Calculating rates

Seldom is it a good idea to simply use raw numbers when telling a story. Take crime, for instance. When speaking of crime, you frequently hear references to crime rates; that is, the frequency with which a certain offence happens, usually for every 100,000 people, although the multiplier could be more or less depending on the population.

If you're telling a story about crime in Ottawa's municipal wards where the populations range from 20,000 to 50,000, then perhaps it makes more sense to make the multiplier a smaller number, say 10,000. If, on the other hand, you're dealing with large North American cities or provinces, then a larger multiplier like 100,000 is a better option. This, by the way, is the multiplier that Statistics Canada and police forces like the one in Ottawa use when calculating their rates.

So what does the rate mean?

Essentially, you're saying that for every 100,000 people, something happens: in the case of crime, it could be a murder, assault, home break-in, or identity theft. We use rates in order to compare wards, cities, provinces, countries. Raw numbers don't tell us a whole. In fact, they can be misleading. If we're comparing sexual assaults among major cities in Canada, Toronto will likely come out top. Not because it's necessarily the most dangerous municipality, but because he has the largest population. What you really want to do is to compare the frequency that this serious crime occurs, which then allows you to see how the different jurisdictions stack up against one another. So while Toronto may have had the highest number of sexual assaults in any given year, it may actually possess one of the lowest sexual assault rates. Put another way, in which city are you more likely to get assaulted? This is the question that a rate can answer.

It is for this reason that it's worth learning how to calculate a rate, a surprisingly simple task that Computer-Assisted Reporting covers on pages 81 to 83.

For this tutorial, we'll use Statistics Canada's crime data.

So let's get started.

1) Go to Statistics Canada's "Incident-based crime statistics, by detailed violations"

2) You can use the "Add/Remove data" tab to customise your table.

Table 252-0051 ± ≤ 3, 24

Incident-based crime statistics, by detailed violations

annual (number unless otherwise noted)

Data table | Add/Remove data | Manipulate | Download | Related information | Help

The data below is a part of CANSIM table 252-0051. Use the Add/Remove data tab to customize your table.

Selected items [Add/Remove data]

Violations = Total, all violations [0]

Geography [3, 47]	Statistics	2010	2011	2012	2013	2014
	Actual incidents	2,379,130	2,275,917	2,244,458	2,098,776	2,052,191
	Rate per 100,000 population	6,996.36	6,627.06	6,458.48	5,970.19	5,774.25
	Percentage change in rate [22]	-3.92	-5.28	-2.54	-7.56	-3.28
	Total cleared	1,096,584	1,066,428	1,050,701	991,939	945,776
	Cleared by charge	682,067	658,522	660,653	626,019	604,987
	Cleared otherwise	414,517	407,906	390,048	365,920	340,789
	Total, persons charged [23]	656,494	629,943	628,614	595,717	575,850

3) When choosing this tab, there are a number of steps that allow you to select the categories you want.

Step 1- Select: Geography [3, 47]
(48 of 48 items selected)

Use the following checkboxes to select/deselect items from the list below: + Expand ▲

☑ All ☑ ☑ ☑
   ☑ Canada [50]
      ☑ Newfoundland and Labrador
         ☑ St. John's, Newfoundland and Labrador [4]
      ☑ Prince Edward Island [51]

Step 2- Select: Violations
(1 of 250 items selected)

Use the following checkboxes to select/deselect items from the list below: + Expand ▲

☐ All ☑ ☐ ☐ ☐ ☐ ☐
   ☑ Total, all violations [0]
      ☐ Total, all Criminal Code violations (including traffic) [25]
         ☐ Total, all Criminal Code violations (excluding traffic) [50]
         ☐ Total violent Criminal Code violations [100] [16]

Step 3- Select: Statistics
(14 of 14 items selected)

Use the following checkboxes to select/deselect items from the list below: + Expand ▲

☑ All ☑ ☑
   ☑ Actual incidents
   ☑ Rate per 100,000 population
   ☑ Percentage change in rate [22]
   ☑ Total cleared

Step 4 - Select the time frame

By default, only data for the most recent periods available will be retrieved. You may use the lists below to select a different time frame.

