IDC IDEA DATA CENTER | Collect, Report, Analyze, and Use High-Quality Part B Data

Outlier Analyses

Step-by-Step Guide

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Outlier Analyses: Step-by-Step Guide

Purpose and Intended Audience

Outlier analysis provides an important tool for examining data to identify observations [among local education agencies (LEAs), schools, students] with data that deviate from an established norm so that states can investigate the observations as possible data errors. This guide introduces the principles of outlier analysis and includes six tutorials on completing an outlier analysis. It is a companion for the *IDEA Data Quality: Outlier Analyses Tool*, an Excel-based tool states can use to identify outliers using the interquartile range approach described in the step-by-step tutorials. IDC designed these two products—the outlier analyses tool and this step-by-step guide—for state personnel responsible for the IDEA 618 and/or 616 data to use. IDEA Part B state staff working with LEAs also can use the products to analyze their local data. Any state staff with the ability to examine and analyze IDEA 618 and/or 616 data also can benefit from these technical assistance (TA) products. Such staff include data managers, Information Technology (IT) personnel, coordinators, and directors.

This guide provides an overview of outlier analysis. It is organized around four questions:

1. What is an outlier?
2. Why is outlier analysis important for data validity and reliability?
3. What action should states take after conducting an outlier analysis?
4. How can states conduct and display an outlier analysis?

IDC's principles for high-quality data include addressing data quality at all stages—collecting, submitting, analyzing, reporting, and using.

At the most fundamental level, high-quality data are timely, accurate, and complete.

- ***Timely*** data are current per a specific period of time.
- ***Accurate*** data are
  - Reliable, that is, consistent across time, methods, and locations; and
  - Valid, that is, representative of what they are designed to measure.
- ***Complete*** data represent the intended population (e.g., national, state, or local level) and relevant subgroups (e.g., race/ethnicity, grade level, socioeconomic level, gender).

Beyond these fundamental components, high-quality data are also *accessible*, *usable*, and *secure*.

- ***Accessible*** data are readily available in formats that are understandable, user friendly, and practical.
- ***Usable*** data promote sound management, strong governance, and dedication to improving results for children and youth with disabilities and their families.
- *Secure* data are collected and stored with due consideration to maintaining confidentiality and with electronic and physical protections commensurate with the sensitivity of the data.

Question 1: What Is an Outlier?

"An outlier is an observation which deviates so much from the other observations as to arouse suspicions that it was generated by a different mechanism" (Hawkins, 1980). Outlier analysis also includes investigating whether the data are valid or invalid. In the fields of statistics and data mining, outliers may be referred to as anomalies, abnormalities, deviants, and discordant data. When conducting an outlier analysis, states define what value or combination of values are outside the expected norm. These parameters can help specify the LEAs that have data outside of the "normal" parameters the state sets. There may be times when states see differences in LEAs

that the state considers normal. It is up to the states to determine what constitutes a "sufficient" anomaly.

Outlier analysis may identify valid as well as invalid data. Invalid outliers are the target of outlier analysis, as they represent errors in the data. On the other hand, valid outliers may appear to be outside the norm, but investigation demonstrates that the data are not in error. Valid outliers may occur due to random variation, which occurs due to chance and is inherent in a system.

Question 2: Why Is Outlier Analysis Important for Data Validity and Reliability?

Outlier analysis is primarily important because it helps to identify errors in the data, which, when investigated, may reveal systematic errors in data collection, coding, or entry. **Invalid outliers should be corrected, and the processes that resulted in such errors should be fixed**.

Outlier analysis also can be important because it may identify LEAs that are performing better or worse than the norm. Identifying these high or low performers provides opportunities for understanding the factors behind high performance or providing targeted TA where it is needed.

Question 3: What Action Should States Take After Conducting an Outlier Analysis?

After conducting an outlier analysis, states should investigate any identified outliers to understand why the data are so different from the norm. If the data are outside the parameters states set for valid outliers, then states should follow up with the LEAs to determine the root cause of the outlying data. Questions to focus outlier investigations[1] follow.

1. Are the outliers found in just one LEA?

Knowing that all outliers are found in just one LEA can help state personnel focus their investigation into the cause of outliers.

2. Are the same LEAs identified with outliers in more than one data submission

State personnel may want to review LEAs that have outlier data in more than one data submission. The outliers may indicate a need for the LEA to review the data entry or coding policies. They also may indicate that the LEA lacks understanding of the data that the data submissions require.

3. Are multiple outliers commonly identified in the same LEAs?

If an outlier analysis reveals multiple outliers commonly identified in the same LEAs, state personnel may want to review the similarities in demographics or data collection practices in these LEAs or both.

[1] The Office of Elementary and Secondary Education (OESE) compiled a list of possible causes of data quality problems related to the *Elementary and Secondary Education Act* (ESEA) and other data reporting. States can review the list to help determine areas of data quality that the outlier analysis affects (U.S. Department of Education 2006).

4. Are the LEAs with outliers using non-standard data collection definitions?

State personnel may want to review the definitions LEAs use to ensure that, within the state context, the LEAs understand and use the definitions the Office of Special Education Programs (OSEP) provides for the IDEA 618 data collections. For example, outliers in the discipline data could be due to an LEA's interpretation of the terms "suspension" and "expulsion."

5. Are the LEAs with outliers using non-standard methods for aggregating the data?

States that collect aggregated data from LEAs may want to review the methods LEAs use to aggregate student-level data to create totals. Inconsistencies in how LEAs aggregate data could lead to outliers. For example, the state education agency (SEA) may want to review the methods LEAs use to aggregate the number of students with disabilities by race/ethnicity to ensure that the LEAs appropriately count each child in the seven categories OSEP requires.

6. Are the LEAs with outliers using non-standard methods to collect the data?

State personnel may want to review whether LEAs are using similar, standard policies and procedures for collecting the data. For example, this can include ensuring that all LEAs use the U.S. Department of Education's race/ethnicity guidelines. It also could include ensuring all locals define suspension and expulsion consistently.

7. Did the small *n*-size affect the analysis?

States can analyze *n* size in two different ways. The *n* size can skew the results of the analysis. If an LEA has a small population, then it may lead to outliers because of the proportion of the population to the rest of the state's LEAs. To investigate if this scenario has occurred, users would disaggregate the data and determine if they are sensible based on the local small populations. The second scenario can lead to outliers when reporting IDEA data. States can review the *n* size used to calculate the Annual Performance Report (APR) for Part B Indicator B4 around discipline and significant discrepancy to determine if outliers have skewed the results of the analyses.

For more information on examining root cause, states can review *Equity, Inclusion, and Opportunity: Addressing Success Gaps, White Paper.*

Question 4: How Can States Conduct and Display an Outlier Analysis?

States can use several possible approaches to conduct an outlier analysis. The *IDEA Data Quality: Outlier Analyses Tool* provides assistance with automatic calculation of an outlier analysis. State staff who want to calculate their outlier analysis using their databases and/or programs can use this step-by-step guide instead.

There is no single right way to do an outlier analysis. Staff need to choose an approach and be systematic.

This guide provides six different tutorials covering different methods states can use to identify and visualize outliers. Five of the six tutorials explain approaches using Microsoft Excel. The sixth approach uses Tableau to visualize outliers. Staff should pick the method, or methods, that make the most sense to them.

Identifying an Outlier

Identifying an outlier starts with a simple question, "What Is Normal?" The six tutorials in this guide can help state staff define what is normal and use data visualization to make identified outliers more noticeable.

Outliers are the numbers outside of a range of data considered normal. The following three tutorials present different ways of identifying what is normal:

- Tutorial 1: Systematically Determining What Is Normal Using the Interquartile Range
- Tutorial 2: Qualitatively Defining a Normal Range
- Tutorial 3: Simply Sorting

Data visualization can help support outlier analyses by making identified outliers more noticeable. The following three tutorials present visual approaches that pair well with any of the first three approaches to calculating outlier analysis.

- Tutorial 4: Heat Maps in Excel
- Tutorial 5: Dot Plots in Excel
- Tutorial 6: Dot Plots in Tableau

A Range of Normal

As stated previously, outliers are the numbers outside of a range of data that state staff identified as normal. Here are a few ways to define a normal range.

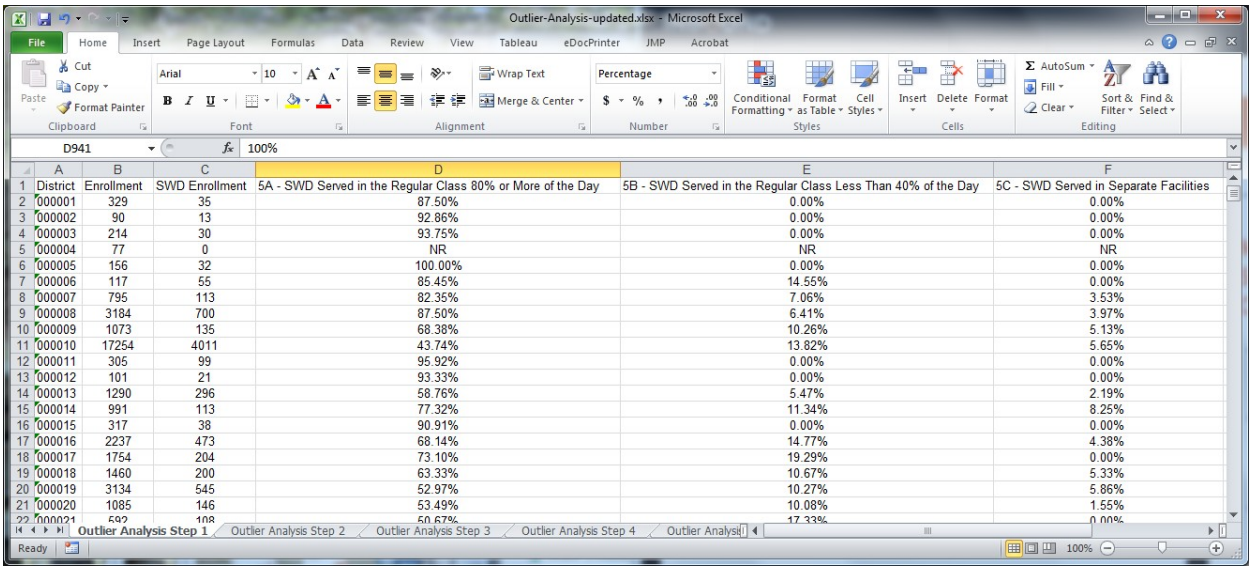
(Note: Within this section, the guide refers to the edges of the normal range as Upper and Lower Fences.)

