Coronavirus Website Effectiveness

Cost Estimation and Metrics Final Report

Coronavirus Website Effectiveness

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"I pledge my honor that I have abided by the Stevens Honor System."

1. Summary

Throughout the past year, coronavirus has caused fear and distress for people across the globe. With the virus having such devastating effects on society, there is a necessity to remain up to date on current updates and information. Within the United States, each state has developed a website for its citizens to provide them with the needed information on prevention and developments of the virus in the area. Due to the importance of information regarding vaccines, testing, current state reopening statuses, and scientific understanding, these websites hold a key point for communication between experts and the general population. The effectiveness of these websites to provide information to the general public is pivotal for the safety and well-being of the population as a whole.

Through this, the team developed a project which analyzed the effectiveness of state coronavirus websites. By identifying 18 states with open-source information, we were able to gather data which provided metrics for how engaging the website was, its ease of navigation, number of defects, and the website's popularity. This data included seven key metrics the team identified for analysis which were bounce rate, average pages per visit, average visit duration, backlinks, broken links, page speed, and average monthly traffic. From these, a final model was created which weighted each metric based on its imagined importance towards the overall effectiveness of coronavirus sites, which then allowed for the team to identify the states which had the most and least effective websites.

2. Table of Contents

3. Introduction

3.1 Background

The coronavirus pandemic brought on challenges in every aspect of life, especially in how the government communicates with the public in order to minimize the many consequences of the situation. While this can be accomplished through television announcements, statements released on the internet, email newsletters, or physical letters and handouts, one of the most effective ways to provide the public with up to date, detailed, and accurate information is through a well maintained government website. This allows the government to directly publish information without going through a third party while also making the information easily accessible. These websites, at the state level, were paramount to informing their state population about symptoms, state statistics, testing information, and eventually vaccine registration information. Since these websites are so important for fighting the pandemic, these websites need to be effective in their ability to portray this information in a clear and easy way.

3.2 Problem

State coronavirus websites are heavily used by a variety of people with different levels of experience of technology. Therefore, the websites must be effective in displaying the information the users request without being overly complex, but not too simple to the point where they are no longer informative or take too long to navigate.

4. Proposed Metrics

4.1 Goal

Our goal statement is “Determine the effectiveness of government coronavirus sites on a state-by-state basis.” More specifically, this project is meant to determine how effective coronavirus websites are at providing the public with a portal for all coronavirus information. An effective state coronavirus website would result in a well-informed state population, where citizens can easily schedule testing and vaccine appointments. In order to determine the effectiveness of these websites, multiple aspects of a state’s website will be analyzed and compared to other state’s websites. These metrics will represent a website's speed, navigability, and defects. 18 states were chosen for this model. The states were chosen based on the ability to collect the metrics of the website. The states chosen were Alaska, California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Maryland, Montana, Nevada, New Jersey, Ohio, South Dakota, Utah, and Washington.

4.2 Questions

- How engaging is the website?
    - Corresponding Metrics:
        - Bounce Rate
        - Average Pages per Visit
        - Average Visit Duration
- How easy is it to navigate through the website?
    - Corresponding Metrics:
        - Broken Links
        - Page Speed
- How many defects are there in the website?
    - Corresponding Metrics:
        - Broken Links
- How popular is the website?
    - Corresponding Metrics:
        - Backlinks
        - Average Monthly Traffic

4.3 Hypothesis

Prior to data collection, the team made a hypothesis about the effectiveness of the websites. The team believed that states with larger populations would have more effective websites. This is because states with larger populations would have more funding (taxes, etc), which would lead to a better funded website, which should be more effective than a website with little funding.

4.4 Backlinks

4.4.1 Background

Backlinks are website links that go from one website to another website. Backlinks can be valuable for measuring effectiveness because an increased number of backlinks to a website can indicate the content on that website is important and worth sharing. This model will use the number of backlinks leading to each coronavirus website.

4.4.2 Collection

In order to collect information about the number of backlinks for each website, the backlink checker on ahrefs.com was used. This tool provided the number of backlinks leading to the website provided in the search bar.

4.4.3 Results

Table 1 Number of Backlinks per State Website

State	Backlinks
Alaska	47,935
California	1,544,350
Colorado	360,537
Delaware	894,056
Florida	3,096,190
Georgia	556,634
Idaho	168,560
Illinois	231,811
Indiana	272,209
Iowa	129,060
Maryland	123,631
Montana	88,572
Nevada	2,874,090
New Jersey	6,300,264
Ohio	1,044,224
South Dakota	22,239
Utah	1,010,885
Washington	6,681,514

Figure 1 Backlinks Column Chart

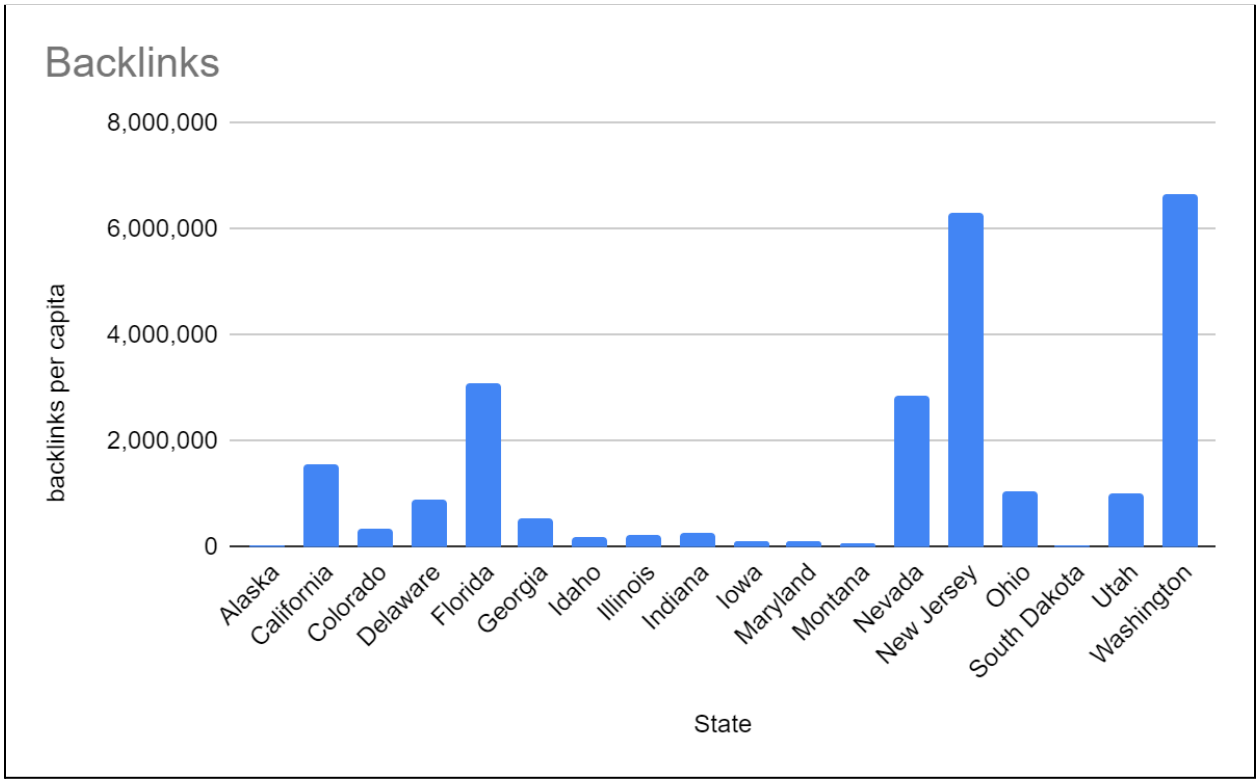
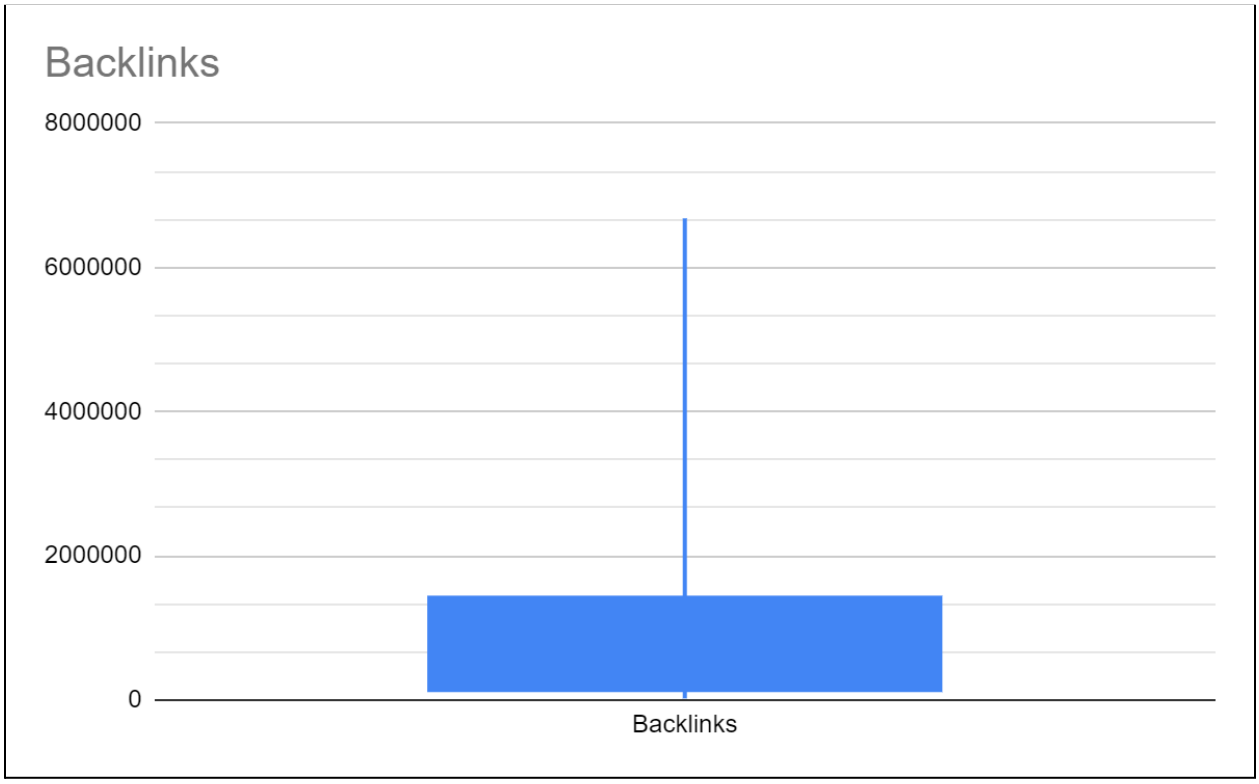


