Correlations of Social Demographics and Autism Spectrum Disorder

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Abstract

Autism spectrum disorder (ASD) is a neurological developmental disorder that occurs in approximately 1 in 44 individuals and has a wide variety of associated characteristics and traits.[17] Within the U.S., the diagnosis of autism is largely affected by race, sex, gender, socioeconomic status, and geographic location. For this reason our aim was to explore how different components of social demographics contribute to the diagnosis of autism. We chose to explore three components of social demographics: (1) language and sentiment of different politically leaning new outlets, (2) racial diversity in autism research of states based on state partisanship, and (3) prevalence of autism diagnosis by state based on state partisanship and poverty level. We hypothesized that left-leaning articles will demonstrate a more positive sentiment toward ASD, left-leaning states will have a greater amount of autism research and more racially diverse samples, and right-leaning states and states with lower poverty levels will have a lower percentage of autism diagnoses. Analysis of 4 left-leaning news outlets, 1 moderate liberal-leaning outlet, 4 right-wing news outlets, and 1 moderate-leaning outlet resulted in evidence that suggests right-leaning news outlets are more likely to use negative and ableist language in articles relating to autism as compared to right-leaning outlets. No strong correlations were found between state partisanship and racially diverse samples in the analysis of 27 research articles from around the U.S. regarding ASD. A strong correlation was found in the analysis of CDC data reporting ASD prevalence by state, and state partisanship based on the state voting results of the 2020 election. Although little correlation was found between state poverty level and autism diagnosis, there was strong evidence for conservative states to have lower instances of autism diagnosis compared to liberal voting states. While these results are not conclusive as to representing the full breadth of the effects of social demographics on ASD, they do provide some strong preliminary research into how political partisanship may contribute to language use, diversity in research, and diagnostic prevalences of ASD.

Introduction

Autism Spectrum Disorder (ASD) is regarded as a relatively common developmental disorder occurring in approximately 1 in 44 individuals. [17] In the U.S., validity and accessibility to a diagnosis of ASD is largely affected by many barriers including those of race, ethnicity, gender, socioeconomic status, and geographic location. In a literature review and analysis done in 2013, of 1013 articles and extracted data just 25% of the articles reported data on race and ethnicity. Of that 25%, research participation was dominated by white participants at 64.8% of the sample pool. Subsequently, just 9.4% of the sample identified as hispanic or latino,

just 7.7% as black, and 6.4% as asian. [53] Not only in research participation, in 2015, but an analysis of 2729 questionnaires from parents with children with ASD also found that non-English speaking hispanic children and non-hispianic black children have a disproportionately higher prevalence of later diagnosis and a lower confidence interval for diagnostic measures themself. [30] In terms of gender, transgender and gender-diverse individuals have, on average, higher rates of autism, other neurodevelopmental and psychiatric diagnoses, and yet studies still report gender as simply male, female, or other. [58] Subsequently, there is severe underdiagnosis of autism in females, and girls who meet criteria for ASD are at disproportionate risk of not receiving a clinical diagnosis. Furthermore, SES which predicts service needs and receipt for families with ASD shows that greater service needs are for individuals of African American race and the number of physical and behavioral health diagnoses. Predictors of greater service receipt were employment status, housing type, and school enrollment. However, research found that there was lower service receipt for those of African American race, Hispanic ethnicity, individuals over age 21 years, and individuals who had completed college. In addition, higher SES correlates with higher diagnostic confidence in autistic observations in clinical settings. [20, 49]

With all of these factors in mind, it is quite apparent to see that validity and accessibility to an autism diagnosis is entirely circumstantial. And when access to services and assistive programs rely solely upon a clinical diagnosis, the consequences of these gaps and disparities pose significant barriers for families of diverse backgrounds. For these reasons, our project proposes preliminary evidence that social demographics play additional roles in both research and the diagnosis of ASD.

