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COVID-19 Mitigations in the U.S. September 2020 to February 2021

March 2021

COVID-19 Mitigations in the U.S.

September 2020 – February 2021

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COVID-19 Mitigations in the U.S.

September – December, 2020

This report provides highlights of a weekly survey of practices regarding the mitigation of the spread of COVID-19 in the U.S. during the final four months of 2020 and the first two months of 2021. The survey asks about the degree to which the respondents perceive that people in their community are following 21 common mitigation practices. The responses are separated by state and compared to state level statistics regarding the level of COVID-19 infections from the Johns Hopkins COVID database for the same time period.

Executive Summary

Over the six-month period there was a steady decrease in community mitigation practices across the country from 64.7% in September to 62.5% in February. This trend took place as fall and winter weather forced much activity indoors where virus transmission is stronger than outdoors and as COVID-19 infection levels skyrocketed. These observations of mitigation practices are based upon 7210 surveys that were collected on a weekly basis. During that six-month period, the average level of active infections per 100,000 people rose from 171 in September to 904 in January. New COVID-19 infections exceeded 6 million for both December and January. This is more than 5 times the 1.2 million new cases reported in September. In February, there was a dramatic drop in active cases to 2.4 million.

Additional findings from the four months:

- Six practices had a drop in mitigation over the six months that were more than double the overall average. These includes Reduced Seating at Restaurants (-13%), Limit Large Gatherings (-6%) and Quarantine People with Positive Tests (-6%) which are all highly important to controlling COVID spread.
- Among states where we collected 10 or more observations in each of the six months, Minnesota reported the highest six-month average compliance over all mitigation practices with 70% while Tennessee reported the lowest with 56% average compliance. Tennessee also reported the largest increase in average compliance over the six months with an 8% improvement, almost twice the second largest improvement in California of 5%. Virginia reported a 15% decline in compliance, ending the six-month period with the lowest average monthly compliance of 55%.
- Eight of the twenty-one practices had negative correlation that was -50% or stronger to the Infection Level for the US in total over the six months. That means that as use of these mitigations increased, Infection Level decreased. Limiting large gatherings had a negative correlation of -75%. At the same time, nine practices had positive correlation with Infection Level. Which means that when compliance increased, Infection Level was also increasing. Looking at the two practices with the largest positive correlations, Colleges closed/remote and Local level of COVID infections known, it seems that these practices may have a positive correlation because they are taken up as Infection Levels increase.
- COVID levels were lower in New York than California for five of the six months studied. While in New York infections spiked in February, they fell in California. Mitigation compliance was higher in New York than California for the same five months, but California mitigation showed a sharp upturn in February demonstrating a correlation between mitigation and infection levels in those two states.

The full list of mitigations surveyed is included in the appendix to this report.

Project Overview

This report follows the mitigations that are the practices in the U.S. to slow the spread of COVID-19 over the six months starting with September 2020 and running through the end of February 2021. The information about the behavior of people in various states is captured through a crowdsourcing approach via a survey instrument. Over this six-month period, 7210 surveys were collected from people in all 50 states. Throughout the six-month period, we have collected observations about the degree of compliance with 21 specific mitigation practices on a weekly basis.

In addition, we look at reported ups and downs of COVID-19 infections throughout the country based upon data from the John Hopkins COVID-19 database.

The primary objective of this report and of the entire COVID Mitigation Monitoring Project is to produce information about actual community practices. Most information that was available at the outset of the project looked primarily at whether or not officials in various jurisdictions were requiring or recommending particular mitigation practices. This report and the CMMP takes that at least one step further to pay attention to the degree to which people are actually following the requirements and recommendations, which we refer to as Compliance.

Survey Details

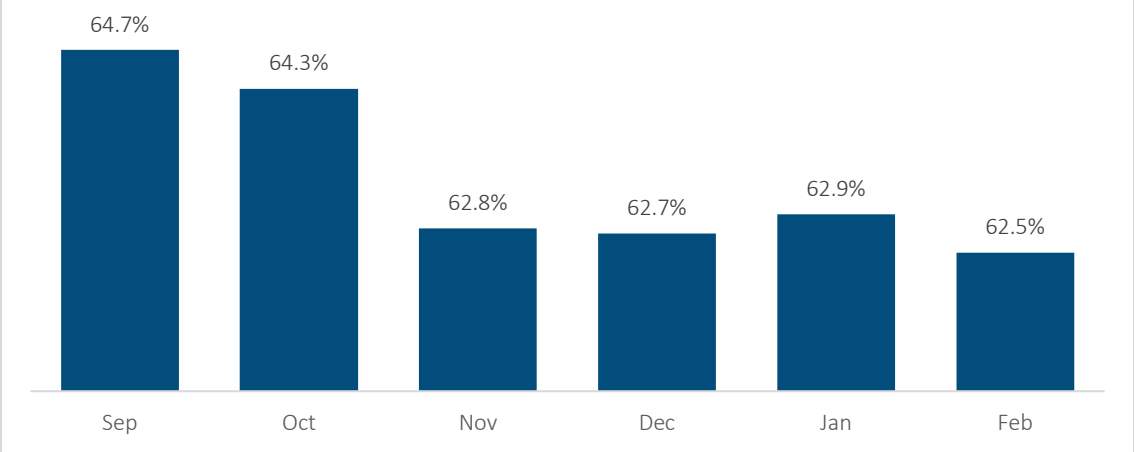
Collects information from volunteers on perceptions of community compliance with 21 COVID Mitigation strategies.
Participants answer between 0% and 100% that they see the strategy in use in their area.
Participants are asked to fill out survey every week.

Over the six-month period aggregate compliance with the 21 practices has dropped steadily. However, there were significant increases and decreases in compliance across the 21 practices as well as by state.

U.S. Mitigation Practices

National average mitigation compliance fell slowly but steadily through the four-month period.

Figure 1. Weighted-Average mitigation – U.S. All states



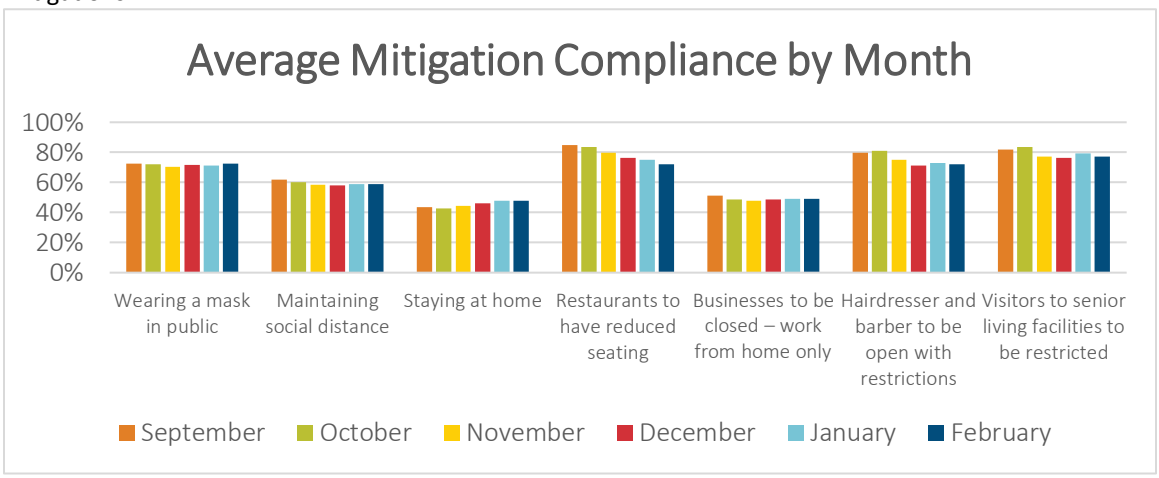
This, however, is a net result of larger and smaller changes in compliance levels both up and down for different mitigation practices and for different states. While the weighted average fell by 2.2% from September to February, compliance for many individual practices changed by much more or much less than that.