From : 2010 ▼ To : 2014 ▼ (Annual data)

Step 5 - Select the Screen output format

HTML table, time as columns ▼

Series details: normal retrieval
                vector identifier, plus coordinate, plus data

Step 6

Apply   Back to original table

4) You can also expand each section to see the entire selection. If, for instance, you only wanted Ontario in step one's geography section, then you would choose the municipalities in that province. If you only wanted to compare the provinces, then you would only choose those jurisdictions. Because we mentioned them at the beginning of this tutorial, let's choose

Ottawa and Toronto.

Step 1- Select: Geography [3, 47]
(48 of 48 items selected)

Use the following checkboxes to select/deselect items from the list below: – Collapse

☐ All ☐ ☑ ☑
   ☐ Canada [50]
      ☐ Newfoundland and Labrador
         ☐ St. John's, Newfoundland and Labrador [4]
      ☐ Prince Edward Island [51]
      ☐ Nova Scotia
         ☐ Halifax, Nova Scotia
      ☐ New Brunswick
         ☐ Moncton, New Brunswick [8, 58]
         ☐ Saint John, New Brunswick [4, 47, 58]
      ☐ Quebec [50, 62]
         ☐ Saguenay, Quebec [5, 55]
         ☐ Québec, Quebec
         ☐ Sherbrooke, Quebec [32, 37]
         ☐ Trois-Rivières, Quebec
         ☐ Montréal, Quebec [38, 50, 53]
         ☐ Ottawa-Gatineau, Quebec part [5, 61]
      ☐ Ontario [7, 67]
         ☐ Ottawa-Gatineau, Ontario/Quebec [5, 52, 61, 68]
         ◉ Ottawa-Gatineau, Ontario part [5, 52, 68]
         ☐ Kingston, Ontario [8]
         ☐ Peterborough, Ontario [8]
         ◉ Toronto, Ontario [33]
         ☐ Hamilton, Ontario [33]
         ☐ St.Catharines-Niagara, Ontario
         ☐ Kitchener-Cambridge-Waterloo, Ontario
         ☐ Brantford, Ontario [8]
         ☐ Guelph, Ontario [8]
         ☐ London, Ontario
         ☐ Windsor, Ontario
         ☐ Barrie, Ontario [8]
         ☐ Sudbury, Ontario [60]
         ☐ Thunder Bay, Ontario
      ☐ Manitoba
         ☐ Winnipeg, Manitoba [9, 10, 47]
      ☐ Saskatchewan [11]
         ☐ Regina, Saskatchewan
         ☐ Saskatoon, Saskatchewan
      ☐ Alberta

5) Scroll down to Step 2, expand that section and choose and choose "Assault, level 1 [1330]. Note that it's important to research the specific offence so you can accurately portray it in your story. Assaults, for instance, are broken down by many types. The Statistics Canada website has a detailed

description of each offence.

Step 2- Select: Violations
(1 of 250 items selected)

Use the following checkboxes to select/deselect items from the list below: - Collapse

☐ All ☑ ☐ ☐ ☐ ☑ ☐
   ☑ Total, all violations [0]
      ☐ Total, all Criminal Code violations (including traffic) [25]
         ☐ Total, all Criminal Code violations (excluding traffic) [50]
            ☐ Total violent Criminal Code violations [100] [16]
               ☐ Homicide [110] [17, 24]
                  ☐ Murder, first degree [1110] [17, 24]
                  ☐ Murder, second degree [1120] [17, 24]
                  ☐ Manslaughter [1130] [17, 24]
                  ☐ Infanticide [1140] [17, 24]
               ☐ Total other violations causing death [120]
                  ☐ Criminal negligence causing death [1150]
                  ☐ Other related violations causing death [1160]
               ☐ Attempted murder [1210]
               ☐ Sexual assault, level 3, aggravated [1310]
               ☐ Sexual assault, level 2, weapon or bodily harm [1320]
               ☑ Sexual assault, level 1 [1330]
               ☐ Total sexual violations against children [130] [26]
                  ☐ Sexual interference [1345] [26]
                  ☐ Invitation to sexual touching [1350] [26]
                  ☐ Sexual exploitation [1355] [26]
                  ☐ Making sexually explicit material available to children [1367] [48]
                  ☐ Luring a child via a computer [1370] [26]
               ☐ Assault, level 3, aggravated [1410]
               ☐ Assault, level 2, weapon or bodily harm [1420]
               ☐ Assault, level 1 [1430]
               ☐ Total assaults against a peace officer [135] [25, 35]
               ☐ Total other assaults [140]
                  ☐ Unlawfully causing bodily harm [1440]
                  ☐ Criminal negligence causing bodily harm [1470]
                  ☐ Other assaults [1480]
               ☐ Total firearms, use of, discharge, pointing [150]
                  ☐ Discharge firearm with intent [1450]

6) Continue to the third step, and only select the "Actual incidents" (being a statistical agency, Statistics Canada calculates the rates, but for the

purposes of this exercise, we will do so manually).

