



## Excel: UCR data to Calculate Crime Rates and make Choropleth Maps

Summary by Kaitlyn Campbell and Hannah Steinman

This guide will walk you through using Uniform Crime Report Data and calculating the crime rate per 100,000 people across reporting counties in Arkansas for aggravated assault. The data that were used in this guide is from Dr. Jacob Kaplan at the University of Pennsylvania made open access by ICPSR at <https://www.openicpsr.org/openicpsr/project/108164/version/V3/view>

Before we begin, let us go over some basics of statistics, the measures of central tendency:

- **Mean (average):** Sum all number together and divide by the number of values will give you the mean
  - Example: 7, 3, 13, 1, 27, 14, 22 ->  $(7+3+13+1+27+14+22)/7 = 77/7 = 11$
- **Median:** The middle value in a data set ordered from least to greatest
  - Example: 1, 3, 7, 13, 14, 22, 27)
- **Mode:** The number that appears the most in a dataset
  - Example: 1, 1, 4, 6, 22, 6, 7, 2, 1

1. The Uniform Crime Report is an FBI program that collects statistics and data across the country from participating law enforcement agencies. There is **agency, incident,** and **county level** data made available dating back to 1960. With agency level data, the police agency is the unit of analysis. Incident level data are collected through the National Incident Based Reporting System (NIBRS) with data on incident and arrest. County level data only includes reported arrests and crimes. For this guide we are investigating **County Level** data based on **Crimes Reported**. This data includes Actual crime counts and Cleared crime counts. Below is what this data looks like!

A	B	C	D	E	F	G	H	I	J	K	L	M	N	
1	year	county_name	state	coverage_inci	state_al	fips_state_c	fips_county	fips_state_co	county_popul	officers_killed_by	officers_killed_by_a	officers_assa	actual_mur	actual_manslau
2	2017	Arkansas County	arkansas	96.35444	AR	5	1	5001	18790	0	0	0	2	0
3	2017	Ashley County	arkansas	97.59158	AR	5	3	5003	20802	0	0	0	1	0
4	2017	Baxter County	arkansas	100	AR	5	5	5005	40534	0	0	0	2	0
5	2017	Benton County	arkansas	100	AR	5	7	5007	257799	0	0	0	5	0
6	2017	Boone County	arkansas	98.07195	AR	5	9	5009	37417	0	0	0	1	0
7	2017	Bradley County	arkansas	93.29919	AR	5	11	5011	11715	0	0	0	2	0
8	2017	Calhoun County	arkansas	100	AR	5	13	5013	5119	0	0	0	0	0
9	2017	Carroll County	arkansas	100	AR	5	15	5015	27697	0	0	0	9	0
10	2017	Chicot County	arkansas	100	AR	5	17	5017	10823	0	0	0	0	0
11	2017	Clark County	arkansas	100	AR	5	19	5019	21939	0	0	0	1	0
12	2017	Clay County	arkansas	100	AR	5	21	5021	14757	0	0	0	0	1
13	2017	Cleburne County	arkansas	100	AR	5	23	5023	24793	0	0	0	1	2
14	2017	Cleveland County	arkansas	100	AR	5	25	5025	8179	0	0	0	0	0
15	2017	Columbia County	arkansas	100	AR	5	27	5027	23791	0	0	0	0	0
16	2017	Conway County	arkansas	100	AR	5	29	5029	20912	0	0	0	1	0
17	2017	Craighead County	arkansas	100	AR	5	31	5031	107562	0	0	0	16	0
18	2017	Crawford County	arkansas	100	AR	5	33	5033	59533	0	0	0	0	0
19	2017	Crittenden County	arkansas	95.77676	AR	5	35	5035	48902	0	0	0	9	1
20	2017	Cross County	arkansas	95.77517	AR	5	37	5037	16332	0	0	0	0	0
21	2017	Dallas County	arkansas	100	AR	5	39	5039	7383	0	0	0	1	0
22	2017	Desha County	arkansas	57.90522	AR	5	41	5041	11718	0	0	0	2	0
23	2017	Drew County	arkansas	100	AR	5	43	5043	18672	0	0	0	2	0
24	2017	Faulkner County	arkansas	100	AR	5	45	5045	123624	0	0	0	3	1
25	2017	Franklin County	arkansas	100	AR	5	47	5047	17565	0	0	0	1	0
26	2017	Fulton County	arkansas	100	AR	5	49	5049	11180	0	0	0	0	0
27	2017	Garland County	arkansas	99.21094	AR	5	51	5051	98598	0	0	0	8	0
28	2017	Grant County	arkansas	100	AR	5	53	5053	18135	0	0	0	1	0

