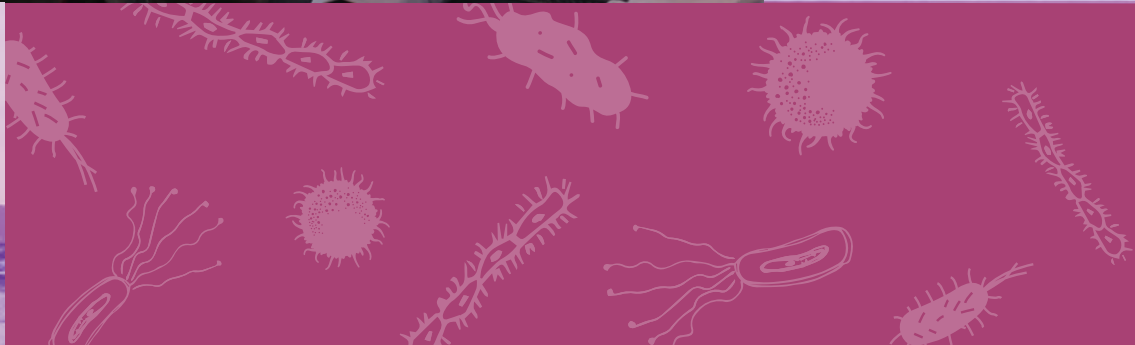
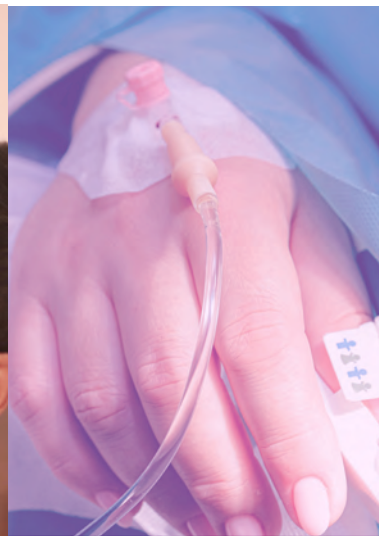




TPP
Alberta **Antibiotic
Prescription Atlas 2019**





Alberta's prescription drug monitoring program, TPP Alberta, uses data to optimize safe patient care. Since it was established in 1986, TPP Alberta has been monitoring the use of certain medications prone to misuse.

The mandate of TPP Alberta is:

- To monitor prescribing, dispensing and utilization practices regarding targeted medications;
- To provide timely and relevant information on targeted medications to prescribers, dispensers, consumers, regulatory bodies and stakeholders;
- To work with stakeholders to enable system level change to ensure appropriate use of targeted medications;
- To ensure efficient and effective functioning of TPP Alberta.

Funded primarily by the province of Alberta, TPP Alberta represents a partnership with program administration by the College of Physicians & Surgeons of Alberta (CPSA). The list of partners includes:

Alberta College of Pharmacy

Alberta Dental Association and College

Alberta Health

Alberta Health Services

Alberta Medical Association

Alberta Pharmacists' Association

Alberta Veterinary Medical Association

College and Association of Registered Nurses of Alberta

College of Physicians & Surgeons of Alberta

College of Podiatric Physicians of Alberta

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Background and Methods

About the Atlas

The TPP Alberta Antibiotic Prescription Atlas 2019 provides an overview of provincial antibiotic medication utilization for the year 2019. Alberta's Pharmaceutical Information Network (PIN) is the source of medication utilization information.

Data used in the Atlas analyses were extracted on October 25, 2020. Age and Sex Standardized rates are used throughout the Atlas. All antibiotic prescriptions included in this Atlas were prescribed for administration by the oral route. Compounded prescriptions were excluded from the analyses. Antibiotic products that have a Drug Information Number (DIN), such as amoxicillin–clavulanate, were included.

Antibiotic Prescription Data Source

Trend data for 2017 to 2019 are included as well as 2019–specific information. PIN data consist of dispense records from community pharmacies in Alberta. Ongoing gaps within PIN data include dispensing information from hospital pharmacies and facilities such as hospices.

As PIN records consist of dispenses (not prescriptions), prescriptions were measured using the unique combination of pharmacy license and prescription numbers. PIN prescription numbers were used for missing pharmacy numbers.

PIN data do not discriminate between medications actually dispensed from those awaiting release to the patient. As pharmacy records may be modified or reversed before the actual dispense, PIN data are dynamic. In an effort to capture actual dispensing as closely as possible, data were extracted from PIN on October 25, 2020, by which time most modifications and reversals would have occurred.

Pharmacy Local Aggregated Geography

This Atlas uses Pharmacy Local Aggregated Geographies (PhLAGs) instead of usual local geographies. PhLAGs merge neighbouring geographies where residents from one or more local geographies may be dispensed medications. This eliminates issues with utilization rates being artificially high or low in a local geography. The method used to develop PhLAGs is consistent with those used to develop other Alberta geographic aggregations used in the health system, such as subzones. The merging of geographies has primarily occurred in smaller cities such as Red Deer, Lethbridge, Medicine Hat, Grande Prairie, Fort McMurray, Spruce Grove, etc. The total number of geographic units has been reduced from 132 local geographies to 105 pharmacy local aggregated geographies. Rural PhLAG names include various municipality types, such as County, Planning and Special Area, and Municipal District.

Antibiotic Utilization Analyses

Analyses of medication utilization were carried out based on the main ingredient of interest within each drug. In the case where a drug had two ingredients of interest, one was chosen as the main ingredient.

Only medications with an oral route of administration were included. Patients of all ages were included in analyses, except for DDD calculations. Only patients 15 years and older were included in DDD calculations to eliminate most liquid dispenses from the DDD calculations.

Appendix A shows the patients, prescriptions, prescribers and pharmacies associated with the 20 most commonly prescribed antibiotics during 2019, by main ingredient and ATC Code. Appendix B portrays PhLAG boundaries and neighbourhood boundaries in Calgary and Edmonton to provide context for the boundary locations in these two cities. Appendix C provides information on interpretation of graphs and maps.

Atlas Measures

Antibiotic utilization is presented in this Atlas using counts and age and sex standardized rates. Patient age was calculated at July 1, 2019.

Days of Treatment

Days of Treatment measures are presented by main ingredient due to the large differences between antibiotics in standard days of treatment. We have included the top 20 ingredients prescribed. Treatment days are calculated by summing the “days of supply” for the entire year for each patient or prescription. The mean value for all patients and prescriptions are calculated for each of the more common antibiotics to obtain “treatment days per patient” and “treatment days per prescription”. The total number of prescriptions are calculated for every patient for a whole year and the mean is calculated for the common antibiotics to obtain “prescription per patient.”

These Days of Treatment measures highlight the length of treatment associated with each ingredient, including:

- Treatment days per patient
- Treatment days per prescription
- Prescriptions per patient

Defined Daily Dose (DDD)

The defined daily dose (DDD), as defined by the World Health Organization (WHO), is the assumed average daily maintenance dose for a drug used for its main indication in adults.¹ Drug DDD values were obtained primarily from the WHO DDD/ATC Index.² The number of DDDs (i.e., the dose in multiples of the DDD) was used as the standard measure of dosing across all drugs.

Only patients 15 years and older are included in DDD calculations in an attempt to remove liquid preparation prescriptions from the analyses.

The DDD for a specific drug dispense was calculated as follows:*

$$\text{Dispense DDD} = \text{strength} \times \text{quantity} / \text{drug DDD}$$

A patient’s total DDD was calculated as follows:*

$$\text{Patient DDD} = \text{the sum of the DDDs for all drug dispenses to the patient in the time period analyzed}$$

*DDD calculations only include patients 15 years and older

Population utilization of antibiotics was presented using the two measures below. Age and sex standardized population rates were used for comparison between pharmacy local aggregate geographies. Population data were obtained from Alberta Health at the LGA level and these were aggregated to PhLAG boundaries. The population is mid-year and is calculated six months later to account for late submissions or changes.

Antibiotic prescriptions = the number of antibiotic prescriptions in the time period analyzed / 1,000 population

Antibiotic prescription patients = the number of patients who received at least one antibiotic prescription in the time period analyzed / 1,000 population

¹ Norwegian Institute of Public Health. WHOCC – Definition and General Considerations [Internet]. WHO Collaborating Centre for Drug Statistics Methodology. 2009 [cited 2014 Oct 7]. Available from: http://www.whooc.no/ddd/definition_and_general_considera/

² http://www.whooc.no/atc_ddd_index/

Antibiotic Utilization

During 2019, over 2.5 million prescriptions for antibiotics occurred among approximately 1.4 million unique patients (Table 1). As expected, notable seasonal trends were observed in the dispensation of antibiotics between 2017 to 2019 (Figure 1 and 2). Differences were observed according to both age and sex (Table 2 and 3).

Table 1. Utilization of Prescription Antibiotics in Alberta, 2017–2019

Years	Patients	Prescriptions	Prescribers	Pharmacies	Population	Population 15+ Age
2017	1,398,185	2,494,172	16,990	1,386	4,285,997	3,491,584
2018	1,392,682	2,474,093	17,335	1,495	4,306,822	3,492,376
2019	1,426,001	2,530,455	17,546	1,527	4,371,154	3,551,379

Years	Patients /1,000 pop	Prescriptions /1,000 pop	DDDs /1,000 pop
2017	326	582	6,430
2018	323	574	6,421
2019	326	579	6,404

