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Abstract

A crucial question in the governance of infectious disease outbreaks is how to ensure that people continue to adhere to mitigation measures for the longer duration of the pandemic. The present paper examines this question by means of a nationally representative cross-sectional set of studies conducted in the United States in May, June, and July 2020. It seeks to understand to what extent Americans continued to adhere to social distancing measures in the period after the first lockdown ended during the first wave of COVID-19. Moreover, it seeks to uncover which situational and motivational variables sustained (or undermined) adherence. Our findings reveal a mix of situational and motivational variables that contributed to adherence in the period after the first lockdown: individuals' knowledge of social distancing measures, their practical capacity to adhere to them, their opportunities for not doing so, and their impulsivity (situational influences), as well as their moral alignment with mitigation measures against the virus, perceptions of its health threat, and perceived norms for adherence in their community (motivational influences). The results also reveal, however, that adherence among Americans declined during this period, as did important situational and motivational processes that sustained this. The findings show that adherence does not just originate in motivations and that situational variables play a central role. Moreover, they show that adherence is dynamic, as the core variables that sustain can change over a short period of time. These insights help to advance understanding of pandemic governance, as well as illuminating the interaction between rules and human conduct and compliance more generally. Moreover, they identify important avenues for policy to promote and sustain adherence to mitigation measures during the COVID-19 pandemic and in future outbreaks.

Introduction

The global COVID-19 outbreak in 2020 has made clear that the initial defense against a new deadly infectious disease requires large scale behavioral modification. Until there is a vaccine or a cure, the only protection people have is to ensure that the spread of the disease is halted as much as possible. This entails a range of changes in basic human conduct, from things that have limited economic and social consequences, such as better hand hygiene and the adoption of face masks, to highly impactful measures such as social distancing, forced isolation, quarantine, and broader lockdowns. Such measures only work, however, if people follow them. In this way, the 2020 pandemic has shown the importance of understanding compliance and adherence to outbreak mitigation measures.

There is now a quite well-developed body of research about what made people across the globe follow mitigation measures when they were first adopted. When many governments adopted lockdown rules and social distancing measures as compulsory mandates during this initial "first wave" period, compliance levels were high. This is demonstrated not only by drastic reductions in mobility [1], but also by consequences associated with this, such as the unprecedented event that the price of oil turned negative [2]. A recent review identifies a range of variables that predicted compliance with social distancing measures during the first pandemic wave, including psychosocial, institutional, and situational variables, as well as incentives [3]. Furthermore, this review showed that some highly important policy variables were not associated with compliance during this period. These included for instance deterrence where neither the threat of stricter punishment nor more certain punishment predicted compliance.

After the first wave, many countries lifted the most invasive restrictions, such as lockdowns, and even some of the social distancing measures. Yet as the outbreak was neither controlled nor overcome through a vaccine or medicine, mitigation measures have remained essential for keeping the virus at bay. During the fall, however, many countries found themselves faced with a second pandemic wave. This raises the question of how adherence to mitigation measures has developed

during the summer months after the initial strict behavioral measures of the first wave were repealed. Is it the case that social distancing has degraded back toward pre-pandemic normality, and thus gave fertile ground for a resurgence of infections? And if so, what shaped such changes and caused people to abandon (or sustain) social distancing?

To understand these questions, the present research collected three cross-sectional surveys in May, June, and July of 2020, from a nationally representative sample in the United States. We examined how participants' adherence to social distancing measures has developed across this period and which factors have sustained or undermined this.

Our study sought to assess two types of influences on adherence. The first are motivational influences, these are variables that shape the motivation people have to follow or break the relevant rules. These include for instance the costs and benefits of compliance, fear of punishment, social norms, and their moral views of the rules. A second set of potential influences on compliance, the paper assess situational variables that concern the context under which people make decisions on how to respond to the mitigation measures. These include practical situations, such as people's practical capacity to follow the rules, or the opportunity they have to break them. But they also include the cognitive and mental state that people have been in, such as their impulsivity and negative emotions. The paper allows us to understand how these motivational and situational variables shape adherence to social distancing measures over a longer period of time following a first wave in a pandemic outbreak. We thereby contribute to the overall understanding of pandemic governance, as well as to understanding of the interaction between rules and human conduct most generally. We also contribute to compliance theory by illuminating how motivational and situational variables shape compliance behavior over a longer time period. And finally, we identify important avenues for policy, on how adherence to mitigation measures can be promoted when strict measures are lifted.

The present study

Following the initial lockdown period, the United States underwent dramatic changes, both in terms of the spread of the virus and the measures to counter it. At the beginning of April,

approximately 70% of Americans were subject to stay-at-home and social distancing measures [4, 5]. However, by the end of April, infections began to decline [6], and states began re-opening, starting with the Southern and Midwestern regions [7]. During the same period, federal social distancing guidelines were repealed [8], although the requirement to do so remained in place nearly everywhere at the state level [9]. Infection rates strongly accelerated from mid-June to late July, however, reaching a peak of almost 75,000 new cases per day [6].

The period between May and July was also characterized by increasing controversy over mitigation measures. There was a continuation of protests against mitigation measures, where people deliberately violated social distancing and other mitigation measures [10, 11]. Furthermore, mitigation measures became increasingly politicized. Compared to Democrats, Republicans voiced greater concern over the economic costs of mitigation measures, and less so over the threat of the virus [12, 13]. This was illustrated during the election campaign, where Republican mass rallies were resumed, and some organizers actively countered social distancing measures (e.g., by removing "do not sit here" stickers) [14].

Throughout this period, mitigation measures have remained essential for keeping the virus at bay. But to what extent have Americans followed these measures during the summer period, and what factors influenced them to do so (or not)? By leveraging three surveys, collected in May, June, and July among nationally representative samples of Americans, we aim to answer these questions.

Our surveys focus on adherence to social distancing recommendations. Although they became less visible in federal public health recommendations after this period, social distancing recommendations continue to exist nearly everywhere at the state level [9]. Our surveys assessed self-reported adherence to social distancing recommendations across various situations, and examine how this has developed in the period after the first wave lockdown. Furthermore, we explored a range of factors that may explain why people did, or did not adhere to these measures, derived from insights on compliance from psychology, criminology, sociology, and economics [5, 15-18]. In operationalizing the present study we broadly distinguish two categories of variables [19]: situational variables and

motivational variables. With situational variables, we refer to factual situations and states that constrain or augment one's ability to comply. With motivational variables, we refer to intrinsic motives and extrinsic influences that may shape one's willingness to comply.

The situational variables we tested were:

(1) individuals' *capacity to adhere to the measures*. In order for people to effectively do as the measures recommend, it is necessary that they are effectively able to do so. However, in practice, the circumstances may often make this difficult (e.g., crowded environments; obligations to be physically present). To capture this, our surveys assess to what extent people are practically able to do as the measures demand. Another aspect of the capacity to adhere is whether people have sufficient knowledge of what is expected from them [20-22], and whether the measures are clear to them [23]. Logically, the lower that people's capacity to adhere is, the lower should be their adherence.

(2) their *impulsivity*. To effectively distance oneself from others, it is necessary to inhibit one's usual tendency to get close to them. However, criminological and psychological research shows that people differ in impulsivity, and that high levels of impulsivity predict deviant and rule breaking behavior [24-28]. Accordingly, as the second situational variable, we look at impulsivity as this is a vital condition that shapes the way people respond to the measures. We expected adherence to be lower among more impulsive individuals.

(3) their *opportunities to violate the measures.* In order to violate social distancing recommendations, it first is necessary that there are practical opportunities to do so. Insights from routine activities theory [29-31] and situational crime prevention [32, 33] show that there is less rule breaking when there are less practical opportunities to do so. Accordingly, our surveys also assessed participants' perceived opportunities for getting close to others. Greater perceived opportunities for violating were expected to predict lower adherence.

(4) their *emotional state due to the measures*. The pandemic may evoke powerful negative emotions [34]. According to strain theory, people may cope with negative emotions through rule violating behavior [35-41]; indeed, studies during quarantine also show that negative emotions may

lead to lower compliance with quarantine measures [42]. For this reason, we assessed participants' negative emotions due to the pandemic as the fourth and final situational variable that shapes people's responses to the measures. More negative emotions were expected to predict lower adherence to social distancing measures.

The motivational variables we assessed are:

(1) individuals' *substantive support for the measures*. This refers to the extent to which people agree with the substance of the measures [43, 44]. Americans have differed in their support for mitigation measures [45, 46], and we expected that greater support would predict greater adherence. Related to this are their perceptions of the threat of the virus, to their own health and that of others. The virus seems to affect some people disproportionately, for instance by having more serious and lethal effects for the elderly or for those with pre-existing conditions and much less so for younger people [47-49]. For this reason, we expected that adherence would be greater among people who perceive the virus as a greater health threat. Moreover, these perspectives may relate to how people evaluate the overall response of the authorities against the pandemic, which has varied among Americans [50]. More favourable perceptions of the (comparatively restricted) authority response were expected to predict lower adherence.

(2) their perceived *obligation to obey legal rules*. Mitigation measures have been created and implemented by (federal, public health, state, or local) authorities. Accordingly, people's tendency to adhere to such measures may also derive from their felt obligation to obey these authorities, and the rules, laws, and measures that they create, A large body of work in psychology and criminology shows that people who feel more obligated to obey the law are more likely to comply. This obligation may originate from a variety of reasons. On the one hand, OOL has a normative dimension; people voluntarily obey the rules if they have been made and enforced in a procedurally just way by a properly-established authority [43, 44, 51-54]. Yet there is also a non-normative dimension to OOL, which exists when people have a sense to of duty to obey the rules out of a sense of coercion, thinking that they have no other choice but to obey [55]. To capture this, our surveys also measured

participants' normative and non-normative obligation to obey the authorities handling the pandemic, as well as perceptions of their procedural justice. Furthermore, we also assessed participants' felt obligation to obey the law in general. Greater OOL was expected to predict greater adherence.

(3) their perceptions of the *cost of adherence.* Due to the pandemic and the measures to mitigate it, many Americans have suffered decreases to their income or employment opportunities [56]. Rational choice theory would predict that as the costs of adhering increase, people's tendency to do so will be lower [57, 58]. Our surveys therefore assessed the costs that participants suffered as a result of the mitigation measures. Greater costs were expected to predict lower adherence.

(4) *deterrence*, i.e., their fear of being punished for violating the measures. Mitigation measures may evoke fears that failure to adhere to them will be punished by the authorities. According to general deterrence theory, people become more likely to comply with rules when there is a greater certainty and severity of punishment [59-61]. Moreover, perceptual deterrence research shows that deterrence is subjective [62, 63], and that it thus is especially important to evaluate people's perceptions of the certainty and the relative impact that punishment will have on their lives [64]. For this reason, our surveys measured people's perceptions of the certainty and severity of punishment for failing to adhere to social distancing measures. Greater deterrence perceptions were expected to predict greater adherence.