2. What if we wanted to know the average aggravated assault count across counties in Arkansas? At the **Home** tab, above editing, there is an **AutoSum** function. You can highlight the column or columns that you want to average, click **AutoSum** and choose **Average**. Similarly, you can click **More Functions** and choose median, or mode, although mode is not very helpful here. You can now get average crime counts across Arkansas Counties. The average count of county aggravated assaults is 168.69 in 2017.

The screenshot illustrates the process of calculating the average aggravated assault count across counties in Arkansas. It shows the Excel ribbon's **AutoSum** menu, a data table, and the **Insert Function** dialog box.

Lincoln	14818	20
Polk	20116	23
Cleveland	8179	9
Prairie	8186	9
Howard	13324	12
Searcy	7942	4
Montgomery	8752	4
Pike	10812	3

The **Insert Function** dialog box shows the search for a function: "median". The function list includes MEDIAN, QUARTILE, QUARTILE.EXC, and QUARTILE.INC. The **MEDIAN** function is selected, and the **OK** button is highlighted.

**You can also type the formula**  
**=AVERAGE(cell:cell)**  
**=MEDIAN(cell:cell)**  
**=MODE(cell:cell)**

Okay so now we have crime counts, this does not tell us a lot...what about *crime rates*?

## BEFORE WE BEGIN...

Why are we using crime *rates* instead of *counts*? Crime counts can be deceiving. You may see a large number of violent crimes for an area and think "*Wow, this place is wild!*" but the crime count does not take population into account...this is important because without considering population we are not getting the full picture. 300+ violent crimes in a county with 100,000 people is a lot different than 300+ violent crimes in a county with 50,000 people. A county crime rate is calculated by taking the total number of crimes, dividing it by the total population, and multiplying by 100,000.

$$\left( \frac{\textit{Crime Count}}{\textit{Population}} \right) * 100,000$$

**Note:** Calculating rates for counties of less than 100,000 will generate an inflated rate when compared to counties with populations of 100,000 or more; therefore, rates are normally not calculated for counties with populations of less than 100,000, outside of this guide...

3. Create a new column for crime rate. We are going to be looking at the aggravated assault rate across counties in Arkansas. In the first cell our formula is going to be the aggravated assault divided by the population multiplied by 100,000. In the cell this would look like  $=(C7/D7)*100000$ . Double-click the bottom right hand corner of the cell to auto-populate the new violent crime rate for the rest of the column We can then right click the new rate, go to **format cell**, and round to **two decimal places**. The average county aggravated assault rate per 100,000 is 325.27 for 2017.

