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Technical Brief - Updated July 2026

Significance Testing Using State Health Compare

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State Health Compare

SHADAC's State Health Compare Compare is a free, user-friendly online data tool for obtaining state-level estimates on topics related to health and health care. Analysts and policymakers can use State Health Compare to break down estimates by demographic categories, observe changes and trends over time, generate data visualizations and download data sets.

Click here to visit State Health Compare

Introduction

Though SHADAC and many other health research organizations offer detailed analysis of their own or third-party datasets that include significance testing, there may also be times when researchers and analysts want to conduct their own significance tests. Significance testing can demonstrate, within a certain level of confidence, whether an estimate is statistically different from another estimate. If a significance test shows that there is a statistical difference between two estimates, it is considered **statistically significant**.

There are multiple types of statistical tests that can be used to determine significance; in this technical brief, we will review how users can perform significance testing via a specific type of test known as a "t-test" using data and estimates from SHADAC's data tool "State Health Compare."

For more information about statistical testing and statistical significance, check out SHADAC's basics blog on the topic here.

State Health Compare Provides Margins of Error

In addition to providing state-level estimates related to health and health care from multiple federal surveys, SHADAC's State Health Compare data tool provides information about the margins of error (MOE) for these same estimates. The margin of error for a data point gives information about the (im)precision of an estimate. For practical purposes, it allows the user to say with a specified level of confidence (in this case, a 95% confidence level) that the true population value lies within a certain range of the provided estimate. A larger margin of error indicates a lower level of precision in the estimate.

Below we walk through two ways to test statistical significance using State Health Compare—a 'Fast' method that is a quick, visual test and a 'Robust' method that uses a formula to test significance.

Fast Method: Using Margins of Error to Visually Test Differences

The margin of error also allows users to assess the statistical significance of differences in estimates from state to state, from year to year, or between demographic groups. One easy way to see if two estimates are statistically different is to compare their margins of error on State Health Compare's state ranking charts.

Once you select a measure, click the "Rank" button on the landing page. This will take you to a page where data for all states, the District of Columbia, and the U.S. nationally are available via a bar graph. You can choose to display all states or just a selection of states you are interested in.

From there, the option to include "Margin of Error" is available via a clickable checkbox under the subheading "Data Type."

Prevalence of Diabetes, CVD, and Asthma in Adults

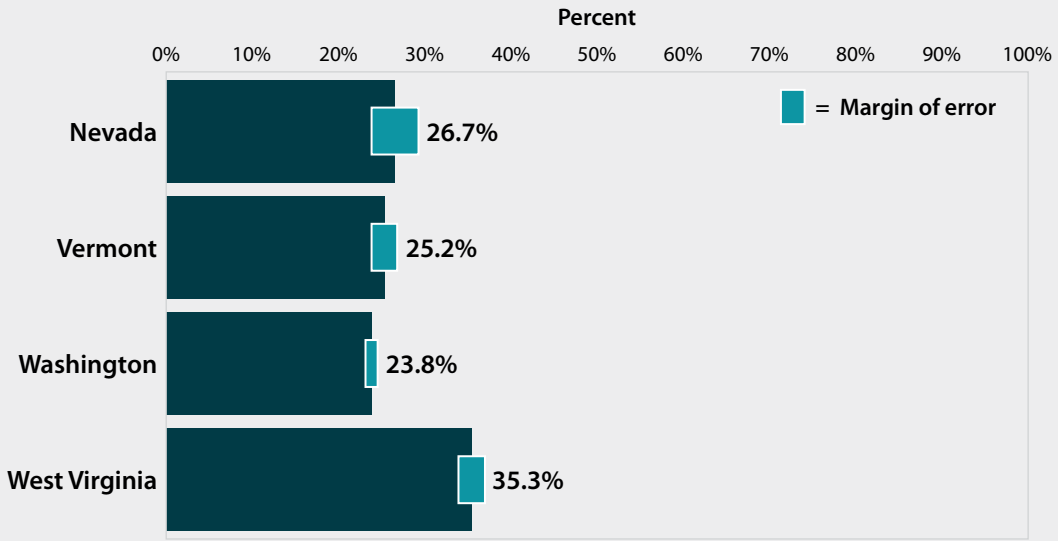
Let's look at an example of using margins of error to visually test statistical significance using the Behavioral Risk Factor Surveillance System (BRFSS) measure, "Chronic Disease Prevalence." Chronic disease is generally defined as any disease, illness, or condition that lasts one year or longer, and requires ongoing health or medical care or limits daily life (or both). The "chronic disease" data from the BRFSS provide the percentage of adults who report having one more of the following chronic diseases: diabetes, cardiovascular disease (CVD), heart attack, stroke, and/or asthma.