Tutorial 1: Systematically Determining What Is Normal Using the Interquartile Range

Tutorial 1 is the typical statistical approach to defining what is normal. This approach uses an easy-to- calculate "interquartile range" to identify a normal range for a provided series of data. This series could be data from across all LEAs in a state for a single measure. Most likely, state staff will analyze a distribution within a single column in Excel.

Step 1.

To start, staff will need an Excel workbook with at least two columns of data. The following example uses district-level Indicator B5 data.



	A	B	C	D	E	F
1	District	Enrollment	SWD Enrollment	5A - SWD Served in the Regular Class 80% or More of the Day	5B - SWD Served in the Regular Class Less Than 40% of the Day	5C - SWD Served in Separate Facilities
2	000001	329	35	87.50%	0.00%	0.00%
3	000002	90	13	92.86%	0.00%	0.00%
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5	000004	77	0	NR	NR	NR
6	000005	156	32	100.00%	0.00%	0.00%
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8	000007	795	113	82.35%	7.06%	3.53%
9	000008	3184	700	87.50%	6.41%	3.97%
10	000009	1073	135	68.38%	10.26%	5.13%
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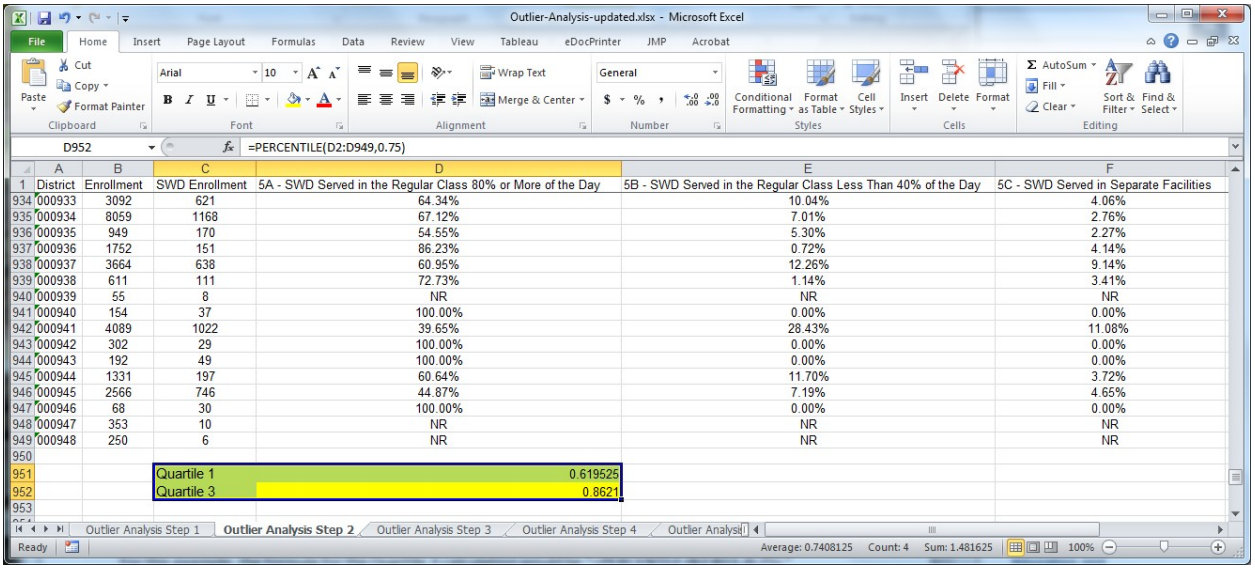
12	000011	305	99	95.92%	0.00%	0.00%
13	000012	101	21	93.33%	0.00%	0.00%
14	000013	1290	296	58.76%	5.47%	2.19%
15	000014	991	113	77.32%	11.34%	8.25%
16	000015	317	38	90.91%	0.00%	0.00%
17	000016	2237	473	68.14%	14.77%	4.38%
18	000017	1754	204	73.10%	19.29%	0.00%
19	000018	1460	200	63.33%	10.67%	5.33%
20	000019	3134	545	52.97%	10.27%	5.86%
21	000020	1085	146	53.49%	10.08%	1.55%
22	000021	592	108	50.67%	17.33%	0.00%

Step 2.

The first calculations are for the first and third quartiles, using the following formulas in Excel: "=PERCENTILE(<Cell Range>,0.25)" AND "=PERCENTILE(<Cell Range>,0.75)"; staff should just replace <Cell Range> with the range of values they are checking.

For this example, the formula for the Quartile 1 calculation would be "=PERCENTILE(D2:D949,0.25)," and the Quartile 3 calculation would be "=PERCENTILE(D2:D949,0.75)."



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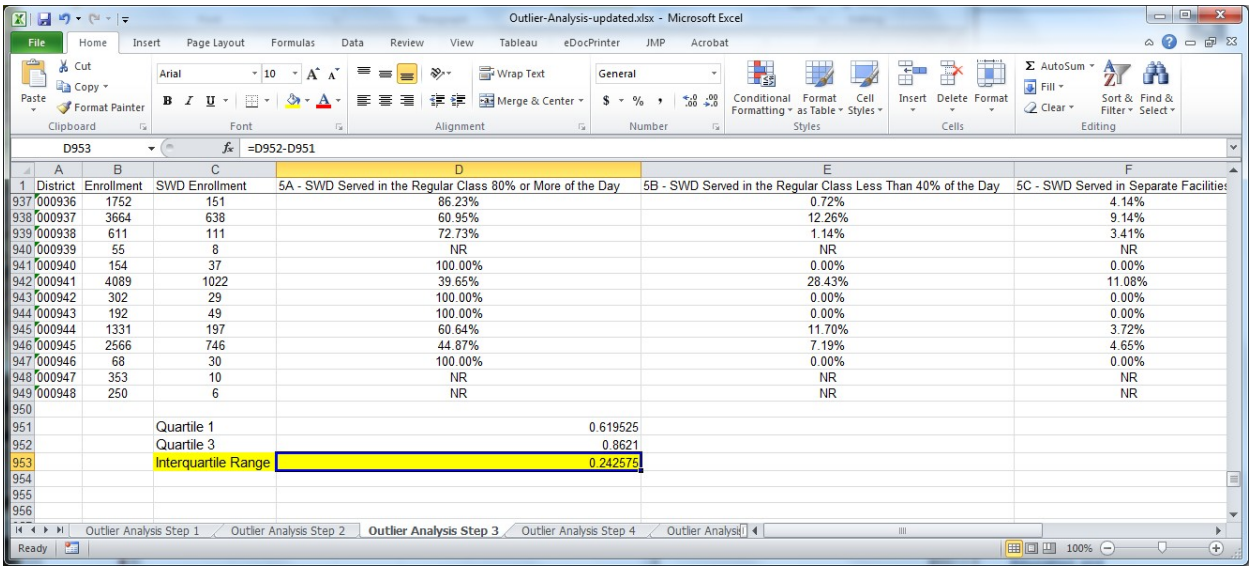
934	000933	3092	621	64.34%	10.04%	4.06%
935	000934	8059	1168	67.12%	7.01%	2.76%
936	000935	949	170	54.55%	5.30%	2.27%
937	000936	1752	151	86.23%	0.72%	4.14%
938	000937	3664	638	60.95%	12.26%	9.14%
939	000938	611	111	72.73%	1.14%	3.41%
940	000939	55	8	NR	NR	NR
941	000940	154	37	100.00%	0.00%	0.00%
942	000941	4089	1022	39.65%	28.43%	11.08%
943	000942	302	29	100.00%	0.00%	0.00%
944	000943	192	49	100.00%	0.00%	0.00%
945	000944	1331	197	60.64%	11.70%	3.72%
946	000945	2566	746	44.87%	7.19%	4.65%
947	000946	68	30	100.00%	0.00%	0.00%
948	000947	353	10	NR	NR	NR
949	000948	250	6	NR	NR	NR
950						
951			Quartile 1	0.619525		
952			Quartile 3	0.8621		
953						

Step 3.

Next, staff should calculate the interquartile range, which is simply Quartile 3-Quartile 1. In this example, the formula would be "=D952-D951."



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941	000940	154	37	100.00%	0.00%	0.00%
942	000941	4089	1022	39.65%	28.43%	11.08%
943	000942	302	29	100.00%	0.00%	0.00%
944	000943	192	49	100.00%	0.00%	0.00%
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946	000945	2566	746	44.87%	7.19%	4.65%
947	000946	68	30	100.00%	0.00%	0.00%
948	000947	353	10	NR	NR	NR
949	000948	250	6	NR	NR	NR
950						
951			Quartile 1	0.619525		
952			Quartile 3	0.8621		
953			Interquartile Range	0.242575		
954						
955						
956						

Step 4.