(5) *descriptive social norms* regarding adherence. Research shows that the more people see others comply with rules or requests, the more likely they are to comply themselves; conversely, the more that they see others violate or disobey, the more likely they are to offend [65-68]. As such, we also assessed perceived (descriptive) social norms for social distancing in their community. Stronger social norms for adhering were expected to predict greater adherence.

Lastly, our study examines how adherence relates to demographic (i.e., age, gender, education level, employment status, education, inclusion in an ethnic minority group), socio-economic (i.e., socio-economic status, before and after COVID-19), health-related (i.e., health risk of COVID-19 to

self and others), and ideological variables (i.e., political orientation, trust in science, trust in media). These variables will be utilized as control variables in our analyses.

Method

We obtained ethical approval for this project from the Institutional Review Board of the University of California, Irvine and by the Ethics Review Board of the University of Amsterdam. All participants provided consent before participating in the study. Participation was voluntary, and all participants could stop the survey at any time.

Participants

Participants were residents (18 years or older) of the U.S. that were recruited using a stratified sampling approach to become nationally representative on age, gender, and ethnicity. They were recruited by the online survey platform SurveyMonkey (https://surveymonkey.com). Surveys were administered in May, June, and July using different samples of participants. Participants were paid $3.00 for participating.

1,452 participants took part in Survey 1 (May 8-18). Here, 436 participants were excluded from the sample because they failed to complete the survey, provided incomplete responses, or failed to pass two attention checks. The final sample therefore consisted of 1,016 cases (56.3% women, 43.3% men, 0.4% non-binary; M_{age} = 40.29 years).

1,711 participants took part in Survey 2 (June 8-16). Here, 723 participants failed to complete the survey, provided incomplete responses, or failed to pass two attention checks; these participants were excluded from the sample. The final sample therefore consisted of 988 cases (54.1% women, 45.6% men, 0.2% non-binary; M_{age} = 40.22 years).

1,758 participants took part in Survey 3 (July 11-17). Here, 835 participants failed to complete the survey, provided partial responses, or failed to pass two attention checks; again, these participants were excluded from the sample. As such, the final sample consisted of 923 cases (52.5% women, 47.2% men, 0.2% non-binary; M_{age} = 40.17 years). Demographical information for all three

samples is displayed in Table 1. The final samples were slightly more female and older than the general population (2019 census: 50.9% women, 49.0% men; M_{age} = 38.3 years) [69], and showed some variability on specific variables (i.e., education, COVID care, ethnicity, insurance status, SES change, and health risk to self and others). These variables were either unrelated to adherence or controlled for in the analyses.

Table 1.

Sample characteristics and control variables, May, June, and July samples (Surveys 1, 2 and 3).

	Survey 1 (May 8-18)	Survey 2 (June 8-16)	Survey 3 (July 11-17)
Age	40.29 (12.91)	40.22 (13.49)	40.17 (12.86)
Gender			
Female	56.4%	54.1%	52.5%
Male	43.3%	45.6%	47.2%
Other (non-binary)	0.4%	0.2%	0.2%
Ethnic minority	31.0%	38.7%	33.4%
Insurance			
Uninsured	14.7%	15.0%	13.5%
Public insurance	28.4%	27.3%	33.8%
Private insurance	56.9%	57.7%	52.7%
Education			
No diploma	2.5%	3.0%	3.3%
High school degree	41.1%	43.2%	46.1%
Associate degree	12.8%	13.2%	13.1%
College degree and higher	43.7 %	40.6%	37.6%
Employed	65.7%	64.0%	61.9%
Care professionally for COVID	6.8%	10.1%	9.5%
Socio-econ status, pre-COVID	6.05 (1.95)	5.99 (2.10)	5.86 (2.09)
Socio-econ status, post-COVID	5.61 (2.11)	5.79 (2.20)	5.63 (2.28)
Socio-econ status, change	-.44 (1.66)	-.20 (1.59)	-.23 (1.70)

Political view			
Very progressive	16.2%	20.5%	17.6%
Slightly progressive	25.1%	24.9%	24.1%
Slightly conservative	29.5%	28.9%	27.8%
Very conservative	16.7%	14.8%	17.7%
Prefer not to say	12.4%	10.8%	12.9%
Health risk self	32.0%	32.3%	37.9%
Health risk others	58.1%	55.2%	62.2%
Trust in science	3.89 (0.96)	3.83 (0.99)	3.83 (1.00)
Trust in media	2.91 (1.30)	2.93 (1.29)	2.83 (1.34)
N	1016	988	923

Note. Standard deviations between parentheses.

Materials

Terminology. Throughout the survey, we referred to COVID-19 as "the coronavirus"; this reflects the greater usage of this name in everyday speech, especially during the early stages of the pandemic.

Control variables. The following demographic variables were recorded: age, gender, nationality, information on residency (state), employment status, education, inclusion in an ethnic minority group, social economic status before and after COVID-19 (MacArthur Scale of Subjective Social Status [70]), and political orientation (adapted from [71-73]). For political orientation, a considerable number of participants preferred to not disclose their preference (Survey 1: 12.4%; Survey 2: 10.8%; Survey 3: 12.9%). To enable such cases to be retained in the analysis, this variable was recoded into two dummy variables: one comparing conservative to progressive orientation (1 = very conservative or conservative, 0 = progressive, very progressive, or prefer not to say) and one comparing undisclosed to progressive orientation (1 = prefer not to say, 0 = very conservative, conservative, progressive, very progressive). This approach yielded the same results for adherence as the scale measure, but allowed all cases to be utilized.

Additionally, we asked several questions that probed exposure to and risk from COVID-19. Specifically, we asked participants to indicate whether they provided professional care for coronavirus patients, and whether they or anyone they knew had underlying health issues that would put them more at-risk to suffer complications from the coronavirus.

In light of the prominent role of science and media reporting in the COVID-19 crisis, we further asked participants to indicate their trust in science (mean of four items [74]; Survey 1: $\alpha = .92$; Survey 2: $\alpha = .92$; Survey 3: $\alpha = .92$), and trust in media reporting (on a single item, see [5]). Correlations between the control variables for all three surveys are displayed in Appendix A.1-A.3.

Adherence to social distancing measures. To assess adherence to social distancing measures, we measured participants' self-reported tendency to keep a safe distance from others in various situations [18]. Specifically, we included seven questions that measured their tendency to keep a safe distance (six feet or more) from: 1) "others outside of my direct household," 2) "my neighbors," 3) "colleagues at work," 4) "friends and family from outside of my direct household," 5) "others when grocery shopping," 6) "others when taking a walk or exercising," and 7) "others when commuting or traveling" (1 = "never," 7 = "always"). Responses were mean-scored into a single measure for each wave (Survey 1: $\alpha = .92$; Survey 2: $\alpha = .92$; Survey 3: $\alpha = .93$), with higher scores indicating greater adherence to COVID-19 social distancing measures (see Table 2).

Table 2.

Descriptive statistics of dependent variables, May, June, and July samples (Surveys 1, 2 and 3).

	Survey 1 (May 8-18)	Survey 2 (June 8-16)	Survey 3 (July 11-17)
I keep a safe distance (six feet or more) from…			
Others outside of household	6.02 (1.41)	5.85 (1.51)	5.83 (1.55)
Neighbors	6.13 (1.36)	5.85 (1.53)	5.84 (1.64)
Colleagues at work	5.88 (1.69)	5.58 (1.84)	5.56 (1.91)
Friends and family outside household	5.67 (1.60)	5.38 (1.74)	5.27 (1.84)

Others when grocery shopping	6.08 (1.25)	5.92 (1.38)	5.94 (1.44)
Others when walking or exercising	6.13 (1.36)	5.96 (1.47)	5.94 (1.54)
Others when commuting or traveling	6.16 (1.39)	5.94 (1.54)	5.94 (1.60)
Adherence scale measure	6.01 (1.20)	5.78 (1.29)	5.76 (1.39)

Note. Standard deviations between parentheses.

Situational variables. Participants' practical capacity to adhere to social distancing mitigation measures was measured by means of seven items, based on our measures of reported adherence. Participants were asked whether they were capable of keeping a safe distance (six feet or more) from: 1) "others outside of my direct household," 2) "my neighbors," 3) "colleagues at work," 4) "friends and family from outside of my direct household," 5) "others when grocery shopping," 6) "others when taking a walk or exercising," and 7) "others in traffic or public transport" (1 = "disagree completely," 7 = "agree completely"). Responses were mean-scored into a single scale measure (Survey 1: $\alpha = .87$; Survey 2: $\alpha = .85$; Survey 3: $\alpha = .89$), with higher scores indicating greater practical capacity to adhere to social distancing mitigation measures.

To assess their knowledge of social distancing measures, we asked participants to indicate whether current COVID-19 mitigation measures required them to keep a safe distance (six feet or more) from others (1 = yes, 2 = no, 3 = don't know). The key comparison is whether people who know that they are under social distancing measures adhere more to these recommendations than people who do not, or are unsure of this. To capture this, these responses were recoded (1 = yes, 0 = no or don't know).

One item was solicited to assess the perceived clarity of the measures taken by the authorities to reduce the spread of the coronavirus (1 = "extremely unclear;" 7 = "extremely clear").

Impulsivity was measured by means of a subset of five items taken from the 8-item impulse control subscale from the Weinberger Adjustment Inventory (WAI; [75]): 1) "I should try harder to control myself when I'm having fun," 2) "I do things without giving them enough thought," 3) "When I'm doing something fun (like partying or acting silly), I tend to get carried away and go too far," 4) "I

say the first thing that comes to my mind without thinking enough about it," and 5) "I stop and think things through before I act" (1 = "false," 5 = "true;" last item reverse coded). The last item correlated poorly with the other items, and hence was eliminated. The remaining four items were combined into a scale measure (Survey 1: $\alpha = .82$; Survey 2: $\alpha = .82$; Survey 3: $\alpha = .82$), with higher scores indicating greater impulsivity.

Opportunity to violate social distancing measures was measured by mean-scoring responses to seven items (again based on our measures of adherence). Participants were asked whether, at the present time, it was still possible for them to come within an unsafe distance (closer than six feet) from: 1) "others outside of my direct household," 2) "my neighbors," 3) "colleagues at work," 4) "friends and family from outside of my direct household," 5) "others when grocery shopping," 6) "others when taking a walk or exercising," and 7) "others in traffic or public transport" (1 = "disagree completely," 7 = "agree completely"). Again, participants' responses were aggregated into a single scale measure (Survey 1: $\alpha = .94$; Survey 2: $\alpha = .94$; Survey 3: $\alpha = .94$), with higher scores indicating greater practical opportunity to violate social distancing measures.