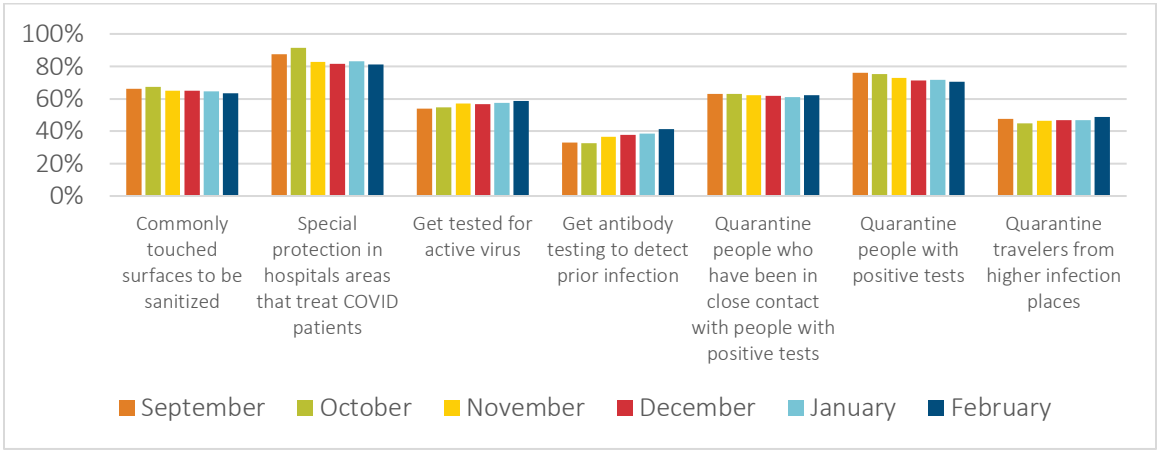
Table 1: Net change in percent compliance for 21 Mitigations from September to December, 2020

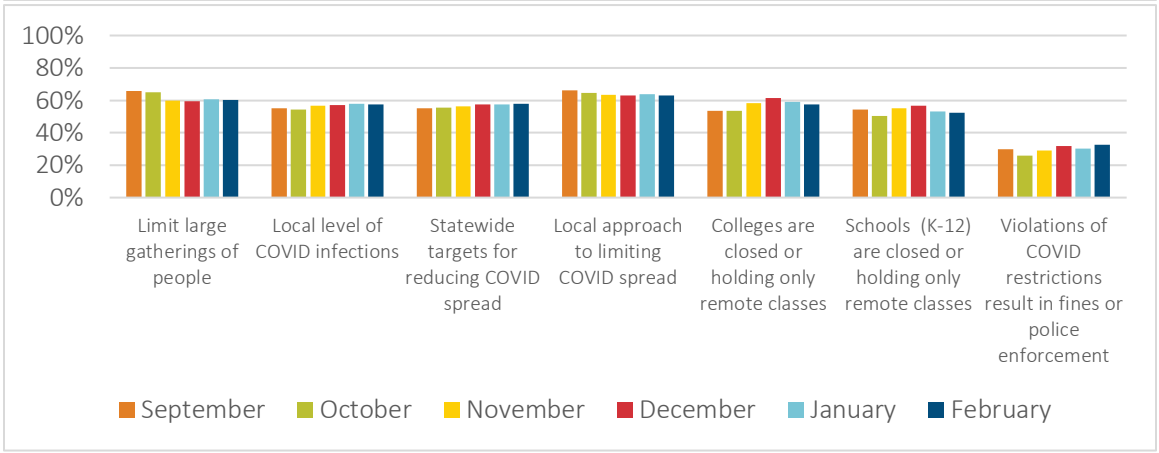
Mitigation Practice	Sep-20	Feb-21	Change
Restaurants to have reduced seating	85%	72%	**-13%**
Hairdresser and barber to be open with restrictions	80%	72%	**-8%**
Special protection in hospitals areas that treat COVID patients	87%	81%	**-6%**
Limit large gatherings of people	66%	60%	**-6%**
Quarantine people with positive tests	76%	71%	**-6%**
Visitors to senior living facilities to be restricted	82%	77%	**-5%**
Local approach to limiting COVID spread is known	66%	63%	**-3%**
Maintaining social distance	62%	59%	**-3%**
Commonly touched surfaces to be sanitized	66%	63%	**-3%**
Businesses to be closed – work from home only	51%	49%	**-2%**
Schools (K-12) are closed or holding only remote classes	54%	53%	**-2%**
Quarantine people who have been in close contact with people with positive tests	63%	62%	**-1%**
Wearing a mask in public	72%	72%	**0%**
Quarantine travelers from higher infection places	48%	49%	**1%**
Local level of COVID infections	55%	58%	**2%**
Statewide targets for reducing COVID spread	55%	58%	**3%**
Violations of COVID restrictions result in fines or police enforcement	30%	32%	**3%**
Staying at home	44%	48%	**4%**
Colleges are closed or holding only remote classes	54%	58%	**4%**
Get tested for active virus	54%	59%	**5%**
Get antibody testing to detect prior infection	33%	41%	**8%**

Nine of the twenty-one mitigations had decreases in average compliance of more than 2%. Six had increases in average compliance of more than 2% and six changed 2% or less. This overall pattern, of decreasing compliance, indicates that in general, communities (or a significant minority of people within U.S. communities) have chosen to allow the spread of COVID-19 rather than continue with practices that were slowing the spread in August and September.

The following graphs show the path of compliance over the six months and the level for each of the 21 mitigations.

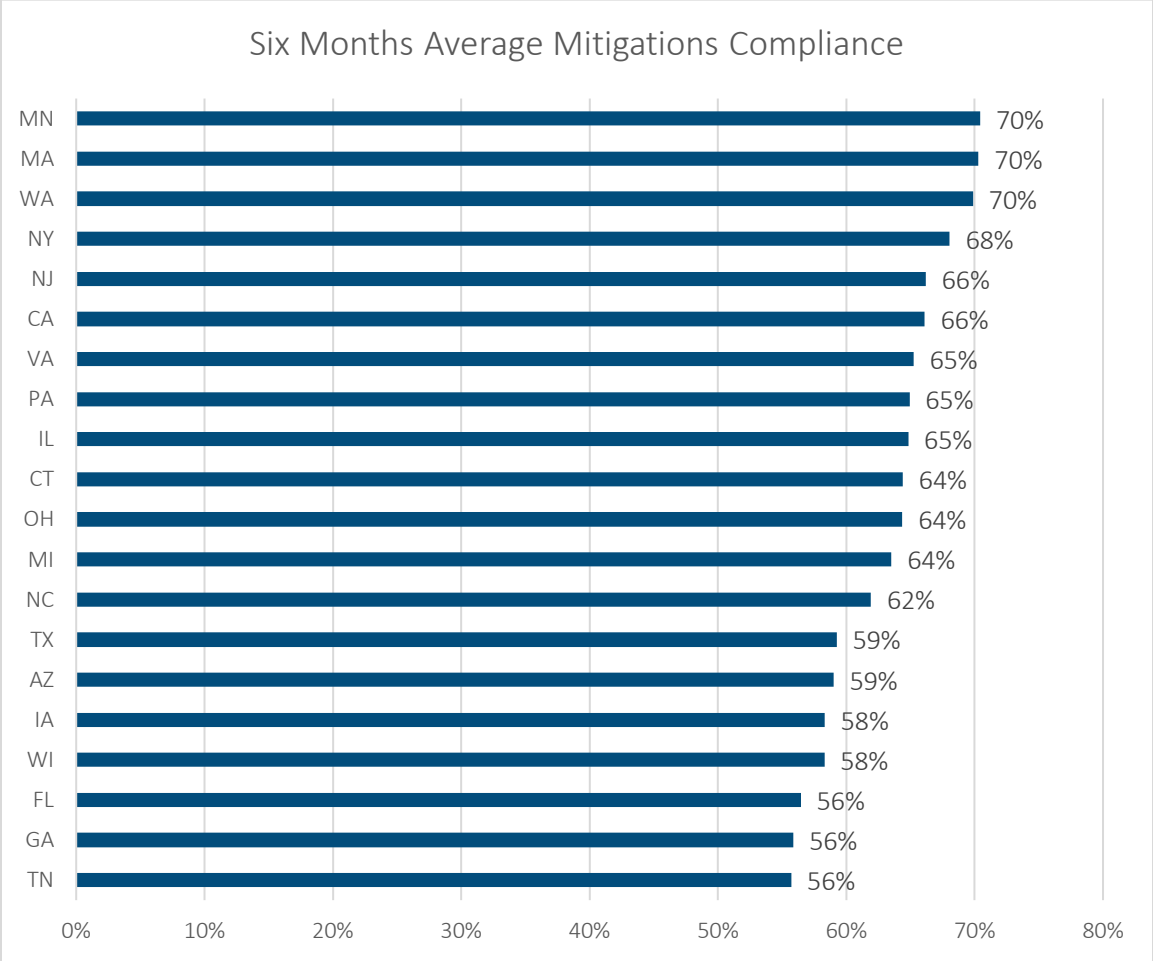






Mitigation Practices – State Level

There were ten or more observations in each of the six months for 20 states. Below is the average mitigation compliance over the six-month period for those 20 states. This shows the highest average compliance for Minnesota with 70% and the lowest for Tennessee with 56%.