Figure 2 Backlinks Box and Whisker Chart



4.5 Bounce Rate

4.5.1 Background

Bounce rate is the percentage of users that leave the website after viewing just one page. This is a valuable metric because an effective website should be engaging and lead the viewer to click to different pages. If a user leaves a website after viewing just one page, they may have found it confusing, uninformative, or taking too long to load.

4.5.2 Collection

In order to collect information about bounce rate, the team used similarweb.com. This tool provides various metrics regarding traffic and user patterns on a given website.

4.5.3 Results

Table 2 Bounce Rate Percentage for each State Website

State	Bounce Rate %
Alaska	66.08%
California	44.14%
Colorado	61.75%
Delaware	59.67%
Florida	55.61%
Georgia	46.40%
Idaho	39.80%
Illinois	67.52%
Indiana	64.36%
Iowa	36.76%
Maryland	71.54%
Montana	31.72%
Nevada	61.10%
New Jersey	58.96%
Ohio	60.86%
South Dakota	59.38%
Utah	49.42%
Washington	53.88%

Figure 3 Bounce Rate Column Chart

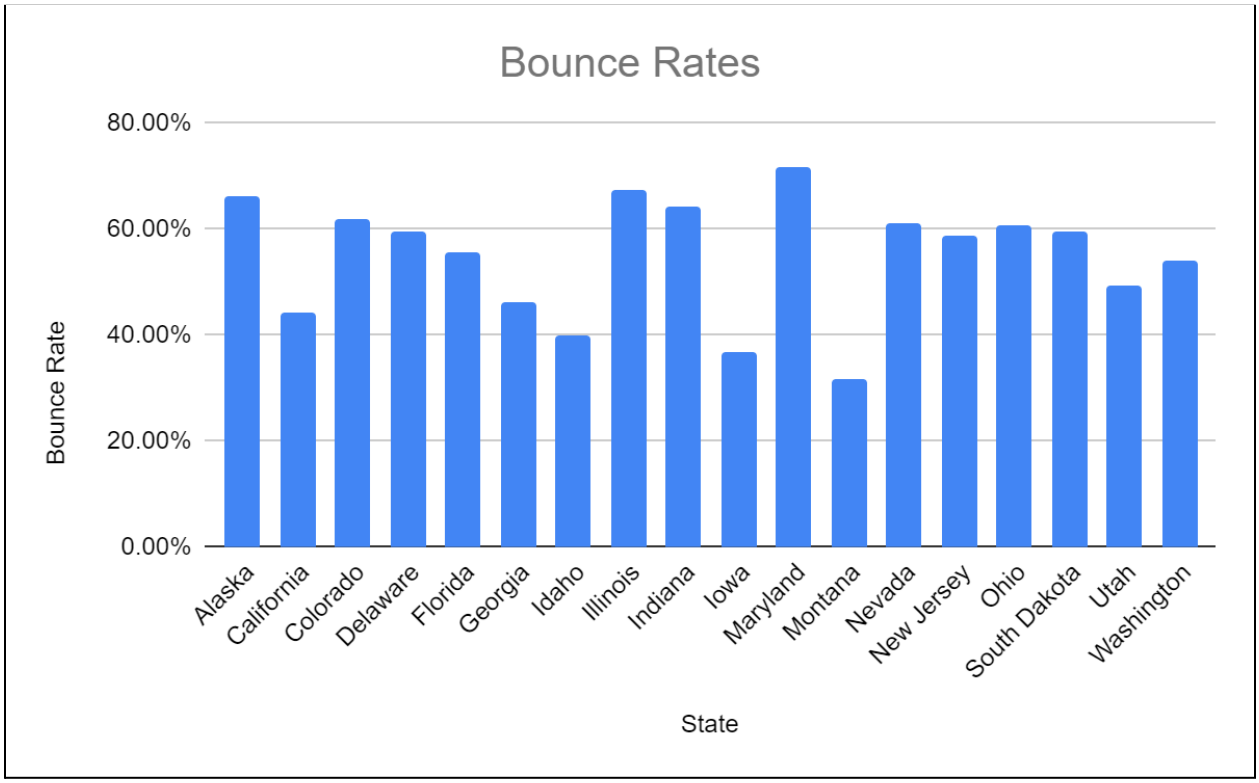
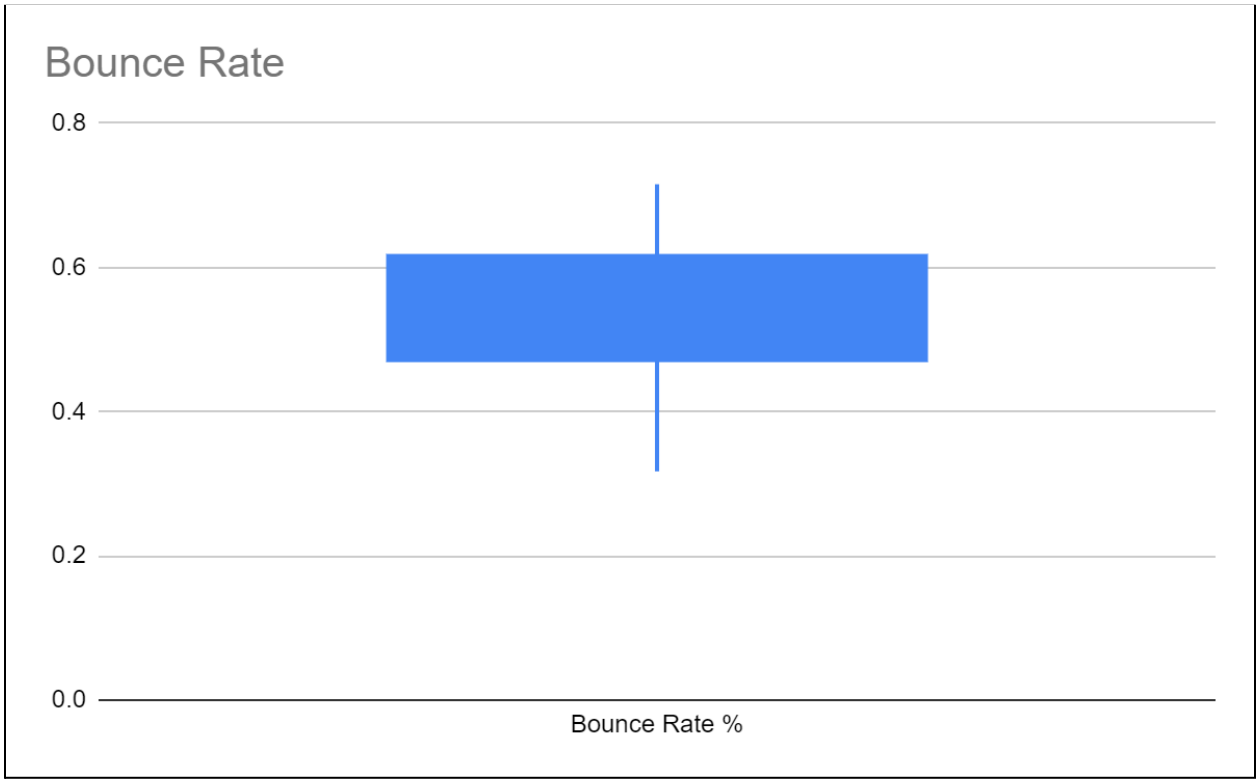


Figure 4 Bounce Rate Box and Whisker Chart



4.6 Broken Links

4.6.1 Background

Broken links are website links that go to a page that is no longer available. These links commonly occur when an existing page is moved, but the link is not updated. Broken links show a lack of proper maintenance on a website. An effective website minimizes the number of broken links to reduce confusion to the user.