Negative emotional state due to COVID-19 was assessed by means of six items. Participants indicated to what extent the coronavirus made them feel 1) "angry," 2) "scared," 3) "powerless," 4) "depressed," 5) "stressed," and 6) "lonely" (1 = "strongly disagree," 7 = "strongly agree"). Responses were aggregated into a scale measure (Survey 1: $\alpha = .89$; Survey 2: $\alpha = .91$; Survey 3: $\alpha = .90$), with higher scores indicating more negative emotions.

Motivational variables. Moral alignment with social distancing measures was measured by assessing the extent to which extent participants "morally believe that people should keep a safe distance from others (six feet or more) in order to contain the coronavirus" (1 = "strongly disagree," 7 = "strongly agree").

The perceived health threat of COVID-19 was measured by mean-scoring three items. These asked participants to indicate to what extent they believed the coronavirus to be a major threat to 1) their own health, 2) the health of friends and relatives, and 3) the general health (1 = "strongly

disagree," 7 = "strongly agree"). Their answers were combined into a scale measure (Survey 1: α = .91; Survey 2: α = .92; Survey 3: α = .92), with higher scores indicating greater perceived health threat.

Support for the authority response was measured using two items. These asked to which extent participants believed the authorities to have been 1) "consistent," and 2) "adequate" in their response to contain the coronavirus (1 = "strongly disagree," 7 = "strongly agree"). Both items were strongly correlated (Survey 1: r = .81; Survey 2: r = .79; Survey 3: r = .80); accordingly, a scale measure was constructed from their responses, with higher scores indicating greater support for current policies.

Participants' normative obligation to obey the authorities handling COVID-19 was measured by mean-scoring three items (adapted for this study following [55, 76]): 1) "I feel a moral obligation to obey the authorities handling the coronavirus," 2) "I feel a moral duty to support the decisions of the authorities handling the coronavirus, even if I disagree with them," and 3) "I feel a moral duty to obey the instructions of the authorities handling the coronavirus, even when I don't understand the reasons behind them" (1 = "strongly disagree," 5 = "strongly agree"). Answers were aggregated into a scale measure (Survey 1: α = .87; Survey 2: α = .89; Survey 3: α = .90). Higher scores indicated greater normative obligation to obey.

Participants' non-normative or coerced obligation to obey the authorities handling COVID-19 was assessed with three items (again adapted for this study following [55, 76]): 1) "people like me have no choice but to obey the authorities handling the coronavirus," 2) "if you don't do what the authorities handling the coronavirus tell you they will treat you badly," and 3) "I only obey the authorities handling the coronavirus because I am afraid of them" (1 = "strongly disagree," 5 = "strongly agree"). Responses were combined into a scale measure (Survey 1: α = .72; Survey 2: α = .73; Survey 3: α = .70), with higher scores indicating greater non-normative obligation to obey, or more obligation out of coercion.

Perceptions of the procedural fairness of the enforcement of COVID-19 mitigation measures were measured by means of four items (adapted from [43, 77-79]): Participants were asked whether, in enforcing the measures to reduce the spread of the coronavirus, they expected that the authorities would: 1) "treat people with respect," 2) "give a person the chance to tell their side of the story if the person is accused of violating measures to contain the coronavirus," 3) "treat people fairly, despite gender, race, religion, or socioeconomic background," and 4) "be honest in enforcing measures to contain the coronavirus" (1 = "strongly disagree," 7 = "strongly agree"). Participants' responses were aggregated into a scale measure of the perceived procedural fairness of enforcement (Survey 1: α = .92; Survey 2: α = .93; Survey 3: α = .92).

Participants' felt obligation to obey the law in general was using the 12-item Rule Orientation scale [52]. This instrument assesses the perceived acceptability of breaking legal rules across a range of situations (e.g., when the rule is against one's moral principles; when the rule is not enforced; when others think that breaking the rule is justified, etc.; 1 = "strongly disagree," 7 = "strongly agree"). A scale measure was constructed by aggregating participants' responses (Survey 1: α = .94; Survey 2: α = .95; Survey 3: α = .94), with higher scores indicating more felt obligation to obey the law in general.

Costs of adherence to COVID-19 mitigation measures were assessed by means of five items. Specifically, we asked participants to indicate how likely it was that they would 1) "lose income," 2) "lose their job," 3) "not be able to work," 4) "not be able to work as effectively as normal," and 5) "experience a negative impact on their social life" as a result of the measures (1 = "extremely unlikely," 7 = "extremely likely"). These were combined into a scale measure of costs of adherence (Survey 1: α = .86; Survey 2: α = .86; Survey 3: α = .86), with higher scores indicating greater costs.

Perceptions of punishment certainty for violating social distancing measures were measured with two questions. These assessed the perceived likelihood that the authorities would 1) "find out," and 2) "punish you" if participants would not keep a safe distance (six feet or more) from others (1 = "very improbable," 7 = "very probable"). Both items were highly correlated (Survey 1: r = .75;

Survey 2: $r = .75$; Survey 3: $r = .74$), and hence were aggregated into a scale measure, with higher scores indicating greater perceived likelihood of punishment.

Perceptions of punishment severity were assessed using one item. Participants indicated how much they would "suffer" if the authorities would punish them for not keeping a safe distance (six feet or more) from others (1 = "extreme suffering;" 6 = "no suffering at all"). The item was reverse-coded so that higher scores indicate greater perceived severity of punishment.

Perceived descriptive social norms regarding safe-distancing measures were measured by means of seven items (again based on our measure of adherence). Participants were asked whether most people they knew were keeping a safe distance (six feet or more) from: 1) "others outside of my direct household," 2) "my neighbors," 3) "colleagues at work," 4) "friends and family from outside of my direct household," 5) "others when grocery shopping," 6) "others when taking a walk or exercising," and 7) "others in traffic or public transport" (1 = "disagree completely," 7 = "agree completely"). Participants' answers were combined into a scale measure of perceived descriptive norms (Survey 1: $\alpha = .94$; Survey 2: $\alpha = .95$; Survey 3: $\alpha = .95$). Higher scores indicate greater perceived adherence within one's social environment (i.e., descriptive norms). Descriptive statistics of all independent variables are displayed for all three samples in Table 3, and correlations are shown in Appendix B.1-B.3.

Table 3.

Descriptive statistics of independent variables, May, June, and July samples (Surveys 1, 2 and 3).

	Survey 1 (May 8-18)	Survey 2 (June 8-16)	Survey 3 (July 11-17)
Situational variables			
Practical capacity to adhere	6.06 (0.94)	5.97 (0.94)	5.91 (1.08)
Knowledge of measures	90.5%	82.8%	86.2%
Clarity of measures	5.36 (1.62)	5.15 (1.74)	5.03 (1.81)
Impulsivity	2.39 (1.10)	2.52 (1.14)	2.46 (1.13)

Opportunity to violate	4.46 (1.78)	4.70 (1.75)	4.61 (1.71)
Negative emotions	4.60 (1.53)	4.53 (1.61)	4.62 (1.57)
Motivational variables			
Moral alignment	6.21 (1.18)	6.10 (1.34)	6.15 (1.36)
Perceived health threat	5.60 (1.47)	5.53 (1.55)	5.74 (1.48)
Authority response	4.29 (1.85)	4.36 (1.84)	3.82 (1.95)
Normative obligation to obey	3.97 (0.85)	3.84 (0.92)	3.90 (0.93)
Non-normative obligation to obey	2.95 (0.99)	2.97 (1.02)	2.94 (0.98)
Procedural justice of enforcement	5.24 (1.52)	5.05 (1.68)	5.08 (1.65)
Obligation to obey the law (general)	4.40 (1.46)	4.29 (1.50)	4.38 (1.49)
Costs of adherence	4.31 (1.61)	4.09 (1.66)	4.15 (1.64)
Punishment certainty	3.34 (1.76)	3.19 (1.78)	3.24 (1.74)
Punishment severity	3.80 (1.70)	3.81 (1.73)	3.89 (1.73)
Descriptive social norms	5.46 (1.30)	5.21 (1.40)	5.08 (1.47)

Note. Standard deviations between parentheses.

Analysis plan

Our research focused on three major questions: (1) To what extent have Americans adhered to social distancing measures in the period after the first wave lockdown, between May and July 2020? (2) how have the motivational and situational forces that were hypothesized to influence adherence developed during this period? And (3) which of these motivational and situational factors in fact influenced adherence during this period? Accordingly, our analysis consisted of two steps.

To examine the first two questions, we explored how adherence to social distancing measures, as well as the situational and motivational variables that were hypothesized to sustain it, evolved from May to July. To do so, we compare these variables between the three survey waves by means of analyses of covariance (ANCOVA), with parameter estimates with robust standard errors (HC3) to conduct pairwise comparisons between months. To illuminate the strictness with which individuals

adhere to social distancing recommendations, we also compare frequencies of full adherence. This approach exploits the notion that anyone who reports anything less than full adherence (7 = "always") in fact admits to not having followed the measures (either occasionally or more frequently); this therefore represents a stricter measure of adherence than the average. We compared the frequency of full adherence (across all seven situations) between survey waves using negative binomial regression; to compare the probability of full adherence within specific situations, logistic regression was utilized. All analyses controlled for all demographic and control variables.

To examine the third question, we examined how adherence to social distancing measures was predicted by the situational and motivational variables that were hypothesized to sustain it. To do so, we relied on linear (OLS) regression analyses, in which self-reported adherence to social distancing measures was regressed upon these variables (for a similar approach, see [5]). To identify relevant covariates, we first conducted an analysis that included only the demographic and control variables. Then, we estimated a model that entered all independent variables as predictors, along with the covariates identified in the previous analysis. All analyses were adjusted for heteroscedasticity using Huber/White robust standard error estimation.