Figure 1. Patients by Quarter, 2017–2019

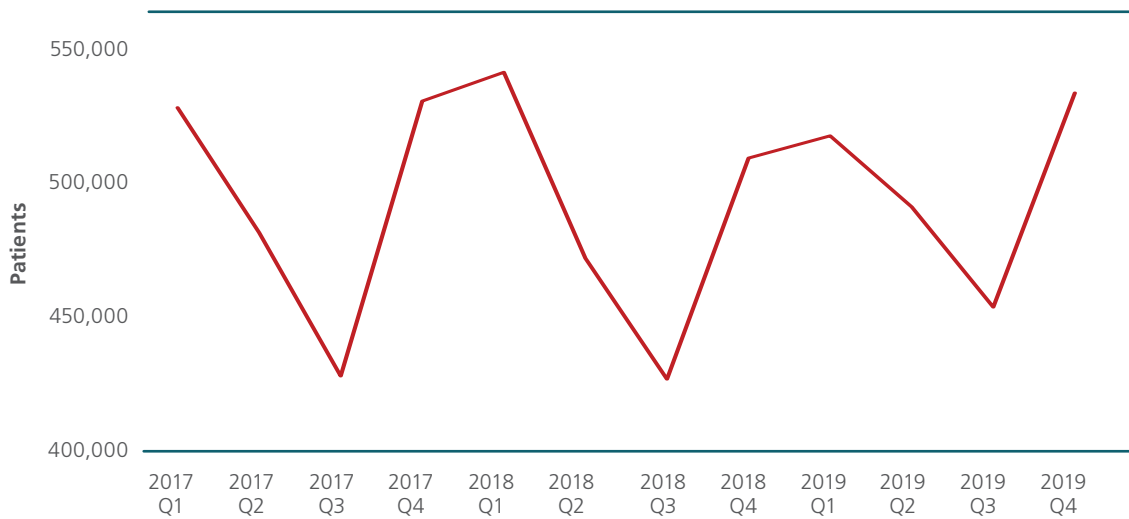


Figure 2. Prescriptions by Quarter, 2017–2019

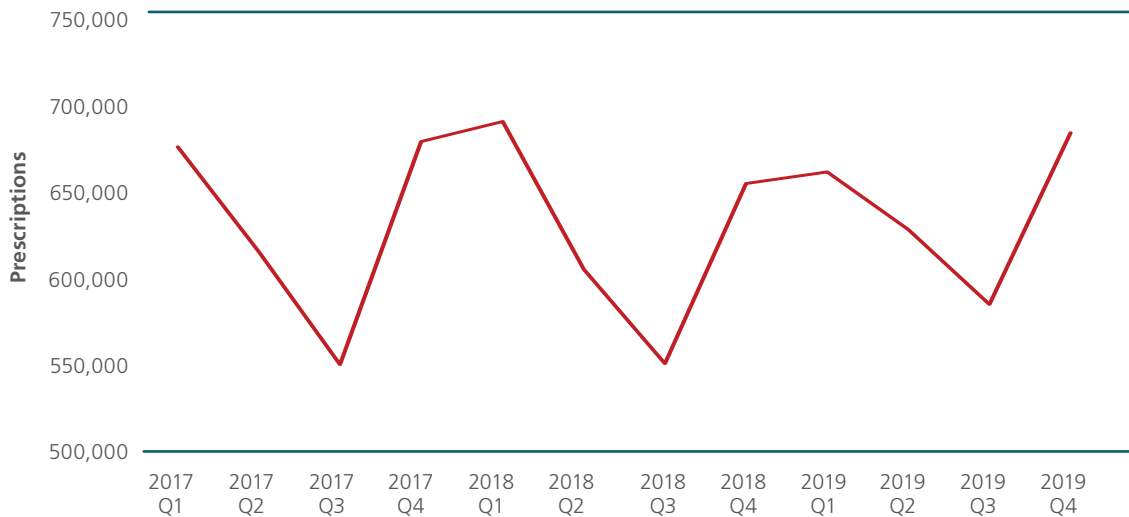


Table 2. Patients by Age and Sex, 2019*

Age	Females	Males	Females	Males
90+	9,460	4,398		
85-89	11,861	8,048		
80-84	16,540	12,472		
75-79	22,840	18,555		
70-74	32,569	27,525		
65-69	41,914	35,059		
60-64	51,856	42,311		
55-59	56,006	43,104		
50-54	50,462	38,194		
45-49	51,728	38,883		
40-44	58,185	40,845		
35-39	68,842	44,523		
30-34	68,805	40,778		
25-29	59,405	33,776		
20-24	51,132	30,350		
15-19	43,303	33,614		
10-14	32,416	31,691		
5-9	43,672	44,458		
0-4	40,659	45,734		
Total	811,657	614,340		

*26 patients excluded because of unknown age and/or sex

Table 3. Antibiotic Utilization Rates by Age and Sex, 2019

Age Group	Female Patients per 1,000 pop	Male Patients per 1,000 pop	Female Prescriptions per 1,000 pop	Male Prescriptions per 1,000 pop	Female DDDs per 1,000 pop*	Male DDDs per 1,000 pop*
90+	518	518	1,166	1,154	9,585	11,323
85-89	465	456	1,047	987	9,334	10,514
80-84	450	428	1,000	899	9,414	10,391
75-79	437	405	950	821	9,484	9,830
70-74	424	387	887	756	9,152	8,974
65-69	417	358	853	678	8,919	8,036
60-64	403	327	803	606	8,306	7,134
55-59	392	301	764	536	7,833	6,171
50-54	383	281	735	483	7,467	5,504
45-49	371	267	691	445	7,020	4,878
40-44	378	260	696	421	6,871	4,492
35-39	394	251	722	396	6,913	4,180
30-34	393	225	707	345	6,580	3,606
25-29	380	204	669	305	6,360	3,232
20-24	383	210	677	310	6,697	3,621
15-19	348	257	586	380	6,875	5,319
10-14	247	231	359	327	-†	-
5-9	323	313	497	476	-	-
0-4	302	327	500	554	-	-

*DDD per 1,000 population 15 years and older

†Patients less than 15 years of age are not included in DDD calculations.

Antibiotics Prescribed by Prescriber Type

Of more than 17,000 unique prescribers, physicians prescribed 82% of all oral antibiotic prescriptions. Of prescriptions in PIN associated with an identified prescriber type, 23.5% have unknown prescribers. 0.8% of prescriptions have an unknown prescriber type (Table 4). Most patients were dispensed antibiotics from one or two unique prescribers in a year. More than 7% of patients were dispensed antibiotics from three or more prescribers (Table 5). Over 10% of patients were dispensed three or more antibiotics in a year (Table 6).

Table 4. Prescriptions, Patients and Prescribers by Prescriber Type, 2019

Prescriber Type	Prescriptions	Patients	Prescribers*	% Unkown Prescribers
Physician	2,075,026	1,212,235	12,272	3.3%
Dentist	284,604	219,526	–	97.1%
Pharmacist	124,462	107,465	4,006	0.2%
Nurse Practitioner	23,285	18,166	480	11.5%
Unknown	19,273	15,503	–	100.0%
Optometrist	3,385	2,982	–	96.1%
Dental Hygienist	314	272	–	99.4%
Dietician	109	100	–	100.0%

*% Unknown Prescribers shows the percentage of prescriptions prescribed by an unknown prescriber within each prescriber type category.

Table 5. Patients by Number of Unique Prescribers* per Year, 2017–2019

Prescribers	2017		2018		2019	
	Patients	Percent	Patients	Percent	Patients	Percent
1 Prescriber	1,061,369	75.9%	1,062,044	76.3%	1,083,471	76.0%
2 Prescribers	240,034	17.2%	235,469	16.9%	243,019	17.1%
3 Prescribers	66,810	4.8%	65,547	4.7%	68,212	4.8%
4 Prescribers	19,718	1.4%	19,521	1.4%	20,721	1.5%
5 Prescribers	6,597	0.5%	6,407	0.5%	6,728	0.5%
6 Prescribers	2,245	0.2%	2,251	0.2%	2,359	0.2%
7+ Prescribers	1,412	0.1%	1,443	0.1%	1,491	0.1%

*The individual prescriber is not known for the majority of prescriptions with a prescriber type of Dentists, Optometrists, Dental Hygienist, Dietician

Table 6. Patients by Number of Unique Antibiotics per Year, 2017–2019

Antibiotics	2017		2018		2019	
	Patients	Percent	Patients	Percent	Patients	Percent
1 Antibiotic	952,288	68.1%	954,446	68.5%	977,704	68.6%
2 Antibiotics	302,524	21.6%	297,559	21.4%	303,801	21.3%
3 Antibiotics	97,313	7.0%	95,421	6.9%	98,168	6.9%
4 Antibiotics	31,111	2.2%	30,545	2.2%	31,627	2.2%
5 Antibiotics	10,177	0.7%	10,121	0.7%	10,066	0.7%
6 Antibiotics	3,324	0.2%	3,207	0.2%	3,219	0.2%
7+ Antibiotics	1,448	0.1%	1,383	0.1%	1,416	0.1%

Patients and Prescriptions by Type of Antibiotic

Figure 3 and Figure 4 show the number of unique patients and number of prescriptions by antibiotic in each year for the most commonly prescribed antibiotics. Overall, amoxicillin was the most commonly used antibiotic in 2017 to 2019.

Figure 3. Patients by Antibiotic per Year*, 2017–2019

Antibiotic	2017	2018	2019	Trend 2017–2019	2019
Amoxicillin	540,047	529,922	549,429		
Azithromycin	223,080	231,905	254,467		
Cephalexin	196,115	198,957	202,163		
Amox-Clav	166,066	172,616	181,670		
Ciprofloxacin	141,563	133,462	124,009		
Nitrofurantoin	100,415	104,160	111,915		
Doxycycline	90,251	98,725	108,160		
Clarithromycin	114,922	96,460	85,228		
Metronidazole	78,308	80,996	83,706		
Clindamycin	70,719	68,859	66,517		

Figure 4. Prescriptions by Antibiotic per Year*, 2017–2019

Antibiotic	2017	2018	2019	Trend 2017–2019	2019
Amoxicillin	686,312	668,543	692,063		
Azithromycin	255,195	265,497	291,382		
Cephalexin	236,491	240,437	244,664		
Amox-Clav	193,343	201,491	213,053		
Ciprofloxacin	174,244	166,048	153,619		
Nitrofurantoin	125,633	130,640	140,574		
Doxycycline	109,977	120,527	131,887		
Metronidazole	92,551	95,678	98,623		
Clarithromycin	129,815	108,421	95,313		
Clindamycin	86,318	83,964	80,751		

*Only the most commonly-prescribed antibiotics are shown, representing over 84% of all oral antibiotics dispensed. Appendix A shows other commonly prescribed antibiotics in Alberta.

Antibiotic Prescriptions and Treatment Days per Patient

The *average* number of prescriptions per *patient* by the most common antibiotics in 2019 are shown in Figure 5. Figure 6 shows the distribution of the number of prescriptions per patient per year for the same antibiotics. Overall, most patients were dispensed only one to two prescriptions for the same antibiotic. However, depending on antibiotic, one to four percent of patients were dispensed three or more prescriptions in 2019 for the same antibiotic.

For example, just over 80% of patients who received amoxicillin in 2019 had one prescription, about 15% of patients had two prescriptions, 3.5% had three to five prescriptions, 0.05% had six to 10 prescriptions and approximately 0.1% had 11 or more prescriptions (Figure 6, next page).

Figure 7 shows the *average* number of treatment days *per patient* by antibiotic in 2019. It accompanies Figure 8 which displays the distribution of the number of treatment days per patient by antibiotic.

Treatment days refer to the number of treatment days prescribed, regardless of patient compliance.

A substantial number of patients were dispensed antibiotics for greater than 10 treatment days in the year regardless of antibiotic. Doxycycline averaged nearly 26 treatment days per patient (Figure 8, next page).

Figure 9 shows the *average* number of treatment days *per prescription* by antibiotic in 2019. It accompanies Figure 10 which displays the distribution of the number of treatment days per prescription by antibiotic. Treatment days per prescription of more than seven days was common for most antibiotics other than azithromycin (Figure 10, next page).

Figure 5. Average Prescriptions[†] per Patient by Antibiotic*, 2019

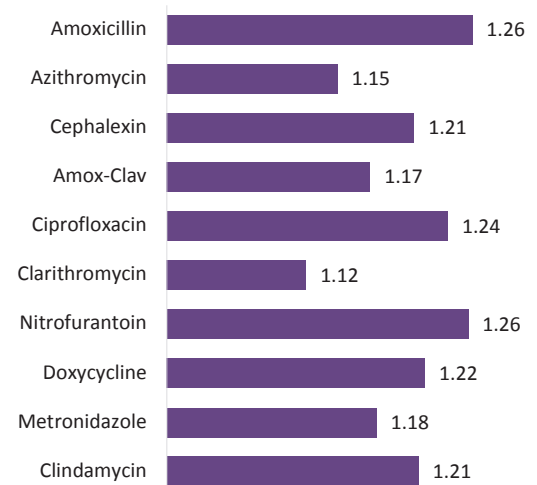


Figure 7. Average Treatment Days per Patient by Antibiotic*, 2019

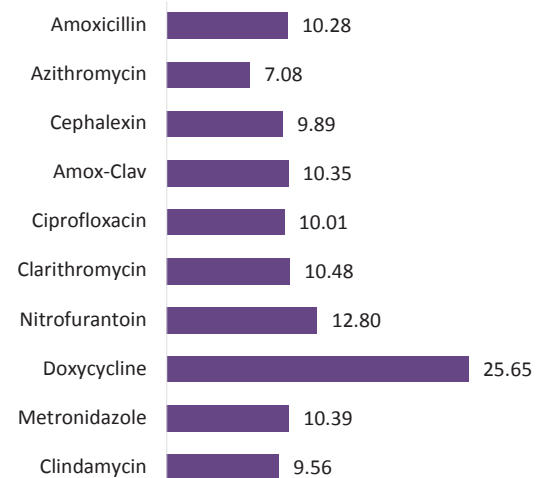
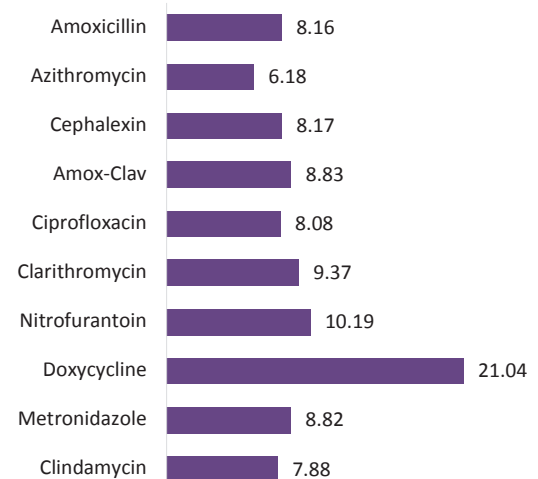


Figure 9. Average Treatment Days per Prescription by Antibiotic*, 2019



[†] See Figure 4 for prescription counts by antibiotic

* Order is ranked by the most common antibiotics.

