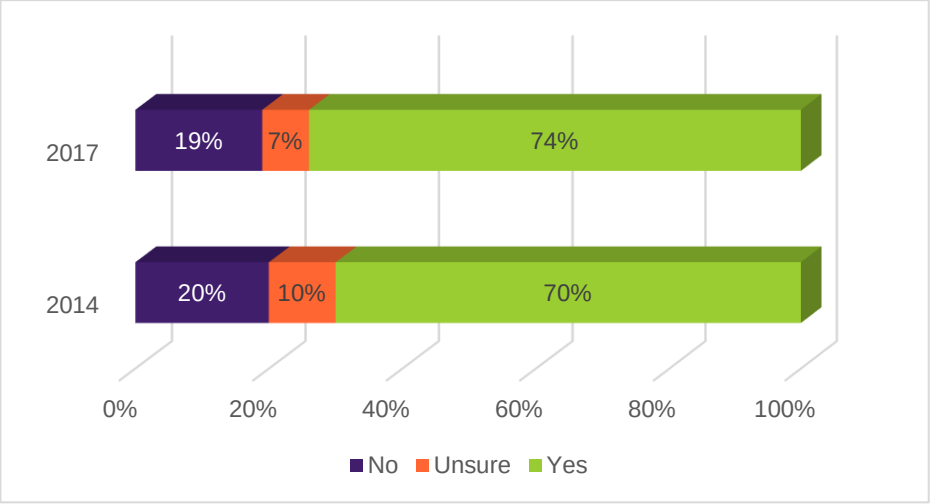

Figure 9: **HAVE YOU HEARD OF THE TERM ANTIBIOTIC RESISTANCE?**

More consumers believe that antibiotic resistance is affecting them now

The proportion of respondents who believe antibiotic resistance is affecting them and their family now has increased from 11% in 2015, to 25% in 2017 ($p < 0.05$). The 2016 Winter Campaign emphasized that antibiotic resistance is happening now and may have contributed to this increase in consumer awareness.

Consumers who reported being unsure about this question remained consistent across the two time-periods, with nearly half of respondents in both time periods (46% in 2017 and 47% in 2015) indicating that they were unsure when antibiotic resistance would pose a problem to them and/or their family.