Looking at the graph generated on State Health Compare for this measure below, we can quickly see that West Virgina had a higher percentage of people with a chronic disease than those in Washington. We can visually test the significance of this difference by examining the margins of error. In this case, the lower bound of the West Virginia estimate's margin of error is greater than the upper bound of the Washington estimate's margin of error, indicating that the difference between these states' estimates *is* statistically significant. On the other hand, because we can see that the error bars for Nevada and Vermont overlap, there is likely no statistically significant difference in the prevalence of chronic disease between these two states.

Prevalence of Diabetes, CVD and Asthma in Adults

Timeframe
2024

Data Type
Percent and Margin of Error



Robust Method: Using Margins of Error to Conduct a Hypothesis Test

While visually comparing margins of error is quick and easy, that method is best used to get a rough approximation of statistical significance. To get a robust test of statistical significance, it is better to use a hypothesis test, also called a statistical test.

Below, we discuss how to conduct a common type of statistical test called a t-test to see if the difference between two independent estimates is significant at the 95% confidence level.

Step 0: Download Data from State Health Compare

Before we can conduct significance testing, we need to download the relevant data from State Health Compare. In this example, we will continue with the BRFSS measure "Prevalence of Diabetes, CVD, and Asthma in Adults."

There are two ways to download data on the State Health Compare website.

Option A. On the State Health Compare homepage, select the "Download Data" button in the upper right-hand corner. After clicking this, there will be a screen with three steps to complete. The first step instructs the user to select one or more locations (in this example, we will use Nevada, Vermont, Washington, and West Virginia). Then, scroll down to complete the second step, which allows users to choose the intended indicator(s) [up to three can be selected at a time] for study. Once again, this example will use the BRFSS measure "Prevalence of Diabetes, CVD, and Asthma in Adults." In this example, we will select "Total" for the population examined. Finally, the third and last step requires users to choose the timeframe for the selected indicators (in this example we will select 2024–2024 because we want only the most recent year of data) and then click the "Download Data" button on the bottom left of the page. The data will be downloaded in a compressed folder that contains a Comma-separated Values (CSV) file that the user should then open in Microsoft Excel.

Option B. Instead of clicking "Download Data" on the homepage, go to "Explore Data." From there, select the measure of interest (again, in this example, "Chronic Disease Prevalence"). Once redirected to the measure landing page, users can choose to view the data in a map, rank, trend, bar, or table view. Once in any of these views, selecting the white "Download Data" button will give users the option to download "Currently Selected Data," with any parameters that might already be selected from the options on the page saved to the downloaded file.

Step 1: Transform Margins of Error into Standard Errors

State Health Compare uses margins of error calculated with a 95% confidence level. T-tests, however, use standard errors. To transform these margins of error (MOE) into standard errors (SE), we first divide the MOE by 1.96, which is the critical t-value, or test statistic, for a two-sided hypothesis test with a 95% level of confidence and a large sample size. It is important to note that if you wish to select a confidence level different than 95%, the critical t-value will be different than 1.96, too; be sure to choose the correct critical t-value for the level of confidence you are testing.