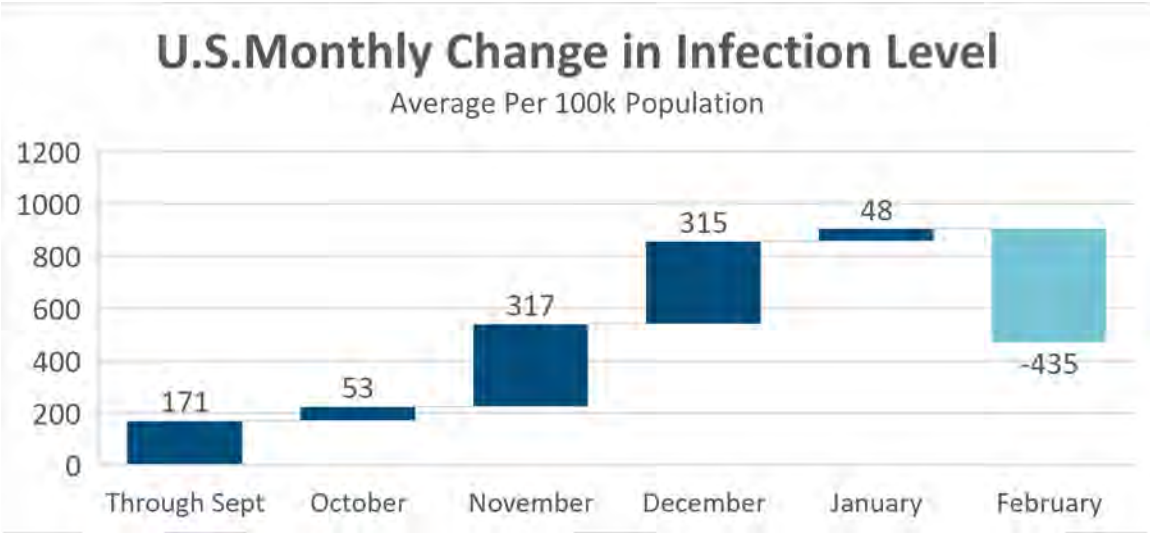
In the same 20 states, the average mitigation compliance changed by 5% or more from September to December in 8 states. Virginia had the largest change with a 15% drop in compliance over the six months.

	Sep	Oct	Nov	Dec	Jan	Feb	Change from September to February
Virginia	71%	68%	63%	63%	69%	56%	**-15%**
Ohio	69%	64%	62%	66%	65%	60%	**-8%**
North Carolina	66%	64%	60%	60%	63%	59%	**-7%**
Illinois	67%	69%	67%	61%	65%	60%	**-7%**
Florida	60%	56%	57%	55%	55%	56%	**-5%**
Michigan	65%	59%	67%	66%	64%	61%	**-4%**
New York	69%	70%	70%	68%	67%	65%	**-4%**
Washington	71%	70%	70%	70%	70%	67%	**-4%**
Texas	62%	59%	57%	59%	61%	59%	**-3%**
Pennsylvania	65%	67%	65%	66%	64%	63%	**-2%**
Iowa	56%	54%	62%	62%	62%	54%	**-1%**
Arizona	61%	58%	55%	57%	62%	60%	**-1%**
Connecticut	66%	64%	64%	62%	65%	65%	**-1%**
Georgia	59%	53%	53%	56%	56%	59%	**0%**
Minnesota	69%	69%	71%	73%	72%	69%	**0%**
New Jersey	66%	67%	62%	66%	68%	68%	**2%**
Massachusetts	70%	74%	66%	70%	70%	72%	**2%**
Wisconsin	56%	59%	55%	60%	60%	60%	**5%**
California	66%	67%	65%	64%	64%	71%	**5%**
Tennessee	51%	60%	52%	57%	56%	59%	**8%**

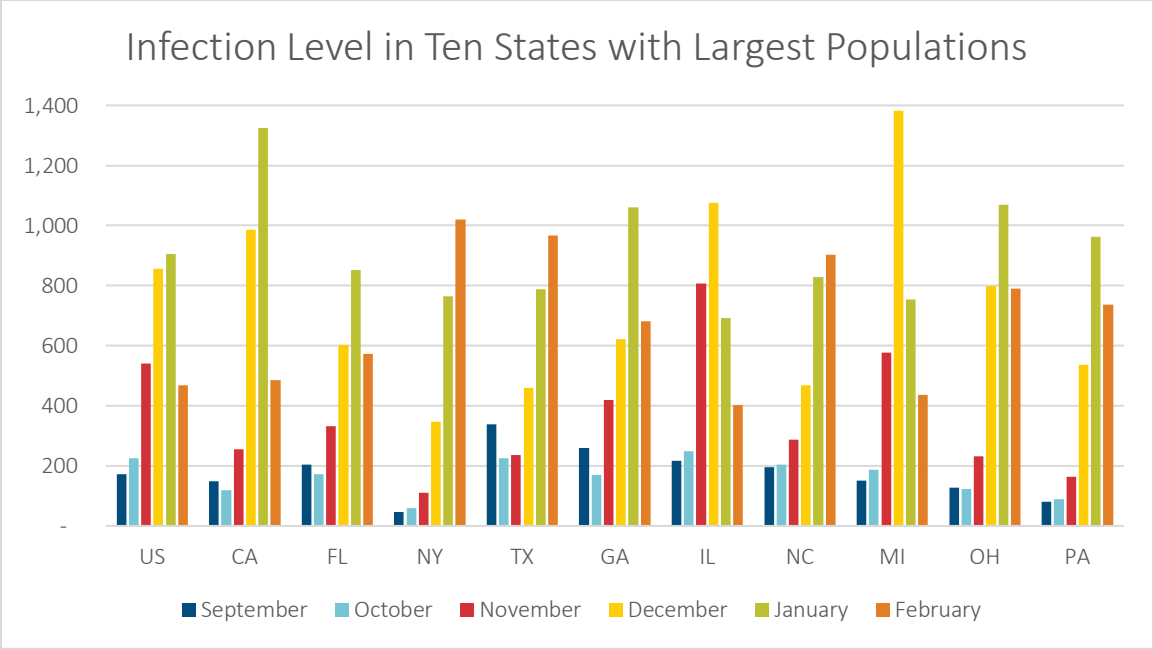
The wide variance across these twenty states in initial compliance and change in compliance across the last six months helps illustrate the complexities built into the nationwide response to COVID-19. While compliance increased from 66% to 71% in California, it remained steady in nearby Arizona. Though New York, Connecticut, Pennsylvania, and New Jersey all had relatively similar mitigation compliance levels throughout the six months, their experiences with COVID varied and use of individual mitigation methods were very different. Virginia's on-and-off approach to mitigation compliance makes it very difficult to track the effectiveness of mitigation strategies within that commonwealth.

COVID-19 Spread of Infections – National

In September the national infection level per 100,000 of population averaged under 200. In October there were small increases in average infection level followed by very large increases in November and December. A modest decrease in January was thankfully followed by a reversal of the trend in February as the impact of the vaccinations become a significant force.