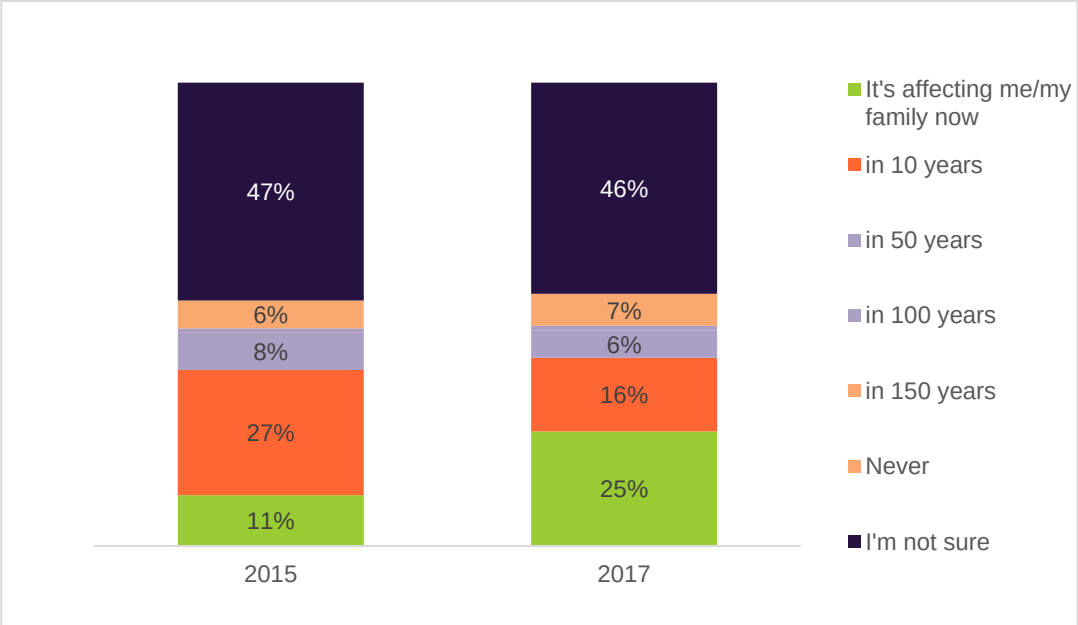

Figure 10: **PERCENTAGE CONSUMERS BY WHEN THEY BELIEVE ANTIBIOTIC RESISTANCE WILL AFFECT THEM**

Intended behaviour regarding colds and flu

A recurring theme of our campaign has been to reinforce the fact that people should not take antibiotics for cold and flu. Patient demand can contribute to inappropriate antibiotic prescribing, so it is desired that consumer would not ask their doctor to prescribe an antibiotic for a cold or flu.

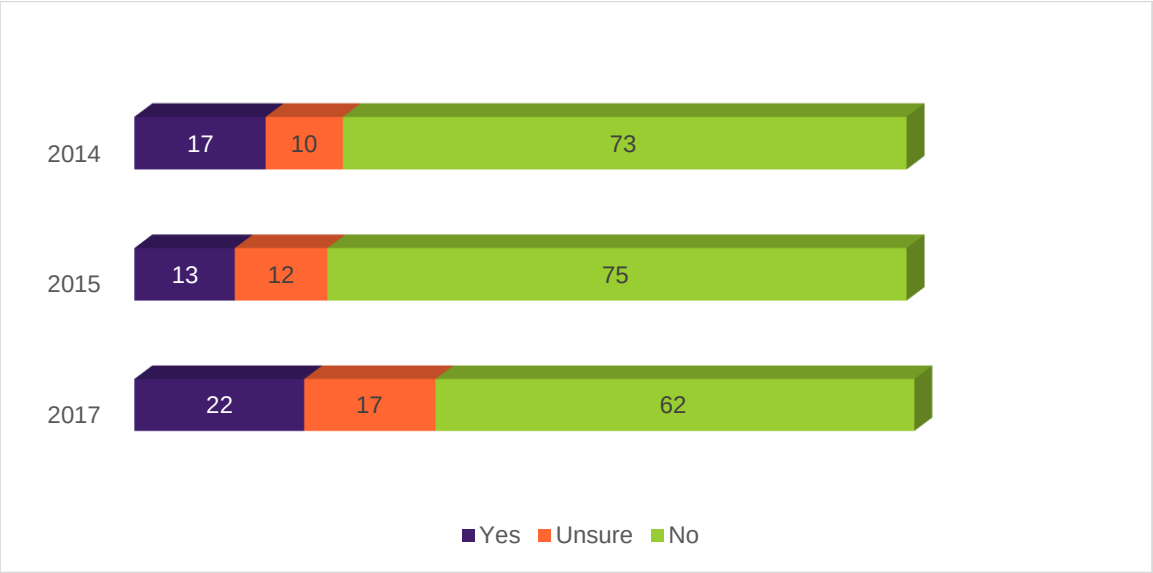

Figure 11: PERCENTAGE CONSUMERS WHO WOULD REQUEST ANTIBIOTICS FOR A COLD OR FLU

From 2014 to 2015 there was a significant reduction in the number of people reporting that they would request antibiotics for cold or flu from 17% to 13%. This reduction was recorded after a major advertising campaign valued at $1.75 million and where this sentiment was one of the key areas of focus. In 2017 there was a significant reversal of this trend, and the proportion of consumers who indicated they would request antibiotics increased from 13% to 22% ($p < 0.05$). This can be linked to a combination of factors including:

- A significant reduction in spend on campaigns in the following years
- A change in message emphasis in 2016 to test alternative communication territories as opposed to a concerted focus on one area
- A further change in messaging in 2017 when our communication approach shifted to educating consumers about symptom duration

Next steps: Understanding consumer expectations for antibiotics according to symptom type and duration