Figure 6. Distribution of Prescriptions per Patient by Antibiotic*, 2019

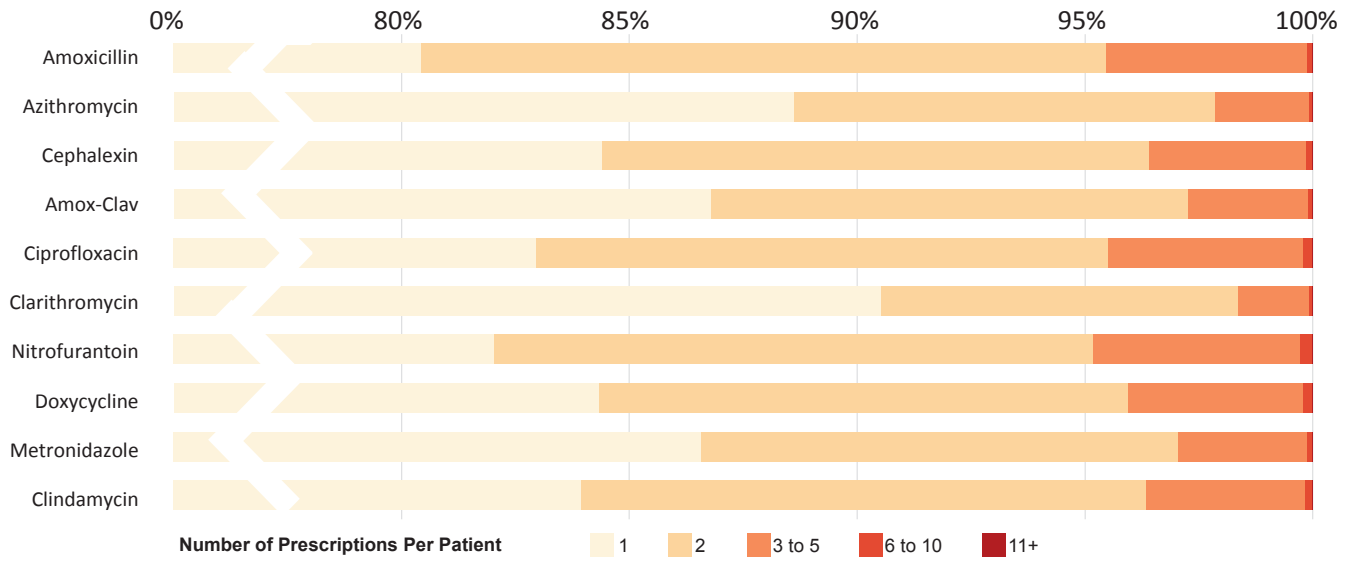


Figure 8. Distribution of Treatment Days per Patient by Antibiotic*, 2019

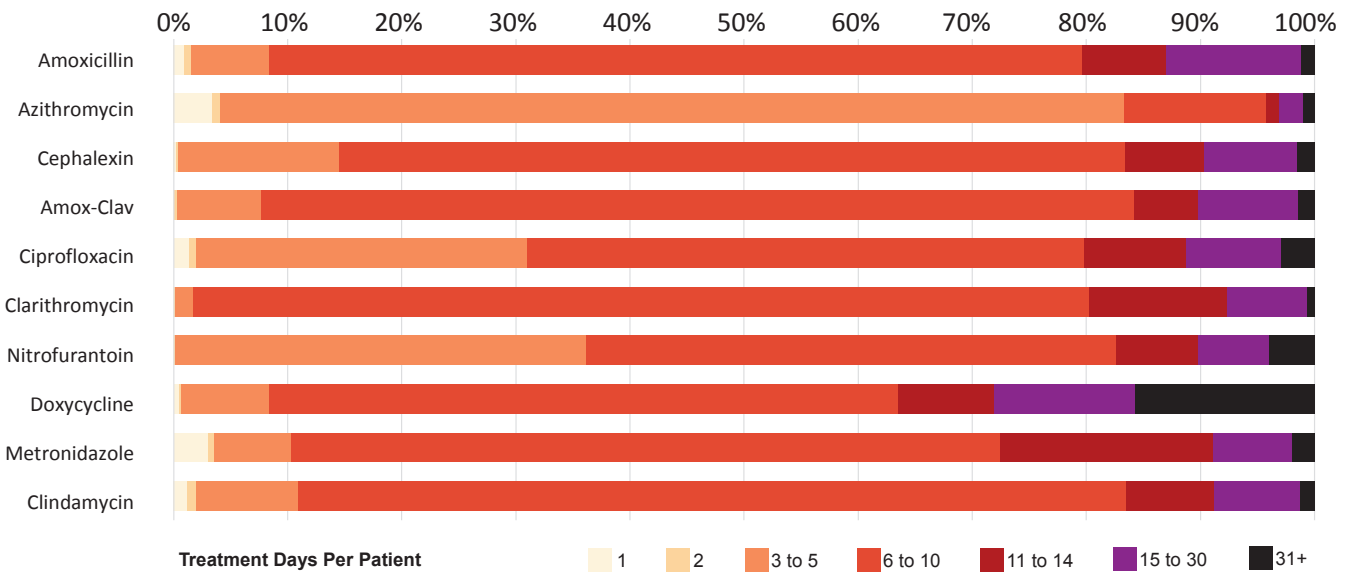


Figure 10. Distribution of Treatment Days per Prescription by Antibiotic*, 2019

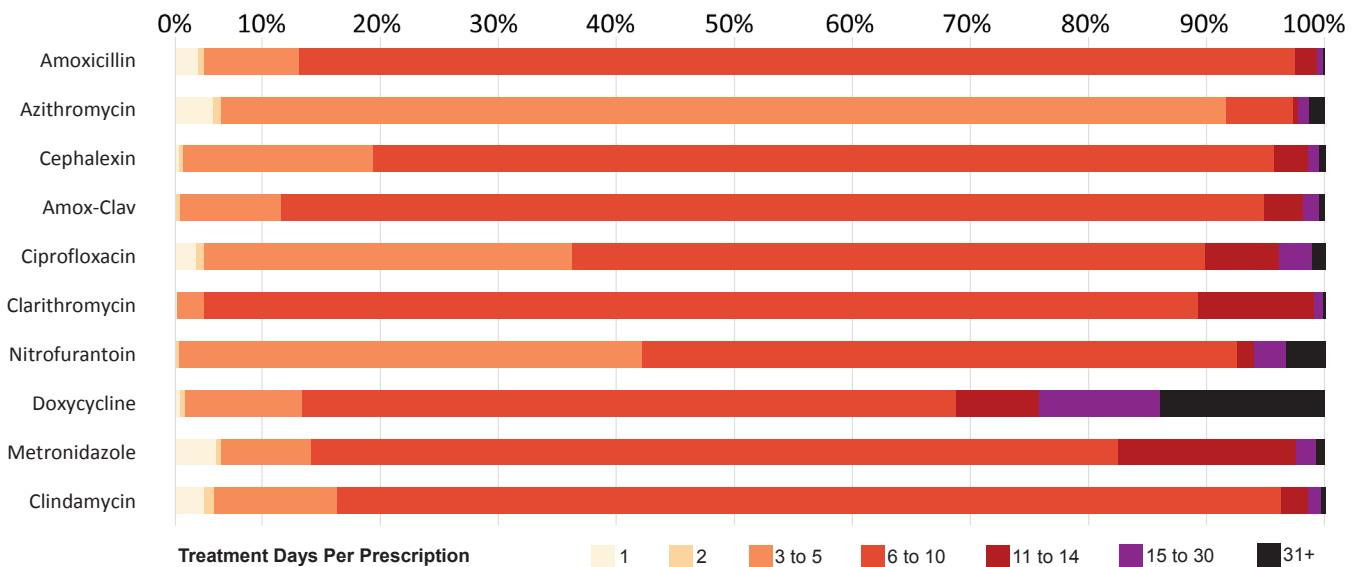


Figure 11. Antibiotic Prescriptions by Specialty for Patients 0–14 Years Old, 2019

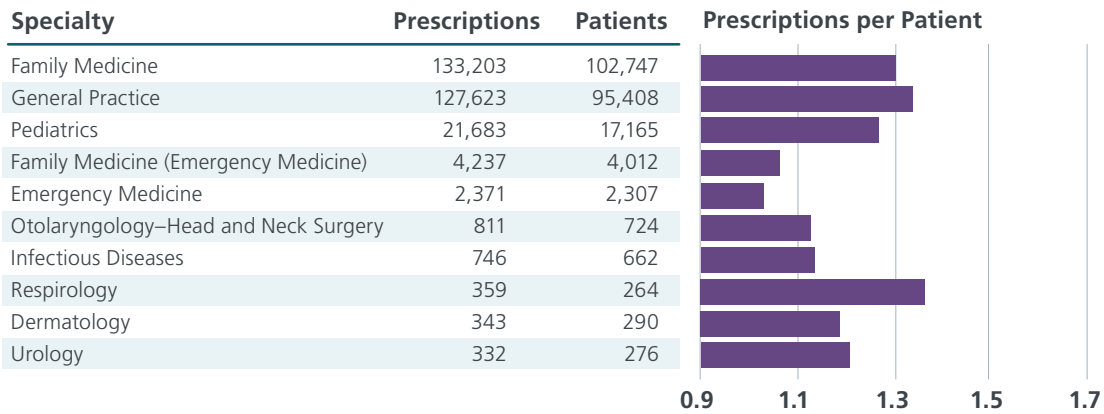


Figure 12. Antibiotic Prescriptions by Specialty for Patients 15–64 Years Old, 2019

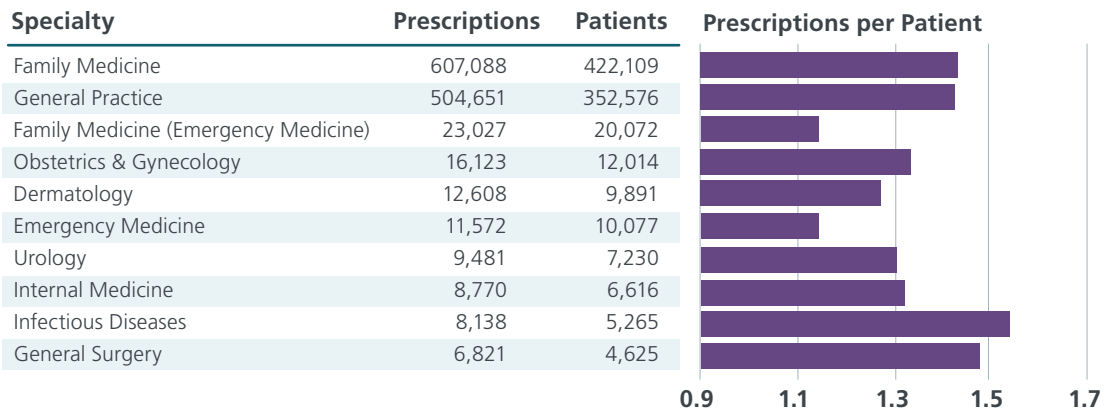
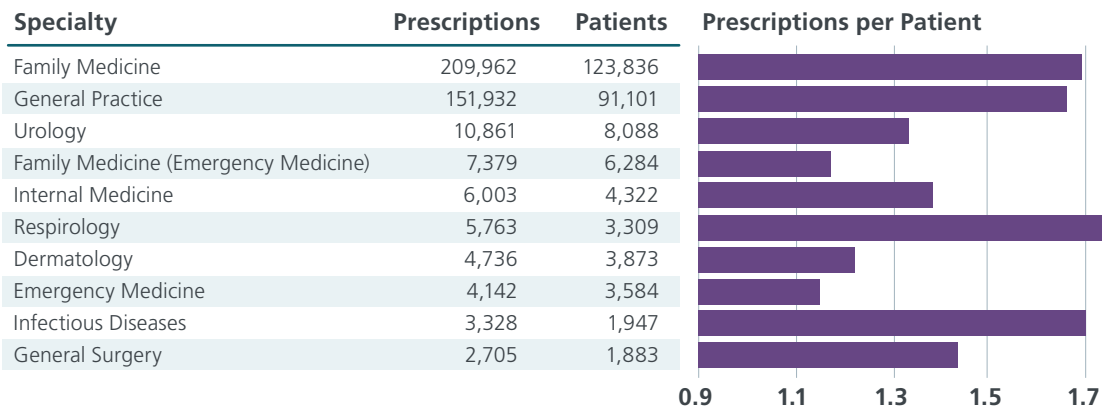
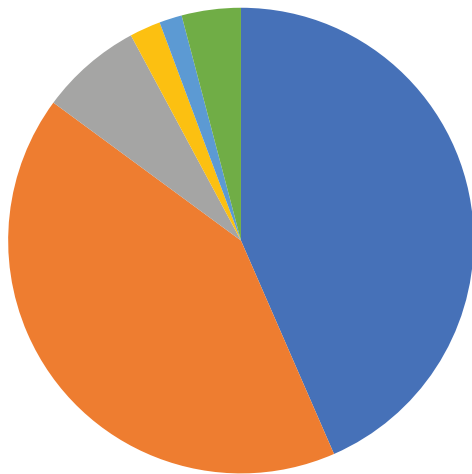


