5.2 Amoxicillin and amoxicillin–clavulanate dispensing, all ages

Context

This section examines amoxicillin and amoxicillin–clavulanate dispensing in Australia between 2013–14 and 2016–17 for people of all ages.

Antimicrobial medicines are used to treat microbial infections. They include antibiotics (or antibacterials), antivirals and antifungals. Use is often driven by factors such as physician experience, patient factors, the incidence of infection, and the prevalence of antimicrobial resistance.[1]

Amoxicillin is an antibiotic, and is the most frequently prescribed antimicrobial in the community. In 2013, amoxicillin accounted for 21% of systemic antimicrobial dispensing, with repeat dispensing ordered on 40% of prescriptions.[2] Amoxicillin is preferred for treating infections that are less likely to be cause by β-lactamase-producing bacteria, such as most upper and lower bacterial respiratory tract infections.[3]

The addition of clavulanic acid, a β-lactamase inhibitor, to amoxicillin broadens its spectrum of activity to include bacteria that commonly harbour acquired β-lactamases, such as *Escherichia coli*, *Klebsiella* species and *Staphylococcus aureus*.[3] The combination of amoxicillin–clavulanate is the third most commonly prescribed antimicrobial in the community.[2] Because antimicrobial resistance is known to be increasing in Australia, amoxicillin–clavulanate is preferred over amoxicillin for treating urinary tract infections.[1,3]

The rate of amoxicillin and amoxicillin–clavulanate dispensing per 100,000 people in all age groups was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015.[1] The first Atlas reported that, combined, these two antimicrobials accounted for more than 10 million Pharmaceutical Benefits Scheme (PBS) prescriptions dispensed in 2013–14; nearly 5.7 million were for amoxicillin and nearly 4.7 million were for amoxicillin–clavulanate.[1]

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As with dispensing for all antimicrobials, rates of amoxicillin and amoxicillin–clavulanate dispensing tended to be higher in areas with socioeconomic disadvantage. This is consistent with poorer health outcomes and higher infection rates observed in areas with socioeconomic disadvantage. Dispensing rates were lower in areas with socioeconomic advantage, as well as in remote communities. Low dispensing rates in remote communities were partly attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[1]

Why is it important to monitor antimicrobial use nationally?

Improving the use of antimicrobials is a national priority because of the ongoing concern about antimicrobial resistance (AMR) and because inappropriate use is exposing patients unnecessarily to the adverse effects of these medicines.

Antimicrobial-resistant microorganisms can stop an antimicrobial from working effectively. AMR is a concern because, as antimicrobials become ineffective, the ability to treat infections becomes more limited. With few new antimicrobials under development, especially for infections that occur in the community, AMR has been declared by the World Health Organization as one of the greatest threats to human and animal health, as well as food and agriculture.[4] Without effective antimicrobials, there is the possibility of a post-antibiotic era when minor infections can no longer be treated. Use of antimicrobials is one of the biggest drivers of resistance in the individual and wider community – the more they are used, the more likely it is that resistance will develop. For example, an individual prescribed an antibiotic for respiratory tract infection is 2.4 times more likely to acquire a bacterium resistant to that antimicrobial and carry it for up to 12 months.[5]

Prescribing antimicrobials inappropriately – for example, for longer than necessary – contributes to resistance and exposes patients unnecessarily to the adverse effects of these medicines. Examining how antimicrobials are being used will help inform strategies to minimise resistance and adverse effects in patients.

Australia continues to have very high overall rates of amoxicillin and amoxicillin–clavulanate use in the community compared with other countries, and misuse is common. For example, amoxicillin–clavulanate, which is the third most commonly dispensed antimicrobial in the community, should only be prescribed for infections where resistance to amoxicillin is suspected or proven. In 2017, the second Australian report on antimicrobial use and resistance in human health reported data obtained from the NPS MedicineWise MedicineInsight program. It showed that 14% of amoxicillin–clavulanate prescriptions were for upper respiratory tract infections, where antimicrobials are not needed, and 15% of prescriptions were for sinusitis, where antimicrobials are only needed in certain circumstances (with amoxicillin being the recommended medicine).[3,6]

What initiatives have taken place since 2015?

