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People dispensed one or more systemic antibiotics in a year, rate per 100

Technical information	
Indicator name (short)	People dispensed one or more systemic antibiotics in a year.
Description	This measure details the rate per 100 of people who are dispensed one or more systemic antibiotics in a year.
Rationale	This denominator focuses on antibiotic dispensing in those attending primary care. Research in Aotearoa New Zealand has found high rates of community antibiotic use with up to 95 percent of all antibiotics dispensed in the community, compared with 5 percent in hospital.¹ This raises questions on the appropriateness of prescribing. See the paper below for further analysis of which antibiotics are dispensed by age group.² This indicator only counts one antibiotic dispensing per person per year and only includes people if they visited primary care in the year. Not all community antibiotics will have been prescribed through primary health care. Prescriptions dispensed in community pharmacies may have come from hospital outpatient clinics, emergency departments or on hospital discharge. Antibiotics supplied using PSO are not included. 1. Duffy E, Ritchie S, Metcalfe S, et al. 2018. Antibacterials dispensed in the community comprise 85%–95% of total human antibacterial consumption. <i>J Clin Pharm Ther</i> 43(1): 59–64. 2. Whyler N, Tomlin A, Tilyard M, et al. 2018. Ethnic disparities in community antibacterial dispensing in New Zealand, 2015. <i>NZ Med J</i> 131(1480).
Numerator	People dispensed a systemic antibiotic in the community.
Denominator	People who had a GP consultation date in the year.
Inclusions	Antibiotics included, chemical ID– note fusidic acid only includes one formulation: • Cephalosporins and cephamycins: cefaclor monohydrate 1228, cefazolin 1236, ceftriaxone 1232, cefuroxime axetil 1081, cefuroxime sodium 1233, cefalexin monohydrate 1234 • Macrolides: azithromycin 1178, clarithromycin 2809, erythromycin ethyl succinate 6026, erythromycin lactobionate 6028, erythromycin stearate 6027, roxithromycin 2790 • Penicillins: amoxicillin 1072, amoxicillin with clavulanic acid 1070, benzathine benzylpenicillin tetrahydrate 1120, benzylpenicillin sodium (penicillin G) 1136, flucloxacillin 1512, phenoxymethylpenicillin (penicillin V) 1970, procaine penicillin 2046 • Tetracyclines: doxycycline 2529, minocycline hydrochloride 1828, tetracycline 3999

	- Other antibiotics: ciprofloxacin 2819, clindamycin 1303, colistin sulphomethate 1346, co-trimoxazole 1361, fusidic acid 1546 – formulation id 154601, gentamicin sulphate 1554, moxifloxacin 3925, paromomycin 3998, pyrimethamine 3992, sulfadiazine sodium 3993, tobramycin 2274, vancomycin 2314 - Urinary tract infections: hexamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300
Exclusions	- Ciprofloxacin 2819 formulation id: 281904 (eye) - Gentamicin sulphate 1554: 155405 (eye) - Tobramycin 2274 formulation ids: 227425 (inhalation), 227404 (eyedrops) and 227405 (eye ointment)
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; Primary Health Organisation (PHO), Ministry of Health.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