Results

Development of adherence levels, May to July

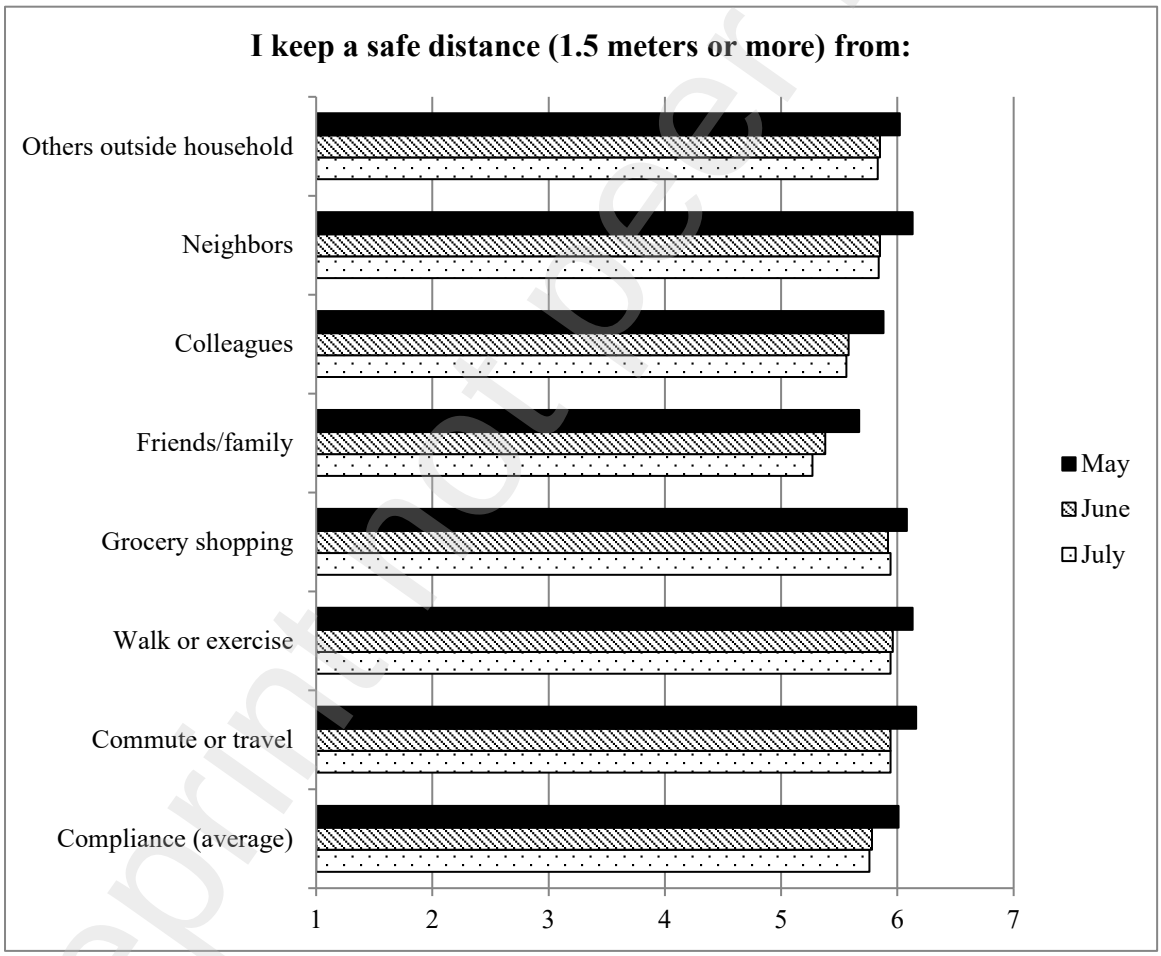
First, we examined how Americans' relative levels of adherence to social distancing measures developed from May to July by comparing average adherence levels between the surveys.

Average adherence. Adherence levels on average as well as by situation are displayed in Figure 1. ANCOVA using parameter estimates with robust standard errors indicated that average levels of adherence among Americans declined from May to June (b = -.19, robust SE = .05, $p < .001$, Cohen's $d = .13$), but did not change further from June to July (b = .01, robust SE = .06, $p = .838$, Cohen's $d = .00$). When separating the seven situations, adherence declined from May to June in all situations (outside household: b = -.13, robust SE = .06, $p = .033$, Cohen's $d = .09$; neighbors: b = -.24, robust SE = .06, $p < .001$, Cohen's $d = .14$; colleagues: b = -.24, robust SE = .08, $p = .001$,

Cohen's d = .11; friends and family: b = -.28, robust SE = .07, p < .001, Cohen's d = .14; grocery shopping: b = -.12, robust SE = .06, p = .029, Cohen's d = .09; walk or exercise: b = -.13, robust SE = .06, p = .034, Cohen's d = .09; commute or travel: b = -.17, robust SE = .06, p = .007, Cohen's d = .09). From June to July, however, no further significant changes in adherence were observed in any of the situations (all ps ≥ .285). In sum, the findings suggest a pattern where adherence to social distancing measures declined from May to June (although differences were relatively modest in terms of effect size), but not further in July.

Figure 1.

Adherence to social distancing measures, May to July.

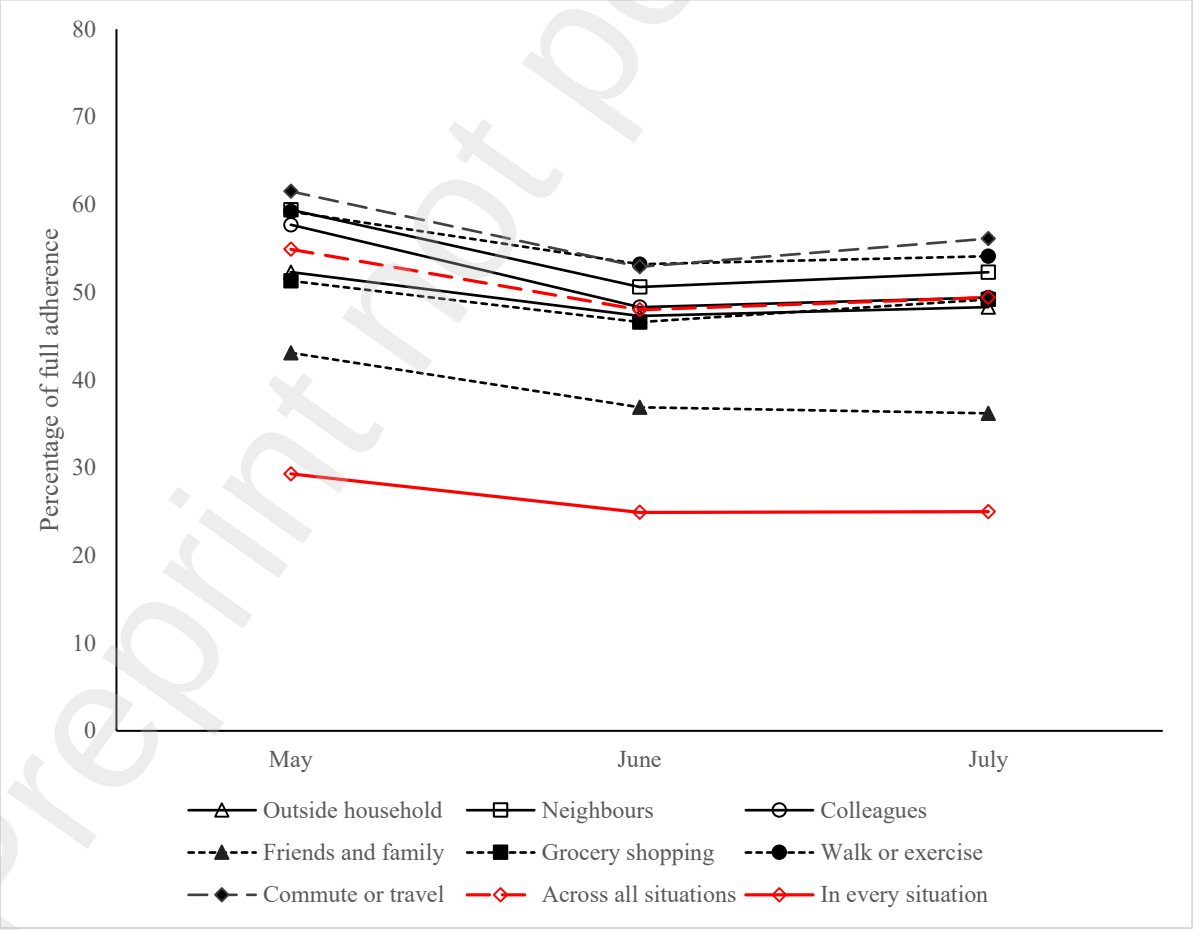


Full adherence. Levels of full adherence are displayed in Figure 2. It displays the percentage of participants who reported adhering fully (7 = "always") in each situation (grey and black lines), as well the average percentage of full adherence across all situations (red dashed line). Moreover, it

displays the percentage of participants who reported full adherence in all seven situations (red solid lines). When comparing levels of full adherence averaged across all seven situations (red dashed line), negative binomial regression revealed a significant difference between the three survey waves, Wald χ^2 (2) = 11.77, p = .003. Average levels of full adherence declined by from May to June (b = -.13, SE = .04, Wald χ^2 (1) = 10.62, p = .001 – a reduction of 12.6% relative to May), but did not change further from June to July (b = -.03, SE = .04, Wald χ^2 (1) = 0.49, p = .484). When comparing the number of participants who reported full adherence in every situation (red solid line), there also was a significant decrease from May to June (b = -.24, SE = .10, Wald χ^2 (1) = 5.33, p = .02 – a reduction of 15.0% relative to May). Here also, no further changes were observed from June to July (b = -.04, SE = .11, Wald χ^2 (1) = 0.11, p = .734).

Figure 2.

Full adherence by situation, across all situations, and in every situation, May to July



When separating the seven situations (grey and black lines), logistic regression indicated that the probability that participants fully adhered to social distancing recommendation declined significantly from May to June in all situations (outside household: b = -.20, SE = .10, Wald χ^2 (1) = 4.66, p = .031; neighbors: b = -.35, SE = .09, Wald χ^2 (1) = 14.11, p < .001; colleagues: b = -.36, SE = .09, Wald χ^2 (1) = 14.76, p < .001; friends and family: b = -.28, SE = .10, Wald χ^2 (1) = 8.65, p = .003; grocery shopping: b = -.20, SE = .09, Wald χ^2 (1) = 4.35, p = .037; walk or exercise: b = -.24, SE = .09, Wald χ^2 (1) = 6.29, p = .012; commute or travel: b = -.34, SE = .09, Wald χ^2 (1) = 12.63, p < .001). From June to July, however, probabilities of full adherence did not change any further (all ps ≥ .107).

Development of situational and motivational variables, May to July

Figure 3 displays the development of the situational variables across the three surveys. ANCOVA using parameter estimates with robust standard errors indicated that relative to May, respondents' reported capacity to adhere to social distancing measures was significantly lower in July (b = -.11, robust SE = .04, p = .008, Cohen's d = .09), as were perceptions of the clarity of mitigation measures (b = -.29, robust SE = .07, p < .001, Cohen's d = .11). Furthermore, logistic regression indicated that levels of knowledge of social distancing measures (Table 3) declined significantly in June (b = -.67, SE = .14, Wald χ^2 (1) = 23.22, p < .001), but partially recovered in July (b = .29, SE = .13, Wald χ^2 (1) = 4.75, p = .029). In contrast, perceived opportunities to violate social distancing measures significantly increased from May to June (b = .20, robust SE = .08, p = .011, Cohen's d = .09). The analysis revealed no significant differences between survey waves for participants' reported negative emotions, as well as their levels of impulsivity (all ps ≥ .068).