Increased antimicrobial use and misuse has prompted a number of policy and regulatory responses in Australia since publication of the first Atlas in 2015. Australia has taken a One Health approach, coordinating responses from all sectors that use antimicrobials. Responses have included:

- Development of Australia's First National Antimicrobial Resistance Strategy, as part of a global response to combat AMR[4]
- Development of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System by the Australian Commission on Safety and Quality in Health Care (the Commission) to inform strategies to prevent and contain AMR[7]
- Establishment of the National Alert System for Critical Antimicrobial Resistance (CARAlert) by the Commission, as part of AURA, to collect close to real-time data on critical resistances to the last-line antimicrobials[7]
- Establishment of the National Centre for Antimicrobial Stewardship, to promote the rational use of antimicrobials across Australia[8]
- Implementation of antimicrobial stewardship programs in all health service organisations across Australia, under the requirements of the National Safety and Quality Health Service Standards[9]
- Continued delivery of the NPS MedicineWise Resistance Fighter campaign (2012–2017) – a national initiative to help raise awareness of antibiotic resistance and encourage reduction in antibiotic use where appropriate and safe to do so[10]
- Letters from Australia's Chief Medical Officer to general practitioners prescribing high amounts of antimicrobials, prompting audit of their antimicrobial prescribing practice to identify areas for quality improvement.[11]

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their admission to public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

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What do the data show?

Magnitude of variation*

In 2016–17, the rate of dispensing of amoxicillin prescriptions was **7.6 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation was stable from 2013–14, then **decreased** from 2015–16 when there was a 7.9-fold difference between the highest and lowest rates (Figure 5.4).

The rate of dispensing of amoxicillin–clavulanate prescriptions was **5.8 times as high** in the SA3 with the highest rate as in the SA3 with the lowest rate 2016–17. The magnitude of variation **increased** from 2013–14, when there was a 5.0-fold difference between the highest and lowest rates (Figure 5.9).

Rate of prescriptions dispensed

In 2016–17, there were 5,443,251 PBS prescriptions dispensed for amoxicillin, representing an Australian rate of **22,286** prescriptions dispensed per 100,000 people of all ages. The Australian rate **decreased** from 2013–14, when 24,112 prescriptions per 100,000 people were dispensed. (Figure 5.4)