A survey of parents was conducted in 2017 to understand their expectation about how long symptoms of URTI should last in their children. It was found that this expectation would then influence when they would take their child to the GP, an interaction where antibiotics could potentially be prescribed. The survey recorded results that patient expectations of when symptoms should improve was much shorter than what could realistically be expected.[16] Benchmark findings established the following expectations:

TABLE 10: PARENT EXPECTATIONS FOR URTI SYPMTOM DURATION IN THEIR CHILDREN

Symptom	Parent expectations of symptom duration	Actual Duration
Cough	6.8 days	Up to 25 days
Cold	6.6 days	Up to 15 days
Earache	4.9 days	7 to 8 days

These findings are important because the point in time parents visit a GP about their child's symptoms correlates with the parents' knowledge about the duration of the symptoms: If a child has a sore throat, cough, cold or earache symptoms persisted longer than expected, parents would bring their child to see a GP within 1 day of the time they believed the specific symptom should have subsided.

Parents' needs from GPs differ depending on the URTI symptom being consulted about. When visiting a GP about sore throat, cough or cold symptoms of their child, most parents seek advice on how to manage symptoms (62-63%) and information about the diagnosis (60-63%), while a lesser proportion look for antibiotics (32-37%). Most parents who consult about earache seek information about the diagnosis (64%), advice on how to manage symptoms (57%) as well as antibiotics (57%).

Parents are more likely to "ask" a GP for antibiotics for the treatment of earache symptoms rather than for sore throat, cough or cold symptoms experienced by their child. A higher proportion of parents would "ask" for antibiotics when consulting a GP about their child's earache symptoms (55%) while a lower proportion of parents would "ask" for antibiotics for sore throat (23%), cough (23%) or cold (19%) symptoms.

These findings influenced a change in approach and messaging for our 2017 campaign. An emphasis was placed on creating communications to educate consumers of the typical duration for coughs, cold and earache symptoms.

PERFORMANCE OF PROGRAM ELEMENTS

This section addresses the evaluation questions, **was uptake of program elements as expected, or did some products perform better/worse than expected?** and **did products developed for RAR achieve their respective participation and/or download targets?**

Addressing these questions is important to understanding whether the program reached its intended target audience, which needs to happen for the program to have an impact on the knowledge, attitudes, and ultimately, practice of GPs and other health professionals.

Key findings

- Over time targets for the program cycles changed, moving from a focus on the number of health professionals participating in a program cycle, to targets for particular products. Despite these changes, it is consistent that participation targets for nurses are low, and regularly exceeded. Targets for GPs/pharmacists were less likely to be met across the program cycle.
- A retrospective pre-test (RPT) survey following the 2012/13 visiting program demonstrated significant increases in GPs knowledge and behaviour, including the intention to use current guidelines when antibiotics are necessary to treat an RTI (86% vs 96%, $p < 0.01$)
- Downloads of shared decision-making resources increased, while hard copy orders for these resources decreased. This aligns with other programs where demand for electronic resources has increased.
- Event kits developed for *World Antibiotic Awareness Week* are a popular resource for health professionals and 97% of respondents who ordered an event kit would order one again in the future.

RAR Health Professional Activities

As outlined in Table 1, NPS MedicineWise has introduced a range of products and activities targeted at both health professionals and consumers as part of the RAR 2012-2017 program.

Evaluations of the RAR program have already been conducted in 2014, 2016 and 2017, with reports predominately focussed on process evaluation figures. Process evaluations have also been undertaken for World Antibiotic Awareness Week in 2015, 2016, and 2017. Key points about program performance identified from those reports are indicated below.

2012-13 Antibiotic Resistance and Respiratory Tract Infections (RTI) program

The 2012-13 Antibiotic Resistance and Respiratory Tract Infections (RTI) program was the first round of products launched as part of the RAR program, and a process evaluation of that program covered the dates from 1 February 2012 to 31 July 2013.

Program targets

The program overall reached over 13,000 unique health professionals. Additionally, nearly 13,000 online antimicrobial stewardship modules were completed, mostly by medical students (74% of recorded completions). The targets for 2012-13 focussed on the number of unique participants from different health professional groups. In the 2012-13 program, the target for participation by nurses was exceeded (160% of target achieved). The GP target was close to meeting the intended

participation level, with 94% of the target achieved. Pharmacist (64% of target achieved) and other health professionals (56% of target achieved) were well below planned participation levels. At the time of the 2012-13 program cycle, there were not specific targets for individual products, but participation in individual products was tracked and used in setting subsequent product targets.

