

COVID-19, Climate Change Denial and the Evolving Politics of Gender

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Submitted: 2024, Jan 10; Accepted: 2024, Feb 02; Published: 2024, Feb 15

Citation: Atkinson, K., Sahagian, D. (2024). COVID-19, Climate Change Denial and the Evolving Politics of Gender. *J Future Med Healthcare Innovation*, 2(1), 01-07.

Abstract

The increasing role of women in leadership roles may be both a cause and effect of public attitudes toward health and science in general. Recent politicization of science amidst increasing polarization of American politics juxtaposed with examples of female leadership (Fleadership) throughout the U.S (and abroad) begs the question of how gender impacts health crisis response decision-making in light of political associations. Here, we investigate at the U.S. state level, female gubernatorial leadership, presidential (and VP) voting patterns in 2016 and 2020, climate denial, juxtaposed against COVID-19/100k rates measured in November 2020 and again in January 2021. Our findings demonstrate strong correlations between high COVID-19/100k, climate denial, low vaccination rates, and the 2016 and 2020 presidential votes for exclusively male candidates. Americans who embraced federal Fleadership in 2016 and again in 2020 were less likely to deny climate change and spread COVID-19. However, this has also been closely aligned with political partisanship. Fleadership had historically been mostly limited to Democratic slates, but with more Fleadership nationally, the gender-party bias is weakening. Our results suggest that rather than Fleadership inspiring responsible COVID-19 preventative behavior at state or national levels, or leading to better understanding of climate change, the populations who previously tended to elect females, also understand science more than those who did not. This further relates to the public acceptance of COVID-19 vaccines at the state level. The states with greater COVID-19 incidence and climate denial, also have the least fraction vaccinated, leading to a predictable positive feedback. The state-wide variability in acceptance of the COVID-19 vaccines aligns with the correlations between climate change denial, COVID-19 infections, and Fleadership. These statistics highlight the connections between climate, public health, and the lack of public understanding of science, and thus the importance of science education at all levels throughout the population. The absence of effective climate policy on a national level may in part reflect the tensions between populations with contrasting science education and resulting actions.

“When you believe in things that you don’t understand, then you suffer. Superstition ain’t the way!” Stevie Wonder, 1972.

Keywords: COVID-19, Politics and Gender, Climate Denial

1. Introduction

Recent years have led to a polarization of attitudes within the American public regarding science, policy, behavior, and governance [1-6]. Here we explore the correlations and relationships between related data sets in the hopes that they may provide insights regarding the causal mechanisms of the widening gap between the world-views in the American population [7-10]. This includes correlations and relationships between COVID-19 cases per 100 thousand population, climate denial, the number of female governors to be elected in each state, and most markedly, and presidential voting trends in 2016 and 2020 with associated political affiliations. We interpret these results in terms of science-based decision making, STEM education, and the service of science for society.

Initial observations led to the following hypothesis, to be further tested by evolving conditions and responses to the ongoing COVID-19 pandemic, recent and future political decisions,

attitudes toward science (climate change in particular), and changing affinities between gender and political party [11, 12].

1.1. Hypothesis

At the state level, populations which have elected female leaders have been also more likely to understand or respect scientific results, and thus respond behaviorally with precautions to avoid COVID-19.

By “understand” we do not necessarily mean serve as a scientific expert, conduct research, and obtain new data as would be done by climate scientists, for example. We assume that those who “understand” the science also respect its findings [13]. However, it is not necessary to be a scientist to respect the results of scientific research, and behave accordingly. We thus use the term “understand” to also mean to respect and accept science as an important means of obtaining practical information upon which

to base individual actions and develop public policy. This would be in stark contrast to obtaining information from “Facebook Friends,” TikTok, and Twitter (X), for example [14, 15].

The direction of the cause-and-effect relationships implied in the above hypothesis is not clear a priori. The hypothesis could as easily be reversed to ask “Does female leadership or political party impose mandates that lead to responsible public behavior to avoid COVID-19, and maintain public education systems that lead to deeper understanding of science?” In the context of a nation dominated by increasing political polarization, the cause and effect of women in government may have now become an overlay on a tapestry woven by tribal ideology inculcated by both necessity and resistance to social change, and enabled by social media and opinionated “newscasts.” As such, we do not attempt to analyze the fascinating complexities of modern socio-political dynamics that have been well-described in the literature. Rather, we explore the changing role of and perception to women in positions of political leadership, and the changing correlations with science-based decision-making. Further, we expect any correlation between gender, politics and public health to weaken as more women are elected to public office.