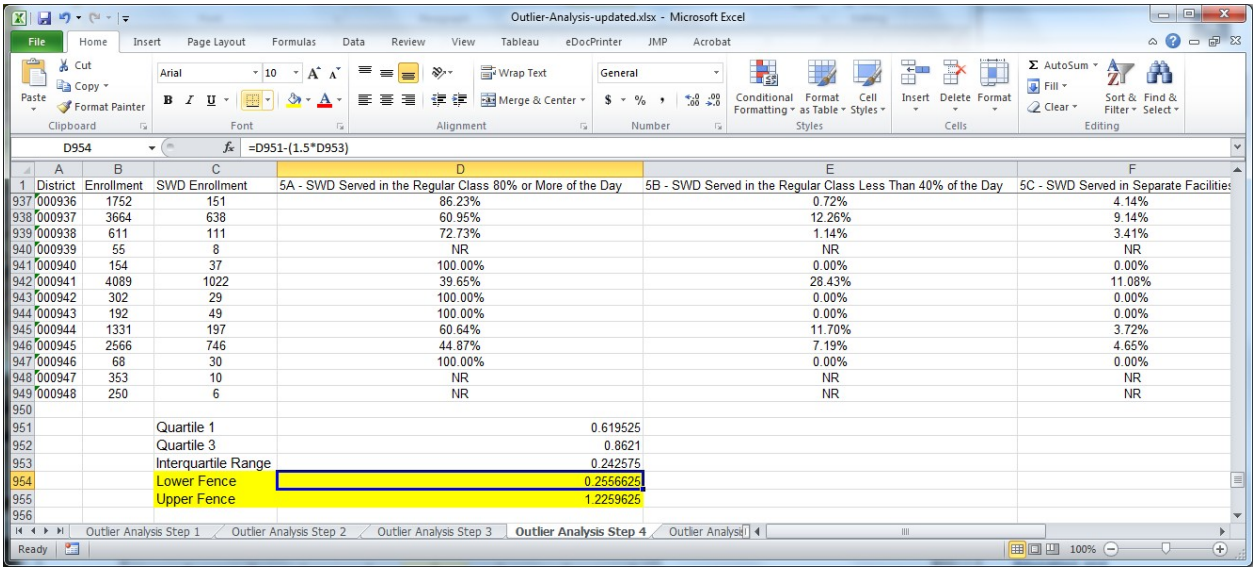
Using the interquartile range (IQR), staff should come up with a "normal range" by setting up fences. The Lower Fence is the bottom of the range, and the Upper Fence is the top.

Calculate the Lower Fence by subtracting 1.5 times the interquartile range from Quartile 1. [Lower Fence = Quartile 1 – (1.5 * IQR)]

Calculate the Upper Fence by adding 1.5 times the interquartile range to Quartile 3.
[Upper Fence = Quartile 3 + (1.5 * IQR)]

In this example, the formula for the Lower Fence would be "=D951-(1.5*D953)," and the formula for the Upper Fence would be "=D952+(1.5*D953)."

[Note: This is subjective. To create a larger range (fewer outliers), staff should multiply by a larger number than 1.5 (maybe 2 or 3). To create a smaller range, staff should not use a multiplier at all. If staff do not use a multiplier, the definition of the percentile indicates that staff will identify about half of their data points.]



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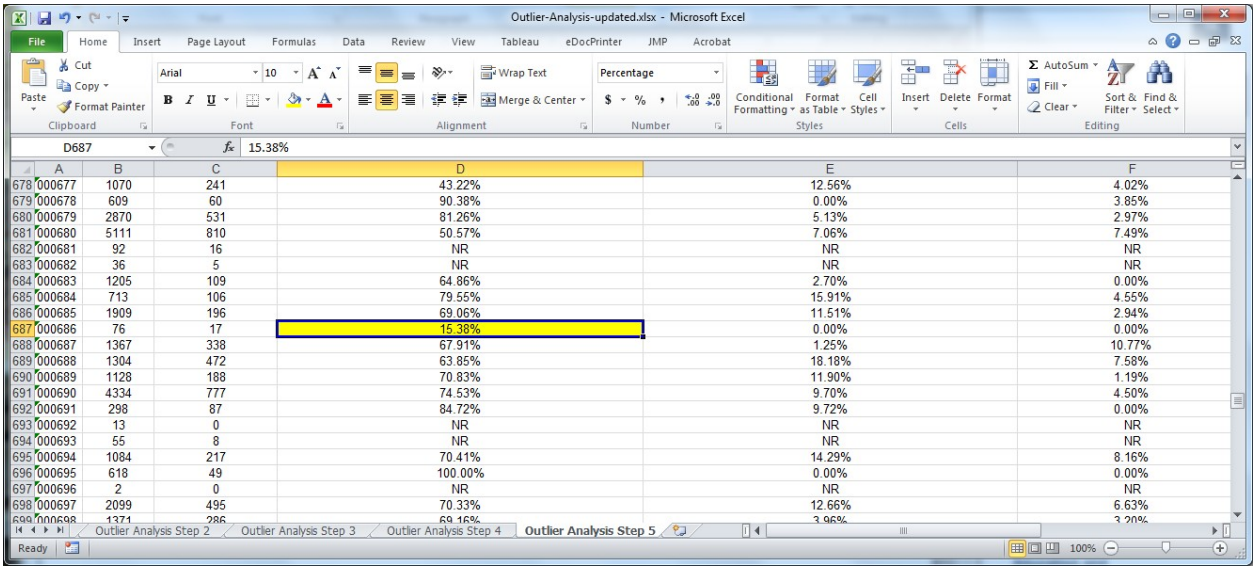
948	000947	353	10	NR	NR	NR
949	000948	250	6	NR	NR	NR
950						
951			Quartile 1	0.619525		
952			Quartile 3	0.8621		
953			Interquartile Range	0.242575		
954			Lower Fence	0.2556625		
955			Upper Fence	1.2259625		
956						

Step 5.

Once the Lower and Upper Fences are known, state staff can identify outliers. An outlier would be any number falling below the Lower Fence or above the Upper Fence.

In this example, that would be any number less than 25.6 percent and any number over 122.6 percent. Staff would consider the value of 15.38 percent an outlier because it falls below 25.6 percent.

(Note: With data that are widely dispersed, it is likely that the Lower Fence could be a negative number or the Upper Fence could fall outside of the possible range of values. Staff could interpret a negative Lower Fence as having no Lower Fence with no low outliers.)

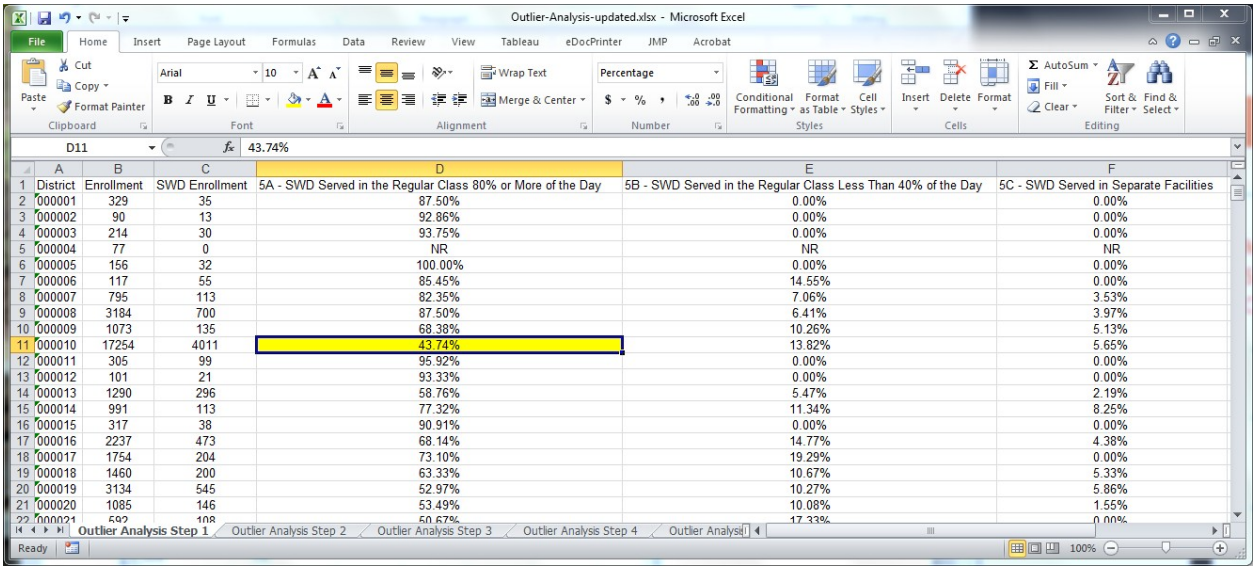


	A	B	C	D	E	F
678	000677	1070	241	43.22%	12.56%	4.02%
679	000678	609	60	90.38%	0.00%	3.85%
680	000679	2870	531	81.26%	5.13%	2.97%
681	000680	5111	810	50.57%	7.06%	7.49%
682	000681	92	16	NR	NR	NR
683	000682	36	5	NR	NR	NR
684	000683	1205	109	64.86%	2.70%	0.00%
685	000684	713	106	79.55%	15.91%	4.55%
686	000685	1909	196	69.06%	11.51%	2.94%
687	000686	76	17	15.38%	0.00%	0.00%
688	000687	1367	338	67.91%	1.25%	10.77%
689	000688	1304	472	63.85%	18.18%	7.58%
690	000689	1128	188	70.83%	11.90%	1.19%
691	000690	4334	777	74.53%	9.70%	4.50%
692	000691	298	87	84.72%	9.72%	0.00%
693	000692	13	0	NR	NR	NR
694	000693	55	8	NR	NR	NR
695	000694	1084	217	70.41%	14.29%	8.16%
696	000695	618	49	100.00%	0.00%	0.00%
697	000696	2	0	NR	NR	NR
698	000697	2099	495	70.33%	12.66%	6.63%

Tutorial 2: Qualitatively Defining a Normal Range

Another way to identify outliers would be to use qualitative information. State staff can identify the numbers that seem out of place given what they know about their state's data, or they can ask colleagues about their own expectations based on experience. Staff should determine a range that seems to make sense, then look at the data.

Turning to the last example, let's say that after speaking with colleagues, staff determined that they should look further at districts if the districts had any less than 50 percent for Indicator B5A. Staff should just go ahead and identify those cases.



