Atlas of Healthcare Variation:
Methodology | Community use of antibiotics

June 2020

General points:

- Data is not presented where the number of people was below 10. This is to preserve confidentiality.
- People were assigned to the district health board (DHB) where they live.
- Ethnicity data presented uses prioritised ethnic group (Māori, Pacific peoples, Asian and European/Other). For people reporting multiple ethnic groups, the most recent value was selected.

Underlying data

If you would like the MS Excel file of the underlying data, please email atlas@hqsc.govt.nz.

Confidence intervals
Data for each DHB is presented as rates. Upper and lower confidence intervals were calculated to a 95 percent level of confidence.

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.

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.

Indicator #1:	**People dispensed one or more systemic antibiotics in a year, rate per 100**
Numerator	People dispensed a systemic antibiotic in the community
Denominator	People who had a GP consultation date in the year
Data source	Pharmaceutical Collection, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018

	Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M
Rationale	This denominator focuses on antibiotic dispensing in those attending primary care.
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
Exclude	Ciprofloxacin 2819 formulation id: 281904 (eye) Gentamicin sulphate 1554: 155405 (eye) Tobramycin 2274 formulation ids: 227425 (inhalation), 227404 (eye drops) and 227405 (eye ointment).
Commentary	**Description**: People dispensed one or more systemic antibiotics in a year, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. The denominator is those who had a primary care visit in a year. **Why is this important?** 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. **What questions might the data prompt?**

	• Are rates increasing or decreasing over time? • Why do rates vary between DHBs? How much can be explained by differences in patient population? • Why are 51 percent of 15–24-year-olds dispensed an antibiotic in the year? Which are the most commonly prescribed antibiotics for this group and what is the indication? • How many of the prescriptions are generated in primary care? • Does the pattern of prescribing seem appropriate? Is it consistent with guidelines and are guidelines regularly reviewed? 1. Duffy E, Ritchie S, Metcalfe S, et al. 2018. Antibacterials dispensed in the community comprise 85%–95% of total human antibacterial consumption. *J Clin Pharm Ther* 43(1): 59–64. 2. Whyler N, Tomlin A, Tilyard M, et al. 2018. Ethnic disparities in community antibacterial dispensing in New Zealand, 2015. *NZ Med J* 131(1480): 50–60.

Indicator #1b:	**All systemic antibiotic dispensings in a year, rate per 100**
Numerator	Number of systemic antibiotics dispensed in the community
Denominator	Number of GP consultations in the year
Data source	Pharmaceutical Collection, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M
Rationale	This indicator is intended to show which population groups receive multiple dispensings of an antibiotic in a year.
Chemicals	**As per indicator #1, systemic antibiotics only included**
Commentary	**Description**: Systemic antibiotics dispensed in a year, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. The denominator is primary care visits in a year. **Why is this important?** 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. **What questions might the data prompt?**

	• Are rates increasing or decreasing over time? • Why do rates vary between DHBs? How much can be explained by differences in patient population? • How many of the prescriptions are generated in primary care? • Does the pattern of prescribing seem appropriate? Is it consistent with guidelines and are guidelines regularly reviewed? 1. Duffy E, Ritchie S, Metcalfe S, et al. 2018. Antibacterials dispensed in the community comprise 85%–95% of total human antibacterial consumption. *J Clin Pharm Ther* 43(1): 59–64. 2. Whyler N, Tomlin A, Tilyard M, et al. 2018. Ethnic disparities in community antibacterial dispensing in New Zealand, 2015. *NZ Med J* 131(1480): 50–60.