Through the analyses of various data sets encompassing social demographics and autism, we chose to explore three subsequent components: (1) language and sentiment of different politically leaning new outlets, (2) racial diversity in autism research of states based on state partisanship, and (3) prevalence of autism diagnosis by state based on state partisanship and poverty level. With the goal being to discover how these components may contribute to autism diagnosis and research, we hypothesized the results to support the following: (1) left-leaning articles will demonstrate a more positive sentiment and use ableist language when discussing ASD (2) left-leaning states will have a greater amount of autism research and more racially diverse samples (3) right-leaning states and states with lower poverty levels will have a lower percentage of autism diagnoses. The term ableism describes the discrimination and social prejudice against people with disabilities, and language use plays a large role in ableist characteristics. Ableist language, therefore, often defines individuals by their disabilities, and places them on an inferior social standing to non-disabled individuals. Exploring ableism, and positive and negative sentiment in news outlets, diversity in research, and cofactors of political partisanship are the ways in which we hope to better understand social demographic correlates to ASD.

The significance of this research will provide evidence for correlations between social demographics and ASD, and whether or not political partisanship has any relationship with ASD diagnosis and research. Very little is known about these correlates, and little to no research institutions use political partisanship to explore social demographics. It goes without saying that correlation is not equal to causation, and so our hope is not to pin one political agenda against another, but to provide some preliminary evidence suggesting that political partisanship may contribute in some way to language use, diversity in research, and diagnostic prevalences of ASD.

Methods

Political Partisanship of News Outlets and Ableist Language and Sentiment:

To explore how political partisanship of news outlets correlates with ASD sentiment, we used a web scraping process to gather articles from various news sites. This was done by gathering the URLs of articles discussing ASD and creating a list of 5 articles per news outlet. The political partisanship of each news outlet was determined using a media bias chart sourced from allsides.com [51]. We used this chart identified four "left-wing" new outlets (CNN, MSNBC, New York Times, Huffington Post), four "right-wing" news outlets (Daily Mail, FOX News, Breitbart, CBN), one "moderate left" news outlet (Washington Post), and one "moderate right" news outlet (Washington Times). With a total of 50 articles, Urlopen was used to import the articles' webpages to python, and the Beautiful Soup library was used to parse the article text for HTML script and CSS styling. Once the text was extracted, each article was processed as a text file for which a sentiment/ableism analysis was done. Ableist language was determined using the guidelines by Bottema-Beutel et al., an article written by autistic advocates for the discontinued use of ableist language in research and suggested alternatives for non-ableist language. [8] Positive and negative language was determined using lists we pulled from our course website that were created by our professors [https://course.ccs.neu.edu/ds2000/schedule.html].

Using Matplotlib, the sentiment score was charted based on news sources (Figure 1). Each article's sentiment score was plotted with an alpha of .2, and the overall average sentiment score per news source was calculated and plotted using an alpha of 1. Matplotlib was also used to chart the ableist to non-ableist language ratios based on news sources (Figure 2).

Racial diversity in ASD research and State Partisanship

Using geospatial and PubMed data, we constructed a map of the U.S., where left-wing leaning and right-wing leaning states are distinguished by color. Left-leaning states are blue and right-leaning states are red.

To acquire the data from articles from PubMed, a literature review was done. First, on PubMed.gov, a search for "Autism Spectrum Disorder," articles were pulled for being published as clinical trial articles, published between 2020-2021, research conducted with humans, and the literature was in English. Articles were excluded if the research took place outside of US, the full article was not accessible, or if the demographics (race/ethnicity) were not reported. This literature review resulted in 113 articles of which 27 articles met both search and exclusionary criteria. Data was then manually collected per each of the 27 articles for location (state), sample size, and race/ethnicity percentages (White, Hispanic/Latinx, Black, Asian, Native Hawaiian/other Pacific Islander, American Indian/Alaska Native, Other, Bi- or multiracial, Unknown).

In order to create the map, we used geopandas and pandas to download a U.S. shapefile. Using a math library, we were able to plot the coordinates of each state. Additionally, through Matplotlib, we created pie charts that represented race percentages of each state that the Autism Spectrum Disorder research articles were based in.

ASD Prevalence, State Partisanship, and Poverty Level

The CDC and U.S. census report the diagnosis of autism and poverty level by state respectively. Using this data, as well as state voting results for the 2020 U.S. election, Matplotlib was used to chart ASD prevalence, state partisanship, and poverty level over time from 2000 to 2020. For the ASD prevalence data set, some of the data points did not have the location (state), so those data points were filtered out. For state partisanship, data was used by looking at the 2020 election results. The state location for the ASD prevalence was then mapped to poverty level for that state in that year. The partisanship was then noted by the color.