We coin a new term to represent female leadership-“Fleadership.” There may be evolutionarily developed genetic differences between males and females pertinent to social behavior and relationships, human health, protection of home and community, decision-making and mechanisms for conflict resolution, but these are beyond the scope of this paper. At this point, we merely present correlative relationships between some readily observable quantities [16-18].

2. The Evolving Role of Women in Political Leadership

In the evolving role of female engagement in the political process, females were once overwhelmingly more successful in elections as Democrats rather than Republicans. However, with the broader political acceptance of Fleadership throughout America, they have made inroads into the Republican party and so the correlation between political affiliation and Fleadership has weakened. Further, in the US, female executives have now been found to be as well-accepted by their constituents as their male counterparts [19]. As such, it may not be the current numbers of women in leadership roles that correlates with the various factors involved in our hypothesis, but rather the historical number. Nonetheless, the attitudes at the state level that had been obstacles for Fleadership may serve as causative mechanisms for the observations regarding climate denial, COVID incidence, vaccine avoidance, and other behavioral characteristics, as explored below.

3. Findings

To test our hypothesis, we compiled data regarding the number of female governors ever to be elected within each state, the positive COVID-19 cases per 100 thousand residents for each state as of

November 2, 2020, and whether the state delegation voted for male Republican (Trump) or female Democrat (Clinton) in the presidential election of 2016, the only time in American history (to date) when there was a female choice for president. The data indicate a strong correlation between climate denial and male (and Republican) choice for president in 2016 (Fig. 1) [20-24]. There is also a strong correlation between climate denial and COVID/100k, seen in each of the following figures, with U.S. states in sequence of increasing COVID/100k from left to right. Some states have elected female governors, while others have not [25, 26].

There is a correlation between the number of female governors ever elected in each state and the fraction of the state that understands climate change [27]. These also relate to COVID-19 numbers. There is also a very strong correlation between climate denial and COVID/100k. While there is also an anticorrelation between COVID-19 and the number of female governors ever elected in each state, there is considerable scatter in Fleadership at the gubernatorial level, as there have been very few women elected as governor to date (maximum 4 in any state, and many with none). In addition, female governors are recently less limited to the Democratic party, suggesting that the exclusion of women from Republican leadership is easing more rapidly than partisan attitudes toward science (e.g. COVID and climate change). A similar reduction in the gender gap has been found in business as well [28].

An additional striking correlation is found in the 2016 presidential election (Fig. 1). The states are still in sequence of increasing COVID/100k left to right, and each state that voted for the male Republican candidate (Trump) increments the curve by one, and each that voted for the female Democrat (Clinton) increments by zero. Figure 2 updates Figure 1 to include COVID100k numbers as of January 2, 2021 as well as the results of the November, 2020 elections. It is interesting to note that on the left side of both graphs (Figs. 1 and 2), states with the lowest levels of COVID/100k all voted for the female Democrat (slope of zero between points), which was Clinton (Pres) in 2016 and Harris (VP) in 2020, while those with the highest COVID/100k all voted for all male tickets in both elections (slope of 1). If there were no correlation between COVID/100k and presidential vote, the points would fall along the best fit straight line, but the upward concavity (positive second derivative) indicates a strong correlation in both Figs. 1 and 2. The sequence of states in Figures 1 and 2 is remarkably similar to the results of a very different study involving housework and domestic activities at the state level relative to family traditionalism and female labor force empowerment [29]. The sequence is also similar to the relation between gender inequality and homicide, and consistent with the link between gender earning gap and violence against abortion clinics [30, 31].