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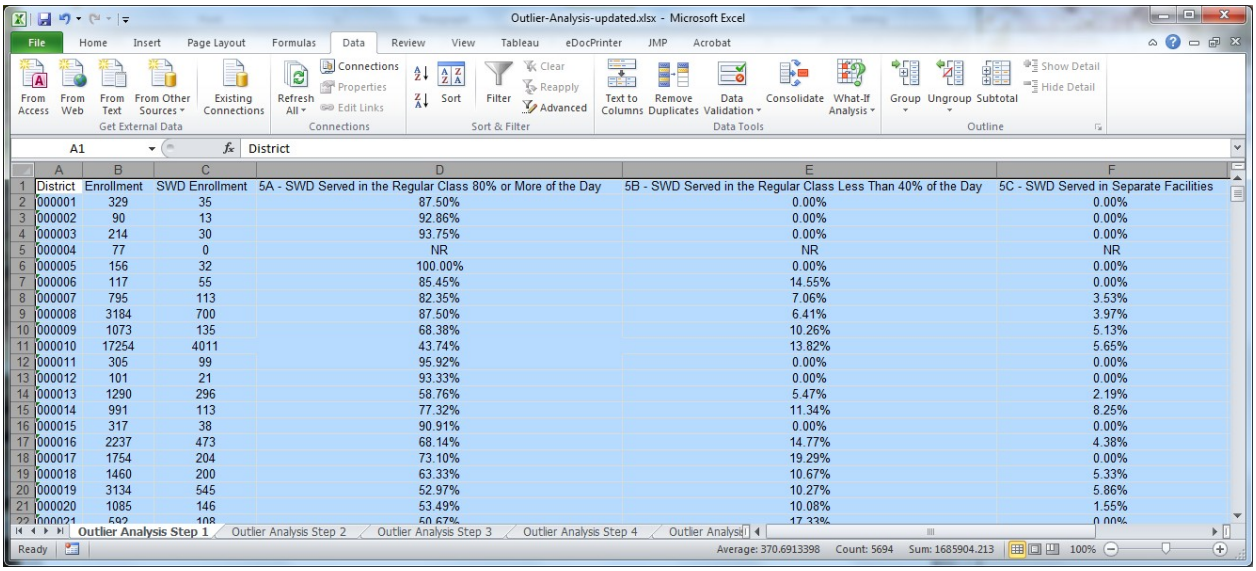
19	000018	1460	200	63.33%	10.67%	5.33%
20	000019	3134	545	52.97%	10.27%	5.86%
21	000020	1085	146	53.49%	10.08%	1.55%
22	000021	592	108	50.67%	17.33%	0.00%

Tutorial 3: Simply Sorting

Sometimes the easiest way to do an analysis would be simply to sort the data. The goal of an outlier analysis is not to support statistical analyses but, rather, to identify potential data issues. There is no harm in singling out data that staff would usually consider part of a normal range.

Step 1.

Staff should highlight their range of data.



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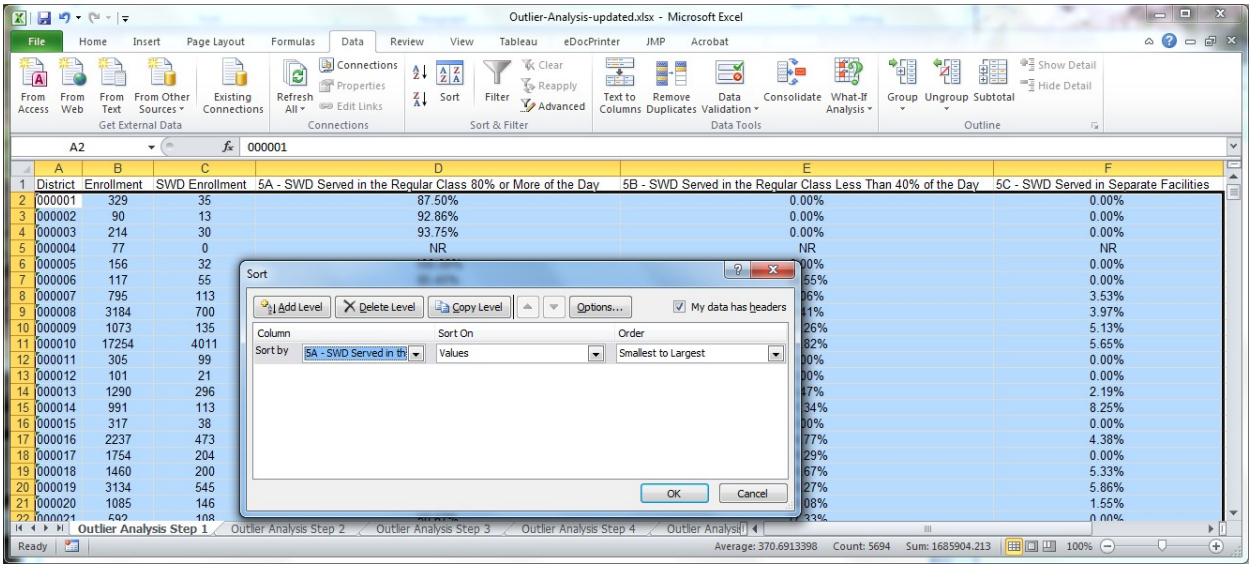
000017	1754	204	73.10%	19.29%	0.00%
000018	1460	200	63.33%	10.67%	5.33%
000019	3134	545	52.97%	10.27%	5.86%
000020	1085	146	53.49%	10.08%	1.55%

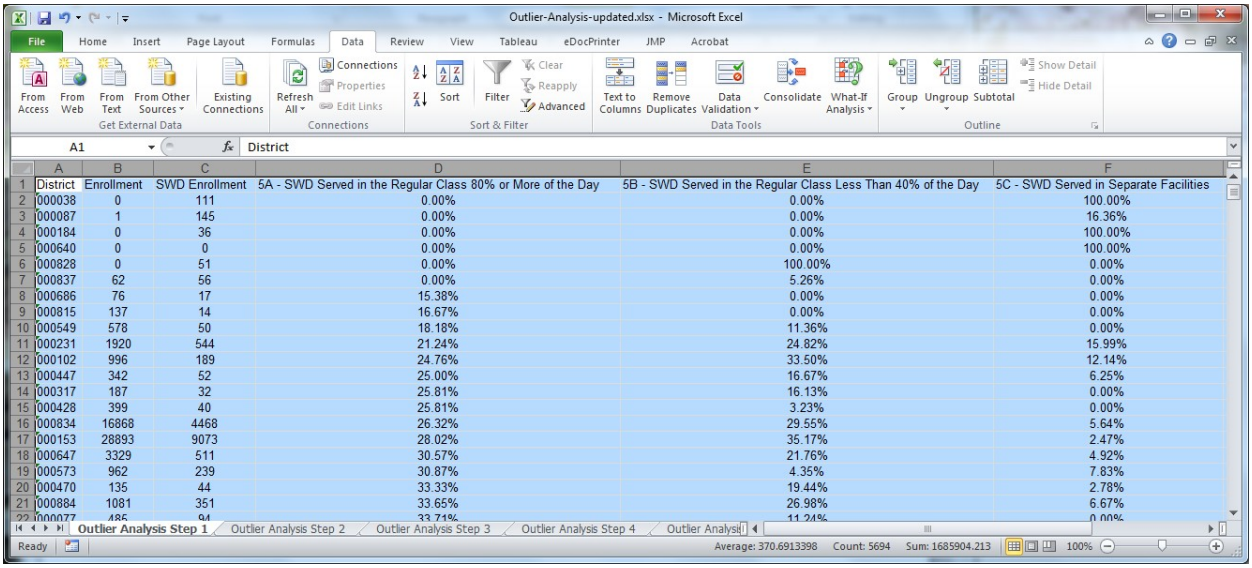
Step 2.

Staff should sort by the measure.



Step 3.

Staff should look more deeply into the values at the top and bottom of the sort.



	A	B	C	D	E	F
1	District	Enrollment	SWD Enrollment	5A - SWD Served in the Regular Class 80% or More of the Day	5B - SWD Served in the Regular Class Less Than 40% of the Day	5C - SWD Served in Separate Facilities
2	000038	0	111	0.00%	0.00%	100.00%
3	000087	1	145	0.00%	0.00%	16.36%
4	000184	0	36	0.00%	0.00%	100.00%
5	000640	0	0	0.00%	0.00%	100.00%
6	000828	0	51	0.00%	100.00%	0.00%
7	000837	62	56	0.00%	5.26%	0.00%
8	000686	76	17	15.38%	0.00%	0.00%
9	000815	137	14	16.67%	0.00%	0.00%
10	000549	578	50	18.18%	11.36%	0.00%
11	000231	1920	544	21.24%	24.82%	15.99%
12	000102	996	189	24.76%	33.50%	12.14%
13	000447	342	52	25.00%	16.67%	6.25%
14	000317	187	32	25.81%	16.13%	0.00%
15	000428	399	40	25.81%	3.23%	0.00%
16	000834	16868	4468	26.32%	29.55%	5.64%
17	000153	28893	9073	28.02%	35.17%	2.47%
18	000647	3329	511	30.57%	21.76%	4.92%
19	000573	962	239	30.87%	4.35%	7.83%
20	000470	135	44	33.33%	19.44%	2.78%
21	000884	1081	351	33.65%	26.98%	6.67%
22	000077	485	94	33.71%	11.24%	0.00%

Data Visualization Support for Outlier Analyses

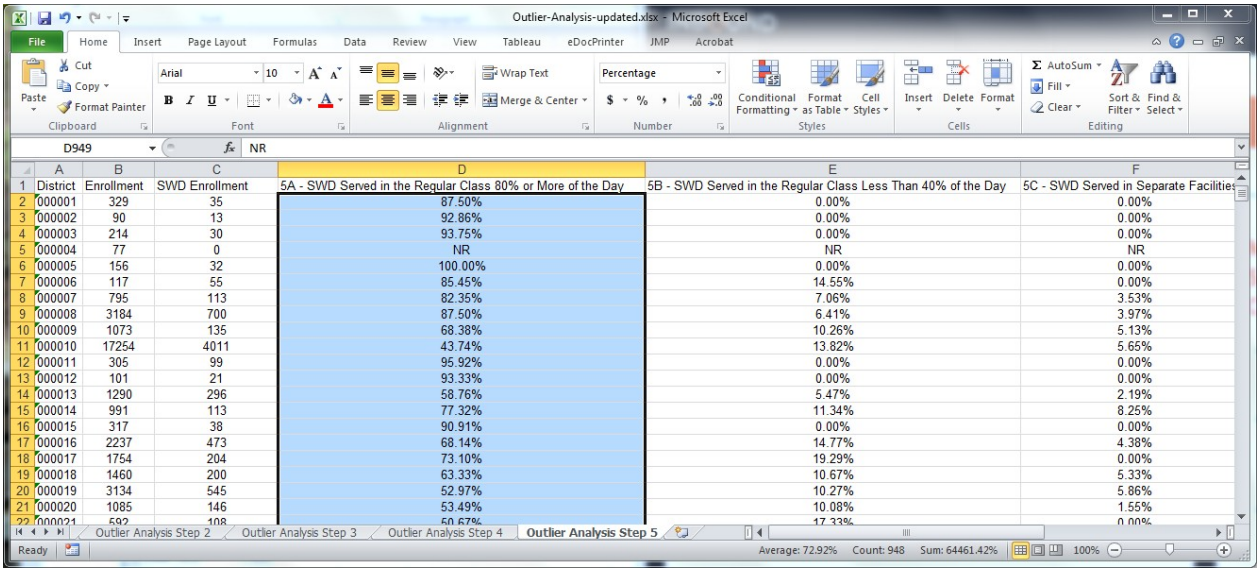
Data visualization can help support outlier analyses by making identified outliers more noticeable. Here are a few ways state staff can use data visualization to support their outlier analyses.