Analysis

Political Partisanship of News Outlets and Ableist Language and Sentiment:

For our News Outlets Partisanship and Article ASD Sentiment data analysis, we performed two main processes. The first was a general sentiment analysis of every article using a list of positive and negative words we consolidated from class as well as at our own discretion. We then organized, averaged, and plotted the sentiment scores by news source to better understand the results, labeling each news source to its corresponding partisanship (see above). Based on our visualization, we were able to determine that left-wing news sources seemed to have a more positive sentiment for their reporting on Autism. However, it is important to keep in mind that sentiment is still generally negative across all news sources regardless of partisanship. Additionally, it is interesting to note that the moderate right-wing articles had a higher scoring sentiment than the moderate left-wing articles. Although, performing the same analysis on more moderate partisanship news sources could have led to a different conclusion as we only used one news source for each moderate partisanship.

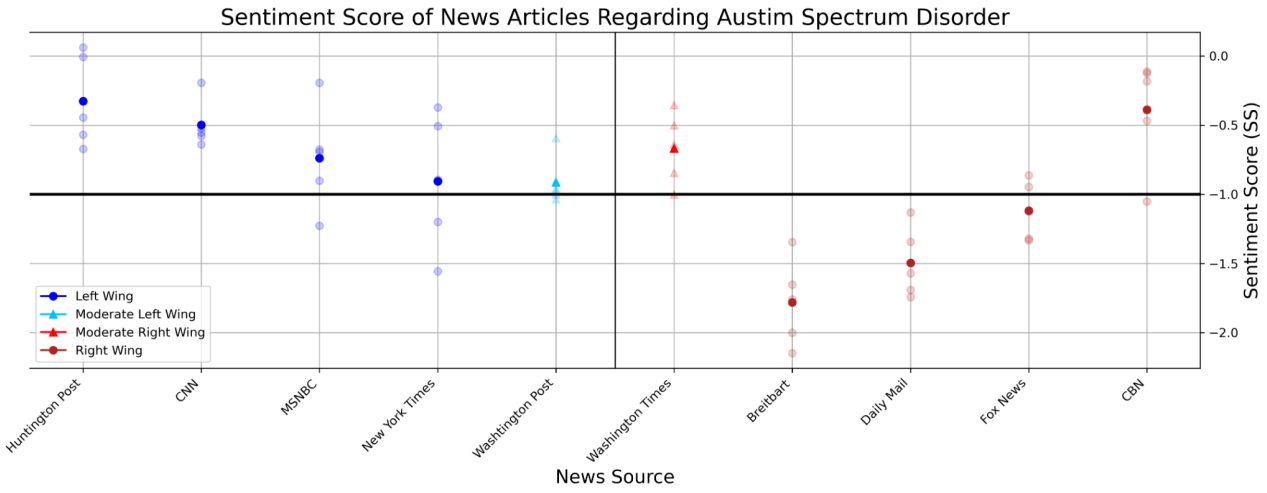


Figure 1: Sentiment score (SS) for news sources across the political spectrum. Average SS is noted as the darkest point per each news outlet.

The second process was another sentiment analysis however this time it was using only a list of ableist words for our negative words and a list of non-ableist words for our positive words. These lists of words were determined by our own discretion and through the help of journal articles [52]. For our visualization, we plotted the sentiment ratio (positive to negative) of the

ableist to non-ableist terms for each news source and organized and labeled them by partisanship (see above). While our visualization confirmed the results of our previous plot (that left-leaning news sources generally have a higher/more positive sentiment regarding ASD), it gave us a deeper understanding of the sentiment from right-leaning news sources. This is because the sentiment of right-leaning news sources was much closer to the sentiment of left-leaning news sources in this plot. One of the possible reasons for this is that the negative words in this case (non-ableist terms) were used much less frequently than general negative words as were used for the analysis of the previous plot. Additionally, this visualization reversed the original conclusion of the previous plot for moderate partisanship news sources as in this plot, the moderate left news source is much higher than its counterpart.