Figure 3.

Situational variables, May to July.

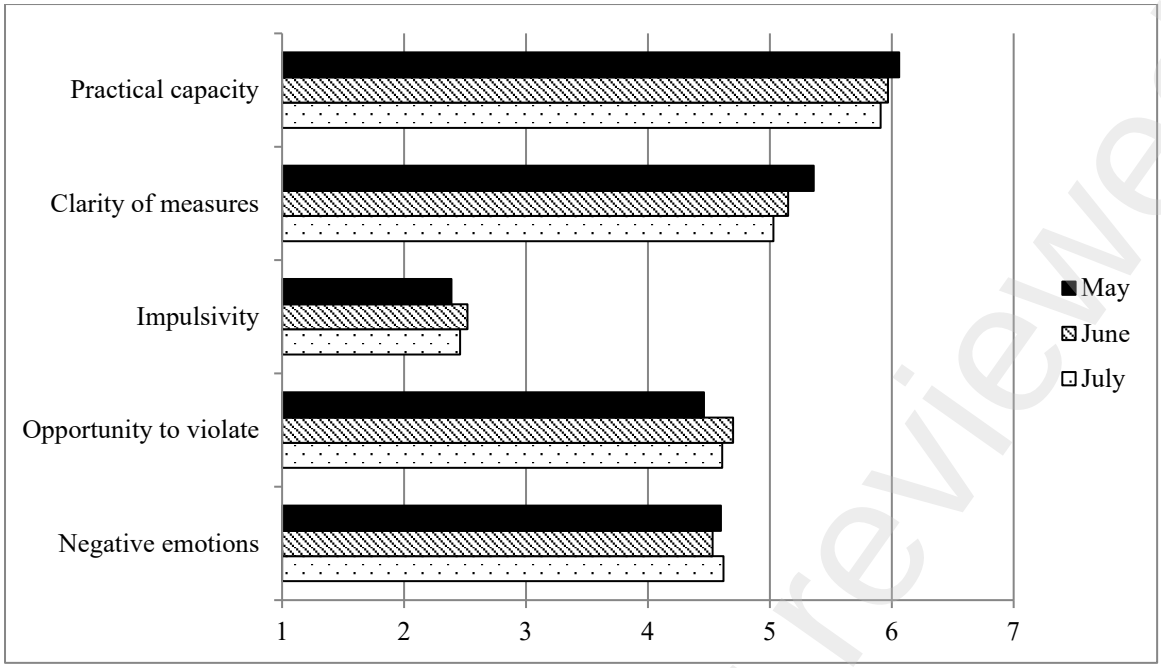
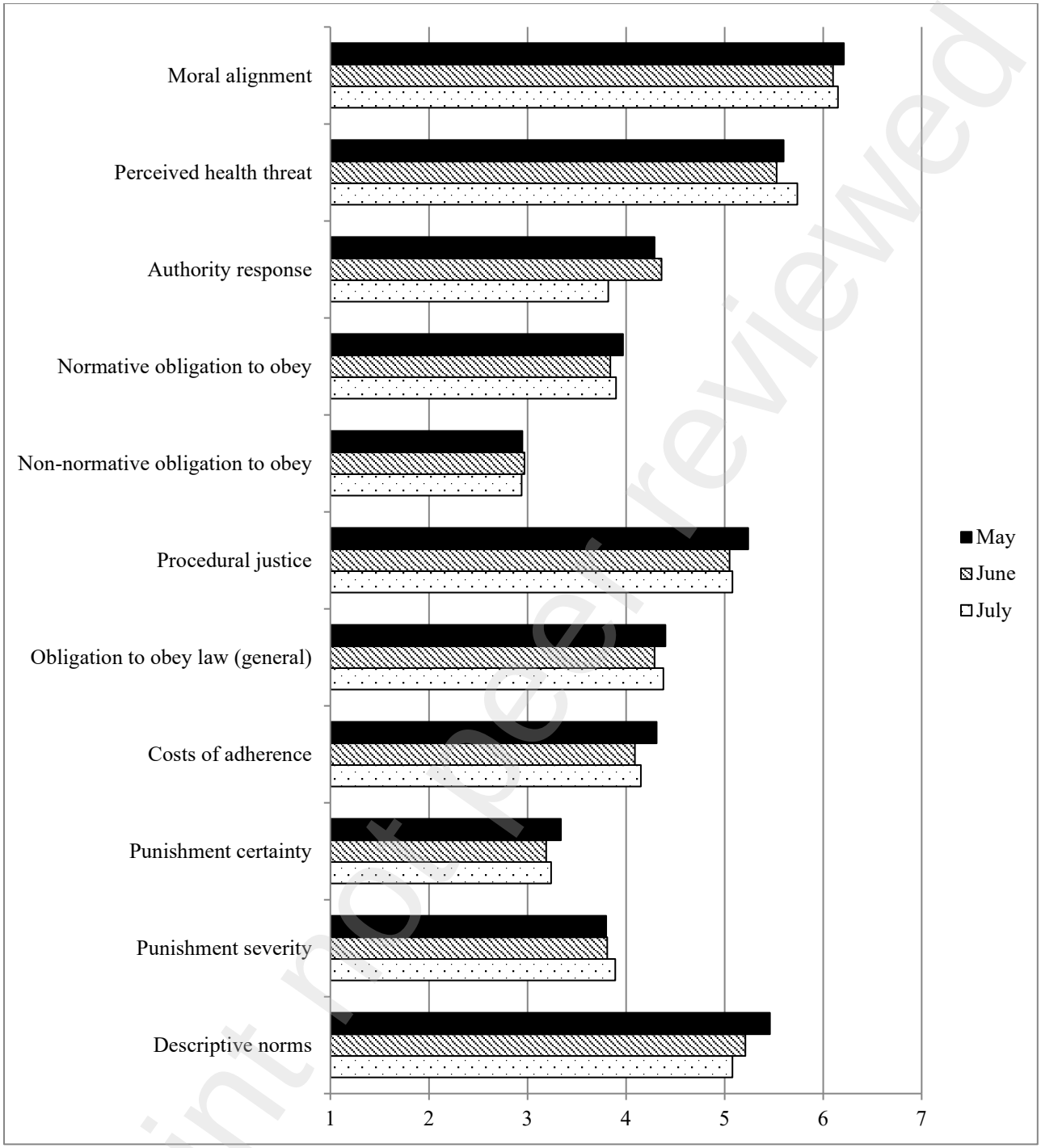


Figure 4 displays the development of the motivational variables across the three surveys. With regard to substantive support, the analyses revealed no significant changes observed in moral alignment with social distancing measures (b = -.09, robust SE = .05, p = .083, Cohen's d = .06). However, threat perceptions increased from June to July (b = .21, robust SE = .06, p < .001, Cohen's d = .13), whereas evaluations of the authority response declined significantly during the same period (b = -.53, robust SE = .08, p < .001, Cohen's d = .25).

Figure 4.

Motivational variables, May to July.



With regard to participants' obligation to obey, the analyses indicated that their normative obligation to obey the COVID-19 authorities declined from May to June (b = -.12, robust SE = .04, p < .001, Cohen's d = .11), as did perceptions of their procedural fairness (b = -.17, robust SE = .07, p = .015, Cohen's d = .09), but neither changed significantly thereafter (both ps ≥ .057). However, no significant changes were observed in non-normative obligation to obey (b = -.01, robust SE = .04, p =

.466, Cohen's d = .00), or in obligation to obey the law in general (b = -.04, robust SE = .06, p = .523, Cohen's d = .00).

With regard to costs and deterrence perceptions, the analysis revealed that perceived costs of adherence (b = -.21, robust SE = .07, p = .003, Cohen's d = .11) and perceptions of the certainty of punishment (b = -.22, robust SE = .07, p = .003, Cohen's d = .11) decreased from May to June, but did not change significantly thereafter (both ps ≥ .061). Perceptions of the severity of punishment, however, did not change significantly between May and July (b = .12, robust SE = .08, p = .123, Cohen's d = .06).

Finally, with regard to social norms, the analysis revealed that relative to May, perceived norms for adhering to social distancing measures were significantly lower in July (b = -.35, robust SE = .06, p < .001, Cohen's d = .21).

In sum, comparison of the three survey waves suggests a decrease in adherence, as well as in several important situational (e.g., capacity) and motivational (e.g., authority support) variables. Conversely, specific situational (e.g., opportunities for violating) and motivational (i.e., perceived threat) increased, while others (e.g., negative emotions, moral alignment) did not change across this period.

Understanding adherence to social distancing measures in May, June, and July

As the previous section demonstrates, adherence to social distancing measures declined in the period after the initial first wave lockdown. Furthermore, changes were observed in the situational and motivational variables that were hypothesized to shape adherence. Our next major question is to understand how these processes shaped adherence to social distancing measures during this period.

Effect of demographic variables. Correlational analysis (Appendix A1-3) revealed 12 demographic variables that showed significant correlations with adherence in one, or across multiple surveys: age, gender, employment status (Surveys 1 and 2), education (Survey 3 only), providing professional care for COVID-19 patients (Survey 1 only), minority group membership (Surveys 1 and 2), SES (Survey 3 only), health risk self (Surveys 2 and 3), health risk to others (Survey 1), political

orientation, trust in science, and trust in media. However, because many of these variables may overlap, we estimated a regression model (with robust standard errors) that included all demographic and control variables to identify relevant covariates (Table 4). Collinearity statistics indicated no issues with multicollinearity (all VIFs ≤ 2.60; all tolerances ≥ .38). In all three surveys (columns 1-3), participants who were older and who had greater trust in science reported greater adherence to social distancing measures.

Table 4.

Linear regression (with robust standard errors), adherence to mitigation measures by demographic and control variables.