Tutorial 4: Heat Maps in Excel

By using conditional formatting in conjunction with the approaches shown previously, staff can make outliers stand out. This can be particularly important when there are multiple columns of data or many rows.

Step 1.

Staff should highlight the range of data and click on the *Conditional Formatting* button in the *Home* tab.

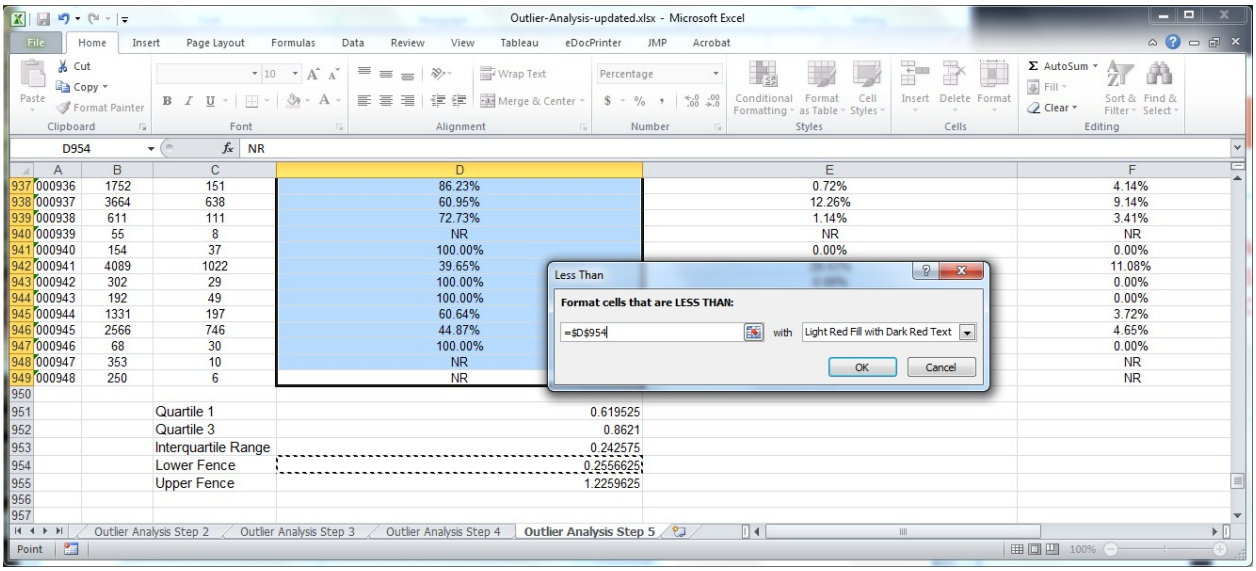


	A	B	C	D	E	F
1	District	Enrollment	SWD Enrollment	5A - SWD Served in the Regular Class 80% or More of the Day	5B - SWD Served in the Regular Class Less Than 40% of the Day	5C - SWD Served in Separate Facilities
2	000001	329	35	87.50%	0.00%	0.00%
3	000002	90	13	92.86%	0.00%	0.00%
4	000003	214	30	93.75%	0.00%	0.00%
5	000004	77	0	NR	NR	NR
6	000005	156	32	100.00%	0.00%	0.00%
7	000006	117	55	85.45%	14.55%	0.00%
8	000007	795	113	82.35%	7.06%	3.53%
9	000008	3184	700	87.50%	6.41%	3.97%
10	000009	1073	135	68.38%	10.26%	5.13%
11	000010	17254	4011	43.74%	13.82%	5.65%
12	000011	305	99	95.92%	0.00%	0.00%
13	000012	101	21	93.33%	0.00%	0.00%
14	000013	1290	296	58.76%	5.47%	2.19%
15	000014	991	113	77.32%	11.34%	8.25%
16	000015	317	38	90.91%	0.00%	0.00%
17	000016	2237	473	68.14%	14.77%	4.38%
18	000017	1754	204	73.10%	19.29%	0.00%
19	000018	1460	200	63.33%	10.67%	5.33%
20	000019	3134	545	52.97%	10.27%	5.86%
21	000020	1085	146	53.49%	10.08%	1.55%
22	000021	592	108	50.67%	17.33%	0.00%

Step 2.

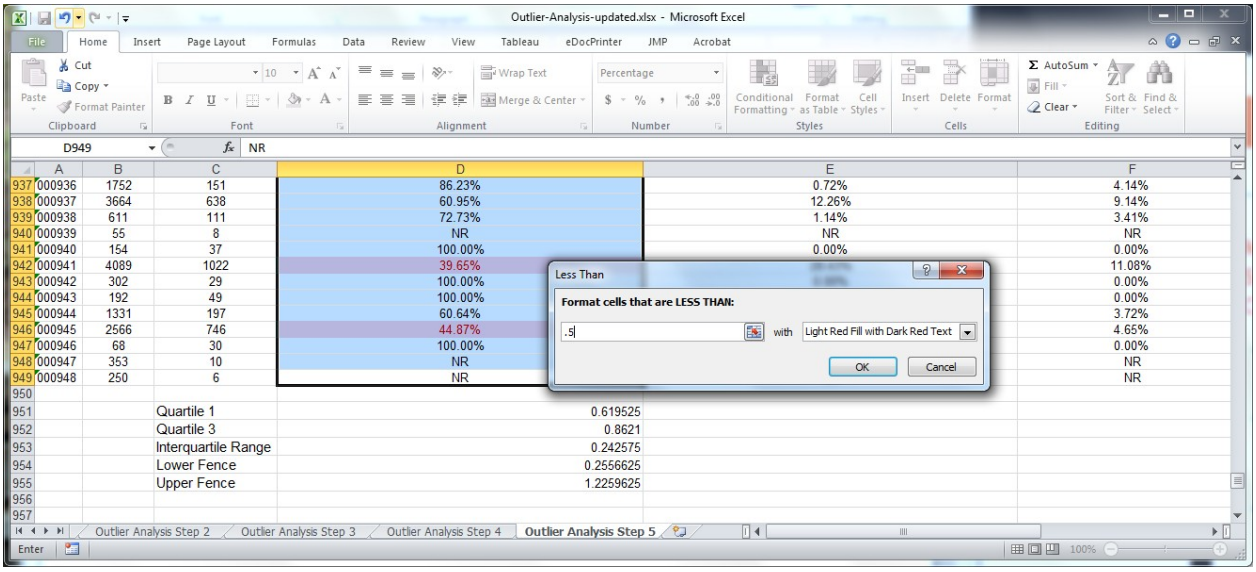
If staff determined the normal range by using the interquartile range, they should select *Highlight Cells Rules*, then select *Less Than*. In the box that asks for a number, they should enter the cell location of the Lower Fence value. They also can adjust the format (color/font/additional symbols).

Staff should do the same for the Upper Fence but use *Greater Than*.



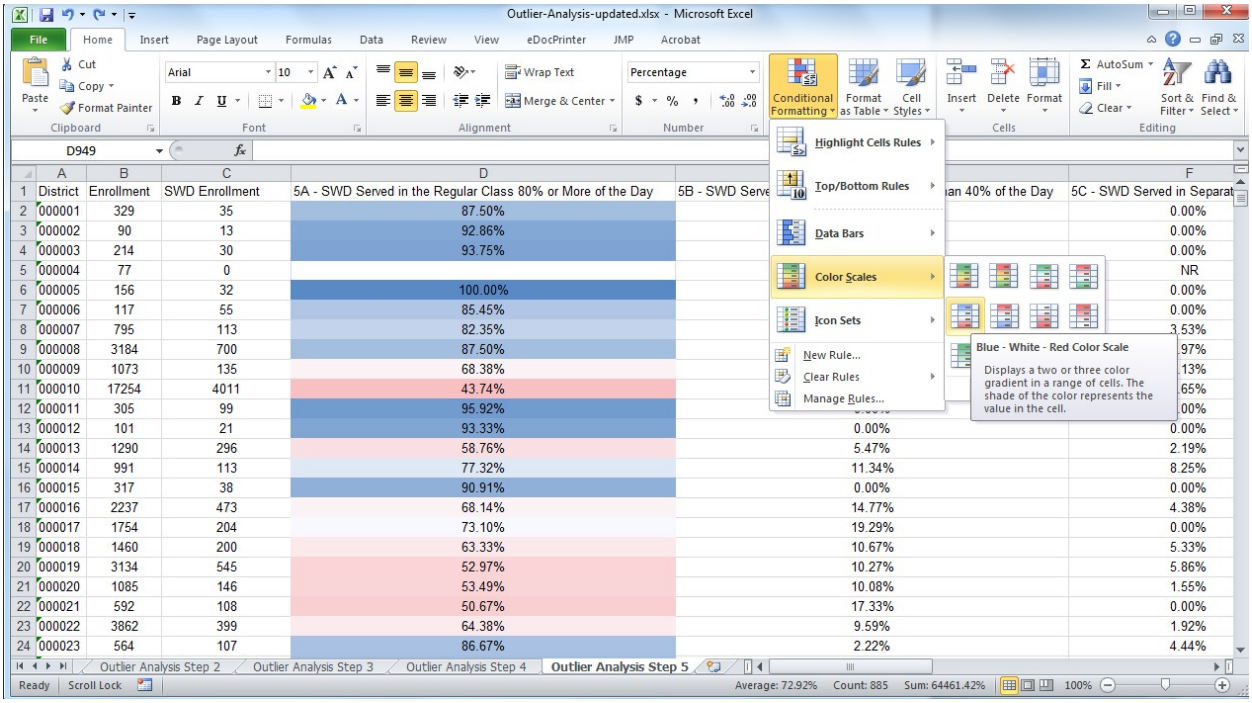
Step 3.