Focusing in on the infection levels for the ten most populous states, a similar but somewhat less severe pattern emerges in many of those states. In September, the average infection level of the 10 most populous states was 177, quite close to the national average of 171. But by December, the national average infection level was 859, while the ten largest states averaged only 728. The average rose by 311% in the largest states, but rose by 402% nationally. However, several of the largest states did much worse than the national average. The most severe examples were California, Michigan, and New York. California was well below the national average at 148 in September but was higher than the national average by 127 per 100,000 by December. Michigan and New York had even higher percentage increases (811% and 652% vs. 565%) than California over the last quarter. In February, eight of the ten large states had infection levels that were higher than the national average with New York and Texas both more than twice the national level. Both New York and North Carolina recorded increases in infections in February while the national average had a large decrease.



Estimated Impact of Immunity

The vaccination programs started during the six-month period under study here. An estimate of the potential impact of immunity gained from vaccinations and from recoveries from COVID infections shows over this time, the impact of immunities on the spread of COVID is growing to a significant level.

	12/31/20	1/31/21	2/28/21
Reported Recovered Immune	16.4 M	23.2 M	27.0 M
Vaccinated Immune	2.0 M	16.9 M	37.7 M
Total Immune	18.4 M	40.1 M	64.7 M
Pct of Population	5.6%	12.3%	19.8%
Observed New Infection Rate[1]	7.6%	6.8%	5.7%
Base New Infection Rate	8.1%	7.8%	7.1%

The base New Infection Rate above is the new infection rate that could apply to the part of the population that is not immune, where the observed New Infection Rate is a weighted average of 0% new infections for the immune part of the population and the Base New Infection Rate for the rest of the population.

While the national average total percent immune at the end of February is shown above to be 19.8%, at the state level, immune percentage ranges from a high of 28% in North Dakota to a low of 15% in Vermont. These differences are mostly driven by the different levels of recovered immune people in the states with a lesser range of vaccinated immune.

Please note that these calculations are estimates based upon average reported efficacy of the vaccines and an assumption that people with immunity would face an average level of exposure to COVID infection. In addition, no adjustments were made to these figures to reflect the exact timing of the onset of immunity from vaccinations which varies by type of vaccine or the fact that some recovered immune people are getting vaccinated.

In addition, these calculations are based upon Reported Infections. Because COVID infections result in a very wide range of individual responses from largely symptom free to severe respiratory distress leading to hospitalization and death, there are thought to be many cases that go unreported. The CDC conducts a study of the seroprevalence of COVID antibodies in blood drawn for a variety of medical tests by commercial labs[2]. Results from that study show that unreported infections may be as high as 120% of the reported infections. If that were true, the Total Immune level estimated above could be as much as 25% higher than the above estimate.

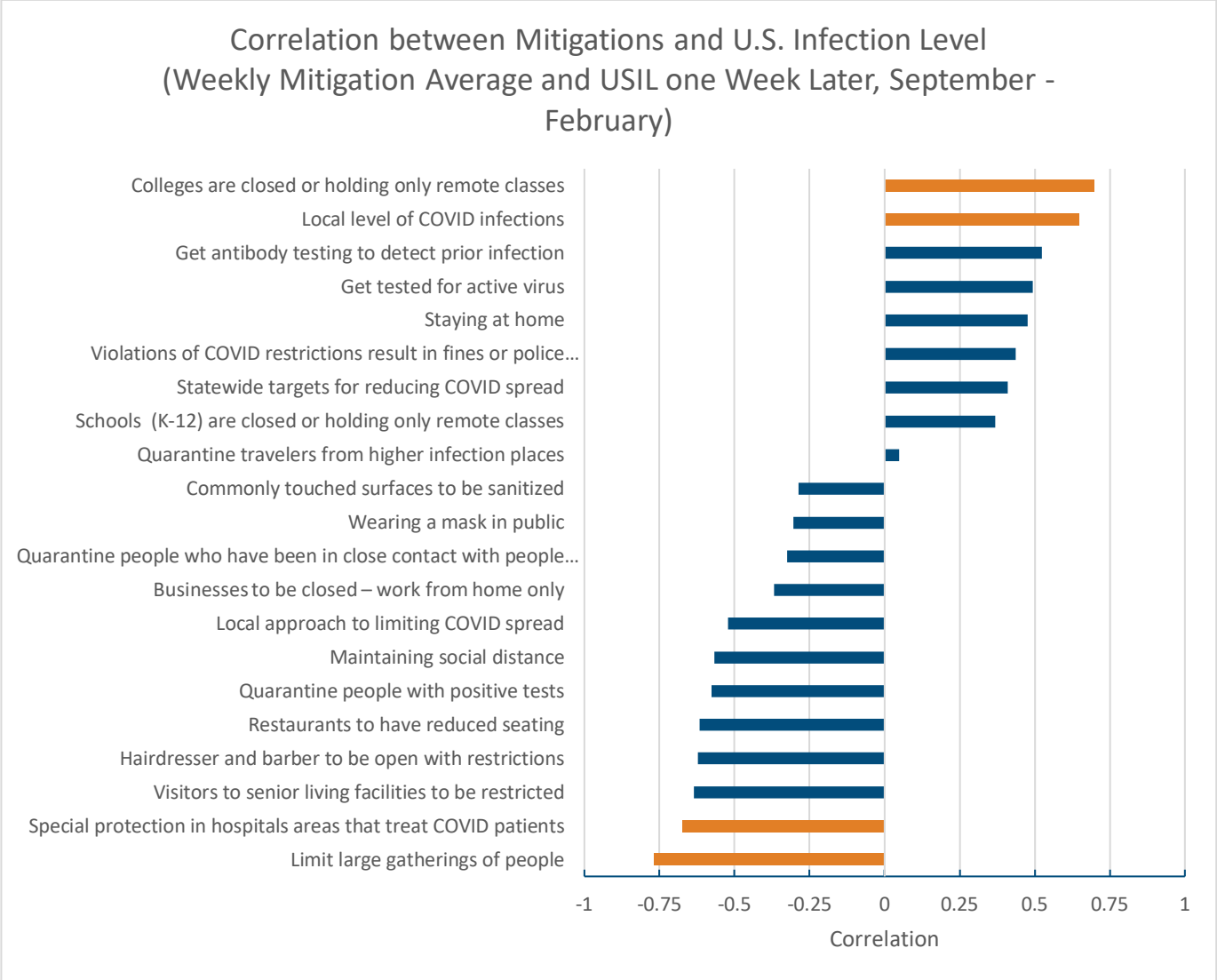
[1] New Infection Rate is defined as the number of new infections for a day divided by the sum of the new infections for the prior 14 days. In this case, the average for the daily New Infection Rate over the entire month is used. Note that a New Infection Rate below 7.14% the number of active infections will shrink and above 7.14% active infections will grow.

[2] This study can be found at https://covid.cdc.gov/covid-data-tracker/?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fcases-updates%2Fcommercial-labs-interactive-serology-dashboard.html#national-lab