All systemic antibiotic dispensings in a year, rate per 100

Technical information	
Indicator name (short)	All systemic antibiotic dispensings in a year.
Description	This measure details the rate per 100 of all systemic antibiotic dispensings in a year.
Rationale	This indicator is intended to show which population groups receive multiple dispensings of an antibiotic in a year. Research in Aotearoa New Zealand has found high rates of community antibiotic use with up to 95 percent of all antibiotics dispensed in the community, compared with 5 percent in hospital.¹ This raises questions on the appropriateness of prescribing. See the paper below for further analysis of which antibiotics are dispensed by age group.² This indicator used the PHO enrolments database to calculate the number of visits per year. This counts up to nine visits per year for individuals. Not all community antibiotics will have been prescribed through primary health care. Prescriptions may have come from hospital outpatient clinics, emergency departments and on hospital discharge. Antibiotics dispensed using PSO are not included. 3. Duffy E, Ritchie S, Metcalfe S, et al. 2018. Antibacterials dispensed in the community comprise 85%–95% of total human antibacterial consumption. <i>J Clin Pharm Ther</i> 43(1): 59–64. 4. Whyler N, Tomlin A, Tilyard M, et al. 2018. Ethnic disparities in community antibacterial dispensing in New Zealand, 2015. <i>NZ Med J</i> 131(1480).
Numerator	Number of systemic antibiotics dispensed in the community.
Denominator	Number of GP consultations in the year.
Inclusions	Antibiotics included, chemical ID– note fusidic acid only includes one formulation: • Cephalosporins and cephamycins: cefaclor monohydrate 1228, cefazolin 1236, ceftriaxone 1232, cefuroxime axetil 1081, cefuroxime sodium 1233, cefalexin monohydrate 1234 • Macrolides: azithromycin 1178, clarithromycin 2809, erythromycin ethyl succinate 6026, erythromycin lactobionate 6028, erythromycin stearate 6027, roxithromycin 2790 • Penicillins: amoxicillin 1072, amoxicillin with clavulanic acid 1070, benzathine benzylpenicillin tetrahydrate 1120, benzylpenicillin sodium (penicillin G) 1136, flucloxacillin 1512, phenoxymethylpenicillin (penicillin V) 1970, procaine penicillin 2046 • Tetracyclines: doxycycline 2529, minocycline hydrochloride 1828, tetracycline 3999 • Other antibiotics: ciprofloxacin 2819, clindamycin 1303, colistin sulphomethate 1346, co-trimoxazole 1361, fusidic acid 1546 –

	formulation id 154601, gentamicin sulphate 1554, moxifloxacin 3925, paromomycin 3998, pyrimethamine 3992, sulfadiazine sodium 3993, tobramycin 2274, vancomycin 2314 • Urinary tract infections: hexamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300
Exclusions	• Ciprofloxacin 2819 formulation id: 281904 (eye) • Gentamicin sulphate 1554: 155405 (eye) • Tobramycin 2274 formulation ids: 227425 (inhalation), 227404 (eyedrops) and 227405 (eye ointment)
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; primary health organisation (PHO), Ministry of Health.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

People listed in aged residential care (ARC) dispensed one or more systemic antibiotics in a year, rate per 100

Technical information	
Indicator name (short)	People listed in ARC dispensed one or more systemic antibiotics in a year.
Description	This measure details the rate per 100 of people listed in an aged residential care facility (ARC) dispensed one or more systemic antibiotics in a year.
Rationale	Research in Aotearoa New Zealand has found higher rates of community antibiotic use for older people in general and especially high rates for people living in ARC due to multimorbidity and frailty.^{1,2} Higher rates of antibiotic-resistant organisms are also found in ARC residents.³ This indicator looks specifically at antibiotic use in people who were living in ARC. This indicator only counts one antibiotic dispensing per person per year and only includes people if they visited primary care in the year. Not all community antibiotics will have been prescribed through primary health care. Prescriptions may have come from hospital outpatient clinics, emergency departments and on hospital discharge. Antibiotics dispensed using practitioner supply orders are not included. - Norris P, Horsburgh S, Keown S, et al. 2011. Too much and too little? Prevalence and extent of antibiotic use in a New Zealand region. <i>J Antimicrob Chemother</i> 66(8): 1921–6. - Beckett CL, Harbarth S, Huttner B. 2015. Special considerations of antibiotic prescription in the geriatric population. <i>Clin Microbiol Infect</i> 21(1): 3–9. - Moor CT, Roberts SA, Simmons G, et al. 2008. Extended-spectrum betalactamase (ESBL)-producing Enterobacteria: factors associated with infection in the community setting, Auckland, New Zealand. <i>J Hosp Infect</i> 68(4): 355–62.
Numerator	People aged 65 and over living in an ARC facility dispensed one or more systemic antibiotics.
Denominator	People aged 65 and over who had a GP consultation in a year listed in the ARC database.
Inclusions	Antibiotics included, chemical ID– note fusidic acid only includes one formulation: - Cephalosporins and cephamycins: cefaclor monohydrate 1228, cefazolin 1236, ceftriaxone 1232, cefuroxime axetil 1081, cefuroxime sodium 1233, cefalexin monohydrate 1234 - Macrolides: azithromycin 1178, clarithromycin 2809, erythromycin ethyl succinate 6026, erythromycin lactobionate 6028, erythromycin stearate 6027, roxithromycin 2790 - Penicillins: amoxicillin 1072, amoxicillin with clavulanic acid 1070, benzathine benzylpenicillin tetrahydrate 1120, benzylpenicillin