Figure 13. Antibiotic Prescriptions by Specialty for Patients 65+ Years Old, 2019

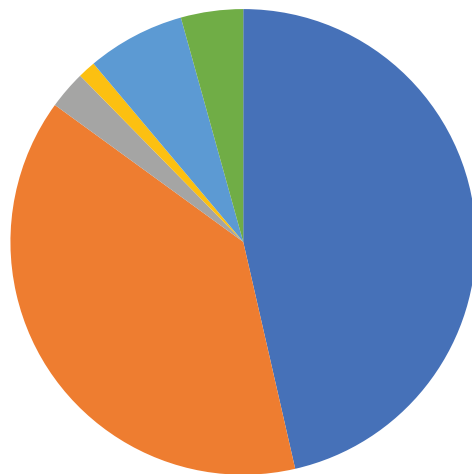


Note: “Family Medicine (Emergency Medicine)” and “Emergency Medicine”.
 “Other” is an aggregation of all remaining specialties.



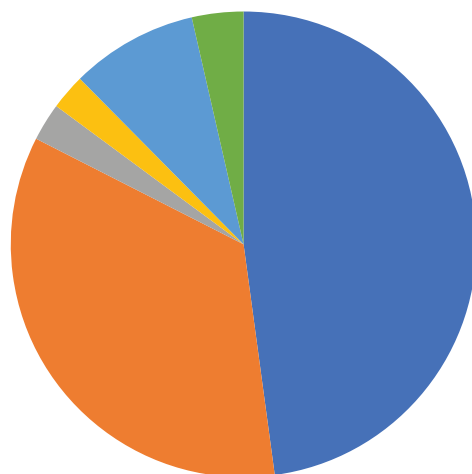
Proportion of Prescriptions Prescribed by Specialty for Patients 0–14 Years Old

- 43% ■ Family Medicine
- 42% ■ General Practice
- 7% ■ Pediatrics
- 2% ■ Emergency Medicine
- 2% ■ Other
- 4% ■ Unknown



Proportion of Prescriptions Prescribed by Specialty for Patients 15–64 Years Old

- 46% ■ Family Medicine
- 39% ■ General Practice
- 3% ■ Emergency Medicine
- 1% ■ Obstetrics & Gynecology
- 7% ■ Other
- 4% ■ Unknown

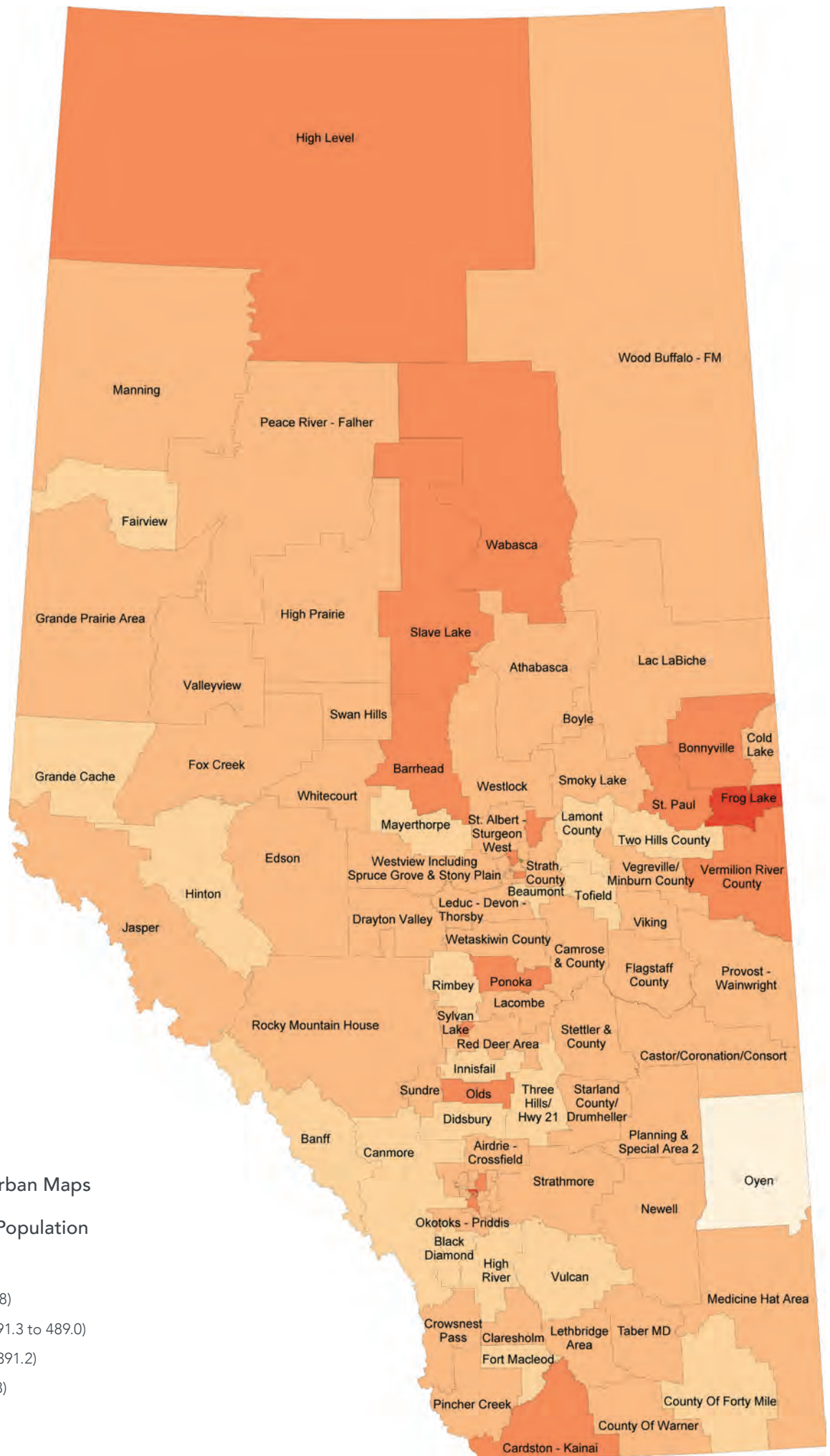


Proportion of Prescriptions Prescribed by Specialty for Patients 65+ Years Old

- 48% ■ Family Medicine
- 35% ■ General Practice
- 3% ■ Emergency Medicine
- 2% ■ Urology
- 9% ■ Other
- 3% ■ Unknown

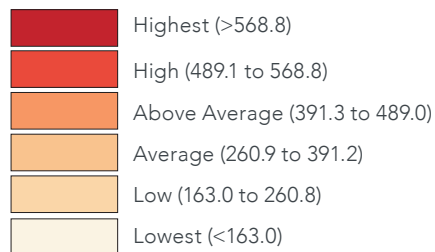
Note: Top four specialties are shown and all other categories were aggregated as "Other".
Family Medicine (Emergency Medicine) and Emergency Medicine were merged together

