# Norm and Behavior Change Among College Aged Republicans and Democrats in Response to COVID-19

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**Abstract**

COVID-19, and the policies designed to alleviate its spread, have led to sudden, sweeping changes in individual and social behavior. Using a large (n>600) longitudinal sample of college students, we trace how the pandemic generates differential responses of behavioral change by political affiliation. First, we track the the contemporaneous correlation between social norms and precautionary behavior in response to the pandemic through repeated online surveys. We then use panel data to evaluate adjustments and changes in behavior and norms over time. Finally we explore the relationship between COVID-19 restrictions and precautionary behavior and norm beliefs. We find that norms and precautionary behavior are weakening during our observation window. Republicans partake in less precautionary behavior although they engage in more precautionary behavior when they believe others are as well. We further show that COVID-19 restrictions positively correlate with injunctive norm miscoordination for Republicans, but not for Democrats nor Independents.

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# 1 Introduction

In late December of 2019, a new virus strain emerged known colloquially as COVID-19. In the space of little over a year, the virus infected and killed over half a million people in the US.[1] As Haushofer and Metcalf 2020 note, for most of 2020, the only approaches to reduce transmission were behavioral (hand washing, social distancing, masks etc.). As such, COVID-19 presented a major challenge that required rapid behavior change within local communities to prevent global spread.

In the United States, partisan political identity has been highlighted as a key impediment to behavioral change. Numerous studies have documented differences in COVID-19-related precautionary behavior and policy preferences by political party affiliation. Findings show that Democrats are more likely to comply with COVID restrictions and more likely to support policies designed to limit the spread of the virus or mitigate its impact (Allcott et al. 2020; Druckman et al. 2021; Gollwitzer et al. 2020; Kahane 2021; Kushner Gadarian et al. 2020). Responses to Governors' recommendations are similarly partisan based (Grossman et al. 2020). These studies vary in terms of sampling strategy (population or specialized samples), methodology (individual-level surveys, mobility data by locality, as well as county or state level compliance or mortality data), but in all cases political affiliation remains an important correlate of behavior and policy preferences across studies. Despite the proliferation of studies documenting a difference, the motivation for these differences remains unclear. The disparities are magnified as the two groups express greater dislike for one another (Druckman et al. 2021), and trusted news sources and political messaging may have exacerbated differences (Pennycook et al. 2021; Zhao et al. 2020). However, the role of social norms in shaping the preferences and behaviors of partisans has not been explored.

Social change is often supported by social norms that are grounded in community values and articulated around collective objectives (Hardin et al. 1982; Ostrom 2000; Sherif 1988). When those norms are contested, community coordination breaks down. The novel coronavirus pandemic arose very quickly and without clear norms to guide behavior. In the US political partisans quickly contested the appropriate responses to the pandemic. Our research team took the rare opportunity to study both emerging behavior and norms in real time. This study traces the behavioral response by a unique sample of US residents to the novel coronavirus and traces the manner in which norms for behavior coalesced over a seven month period in 2020.

In this study we rely on three waves of surveys (conducted in April, July, and October of 2020) of college students attending Rice University, Prairie View A&M University (PVAMU), and Texas A&M University (TAMU).[2] Each wave of the survey asks questions about precautionary

[1] In addition, COVID-19 contributed to the most rapid change in the unemployment rate in modern American history (Chetty et al. 2020).

[2] Rice University is a private research university in Houston, Texas; Texas A&M is a large public land-grant research

behavior related to curbing the spread of COVID-19. We also embed incentivized measures of norms regarding COVID-19. This allows us to focus on *injunctive* and *descriptive* norms. The period of time takes us from the outset of the pandemic (April) to a highly contested partisan election (October).

Our goal is to describe the emerging social distancing behavior and norms between April and October of 2020. Using data we collected during that time period, we take a reduced-form approach to estimate the relationship between social norms and precautionary behaviors as well as correlations between changes in precautionary behavior and changes in social norms. Finally, we test for correlations between changes in the local context (e.g., loosening restrictions on social gatherings) and changes in norms and behavior. Throughout we observe the variation due to strong partisan differences. Unique in these data are that respondents are part of a longitudinal panel so that we can more closely chart the evolution of norms.

We find that contemporaneous norms are correlated with engaging in more precautionary behavior but there are significant heterogeneous effects by political sub-group. Specifically, Republicans engage in less precautionary behavior but their perceptions of norms and their self-reported behavior are more responsive to beliefs about others' behavior. The injunctive norms are also correlated with changes in behavior, but less so than previous-period precautionary behavior. Finally, we show that policy measures aimed at restricting behavior have a weak and possibly negative effect on behavior and specifically so for Republicans.

Our contributions are to propose a simple theoretical framework for how descriptive and prescriptive social norms may impact behavior and to estimate their impact on precautionary behavior related to the pandemic. Our second contribution is to identify differences in how Republicans' and Democrats' norms and behavior change during a time in which social, economic and health incentives dramatically and precipitously changed, acting as forces for norm and behavior change. We show that changing norms takes time (in our setting about six months), which can be an important consideration for policy making. Thus, when policies must be newly created, as with COVID-19, then they are not suited for achieving rapid behavior change. Our third contribution is to characterize the heterogeneous impact of policy levers (that were targeted to restrict behavior) on norms and the targeted behaviors. Our results provide insight into the unintended negative consequences of such tools when the underlying normative alignments of a population are divergent.

university in College Station, Texas and the flagship institution of the Texas A&M University system; and PVAMU is a historically black university also in the Texas A&M University System.

# 2 Motivation

In this paper, we begin with the "behavioral" premise that precautionary behavior is both a personal decision and a social interaction. As such, the behavior is governed by the *grammar* of social interaction - i.e by social norms (Bicchieri 2005). We then use a norms framework to explain the precautionary behavior we observe. This framework captures the intuition that decision makers derive utility from complying with norms, and that the norms may be strengthened or weakened over time by partisan positions (through policy statements, for example).

*Injunctive* social norms are defined as a collective perception among members of a population regarding appropriate behavior for a particular situation (Krupka and Weber 2013). These norms are what a community believes one 'ought' or 'should' do. These are distinguished from *descriptive* social norms which characterize what an individual believes most others are doing (Bicchieri and Dimant 2019; Bicchieri and Mercier 2014; Deutsch and Gerard 1955). A long tradition in psychology distinguishes between injunctive norms that convey prescriptions (or proscriptions) for what one ought to do and descriptive norms which describe what is regularly done (see also Cialdini et al. 1990; Deutsch and Gerard 1955; Krupka and Weber 2009). We follow this literature by focusing on injunctive and descriptive norms.

In their review, Van Bavel et al. 2020 identify the critical role that injunctive and descriptive social norms can play in managing the pandemic. However, only a small number of studies focus on the norms themselves. Goldberg et al. 2020 report very preliminary results estimating the causal effect of perceived social norms on COVID-19 preventive behaviors using data from a national survey. Social norms are proxied by responses to survey questions regarding how often family and friends perform preventive behaviors, and whether they think it is important for the respondent to do so. The paper suggests an important link between perceived social norms and own preventative behavior.[3] Fetzer et al. 2020 conducted a large scale survey between late March and April of 2020 in 58 countries. They find that 91% of respondents report limiting social gatherings and that 97% believe that people should cancel participation in social gatherings; however, they find that only 67% believe that others share their views regarding what is appropriate. The gap between respondent's own beliefs of appropriate behavior and their beliefs about others' perceptions of those norms, critically frames how our approach to norm elicitation differs.

Relatedly, several working papers document correlations between social preferences and precautionary behavior. For example, Campos-Mercade et al. 2020 show that an experimental measure of prosociality predicts precautionary behaviors during the COVID-19 pandemic and that prosocial individuals are more likely to follow physical distancing guidelines. Nikolov et al. 2020

[3] Kuang et al. 2020 study changes in behavior in communities of Tamil Nadu, India, in May 2020, and find little change in precautionary behavior at that time.

use longitudinal data collected in an online field experiment from seven U.S. states between May and July 2020. Participants completed weekly surveys that collected data on social distancing behaviors and survey measures of social preferences related to reciprocal behavior. They find evidence that higher positive reciprocity is correlated with social distancing behaviors. These two papers are particularly relevant as they suggest that more prosocially-oriented individuals are taking more precautionary behavior. Such a finding suggests that norm-sensitive (or compliant) individuals may be more likely to comply with the specific emergent social norms (e.g., a norm about social distancing) we study here.

# 3 Theoretical Framework

To motivate our empirical approach, we adopt a framework in which decision makers wish to comply with social norms. This is, in some sense, a non-standard conceptualization of utility where the actor's preferences depend on beliefs about collective beliefs regarding appropriate and expected behavior in a particular situation - i.e. preferences depend on the injunctive and descriptive norm.[4] Assume that there is a population of agents. Agent $i$ takes action $a_i \in [0, 1]$: for example this could be the extent to which the agent practices social distancing.

**Descriptive norms.** Agent $i$ has a belief $\delta_i = E(a_{-i})$ which is her belief about the mean action taken by others. We call this subjective belief her *descriptive norm*.[5]

**Injunctive norms.** Every agent $i$ also has an *injunctive norm* $\eta_i(R_i, \delta_i)$ which is a function that assigns to each action a degree of appropriateness or inappropriateness or, more conventionally is articulated as what an agent *ought* to do. It as a function of government regulations $R_i$ and the mean actions of other agents $\delta_i$. We make the following assumptions on the evolution of injunctive norms:

$$\begin{aligned} \frac{\partial \eta_i}{\partial R_i} &> 0 \\ \frac{\partial \eta_i}{\partial \delta_i} &> 0 \end{aligned} \tag{1}$$

In other words, injunctive norms increase if government regulations tighten and they should also move with the mean actions of other agents.