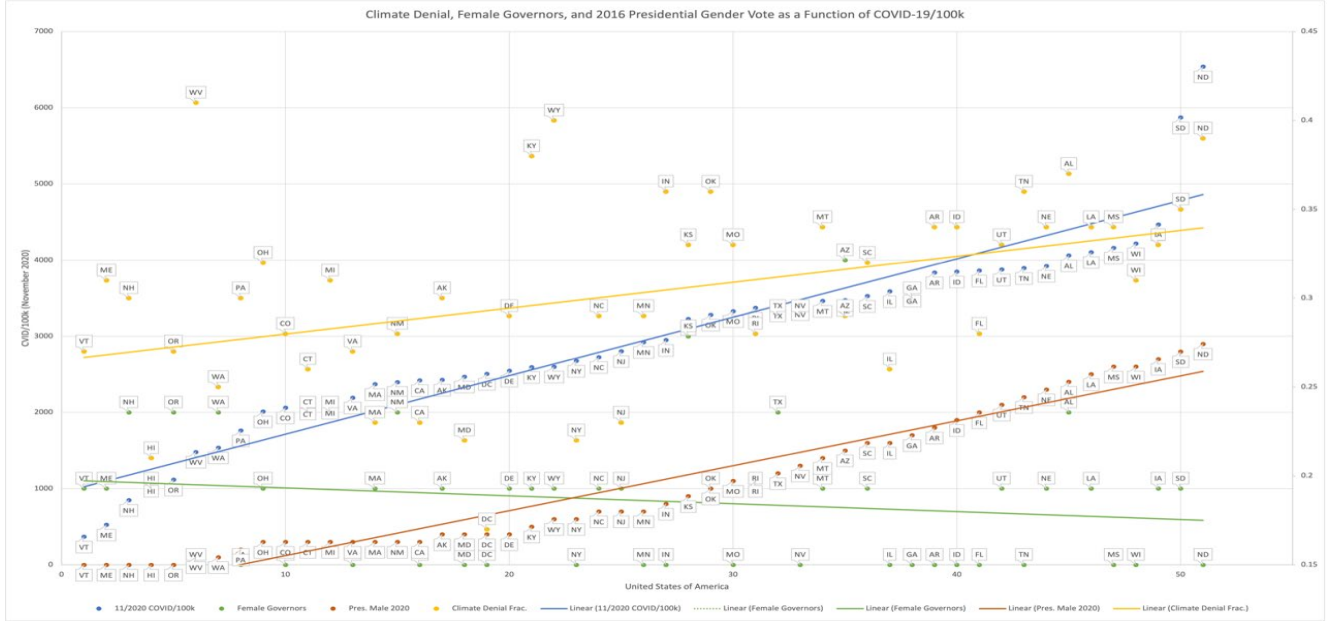


Figure 1: COVID-19 cases (blue) at the state level as of Nov 4, 2020. States are ordered left to right in increasing number of cases per 100k. Fleadership is measured in all past and present (prior to November, 2020 election) female governors (green) in all US states (left axis). Some states have had up to four female governors while some have had none. Understanding of climate change is again measured along the y-axis on the right. The correlation here is weaker than that at the presidential level in Fig. 1. The red line indicates the 2016 Presidential gender vote, incrementing sequentially (left to right) by 1 for each state that voted to reject female leadership and by 0 for each state that embraced it. If there were no correlation, the points would define a linear relationship. The concave upward curve reflects a positive correlation between rejection of Fleadership at the presidential level (in 2016) and COVID-19 in 2020, but party affiliation may have been a stronger driver for this. Further, there is a strong correlation between states that rejected female leadership in 2016, and the highest rates of climate denial (yellow), as well as the greatest COVID-19/100k (blue). Additionally, these states have generally elected less female governors. This raises the questions to what matters most to voting and behavior- Presidential candidate gender or political party? Trust in science or tribalism in attitudes and behavior?