Figure 14a. Patients per 1,000 Population, 2019

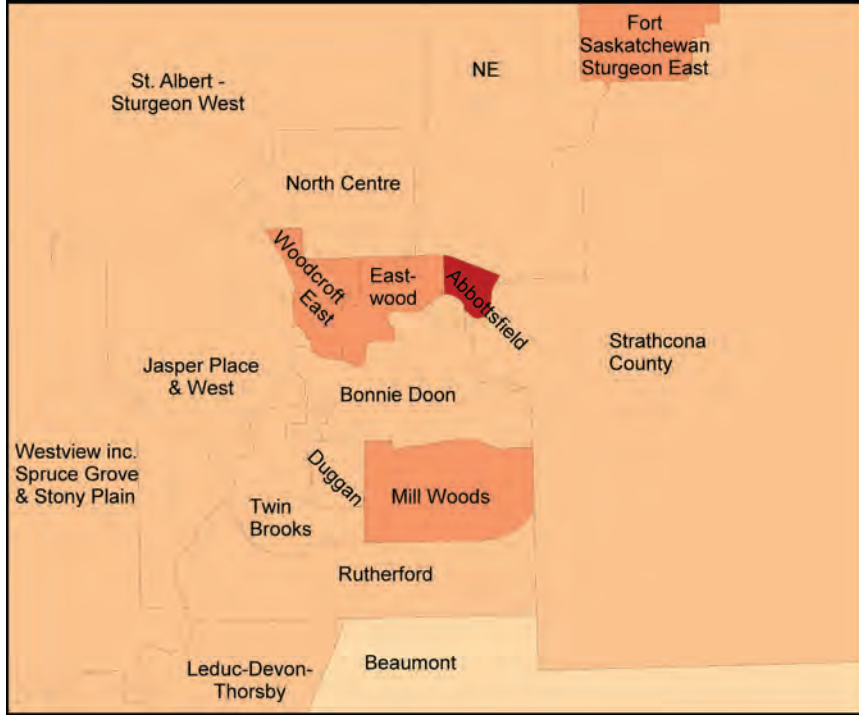


Legend: Provincial and Urban Maps

Total Patients per 1,000 Population



Edmonton



Calgary

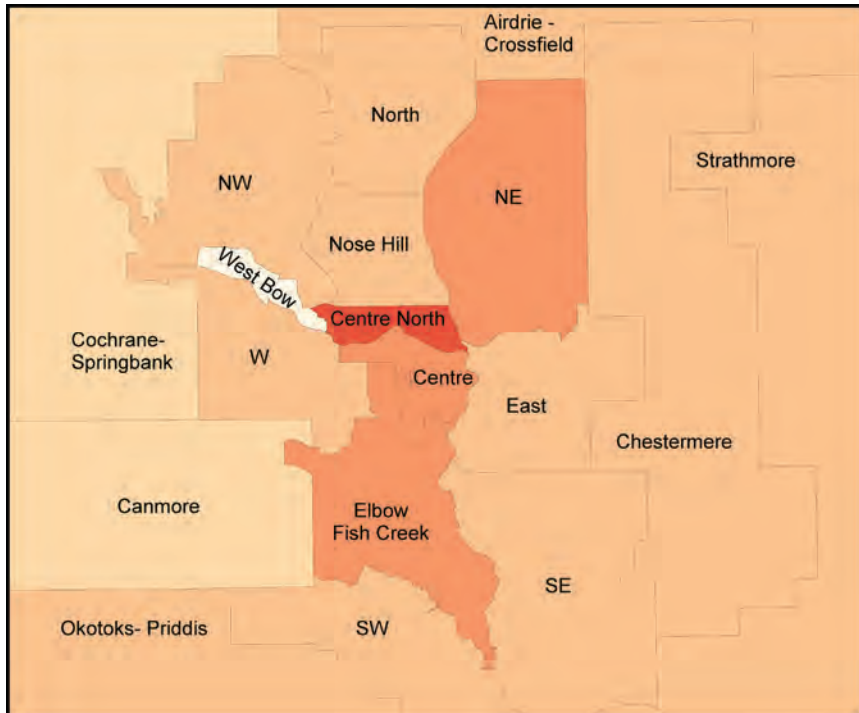
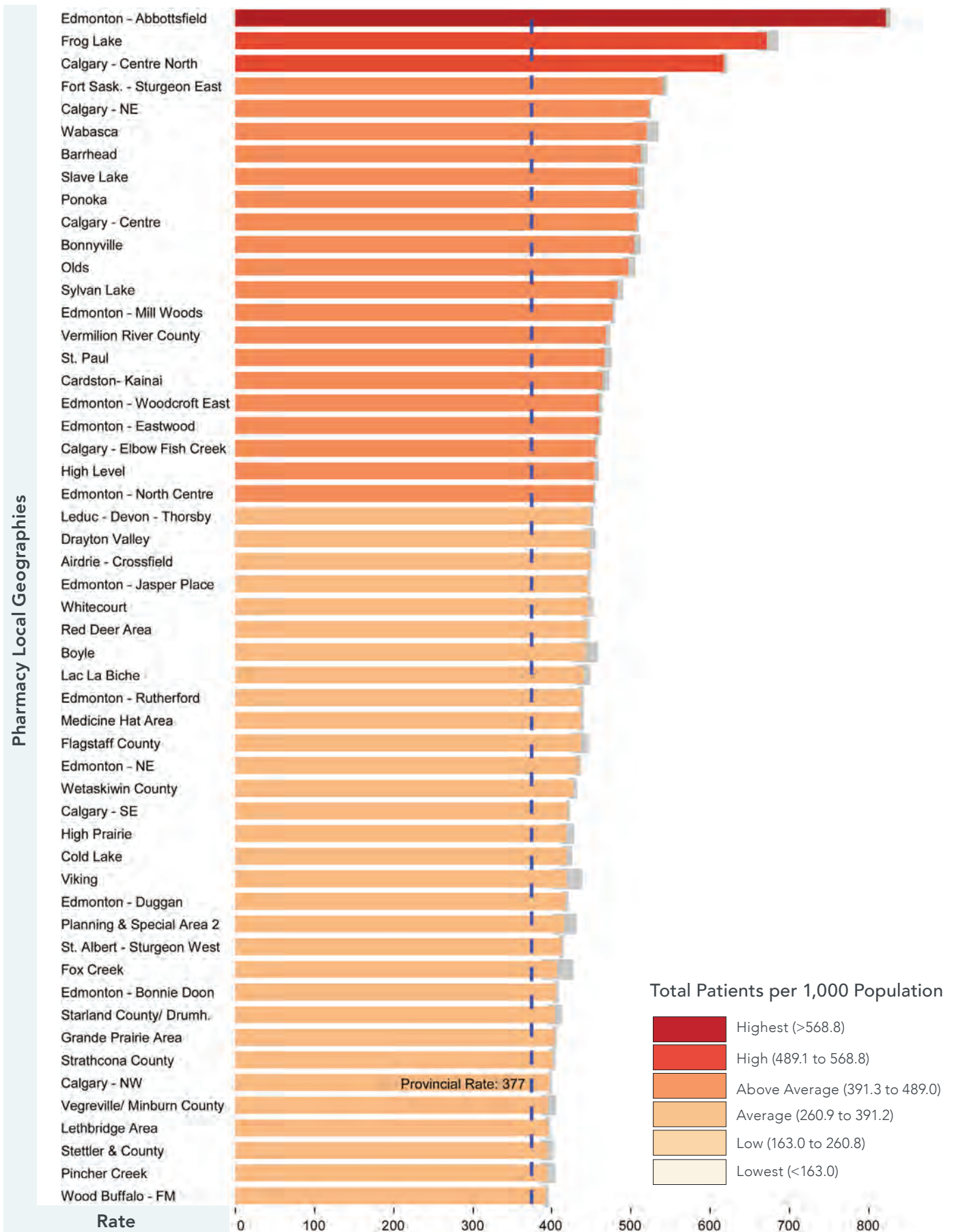


Figure 14b. Patients per 1,000 Population, 2019



Pharmacy Local Geographies

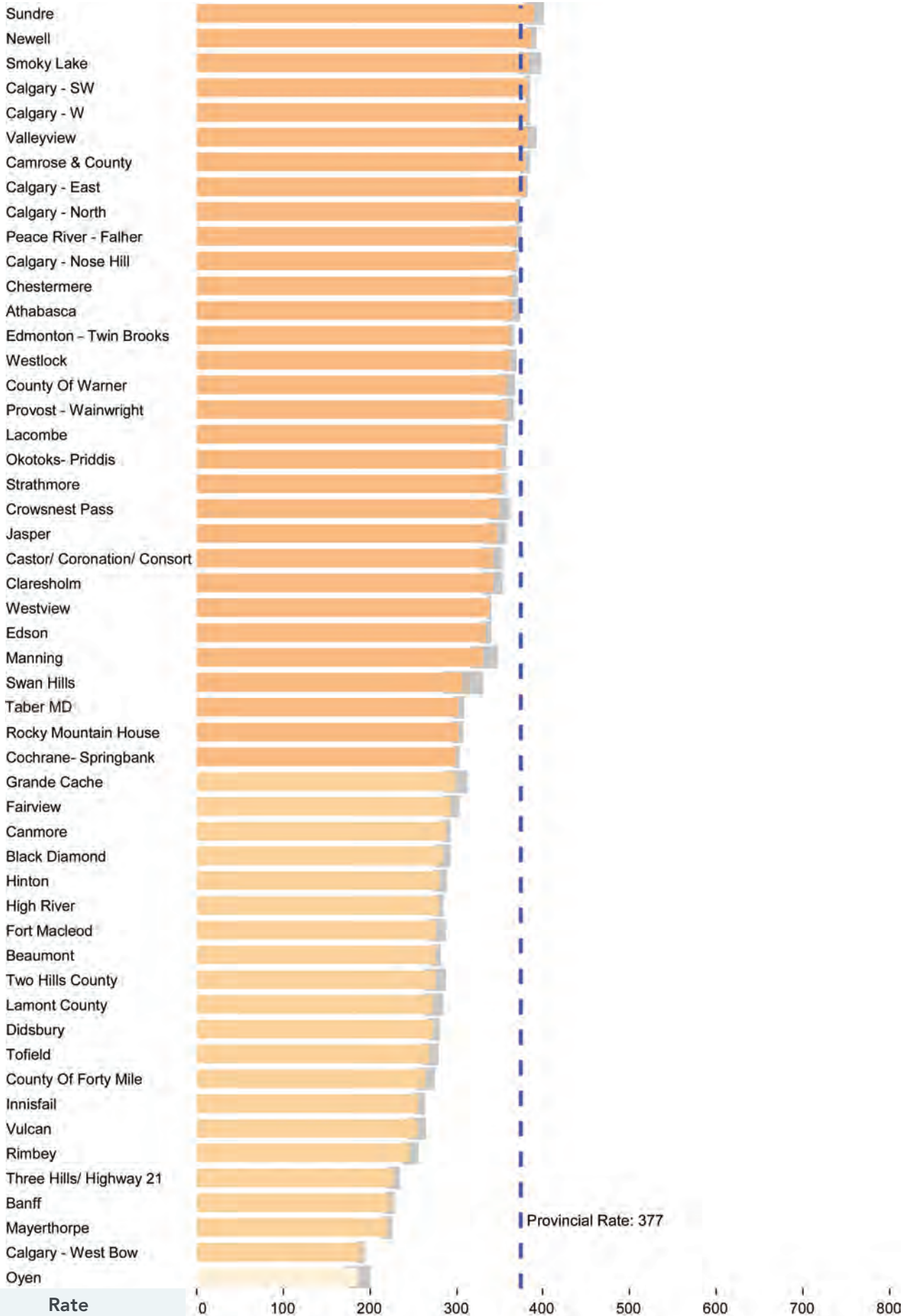
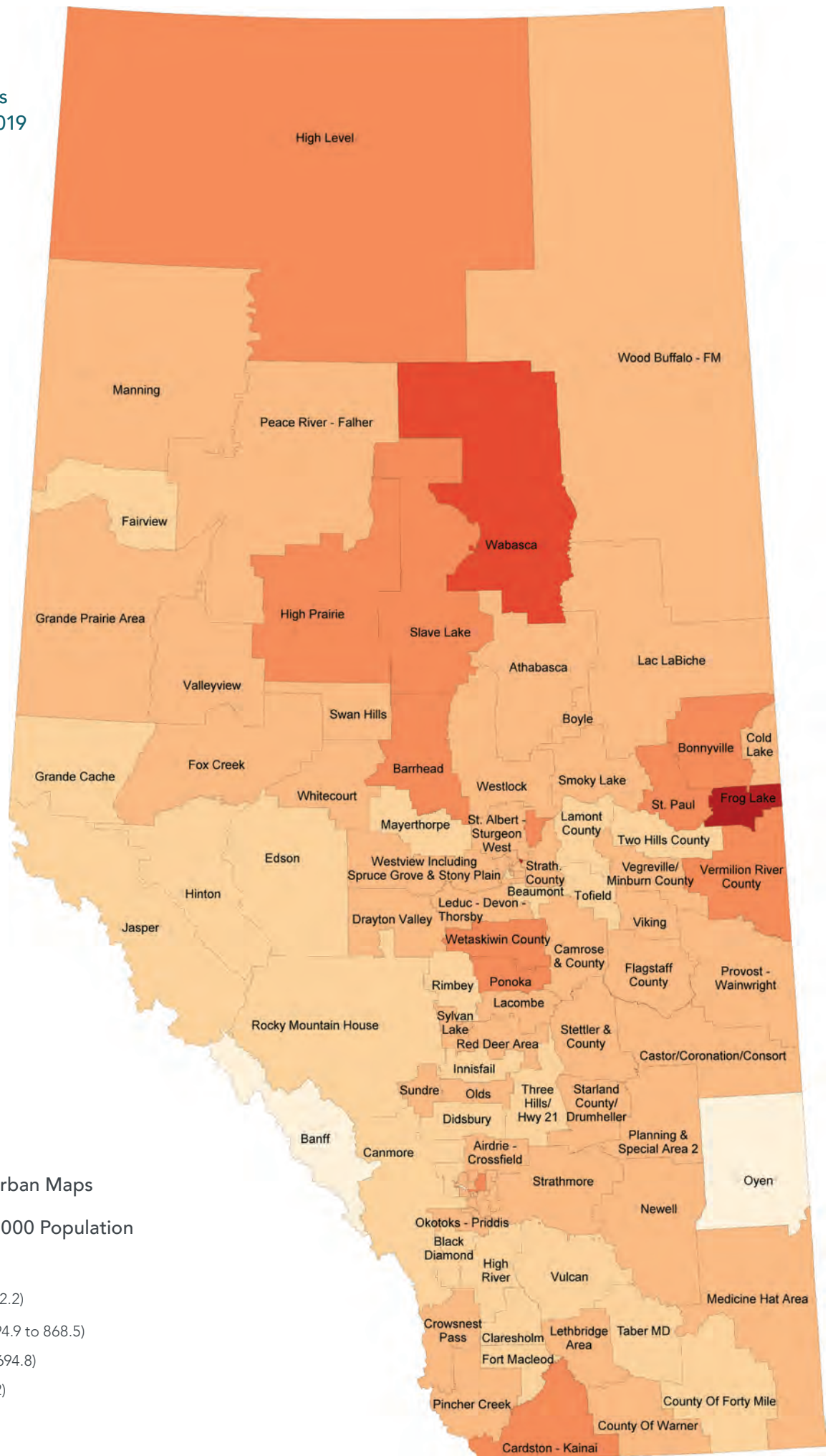
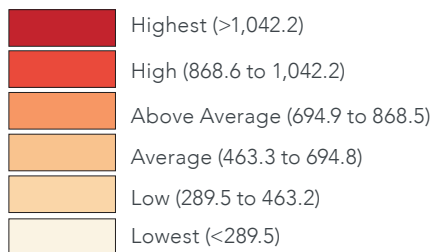