We assume that the agent cares to adhere to the norm which is associated with the action.[6]

[4]This idea has been advanced in multiple papers elsewhere. For example, Akerlof and Kranton 2005 note that "...much of utility depends not only on what economists normally think of as *tastes*, but also on *norms* as to how people think that they and others *should* behave...views as to how people should behave depends upon the particular *situation*...".

[5]Bicchieri 2005 refers to this as the empirical expectation.

[6]We start with the assumption that individuals care about behaving in a manner consistent with norms rather than

The agent's utility from taking action $a_i$ has three components - the direct utility from the action, the disutility from violating one's injunctive norm and the disutility from taking an action that differs from one's descriptive norm:[7]

$$U(a_i) = \underbrace{U^* - \alpha_i(a_i - a^*)^2}_{\text{direct utility}} - \underbrace{\beta_i (a_i - \eta_i)^2}_{\text{injunctive norm violation disutility}} - \underbrace{\gamma_i (a_i - \delta_i)^2}_{\text{descriptive norm violation disutility}} \tag{2}$$

Here $a^*$ denotes the agent's *ideal* action without concerns for norms. The quadratic utility loss ensures that the agent's direct utility decreases the further away her action is from the ideal action. Similarly, the norm violation disutilities increase with the distance of the action from the respective norm.

This model is a quadratic version of the model in Krupka and Weber 2013, who allow for a more general norm utility/disutility function $N(\cdot)$. One advantage of the quadratic formulation is that it is easy to derive the agent's optimal action:

$$a_i = \frac{\alpha_i a^* + \beta_i \eta_i + \gamma_i \delta_i}{\alpha_i + \beta_i + \gamma_i} \tag{3}$$

Intuitively, the agent's optimal action is a weighted average of her ideal action, the injunctive norm and the descriptive norm.

The sensitivity to norm compliance is captured by the weights $\beta_i$ and $\gamma_i$: The larger the sum of these weights, the more the agent cares about norm compliance. In our setting these norms are the appropriateness or empirical expectation of taking social distancing actions such as avoiding large crowds, wearing a mask, and avoiding going out.

## 3.1 Empirical Model

Our empirical model is directly derived from the theory model as described in equation 3:

$$\text{precautionary behavior}_i = \alpha_w + \beta_w \cdot \text{injunctive norm}_i + \gamma_w \cdot \text{descriptive norm}_i + \epsilon_i \tag{4}$$

The weights on the injunctive and descriptive norms are indexed by the survey wave $w$ to capture changes across time. Krupka and Weber 2013 show that the injunctive norm function can be em-

developing a theory of norm compliance based on underlying preferences (Andreoni and Bernheim 2009; Bénabou and Tirole 2011).

[7] We take a reduced-form approach to model norm compliance and refer to Bénabou and Tirole 2011and Andreoni and Bernheim 2009 for micro-foundations.

pirically proxied using coordination games. These norms vary at the group level and are exogenous at the individual level. In corresponding fashion, we can proxy for the descriptive norm. We now turn to describing the data used in our analysis.

# 4 Methods

The overall project (of which this is a component) is conceived as a multi-wave panel of a sample of university students and graduates. The objective of the waves used for this paper is to investigate factors underlying precautionary behavior for the spread of the coronavirus in the face of changing instructions about best practices for prevention and as the pandemic progresses. Embedded in different waves of the present study are incentivized and survey-based measures of preferences, norms, and attitudes about COVID-19 prevention.

The project builds on samples of students from Rice University, Prairie View A&M University (PVAMU) and Texas A&M University (TAMU), that were recruited to participate in two prior studies. The initial studies extend back to 2016 and were funded by the National Science Foundation. The Rice Preferences Study began with a sample of 661 entering undergraduates matriculating in August of 2016.[8] The Black Student Success Study recruited samples from PVAMU and TAMU in 2017 and again in 2019.[9] In March 2020 additional funding was awarded through NSF to expand and follow the Rice, TAMU and PVAMU panels, focusing on the impact of COVID-19.

These panels constitute the subject pool for this paper. Wave 1 ran from April 11 – May 18, 2020. A total of 2,564 invitations were sent to participate in an on-line study (1,696 to Rice, 414 to PVAMU and 454 to TAMU). A total of 1,647 respondents completed the study out of 1,705 who started it. Wave 2 ran from July 15 – August 17, 2020. In that wave we supplemented the

[8]This was 66.7% of the entering class, randomly selected. Of that sample, 553 completed the study with an 83.7% response rate. Prior to coming to campus in fall 2016 Rice students were given a battery of incentivized preference measures including risk aversion, loss aversion, altruism, in-group favoritism, time discounting, competitiveness, etc. Over the subsequent four years that group was tested with new and repeated measures, in 2 to 4 tests per year. As a basis for comparison, each year a smaller sample (between 112 And 148) was drawn from incoming classes and tested with the same instruments. The remaining students from the Class of 2020 who had never been tested were invited in March 2020 to complete the initial study (259 of 376 completed the study). In March 2020, as Rice University closed, the team joined together to build a COVID module for the long-term Rice panel, as well as the other members of the Class of 2020. A total of 670 participated in this wave (67.1% of the graduating class).

[9]This study aimed at understanding the effects of stereotype threat on Black student success in two different university environments in Texas: PVAMU, a historically Black university with about 9,000 students, 65% female, and 83% Black; and TAMU, a large state university with about 70,000 students, 47% female and 3.7% Black. That study was ongoing in 2020 when COVID struck. A total of 880 subjects responded to the initial survey out of a total of 3,709 who were contacted. Black subjects were over-sampled at TAMU, and constituted 37% of the TAMU sample. Respondents completed a one-hour survey that included measures of identity, non-cognitive skills, stereotype-threat vulnerability, and controls for economic preferences (survey measures) and family background. They were paid $20 for completing the study.

PVAMU sample by 500 individuals. A total of 3,118 invitations were sent out with 1,483 starting the study and 1,261 completing it. A total of 1,004 individuals responded to both Wave 1 and Wave 2. Wave 3 ran from October 16 – November 3, 2020. A total of 3,118 invitations were sent out with 1,071 beginning the study and 960 completing it. Altogether 633 respondents participated in all 3 waves of the study.

Wave 1 of the study (April-May) took respondents an average of 22 minutes to complete.[10] For their participation, respondents earned an average of $20.30. The study included 7 modules. In module one, respondents were asked a set of questions about behaviors they had engaged in to avoid contracting or spreading COVID-19. The second module focused on respondent's knowledge of COVID-19 and beliefs about the pandemic. The third module contained incentivized behavioral measures of risk aversion, trust and trustworthiness. The fourth module turned to targets of trust, ranging from the US President to friends and family. The fifth module was incentivized and asked respondents to guess the injunctive norms held by other students from their university concerning COVID-19. The sixth module was also incentivized and asked respondents to guess the descriptive norms of other students concerning COVID-19. The seventh module contained a battery of demographic items and an opportunity to donate their earnings to a charitable organization.

In this study we only analyze precautionary behavior and norms. The precautionary behavior module (one) contains five questions that were common to all three waves and focus on social distancing behavior. The five we use ask about (1) reducing in person contact with friends, (2) trying to keep a distance of six feet or more from strangers, (3) wearing a face mask in public, (4) washing hands more frequently than normal, (5) avoiding crowded places. From these five questions we later construct a precautionary index (described in more detail in the results section). These questions were phrased as follows and were "yes" and "no" (i.e. binary) style responses:

> *"Please check all of the actions that you are currently doing to try to avoid getting COVID-19 or to avoid giving it to others that you don't normally do:"*

The norm elicitation modules (five and six) differ from the self-reported questions about precautionary behaviors in that they elicit subjects' beliefs about social norms with incentives. We follow the procedures developed in Krupka and Weber 2013. We describe a specific action, e.g., social distancing, and ask subjects to coordinate their "social appropriateness" ratings with another subject who is randomly chosen from their university. Depending on the question ("how appropriate" or "really doing"), these questions elicit the injunctive and descriptive norm for their

[10]Because the survey was on-line, respondents could stop and then return to the study at their leisure. A handful of respondents took several days to return to the study. In calculating the average time to completion those values are ignored.

university, respectively. For example, a subject read the following text to elicit the injunctive norm for social distancing:

> *"Rate how socially appropriate the following actions are and remember that your task is not to rate whether you personally believe that the action is "socially appropriate or inappropriate" but to guess how most other [university name here] students participating in this study would rate the behavior: - Social distancing"*

And the text below, to elicit the descriptive norm for their university:

> *"Please guess what you think most other [university name here] students believe people are REALLY doing and remember that your task is to match with everyone else's guess: - Social distancing"*

In the case of the injunctive norm respondents are playing a coordination game over four possible appropriateness ratings: "very socially appropriate," "socially appropriate," "socially inappropriate," and "very socially inappropriate." This four-category scale follows that of Krupka and Weber 2013. In the case of the descriptive norm, respondents play a coordination game over four possible levels of activity: "Most are not doing this (<20%)","some are not doing this (<50%)", "some are doing this (>50%)", and "most are doing this (>80%)".

Krupka and Weber 2013 provide evidence that collectively-recognized social norms create focal points in a matching game (see also Goerg and Walkowitz 2010; Schelling 1980; Mehta et al. 1994; Sugden 1995). Here, subjects have an incentive to anticipate and match how others will rate an action as socially appropriate or inappropriate. If there is a social norm that some actions are more or less socially appropriate, respondents are expected to draw on this shared perception in their attempts to match others' ratings.