	sodium (penicillin G) 1136, flucloxacillin 1512, phenoxymethylpenicillin (penicillin V) 1970, procaine penicillin 2046 • Tetracyclines: doxycycline 2529, minocycline hydrochloride 1828, tetracycline 3999 • Other antibiotics: ciprofloxacin 2819, clindamycin 1303, colistin sulphomethate 1346, co-trimoxazole 1361, fusidic acid 1546 – formulation id 154601, gentamicin sulphate 1554, moxifloxacin 3925, paromomycin 3998, pyrimethamine 3992, sulfadiazine sodium 3993, tobramycin 2274, vancomycin 2314 • Urinary tract infections: hexamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300
Exclusions	• Ciprofloxacin 2819 formulation id: 281904 (eye) • Gentamicin sulphate 1554: 155405 (eye) • Tobramycin 2274 formulation ids: 227425 (inhalation), 227404 (eyedrops) and 227405 (eye ointment)
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; aged residential care (ARC) funding; primary health organisation (PHO), Ministry of Health.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

People dispensed a topical antibiotic in a year, rate per 100

Technical information	
Indicator name (short)	People dispensed a topical antibiotic in a year.
Description	This measure details the rate per 100 of people dispensed a topical antibiotic in the community.
Rationale	This indicator focuses on topical antibiotics dispensed in those attending primary care. It is noted that topical antibiotics are more likely to be shared among family and whānau members or used again in a year. Topical antibiotics have few indications while good skin hygiene and topical antiseptics such as hydrogen peroxide or povidone iodine are recommended for treating localised or minor skin infections, including impetigo.¹ In Aotearoa New Zealand, increasing use of topical fusidic acid has occurred concurrently with increasing fusidic acid resistance.² For these reasons, it is recommended that the use of topical antibiotics is limited. 8. bpac^{nz}. 2018. Topical antibiotics: keep reducing use. URL: www.bpac.org.nz/2018/topical-antibiotics.aspx (accessed November 2018). 9. Williamson DA, Monecke S, Heffernan H, et al. 2014. High usage of topical fusidic acid and rapid clonal expansion of fusidic acid-resistant <i>Staphylococcus aureus</i>: a cautionary tale. <i>Clin Infect Dis</i> 59(10): 1451–4.
Numerator	People dispensed a topical antibiotic in the community.
Denominator	People who had a GP consultation date in the year.
Inclusions	Topical antibiotics: Fusidic acid 1546 formulation ID; 154608, 154609; mupirocin 1835.
Exclusions	- Formulation ID for: fusidic acid 1546: 154604 (eye). - Hydrogen peroxide and silver sulfadiazine 2114 are excluded as they are topical antiseptics.
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; primary health organisation (PHO), Ministry of Health.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	See appendix for more details.