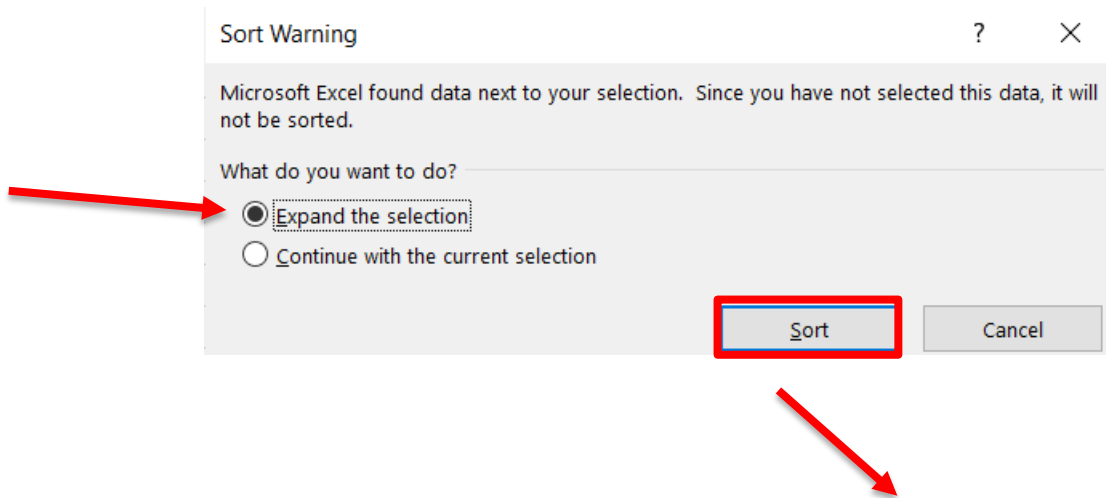
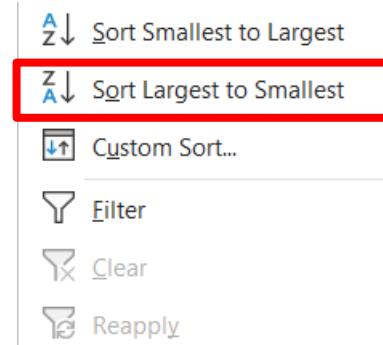
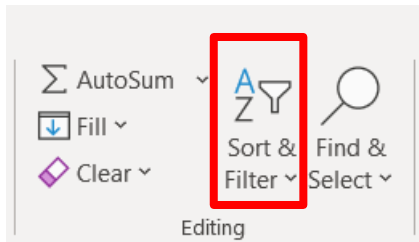
County	State	County Population	actual_assault_aggravated	Aggravated Assault Rate
Arkansas County	Arkansas	18790	78	
Ashley County	Arkansas	20802	51	
Baxter County	Arkansas	40534	72	
Benton County	Arkansas	257799	451	
Boone County	Arkansas	37417	203	

County Population	actual_assault_aggravated	Aggravated Assault Rate
18790	78	$=(G2/F2)*100000$

County Population	actual_assault_aggravated	Aggravated Assault Rate
18790	78	415.1144226
20802	51	245.1687338
40534	72	177.6286574
257799	451	174.942494
37417	203	542.5341422

The screenshot shows the Excel ribbon on the left with the 'Format Cells...' option highlighted in a red box. On the right, the 'Format Cells' dialog box is open, showing the 'Number' tab. The 'Category' list has 'Number' selected. The 'Decimal places' spinner is set to 2. A red arrow points to the 'Number' category, and another red arrow points to the 'Decimal places' spinner.

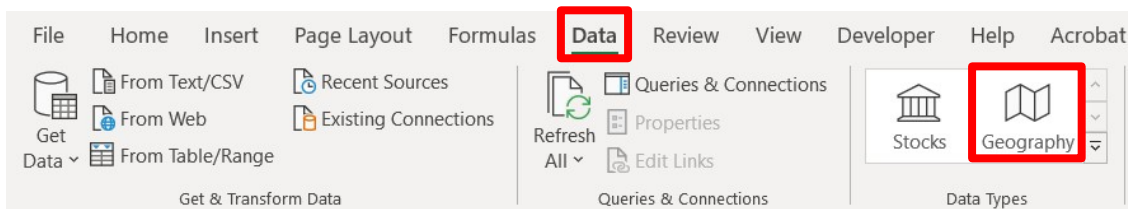
4. Now that we have our crime violent crime rate, we can sort by highest to lowest to see which counties have the highest aggravated assault rate per 100,000 people! Click the violent crime rate column, on the right side of the home tab click **Sort and Filter**. Sort from **Largest to Smallest**. You will then be prompted to **expand the selection**, be sure to expand the selection so your data does not become jumbled.