4.6.2 Collection

In order to collect information about the number of broken links for each website, the broken link checker on ahrefs.com was used. This tool provided the number of broken links on a given website.

4.6.3 Results

Table 3 Number of Broken Links for each State Website

State	Broken Links
Alaska	0
California	4
Colorado	10
Delaware	8
Florida	7
Georgia	94
Idaho	1
Illinois	7
Indiana	27
Iowa	3
Maryland	0
Montana	3
Nevada	55
New Jersey	21
Ohio	0
South Dakota	0
Utah	19
Washington	10

Figure 5 Broken Link Column Chart

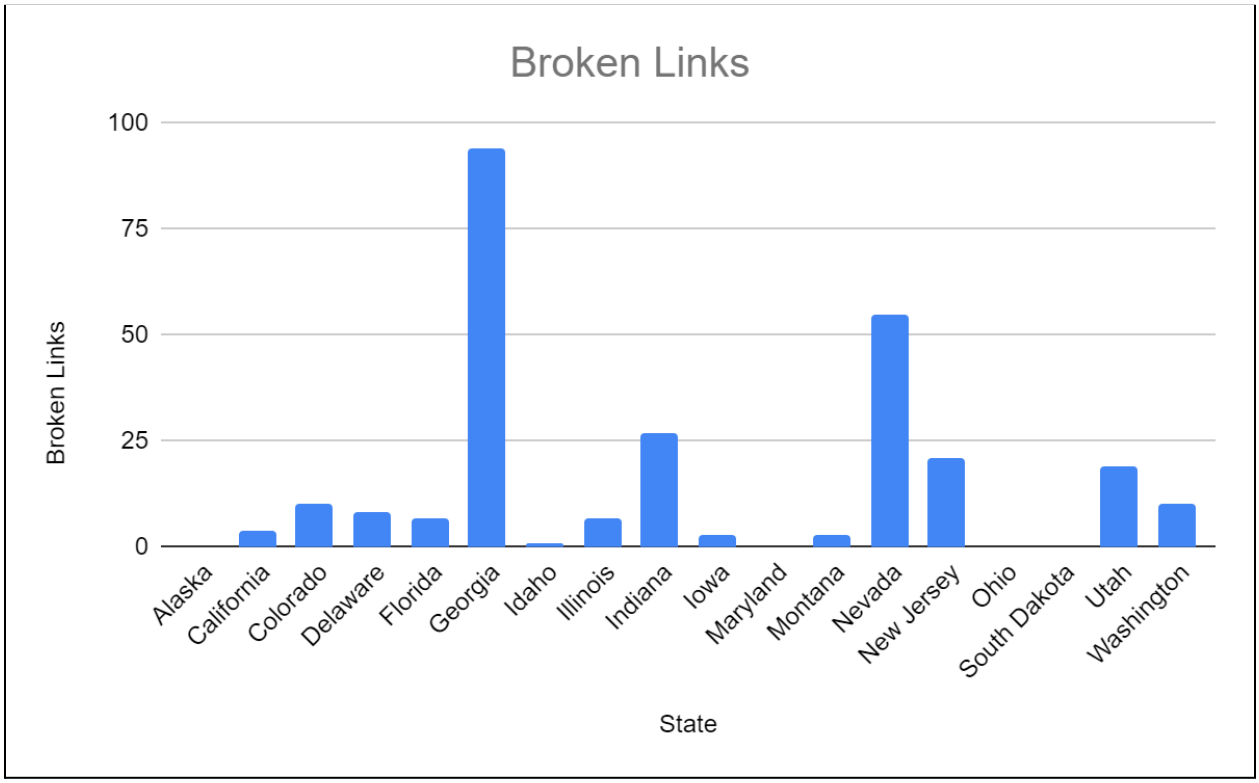
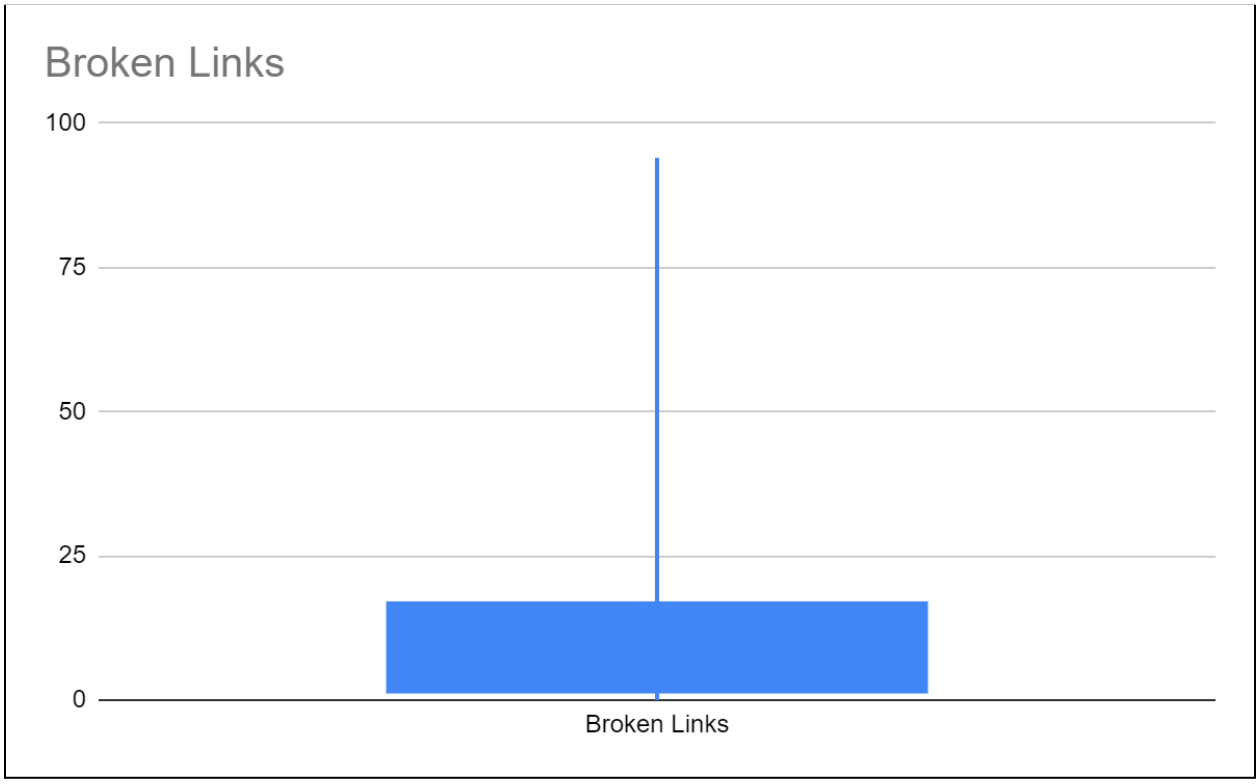


Figure 6 Broken Links Box and Whisker Chart



4.7 Page Speed

4.7.1 Background

Page speed in this study is indicated by a cumulative rating. The page speed ratings are created from the time measurements associated with how long it takes for text or images to populate, the time it takes for the page to become fully interactive, the user's input delay, and more similar metrics seen in Table 4. A page's scores in each individual metric is weighted and put together to create a cumulative page speed rating. Page speed is an indicator of site usability and effectiveness in terms of its ability to display information in a timely manner.

4.7.2 Collection

In order to collect information about the page speed ratings of each website, the PageSpeed Insights tool on developers.google.com was used. This tool provided various metrics about the speed of a given website along with a cumulative speed rating based on the metrics.