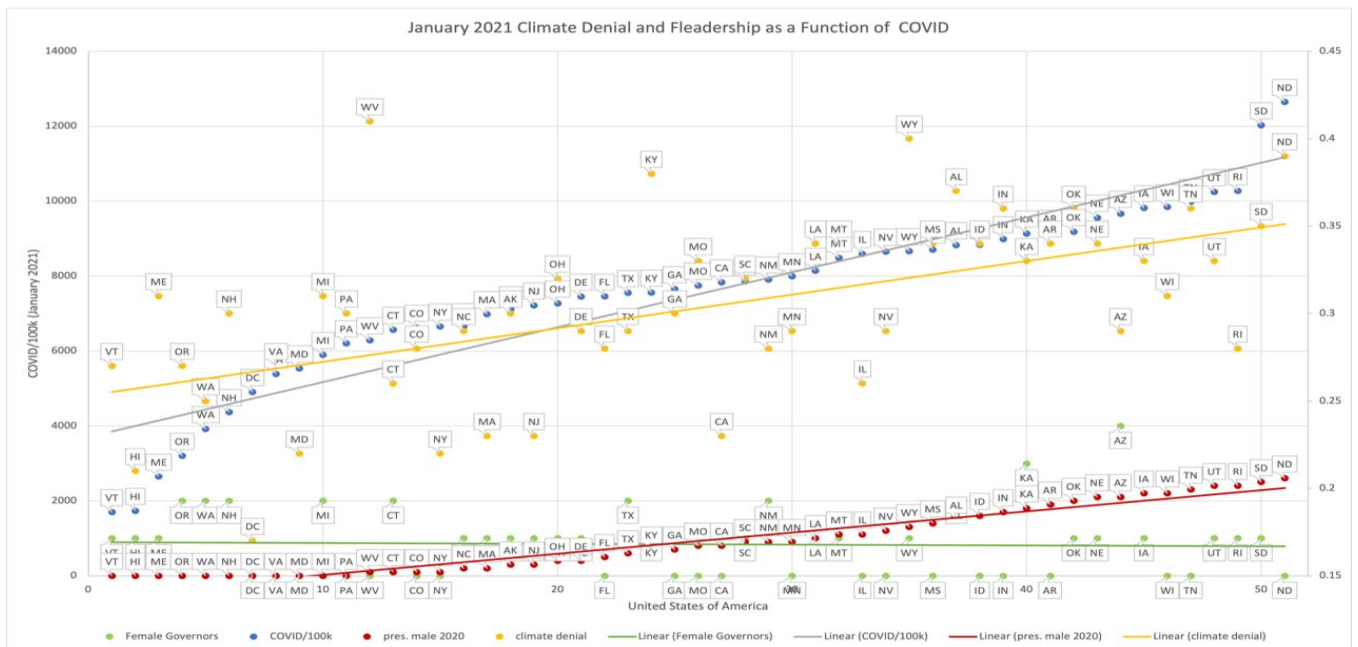


Figure 2: Same scheme as Figure 1, but updated with COVID/100k data from January 2, 2021 and results of the November, 2020 election. While COVID/100K roughly doubled across the board, the increase was much greater in states that also had more climate change denial and voted against Fleadership in 2016. The election results of 2020 did not significantly change this landscape if you count a female Vice-President as Fleadership in the Presidential ticket. The red line remains concave upward, and there was no change in female governors as a result of the 2020 elections. The same questions remain outstanding as raised in Fig. 1.

4. Evolving Vaccine Numerics

As the COVID-19 situation in the United States has continually evolved, it is imperative to make note of the distribution vaccine rollout and rates of vaccinations in relation to our measurement of Fleadership, climate denial, and COVID-19/100k. According to data on vaccines delivered and administered across the United States from the Centers for Disease Control and Prevention, the New York Times found “that both willingness to receive a

coronavirus vaccine and actual vaccination rates were lower, on average, in counties where a majority of residents vote to reelect former President Donald J. Trump in 2021.” Further, these same states are the ones with greatest COVID-19 infection rates in 2020-2021. Combined with climate denial and COVID infection numbers, the low vaccination rates suggest an underlying attitude regarding decisionmaking that is not rooted in science, but rather is driven by other socio-political factors.