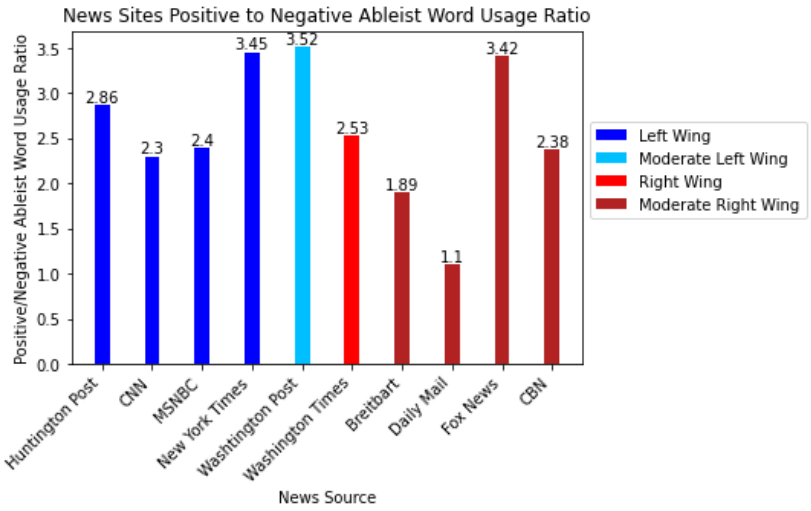


Figure 2: Ratios of ableist to non-ableist word use for news sources across the political spectrum.

Racial diversity in ASD research and State Partisanship

The analysis of diversity in research sample size did not show any significant correlations with state partisanship. While there were several notable states with more diverse sample sizes as seen in Figure 4, there was not an instance in which greater sample diversity was attributable to state partisanship.

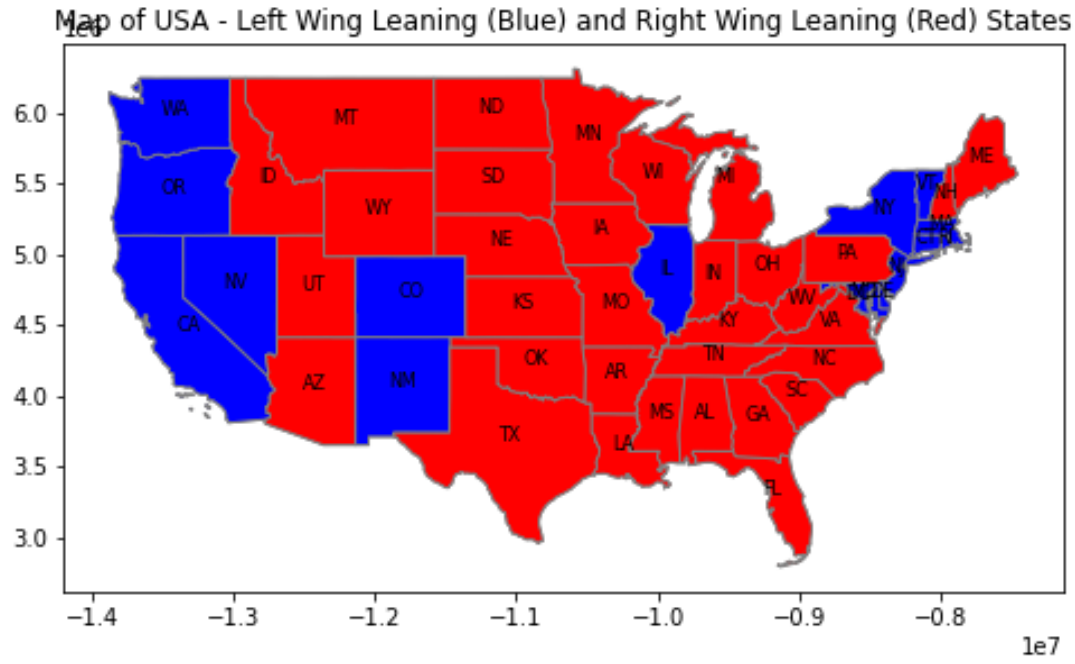
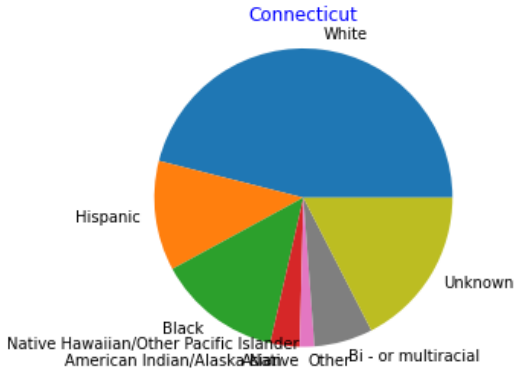
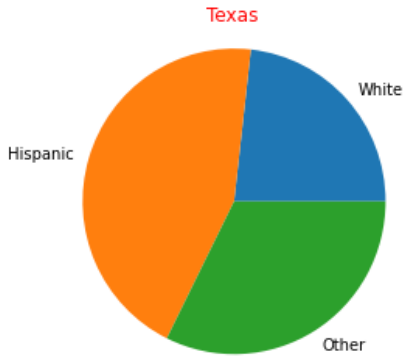