4.7.3 Results

Table 4 PageSpeed Rating and Metrics

State	PageSpeed Rating	First Contentful Paint (FCP)	First Input Delay (FID)	Largest Contentful Paint (LCP)	Cumulative Layout Shift (CLS)
Alaska	45	Poor	Good	Good	Poor
California	99	Good	Good	Good	Good
Colorado	80	Poor	Good	Good	Poor
Delaware	51	Poor	Good	Poor	Poor
Florida	98	Poor	Good	Good	Good
Georgia	67	Poor	Good	Good	Good
Idaho	65	Poor	Good	Good	Good
Illinois	87	Good	Good	Poor	Poor
Indiana	34	Poor	Good	Poor	Good
Iowa	41	Good	Good	Poor	Poor
Maryland	20	Good	Good	Poor	Poor
Montana	41	Poor	Good	Poor	Poor
Nevada	64	Poor	Good	Poor	Good
New Jersey	84	Good	Good	Good	Poor
Ohio	43	Poor	Good	Poor	Poor
South Dakota	69	Poor	Good	Poor	Poor
Utah	68	Poor	Good	Good	Good
Washington	78	Poor	Good	Good	Poor

Figure 7 PageSpeed Rating Column Chart

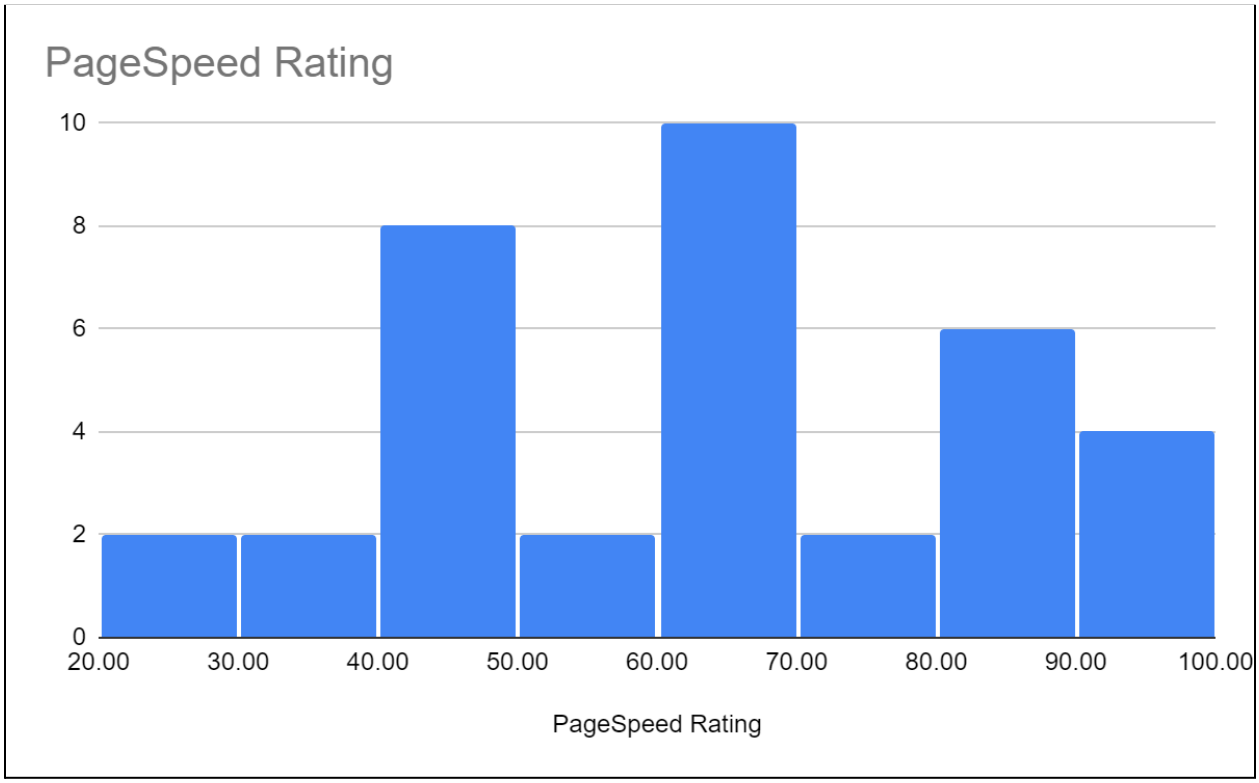
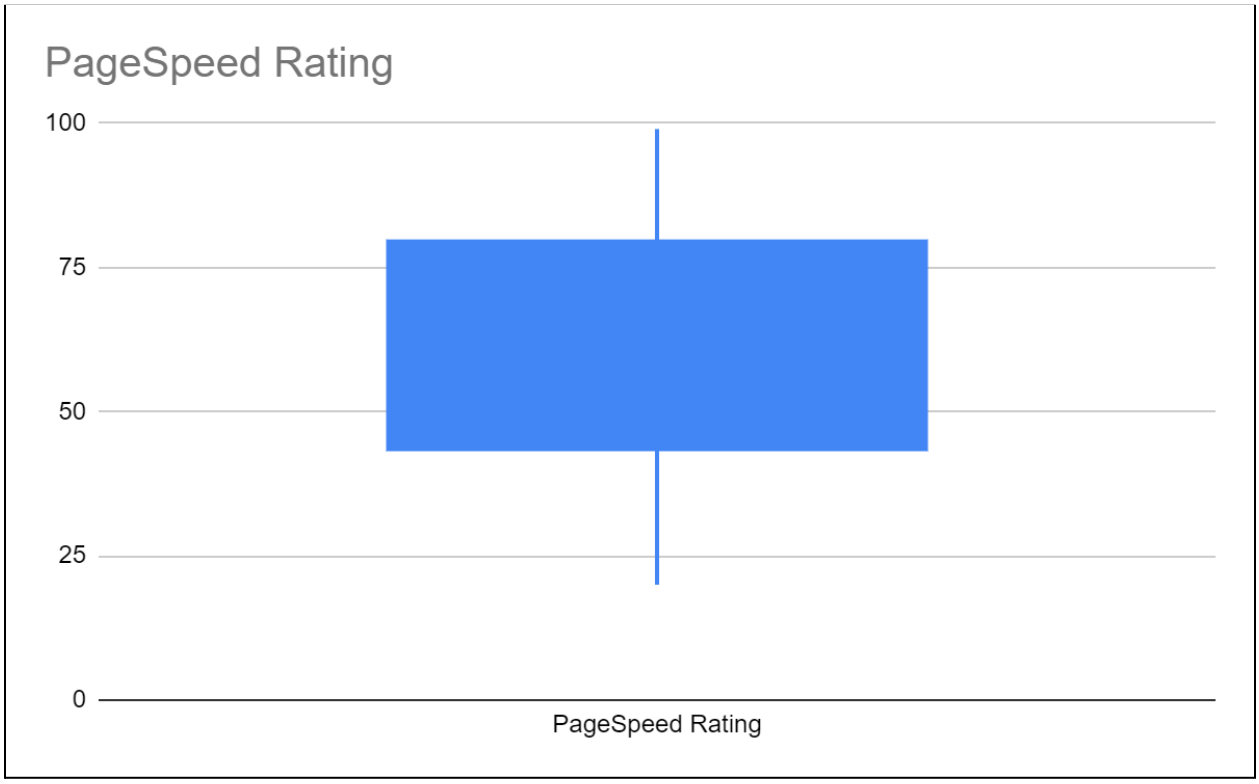


Figure 8 PageSpeed Rating Box and Whisker Chart



4.8 Average Pages per Visit

4.8.1 Background

Pages per visit describes the number of different pages that a user views upon entering the site. The average number of pages viewed per visit can help to indicate the effectiveness of the links displayed on the site as helpful navigation tools within the site that can guide the user to desired information.

4.8.2 Collection

In order to collect information about the average number of pages viewed per visit for each website, the team used similarweb.com. This tool provides various metrics regarding traffic and user patterns on a given website.

4.8.3 Results

Table 5 Average Pages Viewed Per Visit

State	Pages Per Visit
Alaska	1.7
California	1.86
Colorado	2.34
Delaware	2.46
Florida	1.93
Georgia	1.87
Idaho	1.65
Illinois	1.69
Indiana	3.97
Iowa	2.61
Maryland	1.86
Montana	1.35
Nevada	1.55
New Jersey	1.97
Ohio	1.77
South Dakota	3.15
Utah	1.91
Washington	1.70