Wave 2 of the study (July-August) took respondents an average of 27 minutes to complete. In this study not everyone was paid. For the Rice sample 100 respondents were randomly selected and paid $50 for completing the study. Another 50 were randomly chosen and paid for the incentivized norms task. PVAMU and TAMU subjects were paid $10 for completing the study and 50 were randomly chosen from each group and paid for the incentivized norms task. The study covered six modules. The first module repeated the same set of questions about precautionary behaviors as in wave 1. A handful of new items were added about other precautionary behaviors. The second module focused on the respondents' knowledge of COVID, beliefs about the pandemic and attitudes toward vaccines. The third module turned to targets of trust, ranging from the US President to friends and family. The fourth module was incentivized and asked respondents to guess the injunctive norms held by other students from their University concerning COVID-19. The fifth module was also incentivized and asked respondents to guess the descriptive norms of

other students concerning COVID-19. Both of these modules repeated items from Wave 1. The sixth module contained a battery of demographic items.

Wave 3 of the study (October-November) took respondents an average of just under 20 minutes. Again, not all subjects were paid. A sample of 100 Rice students were paid a $50 bonus for completing the study and another 50 were randomly chosen for the incentivized norms task. The PVAMU and TAMU subjects were paid $10 for completing the study and another 50 from each school were randomly chosen and paid for the incentivized norms task. The study covered six modules: preventative behaviors; beliefs and attitudes about coronavirus and vaccines; incentivized injunctive norms; incentivized descriptive norms; and demographic items. The sixth module was focused on the 2020 US Presidential election. There was considerable overlap in items from both Wave 1 and Wave 2.

Across each wave we were able to estimate the respondent's location based on the IP address used to respond to the study. Those IP addresses were then linked to Census tracts. In Waves 1 and 2 respondents were not on their respective campuses. In Wave 3 there was a mixture of respondents who were on campus and those who were not. Using their geocoded information we were able to link respondents to their community and accumulate context-specific data. This includes data about policy mandates at the State and County level,[11] county partisan vote margins from 2016-2020,[12] daily county-level coronavirus infections and deaths taken from the Johns Hopkins data,[13] and census data. All of these data are matched to the respondent's location at the time they completed the study for each wave. We find that between Wave 1 and Wave 2, 36% of respondents participating in both waves moved. Between Wave 2 and Wave 3, 58.3% of the respondents had moved - a result not too surprising since a number of students had returned to their college campuses. These location data provide us with contextual data about the respondent's environment.

# 5 Results

## 5.1 Summary statistics

We limit our analysis to 633 subjects who completed all three waves of the survey. We summarize the time invariant controls in Table 1 by reporting the means (along with standard errors in parentheses) and the number of observations per university in our sample.[14]

[11] Data from the National Governors Association: https://www.nga.org/coronavirus-state-actions-all/

[12] https://github.com/MEDSL/2018-elections-unoffical/blob/master/election-context-2018.md

[13] https://coronavirus.jhu.edu/

[14] Note that risk preferences are used as a control in our analysis below. Risk preferences are measured using the following non-incentivized survey question: "How do you see yourself? Are you generally a person who enjoys taking

Table 1: Control Summary Statistics For Those Who Responded in All Three Waves

| | Prairie View Texas A&M Mean (N=57) | Rice Mean (N=500) | Texas A&M Mean (N=76) | All Mean (N=633) |
|---|---|---|---|---|
| Male | 0.088 | 0.424 | 0.289 | 0.378 |
| | (0.28) | (0.49) | (0.45) | (0.48) |
| Black | 0.912 | 0.050 | 0.447 | 0.175 |
| | (0.28) | (0.22) | (0.50) | (0.38) |
| Asian | 0.000 | 0.342 | 0.079 | 0.280 |
| | (0.00) | (0.47) | (0.27) | (0.45) |
| White | 0.018 | 0.366 | 0.316 | 0.329 |
| | (0.13) | (0.48) | (0.47) | (0.47) |
| Hispanic | 0.035 | 0.120 | 0.092 | 0.109 |
| | (0.18) | (0.33) | (0.29) | (0.31) |
| Other Race | 0.035 | 0.096 | 0.066 | 0.087 |
| | (0.18) | (0.29) | (0.25) | (0.28) |
| Foreign International | 0.000 | 0.026 | 0.000 | 0.021 |
| | (0.00) | (0.16) | (0.00) | (0.14) |
| Social Sciences Major | 0.158 | 0.262 | 0.105 | 0.234 |
| | (0.37) | (0.44) | (0.31) | (0.42) |
| STEM Major | 0.368 | 0.602 | 0.711 | 0.594 |
| | (0.48) | (0.49) | (0.45) | (0.49) |
| Business Major | 0.088 | 0.002 | 0.092 | 0.021 |
| | (0.28) | (0.04) | (0.29) | (0.14) |
| Arts Major | 0.000 | 0.062 | 0.000 | 0.049 |
| | (0.00) | (0.24) | (0.00) | (0.22) |
| Other Major | 0.386 | 0.072 | 0.053 | 0.098 |
| | (0.49) | (0.26) | (0.22) | (0.30) |
| Democrat | 0.877 | 0.808 | 0.697 | 0.801 |
| | (0.33) | (0.39) | (0.46) | (0.40) |
| Independent | 0.018 | 0.048 | 0.040 | 0.044 |
| | (0.13) | (0.21) | (0.20) | (0.21) |
| Republican | 0.105 | 0.144 | 0.263 | 0.155 |
| | (0.31) | (0.35) | (0.44) | (0.36) |
| Risk Preference | 5.088 | 4.579 | 5.044 | 4.680 |
| | (2.25) | (2.13) | (2.15) | (2.15) |

Note: The total number of observations is 633 (or 1,899/3). Standard errors in parentheses.

risks or do you try to avoid taking risks?" The response mode was a scale from 0 to 10 where 0 is "I avoid taking risks" and 10 is "I enjoy taking risks." Questions like this have been validated against incentivized risk-preference measures (Falk et al. 2016).

The majority of our subjects (79%) attend Rice University, with the remaining 12% and 9% attending Texas A&M and Prairie View A&M University, respectively. Our sample consists of 18% black respondents and less than half male respondents (38%).[15] About 80% of all students in our sample identify themselves as Democrats, 16% as Republicans and 4% as Independents. A large majority of students from Prairie View A&M (88%) and Rice University (81%) report that they identify with the Democratic Party. In comparison, there is more heterogeneity among the students from Texas A&M University where about 70% report identifying with the Democratic Party and 26% with the Republican Party.

We merge data from Johns Hopkins to control for the number of coronavirus infections and deaths in each county in which the respondents resided at the time they completed each of the waves of the study. The morbidity and mortality numbers for our sample for each wave by college are summarized in Appendix Table A1.[16] Together, the demographic variables and data on morbidity and mortality are used as controls in all our regressions.

## 5.2 Contemporaneous correlations between precautionary behavior and norms

We begin by testing whether there are contemporaneous correlations between precautionary behavior and norms. To do so we construct indices from the survey questions. The precautionary behavior index uses five questions that are repeated across all waves and reflects direct actions taken by an individual to limit exposure to other people. The precautionary behavior index is an average of responses to: reducing contact with friends, social distancing, wearing a mask, avoiding crowded areas and washing hands, each with a yes/no response mode. The index ranges from 0 to 100, with 0 indicating "no" answers to all items, while 100 indicates "yes" answers to all five questions.

The injunctive and descriptive norms indices are constructed using an average of responses to questions asked in all three waves. The survey items used to construct the injunctive norm index are: appropriateness of social distancing, of avoiding religious services, and of avoiding hanging out with friends. The index ranges from 0 (very inappropriate) to 100 (very appropriate). In the case of the descriptive norm, these questions are: people are social distancing, avoiding attending religious services, and avoiding hanging out with friends. The index ranges from 1 (most are not doing this) to 100 (most are doing this).

[15] For Prairie View A&M University, only 8% of the respondents were men. When we loosen the inclusion restriction of our sample and allow for individuals which do not have all three wave observations, we see that 19% of the Prairie View A&M University respondents are male, in comparison to 46% for Rice University and 39% for Texas A&M University

[16] We do not observe the location of a few of the 633 respondents who lived out of the US, which marginally affects the number of observations used in the regressions.

Table 2: Relationship Between Norms and Behavior - Tobit Specification

| | Wave 1 | | Wave 2 | | Wave 3 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Injunctive Norms Index | 0.12 | -0.07 | -0.02 | 0.25 | 0.41* | 0.22 |
| | (1.39) | (-0.42) | (-0.14) | (0.98) | (2.55) | (0.78) |
| Descriptive Norms Index | 0.10 | 0.13 | 0.09 | -0.10 | 0.10 | -0.10 |
| | (1.22) | (0.92) | (0.79) | (-0.53) | (0.85) | (-0.56) |
| Republican | -19.25*** | -46.05 | -24.47** | -64.05 | -23.68** | -78.81* |
| | (-3.42) | (-1.80) | (-3.09) | (-1.57) | (-3.15) | (-2.11) |
| Democrat | -2.00 | -18.45 | 0.55 | 19.61 | 6.30 | -23.18 |
| | (-0.63) | (-1.10) | (0.12) | (0.87) | (1.41) | (-0.87) |
| Dem. x Desc. Norm Index | | -0.10 | | 0.20 | | 0.19 |
| | | (-0.60) | | (0.85) | | (0.85) |
| Dem. x Inj. Norm Index | | 0.30 | | -0.40 | | 0.26 |
| | | (1.47) | | (-1.28) | | (0.74) |
| Rep. x Desc. Norm Index | | 0.29 | | 0.84* | | 0.97* |
| | | (1.01) | | (2.11) | | (2.58) |
| Rep. x Inj. Norm Index | | 0.10 | | -0.09 | | 0.07 |
| | | (0.36) | | (-0.18) | | (0.13) |
| Observations | 618 | 618 | 616 | 616 | 621 | 621 |
| LR Test $\chi^2$ | | 4.02 | | 6.49 | | 7.98* |
| LR p-value | | (0.40) | | (0.17) | | (0.09) |
| $\frac{\partial P(PB)}{\partial Dem.} = \frac{\partial P(PB)}{\partial Rep.}$ | 17.32*** | 28.00 | 24.77*** | 84.12** | 29.38*** | 56.06** |
| | (0.00) | (0.22) | (0.00) | (0.03) | (0.00) | (0.09) |
| $\frac{\partial P(PB\|Dem.)}{\partial Inj.Norm} = \frac{\partial P(PB\|Rep.)}{\partial Inj.Norm}$ | | 0.09 | | -0.11 | | -0.01 |
| | | (0.60) | | (0.62) | | (0.98) |
| $\frac{\partial P(PB\|Dem.)}{\partial Desc.Norm} = \frac{\partial P(PB\|Rep.)}{\partial Desc.Norm}$ | | -0.27 | | -0.32** | | -0.45** |
| | | (0.10) | | (0.03) | | (0.01) |