TABLE 11: 2012-13 PARTICIPATION TARGETS FOR HEALTH PROFESSIONALS

Health professional group	Target	Actual	% of target achieved
GPs	10,500	9,895	94%
Pharmacists	2,400	1,529	64%
Nurses	950	1,524	160%
Other" Health Professionals	310	174	56%

Short-term impact of 2012/13 visits

As part of the 2012/13 program, 5,096 GPs participated in an educational visit, and 4,056 participated in a small group case-based meeting. In total, there were 9,895 unique GP participants recorded for the 2012/13 activities.

An RPT survey of GPs who participated in an educational visit (high intervention group) was conducted as part of evaluation of the 2012/13 visiting program to identify short to medium-term improvements in GP self-reported knowledge, beliefs, awareness and behaviour for prescribing antibiotics and referrals for medical imaging pre and post the educational visit. A low intervention group consisting of GPs who had participated in other NPS MedicineWise antibiotics interventions were used as a comparison group. Full results are detailed in the 2012/13 evaluation report.[17]

The most significant improvements in the participant group from before to after the intervention were observed in the areas of:

- Increased awareness about the causes of antibiotic resistance ($p<0.01$)
- Increased self-reported practice of following the Therapeutic Guidelines ($p<0.01$)

The areas where the high intervention group was more likely to report significantly higher scores after practice visits compared to the low intervention group were in the areas of:

- Increased awareness about the causes of antibiotic resistance ($p<0.05$, OR 3.6)
- Using current guidelines for diagnosis and treatment of RTIs ($p<0.05$, OR 3.5)
- Recommending hand hygiene as an infection control strategy ($p<0.05$, OR 1.8)

2014-2017 RAR program activities

Across the final three years of the program, a variety of products were released for health professionals and students. The 2014-16 and 2016-17 evaluation report findings are summarised together, as the approach to targets and reporting program data were similar.

Program targets

In the 2014-2016 and 2016-17 evaluation reports, products were compared against specific participation/completion targets, to assess whether resources were being used as expected.

Online learning

Across the online learning activities including National Case Studies and Online Modules, participation targets for nurses were consistently exceeded, while those for other health professional groups were not usually achieved. Recommendations in the relevant evaluation reports included that targets for

different health professionals needed to be reviewed, or promotional approaches to those groups revised to bring demand in line with targets.

TABLE 12: PARTICIPATION IN ONLINE LEARNING COMPARED TO PRODUCT TARGETS

Product	Release Date	GPs		Nurses		Pharmacists	
		Target	Achieved	Target	Achieved	Target	Achieved
National Case Study: Urinary tract infections	Nov-14	1200	25%	200	450%	1000	90%
National Case Study: Otitis media	May-16	600	44%	100	511%	500	124%
Online Module: UTI in RACF	Mar-15	100	15%	250	201%	n/a	n/a

Shared decision-making resources

The 'Antibiotics Symptomatic Management Pad' (2012) and the 'Respiratory Tract Infections (RTI) Action Plan' (2016) were resources designed to facilitate GP communication with their patients in managing respiratory tract infections without antibiotics.

The patterns of uptake of these resources indicates a move towards health professionals accessing resources online. Overall access to the RTI Action Plan increased during the 2016-17 program year. Although the rate of hard copy orders decreased, there was a larger increase in the rate of download of electronic versions of the product. This is aligned with other programs and products where there is more demand for electronic versions of products, rather than for printed copies.