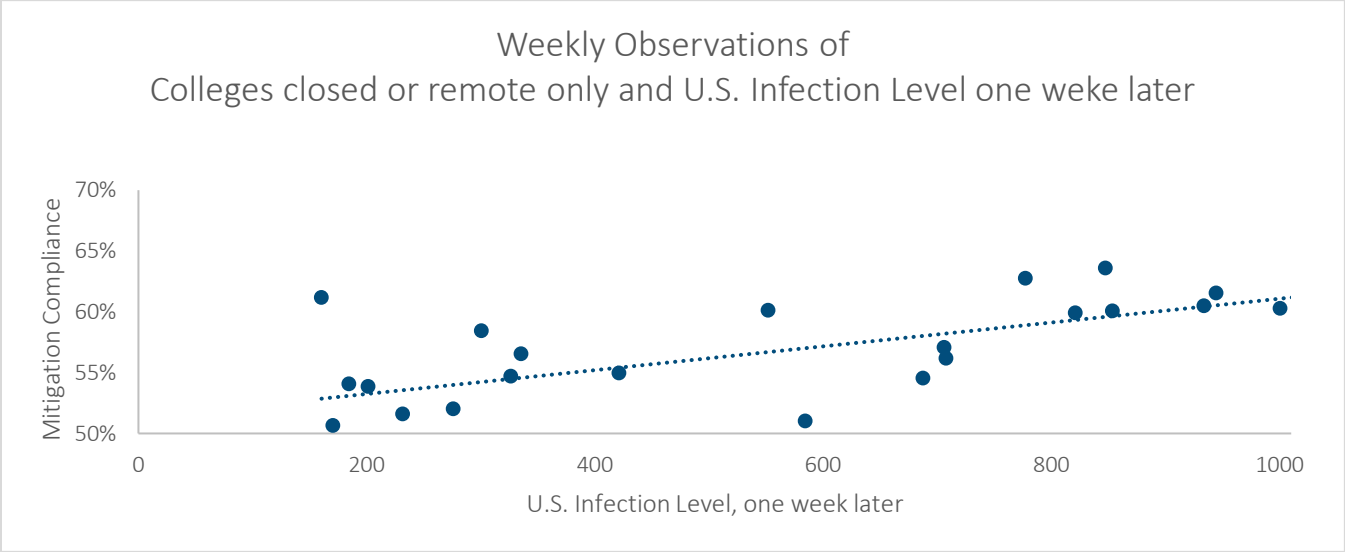
Correlations between Mitigations and Infection Levels

Throughout the course of the pandemic, communities across the country and world have engaged in a near infinite combination of mitigation methods. The multitude of unique combinations of mitigations, both mandated and truly occurring on the ground make it very difficult to assess the effectiveness of individual mitigations or combinations. No communities live in total isolation from others, and the few countries such as New Zealand which have been able to put in place and rigorously enforce their own combination of mitigation methods show that in isolation it is possible to manage the spread of COVID-19 very effectively through mitigation methods.

However, the fragmented and federalist nature of COVID-19 response in the United States has meant that we have not had the ability to create isolated areas of COVID-19 mitigations in the lower 48 states. One state's mitigation methods and existing infected population has a large effect on its neighbors. Despite this inherent complexity, we are able to identify some very interesting correlations between mitigation practices and the U.S. Infection Level. In the following pages we will discuss the two highest and two lowest correlated mitigation methods and what insights we might draw from those correlations.

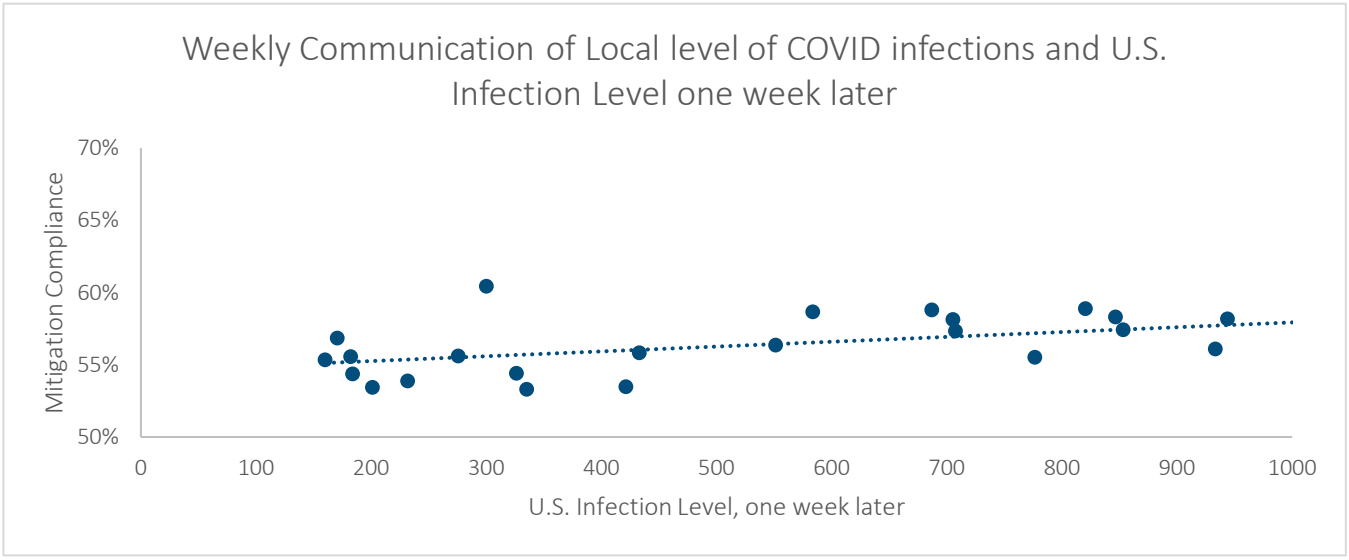


There is a very strong correlation between survey observations that colleges are closed or remote only and the infection level rising. This strong correlation, with weekly data points shown in the chart below, can be understood in a few ways.



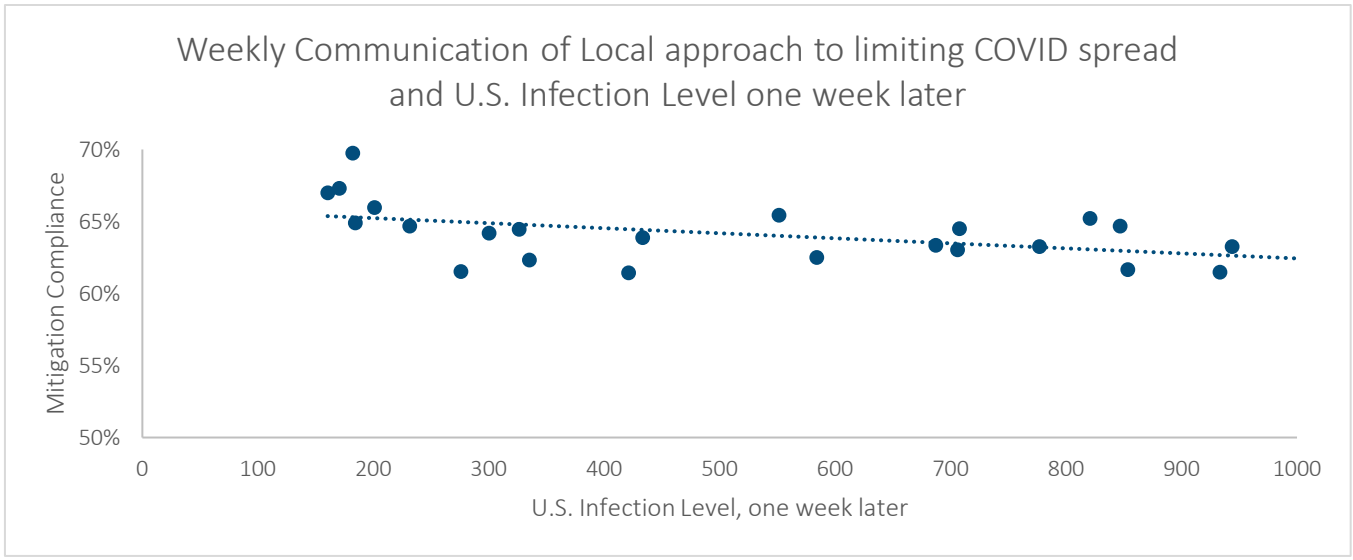
Let's first unpack an initial approach of attributing a causal relationship, such as "Closing colleges causes increased infections." We do not have any data that suggests such a relationship, but for the sake of argument can think through several possibilities of it being true. Colleges are ethically and financially beholden to maintaining the physical wellbeing of their students. If there were an outbreak on campus, the college might choose to send its student home to prevent them from getting the virus. If this outbreak on campus corresponded to a wider increase in cases across the community, the increase in closures would clearly be caused by infections and not the other way around. On the other hand, if colleges send home students who themselves are asymptomatically infected with the virus and they subsequently spread it in new communities as they return home, you could attribute causality to the collegiate closures.