Note: Controls include college, race, major choice, risk tolerance, 7-day moving average of COVID deaths and cases, motivation for taking precautionary behavior, and state indicators. Precautionary Behavior index is created as as average of the following questions: Reduce contact with friends, Social Distancing, Wearing Mask, Washing Hands, Avoid Crowded Areas. Precautionary behavior ranges from 0 to 100 with 0 indicating low or no precautionary behavior while 100 indicates maximum precautionary behavior. The descriptive and injunctive norm index are created using the following questions: Social distancing, Attending religious service, and Hanging out with friends. Norm indexes range from 0 to 100 with 0 being inappropriate behavior to 100 being the most appropriate behavior. Colinear observations are dropped. Linear combination tests report marginal effect estimates and p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

In Table 2 we see both level differences and contemporaneous correlations between norms and behavior. To test this we correlate the injunctive and descriptive norm index with precautionary behavior (with controls) using a Tobit specification regression. The estimated coefficients are reported with t-statistics in parentheses below. Republicans engage in less precautionary behavior than Independents in every wave (columns (1), (3), (5), and (6)). From the linear combination test reported at the bottom of the table, we see that Democrats report engaging in significantly more precautionary behavior than Republicans. Specifically, they report engaging in 17.32, 24.77, and 29.38 percentage points more precautionary behavior than Republicans in waves 1, 2, and 3 respectively.

We also find evidence for contemporaneous correlation between descriptive norms and behavior for Republicans. Republicans engage in more precautionary behavior the more they believe others are. This is tested in Table 2 using interaction terms in columns (2), (4), and (6). Descriptive norms positively correlate with precautionary behavior for Republicans in waves 2 and 3. A linear combination test of the marginal effects show that in comparison to Democrats, Republican's descriptive norms increase precautionary behavior by 0.32 and 0.45 percentage points in waves 2 and 3 respectively. A likelihood-ratio test shows that including the interaction terms did not improve the model fit for waves 1 and 2, but did improve model fit for wave 3.

Taken together, we find that Republicans engage in less precautionary behavior than Independents and Democrats. We also find a correlation between behavior and norms for Republicans. Republicans engage in more precautionary behavior when they believe that others are as well (i.e. when the descriptive norms index is high). On the other hand, Democrats and Independents do not change precautionary behavior in response to their descriptive or normative perceptions.

## 5.3 Change in precautionary behavior and norms

In addition to testing for contemporaneous correlations, it may be that correlations are changing over time (or doing so differently for subgroups). We use paired t-tests to test for differences in the means across waves for the pooled data and by party sub-group. The results are reported in Table 3. Panel A provides the differences in means of the overall sample, while Panel B, C, and D report the differences of Democrats, Republicans, and Independents, respectively. Each column reports the difference in the mean of the index between the waves (while the statistic is reported in parentheses). Thus, for example, a negative sign indicates a greater level of that particular index in the subsequent wave.

Column (1) of Table 3 shows that precautionary behavior increases from wave 1 to wave 2 for the pooled data and sub-samples. For the pooled sample, precautionary behavior was 5.11 percentage points lower in wave 1 than wave 2. Though more attenuated, Republicans and Inde-

pendents also had lower precautionary behavior indexes, 5.1 and 3.65, respectively in wave 1 but the difference is not statistically significant.

However, by wave 3 precautionary behavior appears to fall and more so for Democrats. We see this from two sets of results reported in column (2) and (3). Column (2) tests for differences in our indexes between wave 2 and 3. The average precautionary behavior in wave 2 is 3.89 percentage points *higher* than the average precautionary behavior taken in wave 3. We see this decrease in precautionary behavior for all three political affiliations, although this decrease is only statistically significant for Democrats, who decrease their precautionary behavior by 3.31 percentage points. Furthermore, by comparing waves 1 and 3 reported in column (3), we see there are no significant differences in precautionary behavior taken at the beginning of the survey in wave 1 to the end of the panel in wave 3.

When looking at the injunctive and descriptive norm index, we see evidence of norms weakening across all three waves. Evidence of the decrease in the indices comes from the positive difference in means reported in columns (1) and (2) in Panel A. For example, subjects believe that others are engaging in less precautionary behavior overtime (descriptive norms index mean difference is 10.78, $p < 0.01$). They also believe that it is becoming more appropriate to engage in less precautionary behavior (injunctive norms index mean difference is 3.949, $p < 0.01$). When we break the analysis down by party affiliation, we see a similar pattern, although weak to no statistical difference for the Republican party. Taken together, the evidence suggests that injunctive norms for social distancing and that descriptive norms for social distancing behavior are weakening overtime.

Using the Kolmogorov–Smirnov tests for the equality of distributions over time, we find broad support for changes in the distribution of the precautionary behavior and norms indices as well. The results of these tests are reported in Table A3 in the Appendix.[17]

[17] In the overall sample, each test rejects the equality of distributions of the precautionary behavior index at $p < 0.01$ across all three waves. When we analyze the results separately by party affiliation, we find that each test rejects the equality of distributions for between waves 2 and 3 and for Republicans and Independents, between waves 1 and 3. We also conduct a Kolmogorov–Smirnov test on the descriptive and injunctive norm index distributions across all three waves. In the overall sample, we find that the distributions of both norm indices are significantly different from one another across all three waves. When we look at the results by party affiliation, we see that this is due to Democrats and Independents. Republicans, somewhat surprisingly, fail to reject the null hypothesis of equality of distribution across waves.

Table 3: T-test on Precautionary Behavior, Injunctive, and Descriptive Norms by Wave

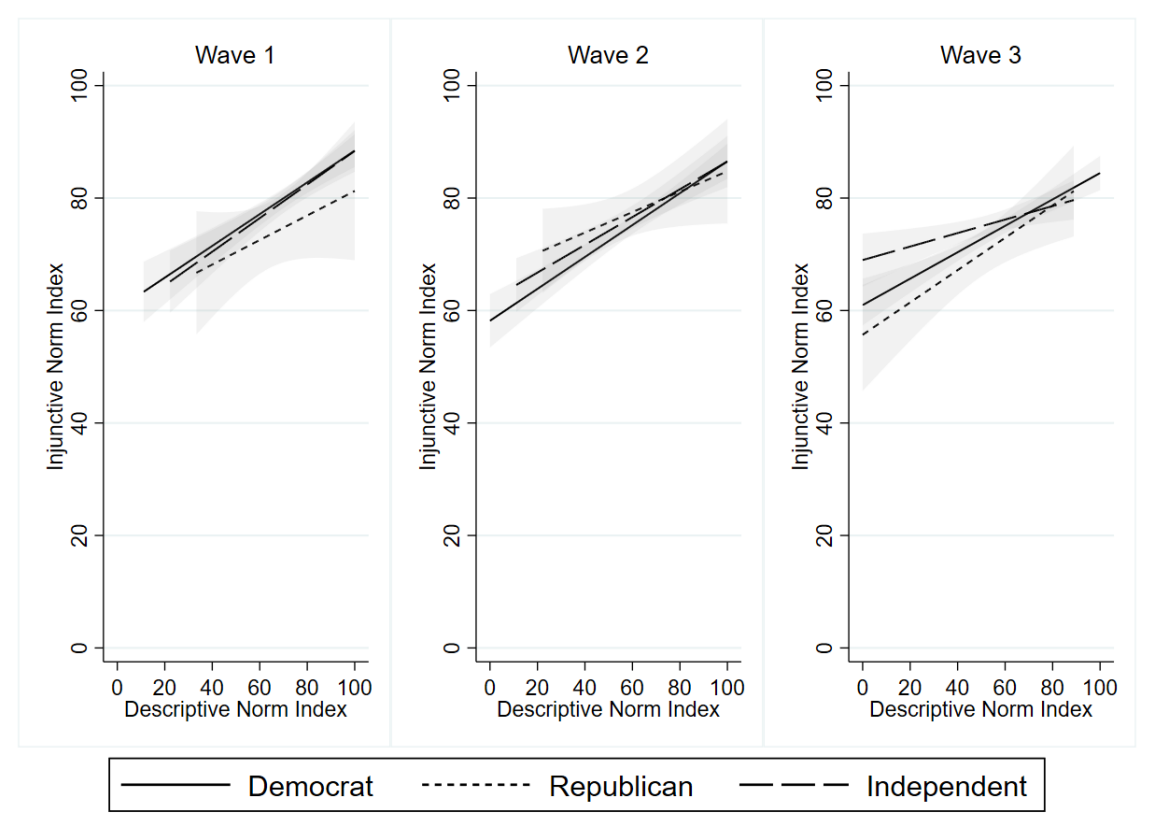
| | Wave 1 vs. Wave 2 | Wave 2 vs. Wave 3 | Wave 1 vs. Wave 3 |
|---|---|---|---|
| | (1) | (2) | (3) |
| *Panel A: All* | | | |
| Precautionary Behavior Index | -5.118*** | 3.886*** | -1.232 |
| | (-5.17) | (3.62) | (-1.12) |
| Descriptive Norms Index | 10.78*** | 6.249*** | 17.03*** |
| | (9.15) | (5.30) | (14.99) |
| Injunctive Norms Index | 3.949*** | 1.826* | 5.775*** |
| | (4.23) | (2.25) | (6.71) |
| Observations | 1266 | 1266 | 1266 |
| *Panel B: Democrats* | | | |
| Precautionary Behavior Index | -5.745*** | 3.306** | -2.439 |
| | (-5.07) | (2.79) | (-1.91) |
| Descriptive Norms Index | 9.455*** | 7.739*** | 17.19*** |
| | (6.07) | (5.00) | (11.35) |
| Injunctive Norms Index | 4.607*** | 2.078 | 6.685*** |
| | (3.68) | (1.92) | (5.82) |
| Observations | 738 | 738 | 738 |
| *Panel C: Republicans* | | | |
| Precautionary Behavior Index | -5.098 | 9.804 | 4.706 |
| | (-1.10) | (1.70) | (0.87) |
| Descriptive Norms Index | 8.497* | 5.229 | 13.73** |
| | (2.05) | (1.20) | (3.32) |
| Injunctive Norms Index | -3.268 | 6.536* | 3.268 |
| | (-0.90) | (2.18) | (0.90) |
| Observations | 102 | 102 | 102 |
| *Panel D: Independents* | | | |
| Precautionary Behavior Index | -3.646 | 2.812 | -0.833 |
| | (-1.90) | (1.40) | (-0.42) |
| Descriptive Norms Index | 13.95*** | 4.340* | 18.29*** |
| | (6.68) | (2.05) | (9.07) |
| Injunctive Norms Index | 3.819* | 0.579 | 4.398** |
| | (2.45) | (0.42) | (3.12) |
| Observations | 384 | 384 | 384 |