If staff determined the normal range using a qualitative approach, they should follow the same instructions as in Step 2. They should enter the number directly into the *LESS THAN* box or place the Lower Fence value into a cell in the worksheet and refer to that.



Alternative Quick Heat Maps

A quicker approach to using heat maps in Excel is using the *Color Scales* feature found under the *Conditional Formatting* drop-down menu. This will automatically color a set of selected cells based on the range of values. Staff also can use data bars and icon sets to identify possible outliers quickly.



	A	B	C	D	E	F
1	District	Enrollment	SWD Enrollment	5A - SWD Served in the Regular Class 80% or More of the Day	5B - SWD Serve	5C - SWD Served in Separat
2	000001	329	35	87.50%		0.00%
3	000002	90	13	92.86%		0.00%
4	000003	214	30	93.75%		0.00%
5	000004	77	0			NR
6	000005	156	32	100.00%		0.00%
7	000006	117	55	85.45%		0.00%
8	000007	795	113	82.35%		3.53%
9	000008	3184	700	87.50%		.97%
10	000009	1073	135	68.38%		.13%
11	000010	17254	4011	43.74%		.65%
12	000011	305	99	95.92%		.00%
13	000012	101	21	93.33%	0.00%	0.00%
14	000013	1290	296	58.76%	5.47%	2.19%
15	000014	991	113	77.32%	11.34%	8.25%
16	000015	317	38	90.91%	0.00%	0.00%
17	000016	2237	473	68.14%	14.77%	4.38%
18	000017	1754	204	73.10%	19.29%	0.00%
19	000018	1460	200	63.33%	10.67%	5.33%
20	000019	3134	545	52.97%	10.27%	5.86%
21	000020	1085	146	53.49%	10.08%	1.55%
22	000021	592	108	50.67%	17.33%	0.00%
23	000022	3862	399	64.38%	9.59%	1.92%
24	000023	564	107	86.67%	2.22%	4.44%

Tutorial 5: Dot Plots in Excel

Another approach to identifying outliers involves visualizing the data. An easy approach is using an in-cell formula that will create a simple dot plot next to the data. Once the formula creates the plot, staff simply look for data points that do not seem to fit with the others.

By using an Excel formula to create an in-cell chart, dot plots always will remain in line with the data. Excel's standard chart functions also can assist in identifying outliers but, ultimately, the standard chart functions will be disconnected from the original data.

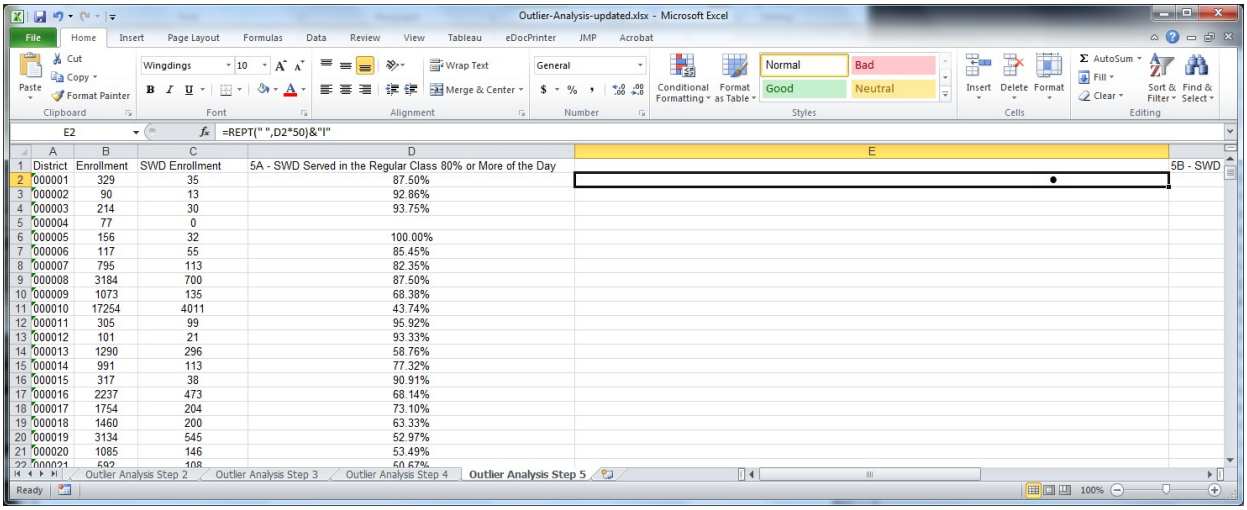
Step 1.

This example uses Excel's REPT function to create this visual. Staff should start by selecting a cell next to the first data point. Basically, staff are instructing Excel to put in a series of repeating blanks based on the data and then add some kind of character at the end.

In this example, the formula looks like this:

=REPT (" ",B2*50)&"l"

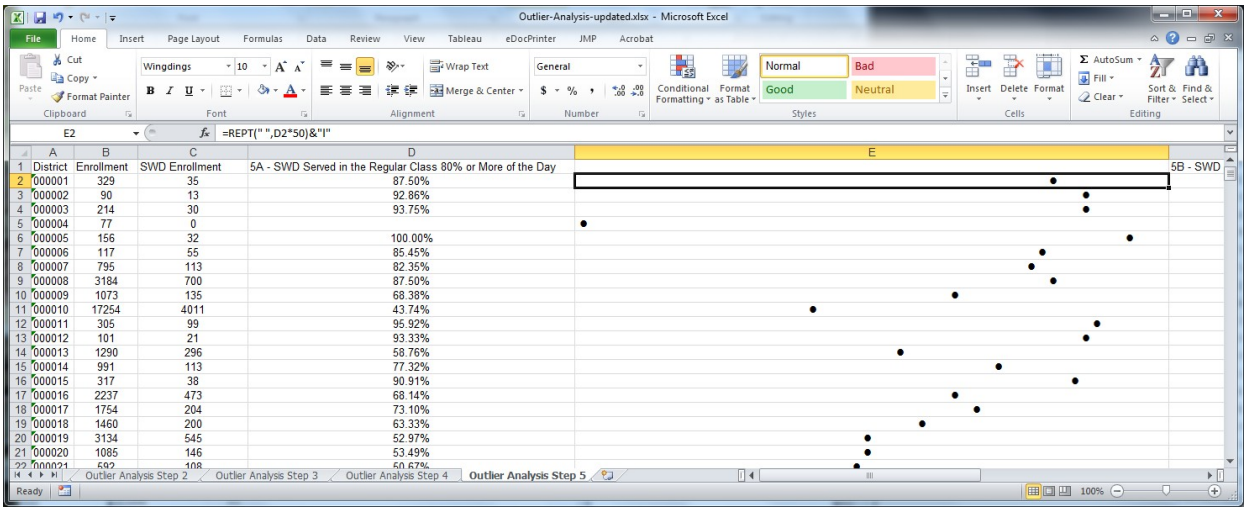
In order to get the dot at the end, staff should use the Wingdings font. The *50 multiplier creates the spacing. If staff desire less spacing, they should use a smaller multiplier.



	A	B	C	D	E
1	District	Enrollment	SWD Enrollment	5A - SWD Served in the Regular Class 80% or More of the Day	5B - SWD
2	000001	329	35	87.50%	
3	000002	90	13	92.86%	
4	000003	214	30	93.75%	
5	000004	77	0		
6	000005	156	32	100.00%	
7	000006	117	55	85.45%	
8	000007	795	113	82.35%	
9	000008	3184	700	87.50%	
10	000009	1073	135	68.38%	
11	000010	17254	4011	43.74%	
12	000011	305	99	95.92%	
13	000012	101	21	93.33%	
14	000013	1290	296	58.76%	
15	000014	991	113	77.32%	
16	000015	317	38	90.91%	
17	000016	2237	473	68.14%	
18	000017	1754	204	73.10%	
19	000018	1460	200	63.33%	
20	000019	3134	545	52.97%	
21	000020	1085	146	53.49%	

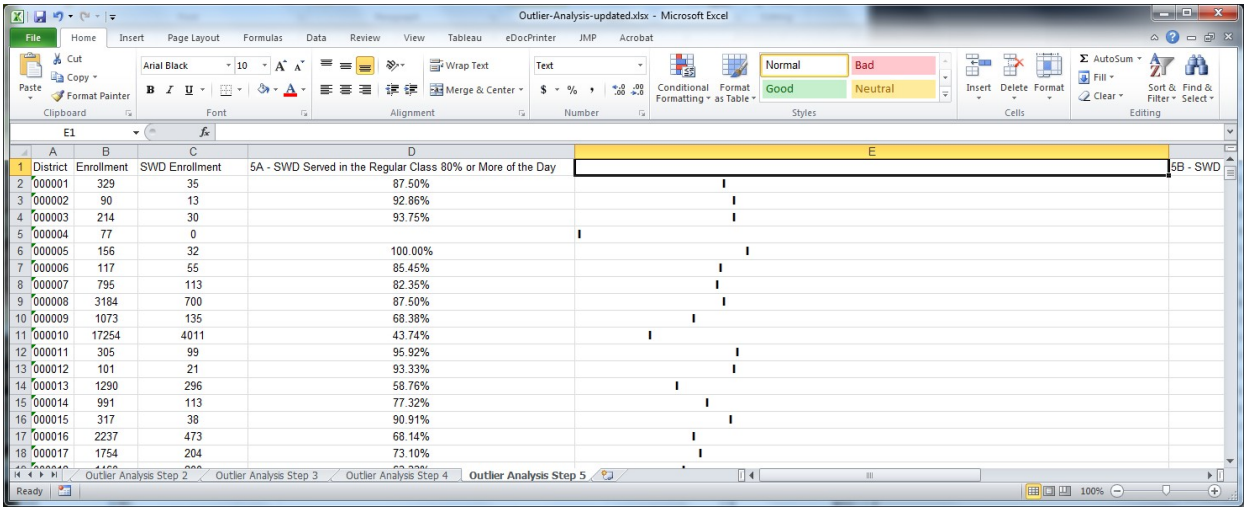
Step 2.