Figure 15a. Prescriptions per 1,000 Population, 2019



Legend: Provincial and Urban Maps

Total Prescriptions per 1,000 Population



Edmonton



Calgary

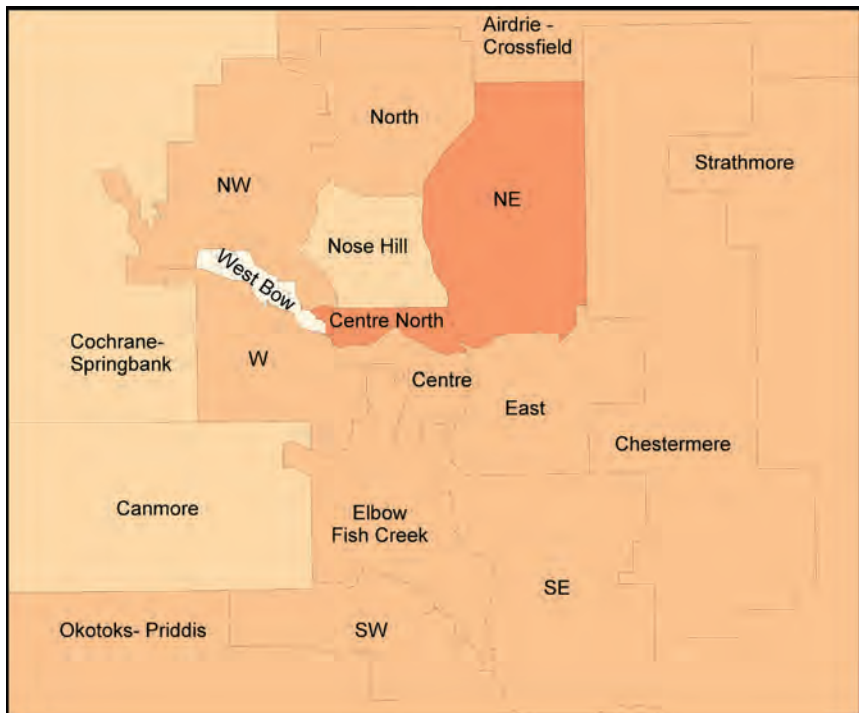
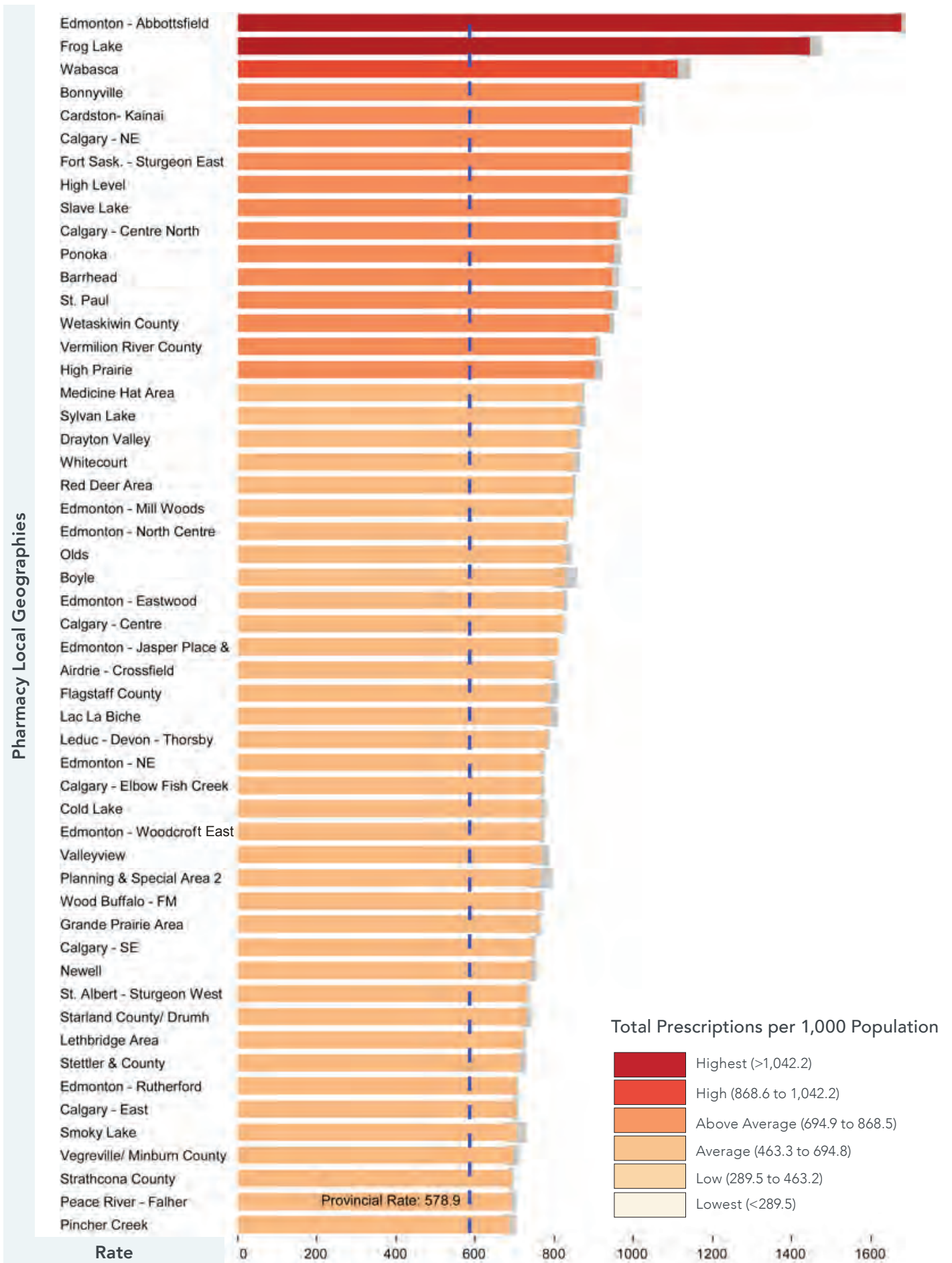


Figure 15b. Prescriptions per 1,000 Population, 2019



Pharmacy Local Geographies

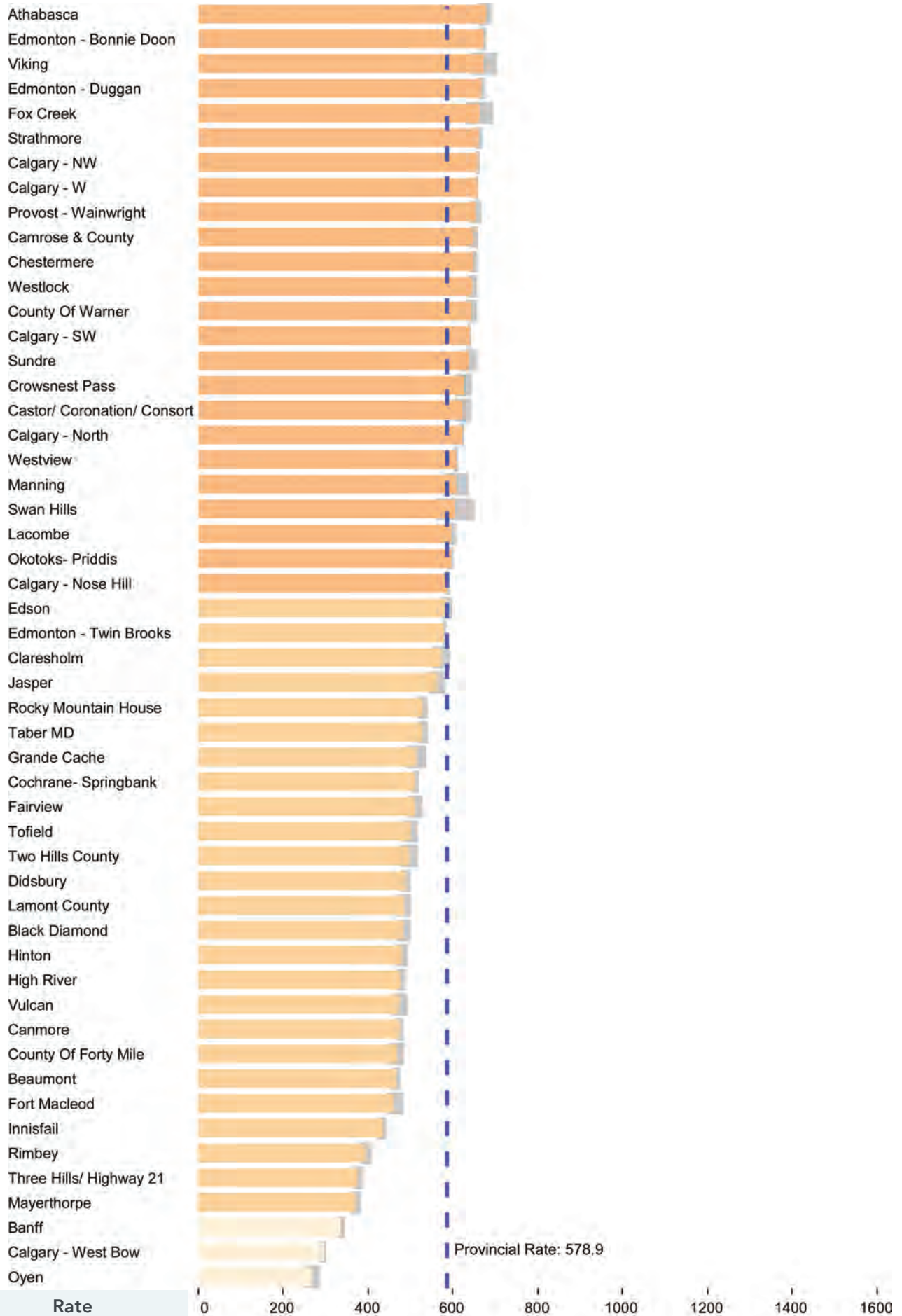
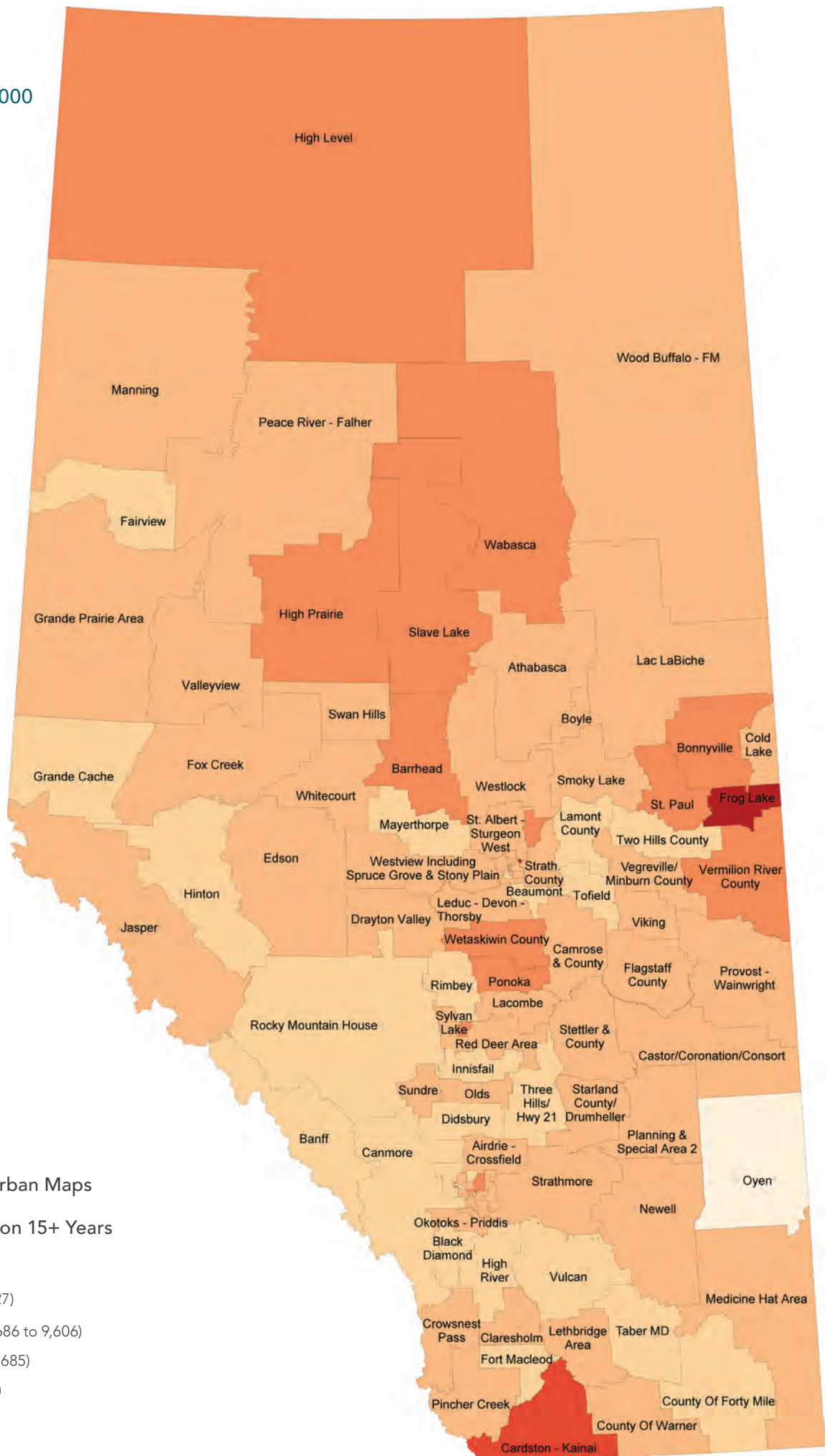
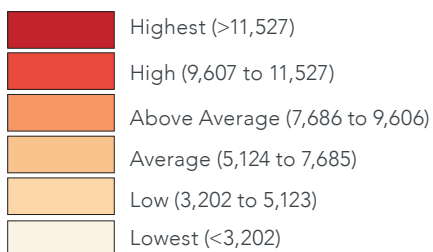