Note: Each column reports the differences in means between waves for the given variable. T-statistic reported in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The visual evidence is reflective of this key finding: norms are weakening across waves. Figure 1 shows the linear fit of the descriptive and injunctive norms by each wave of the study and

party affiliation while the overall means are reported in Table A2 in the appendix. In Figure 1, we see that the injunctive and descriptive norms are positively correlated in all waves regardless of party affiliation but are flattening by wave 3. Second, we observe that relative to a 45 degree angle (corresponding to a one to one relationship), the slopes are not as steep. That is, respondents generally report stronger injunctive norms (higher injunctive norms index) while holding a slightly more pessimistic view on the extent to which others are engaging in social distancing (lower descriptive norms index). We note that by panel 3 the relationship between descriptive and injunctive norms noticeably weakens (the slope of the linear fit decreases from wave 1 to wave 3).

Figure 1: Linear Fit for Descriptive and Injunctive Norms by Party and Wave



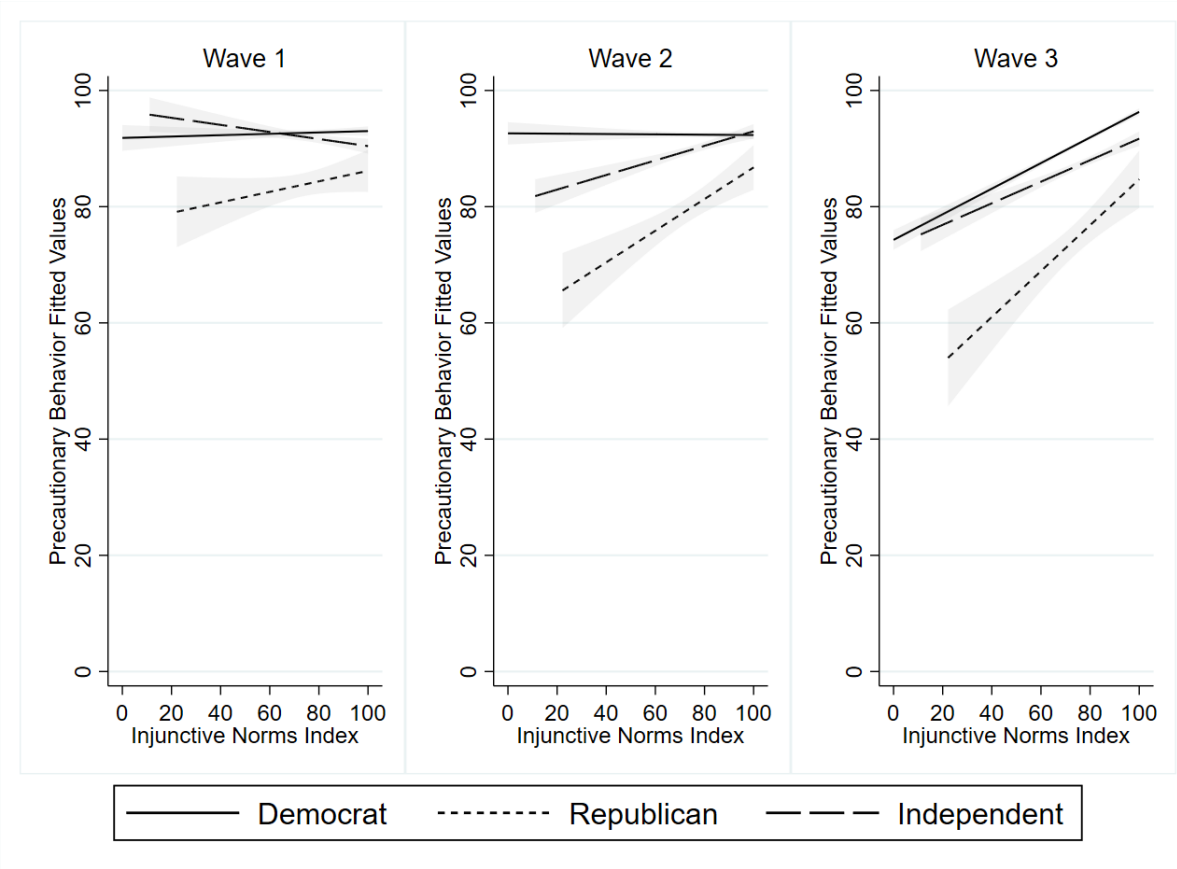

*Note: Gray areas indicate 95% confidence intervals*

In addition to finding evidence that there is a weakening of norms and behavior, we find that the correlations between these indexes are changing over time and differently for political sub-groups. To characterize the relationship between precautionary behavior and injunctive and descriptive norms, we regress both norm indices on precautionary behavior as well as additional controls by wave. We use a Tobit specification to address censoring in responses (see Appendix Figure B1). The results of this regression can be found in Table 2 and are visualized in Figure 2

and Figure 3. For the figures, we plot the linear fit in the injunctive and descriptive norms against the *predicted* precautionary behavior by political affiliation by wave.

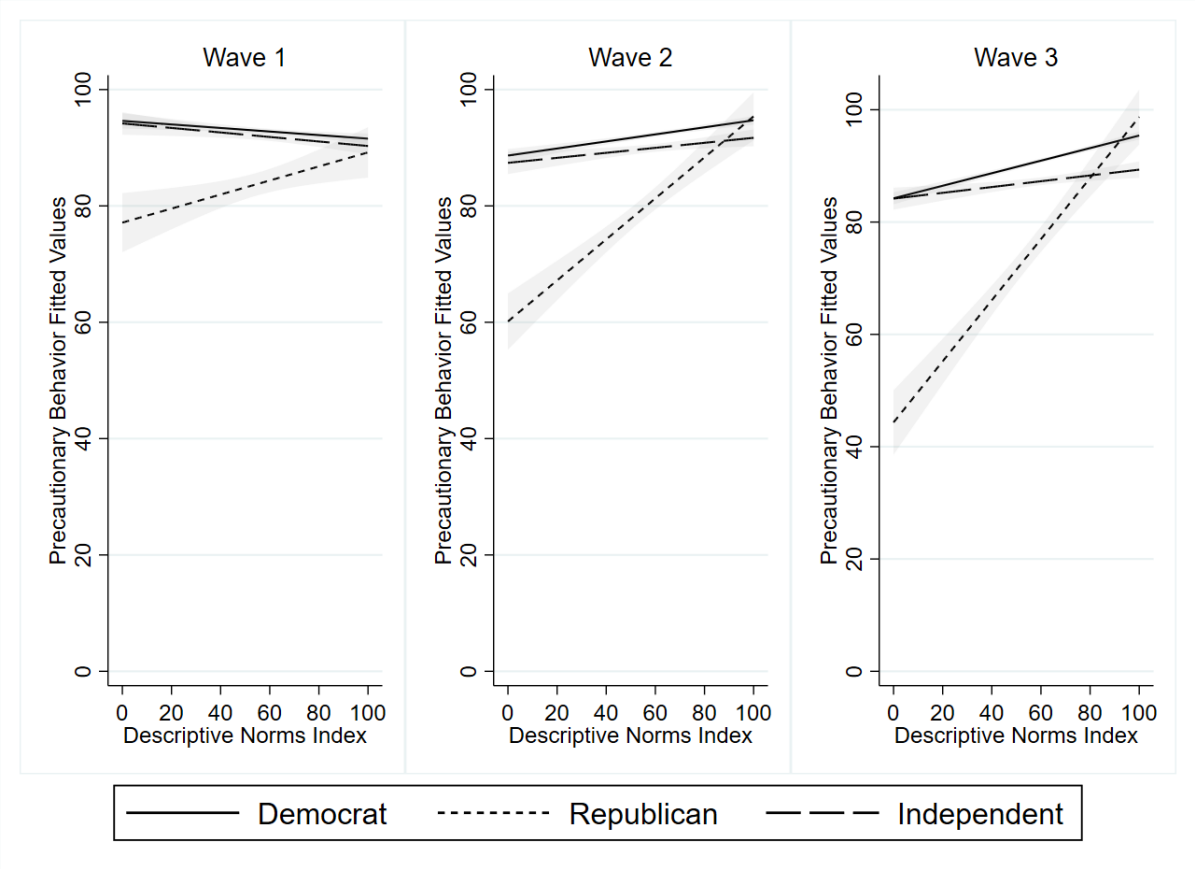
By visual inspection of Figure 2, we see that the relationship between predicted precautionary behavior and injunctive norms is weak in wave 1 and becomes positively correlated by wave 3. In other words, respondent's beliefs regarding injunctive norms become more strongly correlated with their own precautionary behavior by wave 3 for all three political affiliations. Finally, we see a significant level-effect for Republicans. In each wave, they report taking less precautionary behavior and report lower injunctive norms ratings (the Republican line is always below the other lines). However, it appears that the *slope*, or the marginal effect of injunctive norms, has the largest positive change across the three waves for Republicans. That is to say, injunctive norms became more strongly correlated with precautionary behavior for Republicans than they do among other party affiliations by the final wave.