Figure 9 Average Pages per Visit Column Chart

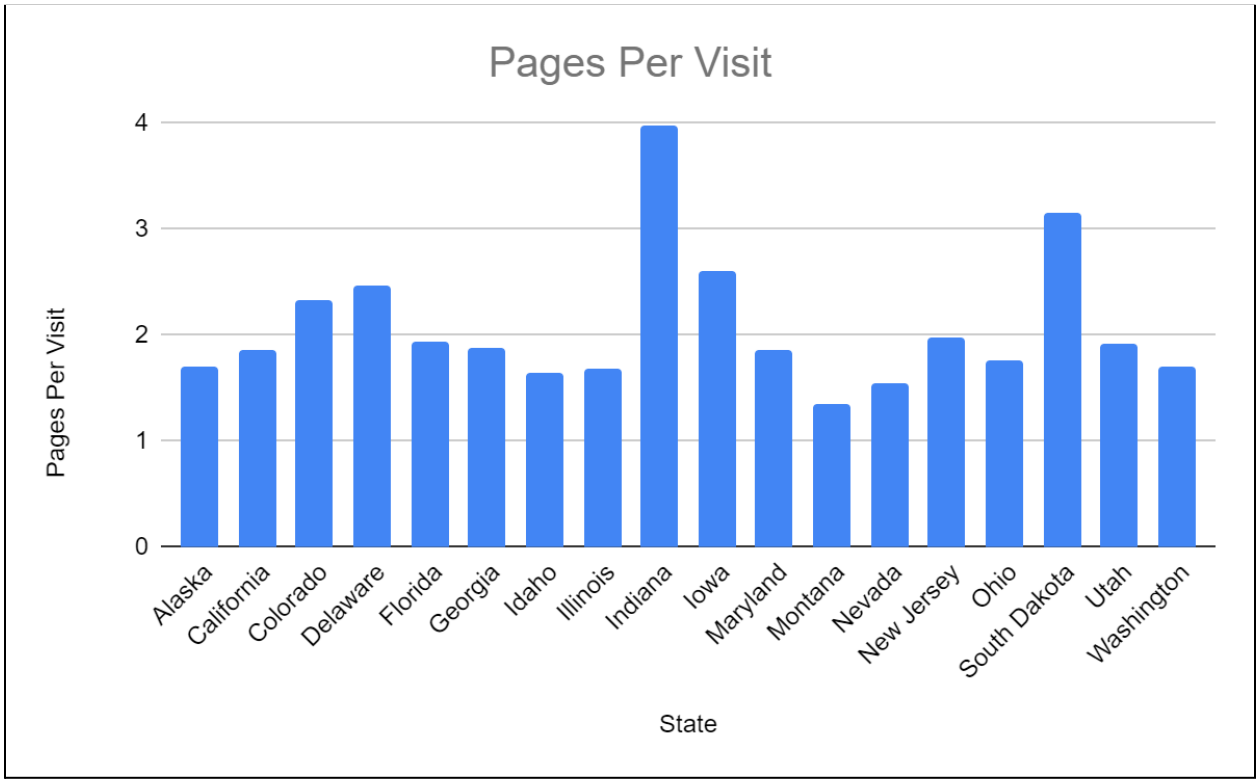
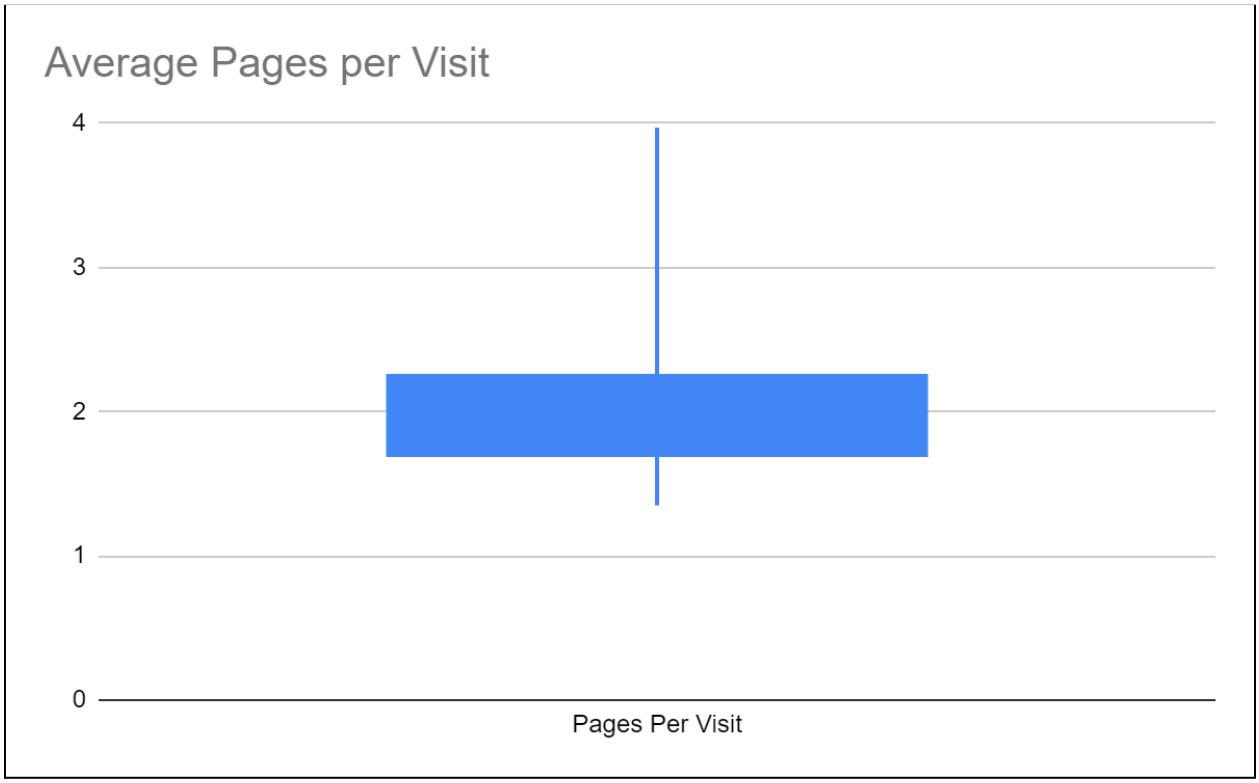


Figure 10 Average Pages per Visit Box and Whisker Chart



4.9 Average Visit Duration

4.9.1 Background

Website visit duration is the measure of the amount of time a user spends on each website. The average visit duration across all users of a site indicates the usefulness of the information which the site contains. Users are likely to spend more time on a site combing through its content if they find it informative and helpful.

4.9.2 Collection

In order to collect information about the average visit duration for each website, the team used similarweb.com. This tool provides various metrics regarding traffic and user patterns on a given website.

4.9.3 Results

Table 6 Average Visit Duration

State	Avg Visit Duration
Alaska	82
California	94
Colorado	74
Delaware	117
Florida	79
Georgia	94
Idaho	28
Illinois	88
Indiana	115
Iowa	96
Maryland	72
Montana	7
Nevada	56
New Jersey	128
Ohio	100
South Dakota	167
Utah	64
Washington	130

Figure 11 Average Visit Duration Column Chart

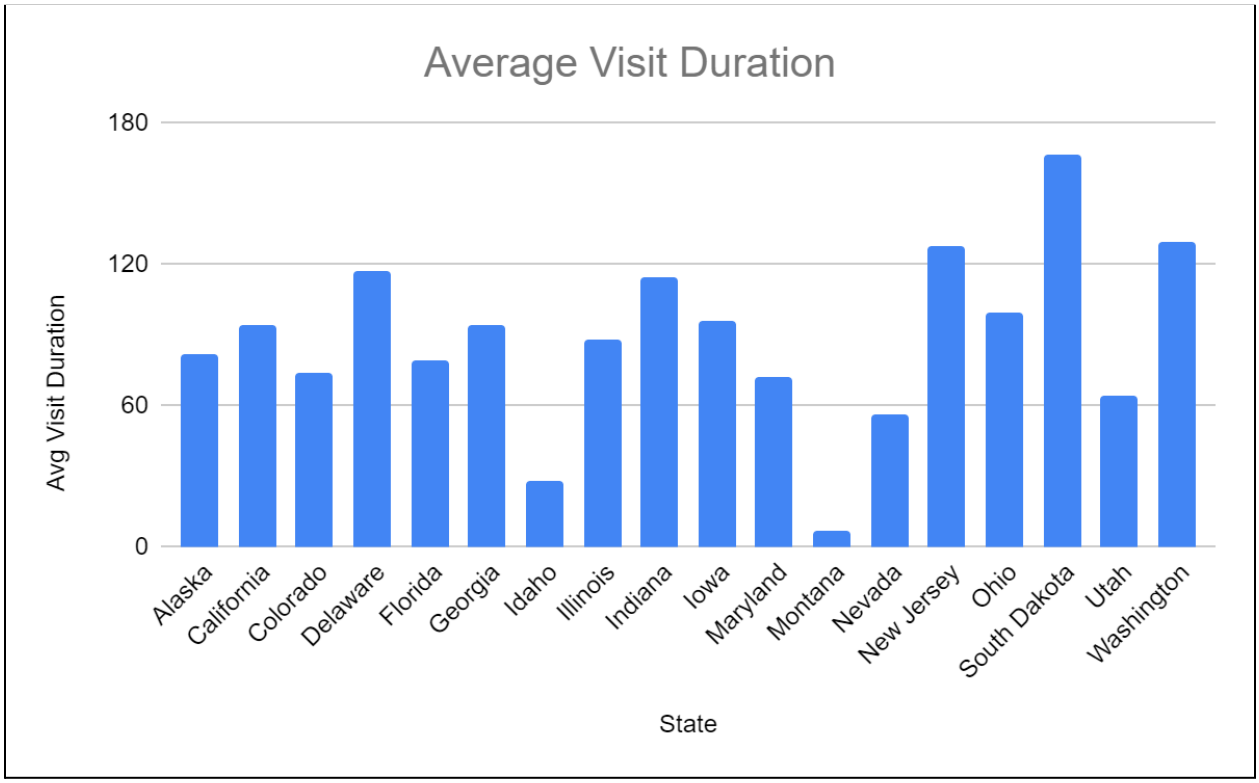
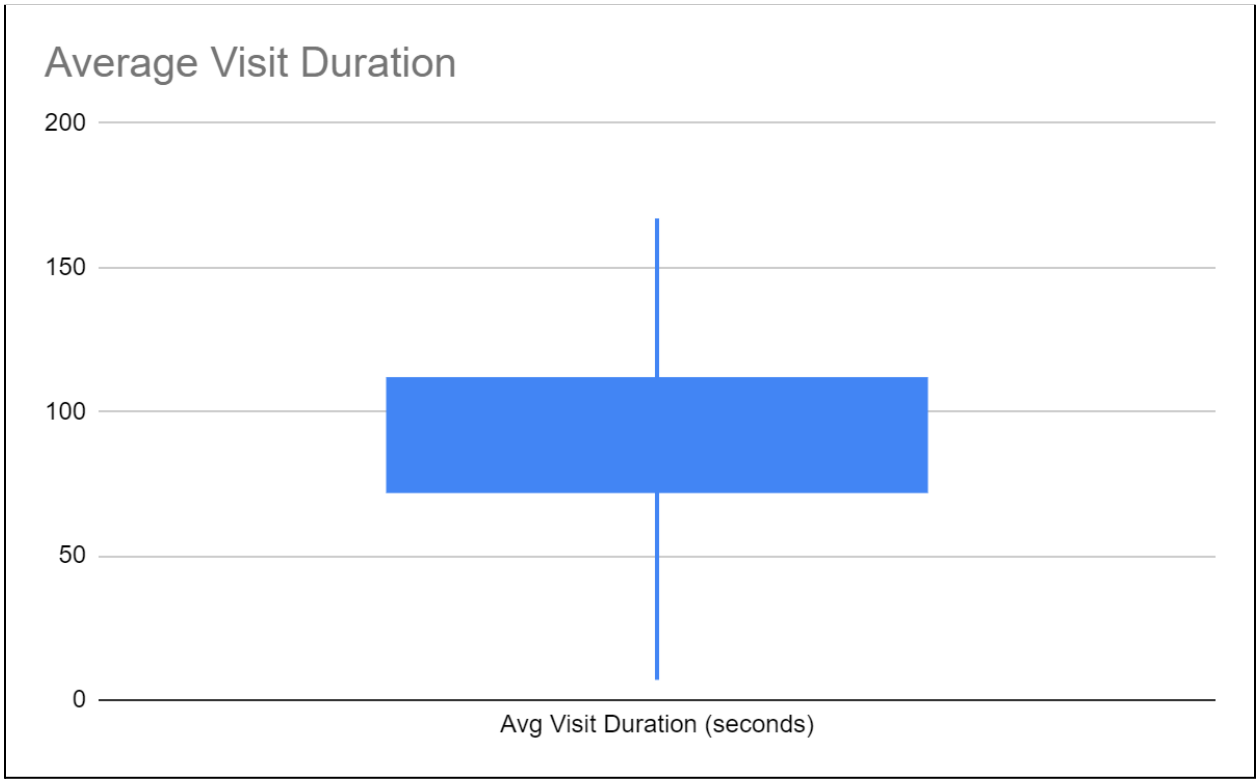