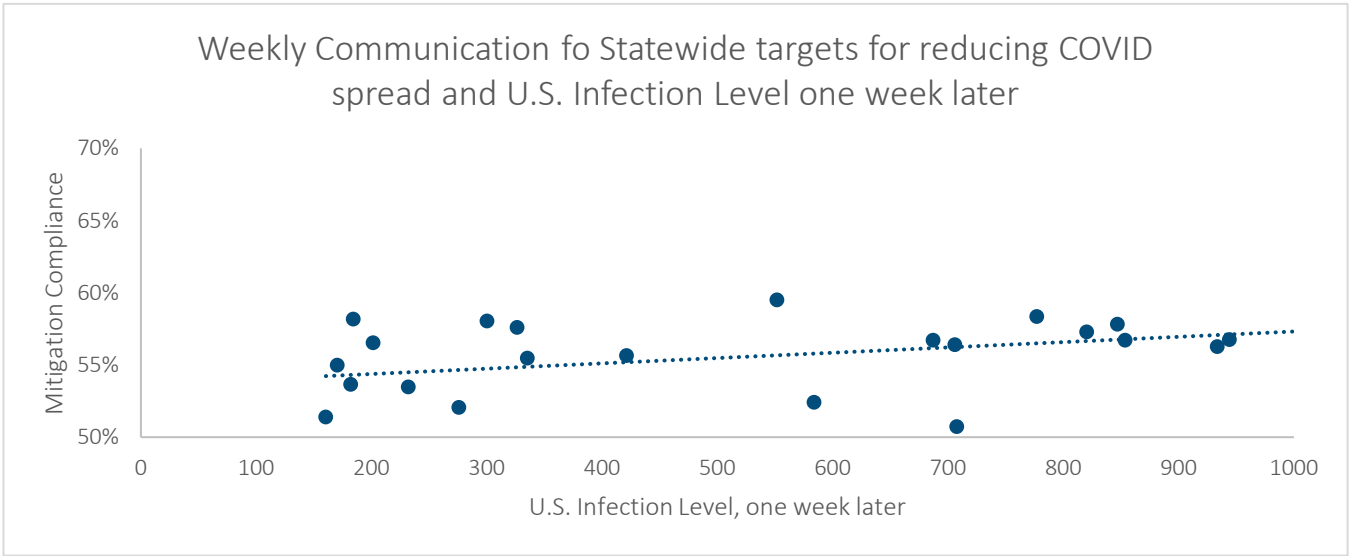
Colleges are likely spending more time and resources tracking the spread of the virus than some other organizations who have less of a burden of care for their constituents. Colleges also have a higher risk of viral spread to be attributed to their action or inaction than a typical business.



The second most positively correlated mitigation, Good communication of local level of COVID-19 infections, also has a difficult to interpret explanation. In isolation we might conclude that as infections increase, local officials feel the need to reach out to their constituents and explain what is happening. As a nation we watched in sordid fascination as Governor Cuomo explained to New Yorkers what was happening in his daily briefings at the beginning of the pandemic. As infections rise, clearly communication about the local level will also rise – death and disease are newsworthy and we should expect the news and politicians to communicate with the public as these things happen.

There were two other mitigations in a similar category to communication of local level of COVID-19. If we group all three of these mitigations together, there is a much more complicated story to tell. The two others were Good communication of statewide targets for reducing COVID-19 spread and Good communication of local approach to limiting COVID-19 spread. Taken together, these three mitigation methods represent the actions of local news organizations and public officials. Prima facia we should assume that communities where citizens know more about the current infections, goals for reducing infections, and local approach will have lower infection levels. Thus, we should see all three of these mitigations negatively correlated to infections.

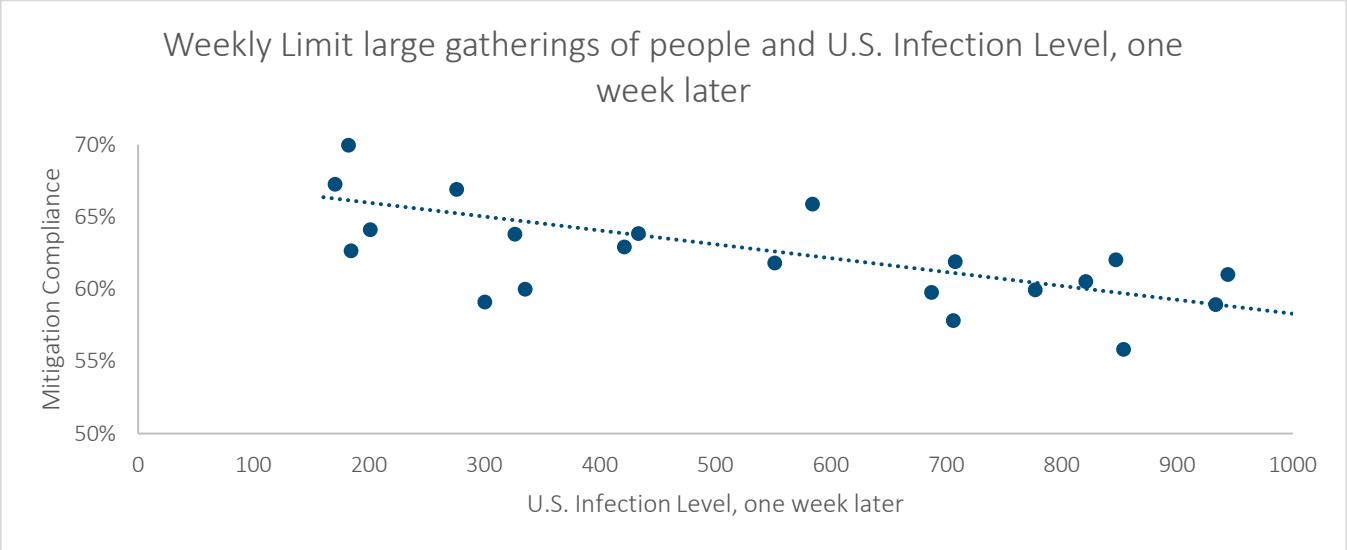




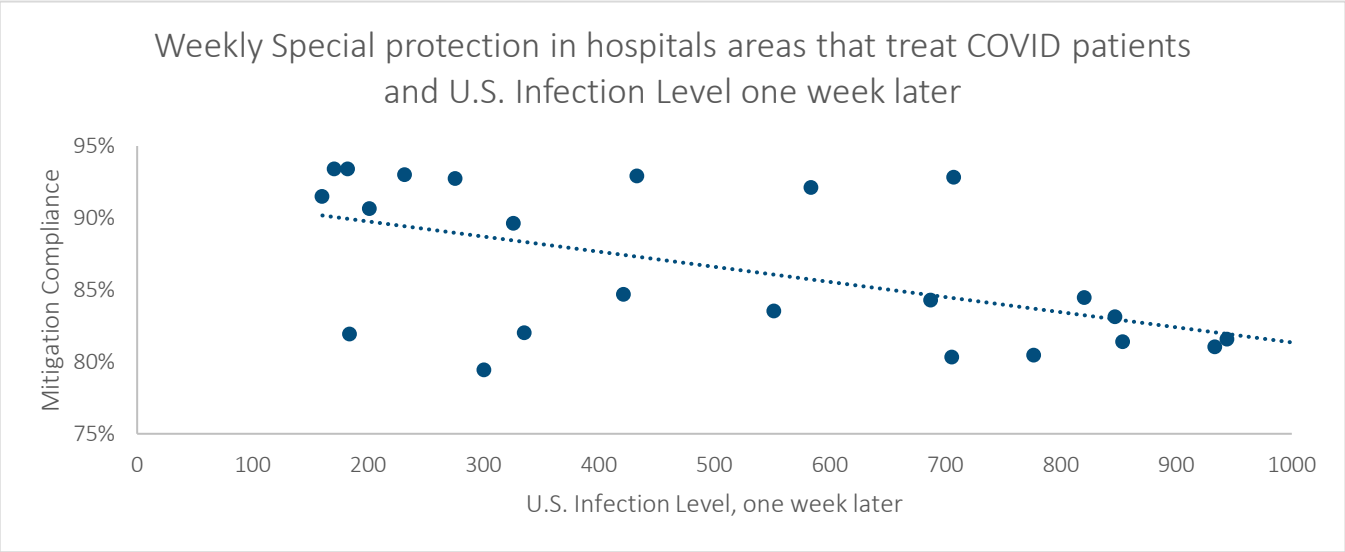
That only one of these three is negatively correlated and all three do not have similar correlations is unsettling. One possible explanation is embedded in the story told above about Governor Cuomo's press conferences. Politicians and news organizations may be more inclined to cover stories about COVID that talk about infections and the goals states have set to reduce infections, but less inclined to get into the details of how local communities are responding and what specifically is their approach. While we conceived of these three questions as telling three different but related portions of the same dimension of COVID-19 mitigation, perhaps they are different enough that they cannot be treated as such. Their relative correlations to each other makes this abundantly clear and is shown below. With little to no correlation between the three mitigations it is clear that our initial assumption that they would be related has not been borne out by the data.