Figure 2: Linear fit for Tobit Fitted Values of Precautionary Behavior and Injunctive Norms by Party and Wave




*Note: Gray areas indicate 95% confidence intervals*

Figure 3: Linear Fit for Tobit Fitted Values of Precautionary Behavior and Descriptive Norms by Party and Wave




*Note: Gray areas indicate 95% confidence intervals*

Figure 3 plots the linear fit between the fitted values of the precautionary behavior index and descriptive norm index. For Republicans, there is a positive correlation between engaging in precautionary behavior and believing that others are as well; this is particularly marked in the third wave. In contrast, the relationship between precautionary behavior and descriptive norms changes less over time for Democrats and Independents and is weaker.

Current precautionary behavior may depend on what level of precautionary behavior one has taken in the past. To explore the temporal relationship between precautionary behavior and norms, we introduce lagged dependent variables of interest to the previous regression specification. These results are reported in Table 4. The dependent variable in this table is precautionary behavior index at time $t$. The "L" prefix indicates a lag of the particular independent variable. Because these are fixed-effects regressions, we do not break results out by political affiliation.

Table 4: Temporal Relationship between Precautionary Behavior and Norms

| | Wave 2 | Wave 3 | Waves 2 and 3 |
|---|---|---|---|
| L.Precautionary Behavior Index | 0.240*** | 0.565*** | 0.237*** |
| | (6.62) | (12.94) | (8.34) |
| Injunctive Norms Index | 0.0213 | 0.151* | 0.0640 |
| | (0.46) | (2.42) | (1.71) |
| L.Injunctive Norms Index | 0.0627 | 0.0663 | 0.0717* |
| | (1.49) | (1.27) | (2.24) |
| Descriptive Norms Index | 0.00325 | -0.00385 | 0.0112 |
| | (0.09) | (-0.09) | (0.42) |
| L.Descriptive Norms Index | 0.0739* | 0.0269 | 0.0681** |
| | (2.04) | (0.69) | (2.71) |
| Observations | 616 | 621 | 1237 |

Note: All columns include controls. Controls include college, race, major choice, risk tolerance, political party, 7-day moving average of COVID deaths and cases, and state indicators. Column 3 includes survey respondent random effects. Precautionary Behavior index is created as as average of the following questions: Reduce contact with friends, Social Distancing, Wearing Mask, Washing Hands, Avoid Crowded Areas. Precautionary behavior ranges from 0 to 100 with 0 indicating low or no precautionary behavior while 100 indicates maximum precautionary behavior. The descriptive and injunctive norm index are created using the following questions: Social distancing, Attending religious service, and Hanging out with friends. Norm indexes range from 0 to 100 with 0 being inappropriate behavior to 100 being the most appropriate behavior. Colinear observations are dropped. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

We find evidence of temporal relationships between past precautionary behavior and past perceptions of norms and current precautionary behavior. Looking across columns, the coefficient on lagged precautionary behavior is significantly correlated in all three waves. Focusing just on column (1), we see that the wave 1 precautionary index (L.Precautionary Behavior Index) is correlated with a 24 point (or 1 category increase) in precautionary behavior in wave 2. Recall that our index goes from 0 (engaging in none of the five precautionary actions) to 100 (doing all five of them). As such, a 24 point increase is equivalent to a person taking one more action in wave 2. Similarly, in column 2, the lagged precautionary behavior index is correlated with a 56 point (or 2 category) increase in precautionary behavior in wave 3. In column 3 we include survey respondent random effects. The lagged precautionary behavior index is correlated with a 24 point (or 1 category) increase in precautionary behavior in the next wave.

The contemporaneous injunctive and descriptive norms indexes are not correlated with precautionary behavior. We see evidence of this in column (1) and column (3). Though we do see that the injunctive norm index is significantly correlated with precautionary behavior in column (2). An increase in the contemporaneous injunctive norm rating is associated with a 15 point increase in precautionary behavior in wave 3. The wave 2 results are also visually captured in the third

panel of Figure 2.

However, lagged norms and precautionary behavior are correlated with precautionary behavior. Focusing on column (3), where we combine both waves, lagged precautionary behavior is a strong predictor of current behavior ($\beta = 0.237$, $p < 0.01$). Lagged injunctive norms ($\beta = 0.07$, $p < 0.1$) and lagged descriptive norms ($\beta = 0.068$, $p < 0.05$) are also correlated. These results suggest that past precautionary behavior is a better predictor than current and past norms of precautionary behavior. In this sense, precautionary behavior is 'sticky'. But we also see suggestive evidence that beliefs about the injunctive and descriptive norms stick from the previous period.

Having identified a link between norms and precautionary behavior, and a (weaker) link between changes in norms and changes in behavior, we can exploit changes in policy during our survey windows to identify the impact of norm change on behavior change. The causality is not perfect, as it is often the case that a loosening of restrictions (e.g., restaurants and gyms are opened up, etc.) are pre-announced in the coming days of news cycles. However, the analysis does give us an imperfect glimpse into what causes changes in norms and behavior.

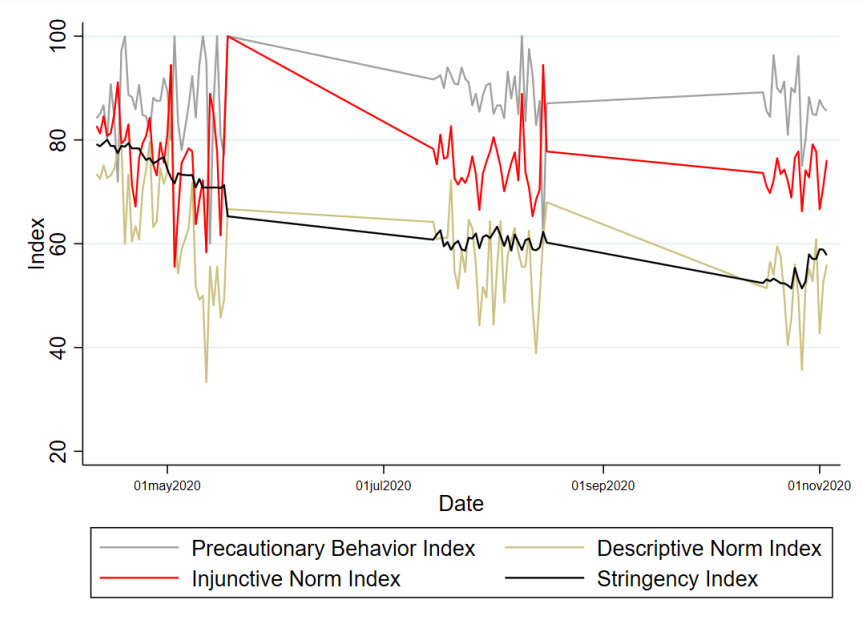
## 5.4 Norm and behavior change in response to COVID restrictions

We analyze how precautionary behavior and norms change in response to COVID policy restrictions over time. The restrictions data comes from the Oxford COVID-19 Government Response Tracker (OxCGRT) maintained by the University of Oxford's Blavatnik School of Government (Hale et al. 2020). Governmental restrictions are recorded at the state-level and reported daily. We utilize their reported stringency index which is composed of nine policy measures. These include school closing, workplace closing, cancelling of public events, restrictions on gathering size, closure of public transport, restrictions on internal movement, restrictions on international travel, and public information campaigns. Using these measures and re-weighting based on if the restriction policy is targeted or general, the stringency index is re-scaled such that the minimum and maximum values are between 0 and 100.

To graphically demonstrate this relationship over time, we plot the stringency index (black line) along with the precautionary behavior index (gray), descriptive norm index (light green), and the injunctive norm index (red line) over time for wave 1, as seen in Figure 4. Visually, we see that the stringency index is declining over our observation window as is the descriptive and injunctive norm.[18]

[18]Note that this figure shows movement within a wave, as data collection was in process, as well as between waves. Smooth lines connect the three waves of data collection.