TABLE 13: HARD COPY ORDERS OF THE RTI ACTION PLAN

Time period	Orders per month (average)
2015-16 program year (Mar- Jun 2016)	95
2016-17 program year (Jun 2016-Jul 2017)	58

TABLE 14: PDF DOWNLOADS FROM NPS MEDICINEWISE WEBSITE

Product/time period	Downloads per month (average)
Antibiotics Symptomatic Management Pad (Jul 2015 - Feb 2016)	131
RTI Action Plan: 2015-16 program year (Mar-Jun 2016)	181
RTI Action Plan: 2016-17 program year (Jun 2016 - Jul 2017)	314

The product is also included in GP software packages Medical Director, Best Practice, Genie, and MedTech 32. During this program year (1 July 2016-30 June 2017), a total of 48 downloads of the RTI Action plan were recorded through GP Software. A limitation to this data is that not all GP software providers report back download statistics; there may have been more downloads of the product that are not trackable.

Feedback reports

The activities with the largest GP reach were two PBS feedback reports, distributed in April 2015 (to 24,222 GPs) and November 2015 (to 28,526 GPs), and an MBS feedback report distributed in May 2017 (to 29,943 GPs).

Small group meetings: MedicineInsight Practice Report

In 2016, a MedicineInsight Antibiotics Practice Report was expanded to include a practice visit, available only to MedicineInsight practices. This was a significantly smaller visiting activity than the 2012/13 program, reaching a total of 303 health professionals, including 255 GPs during the period from January 2016 to June 2017. This smaller visiting program did not include a GP survey as part of its evaluation. GPs were asked to complete an online feedback survey about the degree to which learning outcomes were met.

Out of the 303 health professionals who participated in the visit, only 26 responded to the request to complete an online feedback survey (23 complete responses, 3 partial), resulting in a response rate of 8.6%. Of those who responded, 89% (n=23) indicated that the activity was “entirely relevant” to their practice, while 12% of respondents (n=3) indicated that it was “partially relevant.” The majority of respondents (from 81% to 92% for each outcome) also indicated that each of the four learning outcomes were ‘entirely met.’

Review of campaign evaluation findings: World Antibiotic Awareness Week

World Antibiotic Awareness Week (WAAW) is an annual, global event to raise awareness about the serious health issue of antibiotic resistance. NPS MedicineWise runs the campaign to support the global initiative in Australia each year, which includes resources and messaging for health professionals and consumers.

For the 2015[18], 2016[19], and 2017[20] campaign years, process evaluations of the campaigns were undertaken, and key performance figures tracked. The evaluations now include reflection meetings where the Evaluation Officer and Campaign Manager actively review evaluation recommendations and incorporate them into campaign planning.

The evaluation tracks key campaign metrics each year, allowing comparison of campaign performance year on year.

Event Kit

The event kit was introduced in 2016 and was a resource to support health professionals in holding their own WAAW events. The demand for these kits has been high, and the number of kits produced and ordered increased from 548 in 2016 to 1,667 in 2017. By reducing the cost per kit in 2017, more kits could be produced for a similar budget amount. A 2017 survey of those who ordered kits provided insight into how highly valued the kits were by those who used them, with 97% of respondents (n=247) indicating that they would order an event kit again in the future. Entries to the morning tea competition associated with the kits also increased from 2016 (20 entries) to 2017 (26 entries).

Media coverage

Downloads of the audio news release have been trending upwards since 2015, growing from 342 in 2015 to 1,316 in 2017. Overall social media reach has also been increasing each year, from 147,914 in 2015 to 933,903 in 2017. Some new areas have commenced tracking in 2017, including earned media value, and earned media reach, which will allow for further tracking in forthcoming campaigns. The 2017 campaign achieved 572 media mentions, with an estimated reach of 4.9 million people, at a value of $521,800.

Opportunities for improvement

Landing page visits and downloads of campaign resources decreased in 2017 compared to 2016. This may be due to campaign resources being produced later relative to the campaign launch. Video views also decreased, which may be related to less budget allocation in this area. These areas will be considered when developing the 2018 campaign.

DISCUSSION AND RECOMMENDATIONS

Changes in antibiotic prescribing, GP knowledge, attitudes and practice, and consumer knowledge and beliefs have been detected across the course the course of the five year program.

The program has successfully reduced antibiotic prescribing in Australia

Antibiotic prescribing in Australia decreased during implementation of the RAR program. The specific target of the program was to reduce antibiotic usage from 24 to 19 DDDs per thousand inhabitants per day; this target has been achieved.