Step 3- Select: Statistics
(14 of 14 items selected)

Use the following checkboxes to select/deselect items from the list below: - Collapse

☐ **All** ☑ ☐
    ☑ Actual incidents
    ☐ Rate per 100,000 population
    ☐ Percentage change in rate [22]
    ☐ Total cleared
        ☐ Cleared by charge
        ☐ Cleared otherwise
    ☐ Total, persons charged [23]
    ☐ Rate, total persons charged per 100,000 population aged 12 years and over [31]
    ☐ Total, adult charged
    ☐ Rate, adult charged per 100,000 population aged 18 years and over [31]
    ☐ Total, youth charged [39, 40]
    ☐ Rate, youth charged per 100,000 population aged 12 to 17 years [31]
    ☐ Total, youth not charged [39, 40]
    ☐ Rate, youth not charged per 100,000 population aged 12 to 17 years [31]

7) In step four, you can choose the time frame. Statistics Canada and police forces typically use three-year time frames, which account for spikes caused by rare events such as political demonstrations. So if a police force like Ottawa wants to track crime, it will do so comparing two three-year periods. To repeat this methodology, let's choose a similar time frame: 2008-2014.

Step 4 - Select the time frame
By default, only data for the most recent periods available will be retrieved. You may use the lists below to select a different time frame.
From : [2008 ▼] To : [2014 ▼] (Annual data)

8) The drop-down menu in step 6 gives you the option of selecting the shape of your table. The default is a table with the time (which is really the year the offence was recorded), as column titles for the offences, which are grouped by year. Let's stick with this choice and move on to step six, which allows us to "apply" the result by selecting the tab.

Step 6
[Apply]   [Back to original table]

9) Selecting this tab produces the table, which because it has so few values can be seen easily on the website.

Geography [3, 47]	Violations	2008	2009	2010	2011	2012	2013	2014
Ottawa-Gatineau, Ontario part [6, 52, 68]	Total, all violations [0]	48,648	47,089	44,910	43,987	44,255	39,257	36,554
	Sexual assault, level 1 [1330]	328	292	384	361	376	476	500
Toronto, Ontario [33]	Total, all violations [0]	245,870	237,670	229,239	223,251	211,185	198,029	195,617
	Sexual assault, level 1 [1330]	2,433	2,314	2,636	2,641	2,709	2,578	2,748

10) The other tabs at the top – "Manipulate", for instance – allow us to perform calculations which produce different results, such as determining the percent changes from year to year. However, since we're satisfied with what we have, we can select the "Download" tab, which produces a dialog

box with options.

11)   We can choose the language, the format of the table, the format – which, in this instance, only gives us a csv option – and the kind of retrieval, which we can leave as the default "normal" option.

12)   Select the download tab in option one -- not option two -- which allows you to download the entire table, which will be too large to open in Excel.

13)   Selecting the first download tab produces final step.

14)   Select the download link. Move the csv file from your download folder to the one that you've created for this tutorial, open it, paste the URL into the first available cell in the first row, and save the csv file as an Excel file, and make a copy. Once again, it's important to reiterate that saving the csv file as an Excel file is crucial because a csv file only supports one worksheet. So if you've created multiple sheets and save the file as csv, you'll lose your work!!!

15)   Open your back-up Excel workbook, copy the original table, open a new worksheet, paste the table and clean it up so that the first column contains the titles, and all the footnotes underneath the table are deleted, and reformat the numbers, making sure to include the 1000s separator.

	A	B	C	D	E	F	G	H	I	J
1	Geography (3,47)	Violations	Statistics	2008	2009	2010	2011	2012	2013	2014
2	Ottawa-Gatineau, Ontario part (6,52,68)	Total, all violations [0]	Actual incidents	48,648	47,089	44,910	43,987	44,255	39,257	36,554
3	Ottawa-Gatineau, Ontario part (6,52,68)	Sexual assault, level 1 [1330]	Actual incidents	328	292	384	361	376	476	500
4	Toronto, Ontario (33)	Total, all violations [0]	Actual incidents	245,870	237,670	229,239	223,251	211,185	198,029	195,617
5	Toronto, Ontario (33)	Sexual assault, level 1 [1330]	Actual incidents	2,433	2,314	2,636	2,641	2,709	2,578	2,748

16)   The table has given us two numbers for each category: the total and type of offence. We don't need the totals because they calculate all the violations in that category. We're only interested in one, Sexual assault, level 1. So we can apply the filter to de-select the "Total, all violations"

cells.