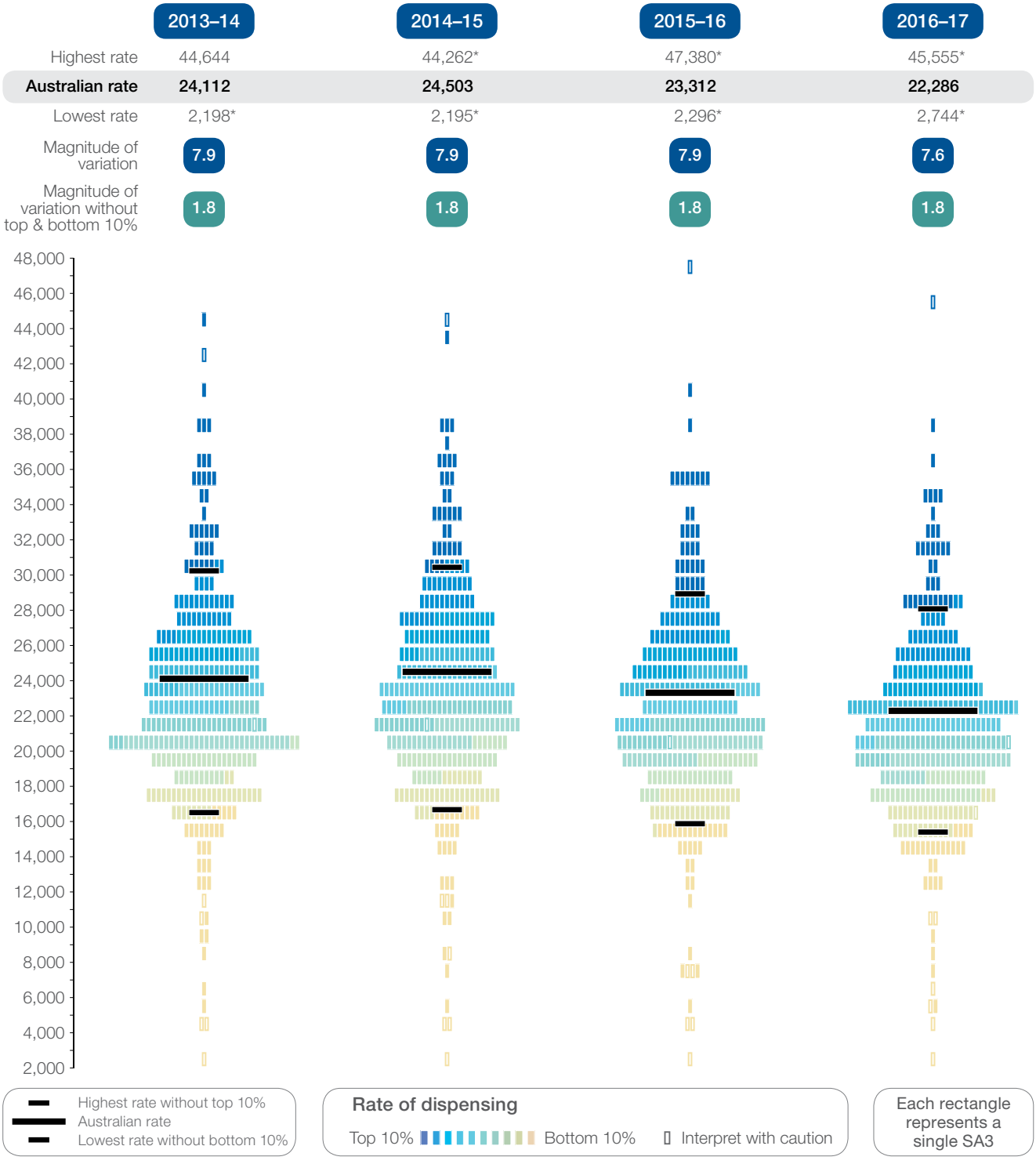
In 2016–17, there were 4,936,412 PBS prescriptions dispensed for amoxicillin–clavulanate, representing an Australian rate of **19,567** prescriptions dispensed per 100,000 people of all ages. The Australian rate **increased** from 2013–14, when 19,110 prescriptions per 100,000 people were dispensed (Figure 5.9).

* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

Amoxicillin dispensing, all ages

Rates across years

Figure 5.4: Number of PBS prescriptions dispensed for amoxicillin per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17



Notes:
Hollow rectangles (▯) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Amoxicillin and amoxicillin–clavulanate dispensing, all ages

People dispensed at least one prescription

In 2016–17, there were **15,143** people per 100,000 people nationally who had at least one prescription dispensed for amoxicillin. The number of people nationally who had at least one prescription dispensed in a year **decreased** from 2013–14, when 15,890 people per 100,000 people nationally had at least one amoxicillin prescription dispensed (Table 5.5).

Table 5.5: Number of people dispensed at least one PBS prescription for amoxicillin per 100,000 people of all ages, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	15,890	16,205	15,733	15,143

In 2016–17, there were **10,683** people per 100,000 people nationally who had at least one prescription dispensed for amoxicillin–clavulanate. The number of people nationally who had at least one prescription dispensed in a year **increased** from 2013–14, when 10,338 people per 100,000 people nationally had at least one amoxicillin–clavulanate prescription dispensed (Table 5.6).