Figure 16a. DDDs per 1,000 Population 15 Years and Older, 2019



Legend: Provincial and Urban Maps

DDD's per 1,000 Population 15+ Years



Edmonton



Calgary

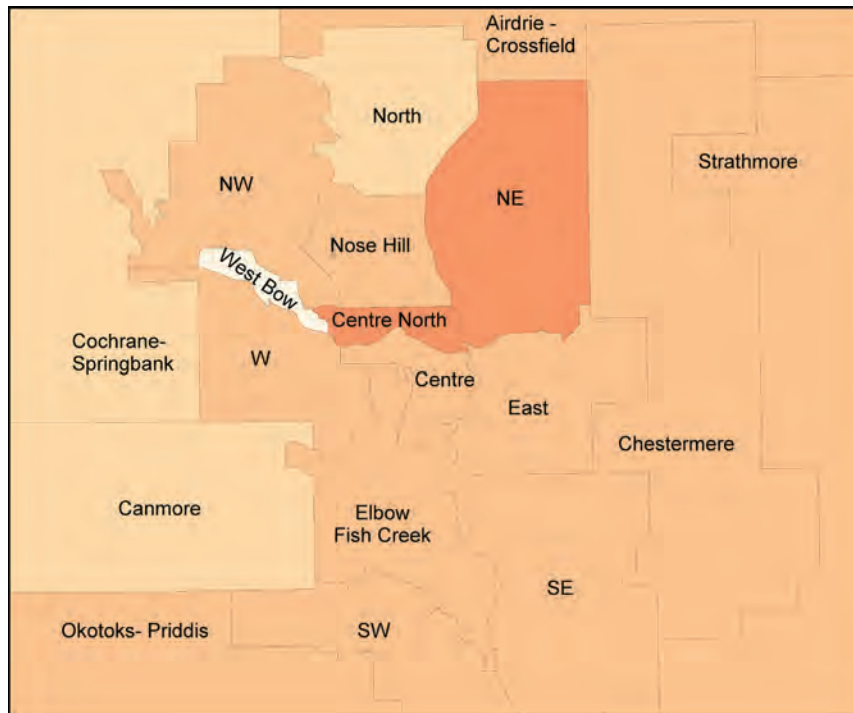
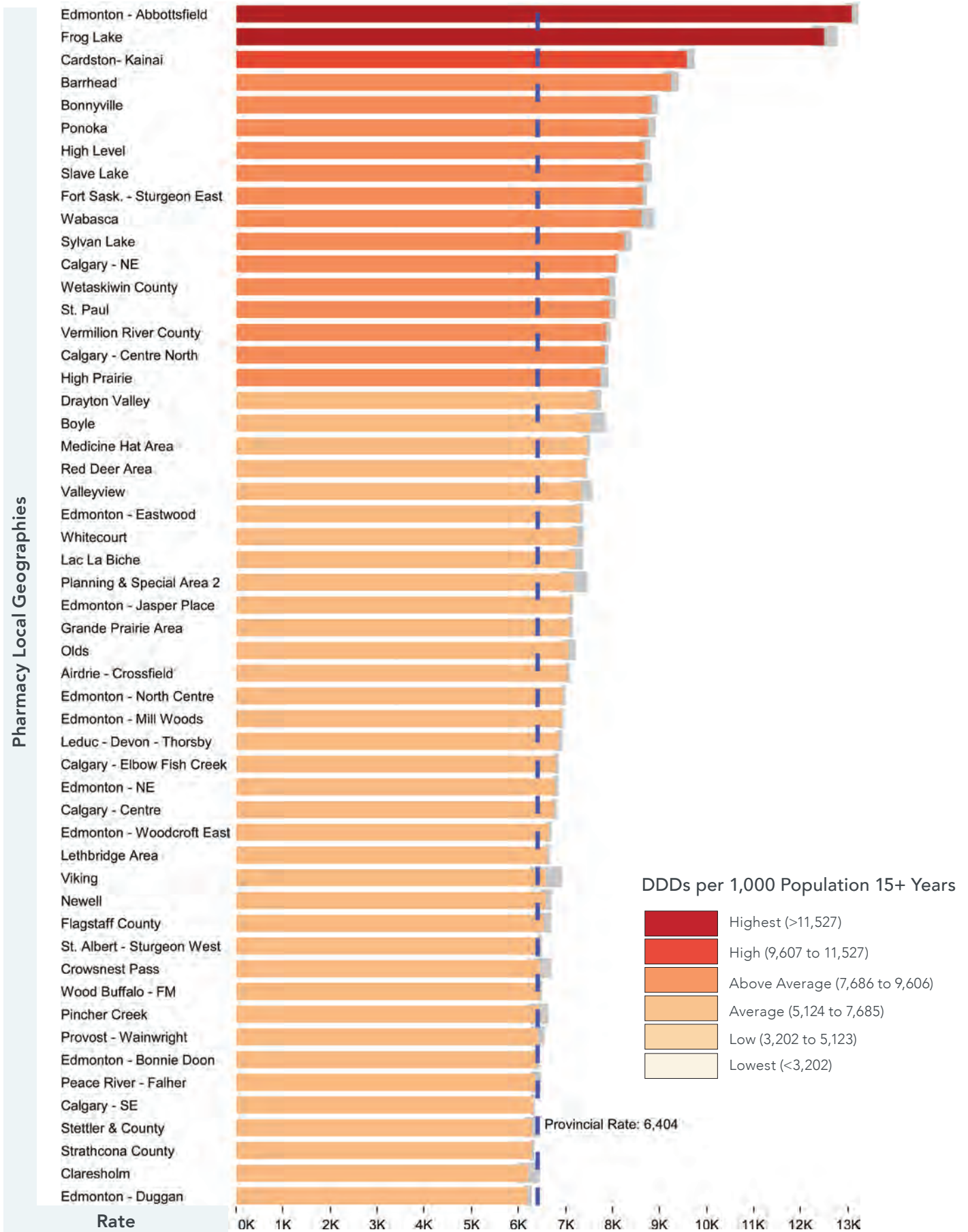
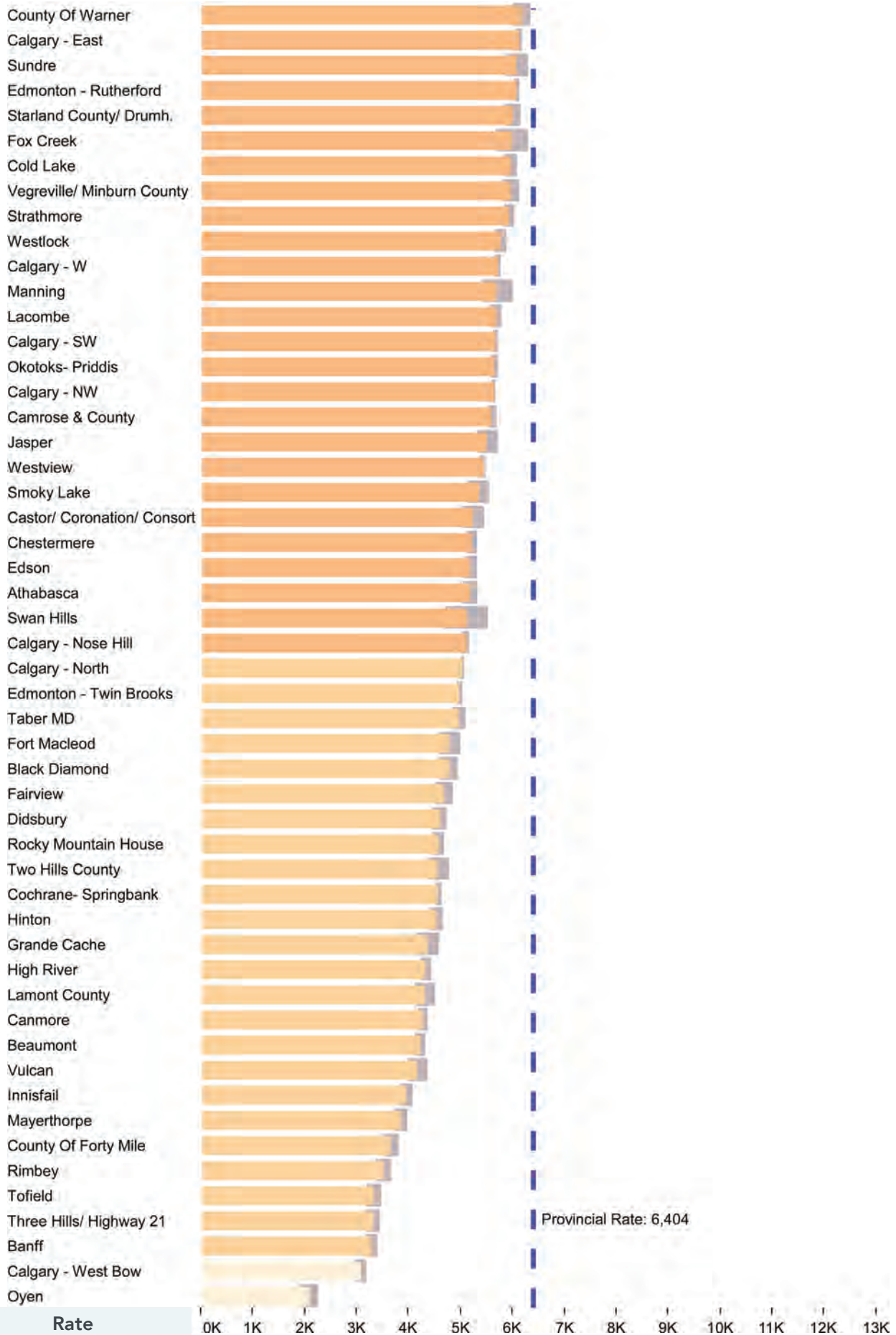