Staff then just need to copy the formula down once they are happy with the look of the first cell. That is all that it takes!



Step 3.

It is easy to change the font or change the character and get a different look. Here is an alternative using the same exact formula with the Arial Black font in 10 point instead of Wingdings. The font change also changes the spacing, so staff should set up cells within the same column using the same font.

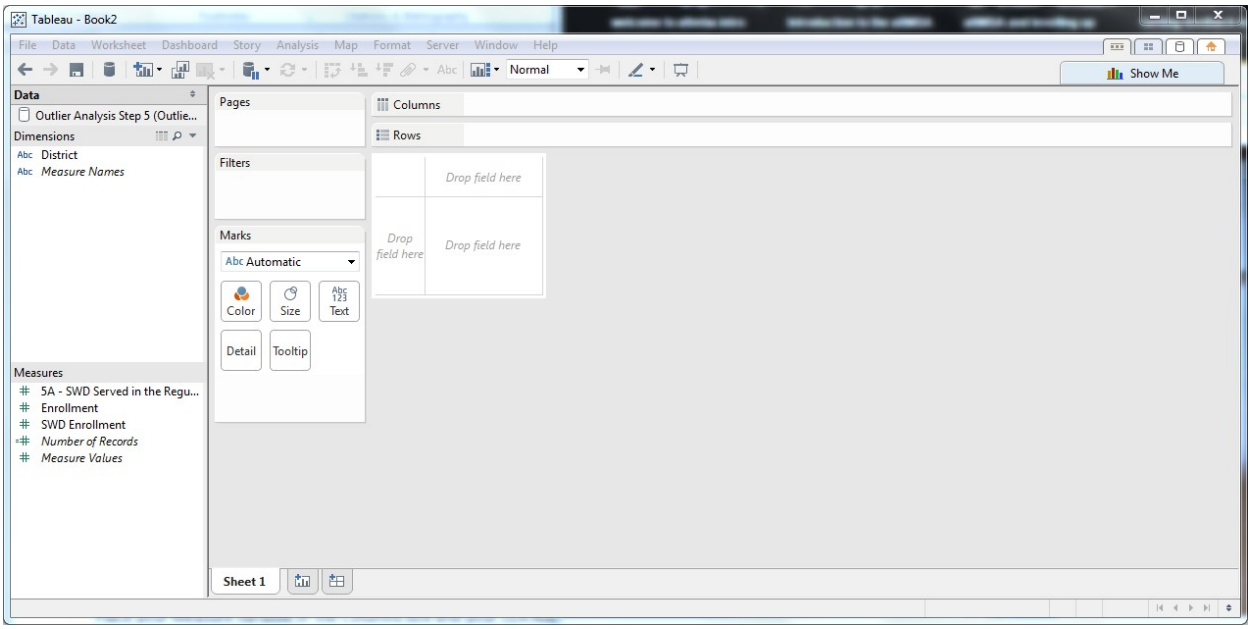


Tutorial 6: Dot Plots in Tableau

Using an interactive visualization program like Tableau can be useful if there is a large amount of data. Such a program allows the user to visualize hundreds of rows and multiple measures quickly and easily. If visualizing public data, state staff can use Tableau Public for free. For private data, staff would need at least a personal version of the Tableau desktop license.

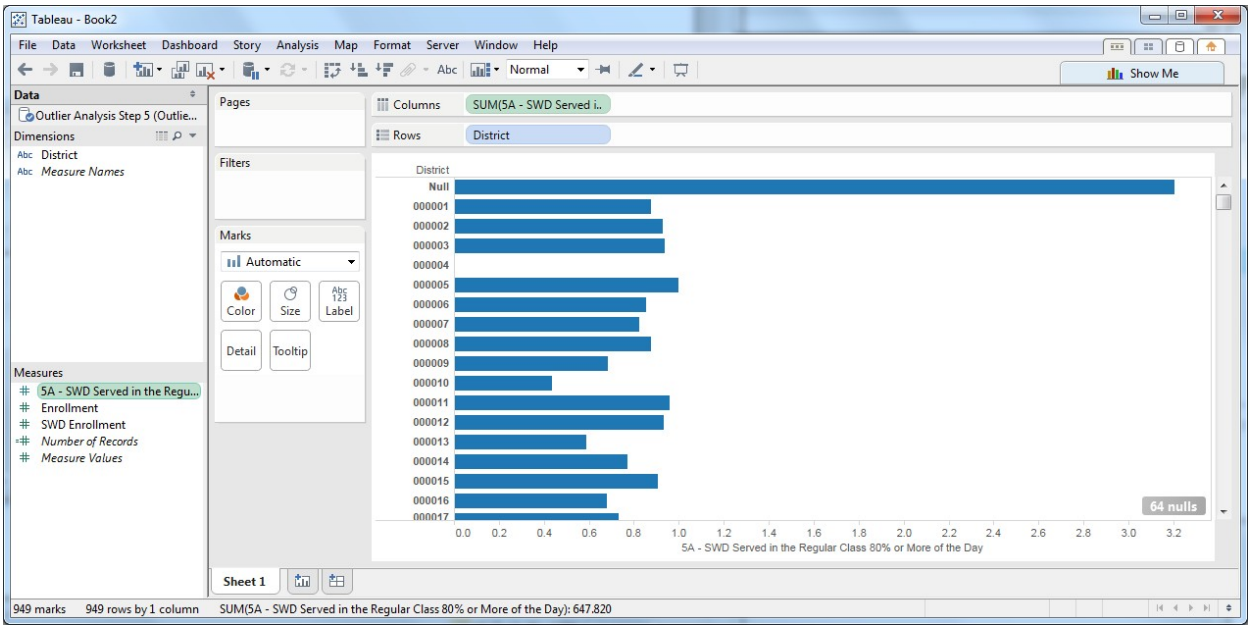
Step 1.

Staff should open the Excel data in Tableau. The measures staff use should be under the *Measures* space in Tableau, and descriptive variables, such as district, should be under *Dimensions*. If this is not the case, staff should right-click on the variable and convert.



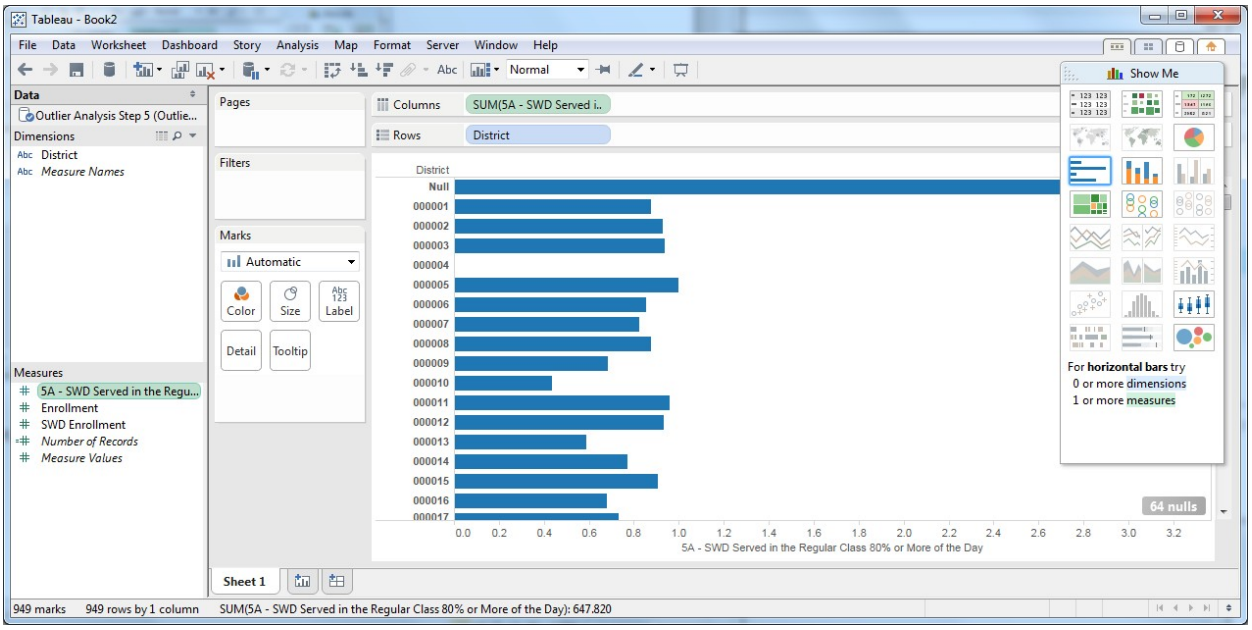
Step 2.

Staff should place the measure variable in the *Columns* box and the district variable in the *Rows* box. The default should be a bar graph. If satisfied with the bar chart, staff should stop here.



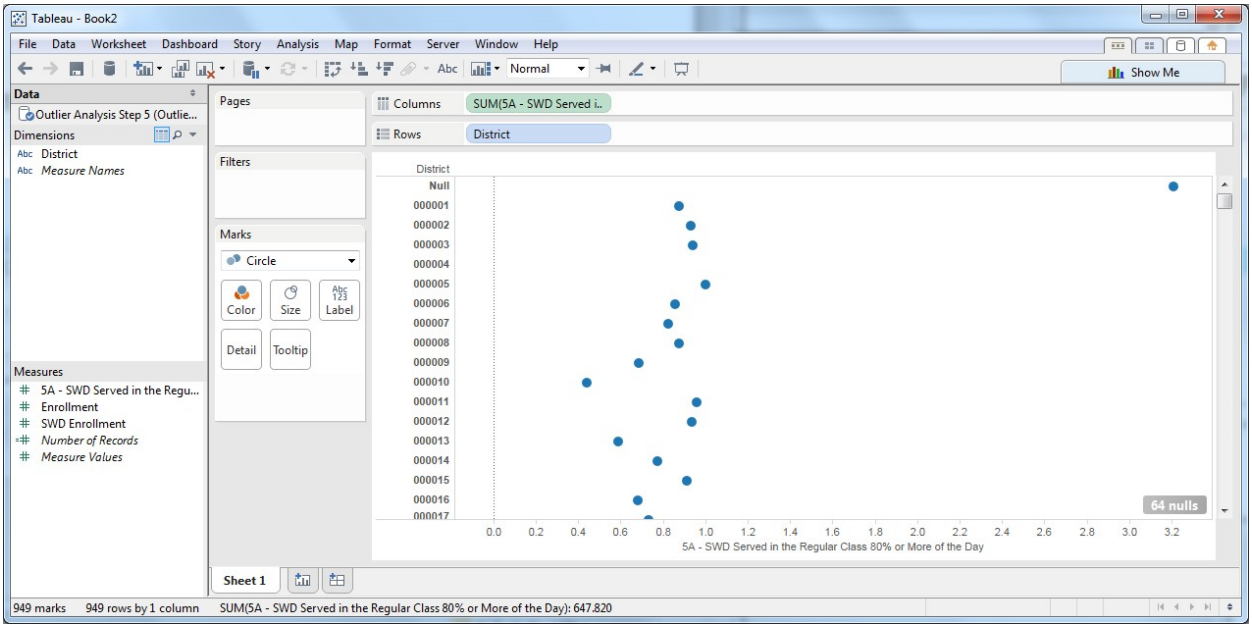
Step 3.

