

Tracking Opioid Use in the U.S.

Lesson Overview

2018 data shows that every day, 123 people in the United States die after overdosing on opioids.¹

Prescription opioids are powerful pain-reducing medications that include oxycodone, hydrocodone, and morphine, among others. These drugs have many benefits as well as serious risks. Public officials are collecting data and looking for solutions to the problem.

The [National Institute on Drug Abuse](#) has compiled the data used in the following lesson. The data is delivered at the state level and has been normalized by population. The data is expressed as Opioid Prescriptions per 100,000 persons. Data is available by state from 2014 to 2018.

The National Institute on Drug Abuse has asked that the data that they have collected be displayed in maps that show percent change from 2014-2018 with graphs and explanation.

¹CDC/NCHS, [National Vital Statistics System](#), Mortality. CDC WONDER, Atlanta, GA: US Department of Health and Human Services, CDC; 2018. <https://wonder.cdc.gov>.

Builds skills in

- Opening and saving an existing map
- Using Arcade expressions to make calculations
- Using Arcade expressions to make map labels
- Configuring pop-ups for each state showing information as text and graphics

Software requirements

- ArcGIS Online account (get a [free trial](#))

Estimated time

- Over 1 hour

Exercise

Step 1: Open, document, and save a map

1. Go to the [Opioid Use 2014-2018, USA](#) map.
2. Click **Sign In** and sign into your ArcGIS account.
3. On the side panel, click **Content**. Point to the **state opioid** layer and click the **Show Table** button.
4. Examine the attribute table. Notice the prescription fields for five years. These numbers represent the number of opioid prescriptions per 100,000 persons in each year. Close the table.
5. On the top ribbon, click **Save** and click **Save As**.
6. For **Title**, type *USA Opioid Use*, followed by your name or initials.
7. Click **Save Map**.

Step 2: Calculate and display percent change from 2014-2018

Percent change is the extent a variable gains or loses intensity. In this lesson it is the change in the amount of opioids prescribed from 2014 to 2018.

1. Under the **state opioid** layer, click **Change Style**.
2. For **Choose an attribute to show**, choose **New Expression**.

A new window appears, where you can write an Arcade expression. Arcade is a simple scripting language that allows you to create custom visualizations and labeling. On the right it shows all of the fields are in the table. The two fields that will be used for this expression are **2018 prescription** and **2014 prescription**.

Plan your expression carefully. In this instance, you want to calculate the percent change between 2014 and 2018. To do this, you will subtract the old value from the new value, then divide by the old value:

$$2018 \text{ prescriptions} - 2014 \text{ prescriptions} / 2014 \text{ prescriptions}$$

Remember to enclose in parentheses the part of the formula that needs to be calculated first:

$$(2018 \text{ prescriptions} - 2014 \text{ prescriptions}) / 2014 \text{ prescriptions}$$

To make the calculation into a percentage you must multiply it by 100:

$$((2018 \text{ prescriptions} - 2014 \text{ prescriptions}) / 2014 \text{ prescriptions}) * 100$$

This gives the percentage with 15 decimal places. Change the decimal places to a number with 2 decimal places by rounding. The expression becomes:

$$\text{Round}(((2018 \text{ prescriptions} - 2014 \text{ prescriptions}) / 2014 \text{ prescriptions}) * 100, 2)$$

3. Type your expression into the window. Click the fields in the list on the right to add them. The expression should look like: `Round((($\$feature["prescription_2018"] - \$feature["prescriptions_2014"]$)/ $\$feature["prescriptions_2014"]$)*100,2)`

4. Click **Test** to check if your expression is correct.

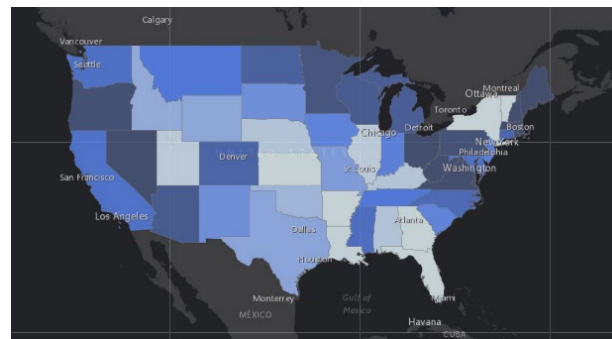
5. The last step is to name your expression. Next to **Custom**, click **Edit**. Type *Percent Change of Opioid Prescriptions from 2014 to 2018*. Click **Save**.