Figure 4: Daily Average Stringency Index, Norm Indices, and Precautionary Behavior




To explore the heterogeneous effects of the stringency index on precautionary behavior, descriptive and injunctive norms indices we conduct a mixed effects Tobit specification with censoring occurring at 0 and at 100. By pooling observations across waves, we are able to control for individual characteristics by specifying a mixed effects model at the survey respondent level. The results of this regression are contained in Table 5. Columns (1) and (2) have the precautionary behavior index as the dependent variable, while columns (3) and (4) and columns (5) and (6) have the descriptive norm index and the injunctive norm index as the dependent variable, respectively.

Columns (1-3) clearly show that Republicans report engaging in less precautionary behavior ($\beta = -63.26$, $p < 0.01$). They also show that Republicans' precautionary behavior is correlated with beliefs about descriptive norms ($\beta = 0.64$, $p < 0.01$). However, precautionary behavior and beliefs about the descriptive norms are not correlated for Democrats or Independents. Evaluating the marginal effect, this difference in reported behavior translates to Republicans engaging in 70.35 percentage points less precautionary behavior than Democrats.[19] Figure 5 visualizes this result by plotting the average marginal effect of the stringency index on precautionary behavior for Democrats and Republicans separately and shows the level difference between Republicans and Democrats and lack of an interaction. Finally, although we find no significant differences in stringency index on precautionary behavior by party affiliation, the inclusion of a stringency index and party interaction term improved the model fit (Vuong statistic of -4.76, $p < 0.01$).

The descriptive norms are not correlated with the stringency index. Though Figure 6

[19]The level differences between Republicans and Democrats is consistent with our contemporaneous correlations from Table 2.

suggests that there is a negative relationship between the stringency index and descriptive norms for Republicans, we do not find evidence of this. The linear combination test of the marginal effect between Democrats and Republicans does not detect a significant difference (Table 2, $\beta = 0.03$, $p > 0.10$).

However, we find evidence that Republicans' beliefs about the injunctive norm are weakening for higher levels of the stringency index while Democrats' beliefs do not vary. This is visually demonstrated in Figure 7, which shows that Republicans report a decreasing average marginal effect of the stringency index on injunctive norms in comparison to Independents and Democrats. As seen in column (6), a linear combination test of the marginal effect of the stringency index on injunctive norms is 0.22 percentage points higher for Democrats compared to Republicans. As such, this provides suggestive evidence that Republicans' injunctive norms on appropriate precautionary behavior displayed an inverse relationship with COVID-19 restrictions. Further, Democrats appear to be more responsive at incorporating signals like the stringency index into their perceptions of what is appropriate.

Table 5: Relationship between Stringency Index, Precautionary Behavior, and Norms

| | Precautionary Behavior | | | Descriptive Norm | | Injunctive Norm | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Injunctive Norms Index | 0.08 | -0.02 | -0.04 | | | | |
| | (1.10) | (-0.19) | (-0.29) | | | | |
| Descriptive Norms Index | 0.01 | -0.06 | -0.11 | | | | |
| | (0.27) | (-0.72) | (-1.25) | | | | |
| Stringency Index | -0.39 | -0.39 | -0.16 | 0.09 | 0.10 | 0.07 | 0.07 |
| | (-1.37) | (-1.36) | (-0.51) | (0.68) | (0.70) | (0.64) | (0.60) |
| Democrat | 1.48 | -9.47 | 6.48 | 3.83** | 3.43 | -0.72 | -2.07 |
| | (0.52) | (-0.80) | (0.45) | (3.07) | (0.64) | (-0.71) | (-0.49) |
| Republican | -21.91*** | -74.91*** | -63.26** | -2.07 | 11.08 | -1.77 | 12.47 |
| | (-4.39) | (-4.11) | (-2.66) | (-0.91) | (1.15) | (-0.94) | (1.62) |
| Dem. x Desc. Norm Index | | 0.04 | 0.12 | | | | |
| | | (0.36) | (1.03) | | | | |
| Dem. x Inj. Norm Index | | 0.11 | 0.13 | | | | |
| | | (0.74) | (0.87) | | | | |
| Rep. x Desc. Norm Index | | 0.59** | 0.64*** | | | | |
| | | (3.28) | (3.40) | | | | |
| Rep. x Inj. Norm Index | | 0.27 | 0.28 | | | | |
| | | (1.15) | (1.20) | | | | |
| Stringency Index x Dem. | | | -0.35 | | 0.01 | | 0.02 |
| | | | (-1.91) | | (0.08) | | (0.33) |
| Stringency Index x Rep. | | | -0.25 | | -0.21 | | -0.22 |
| | | | (-0.86) | | (-1.41) | | (-1.91) |
| Observations | 1855 | 1855 | 1855 | 1855 | 1855 | 1855 | 1855 |
| $\frac{\partial P(Y)}{\partial Dem.} = \frac{\partial P(Y)}{\partial Rep.}$ | 22.99*** | 64.92*** | 70.35*** | 5.76** | -7.46 | 0.92 | -14.52* |
| | (0.00) | (0.00) | (0.00) | (0.01) | (0.42) | (0.62) | (0.05) |
| $\frac{\partial P(Y\|Dem.)}{\partial StringencyIndex} = \frac{\partial P(Y\|Rep.)}{\partial StringencyIndex}$ | | | 0.03 | | 0.20 | | 0.22** |
| | | | (0.95) | | (0.15) | | (0.03) |
| Vuong Statistic | | -11.22*** | -4.76*** | | 0.19 | | -0.84 |
| | | (0.00) | (0.00) | | (0.85) | | (0.40) |

Note: All columns contain controls. Controls include college, race, major choice, risk tolerance, political party, motivation for precautionary behavior, if the individual has been infected with COVID, survey wave and state indicators. Estimation includes survey respondent random intercept. Coefficients are reported with t-statistics in parentheses. Colinear observations are dropped. The linear combination of marginal effects is reported with p-values in parentheses underneath. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

Figure 5: Average Marginal Effects of Stringency Index on Precautionary Behavior (95% CIs)

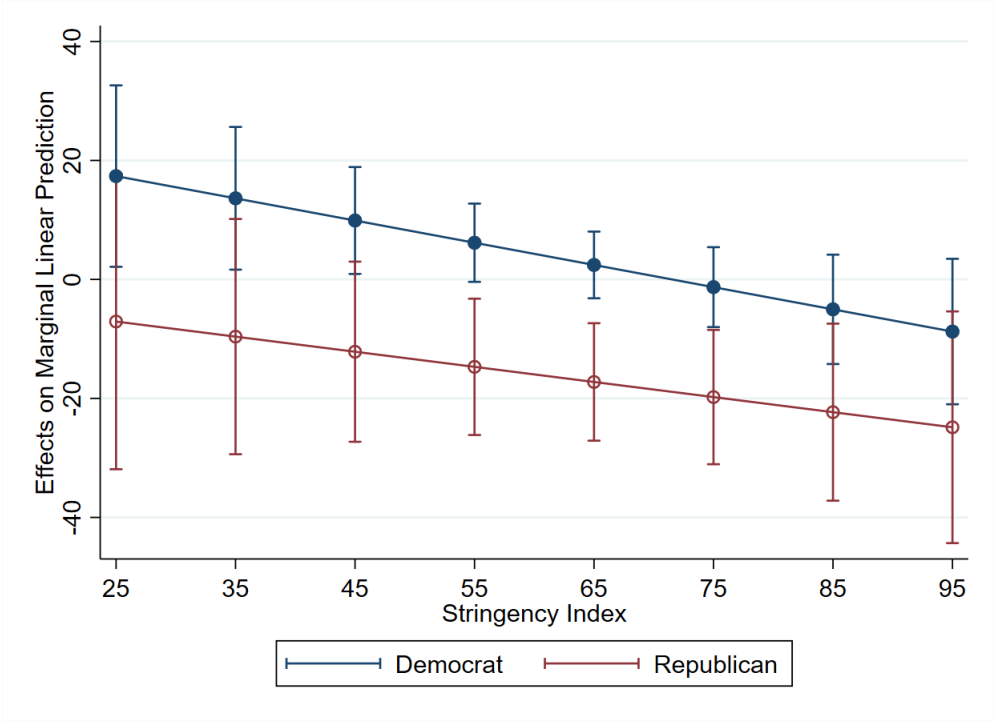



Figure 6: Average Marginal Effects of Stringency Index on Descriptive Norms (95% CIs)