Analysis of concessional PBS data using a Bayesian structural time series model estimated an overall reduction in the number of antibiotic prescriptions dispensed to concessional beneficiaries of 24.8% compared to the volume that would have been expected without the NPS MedicineWise program.

Another analysis, using data from 2012 to 2017 that included both concessional and under co-payment information detected an estimated reduction of 18.4% in the rate of dispensing of J01 class antibiotics, from 23.3 DDDs in 2012, to 19.0 DDDs in 2017. Compared to overall figures, the drop in prescribing among GPs was more pronounced, with a decrease of 21.5%, from 20.2 DDDs in 2012 to 15.9 DDDs in 2017. This analysis is important to add to our understanding of the change because it allows us to identify the difference in prescribing between general practitioners and other practitioners and identifies that most of the decline in overall usage of antibiotics was driven by a decline in usage by GPs. The decrease in prescribing seen among GPs is not evident among other types of practitioners. As the NPS MedicineWise program targeted GPs, this differentiation is important.

Other analysis of antimicrobial usage conducted by OECD and AURA was considered. The largest drop in DDDs among the data sources investigated was in the OECD data, which indicate a decrease from 23.7 in 2012 to 18.5 in 2013, corresponding with the timing of NPS MedicineWise's 2012/13 visiting program. The estimated change in DDDs in the analysis conducted by NPS MedicineWise is more gradual, but in a similar direction.

AURA data indicates higher estimates of DDDs for 2015 (25.4 vs 22.1 DDDs) and 2014 (23.8 vs 21.9 DDDs) than NPS MedicineWise analysis, though again, the direction is similar. Unlike the AURA data, the NPS MedicineWise analysis extends to 2017, when more positive changes are seen, with a reduction to 19.0 DDDs for all health professionals. The AURA report highlighted other indicators of shifts in GP prescribing, which may be in response to the RAR program.

A study of antibiotic prescribing for URTI in the Australian Capital Territory, which used data collected by students during patient encounters, found that the rate of antibiotic prescription in that region decreased over the 2006-2015 study period and suggests that the decline in prescribing may be related to antibiotic stewardship programs, including NPS MedicineWise educational programs.[21]

The NPS MedicineWise program was successful in significantly reducing antibiotic prescribing in Australia.

GP knowledge, attitudes, and practice related to URTI and antibiotic resistance have changed during the RAR program

These changes relate to antibiotic resistance, and practice in consultations for patients presenting with URTI, and most changes are in a positive direction. NPS MedicineWise programs have reached a large proportion of Australian GPs through educational visits, online learning activities, and PBS

feedback reports, and would have contributed to changes in their practice. These changes in practice align with the changes in antibiotic usage outlined above.

The main method of assessing changes to GP practice was a GP survey. Results of a Clinical e-Audit and an evaluation of the impact of the Practice Kits distributed to MedicineInsight practices were also considered. For the survey, ten indicators were directly repeated across the 2011 and 2017 surveys of a sample of Australian GPs. Of the ten indicators, six demonstrated significant positive changes in GP knowledge and practice, one indicated a negative change, and three detected no change in responses across the time periods. Overall these results showed GPs have greater awareness of the problem of antibiotic resistance, are seeing it more in their practice, and are increasingly discussing it with their patients.

The largest change related to GPs not prescribing antibiotics to meet patient expectations. Patients often overestimate the benefit of antibiotics particularly for URTI so meeting patient expectation is likely to increase inappropriate antibiotic prescribing.[22] Patient expectation is often cited by GPs as a key barrier for reducing antibiotic prescribing.

The other largest changes related to antibiotic resistance, with a greater proportion of GPs indicating that they consider antibiotic resistance when prescribing (+13%), and that they discuss it with their patients who present with a URTI (+14%). This shows GPs are more aware of antibiotic resistance as a public health issue which may be as a result of NPS MedicineWise consumer and health professional programs, as well as increasing prominence of this issue nationally and internationally.