6. Click **Ok**.

7. In the **Change Style** pane, for **Select a drawing style**, select **Counts and Amounts (Color)**. Click **Done**.

8. For the **state opioid** layer, click **Show Legend**.

The values on the legend range from -27 to -38, meaning that all states saw a decrease in prescription opioids between 2014 and 2018. The darkest colors represent states that have seen the biggest decrease in prescription opioids.



Q1. Name three states that show the biggest decrease in opioid prescriptions.

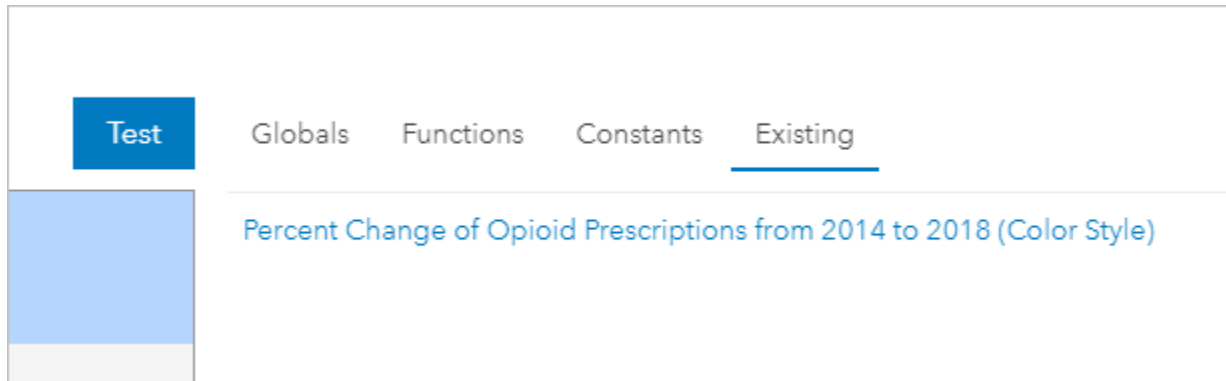
Q2. Name three states that show the least decrease in opioid prescriptions.

Q3. Can you see any spatial patterns on the map?

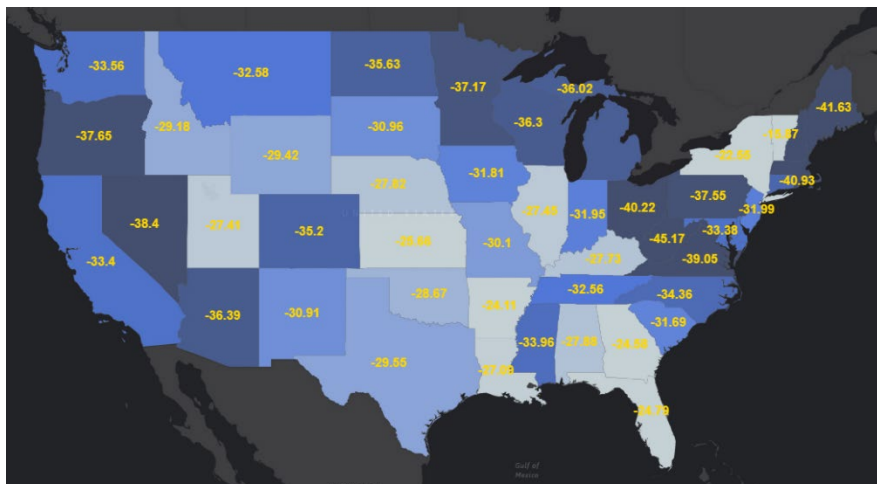
Step 3: Label the map with percent change from 2014 to 2018

You can reuse the work you did to style your map to also label it.

1. Under the **state opioid** layer, click the **More Options** button (three dots) and choose **Create Labels**.
2. For **Text**, choose **New Expression**.
3. Click **Existing**. Here you can find any existing expressions that you've already created.
4. Click **Percent Change of Opioid Prescriptions from 2014 to 2018 (Color Style)**.



5. Click **OK**.
6. Increase the font size to 20 and change the color to yellow.
7. In the **Label Features** pane, click **OK**.