	Survey 1 (May 8-18)	**Survey 2 (June 8-16)**	**Survey 3 (July 11-17)**	**All (Surveys 1-3)**	***Effect size*** *(Cohen's d)*
Demographic variables					
Age	.01*** (.00)	.01** (.00)	.01** (.00)	.01*** (.00)	.21
Gender (female)	.27 (.07)	.24** (.08)	.29** (.09)	.27*** (.05)	.21
Minority	.12 (.08)	.25** (.08)	.13 (.09)	.19*** (.05)	.14
Education	.03 (.03)	.02 (.03)	.09** (.03)	.05** (.02)	.11
Employed	-.18* (.08)	.08 (.09)	.03 (.10)	-.02 (.05)	.02
COVID Care	-.40** (.14)	-.26 (.14)	-.38* (.15)	-.32*** (.08)	.14
Insurance, public (vs no)	.12 (.13)	.17 (.14)	-.00 (.14)	.10 (.08)	.05
Insurance, private (vs no)	.13 (.12)	.16 (.12)	-.03 (.14)	.09 (.07)	.04
Socio-economic status, pre-COVID	.03 (.02)	.01 (.02)	.02 (.02)	.02 (.01)	.06
Socio-economic status change (post-pre)	-.01 (.02)	-.04 (.03)	-.02 (.03)	-.02 (.01)	.06

Health risk self	.03 (.08)	.11 (.09)	.30** (.09)	.13** (.01)	.10
Health risk others	.21** (.08)	.04 (.09)	-.12 (.10)	.06 (.05)	.05
Trust in science	.28*** (.05)	.37*** (.05)	.50*** (.06)	.39*** (.03)	.46
Trust in media	.00 (.03)	.06 (.03)	.05 (.03)	.04 (.02)	.07
Political orientation (conservative)	-.02 (.08)	-.05 (.08)	.01 (.09)	-.03 (.05)	.02
Political orientation (not disclosed)	.14 (.13)	.01 (.15)	.09 (.14)	.10 (.08)	.05
Month: June (vs May)				-.19*** (.05)	.13
Month: July (vs May)				-.20*** (.05)	.14
Constant	3.87*** (.28)	3.22*** (.33)	2.60*** (.34)	3.32*** (.18)	
Rsq	**.09**	**.15**	**.20**	**.15**	

Note. Robust standard errors between parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$.

There also were some variables that inconsistently predicted adherence. Women reported significantly greater adherence than men in both the June and July surveys (but not significantly so in May). Conversely, participants who cared professionally for COVID-19 patients reported significantly lower adherence in both May and July (but not in June). People who were employed were significantly less likely to adhere to the measures in May (but not in June or July), while minority members were significantly more inclined to do so in June (but not in May or July). Finally, there were indications that health conditions that placed people at increased risk play a role in adherence: in July, people who indicated that they themselves suffered from such a condition showed

significantly greater adherence, while in May, people who knew others with such health conditions were more inclined to do so.

To assess which of these variables significantly predicted adherence across the period from May to July, we estimated an additional regression model in which the data from all three surveys were included (column 4, $N = 2{,}927$). All demographic variables were again included as the predictors, while we included survey wave (1= May, 2 = June, 3 = July) as an additional predictor. Across this period, adherence was significantly associated with age, gender, minority group membership, education, providing professional care for COVID-19 patients, health risk to oneself, and trust in science. Accordingly, we included these variables as covariates in all subsequent models, where the relationship between adherence and our situational and motivational variables is tested. Conversely, adherence, employment status, minority group membership, SES, health risk to others, political orientation, and trust in media – which had shown significant correlations to adherence – did not emerge as significant predictors, and thus were dropped in further analyses.

Effect of situational and motivational variables. Next, we examined how adherence to social distancing measures was predicted by our situational and motivational variables. To do so, we estimated additional regression models that included all predictors, as well as the covariates that were identified in the previous step. Table 5 displays the results of the regression models, separately for each survey wave (columns 1-3) and across the period from May to July (column 4). Again, collinearity statistics indicated no issues with multicollinearity (all VIFs ≤ 2.41; all tolerances $\geq .41$). We first discuss the findings for each month, and then the results when aggregating the data.

Table 5.

Linear regression, adherence to mitigation measures by independent variables.

	Survey 1 (May 8-18)	**Survey 2 (June 8-16)**	**Survey 3 (July 11-17)**	**All (Surveys 1-3)**	***Effect size***

					(Cohen's d)
Situational variables					
Practical capacity to adhere	.53***(.05)	.49*** (.05)	.53*** (.06)	.51*** (.03)	.60
Knowledge of measures	.23 (.12)	.27** (.10)	.11 (.12)	.21** (.06)	.12
Clarity of measures	-.03 (.02)	.00 (.02)	-.02 (.02)	-.02 (.01)	.05
Impulsivity	-.11** (.03)	-.07* (.03)	-.08* (.03)	-.09*** (.02)	.18
Opportunity to violate	-.01 (.02)	-.03 (.02)	-.03 (.02)	-.03** (.01)	.10
Negative emotions	.01 (.02)	.04* (.02)	-.01 (.02)	.02 (.01)	.05
Motivational variables					
Moral alignment	.28*** (.04)	.24*** (.05)	.22*** (.04)	.25*** (.03)	.35
Perceived health threat	.12*** (.03)	.15*** (.03)	.11** (.04)	.12*** (.02)	.24
Authority response	-.01 (.01)	-.00 (.02)	-.01 (.02)	-.00 (.01)	.02
Normative obligation to obey	-.02 (.04)	-.00 (.04)	.05 (.05)	.01 (.03)	.02
Non-normative obligation to obey	-.07 (.04)	.02 (.04)	.12** (.03)	.02 (.02)	.03
Procedural justice of enforcement	-.02 (.02)	.01 (.02)	-.02 (.02)	-.01 (.01)	.03
Obligation to obey the law (general)	.01 (.02)	.02 (.02)	.02 (.03)	.02 (.01)	.05
Costs of adherence	.03 (.02)	-.00 (.02)	.04 (.02)	.02 (.01)	.06
Punishment certainty	.03 (.02)	.00 (.02)	-.02 (.02)	.01 (.01)	.02
Punishment severity	-.01 (.02)	-.01 (.02)	.00 (.02)	-.00 (.01)	.01
Descriptive social norms	.03 (.02)	.02 (.02)	.05 (.03)	.03* (.01)	.08
Month: June (vs May)				-.09* (.04)	.08

Month: July (vs May)				-.13** (.04)	.12
Control variables					
Age	.00 (.00)	.00 (.00)	.00 (.00)	.00 (.00)	.05
Gender (female)	.13* (.06)	.09 (.06)	.12 (.06)	.11** (.03)	.12
Minority	-.08 (.06)	-.00 (.06)	-.01 (.07)	-.02 (.04)	.02
Education	.02 (.02)	.04 (.02)	.06** (.02)	.04*** (.01)	.14
COVID Care	-.05 (.14)	-.09 (.11)	-.05 (.12)	-.05 (.07)	.03
Health risk self	.04 (.06)	.02 (.07)	.05 (.07)	.04 (.04)	.04
Trust in science	-.04 (.03)	.02 (.04)	.09* (.04)	.02 (.02)	.03
Constant	0.70* (.33)	-0.04 (.35)	-0.68 (.37)	0.03 (.20)	
Rsq	**.52**	**.50**	**.53**	**.51**	

Note. Robust standard errors between parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$.

The results of the monthly regression models (columns 1-3) demonstrate that the factors that predicted adherence to COVID-19 mitigation measures generally were highly similar in each of the three time points. Adherence to social distancing measures was greater among participants who had greater practical capacity to keep at a safe distance from others, who morally agreed more with the measures (i.e., moral alignment), and who regarded the COVID-19 pandemic as more threatening; this was the case in each of the three survey waves. Conversely, participants who were higher in trait impulsivity consistently showed lower adherence to social distancing measures.

There also were some factors that inconsistently predicted adherence. In the June survey (but not in May or in July), adherence was greater among people with better knowledge of the measures, and among those who experienced more negative emotions as a result of the virus. In July (but not in May or June), adherence was greater among participants whose obedience was based on fear of the authorities (i.e., non-normative obligation to obey).

We finally estimated an additional regression model that tested these processes when the data from all three surveys were considered simultaneously (column 4, $N = 2{,}927$). In this model, all independent variables were again entered as the predictors, along with the covariates, while the survey wave was included as an additional predictor. As in the monthly analyses, participants' practical capacity to adhere, moral alignment with the measures, and perceived threat of the virus predicted greater adherence across this period. Again, impulsivity predicted lower adherence. The analysis also revealed some associations, however, that had not been detected in the monthly analyses (or not consistently so). First, greater knowledge of the measures was associated with greater adherence across the study. Second, perceived (descriptive) social norms for keeping a safe distance predicted greater adherence. Conversely, greater perceived opportunities to violate social distancing measures were associated with lower adherence. Finally, the analysis revealed significant effects of survey wave. Confirming the results of the comparison between survey waves, adherence to social distancing measures declined significantly in the period from May to June, but plateaued from June to July.

Discussion

The results of our study show that a broad range of behavioral mechanisms has been at play in longer term adherence to pandemic mitigation measures. These include both variables that originate in the situation people are in (most notably their capacity to adhere and their level of impulsivity), and particular aspects of their motivations (most notably their moral alignment and perceptions of the health threat of the virus). They thus show that large-scale behavioral change can be accomplished through a combination of situational and motivational factors. Yet, the study also shows that some variables that have received much attention in general psychological, economic, and criminological compliance scholarship did not play a clear and consistent role in shaping adherence. Most notably these are the opportunity to violate [80-83], procedural justice and obligation to obey the law [44, 84] deterrence [85] and social norms [65, 68, 86]

Directly comparing the results from the May-June surveys to findings from our own study conducted in the U.S. during the first wave in April [5], we observe some consistency in the variables

that predict adherence. Both during the first wave and in the months thereafter, impulsivity, capacity and moral alignment were significant predictors. But we also see differences. After the first wave and the stricter measures ended, several factors were no longer predicting adherence: these include the negative emotions, and the obligation to obey the law. Meanwhile, opportunity to violate and social norms were not significant in the monthly samples over the summer (although they did have a significant, but modest effect on adherence when these samples were combined). As such, during the first wave adherence to the measures had a much broader support of a wider range of situational and motivational variables, which were no longer as clearly at play in the period after the lockdown, on which the present paper focuses. The exception is people's fear of the virus, which was not significantly predicting adherence in April, but did do so during the summer months. Overall, this comparison therefore suggests that the overall composition of variables that support adherence has shifted somewhat after more restrictive mitigation measures were repealed, with a core group remaining consistently shaping behavior, but several important ones dropping out. Some caution is advised when directly comparing these results, however, as relative to the April study, small refinements were made to the materials and sampling method.