Indicator #2:	**People listed in aged residential care (ARC) dispensed one or more systemic antibiotics in a year, rate per 100**
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
Data source	Pharmaceutical Collection, ARC funding from Ministry of Health, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 65–74, 75–84 and 85 and over Sex: F, M
Rationale	Are people living in ARC facilities dispensed more antibiotics than those living in the community? Does the dispensing vary by region? How much might be explained by differences in infection rates and how much represents overuse?
Chemicals	As indicator #1, systemic antibiotics only
Commentary	**Description**: People living in ARC dispensed one or more systemic antibiotics in a year, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. The denominator is those living in ARC who had a primary care visit in a year. **Why is this important?** 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. **What questions might the data prompt?** • Are rates increasing or decreasing over time? • Why do rates vary between DHBs? • Does the pattern of prescribing seem appropriate? Is it consistent with guidelines and are guidelines regularly reviewed? • What are the main indications for antibiotic use in ARC? 1. 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. *J Antimicrob Chemother* 66(8): 1921–6. 2. Beckett CL, Harbarth S, Huttner B. 2015. Special considerations of antibiotic prescription in the geriatric population. *Clin Microbiol Infect* 21(1): 3–9. 3. Moor CT, Roberts SA, Simmons G, et al. 2008. Extended-spectrum beta-lactamase (ESBL)-producing Enterobacteria: factors associated with infection in the community setting, Auckland, New Zealand. *J Hosp Infect* 68(4): 355–62.

Indicator #3:	**People dispensed a topical antibiotic in a year, rate per 100**
Numerator	People dispensed a topical antibiotic in the community
Denominator	People who had a GP consultation date in the year
Data source	Pharmaceutical Collection, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M
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	Fusidic acid 1546 formulation ID; 154608, 154609; mupirocin 1835
Exclude	Formulation ID for: fusidic acid 1546: 154604 (eye). Hydrogen peroxide and silver sulfadiazine 2114 are excluded as they are topical antiseptics.
Commentary	**Description:** People dispensed a topical antibiotic in a year, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. The denominator is those who had a primary care visit in a year. **Why is this important?** 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. **What questions might the data prompt?** • Why do rates vary between DHBs? How much can be explained by differences in patient population? • How many of the prescriptions are generated in primary care? • Does the pattern of prescribing seem appropriate? • What is the impact of socioeconomic factors on rates? • What factors are contributing to variation in rates by ethnicity? 1. bpac[nz]. 2018. Topical antibiotics: keep reducing use. URL: www.bpac.org.nz/2018/topical-antibiotics.aspx (accessed November 2018). 2. Williamson DA, Monecke S, Heffernan H, et al. 2014. High usage of topical fusidic acid and rapid clonal expansion of fusidic acid-resistant Staphylococcus aureus: a cautionary tale. *Clin Infect Dis* 59(10): 1451–4.

Indicator #4:	**Seasonal variation in community systemic antibiotic dispensing, percent**
Numerator	Community antibiotic dispensing per day in the winter months (Apr–Sept)
Denominator	Community antibiotic dispensing per day in the summer months (Oct–Mar)
Data source	Pharmaceutical Collection, Statistics New Zealand resident, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M
Source	This indicator is adapted from European Centre for Disease Prevention and Control (ECDC) quality indicators. www.ecdc.europa.eu/en/antimicrobial-consumption/database/quality-indicators
Antibiotics included (systemic only)	Amoxicillin 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
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).

Commentary	**Description**: Seasonal variation in community systemic antibiotic dispensing. Data for 2015–18 is presented by year, ethnicity, age group and sex. **Why is this important?** While bacterial infections increase during winter, increased prescribing in winter may suggest antibiotics are also being used to treat viral respiratory infections. This may represent an opportunity to optimise antibiotic use. This indicator reports the nine most dispensed antibiotics, which are known to be used inappropriately for the treatment of viral respiratory infections. To highlight seasonal variation, flucloxacillin and fusidic acid were excluded from the analysis as their use increases in summer, reflecting a seasonal increase in infectious skin conditions. Monthly antibiotic dispensing data are available in the paper by Whyler et al [2]. **What questions might the data prompt?** • Why does the variation differ between DHBs? How much can be explained by differences in patient population? • Why is seasonal variation higher in children? • Does the pattern of prescribing seem appropriate? 1. bpac^{nz}. 2018. Cold season: managing without antibiotics. URL: www.bpac.org.nz/2018/cold-season.aspx (accessed November 2018). 2. Whyler N, Tomlin A, Tilyard M, et al. 2018. Ethnic disparities in community antibacterial dispensing in New Zealand, 2015. *NZ Med J* 131(1480): 50–60.