Table 5.6: Number of people dispensed at least one PBS prescription for amoxicillin–clavulanate per 100,000 people of all ages, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	10,338	10,996	10,849	10,683

Volume of amoxicillin and amoxicillin–clavulanate use

In 2016–17, there were 5.12 defined daily doses[†] (DDDs) of amoxicillin per 1,000 people dispensed on any given day. The national DDD rate per 1,000 people per day **fell** from 2013–14, when it was 5.33 (Table 5.7).

Table 5.7: Number of defined daily doses of amoxicillin dispensed per 1,000 people of all ages per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	5.33	5.47	5.27	5.12

In 2016–17, there were 4.31 DDDs of amoxicillin–clavulanate per 1,000 people dispensed on any given day. The national DDD per 1,000 people per day **increased** from 2013–14, when it was 4.17 (Table 5.8).

Table 5.8: Number of defined daily doses of amoxicillin–clavulanate dispensed per 1,000 people of all ages per day, age and sex standardised, 2013–14 to 2016–17

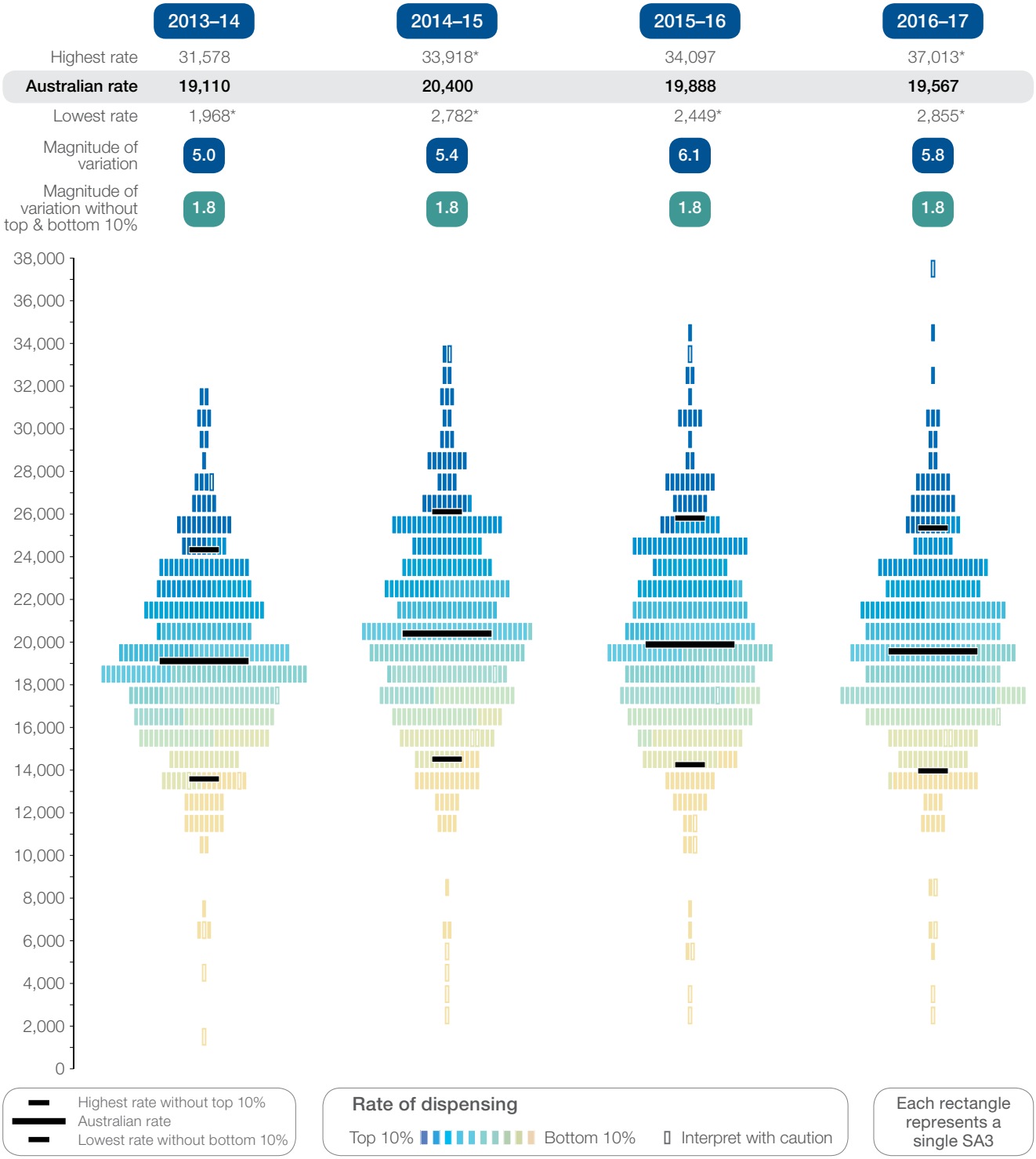
	2013–14	2014–15	2015–16	2016–17
Australian rate	4.17	4.46	4.36	4.31