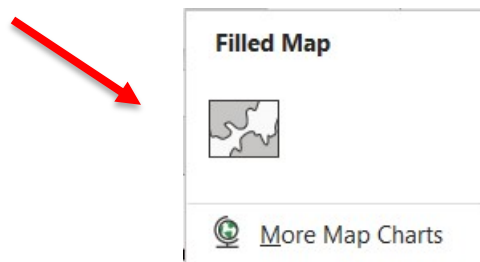
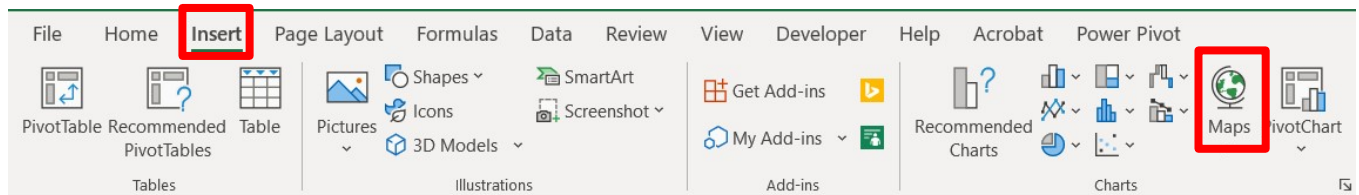
F	G	H	I
County	Population	Aggravated Assault	Aggravated Assault Rate
Crittenden	48902	529	1081.76
Jefferson	69800	669	958.45
Pulaski	397921	3642	915.26
Monroe	7550	59	781.46
Ouachita	24619	174	706.77
Phillips	19105	118	617.64

- Now we will visualize the difference between crime counts and crime rates across reporting counties in Arkansas. To do this we will be using Excel's **Geography** function. We will need to have **State** and **County** so that the geography function can locate where our data is. **Highlight the headings** of the columns you want to use. Go to the **Data** tab, click **Geography**. You will see question marks pop up next to the headings meaning that we are ready to create a choropleth map with our data. Highlight the columns you want to use with the question marks, go to **Insert**, click **Maps** and then **Filled Map**.

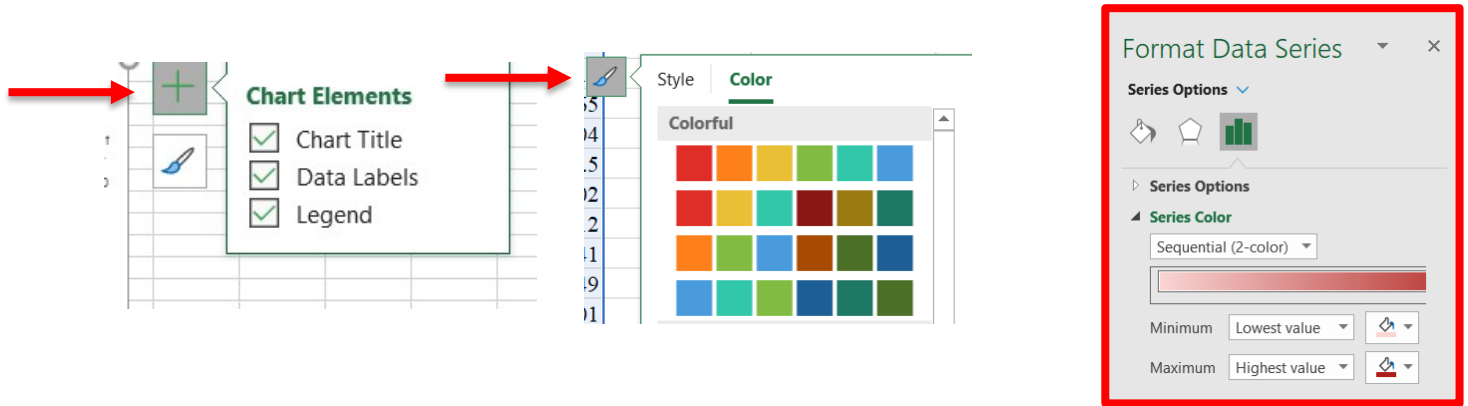
E	F	G	H	I
<b>State</b>	<b>County</b>	<b>Population</b>	<b>Aggravated Assault</b>	<b>Aggravated Assault Rate</b>