Seasonal variation in community systemic antibiotic dispensing, percent

Technical information	
Indicator name (short)	Seasonal variation in community systemic antibiotic dispensing.
Description	This measure shows the percentage of seasonal variation in community systemic antibiotic dispensing.
Rationale	This indicator seeks to ask whether there are areas where antibiotics are over-used in the winter months compared with the summer months of a one-year period. This indicator shows the seasonal dispensing of the most dispensed antibiotics. Flucloxacillin and fusidic acid are excluded as their use increases in summer, reflecting their indication to treat infectious skin conditions. In order to present seasonal variation, flucloxacillin and fusidic acid were excluded from analysis to focus on the use of antibiotics particularly for winter viral respiratory infections (colds and flus).
Numerator	Community antibiotic dispensing per day in the winter months (Apr–Sept).
Denominator	Community antibiotic dispensing per day in the summer months (Oct–Mar).
Inclusions	Antibiotics included (systemic only): moxycillin 1072, amoxicillin with clavulanic acid 1070, doxycycline 2529, roxithromycin 2790, trimethoprim 2300, erythromycin ethyl succinate 6026, co-trimoxazole 1361, cefaclor monohydrate 1228, phenoxymethylpenicillin (penicillin V) 1970.
Exclusions	Antibiotics: Flucloxacillin and fusidic acid.
Note for calculation	Unit of measure: Percentage Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; primary health organisation (PHO), Ministry of Health. New Zealand Resident Population, Statistics New Zealand.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>This indicator is adapted from European Centre for Disease Prevention and Control (ECDC) quality indicators.</i> www.ecdc.europa.eu/en/antimicrobial-consumption/database/qualityindicators <i>See appendix for more details.</i>

People dispensed a broad-spectrum penicillin as a percent of all people dispensed a penicillin

Technical information	
Indicator name (short)	People dispensed a broad-spectrum penicillin as a percentage of all people dispensed a penicillin.
Description	This measure details the percentage of people who are dispensed a broad-spectrum penicillin as a percent of all people dispensed a penicillin.
Rationale	The New Zealand Formulary classifies amoxicillin and amoxicillin with clavulanic acid as broad-spectrum penicillins. Broad-spectrum antibiotics are associated with antimicrobial resistance and are generally recommended only for certain indications¹. The other penicillins are classed as narrow spectrum. This indicator measures amoxicillin or amoxicillin with clavulanic acid use as a percent of total penicillin's dispensing. Wide regional variation in the use of amoxicillin or amoxicillin with clavulanic acid might highlight areas where improvement may be indicated Wide regional variation in the use of amoxicillin or amoxicillin with clavulanic acid might highlight areas where improvement may be indicated. 10. bpac^{nz}. 2015. Amoxicillin clavulanate update report 2015. URL: www.bpac.org.nz/Report/2015/September/antibiotics.aspx (accessed November 2018).
Numerator	The number of people dispensed amoxicillin or amoxicillin with clavulanic acid in a community pharmacy, in a year
Denominator	The number of people dispensed a penicillin in a community pharmacy in a year.
Inclusions	Chemicals included: - Penicillins: amoxicillin 1072, amoxicillin with clavulanic acid 1070, benzathine benzylpenicillin tetrahydrate 1120, benzylpenicillin sodium (penicillin G) 1136, flucloxacillin 1512, phenoxymethylpenicillin (penicillin V) 1970, procaine benzylpenicillin 2046. DANMAP: - Broad-spectrum penicillins: Amoxicillin 1072, amoxicillin with clavulanic acid 1070 - Narrow-spectrum penicillins: Benzathine benzylpenicillin tetrahydrate 1120, benzylpenicillin sodium (penicillin G) 1136, phenoxymethylpenicillin (penicillin V) 1970, flucloxacillin 151, procaine benzylpenicillin 2046.
Exclusions	<i>See appendix for more details.</i>

Note for calculation	Unit of measure: Percentage Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; primary health organisation (PHO), Ministry of Health. New Zealand Resident Population, Statistics New Zealand.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

People dispensed amoxicillin with clavulanic acid one or more times in a year, rate per 100

Technical information	
Indicator name (short)	People dispensed amoxicillin with clavulanic acid one or more times in a year.
Description	This measure details the rate per 100 of people dispensed amoxicillin with clavulanic acid one or more times in a year.
Rationale	Amoxicillin with clavulanic acid is a broad-spectrum antibiotic. Broad-spectrum antibiotics are associated with antimicrobial resistance and are generally recommended only for specific indications (bpacnz: www.bpac.org.nz/Report/2015/September/antibiotics.aspx). Clavulanate possesses little antibacterial activity, but significantly extends the spectrum of activity of amoxicillin when given with it, leading to an increased risk of the development of antimicrobial resistance to an increased risk of the development of antimicrobial resistance.
Numerator	People dispensed amoxicillin with clavulanic acid in a year.
Denominator	People who had a GP consultation in the year.
Inclusions	Chemicals: Amoxicillin with clavulanic acid 1070.
Exclusions	<i>See appendix for more details.</i>
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; primary health organisation (PHO), Ministry of Health. New Zealand Resident Population, Statistics New Zealand.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