Correlation Table	*Local level*	*Statewide targets*	*Local approach*
Local approach to limiting COVID spread	-10%	-	-
Local level of COVID infections	-	13%	-
Statewide targets for reducing COVID spread	-	-	-10%

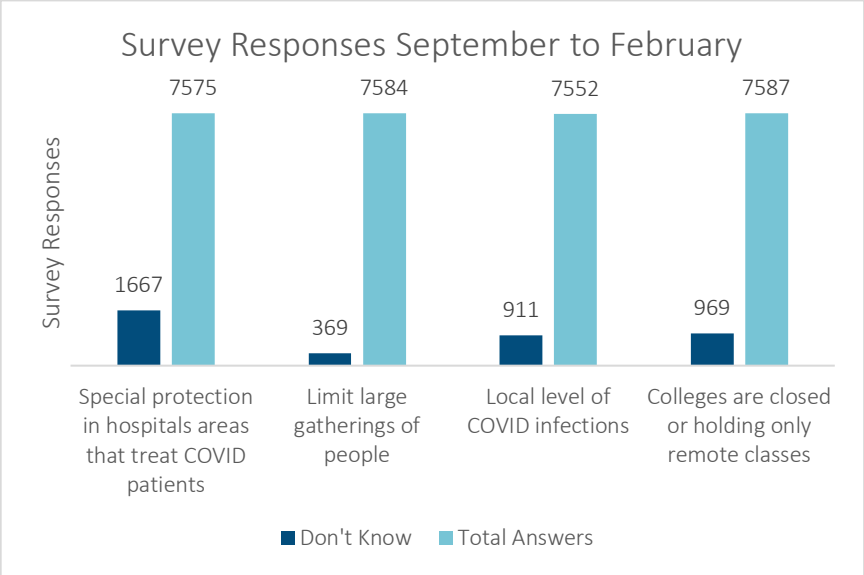
The two mitigations with the most negative correlation to the U.S. Infection Level have much simpler stories to tell. Additionally, they show us that there are things that we can do collectively that are both logically related to the spread of COVID and accomplishable. The most negatively correlated mitigation method was Limiting Large Gatherings of People. This makes total sense with what we know about how the virus spreads. When someone is infected but before they are showing symptoms, they are able to spread the virus to people around them. If we limit the number of large gatherings of people, we should expect each infection vector to decrease commensurately, and we do.



The second most negatively correlated mitigation method is Special protections in hospitals in areas that treat COVID-19 patients. This question had far more people respond that they did not know how their community was handling this mitigation than any of the other top correlated mitigations.



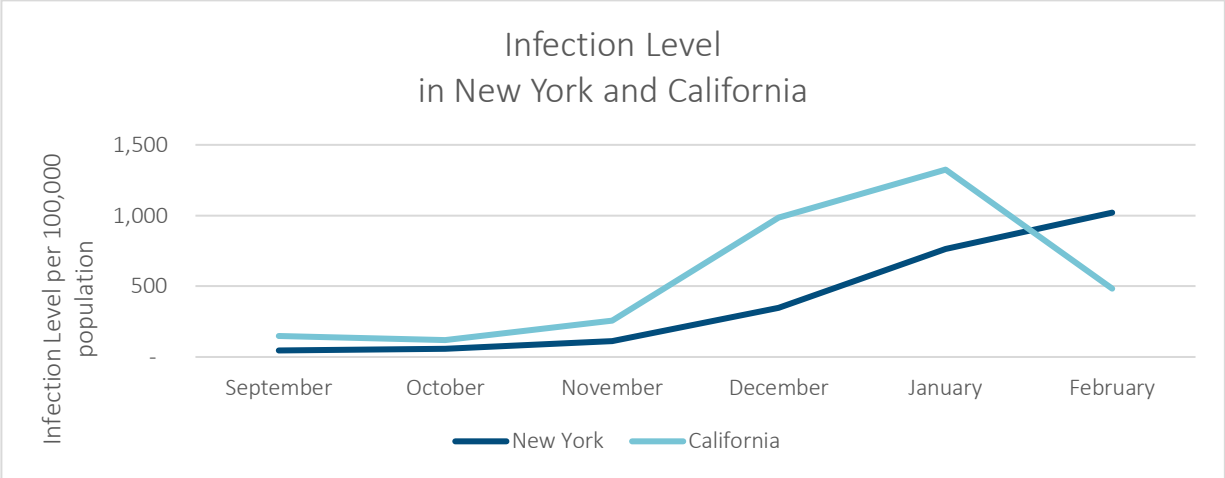
We believe this is because many people do not know what is happening inside hospitals right now and reflects a strength of this survey methodology. People who did not know were able to not answer and the answers we got reflected a clearer and more accurate picture of the situation. Over 22% of respondents did not know what the situation was like inside hospitals, and those that did reported that as special protections increased in hospitals that treated COVID-19 patients, the U.S. infection level the next week fell. While we cannot clearly establish causality in this relationship it makes sense that the location where people with confirmed cases of COVID-19 are being treated is an important vector in preventing the spread of the virus.



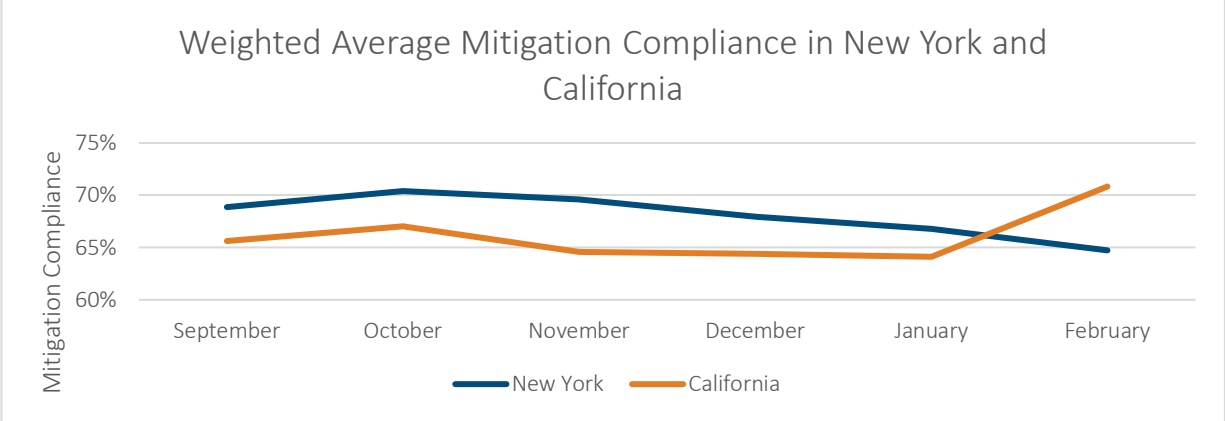
One final item to note with this particular mitigation is that special protections in hospitals has been the highest compliance mitigation in use throughout the last six months. It is a very good sign that the most used mitigation is also one of the most closely negatively correlated mitigations to the spread of COVID-19.

Mitigation vs. COVID Spread in New York and California

In this section the mitigations in California and New York are examined over the last six months to show how those changes have compared to the spread of COVID within those states. These states have the most observations during the six months – 748 for California and 539 for New York. There were more than 50 observations for both states in each of the six months. In addition, the course of the pandemic and the mitigation compliance was very different in the two states.