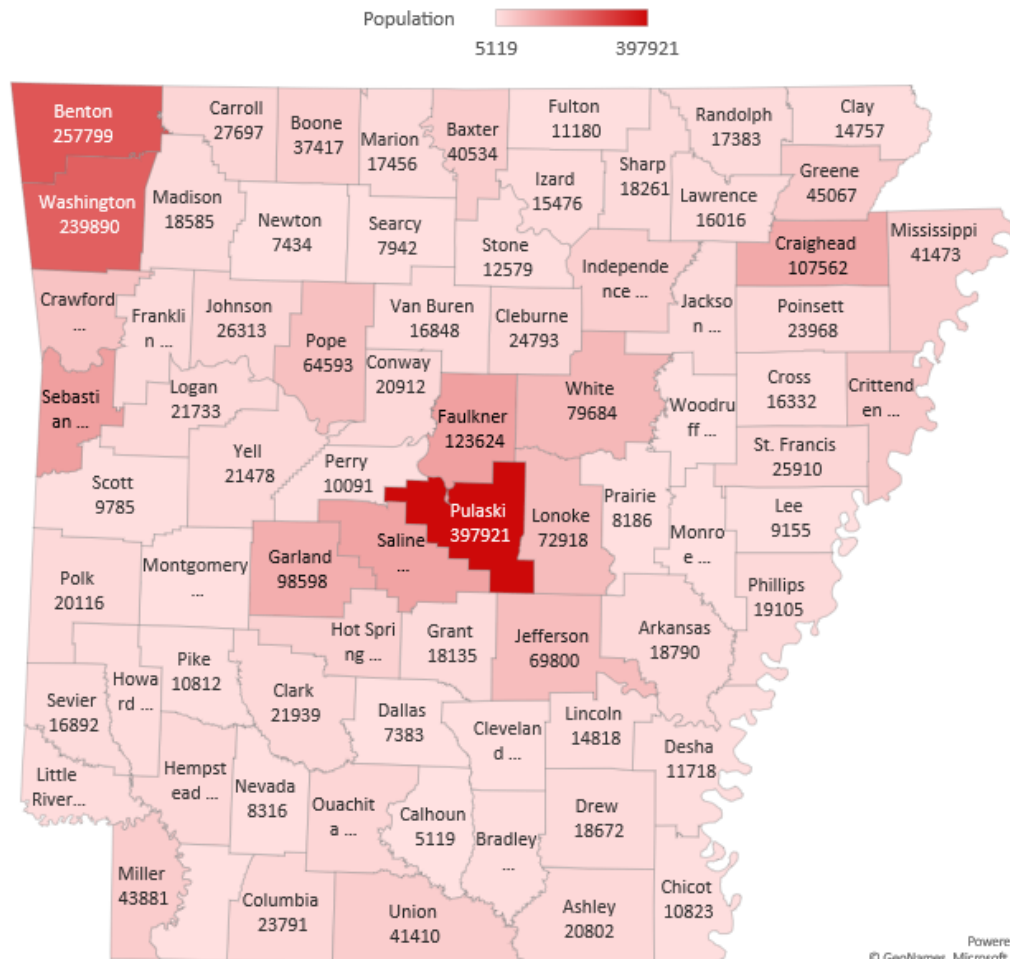
E	F	G	H	I
? <b>State</b>	? <b>County</b>	? <b>Population</b>	? <b>Aggravated Assault</b>	? <b>Aggravated Assault Rate</b>



- You should now have a choropleth map with your selected data! You can do this with different columns to create different maps. If you click the **+ sign** next to your map you can add a title, labels, and legend. To edit the colors of the map you can click the **paintbrush** icon. The data can also be formatted on the right side of the screen under **Format Data Series** where you can edit the color scheme and sequence. Below we have the counties in Arkansas represented by population. The darker the county, the higher the population.