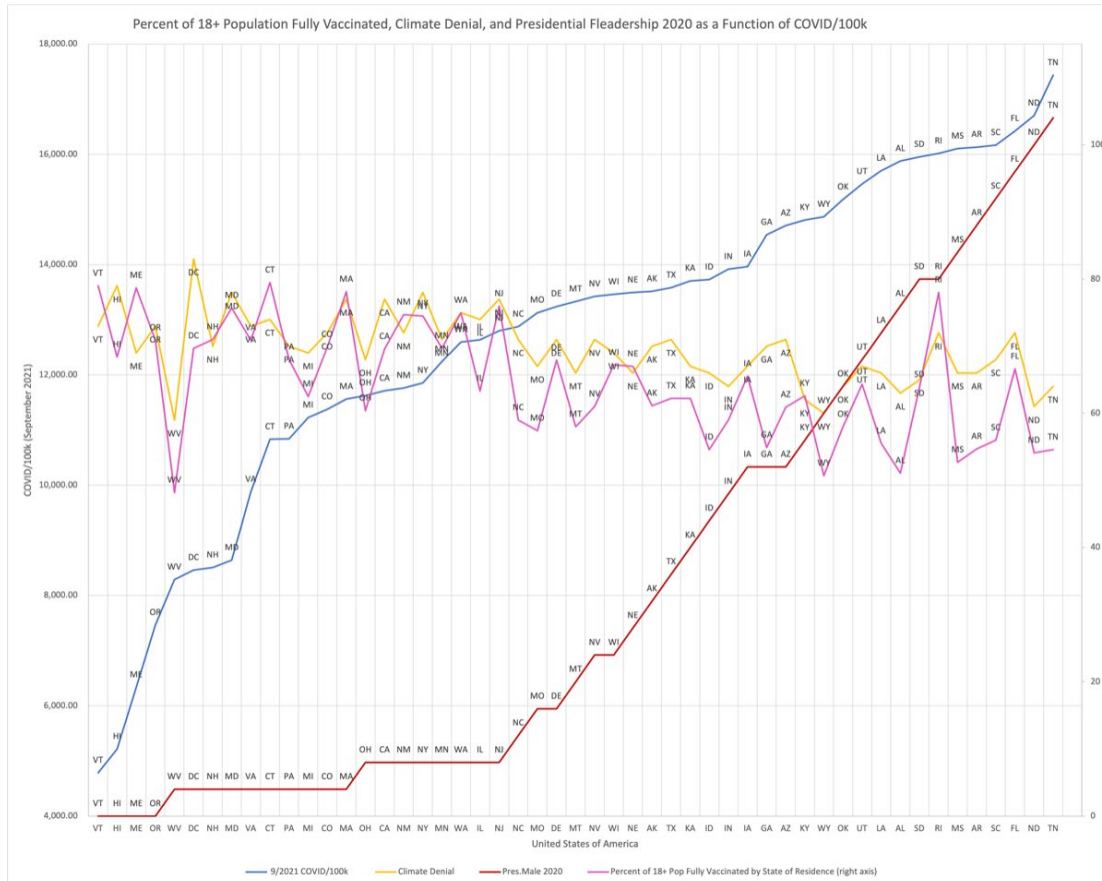


Figure 3: Same scheme as Figures 1 and 2, updated to include vaccination rates (pink) at the state level. For comparison, climate denial (yellow) is inverted so that there is less denial toward the left and more toward the right. There is a striking correlation of climate denial and unvaccinated population at the state level, along with the correlation of COVID cases/100k and voting in the 2020 presidential election. As with earlier figures, states are in a sequence of COVID cases/100k, with VT with the least and TN with the most. The basic observation is that at the state level, those who deny climate change and vote against women (and Democrats in this case), also get more COVID and less vaccines. This calls for further investigation regarding public attitudes regarding the importance of science and the politicization of climate and health issues. As STEM education is enhanced nationally, these correlations may weaken in future analyses.

5. Discussion

The correlations concatenated in Figures 1 and 2 suggest some potential causative mechanisms while raising a number of additional questions. The first involves public attitudes regarding science. Both epidemiology and climate science are well-studied by scientific experts throughout the world, and these studies have resulted in concrete and actionable recommendations [11]. In the case of epidemiology, medical experts have advised Americans regarding airborne disease transmission and simple public actions such as wearing masks and social distancing. The science is clear yet many pockets of the American population do not understand it, do not “believe” it, or choose not to act

on it. Likewise, in the case of climate science, cessation of fossil fuel burning, tropical deforestation, and carbon capture and sequestration have been recommended for the past few decades. Again, many pockets of the American population do not understand, do not “believe”, or choose not to act. Further, these same populations (at the state level) resisted vaccination, even after it became universally and freely available in the US. This suggests that the level of scientific understanding controls people’s decision making, policy preferences and COVID-preventative behaviors [32]. Conversely, this may reflect that a common disregard for scientific understanding in some segments of the population, even at the entire state-averaged level, may be

responsible for both high COVID levels in America, and failure to enact climate change mitigation policies at the federal level.