Staff should click on the *Show Me* tab and select the bar chart.



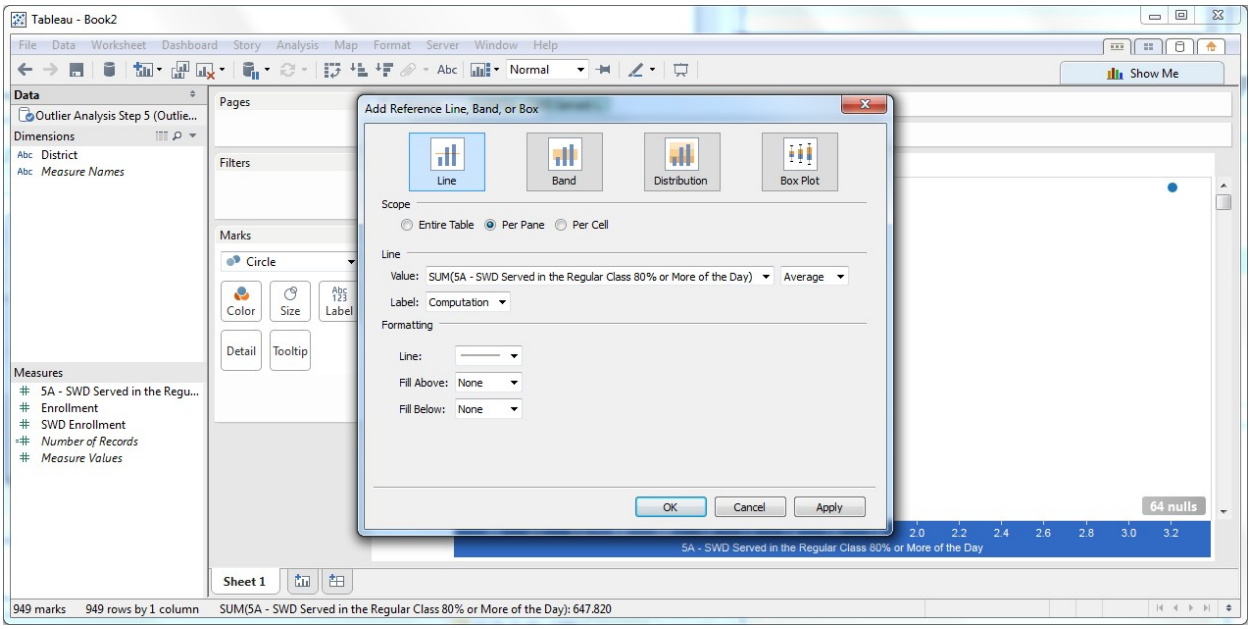
Step 4.

To change to a dot plot, staff should just change the *Marks* from Automatic to Circle.



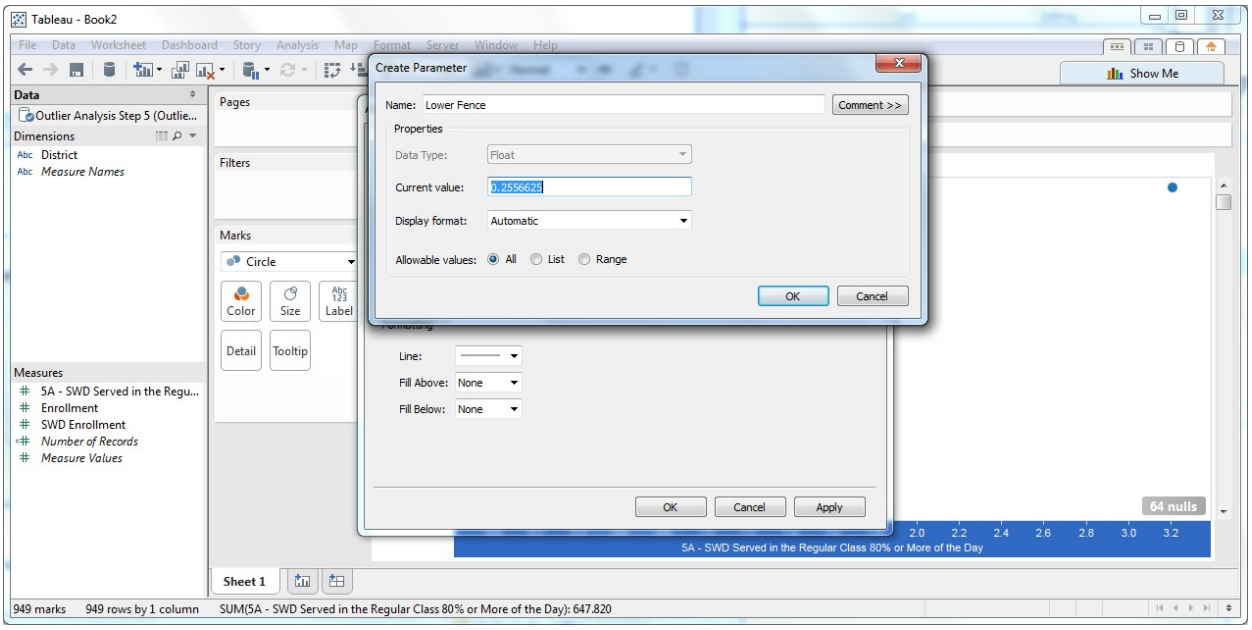
Step 5.

To create a line to identify the Lower and Upper Fences, staff should just right-click on the x-axis and select *Add Reference Line, Band, or Box.* Then, in the *Value* box, select *Create New Parameter.*



Step 6.

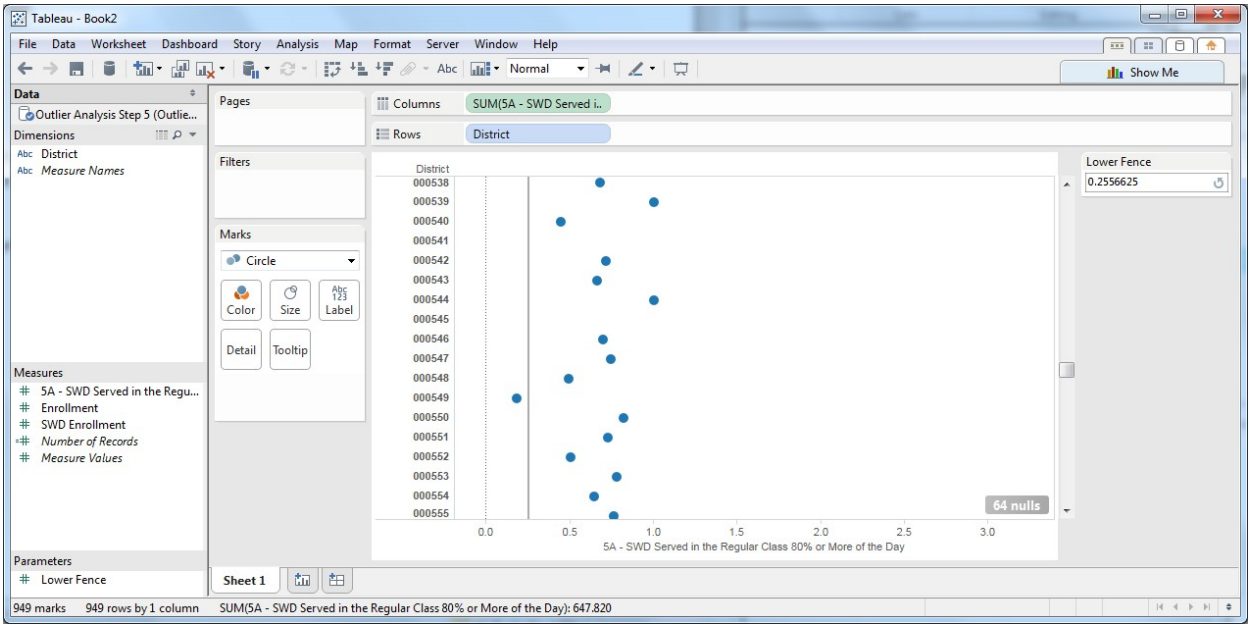
Staff should change the name of the parameter to "Fence" and set the current value as the Lower Fence Value and click *OK*. Then, staff should click *Apply* and *OK*.



Step 7.

To include both the Upper and Lower Fences, staff should just follow the same steps a second time.

Staff also may opt to use the *Parameters* box that the program created on the screen to shift the Fence based on what they are trying to see.



Conclusion

This guide introduces the principles of outlier analysis and includes a handful of approaches state agency staff can use to identify and visualize outliers. There are many others. Staff should find a set of approaches that works well for their state and their data and then apply the approaches systematically.

State staff should visit www.ideadata.org to get in touch with their IDC State Liaison if they have any questions about these approaches.

References

Hawkins, D.M. (1980). *Identification of Outliers*. Netherlands: Springer.

U.S. Department of Education. Office of Elementary and Secondary Education. (2006, April). *Improving Data Quality for Title I Standards, Assessments, and Accountability Reporting: Guidelines for States, LEAs, and Schools*. Retrieved January 3, 2020, from https://www2.ed.gov › guid › standardsassessment › nclbdataguidance