The one negative change in GP knowledge, attitude and behaviour between 2011 and 2017 was that less GPs indicated they would use a narrow spectrum antibiotic when one was available and required. Use of broad-spectrum antibiotics in Australia is high and increasing, and there appears to be significant overuse of amoxicillin and clavulanic acid for URTI when it should only be used as a second line option.

Overall, the survey findings indicate that there were positive changes in GP knowledge, attitudes, and practice from 2011 to 2017.

The two other GP interventions that were analysed for impact found changes in GP practice. Those GPs who completed the audit indicated changes in their management in the second phase of the audit, with their management more aligned to desired indicators. In MedicineInsight practices that received a practice kit, actual prescribing of antibiotics was lower than in those who did not ($p = 0.02$).

Consumer knowledge of antibiotics and antibiotic resistance remains a challenge, but some gains have been made.

Antibiotic resistance is a vastly complicated area that is challenging to communicate to the public. The confusing and scientific nature of the terminology impacts on consumer knowledge. The results of our consumer surveys suggest that maintaining and improving knowledge, beliefs, and behaviour requires continuity of messaging and maintaining a level of investment. There have been some changes in consumer knowledge and beliefs during the RAR campaign, and areas that need attention have been identified.

From 2015 to 2017, the proportion of people who believe antibiotic resistance is affecting their family now has increased (11% vs 25%, $p < 0.05$), but the proportion who believe it will affect their family in 10 years has decreased by a corresponding amount. Just under half the consumers reported being unsure and this has not changed, which indicates an opportunity to communicate to members of the public who are still not aware of the urgency of this issue.

Symptom duration and expectation for antibiotics is a critical area to address. Whilst most people accept and understand that antibiotics have no effect on cold and flu viruses; understanding how long related symptoms can last is underestimated. This in turn continues to be a factor that can drive unnecessary demand, with people attending their GP when they believe symptoms should have subsided.

There has been limited change in consumer knowledge about what antibiotics can do, and the risks of antibiotic use. The proportion of consumers who would not ask their doctor to prescribe antibiotics for a cold or flu has also increased from 73% in 2014 to 75% in 2015, and then decreased again to 62% in 2017.

Attitudes and beliefs are only one component of the overall strategy for health professionals and consumers. Our campaign efforts have made a number of encouraging advancements in the last 5 years over the campaign period. Given the complicated and almost scientific nature of this knowledge area and given the increase in market place noise; the fact that we have not recorded negative change in this area should also be viewed as a positive for the program.

A 2017 systematic review of AMR campaigns to target the public by Price et al found that there is limited evidence for the effectiveness of AMR interventions for the public, and that more well-designed, experimental studies on interventions targeting the public are required.[23] Their search found mass media interventions were the most frequent to appear in their searches (7 out of 20 articles), but only 3 of these demonstrated significant positive changes for key indicators. One of the studies that demonstrated a positive change, was a 2007 study demonstrating impact from NPS MedicineWise's activities from 1999-2004, supporting the positive impact of our consumer activities.[24]

The complex nature of this area and associated results was also a prompt for us to adjust our communications approach by focussing on knowledge and comprehension gaps that are more accessible and easily measured and communicated. NPS MedicineWise activities have contributed to improved consumer awareness of antibiotic resistance; a sustained effort with continuity of message is required to maintain awareness of this complex concept.

Review of documented activities

NPS MedicineWise delivered a suite of products and activities across the five-year program, and through regular evaluation reports tracked the progress and performance of these products and activities.

The intensity of program activity varied, with a significant suite of activities to launch program in 2012/13, followed by other large-scale activities like the PBS Feedback in April and November 2015, which reached more than 24,000 and 28,000 Australian GP's respectively.

Although the primary target of the RAR program was GPs, nurse participation in many activities was high, with participation targets frequently exceeded.

Over the 5-year period there was also a shift toward the use of electronic versions of GP-mediated consumer resources which aligns with the results for other programs.

The suite of activities offered by NPS MedicineWise reached both GPs and other health professionals to generate awareness of antibiotic resistance, and support health professionals in their consultations with their patients.