The correlations regarding Fleadership are more variable, but show an important trend. The correlation between state-level presidential political party and gender vote on the one hand, and COVID and climate denial on the other is very strong. At the gubernatorial level, the states that embrace Fleadership generally have less COVID cases, but the numbers are too low to draw any meaningful correlations (Fig. 1).

It is important to distinguish between public attitudes that elect female leaders, and the influence of female leaders on public behaviors. The correlation raises the question as to whether female governors have enacted policies at the state level that have reduced COVID (e.g. mandatory masks, closing restaurants, etc.), or if the people who have been known to elect female governors (or females on a presidential ticket) also embrace scientific results and behave in a way that reduces the spread of COVID. The latter is suggested by the correlation between female governors and understanding of climate change in Figure 2. It would appear that the same populations that eschew female governors also deny climate change and spread COVID. Previous studies find that compliance with mandates from male and female governors is similar, suggesting that it is the public attitudes that both elect females and understand science, and that these attitudes are largely driven by or reflective of political affiliation [33]. However, there is no guarantee that within each state, the same populations who elect female governors also understand climate change and engage in pro-preventative pandemic behavior. Further investigation would be required at the local level with specific surveys to ascertain the extent of overlap of such populations.

The above interpretation is even more strongly borne out by the presidential vote of 2016. The States that voted for the female candidate (Clinton) had less COVID and less climate denial than states that voted for the male candidate (Trump). However, even though Clinton received more American votes, Trump was elected through the vagaries of the electoral college. Consequently, Fleadership did not play a role in subsequent understanding of climate change or behavior regarding COVID. Yet, the states that voted for Clinton subsequently had less of both COVID and climate denial. These same states (and a few additional) also voted for Harris as Vice President in 2020. Furthermore, these same states have higher COVID vaccination rates (see below). This indicates that the mechanism is bottom-up, and that Fleadership reflects public attitudes more than shaping them, and that those populations at the state level who would elect female leaders (at both state and federal levels) also understand science and avoid COVID.

The history of women in politics shows a marked increase in involvement and acceptance throughout the 20th century, from basic suffrage, to running for local elections, to state and federal representatives, to governors and finally to the White House. As inroads were made at each level, women were disproportionately

associated with Democrats. However, as gender became less of an issue in elections, even among conservative Republicans, this bias has decreased, and elected women have become sub-equally represented in both parties at local and regional levels, and this trend is influencing the gubernatorial and federal levels now as well.

The 2016 presidential election was most likely to have been influenced by political party affiliation (primarily) in addition to gender control (secondarily). In fact, there is no way, on the basis of our data, to distinguish party from gender in this all-time first instance of a woman being nominated by a major party to run for election for President. However, (the albeit weak) gubernatorial correlation suggests that gender has played at least some role in voting behavior. The growing number of female candidates of both parties may someday erase this signal, but these pivotal times of women entering the political arena at the state and federal level may indeed record a gradual reduction in gender bias across the board. In fact, in December, 2020, the current governors of Maine, Alabama, Oregon, New Mexico, South Dakota, Kansas, Michigan, and Rhode Island (and DC) served in states that span the spectrum of both COVID, Climate denial, and political tendencies. As such, the data in Figure 1 regarding Fleadership may reflect a path of reduction of gender bias in political leadership.