People dispensed an antibiotic specifically indicated for urinary tract infections (UTIs), rate per 100

Technical information	
Indicator name (short)	People dispensed an antibiotic specifically indicated for urinary tract infections (UTIs).
Description	This measure details the rate per 100 of people dispensed an antibiotic specifically indicated for urinary tract infections UTIs.
Rationale	Nitrofurantoin or trimethoprim are recommended as first-line treatment for UTIs. Norfloxacin is second-line treatment. The rationale for this indicator is to explore the use of antibiotics for UTIs, with a view identifying whether there are areas of high use of these antibiotics. A Cochrane Review (2015) concluded there was no clinical benefit from treating asymptomatic bacteriuria in the studies included (www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD009534.pub2/epdf/full).
Numerator	People dispensed an antibiotic for UTIs in a year.
Denominator	People who had a GP consultation in the year.
Inclusions	Chemicals: Methenamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300
Exclusions	<i>See appendix for more details.</i>
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; primary health organisation (PHO), Ministry of Health. New Zealand Resident Population, Statistics New Zealand.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	Nitrofurantoin is not usually indicated for use in children. Norfloxacin is not approved for use in children (www.nzfchildren.org.nz/nzf_3283) although the New Zealand Formulary notes there may be some specific circumstances when use may be justified in children. Norfloxacin use is associated with antibiotic resistance and isn't recommended for first-line treatment. <i>See appendix for more details.</i>

People listed in ARC dispensed an antibiotic specifically indicated for UTIs, rate per 100

Technical information	
Indicator name (short)	People dispensed an antibiotic specifically indicated for urinary tract infections (UTIs).
Description	This measure details the rate per 100 of people listed in an aged residential care facility (ARC) dispensed an antibiotic specifically indicated for UTIs.
Rationale	Nitrofurantoin or trimethoprim are recommended as first-line treatment for UTIs. Norfloxacin is second-line treatment. The rationale for this indicator is to explore the use of antibiotics for UTIs, with a view identifying whether there are areas of high use of these antibiotics. A Cochrane Review (2015) concluded there was no clinical benefit from treating asymptomatic bacteriuria in the studies included (www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD009534.pub2/epdf/full).
Numerator	People aged 65 and over living in an aged residential care facility (ARC) who were dispensed an antibiotic for UTIs in a year.
Denominator	People aged 65 and over who had a GP consultation in a year and are listed in the aged residential care facility (ARC) database.
Inclusions	Chemicals: Methenamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300.
Exclusions	Pharmacists can sell trimethoprim and methenamine hippurate over the counter and this use is not captured here.
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; Primary Health Organisation (PHO), Ministry of Health. New Zealand Resident Population, Statistics New Zealand.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	Nitrofurantoin is not usually indicated for use in children. Norfloxacin is not approved for use in children (www.nzfchildren.org.nz/nzf_3283) although the New Zealand Formulary notes there may be some specific circumstances when use may be justified in children. Norfloxacin use is associated with antibiotic resistance and isn't recommended for first-line treatment. <i>See appendix for more details.</i>

Medical hospital admissions with an antibiotic dispensed within 30 days of discharge, rate per 100