Formula
MOE/1.96 = SE

SE for Nevada
0.02635/1.96 = 0.01344

Table 1. Transforming Margins of Error into Standard Errors

Location	Time Frame	Data Type	Data	MOE	SE
Nevada	2024	Percent	0.2667	0.02635	0.0134
Vermont	2024	Percent	0.2520	0.01330	0.0068
Washington	2024	Percent	0.2378	0.00647	0.0033
West Virginia	2024	Percent	0.3531	0.01479	0.0075

Step 2: Find the Difference Between the Two Estimates of Interest

The next step is to calculate the difference between the two estimates you are testing for significance. In this case, we will compare Nevada to Vermont, and Washington to West Virginia. To take the difference, subtract Estimate 2 (Vermont, in this case) from Estimate 1 (Nevada). The same process is repeated for the second pair of states, Washington (Estimate 1) and West Virginia (Estimate 2).

Formula
Difference Between the Estimates
= Estimate 1 - Estimate 2

Difference between NV and VT
= 0.2667 - 0.2520
= 0.0147

Table 2. Taking the Difference Between Estimates

State	Percent	Standard Error	Difference
Nevada	0.2667	0.01344	0.0147
Vermont	0.2520	0.00678	
Washington	0.2378	0.00330	-0.1153
West Virginia	0.3531	0.00754	

Step 3: Calculate the t-score

A "t-score" is the ratio of the difference between the two estimates to the variability of the estimates. It answers the question, "How close to '0' is this difference, given the variability of the estimates?"

The t-score is calculated using the formula below.

Formula
Difference in estimates/√(SE_1^2+SE_2^2)

t-score for NV and VT
0.0147/√(0.01344^2 + 0.00678^2)
=0.972

Table 3. Calculating the t-score

State	Percent	Standard Error	Difference	T-score
Nevada	0.2667	0.01344	0.0147	0.972
Vermont	0.2520	0.00678		
Washington	0.2378	0.00330	-0.1153	-14.000
West Virginia	0.3531	0.00754		

Note: t-scores were calculated using unrounded estimates and standard errors and may differ from those calculated with rounded estimates and standard errors as presented.

Step 4: Establish a Critical t-value and Determine Statistical Significance

The final step is to determine if the two estimates are statistically significantly different. We do this by establishing a "critical t-value" that we want to indicate statistical significance. If the t-score is larger than this critical t-value, we can say that the difference in estimates is statistically significant with a certain level of confidence.

To establish a critical t-value, we need to select a desired level of confidence. A 95% level of confidence is typical. With a large sample size, a two-tailed critical t-value for a 95% level of confidence is 1.96.[i] This means that if the absolute value of our t-score is larger than 1.96, we can say that the estimates are significantly different at the 95% confidence level.

To have Excel place a star next to any estimate significant at this level of confidence, use the Excel formula below:

Formula

=IF(ABS(t-score)>1.96,"*"",--")

Table 4. Determining Statistical Significance

State	Percent	Standard Error	Difference	T-score	Significance
Nevada	0.2667	0.01344	0.0147	0.972	--
Vermont	0.2520	0.00678			
Washington	0.2378	0.00330	-0.1153	-14.000	*
West Virginia	0.3531	0.00754			

Table 4 shows that the difference between Washington and West Virginia is statistically significant at a 95% confidence level, while the difference between Nevada and Vermont is not statistically significant at this level.

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[i] To establish a critical t-value with a different level of confidence or with a different sample size, users can reference tables of critical t-values freely available on the web. The National Institute of Standards and Technology provides a free table of critical t-values, available from https://www.itl.nist.gov/div898/handbook/eda/section3/eda3672.htm. The "degrees of freedom" is one less than the sample size.

Source: SHADAC analysis of the Behavioral Risk Factor Surveillance System (BRFSS) public use files.

Notes: National estimates represent the total population rate of people who reported this measure. The margin of error (MOE) represents the uncertainty of an estimate due to sampling variability; the calculated MOE is 95%. N/A indicates that data were not available or suppressed because the number of sample cases was too small.

Measure Definition: Percent of adults who report having one or more of the following chronic conditions: diabetes, cardiovascular disease, heart attack, stroke, and/or asthma for the civilian non-institutionalized population 18 years and over.