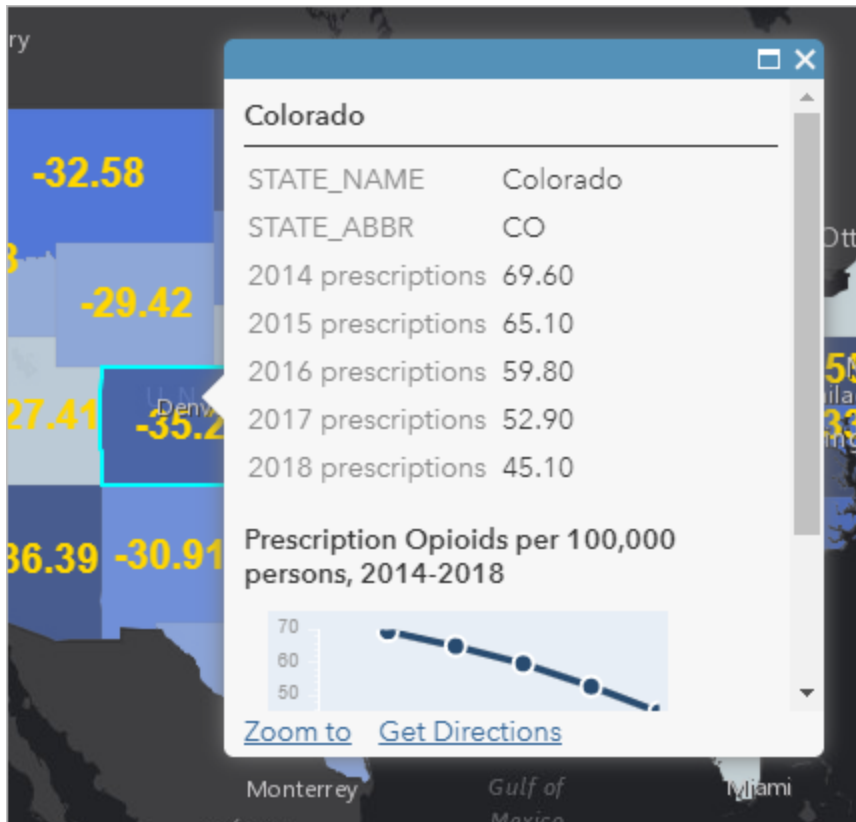


8. Save the map.

Step 4: Configure pop-ups with text and graphs

Pop-ups can be configured to show attribute information associated with the feature as well as graphs.

1. On the **state opioid** layer, click **More Options** and choose **Configure Pop-up**.
2. Click **Configure Attributes**. Uncheck everything except:
 - STATE_NAME
 - STATE_ABBR
 - 2014 prescriptions
 - 2015 prescriptions
 - 2016 prescriptions
 - 2017 prescriptions
 - 2018 prescriptions
3. Use the arrow buttons to reorder the fields to match the order shown above. Click **OK**.
4. Under **Pop-up Media** click **Add** and click **Line Chart**.
5. For **Title**, type *Prescription Opioids per 100,000 persons, 2014-2018*.
6. For **Chart Fields**, check all of the prescription fields.
7. Click **OK** and click **OK** again.
8. Click a state on the map to view its pop-up.



9. Save the map.

Q4. What is the trend of the data? Does the percent of prescribed opioids decrease or increase?

In this lesson you used Arcade expressions to visualize the percent change of opioid prescriptions between 2014 and 2018.

Assessment

Using the opioid prescription data, calculate the percent change between any two other years (for example 2014 to 2015 or 2017 to 2018.)

Exercise Answers

Q1. Name three states that show the biggest decrease in opioid prescriptions.

A1. Any of the following states can be listed: Oregon, Nevada, Minnesota, Ohio, West Virginia, Virginia, Pennsylvania, Maine, Massachusetts, and New Hampshire.

Q2. Name three states that show the lease decrease in opioid prescriptions.

A2. Any of the following states can be listed: Utah, Kansas, Arkansas, Louisiana, Georgia, Florida, New York, and Vermont.

Q3. Can you see any spatial patterns on the map?

A3. There is not a distinguishable pattern.

Q4. What is the trend of the data? Does the percent of prescribed opioids decrease or increase?

A4. The rate of opioid prescriptions has decreased each year of the five-year study period.

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About the author

This lesson was written by a K-12 educator with support from the Learn ArcGIS team at Esri.

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