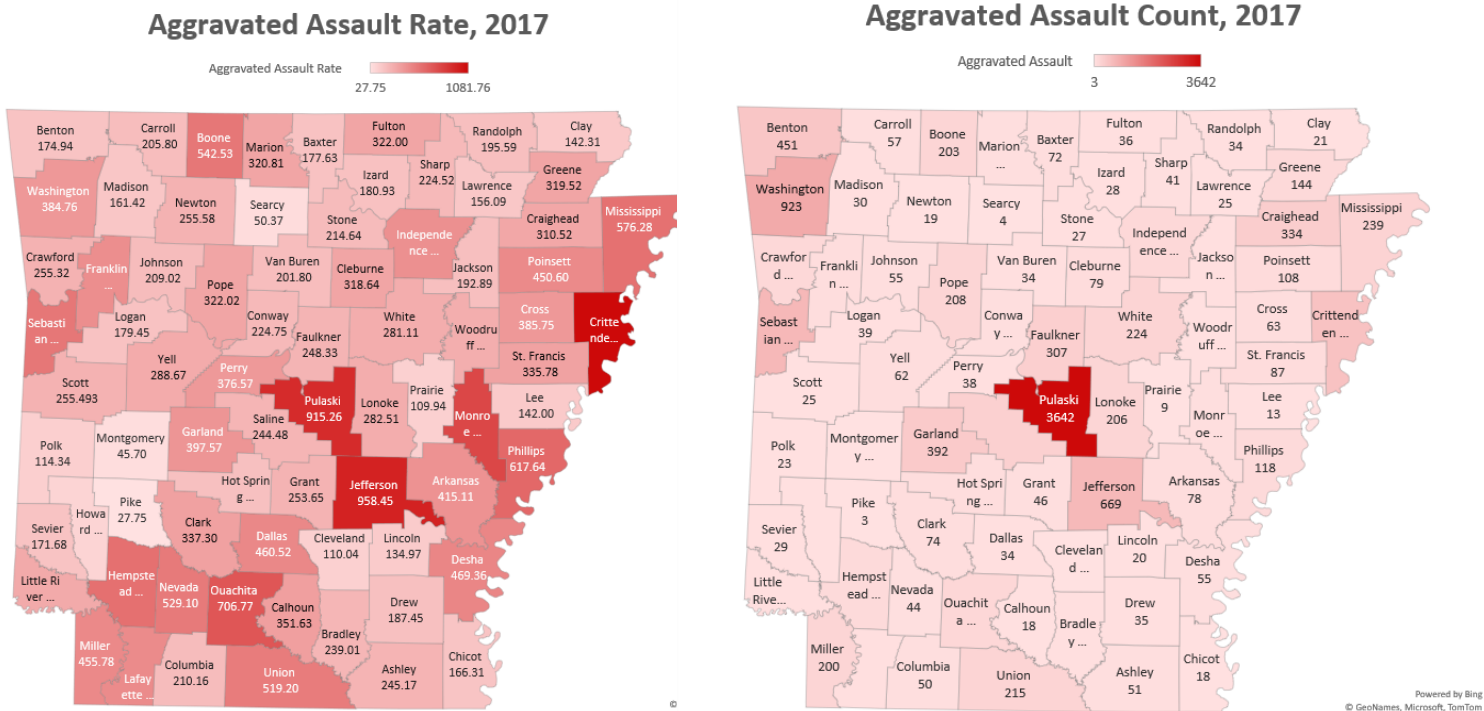


## Arkansas Counties by Population, 2017



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7. Below, we have the visuals for the aggravated assault crime counts across counties in Arkansas and the aggravated assault rates. This is a helpful tool that aids in understanding and visualizing the difference between crime counts and rates!



**You should now know the difference between crime rates and counts and how to display your data visually through Excel!**

**DATA FROM:** Kaplan, Jacob. Uniform Crime Reporting (UCR) Program Data: County-Level Detailed Arrest and Offense Data. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2019-02-10. <https://doi.org/10.3886/E108164V3>