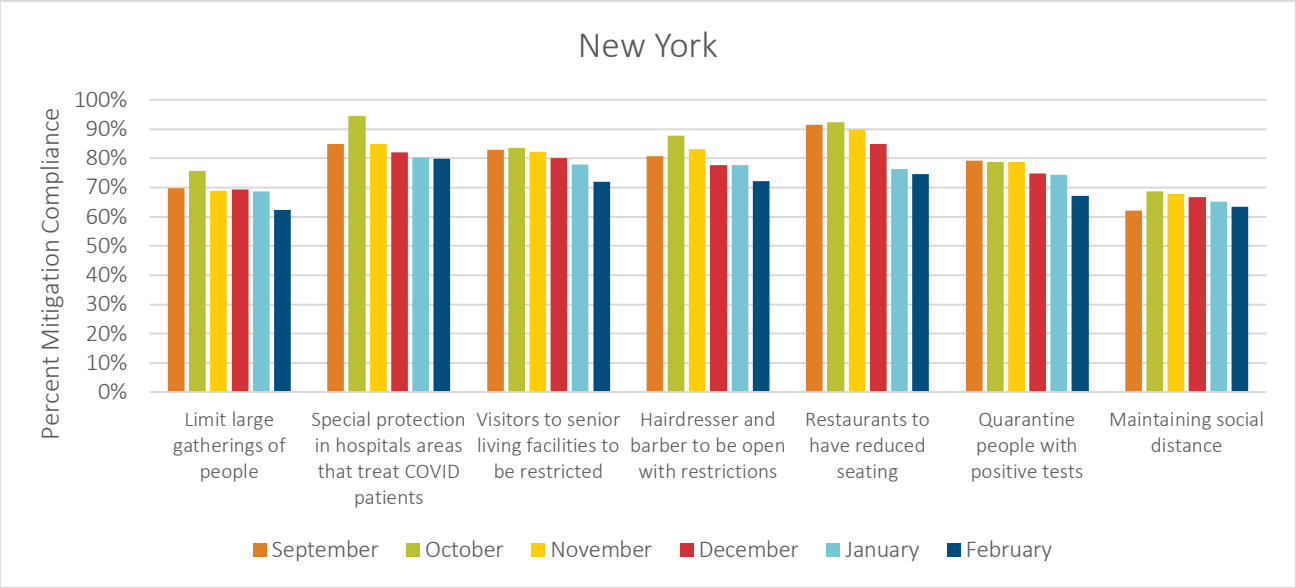


In the first three months, infections ran substantially higher in California than New York. Infections in New York doubled while California's rose by 60%. In December and January, Infections in both states rose at a much higher pace with New York increasing by 587% and California by 419%. But in February, the two states diverged with California falling dramatically and New York continuing to rise.

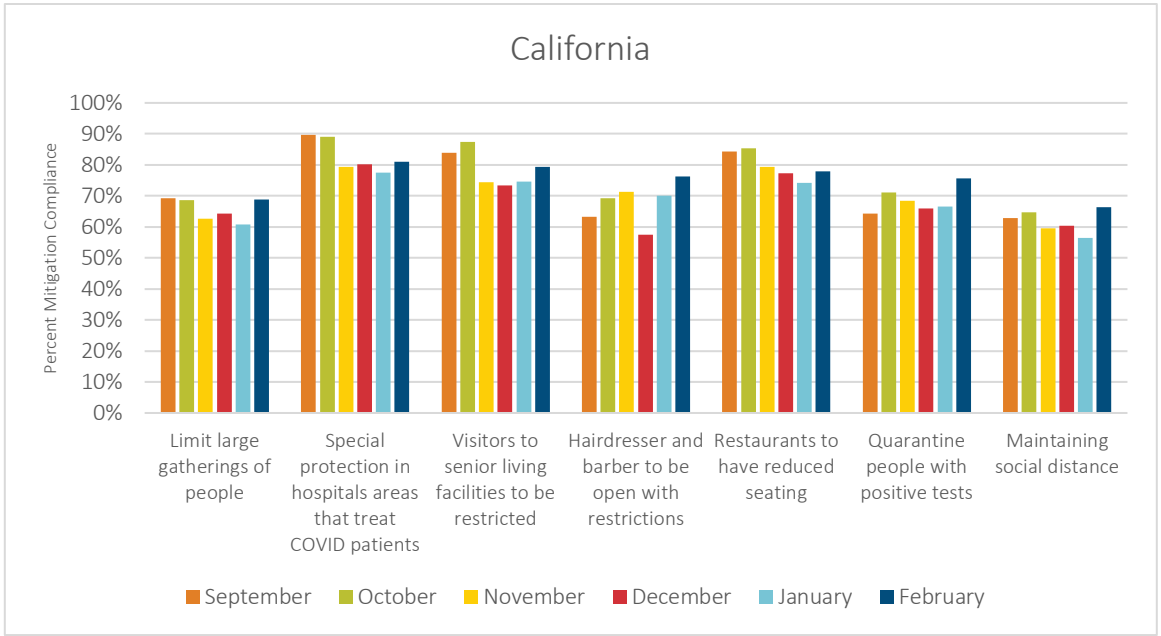


The weighted average mitigations for the two states track closely with the infection levels. From September to January, New York showed consistently higher mitigation compliance than California, but in February, mitigation compliance in California rose dramatically while New York continued the long term declining compliance trend. This type of study cannot provide proof of cause and effect, but it does provide a clear example of contemporaneous strengthening of mitigation and decrease of infections.

In the two graphs below, monthly average compliance percentages are shown for the seven mitigations that were found above to have the highest correlation with the infection level. For all seven mitigations, compliance in New York is seen to be declining or at best level for each month. Reduced seating in Restaurants was the mitigation from this set with the largest decrease in compliance in New York over the six-month period.



California, on the other hand, has much more uneven trend among the seven mitigations for the six-month period, though all seven mitigations show higher compliance in February. In fact, all twenty-one mitigations showed increased compliance in February over January. Maintaining Social Distance, Quarantine people with positive tests and Hairdresser/Barber Open with Restrictions were all up by more than 5% over the average level of compliance for the prior 5 months.



Acknowledgments

The researchers' gratitude goes to those without whose efforts this project could not have come to fruition: The Project Working Group and others for their diligent work overseeing questionnaire development, analyzing and discussing respondent answers, and reviewing and editing this report for accuracy and relevance.

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Note on Mitigation Compliance Observations

The COVID mitigation information is collected via a SurveyMonkey survey. In that survey, observers are asked to say what they are seeing in their community regarding the percentage compliance with 21 specific mitigation activities. The observers are volunteers who were either recruited personally by the project team or who responded to a variety of solicitations for observers via Twitter, Facebook, LinkedIn, and SurveyMonkey. This data is subject to self-selection and other biases. No adjustments have been made to the data that we have collected in order to respond to possible biases. Responses are aggregated and the average of multiple views are treated as true information about the mitigation activity in a state. The variance of the responses in a state has been examined and targets are set for a higher number of responses in states where there is a higher variance of responses.

Appendix List of Mitigations under Study

- Wearing a mask in public
- Maintaining social distance
- Staying at home
- Restaurants to have reduced seating
- Businesses to be closed – work from home only
- Hairdresser and barber to be open with restrictions
- Visitors to senior living facilities to be restricted
- Commonly touched surfaces to be sanitized
- Special protection in hospitals areas that treat COVID patients
- Get tested for active virus
- Get antibody testing to detect prior infection
- Quarantine people who have been in close contact with people with positive tests
- Quarantine people with positive tests
- Quarantine travelers from higher infection places
- Limit large gatherings of people
- Local level of COVID infections
- Statewide targets for reducing COVID spread
- Local approach to limiting COVID spread
- Colleges are closed or holding only remote classes
- Schools (K-12) are closed or holding only remote classes
- Violations of COVID restrictions result in fines or police enforcement

About the Society of Actuaries

With roots dating back to 1889, the Society of Actuaries (SOA) is the world's largest actuarial professional organization with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

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Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

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