Indicator #5:	**People dispensed a broad-spectrum penicillin as a percent of all people dispensed a penicillin**
Numerator	Number of people dispensed amoxicillin or amoxicillin with clavulanic acid in a community pharmacy, in a year
Denominator	Number of people dispensed a penicillin in a community pharmacy in a year
Data source	Pharmaceutical Collection, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M
Rationale	Wide regional variation in the use of amoxicillin or amoxicillin with clavulanic acid might highlight areas where improvement may be indicated.

Chemicals	**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
Commentary	**Description:** People dispensed amoxicillin or amoxicillin with clavulanic acid as a percent of all people dispensed a penicillin. Data for 2015–18 is presented by year, ethnicity, age group and sex. **Why is this important?** 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 indications [1]. The other penicillins are classed as narrow-spectrum. This indicator measures amoxicillin or amoxicillin with clavulanic acid use as a percent of total penicillins dispensing. Wide regional variation in the use of amoxicillin or amoxicillin with clavulanic acid might highlight areas where improvement may be indicated. **What questions might the data prompt?** • Are rates increasing or decreasing over time? • Why do rates vary between DHBs? How much can be explained by differences in patient population? • Does the pattern of prescribing seem appropriate? 1. bpac^{nz}. 2015. *Amoxicillin clavulanate update report 2015.* URL: www.bpac.org.nz/Report/2015/September/antibiotics.aspx (accessed November 2018).

Indicator #6:	**People dispensed amoxicillin with clavulanic acid one or more times in a year, rate per 100**
Numerator	People dispensed amoxicillin with clavulanic acid in a year
Denominator	People who had a GP consultation in the year
Data source	Pharmaceutical Collection, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M
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 (bpac^{nz}: 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.
Chemicals	Amoxicillin with clavulanic acid 1070
Commentary	**Description**: People dispensed amoxicillin with clavulanic acid one or more times in a year, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. **Why is this important?** 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 [1]. **What questions might the data prompt?** • Are rates increasing or decreasing over time? • Why do rates vary between DHBs? How much can be explained by differences in patient population? • What is the main indication this antibiotic is being prescribed for? • Does the pattern of prescribing seem appropriate? 1. bpac^{nz}. 2015. *Amoxicillin clavulanate update report 2015.* URL: www.bpac.org.nz/Report/2015/September/antibiotics.aspx (accessed November 2018).

Indicator #7:	**People dispensed an antibiotic specifically indicated for urinary tract infections (UTIs), rate per 100**
Numerator	People dispensed an antibiotic for UTIs in a year
Denominator	People who had a GP consultation in a year
Data source	Pharmaceutical collection, PHO enrolments
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 45–64, 65–74, 75–84 and 85 and over Sex: F, M
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).
Exclusions	Pharmacists can sell trimethoprim and methenamine hippurate over the counter and this use is not captured here. 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.
Chemicals	Methenamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300
Commentary	**Description:** People dispensed an antibiotic specifically indicated for UTIs, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. Trimethoprim, nitrofurantoin and norfloxacin are mainly used to treat UTIs, however some of the dispensing included in this Atlas domain may be for other indications. **Why is this important?** Trimethoprim or nitrofurantoin are recommended as first-line treatment for a UTI. Norfloxacin is second-line treatment. In people aged 65 and over, asymptomatic bacteriuria and UTIs can be common. A Cochrane Review (2015) concluded there was no clinical benefit from treating asymptomatic bacteriuria [1]. **What questions might the data prompt?** • Are rates for your DHB increasing or decreasing over time? • Why do rates vary between DHBs? • How much can be explained by prevalence of UTIs? • Are areas with high use of UTI antibiotics using them to treat asymptomatic bacteriuria? • Does the pattern of prescribing seem appropriate? 1. Zalmanovici Trestioreanu A, Lador A, et al. Antibiotics for asymptomatic bacteriuria. *Cochrane Database Syst Rev* 2015, Issue 4, Art. No. CD009534. URL: www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD009534.pub2/epdf/full (accessed November 2018).