Figure 12 Average Visit Duration Box and Whisker Chart



4.10 Average Monthly Traffic

4.10.1 Background

Average monthly traffic is the average number of users who visit each site on a monthly basis. This metric is valuable in evaluating the overall effectiveness of a website as a primary indicator of how many users look to the website to answer their questions and address their concerns. Monthly traffic speaks to the value of the information that the website provides. The team found that analyzing the average monthly traffic as a percent of the state population was most essential since a given State's population will greatly influence the monthly traffic on its coronavirus website.

4.10.2 Collection

In order to collect information about the average monthly traffic for each website, the team used similarweb.com. This tool provides various metrics regarding traffic and user patterns on a given website. State population information was gathered from Wikipedia.

4.10.3 Results

Table 7 Average Monthly Traffic

State	Avg Monthly Visits	State Pop.	% Pop Avg Monthly Visits
Alaska	80,833	731,158	11.06%
California	6,675,000	39,368,078	16.96%
Colorado	2,350,000	5,807,719	40.46%
Delaware	565,000	986,809	57.26%
Florida	2,500,000	21,733,312	11.50%
Georgia	3,833,333	10,710,017	35.79%
Idaho	715,000	1,826,913	39.14%
Illinois	815,000	12,587,530	6.47%
Indiana	3,466,667	6,754,953	51.32%
Iowa	716,667	3,163,561	22.65%
Maryland	2,866,667	6,055,802	47.34%
Montana	136,667	1,080,577	12.65%
Nevada	371,667	3,138,259	11.84%
New Jersey	4,225,000	8,882,371	47.57%
Ohio	3,891,667	11,693,217	33.28%
South Dakota	79,167	892,717	8.87%
Utah	1,433,333	3,249,879	44.10%
Washington	953,333	7,693,612	12.39%

Figure 11 Average Monthly Visits as a Percent of State Population Column Chart

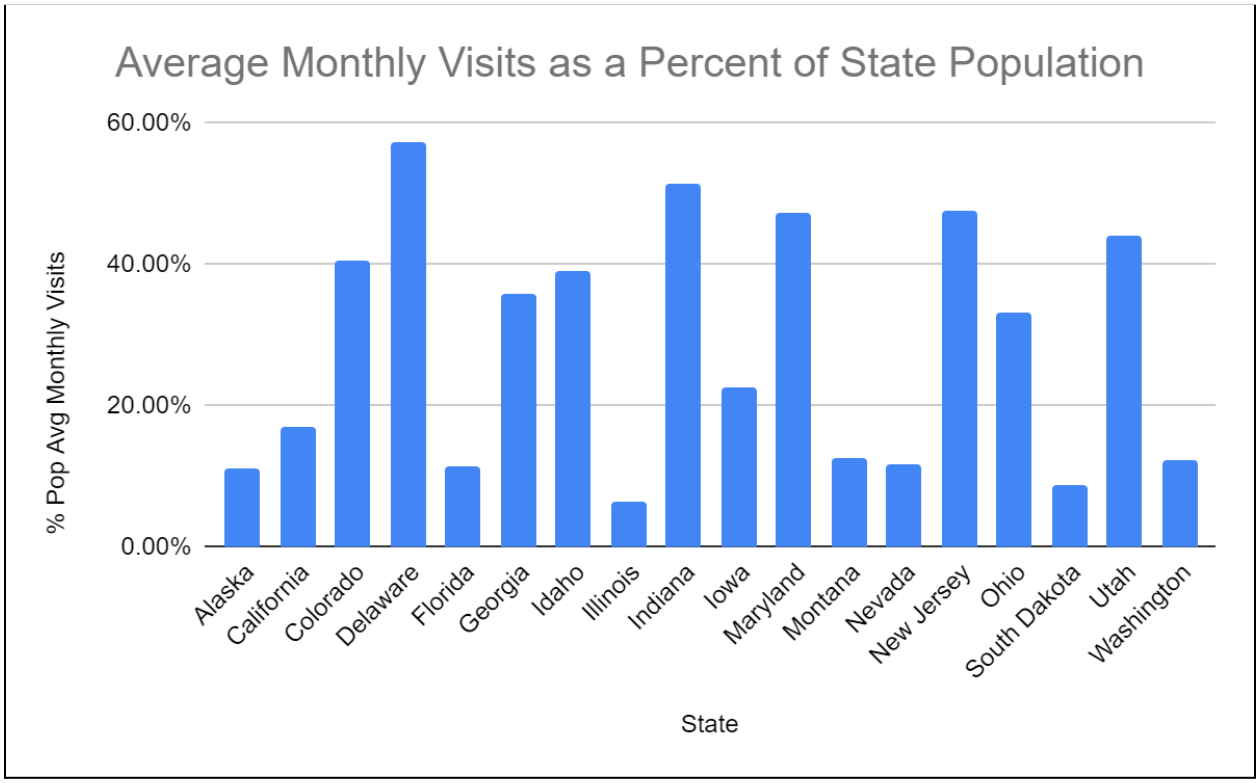
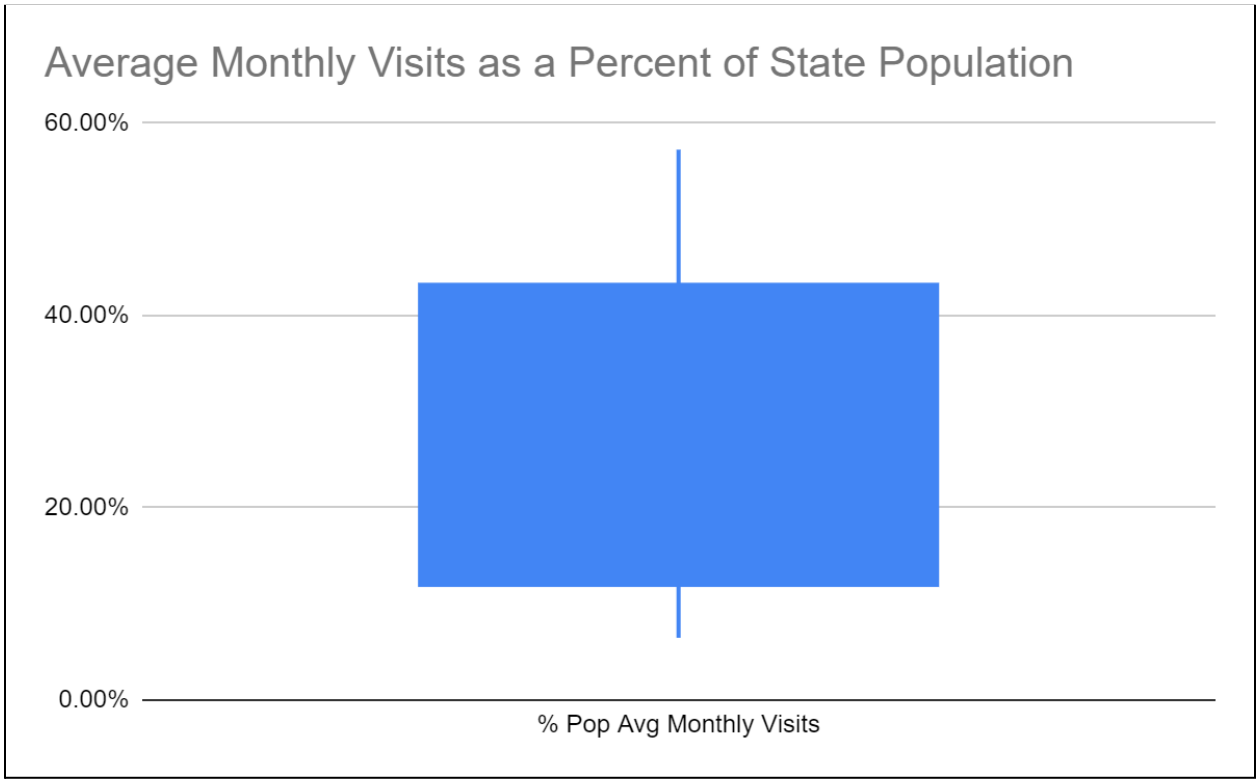