Figure 3: Map of the U.S. indicating states that voted Democratic as blue, and Republican as red in the 2020 U.S. election.

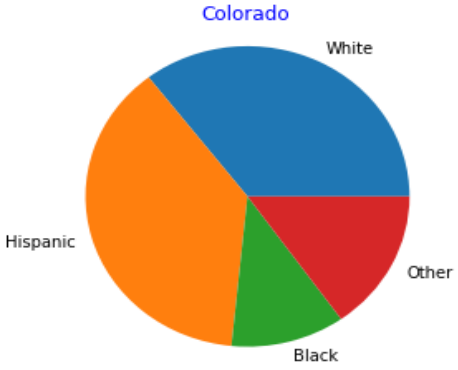
A.


Connecticut
White
Hispanic
Unknown
Black
Native Hawaiian/Other Pacific Islander
American Indian/Alaska Native
Asian
Other
Bi - or multiracial

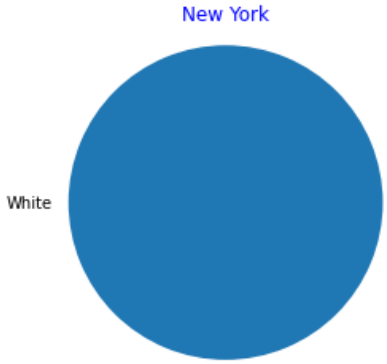
B.


Texas
White
Hispanic
Other

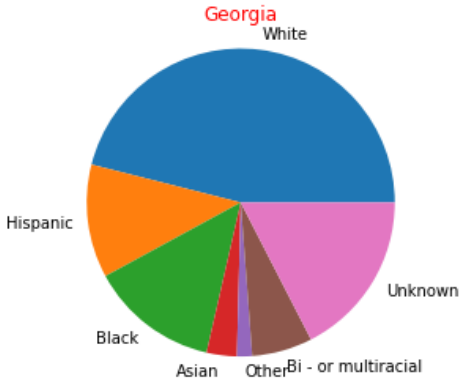
C.


Colorado
White
Hispanic
Other
Black

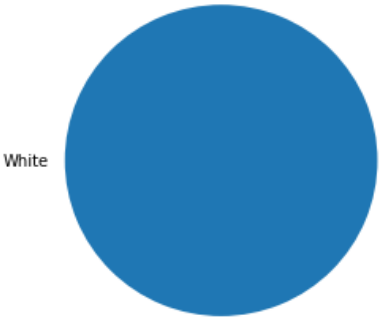
D.


New York
White

E.


Georgia
White
Hispanic
Unknown
Black
Asian
Other
Bi - or multiracial

F.