Theoretically, the present comparison of adherence over the summer months demonstrates that the nature of behavioral change and influence on behavior is not static. Rather, our findings show that across similar samples of people, with similar measures staying in place, what shapes such behavior can change even in a matter of months. Our data allow us to trace these processes more deeply by examining how the key situational and motivational variables have changed over the summer months. On the one hand, the data show that key situational factors changed: people reported, for instance, to have more opportunity to violate the social distancing measures (which makes sense given that stay-at-home orders were mostly lifted in this period), and lower capacity to follow the rules (possibly due to the fact that there were larger crowds and that more people were expected to resume normal work and social activities). On the other hand, there were also clear changes in motivational factors, such as a decline in people's moral alignment with the social distancing measures and a decline in social norms of adherence, while there was a rise in people's fear of the

disease. When viewed together, these changes provide important indications of why adherence has changed over time. These processes do not seem to indicate that there was a so-called general behavioral fatigue [87, 88] at play at this time, but rather that lower adherence may have resulted from very particular and factual changes in people's circumstances, the environment, and their motivations. By providing insight into which situational and motivational variables do (and do not) shape adherence, the present research offers a more practical way of assessing whether people are able to sustain behavioral change for as long as needed, compared to broad and vague concepts such as behavioral fatigue (which rely more on common-sense understanding than mechanisms from behavioral science). An important question for future research, however, is to understand more deeply how the changes in situational and motivational variables that we observed across this period may be connected to local developments in policy, society, and the pandemic. For this, a more fine-grained analysis is needed, which takes into account how these processes developed locally at the level of states, counties, or even cities.

Our findings on deterrence deserve extra discussion. In light of the fact that stricter mitigation measures have been repealed, and thus are no longer widely enforced [89], it is noteworthy that Americans nevertheless reported moderately high levels (i.e., close to the scale midpoint) of perceived punishment certainty and severity. One explanation for such continuing perceptions of deterrence when there is no longer any enforcement is that there are spill-over effects. In this case, this might mean that prior enforcement continues to drive deterrence perceptions even after it has ended, or that enforcement of other measures (e.g., facemasks; quarantine) also shapes deterrence perceptions for social distancing [90]. A second, and related explanation is that people generally do not have very good perceptions of deterrence and can underestimate or overestimate both the certainty and severity of punishment [62]. Importantly, however, even though many Americans considered it quite likely that they would be punished when not keeping a safe distance, and regarded such punishment as quite severe, these beliefs did not predict greater adherence. This finding is in line with studies in other countries where there was actual enforcement of social distancing measures, where also no effects of

deterrence on compliance were observed [18]. However, these conclusions clearly oppose belief in the effectiveness of strong punishment for COVID-19 violations [91, 92].

Finally our findings shed light on whether political orientation mattered for adherence to the social distancing measures. Even though in the U.S. social distancing has become a highly politicized topic, with Republican party directly criticizing and at times publicly ignoring the measures [12, 14, 93, 94], our findings do not show a clear direct association between political views and social distancing adherence. This may seem surprising, as a number of studies have demonstrated that political orientation is an important, if not the most important, factor in adherence to mitigation measures [95, 96]. An important reason for this distinction may lie in the fact that our study included several control measures that are related to or overlap with conservatism such as (dis)trust in science or media (see [96]) that were more directly associated with nonadherence. When omitting trust in science and trust in media from the initial regression model involving the demographic variables (Table 4), the effect of conservatism on adherence (which previously was not significant) is significant and negative (b = -.27, robust SE = .08, $p < .001$, Cohen's $d = .20$), such that greater conservatism predicts lower adherence. However, when the situational and motivational variables were included in the model, it were these more proximal predictors (like perceived threat, moral support, or capacity to adhere) that predicted adherence to social distancing recommendations. As such, understanding people's motivation and situation – which may reflect a spectrum of factors, including political orientation – appears to be more directly relevant for understanding adherence.

Our findings have several policy implications, which may aid authorities in the U.S. and elsewhere to sustain adherence with mitigation measures, both for the current outbreak and for future pandemics. The results of our surveys identify six major factors that influence adherence.

First, authorities can increase adherence through making it more difficult for individuals to violate the measures. In context of social distancing, this may involve creating circumstances that make it easier for citizens to stay at a safe distance from others or that remove opportunities for getting close to others. A core issue here is to prevent large crowds, because as soon as people gather

in larger groups, the likelihood that they keep up social distancing greatly diminishes [97]. Here, policy makers must look beyond the highly costly options of lockdowns and stay-at-home orders and consider less invasive interventions that may receive more substantive support, such as arrangements that guide crowds through public venues in ways that keep them apart as much as possible, facilitating telework where possible, instituting caps on the number of people able to enter a public space, and promoting technical aids that warn people when getting too close to others.

Second, our findings show that knowledge of social distancing guidelines is an important factor for promoting adherence. Due to the fragmented authority response in the U.S., mitigation measures may differ substantially between states, counties, and municipalities. Consequently, it can be unclear to citizens what mitigation measures require of them. Accordingly, authorities can promote adherence by clearly communicating what the measures are and what they require of citizens.

Third, our results show that individuals adhere more to mitigation measures when they morally agree with these measures. This finding suggests that authorities can increase adherence by convincing citizens of the importance and legitimacy of such measures. For example, authorities may show evidence of how social distancing measures prevent the spread of the virus or emphasize citizens' shared moral duty to protect vulnerable individuals.

Fourth, perceptions of threat to oneself and others are an important predictor of adherence to mitigation measures. Findings from our studies in the Netherlands [18] demonstrate, however, that threat perceptions can quickly recede as the pandemic wanes, with deleterious effects on support for, and adherence to, strict mitigation measures. Accordingly, it is important that authorities do not give the impression that the threat is waning once infections recede [98]. Rather, authorities can sustain adherence by expressing the continuing health threat to self and others.

Fifth, the results of the combined analysis show that people's adherence to mitigation measures is influenced by the behavior of others in their community (i.e., descriptive social norms). If more people around them adhere to social distancing measures, then people also are more inclined to do so themselves. Although this effect was modest in terms of effect size, effects of social norms on

social distancing have also been demonstrated in other research [18, 99, 100]. This means that authorities should take care to not convey the impression that violations of these measures are ubiquitous and normal. In this regard, it seems likely (although we did not analyze this directly) that the portrayal of mass gatherings where people do not keep at a safe distance from each other could have an important negative influence, as this may normalize lack of distancing, and thus undermine adherence. Conversely, to increase adherence to mitigation measures, authorities could express that this is the norm (or ought to be), highlight examples where many others are seen to adhere, and show adherence themselves.

Overall, the study of adherence of social distancing measures has important implications for the study of compliance generally and the way rules shape human behavior. Just like adherence with mitigation measures studied here, compliance generally is not the product purely of motivational factors, but can very much be shaped also by situational factors, such as impulsivity, practical capacity and to a lesser extent knowledge of the rules and opportunity. This insight shows that the study of compliance should move beyond a focus on motivational variables such as social norms and deterrence, and also take into account major situational theories, such as those on impulse control, strain, routine activities, and opportunity. Here, the field of law and behavior has much to learn from criminology where such situational theories have long been influential.

Our study has several limitations. First, our surveys rely on self-reported measures that may be subject to imperfect recall or social desirability bias [101, 102], though a recent study demonstrated that social desirability bias did not inflate the estimates of compliance with COVID-19 measures in online surveys [103]. We do note, however, that the finding of high self-reported adherence is in line with objective data from Google COVID19 Community Mobility [104]. Furthermore, prior research shows that there can be strong concordance between self-reported and objective compliance measures when surveys are used (see [105] p. 29). Second, a considerable subset of participants failed to complete the survey or pass the attention checks. We have eliminated these participants from our analyses removes the threat of bias due to careless and inattentive responding. Crucially, however, the samples remained comparable in terms of broad demographics.

Conclusion

In the summer of 2020, the United States reopened society following the lockdown and stay-at-home measures that were in force in spring. The present findings, based on three nationally representative samples collected in May, June, and July, show that Americans' adherence to social distancing measures declined, as did several of the situational and motivational variables that sustained it – including people's practical capacity to adhere, their knowledge of the measures, and social norms for adherence. Our research identifies key situational and motivational variables that predicted greater adherence as the country reopened. By doing so, this research contributes to the understanding of pandemic governance and the interaction between rules and human conduct more generally. Moreover, in the current stage of the pandemic, where COVID-19 infections are continuing to rise to unprecedented levels in the U.S., these findings provide important directions for the public health response: by highlighting avenues through which adherence can be promoted, to mitigate the spread of the pandemic.

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Supporting Information

1. https://uvaauas.figshare.com/articles/dataset/Social_Distancing_in_America_Compliance_with_COVID-19_mitigation_measures_in_the_United_States/13125206 Data files and analysis syntax, Survey 1 (May), Survey 2 (June), Survey 3 (July), and Surveys 1-3 combined (May-July).
2. Regression results Survey 1 May.pdf. Full regression results Survey 1 (May).
3. Regression results Survey 2 June.pdf. Full regression results Survey 2 (June).
4. Regression results Survey 3 July.pdf. Full regression results Survey 3 (July).
5. Regression results Survey 1-3 May-July.pdf. Full regression results Surveys 1-3 combined (May-July).

Appendix A.1

Kendall's tau correlations between demographic variables and adherence, May 8-18 (Survey 1, N = 1016)

	Age	Gender	Employed	Education	COVID Care	Minority	Insurance	SES pre-COVID-19	SES change	Health risk self	Health risk others	Political orientation	Trust in science	Trust in media
Gender	-0,018													
Employed	-0,043	-,151**												
Education	0,034	-,074**	,299**											
COVID Care	-,074**	-0,038	,162**	,065*										
Minority	-,072**	0,020	-0,032	-0,041	0,056									
Insurance	.033	.006	.231**	.250**	.082**	-.058*								
SES pre-COVID-19	-,057*	-0,043	,061*	,147**	,100**	-0,020	.145**							
SES change	0,037	-,077**	0,049	-0,011	0,028	0,034	.000	-,200**						

Health risk self	,135**	0,013	-0,056	-0,026	,167**	-,063*	.025	-0,029	-0,004					
Health risk others	,060*	,084**	-0,012	0,009	,063*	-0,047	.058*	-0,038	-0,028	,343**				
Political orientation	,104**	-0,026	-0,006	-,082**	-0,058	-,084**	-.012	-0,012	0,023	-,074*	-,097**			
Trust in science	-0,027	-,067*	0,009	,075**	,092**	-0,051	.078**	,108**	,052*	0,044	,100**	-,265**		
Trust in media	0,032	-0,015	-0,008	0,030	,117**	,110**	-.001	,109**	0,021	,068*	0,013	-,266**	,363**	
Adherence	,091**	,101**	-,083**	-0,008	-,077**	0,030	.032	0,032	-0,008	0,038	,078**	-,070**	,160**	,104**

Nb. * – Correlation is significant at the .05 level. ** – Correlation is significant at the .01 level. Gender – Female as reference category. Political orientation – $N = 890$

Appendix A.2

Kendall's tau correlations between demographic variables and adherence, June 8-16 (Survey 2, N = 988)