[†] A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Amoxicillin–clavulanate dispensing, all ages

Rates across years

Figure 5.9: Number of PBS prescriptions dispensed for amoxicillin–clavulanate per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17



Notes:
Hollow rectangles (▯) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

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Interpretation

Between 2013–14 and 2016–17, the rate of amoxicillin prescriptions dispensed per 100,000 people nationally decreased by 7.6%, and the rate of people dispensed at least one prescription for amoxicillin also decreased. In contrast, the rate of amoxicillin–clavulanate prescriptions dispensed per 100,000 people nationally increased by 2.4%. Collectively, the volume of both medicines used in the Australian community, as indicated by the DDDs per 1,000 people per day, has remained relatively stable, indicating that there has been little change in the amount of either of these antimicrobials supplied during the four-year period. The magnitude of variation in dispensing decreased for amoxicillin, but increased for amoxicillin–clavulanate. It is unclear whether these patterns indicate changes in some areas and not others.

Potential reasons for these patterns include:

- The number of authority prescriptions dispensed – for example, a rise in these types of prescriptions for an increased quantity supplied could lower rates of prescriptions dispensed
- Changes in guidelines and prescribing behaviours, affecting the choice of amoxicillin or amoxicillin–clavulanate and dose dispensed (as different conditions might require courses with a different dose or the same condition may be treated with a higher dose, which will not affect the rate of prescriptions dispensed, but will affect the DDD).

To explore this, further analysis could potentially focus on:

- Reasons for prescribing and doses being dispensed
- Quantities being dispensed on authority prescriptions
- The context in which these antibiotics are being prescribed and whether it is in accordance with guidelines.

Is there more to be done?

Although amoxicillin dispensing rates fell in Australia between 2013–14 and 2016–17, rates for amoxicillin–clavulanate dispensing did not. The magnitude of variation in dispensing rates decreased for amoxicillin and increased for amoxicillin–clavulanate, which is unlikely to be explained by infection rates. Australia still has high volumes of use of both amoxicillin and amoxicillin–clavulanate. Further investigation is required to identify whether these patterns are warranted. Improving prescribing of these antimicrobials requires a sustained, multi-pronged approach. Australia's first National Antimicrobial Resistance Strategy describes the collaborative efforts required to bring about practice change where appropriate, and to implement initiatives that support improvement in use in all settings of health care.[4]

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local area. This information will help to identify whether changes in the use of these antimicrobials are occurring in some areas and not others, and what further targeted strategies are needed to promote safe and appropriate use of these medicines in Australia.

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