	A	B	C	D	E	F	G	H	I	J
1	Geography (3,47)	Violations	Statistics	20	20	20	20	20	20	20
3	Ottawa-Gatineau, Ontario part (6,52,68)	Sexual assault, level 1 [1330]	Actual incidents	328	292	384	361	376	476	500
5	Toronto, Ontario (33)	Sexual assault, level 1 [1330]	Actual incidents	2,433	2,314	2,636	2,641	2,709	2,578	2,748
6										

17)   Now in order to calculate the rate, we will need the population figures for both cities, which can find on the StatsCan website by clicking agency's "Estimates by population by census metropolitan area site.

Home › CANSIM › Search results ›

Table 051-0056 1, 2, 3, 4, 5, 7, 8

Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2011
annual (persons)

Data table   Add/Remove data   Manipulate   Download   Related information   Help

The data below is a part of CANSIM table 051-0056. Use the Add/Remove data tab to customize your table.

Selected items [Add/Remove data]

Sex = Both sexes
Age group 6 = All ages

Geography	2010	2011	2012	2013	2014
St. John's, Newfoundland and Labrador [10001]	198,436	202,533	205,899	209,212	211,724
Halifax, Nova Scotia [12205]	398,259	402,433	406,757	409,974	414,398
Moncton, New Brunswick [13305]	137,655	140,228	142,758	144,406	146,073
Saint John, New Brunswick [13310]	128,020	128,605	128,495	127,991	127,314
Saguenay, Quebec [24408]	158,651	159,383	159,982	160,267	160,138
Québec, Quebec [24421]	766,563	776,821	785,227	793,519	799,632
Sherbrooke, Quebec [24433]	201,657	204,709	207,492	210,093	212,061
Trois-Rivières, Quebec [24442]	151,895	153,247	154,396	155,107	155,813
Montréal, Quebec [24462]	3,842,786	3,885,709	3,937,443	3,984,462	4,027,121
Ottawa-Gatineau, Ontario/Quebec [24505, 35505]	1,250,553	1,270,232	1,288,562	1,302,905	1,318,122
Kingston, Ontario [35521]	162,913	164,492	165,957	167,149	168,353
Peterborough, Ontario [35529]	121,865	122,197	122,732	123,058	123,270
Oshawa, Ontario [35532]	362,255	367,266	373,778	379,062	384,143
Toronto, Ontario [35535]	5,681,721	5,769,759	5,868,897	5,966,339	6,055,724
Hamilton, Ontario [35537]	736,141	742,498	750,721	758,291	765,228
St. Catharines-Niagara, Ontario [35539]	401,957	402,563	404,042	405,168	405,906
Kitchener-Cambridge-Waterloo, Ontario [35541]	487,186	492,961	498,879	503,067	506,858
Brantford, Ontario [35543]	138,465	139,388	140,426	141,787	143,074
Guelph, Ontario [35550]	144,204	145,637	148,036	149,543	150,946

18)   You can select and copy the entire table and paste it into a new worksheet in the Excel workbook we've created. Computer-Assisted Reporting covers pasting html tables into Excel on pages 56 to 58. If this doesn't work in Chrome, try a different browser like Firefox, or Explorer for non-Mac users.

19)   Once you've pasted the table into the Excel worksheet, reformatted the information by getting rid of the text wrap, removed the hyperlinks in column A, and renamed the worksheet, filter the table for "Ottawa-Gatineau, Ontario/Quebec" and "Toronto".

	A	B 2010	C 2011	D 2012	E 2013	F 2014
1	Geography					
12	Ottawa-Gatineau, Ontario/Quebec [24505, 35505]	1,250,553	1,270,232	1,288,562	1,302,905	1,318,122
16	Toronto, Ontario [35535]	5,681,721	5,769,759	5,868,897	5,966,339	6,055,724

20)   Now that we have the population numbers, we can return to the working copy worksheet that contains our assault data, and create a new column in K we can call, "Population_2014".