Figure 12 Average Monthly Visits as a Percent of State Population Box and Whisker Chart



5. Results and Discussion

5.1 Model Definition

5.1.1 Normalization

For each metric, the data values for each state are normalized based on the sample with all other states. Normalizing the values allows for each metric to be treated equally, instead of metrics with higher natural values having a greater significance than metrics with lower natural values. The values are normalized using z scores.

Table 8 Normalized Values for each State by Metric

State	Backlinks	Bounce Rate	Broken Links	Page Speed	Avg Pages per Visit	Avg Visit Duration	Avg Monthly Traffic
Alaska	-0.6630	0.9916	-0.6234	-0.7975	-0.5856	-0.1708	-1.0035
California	0.0634	-0.9617	-0.4566	1.5950	-0.3354	0.1500	-0.6615
Colorado	-0.5112	0.6061	-0.2063	0.7532	0.4153	-0.3847	0.7009
Delaware	-0.2523	0.4210	-0.2897	-0.5317	0.6030	0.7649	1.6741
Florida	0.8167	0.0595	-0.3314	1.5507	-0.2259	-0.2510	-0.9775
Georgia	-0.4160	-0.7605	3.2979	0.1772	-0.3198	0.1500	0.4302
Idaho	-0.6044	-1.3481	-0.5817	0.0886	-0.6639	-1.6146	0.6241
Illinois	-0.5737	1.1198	-0.3314	1.0634	-0.6013	-0.0104	-1.2690
Indiana	-0.5541	0.8385	0.5029	-1.2849	2.9647	0.7115	1.3302
Iowa	-0.6236	-1.6187	-0.4983	-0.9747	0.8376	0.2035	-0.3313
Maryland	-0.6262	1.4777	-0.6234	-1.9052	-0.3354	-0.4382	1.0993
Montana	-0.6433	-2.0674	-0.4983	-0.9747	-1.1331	-2.1760	-0.9112
Nevada	0.7089	0.5483	1.6709	0.0443	-0.8203	-0.8660	-0.9578
New Jersey	2.3721	0.3577	0.2526	0.9304	-0.1634	1.0590	1.1126
Ohio	-0.1794	0.5269	-0.6234	-0.8861	-0.4762	0.3104	0.2847
South Dakota	-0.6755	0.3951	-0.6234	0.2658	1.6822	2.1018	-1.1302
Utah	-0.1955	-0.4916	0.1692	0.2215	-0.2572	-0.6521	0.9119
Washington	2.5571	-0.0945	-0.2063	0.6646	-0.5856	1.1125	-0.9261

5.1.2 Weights

Each metric is assigned a weight based on its importance to a website's effectiveness. Weights are on a scale for 1-5, with 1 being the least important and 5 being the most important.

Table 9 Weights for each Metric

	Backlinks	Bounce Rate	Broken Links	Page Speed	Avg Pages per Visit	Avg Visit Duration	Avg Monthly Traffic
Weights	1	4	5	1	4	5	3

Broken links and average visit duration are considered the most important. Broken links on a website shows a lack of maintenance and can be very frustrating to users if encountered. Average visit duration shows how much users are using the website. Users will spend more time on a website if they find the website engaging or if the page contains what the user is looking for. For these reasons, these two metrics are considered the most important.

Bounce rate and average pages per visit are the next most important with a weight of 4. While both metrics are valuable and can accurately determine effectiveness, the team decided that they are slightly less important than broken links and average visit duration.

Average monthly traffic has a weight of 3. This metric was put in the middle because while traffic is useful, an effective website does not need to have high amounts of traffic. Some websites may only need to be visited infrequently, but are very effective when they are needed.

Backlinks is weighted the least important at 1 because it is not a metric directly related to the website. Since backlinks originate on other websites, the team felt it should be rated the lowest on the list. Additionally, just because a site has a low number of backlinks does not mean it is ineffective.

5.1.3 Final Score

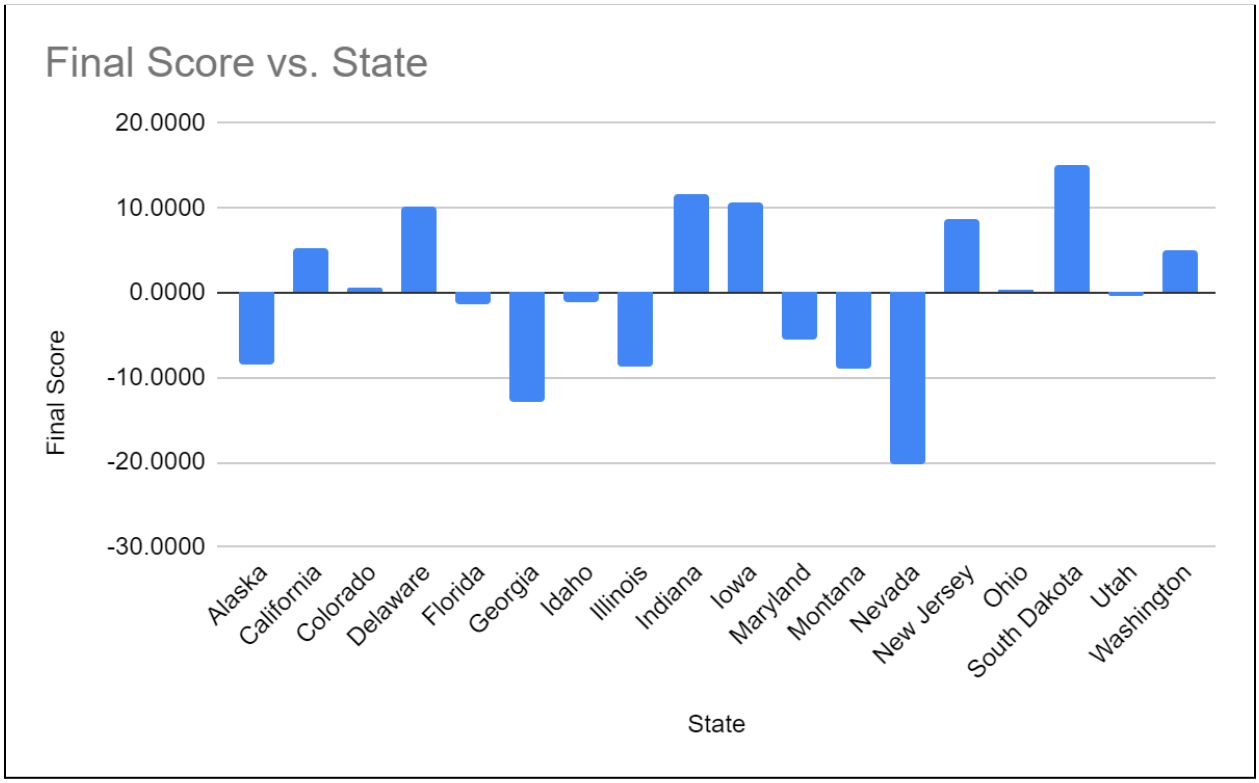
A final score for a state is determined by multiplying each normalized value by its corresponding metric weight, then adding all these values together (broken links and bounce rate are subtracted since they are inversely related to effectiveness). Since all values are normalized around 0, a final score of 0 indicates an average effectiveness, while increasingly negative scores are increasingly ineffective, and increasingly positive scores are increasingly effective.