Recommendations

GP and Health Professionals

- In future activities, consider addressing the appropriate use of amoxicillin and clavulanic acid in situations where an antibiotic is indicated, as well as other agents that are not recommended as first-line for URTI. The use of broad spectrum agents such as amoxicillin and clavulanic acid is an issue nationally that could be targeted through NPS MedicineWise antibiotic programs.
- Investigate ways to improve GP communication skills, including how they elicit information from patients about their expectations.

- Improve GP use of shared decision-making strategies to reduce unnecessary antibiotic prescribing by further educating GPs and providing tools for shared decision making such as patient decision aids that have been developed to support these conversations. NPS MedicineWise has already developed resources that could be further promoted.
- Develop a range of real-life case-based scenarios that demonstrate different GP strategies for managing the consultation safely reducing the likelihood of antibiotic prescriptions being dispensed as an outcome.
- Develop better mechanisms to ensure ready access to consumer materials and self-management resources at the point of consultation, such as patient action plan.
- Address GP knowledge of the current and increasing impact of antibiotic resistance for individuals and their community.
- Address GP knowledge of the potential impact of a single course of antibiotics on resistance for individual patients
- Emphasize how inappropriate prescribing contributes to the risk of antimicrobial resistance (AMR) in an individual as well as to society.
- Repeat selected indicators from the 2011 and 2017 surveys in the GP survey for the 2019 Antibiotics therapeutic topic to allow tracking of GP knowledge, attitudes, and practice longitudinally.

Consumers

- Continue to raise awareness of antibiotic resistance in the community; emphasize the negligible benefit of antibiotics for URTI to reduce patient demand for antibiotics to GPs.
- Emphasize to both health professionals and consumers that all individuals need to act to reduce inappropriate antibiotic use.
- Continuity of messaging and maintaining a level of investment is recommended to maintain and improve on consumer knowledge, beliefs, and behaviour.

APPENDIX A: PBS ITEM CODES

The table below outlines the item codes that were used in analysing reductions of antibiotic supply to concessional patients for specified antibiotics commonly prescribed for URTI

TABLE 15: PBS ITEM CODES USED IN THE FINANCIAL IMPACT ANALYSIS OF THE NPS MEDICINEWISE ANTIBIOTIC RESISTANCE PROGRAMS – SPECIFIC ANTIBIOTICS COMMONLY PRESCRIBED FOR URTI

Drug	PBS item numbers
Doxycycline	10176N, 1800R, 2702F, 2703G, 2707L, 2708M, 2709N, 2711Q, 2714W, 2715X, 6015N, 6016P, 6023B, 6024C, 6026E, 6027F, 6081C, 6082D, 9105F, 9106G, 9107H, 9108J
Amoxycillin	1878W, 1883D, 1884E, 1886G, 1887H, 1888J, 1889K, 8581P, 8705E, 9714G
Amoxycillin + Clavulanic acid	1890L, 1891M, 1892N, 1893P, 8254K, 8319W
Phenoxymethylpenicillin	1702N, 1703P, 1705R, 1786B, 1787C, 1789E, 2354X, 2356B, 2965C, 3028J, 8976K, 8977L, 9143F
Benzathine benzylpencillin	2267H
Benzathine penicillin	1766Y, 8167W, 8743E, 9002T, 9003W
Benzathine pencillin + Procaine pencillin + Benzylpencillin potassium	1767B
Cefaclor	1155T, 1169M, 2460L, 2461M
Cephalexin	3058Y, 3094W, 3095X, 3119E, 2655R
Cefuroxime axetil	8292K, 5499K
Trimethoprim + sulfamethoxazole	2949F, 2951H, 3103H
Erythromycin	1395K, 1399P, 1400Q, 1402T, 1404X
Erythromycin lactobionate	1397M, 1398N
Erythromycin stearate	1401R, 1403W, 2425P, 2610J
Erythromycin estolate	2423M, 2499M
Erythromycin ethylsuccinate	2424N, 2428T, 2750R
Roxithromycin	1760P, 8016X, 8129W
Azithromycin	2484R, 8200N, 8201P, 8336R
Clarithromycin	8318T, 9192T
Ciprofloxacin	1208N, 1209P, 1210Q, 1311B

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