	Age	Gender	Employed	Education	Care for COVID	Minority	Insurance	SES pre-COVID-19	SES change	Health risk self	Health risk others	Political orientation	Trust in science	Trust in media
Gender	-0,033													
Employed	-,057*	-,115**												
Education	0,016	-,079**	,278**											
COVID Care	-,125**	-,082*	,168**	,076**										
Minority	-,053*	,067*	-0,028	-0,021	,071*									
Insurance	0,018	-0,031	,251**	,219**	0,031	-,108**								
SES pre-COVID-19	-0,038	-,066*	,121**	,131**	,137**	0,039	,148**							
SES change	,067**	-0,028	-0,011	-0,014	0,015	,066*	-0,004	-,215**						
Health risk self	,145**	0,032	-,095**	-0,025	,084**	-,068*	-0,020	-0,004	-0,039					

Health risk others	0,050	,138**	-0,049	0,004	0,039	-,153**	0,035	-0,043	-,061*	,401**				
Political orientation	,135**	-0,031	-0,022	-0,021	-,075*	-,087**	0,019	,080**	-0,009	-,061*	-0,057			
Trust in science	-0,006	-0,019	-0,038	,054*	,054*	-0,013	0,021	,064**	-0,014	,095**	,060*	-,218**		
Trust in media	,047*	0,044	-0,050	-0,016	,130**	,112**	-0,011	,108**	0,012	,057*	-0,003	-,186**	,331**	
Adherence	,087**	,087**	-,062*	0,001	-0,030	,084**	-0,006	0,036	-0,041	,074**	0,020	-,070**	,196**	,137**

Nb. * – Correlation is significant at the .05 level. ** – Correlation is significant at the .01 level. Gender – Female as reference category. Political orientation – *N* = 881

Appendix A.3

Kendall's tau correlations between demographic variables and adherence, July 11-17 (Survey 3, N = 923)

	Age	Gender	Employed	Education	COVID Care	Minority	Insurance	SES pre-COVID-19	SES change	Health risk self	Health risk others	Political orientation	Trust in science	Trust in media
Gender	0,045													
Employed	-0,044	-,125**												
Education	0,014	-,059*	,342**											
COVID Care	-,094**	-,142**	,232**	,137**										
Minority	-0,050	0,010	0,031	0,038	,068*									
Insurance	-0,008	-0,022	,320**	,269**	0,046	-0,041								
SES pre-COVID-19	-0,044	-,084**	,170**	,185**	,153**	0,015	,151**							
SES change	0,013	-0,017	-0,035	-0,034	0,027	0,035	-0,034	-,183**						
Health risk self	,192**	0,041	-,108**	0,010	,081*	-0,027	-0,052	-,060*	-0,040					

Health risk others	,104**	,154**	-0,028	,059*	0,002	-,116**	0,002	-,071*	-0,056	,476**				
Political orientation	,118**	0,006	-0,024	-,066*	-0,062	-,111**	-0,018	-0,028	0,025	0,007	-0,049			
Trust in science	0,020	-0,037	0,029	,099**	,103**	0,014	0,032	,069**	-0,006	,091**	,146**	-,277**		
Trust in media	0,021	0,038	-0,009	,070**	,155**	,131**	-0,011	,111**	0,046	,088**	0,037	-,242**	,354**	
Adherence	,105**	,092**	-0,033	,072**	-0,033	,073**	-0,009	,057*	-0,020	,126**	0,044	-,109**	,251**	,186**

Nb. * – Correlation is significant at the .05 level. ** – Correlation is significant at the .01 level. Gender – Female as reference category. Political orientation – $N = 804$

Appendix B.1

Kendall's tau correlations between independent variables and adherence, May 8-18 (Survey 1, N = 1016)

	Capacity to comply	Knowledge measures	Clarity measures	Impulsivity	Opportunity to violate	Negative emotions	Moral alignment	Perceived heath threat	Authority response	Normative OOL	Non-norm. OOL	Procedural justice OOL (general)	Cost of adherence	Punishment certainty	Punishment severity	Social norms
Knowledge measures	,144**															
Clarity measures	,233**	,183**														
Impulsivity	-,092**	-,078**	-0,019													
Opportunity to violate	0,015	-0,007	0,040	,160**												
Negative emotions	,065**	0,047	0,006	,176**	,076**											
Moral alignment	,403**	,198**	,316**	-,057*	0,004	,102**										
Perceived health threat	,298**	,150**	,248**	0,017	,071**	,203**	,565**									

Authority response	,114**	,062*	,248**	,134**	,113**	-0,005	,094**	,090**									
Normative OOL	,319**	,153**	,360**	0,011	,047*	,105**	,391**	,364**	,228**								
Non-normative OOL	0,022	0,013	0,022	,240**	,185**	,188**	0,009	,115**	,158**	,107**							
Procedural justice	,218**	,080**	,272**	0,025	,079**	,064**	,206**	,160**	,267**	,333**	0,044						
OOL (general)	,170**	,107**	,121**	-,313**	-,170**	-,070**	,199**	,115**	-,079**	,183**	-,226**	-0,010					
Cost of adherence	,048*	0,027	0,036	,116**	,118**	,290**	,106**	,200**	0,030	,096**	,197**	,054*	-,099**				
Punishment certainty	,058*	0,027	,099**	,178**	,128**	,077**	0,043	,137**	,224**	,087**	,282**	,083**	-,121**	,195**			
Punishment severity	-,054*	-,059*	-,096**	-,107**	-,055*	-,139**	-,059*	-,108**	-,129**	-,076**	-,232**	-,071**	,072**	-,134**	-,228**		
Social norms	,410**	,127**	,207**	0,043	,112**	,088**	,249**	,203**	,212**	,276**	,145**	,216**	0,028	,084**	,143**	-,135**	
Adherence	,506**	,160**	,200**	-,136**	-,046*	,068**	,481**	,356**	,047*	,280**	-0,030	,142**	,223**	,067**	,065**	-0,037	,285**

Nb. * – Correlation is significant at the .05 level. ** – Correlation is significant at the .01 level.

Appendix B.2

Kendall's tau correlations between independent variables and adherence, June 8-16 (Survey 2, N = 988)

	Capacity to comply	Knowledge measures	Clarity measures	Impulsivity	Opportunity to violate	Negative emotions	Moral alignment	Perceived heath threat	Authority response	Normative OOL	Non-norm. OOL	Procedural justice OOL (general)	Cost of adherence	Punishment certainty	Punishment severity	Social norms
Knowledge measures	,187**															
Clarity measures	,237**	,230**														
Impulsivity	-,081**	-0,048	-,059*													
Opportunity to violate	,097**	-0,018	,054*	,180**												
Negative emotions	,062**	0,012	-,047*	,134**	,095**											
Moral alignment	,364**	,210**	,262**	-,067**	0,034	,101**										
Perceived health threat	,315**	,178**	,223**	0,015	,118**	,170**	,550**									

Authority response	,119**	0,042	,298**	,156**	,147**	0,001	,090**	,135**									
Normative OOL	,282**	,180**	,309**	0,010	,114**	,104**	,297**	,303**	,227**								
Non-normative OOL	0,004	-0,023	-0,011	,280**	,164**	,199**	0,002	,097**	,188**	,100**							
Procedural justice	,158**	,094**	,196**	,103**	,141**	,054*	,124**	,159**	,266**	,304**	,069**						
OOL (general)	,095**	,056*	,100**	-,351**	-,126**	-,092**	,143**	,059**	-,077**	,105**	-,229**	-0,032					
Cost of adherence	0,037	0,037	-0,039	,156**	,101**	,298**	,068**	,140**	0,028	,061**	,200**	,063**	-,136**				
Punishment certainty	0,020	0,043	,070**	,231**	,174**	,137**	0,025	,142**	,232**	,098**	,363**	,130**	-,155**	,212**			
Punishment severity	0,018	0,014	0,005	-,137**	-,079**	-,178**	-0,008	-,067**	-,059*	-0,030	-,224**	-0,016	,104**	-,205**	-,246**		
Social norms	,361**	,112**	,189**	,098**	,180**	,109**	,185**	,204**	,242**	,240**	,176**	,210**	-0,026	,095**	,183**	-0,016	
Adherence	,480**	,193**	,205**	-,089**	0,031	,102**	,453**	,409**	,086**	,222**	0,021	,114**	,129**	,065**	,047*	-0,017	,236**

Nb. * – Correlation is significant at the .05 level. ** – Correlation is significant at the .01 level.

Appendix B.3

Kendall's tau correlations between independent variables and adherence, July 11-17 (Survey 3, N = 923)

	Capacity to comply	Knowledge measures	Clarity measures	Impulsivity	Opportunity to violate	Negative emotions	Moral alignment	Perceived heath threat	Authority response	Normative OOL	Non-norm. OOL	Procedural justice OOL (general)	Cost of adherence	Punishment certainty	Punishment severity	Social norms
Knowledge measures	,150**															
Clarity measures	,242**	,206**														
Impulsivity	-,086**	-,072**	-0,020													
Opportunity to violate	,062**	0,025	0,030	,123**												
Negative emotions	,077**	0,022	0,013	,123**	,066**											
Moral alignment	,373**	,148**	,242**	-0,039	0,010	,168**										
Perceived health threat	,300**	,114**	,212**	0,024	,071**	,230**	,544**									

Authority response	,076**	0,029	,186**	,203**	,143**	0,034	-0,018	0,038									
Normative OOL	,306**	,149**	,326**	-0,008	,083**	,122**	,360**	,322**	,168**								
Non-normative OOL	0,003	-0,020	-0,018	,247**	,162**	,194**	0,018	,101**	,198**	,092**							
Procedural justice	,164**	,076**	,228**	,061**	,107**	,081**	,130**	,184**	,260**	,337**	,090**						
OOL (general)	,101**	,068*	,147**	-,319**	-,128**	-,093**	,147**	,084**	-,108**	,158**	-,227**	0,019					
Cost of adherence	,064**	0,000	0,009	,142**	,047*	,274**	,093**	,208**	0,031	,087**	,184**	,053*	-,129**				
Punishment certainty	,065**	0,035	,094**	,230**	,109**	,107**	,064*	,160**	,336**	,113**	,266**	,171**	-,146**	,227**			
Punishment severity	-0,003	-,076**	-,062*	-,117**	-,081**	-,150**	-0,018	-,127**	-,143**	-,081**	-,186**	-,116**	,063**	-,167**	-,260**		
Social norms	,374**	,110**	,233**	0,036	,195**	0,037	,206**	,187**	,240**	,258**	,105**	,230**	0,001	0,027	,157**	-0,035	
Adherence	,509**	,128**	,208**	-,103**	0,034	,098**	,434**	,371**	0,025	,280**	0,039	,118**	,129**	,091**	,054*	-0,014	,280**

Nb. * – Correlation is significant at the .05 level. ** – Correlation is significant at the .01 level