5.2 Results

Table 10 Final Results

State	Backlinks	Bounce Rate	Broken Links	Page Speed	Avg Pages per Visit	Avg Visit Duration	Avg Monthly Traffic	Final Score
Alaska	-0.6630	0.9916	-0.6234	-0.7975	-0.5856	-0.1708	-1.0035	-8.5170
California	0.0634	-0.9617	-0.4566	1.5950	-0.3354	0.1500	-0.6615	5.2118
Colorado	-0.5112	0.6061	-0.2063	0.7532	0.4153	-0.3847	0.7009	0.6894
Delaware	-0.2523	0.4210	-0.2897	-0.5317	0.6030	0.7649	1.6741	10.2400
Florida	0.8167	0.0595	-0.3314	1.5507	-0.2259	-0.2510	-0.9775	-1.3049
Georgia	-0.4160	-0.7605	3.2979	0.1772	-0.3198	0.1500	0.4302	-12.9247
Idaho	-0.6044	-1.3481	-0.5817	0.0886	-0.6639	-1.6146	0.6241	-1.0711
Illinois	-0.5737	1.1198	-0.3314	1.0634	-0.6013	-0.0104	-1.2690	-8.5967
Indiana	-0.5541	0.8385	0.5029	-1.2849	2.9647	0.7115	1.3302	11.6993
Iowa	-0.6236	-1.6187	-0.4983	-0.9747	0.8376	0.2035	-0.3313	10.7420
Maryland	-0.6262	1.4777	-0.6234	-1.9052	-0.3354	-0.4382	1.0993	-5.5597
Montana	-0.6433	-2.0674	-0.4983	-0.9747	-1.1331	-2.1760	-0.9112	-9.0030
Nevada	0.7089	0.5483	1.6709	0.0443	-0.8203	-0.8660	-0.9578	-20.2789
New Jersey	2.3721	0.3577	0.2526	0.9304	-0.1634	1.0590	1.1126	8.5880
Ohio	-0.1794	0.5269	-0.6234	-0.8861	-0.4762	0.3104	0.2847	0.4456
South Dakota	-0.6755	0.3951	-0.6234	0.2658	1.6822	2.1018	-1.1302	14.9738
Utah	-0.1955	-0.4916	0.1692	0.2215	-0.2572	-0.6521	0.9119	-0.4068
Washington	2.5571	-0.0945	-0.2063	0.6646	-0.5856	1.1125	-0.9261	5.0730
Weights	1	4	5	1	4	5	3	

Figure 13 Final Results Column Chart



5.3 Discussion

The final scores show the effectiveness of each state's website. Nine states received a negative score: Alaska, Florida, Georgia, Idaho, Illinois, Maryland, Montana, Nevada, and Utah. Nevada received the worst score of -20.2789. Nine states received a positive score: California, Colorado, Delaware, Indiana, Iowa, New Jersey, Ohio, South Dakota, and Washington. South Dakota received the best score of 14.9738. Five states received scores that are close to the 0 average score: Colorado, Florida, Idaho, Ohio, and Utah. Utah was the closest to an average score with a score of -0.4068.

6. Limitations

The first limitation faced is based on the limited number of observable websites based on the fact that it must be a coronavirus website for a State in the United States. So at most, 50 websites would be available for observation. While 50 websites is not insignificant, more options are always preferred, since some websites may not be useful for various reasons.

This leads to the second limitation the team experienced: lack of available data for a large number of states. Of the 50 states, only 18 were observed for this analysis. This is because the remaining 32 states did not have data available for multiple metrics. More specifically, bounce rate, average pages per visit, average visit duration, and average monthly traffic data was unavailable for these states. Since these four metrics make a majority of the total metrics in the model, it was best to not include these 32 states into the analysis.

The last limitation the team faced was in regards to the type of metrics we were able to collect data on. Since all of our data came from publicly available tools, our metrics could not be anything that was unavailable to the public. While this did limit the types of metrics collected, the team still feels that the metrics used in the analysis are strong enough to make an effective model.

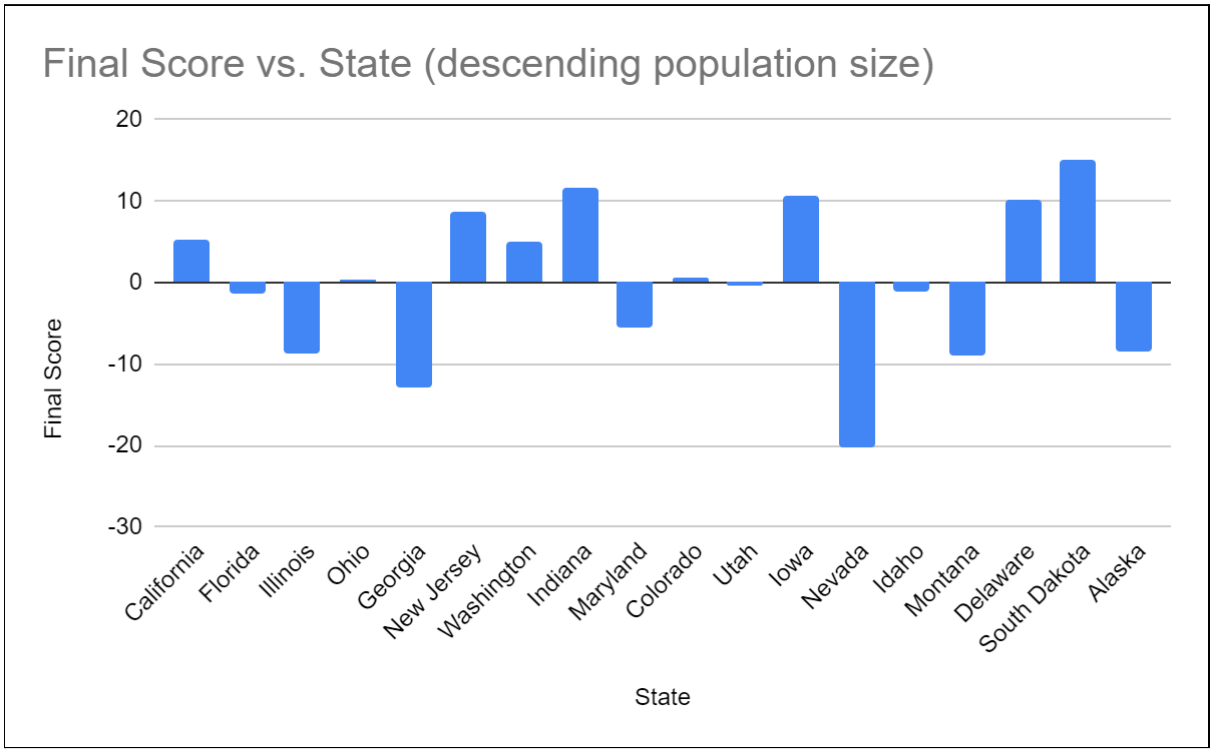
7. Conclusions

In conclusion, the team developed a project based on the importance of communicating information between the government and the general public regarding the coronavirus. Through the use of open-source data, the team identified seven key metrics in order to analyze the effectiveness of eighteen states' coronavirus websites. Once the data for these metrics was analyzed, the team created a final model, which weighted the metrics based on their importance to overall effectiveness in order to calculate a final score for each state.

The initial hypothesis which stated more populous states would provide a more effective website was proven incorrect based on the results of the final model created by the team. In the final model, population held no noticeable correlation to the website's effectiveness, shown by the most populated states falling in both the negative and positive scoring.

Through the analysis, the team has identified that by correcting and limiting the number of broken links present on the website, the effectiveness would significantly improve. Through this, the website would ensure the user would not receive an error by trying to access information on the page which would in turn improve the users experience. Another area of improvement identified from the teams analysis is improving the bounce rate of the website. This improvement can be made by effectively using headers on the website, which include large fonts and use a different shade of color from the page to draw the user's eye.

Figure 14 Final State Scores in Descending Order of Population Column Chart



8. Reflection

8.1 Hypothesis Reflection

The team's original hypothesis was that the more populous states would prove to have more effective coronavirus websites than those of the less populous states. The rationale behind such a hypothesis was that these states would likely have more tax dollars and budget to put towards the website development, and that the state's officials would feel especially obligated to keep their large population informed. Through this hypothesis being proved wrong, the team realizes that there is much more to the issue than population alone. Another probable contributing factor to the resources being put towards the websites is politics. The team might have been able to make a stronger hypothesis by looking into the political makeup of each state, given that politics have been a major source of divide on the issue of the pandemic, including the allocation of resources to pandemic-related programs. With a nationwide political analysis, the team's hypothesis may have appeared more in line with the results.

8.2 Improvements

To improve the project's final model further, the team would look to expand upon the key metrics identified, gather information on the remaining 32 states, and look to survey experts in website design to improve the accuracy of the weighting of the final model. 32 states were left out of the dataset because not all of the team's identified metrics were publicly available for those states' websites. The addition of data from those states would greatly strengthen the model and help the team to identify trends within a larger dataset. By receiving input from experts in the field, the team would be able to limit inaccuracy in weighting and ensure the final model correlates with industry standards and supported evidence of the makeup of website effectiveness.

9. References

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