	A	B	C	D	E	F	G	H	I	J	K
1	Geography (3,47)	Violations	Statistics	20	20	20	20	20	20	20	Popualtion 2014
3	Ottawa-Gatineau, Ontario part (6,52,68)	Sexual assault, level 1 [1330]	Actual incidents	328	292	384	361	376	476	500	
5	Toronto, Ontario (33)	Sexual assault, level 1 [1330]	Actual incidents	2,433	2,314	2,636	2,641	2,709	2,578	2,748	

21)   There are three ways we can plug the population numbers into K3 and K5: copy and paste; type them in; or import them. The first two methods are fine, especially for a small data set like this one. However, importing them using the method you're about to learn is also easy. So in K3 type the "=" sign, and click on the worksheet that I have labelled

"Population".

22)   If you look at the formula bar in the screenshot above, you can see what Excel has done, identified the worksheet that contains the value that you're about to import.

23)   Click on the cell that contains the population figure you want, in this case F12.

24)   Excel has added that cell reference to the formula.

25)   Hit enter to return to the previous worksheet. (An advantage to using this method is that if you happen to change the population number, the calculations which are based on the population figures adjust automatically.

26) Excel has brought in the population figure into K3. Now repeat the same process for Toronto.

	A	B	C	D	E	F	G	H	I	J	K	
1	Geography (3,47)	Violations	Statistics	20	20	20	20	20	20	20	Popualtion 2014	
3	Ottawa-Gatineau, Ontario part (6,52,68)	Sexual assault, level 1 [1330]	Actual incidents	328	292	384	361	376	476	500		1,318,122
5	Toronto, Ontario (33)	Sexual assault, level 1 [1330]	Actual incidents	2,433	2,314	2,636	2,641	2,709	2,578	2,748		6,055,724
6												

27) The Ottawa and Toronto numbers account for the entire census metropolitan area that Statistics Canada measures. In Ottawa's case, this takes in both sides of the Ottawa River. In Toronto, the figure includes city and the surrounding areas.

28) Now, let's create a new column in L we can call "Rate for 2014" and calculate the rate by dividing the number of assaults in 2014 contained in column J by the population counts contained in the adjacent column to the right.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Geography (3,47)	Violations	Statistics	20	20	20	20	20	20	20	Popualtion 2014	Rate for 2014
3	Ottawa-Gatineau, Ontario part (6,52,68)	Sexual assault, level 1 [1330]	Actual incidents	328	292	384	361	376	47	500	1,318,122	0.000379328
5	Toronto, Ontario (33)	Sexual assault, level 1 [1330]	Actual incidents	2,433	2,314	2,636	2,641	2,709	2,57	2,748	6,055,724	0.000453786
6												

29) While the numbers in column L are accurate, the fractions are so small that they would make no sense to our audience. So we must use a multiplier to determine the frequency which, in this case, will be for every 100,000 residents.

30) To do this, we can place the first part of the formula in brackets, and the multiply (using the asterisk "*") by 100,000. Placing the first part of the formula in brackets instructs Excel to perform that calculation first.

J	K	L
20 ▾	Popualtion 2014 ▾	Rate for 2014
6 500	1,318,122	=(J3/K3)*100000
8 2,748	6,055,724	0.000453786

K	L
0 ▾ Popualtion 2014 ▾	Rate for 2014
500 1,318,122	37.93275585
748 6,055,724	0.000453786

31) Reformat the number in column L to limit the number of decimal places to one, and then repeat the same formula for the next cell.

Geography (3,47)	Violations	Statistics	20 ▾	20 ▾	20 ▾	20 ▾	20 ▾	20 ▾	20 ▾	Popualtion 2014	Rate for 2014
Ottawa-Gatineau, Ontario part (6,52,68)	Sexual assault, level 1 [1330]	Actual incidents	328	292	384	361	376	476	500	1,318,122	37.9
Toronto, Ontario (33)	Sexual assault, level 1 [1330]	Actual incidents	2,433	2,314	2,636	2,641	2,709	2,578	2,748	6,055,724	45.4

32) So Ottawa-Gatineau has 37.9 level one assaults for every 100,000 residents compared to 45.4 for the Toronto area. While the Toronto rate is higher, the result is much closer than the raw numbers would suggest. Just using the raw numbers, Toronto has more than five times as many assaults. But when calculating the rate, which is another way of adjusting for their differences in population, the difference is much smaller.

33) So calculating the rate can be a more accurate way of analyzing your data.