Technical information	
Indicator name (short)	Medical hospital admissions dispensed an antibiotic within 30 days of discharge.
Description	This measure details the rate per 100 of medical hospital admissions with an antibiotic dispensed within 30 days of discharge.
Rationale	It is recommended that, along with good infection control, antibiotics be prescribed only when needed, with the narrowest spectrum of antimicrobial activity. Previous research in Aotearoa New Zealand concluded a significant proportion of antibiotics prescribed to patients discharged following surgery was inappropriate and recommended enhanced antimicrobial stewardship in this area.¹ It appears there may be a similar pattern in medical patients. 11. De Almeida M, Gerard C, Freeman JT, et al. 2018. Inappropriate prescribing of antibiotics following discharge after major surgery: an area for improvement. <i>NZ Med J</i> 131(1475): 35–43.
Numerator	Medical hospital admissions dispensed an antibiotic within 30 days of discharge.
Denominator	Medical hospital admissions with a length of stay of at least one day.
Inclusions	Admission type: Medical diagnostic-related groups (DRGs) only.
Exclusions	- Exclude non-case-mix events, to remove events related to mental health, maternity, and aged care. Events of less than one day were excluded to ensure only inpatient events were included. - Topical antibiotics were excluded.
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; National Minimum Dataset (NMDS), Ministry of Health.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

Surgical hospital admissions with an antibiotic dispensed within 30 days of discharge

Technical information	
Indicator name (short)	Surgical hospital admissions dispensed an antibiotic within 30 days of discharge.
Description	This measure details the rate per 100 of surgical hospital admissions with an antibiotic dispensed within 30 days of discharge.
Rationale	It is recommended that, along with good infection control, antibiotics be prescribed only when needed, with the narrowest spectrum of antimicrobial activity. It is not best practice for antibiotics to be administered routinely postoperatively. NICE recommends antibiotics be used only in cases where infection is clinically evident.¹ Previous research in Aotearoa New Zealand concluded a significant proportion of antibiotics dispensed in patients discharged following surgery was inappropriate and recommended enhanced antimicrobial stewardship in this area.² 1. NICE. Preventing and treating surgical site infections. London: NICE. URL: https://pathways.nice.org.uk/pathways/prevention-and-control-of-healthcare-associated-infections (accessed December 2018). 2. De Almeida M, Gerard C, Freeman JT, et al. 2018. Inappropriate prescribing of antibiotics following discharge after major surgery: an area for improvement. <i>NZ Med J</i> 131(1475): 35–43.
Numerator	Surgical hospital admissions dispensed an antibiotic within 30 days of discharge.
Denominator	Surgical hospital admissions with a length of stay of at least 1 day.
Inclusions	Admission type: Surgical diagnostic-related groups (DRGs) only.
Exclusions	• Exclude non-case-mix events to remove events related to mental health, maternity, and aged care. Events of less than one day were excluded to ensure only inpatient events were included. • Topical antibiotics were excluded.
Note for calculation	Unit of measure: Rate Adjustment applied: None District health board (DHB) assignment: Domicile
Data sources	Pharmaceutical Collection; National Minimum Dataset (NMDS), Ministry of Health.
Suppression rule	Data is not presented where the denominator was less than 10.
Notes	<i>See appendix for more details.</i>

Appendix 1. Interpretation notes

Units reported and denominator used
In developing this Atlas domain, we explored different metrics. We decided not to use defined daily doses (DDD) because they are based on adult doses so don't apply well to children. We trialled reporting prescription items dispensed per 1,000 population per day but decided not to progress with this because it does not account for the duration of treatment. This means that an antibiotic dispensed for one day is counted the same as an antibiotic with a 90-day supply. Instead, we chose to report people who were dispensed an antibiotic one or more times in a year. We explored different denominator populations and elected to use one based on those who attended primary care in the year of interest. Our analysis found that using the denominator of people attending primary care in the year was the best measure for DHB variation because it accounts for need. For example, a DHB with a younger or older age structure is likely to have a greater proportion of its population attend primary care in a year. Other denominators explored were the primary health organisation (PHO) enrolled population and the Statistics New Zealand DHB resident population.
Confidence intervals
Data for each DHB are presented as rate per 1,000 population. Upper and lower confidence intervals were calculated to 95 percent level of confidence.
Practitioner supply order (PSO)
Several antibiotics included in our analysis are also available on PSO. PHARMAC defines this as a written order made by a prescriber for the funded supply of pharmaceuticals for emergency use, teaching and demonstration purposes and for provision to certain patient groups where an individual prescription is not practicable. Antibiotics given to people using a PSO cannot be included in this Atlas domain because they are not linked to an NHI number.

Te Kāwanatanga o Aotearoa
New Zealand Government