Wisconsin
White

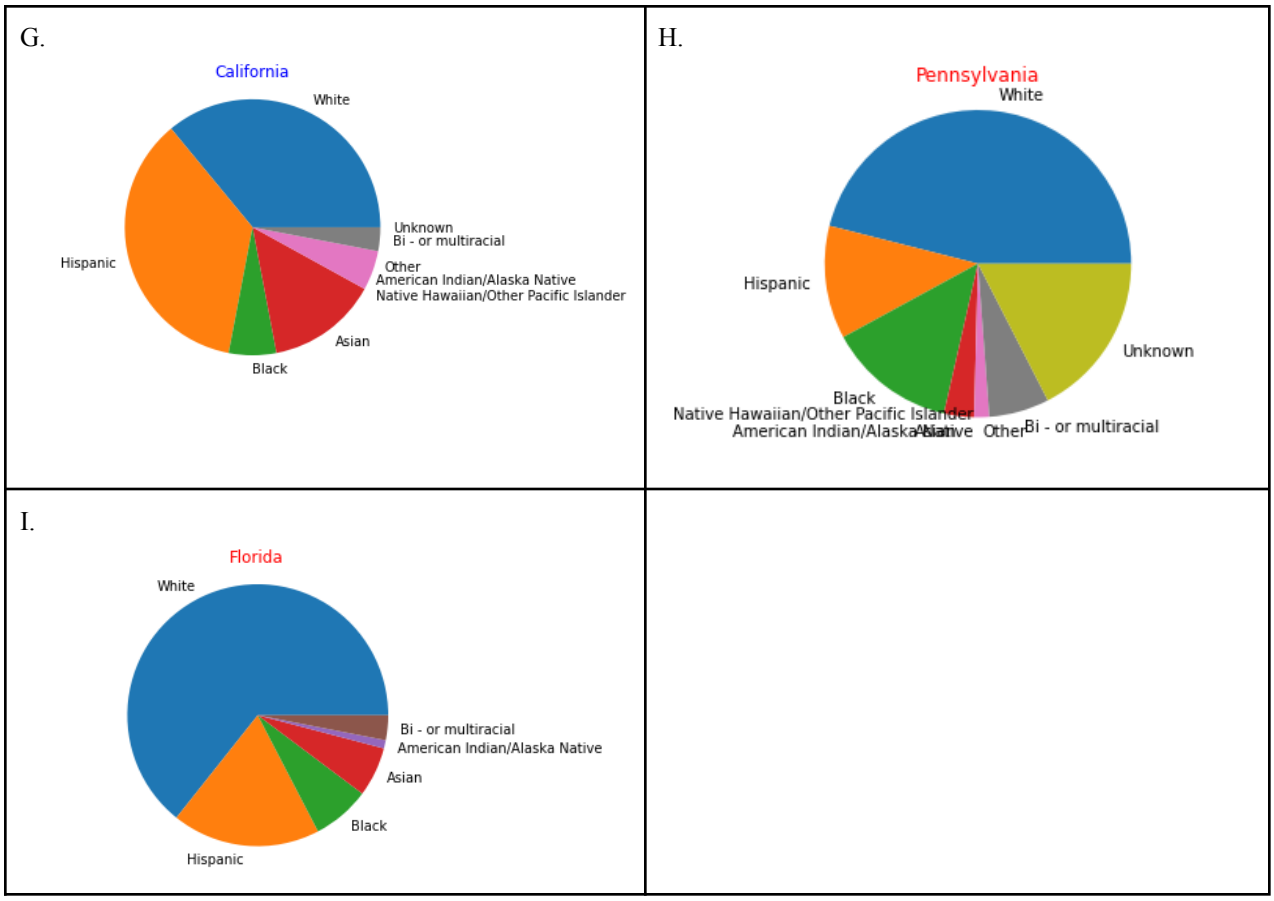


Figure 4: Pi-chart presenting the diversity of sample sizes in research by state

ASD Prevalence, State Partisanship, and Poverty Level

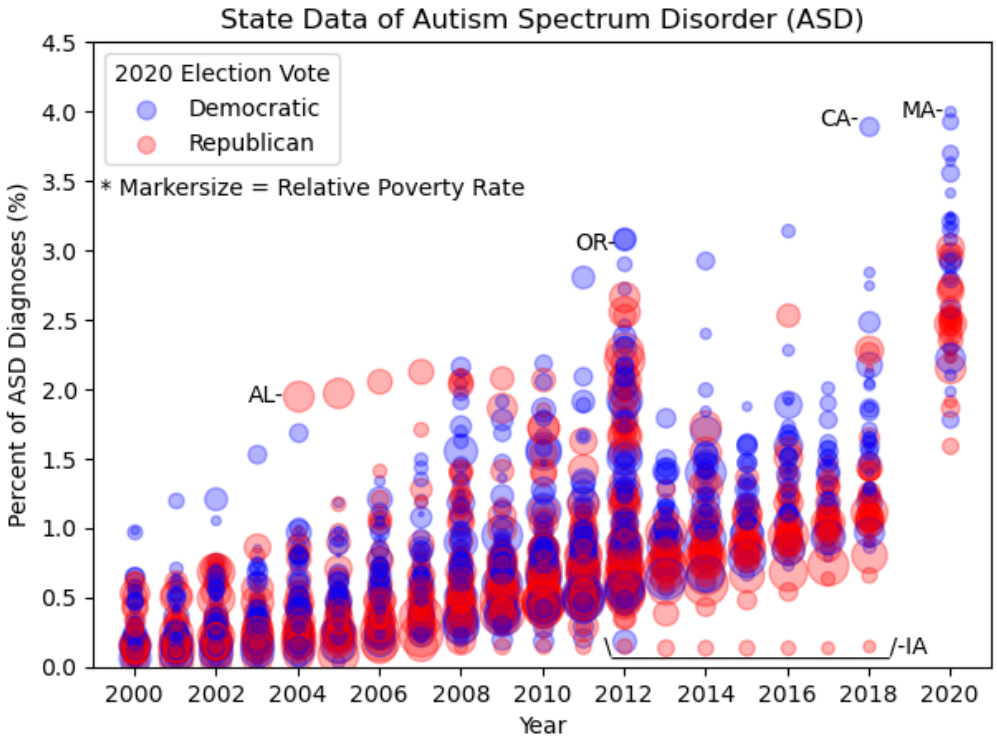


Figure 4: ASD diagnosis as percent of state population as related to state political partisanship and poverty level over time.

The analysis of data combining ASD prevalence, state partisanship, and poverty showed that (1) Autism is trending towards an upward rate, (2) there is a general correlation between Republican voting states having a lower rate of autism, (3) there does not appear to be a strong correlation between poverty and rate of autism. While statistical analysis would need to be done to determine whether the relationship between autism prevalence and state partisanship is statistically significant, this graph does demonstrate some relevant relationship between state partisanship and ASD prevalence.

Conclusions

Based on data analysis, the evidence from our research suggests that left-leaning media and liberal states generally have better sentiment in reporting news about ASD and better diagnostic prevalence than conservative states and media. This exploration of correlates demonstrates that language plays an important role in shaping both awareness and accessibility in Autism research. Moreover, diversity in research is important to curating accurate and effective diagnostic measures and subsequent interventions and services. However, research on Autism Spectrum Disorder and the effects of social demographics on diagnosis is limited. For instance, although poverty did not seem to have strong correlations with Autism diagnosis, state partisanship did seem to coincide with language use, diversity in research, and diagnostic

prevalences. This is not to say that poverty may not coincide with ASD prevalence or state partisanship, but only that we were not able to visualize a trend with the graph created.

There were limitations in determining objective measures as to whether a news source was left wing or right wing, and a future direction could be to have a larger list of news sources with a quantified approach to determining political biases. Furthermore, the data used for the analysis of diversity in ASD research correlating with state partisanship included just 27 articles from a time period of 2020-2021. This data size