In general, the results displayed in Figure 3 suggest that our representative government reflects, rather than shapes, the attitudes of the people when it comes to leadership gender (Fleadership) [34]. It is not that female leaders cause populations to behave or understand science differently than male leaders, but rather that the populations that were the first to cast aside 19th and 20th century gender bias to elect (or at least vote for) female leaders also understand science and behave accordingly [33]. This is highlighted in Figure 2, in which relative to 2016, five additional states voted for Fleadership (VP) in 2020. The presidential gender vote curve remains concave upward, with its flat trend on the low COVID end extended even farther to the right compared to Figure 1 (2016). The fact that those states voted in favor of Fleadership in 2016 (Clinton) but did not subsequently see her in the White House and those who voted in favor of Fleadership in 2020 (Harris) but did not have time for her to influence policy or behavior since that election, and still have less COVID and lower climate denial is indicative of the representative government that reflects the attitudes of the people as opposed to shaping them [33]. At the gubernatorial level there is a much weaker correlation between science and voting. This is in contrast to Fleadership at the local level as found in previous studies of female urban mayors [35]. We cannot speak to comparable correlations in Congress, however, as there are already numerous women in both the House and the Senate who represent the full spectrum of science understanding, climate denial and partisan ideology. As such, at the congressional level, the correlations we see in Figures 1-3 may already be washing out. This is a topic ripe for future analysis in an evolving political milieu.

Now, in 2024, COVID-19 has evolved from a pandemic to an endemic that may remain with us for decades or beyond. By now, while testing continues amongst the American population, there is markedly less reporting, so statistics in this paper would be difficult to reliably update to the present day. Thus, although public attitudes regarding leadership, politics, medicine and climate may remain similarly correlated, the fundamental sequencing of states in these graphs, based on COVID-19 cases, is no longer possible. However, another parameter not considered in this paper could be chosen for the sequencing- that of educational levels (percent of each state graduating either high school or college). This is left for future studies.

6. Conclusions

The strong correlation between high COVID-19/100k, climate denial, and the 2016 and 2020 presidential gender votes indicates that behavior is driven by public attitudes (be they partisan or gender-biased) rather than elected leadership (e.g. leadership). At the state level, Americans who rejected female leadership (and Democrats) in 2016 and 2020 were more likely to deny climate change and engage in irresponsible COVID spreading behaviors such as ignoring social distancing and masking guidelines. This is further supported at the gubernatorial level [36]. Further, these populations also subsequently had lower vaccination rates. Female governors may promote COVID-mitigating policies, but is more likely that the long-term trend of electing female leaders reflects public attitudes that more strongly control behavior and response to crises such as COVID-19 and climate change. Thus the “traditional” association of leadership with Democrats led to a strong correlation between leadership and science-based decision-making, but this correlation has weakened due to the mainstreaming of elected women across the political spectrum, chronologically progressing from local to regional to national political positions.

These correlations may also be pertinent at the international level and political arena [37]. Considering that the United States stands as a world leader and economic power, the actions it takes and the rhetoric it promulgates have the potential to percolate throughout the international system. In the case of the COVID-19 pandemic, the United States essentially caused a wall to be built around itself as it failed early on to curb the spread of the virus as compared to other countries. (With the advent of the vaccines, this situation changed, as the U.S. population got universal access to vaccines, while many countries did not.) Climate change, however, is an issue that does not discriminate and cannot simply be stopped at borders. Action (or inaction) on this issue by the United States sets a precedent for its allies, competitors, and all states in the international community. The same correlations that we see between the U.S. states may also apply in various geopolitical relationships as modulated by contrasting international cultural norms. This analysis could be extended to the international levels to nations that have had female leaders, and women in significant decision-making positions, to determine if the correlations observed between the states and the U.S. can be reflected in other countries and regions [38].

The correlation between climate denial and high rates of COVID/100k highlights the importance of public education in the areas of critical thinking and STEM disciplines [39]. The onus is thus on our public education systems to enable a more robust understanding of science, broad public understanding of the significance of climate change, behavior that avoids COVID (and future pandemics), and abandonment of historical gender bias in government. As such, K-12 educational goals should focus not only on STEM education, but also on civics and the linkages between science and policy at the state and federal levels [40]. This may lead to a “Catch-22” in that only populations that already value education would be ready and willing to enhance public education in these areas. The solution of this conundrum is beyond the scope of this paper but presents a challenge for current and future policy makers, public health officials, teachers, parents, and students to meet in the coming years.

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