Figure 16b. DDDs per 1,000 Population 15 Years and Older, 2019



Pharmacy Local Geographies

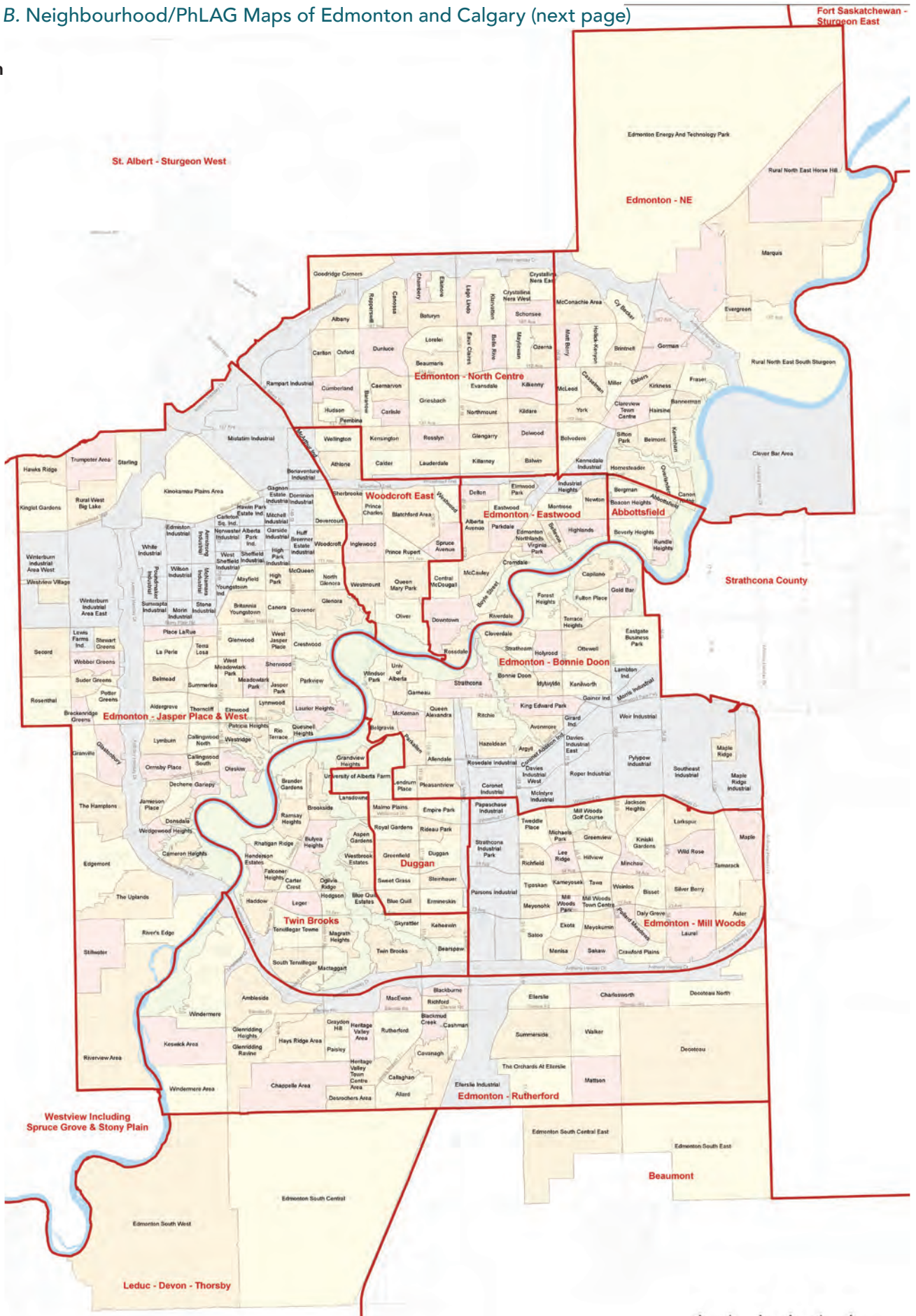


Appendices

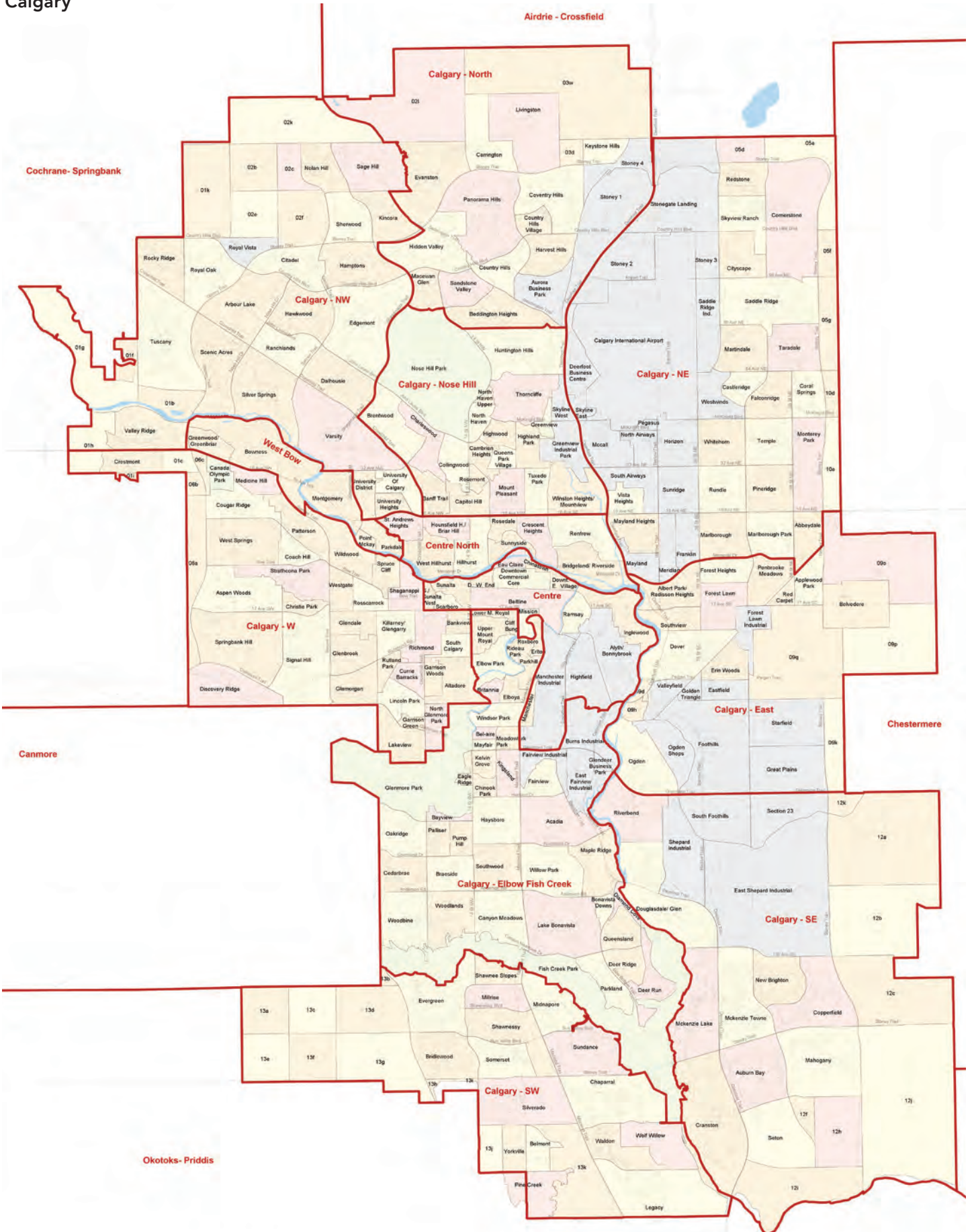
Appendix A. Patients, Prescriptions, Prescribers and Pharmacies by Antibiotic and ATC Code, 2019*

Main Ingredient	ATC Code	Prescriptions	Patients	Prescribers	Pharmacies
AMOX-CLAV	J01CR02	213,053	181,670	10,282	1,496
AMOXICILLIN	J01CA04	692,063	549,429	11,879	1,514
AMOXICILLIN-CLARITHROMYCIN	A02BD07	2,817	2,709	884	693
AMPICILLIN	J01CA01	426	389	270	235
ATOVAQUONE	P01AX06	296	204	139	148
AZITHROMYCIN	J01FA10	291,382	254,467	9,372	1,506
CEFADROXIL	J01DB05	2,526	2,091	319	327
CEFIXIME	J01DD08	67,366	56,752	6,436	1,411
CEFPROZIL	J01DC10	14,152	12,383	925	916
CEFUROXIME	J01DC02	18,955	16,670	3,119	1,240
CEPHALEXIN	J01DB01	244,664	202,163	10,905	1,501
CIPROFLOXACIN	J01MA02	153,619	124,009	9,738	1,489
CLARITHROMYCIN	J01FA09	95,313	85,228	6,100	1,462
CLINDAMYCIN	J01FF01	80,751	66,517	6,714	1,474
CLOXACILLIN	J01CF02	13,435	11,945	2,542	1,197
DAPSONE	J04BA02	1,350	670	597	446
DOXYCYCLINE	A01AB22	508	412	79	257
DOXYCYCLINE	J01AA02	131,379	107,795	8,461	1,493
ERYTHROMYCIN	J01FA01	4,020	3,381	1,125	931
ETHAMBUTOL	J04AK02	437	187	67	83
FIDAXOMICIN	A07AA12	82	71	61	59
FOSFOMYCIN	J01XX01	20,854	17,491	3,628	1,286
GREPAFLOXACIN	J01MA11	7	1	1	1
LEVOFLOXACIN	J01MA12	35,231	29,433	5,659	1,399
LINEZOLID	J01XX08	165	136	104	81
METRONIDAZOLE	J01XD01	7	7	7	7
METRONIDAZOLE	P01AB01	98,616	83,699	8,449	1,475
MINOCYCLINE	J01AA08	37,760	26,622	4,786	1,398
MOXIFLOXACIN	J01MA14	12,719	10,888	1,637	1,170
NITROFURANTOIN	J01XE01	140,574	111,915	8,218	1,486
NORFLOXACIN	J01MA06	1,783	1,398	614	485
OFLOXACIN	J01MA01	2	2	2	2
PAROMOMYCIN	A07AA06	72	71	60	66
PENICILLIN	J01CE02	68,375	61,868	5,522	1,436
PYRAZINAMIDE	J04AK01	5	4	1	1
RIFABUTIN	J04AB04	67	51	31	41
RIFAMPIN	J04AB02	1,257	772	436	413
RIFAXIMIN	A07AA11	2,673	1,400	1,008	682
SMX-TMP	J01EE01	71,342	54,108	8,270	1,456
SPIRAMYCIN	J01FA02	9	7	4	7
TETRACYCLINE	J01AA07	5,469	4,401	2,071	1,069
TRIMETHOPRIM	J01EA01	1,582	1,013	581	510

Edmonton



Calgary



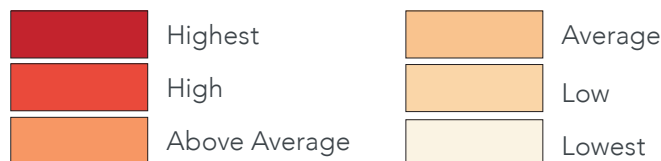
Appendix C. Graph and Map Legend

Example section of the graph showing individual Pharmacy Local Aggregated Geography (PhLAG) rates with 95% confidence intervals.



- Grey bar represents the 95% confidence limits.
- Dashed blue line represents average provincial rate.
- Length of bar represents observed rate.

Bar colour in graph/map corresponds to rate ratio category.



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