Indicator #8:	**People listed in ARC dispensed an antibiotic specifically indicated for UTIs, rate per 100**
Numerator	People aged 65 and over living in an ARC facility dispensed an antibiotic for UTIs
Denominator	People aged 65 and over who had a GP consultation in a year listed in the ARC database
Data source	Pharmaceutical Collection, PHO enrolments

Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 65–74, 75–84 and 85 and over Sex: F, M
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).
Exclusions	Pharmacists can sell trimethoprim and methenamine hippurate over the counter and this use is not captured here. 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.
Chemicals	Methenamine hippurate 1594, nitrofurantoin 1867, norfloxacin 1874, trimethoprim 2300
Commentary	**Description:** People listed in an ARC facility dispensed an antibiotic specifically indicated for UTIs, rate per 100. Data for 2015–18 is presented by year, ethnicity, age group and sex. Trimethoprim, nitrofurantoin and norfloxacin are mainly used to treat UTIs, however some of the dispensing included in this Atlas domain may be for other indications. **Why is this important?** Trimethoprim or nitrofurantoin are recommended as first-line treatment for a UTI. Norfloxacin is second-line treatment. In people aged 65 and over, asymptomatic bacteriuria and UTIs can be common [1]. A Cochrane Review (2015) concluded there was no clinical benefit from treating asymptomatic bacteriuria [2]. **What questions might the data prompt?** • Are rates for your DHB increasing or decreasing over time? • Why do rates vary between DHBs? • How much can be explained by prevalence of UTIs? • Are areas with high use of UTI antibiotics using them to treat asymptomatic bacteriuria? • Does the pattern of prescribing seem appropriate? 1. Nicolle LE. 2016. Urinary tract infections in the older adult. *Clin Geriatr Med* 32: 523–38. 2. Zalmanovici Trestioreanu A, Lador A, Sauerbrun-Cutler MT, et al. Antibiotics

	for asymptomatic bacteriuria. *Cochrane Database Syst Rev* 2015, Issue 4, Art. No. CD009534. URL: www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD009534.pub2/epdf/full (accessed November 2018).

Indicator #9:	**Medical hospital admissions with an antibiotic dispensed within 30 days of discharge, rate per 100**
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
Data source	Pharmaceutical Collection, National Minimum Dataset
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M Admission type: medical diagnostic-related groups (DRGs) only
Rationale	As indicator #10 below, but comparing medical versus surgical DRGs.
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.
Commentary	**Description:** Medical hospital admissions with an antibiotic dispensed within 30 days of discharge. Data for 2015–18 is presented by year, ethnicity, age group and sex. All events in a year were included. **Why is this important?** 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. **What questions might the data prompt?** • How many prescriptions were 'just in case'? • How many prescriptions were generated in a follow-up appointment? • What proportion of prescriptions were for infections that were present prior to admission? • How does antibiotic use in this cohort compare with the general population and surgical admissions? 1. De Almeida M, Gerard C, Freeman JT, et al. 2018. Inappropriate prescribing of antibiotics following discharge after major surgery: an area for improvement. *NZ Med J* 131(1475): 35–43.

Indicator #10:	**Surgical hospital admissions with an antibiotic dispensed within 30 days of discharge, rate per 100**
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
Data source	Pharmaceutical Collection, National Minimum Dataset
Analysis	By year: 2015, 2016, 2017, 2018 Ethnicity: Māori, Pacific peoples, Asian, European/Other Age group (years): 0–4, 5–9, 10–14, 15–24, 25–44, 45–64, 65–74, 75–84 and 85 and over Sex: F, M Admission type: surgical DRGs only
Rationale	As indicator #9 above, but comparing surgical versus medical DRGs.
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.
Commentary	**Description:** Surgical hospital admissions with an antibiotic dispensed within 30 days of discharge. Data for 2015–18 is presented by year, ethnicity, age group and sex. All events in a year were included. **Why is this important?** 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]. **What questions might the data prompt?** • How many prescriptions were 'just in case'? • How many prescriptions were generated in a follow-up appointment? • What proportion of prescriptions were for infections unrelated to the surgery? • How does antibiotic use in this cohort compare with the general population and medical admissions? 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. *NZ Med J* 131(1475): 35–43.