was limited by the ability to acquire racial/ethnic data by hand per each article, and so a better method would be needed for the future should an analysis be done with a larger data size. Finally, the data in the analysis for ASD prevalence, poverty, and state partisanship could have been better represented. A future direction could be to show two additional graphs, one with only left leaning states, and one with right leaning states. It would also have been interesting to explore how political affiliations changed over time, and so modulating the democratic and republican voting colors on the graph according to what they had voted for during that presidential term.

With the limitation in mind, although there were strong correlations that supported our hypothesis regarding left wing news sources showing greater positive sentiment and less ableist use of language, as well as increased ASD prevalence in Democratic voting state, our data project does not prove that these correlations are related to the casualty of these ASD factors. This would have required statistical evidence and in our case without this statistical backing correlation does not entail causation. We do hope, however, that our research is helpful for those interested in the topic and can be used to possibly demonstrate causality with further analysis.

Author Contributions

Jack Krolik: Responsible for Political Partisanship of News Outlets and Ableist Language and Sentiment analysis encompassing both the visualizations and the data gathering. Additionally, Jack contributed equally to all other portions of the projects such as the presentation and the final write-up.
Meagan Tsou: Responsible for the analysis of ASD Prevalence, State Partisanship, and Poverty Level through both acquiring the data and the visualizations. Meagan also was responsible for the acquisition of the data munging from Pubmed for the analysis of Racial diversity in ASD research and State Partisanship Meagan also contributed equally to all other portions of the project including the presentation and final write-up.
Melissa Rejuan: Responsible for the analysis of Racial diversity in ASD research and State Partisanship through the creation of the graph visualization. Melissa also contributed equally to all other portions of the project including the presentation and final write-up.

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