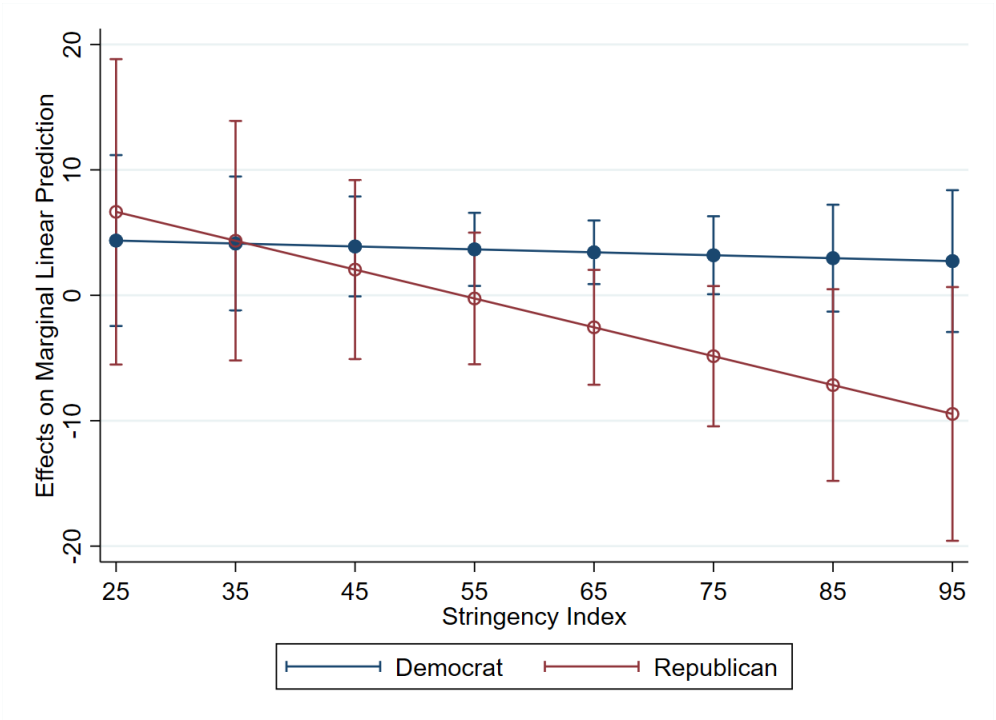
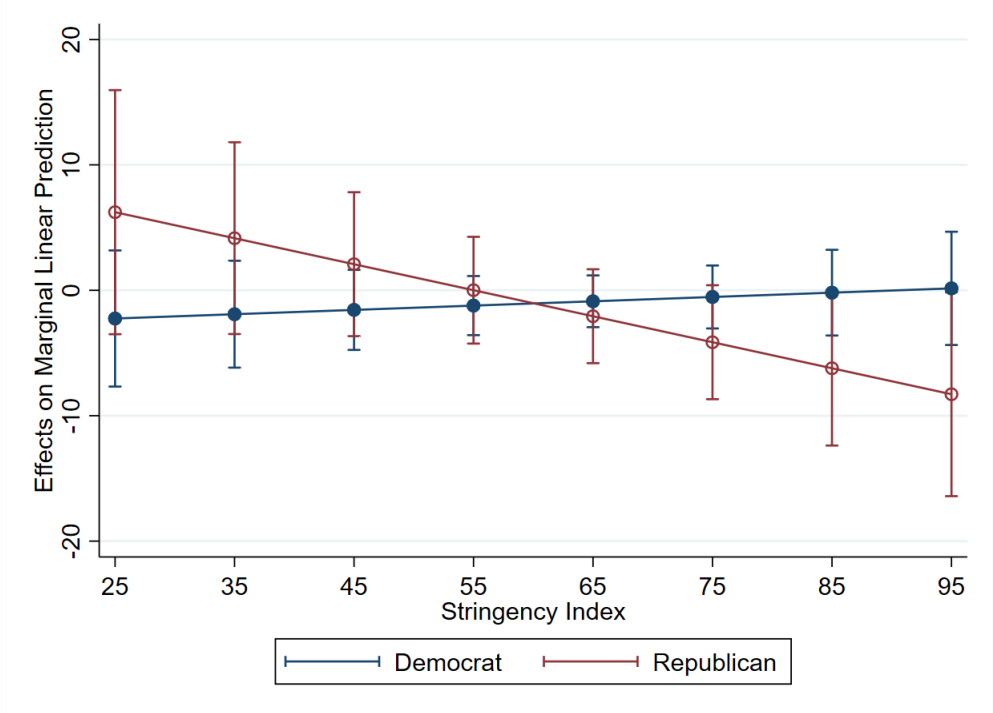


Figure 7: Average Marginal Effects of Stringency Index on Injunctive Norms (95% CIs)




Up to this point we have used the panel nature of our data to explore how precautionary behavior, descriptive norms, and injunctive norms vary by party affiliation and by COVID-19 restrictions. We find that though Republicans engage in less precautionary behavior, there is no overall effect of variation in the stringency index on precautionary behavior. There is suggestive evidence that the stringency index influences beliefs about the injunctive rather than descriptive norms. Finally, it appears that Republicans' hold weaker beliefs about the injunctive norms at higher levels of the stringency index.

### 5.4.1 An alternative way to characterize policy impact

Having tested for the correlation between the stringency index and norms by testing differences in means and distributions, we now turn to an alternative way to characterize policy impact. We use miscoordination in our norm elicitation technique. The norm elicitation technique uses coordination games over appropriateness ratings to capture norms; thus, changes in miscoordination over waves can characterize changes in norm perception.

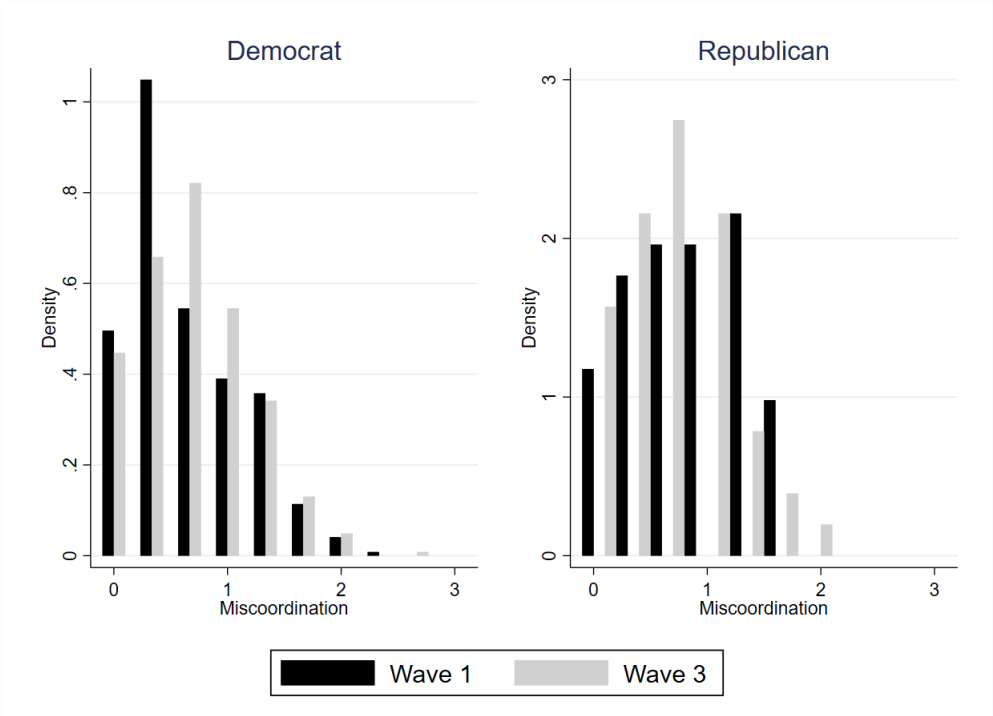
Our preferred method of measuring norm miscoordination is the difference between individual-level and the University-level modal response by wave.[20] For Texas A&M, the observed

[20]Recall that subjects are asked to match their responses to the model response of their University in any given survey wave.

modal response does not correspond to the University-level modal response, as the survey intentionally over-sampled Black students from a previous study. To correct for this over-sampling, we calculate survey weights by iterative proportional fitting (raking) and use the race distribution of each University in Fall of 2020. The sum of the weights, as opposed to the sum of the observations, is used to determine the modal response of each norm elicitation task.[21]

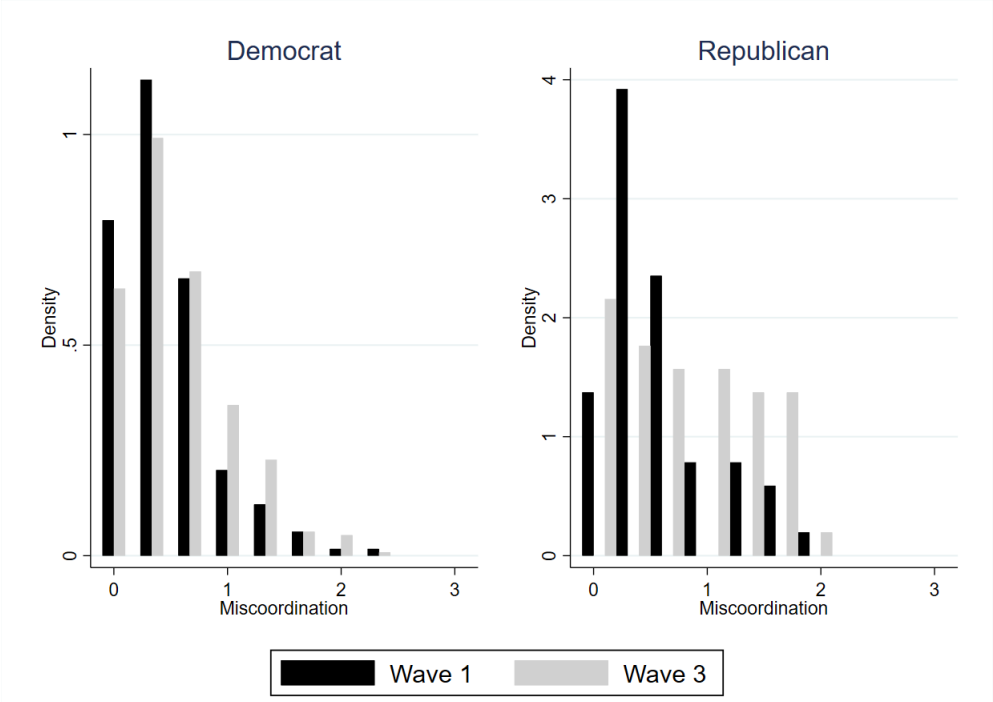
Using the elicited norm measures, we define miscoordination as the absolute difference between a respondent's elicited norm and the weighted modal response of their respective college within each wave. We used the three questions that compose the descriptive and injunctive norm index, which include the appropriateness of social distancing, attending a religious service, and hanging out with friends. From the inferred level of miscoordination in each of these three questions, we compute the average level of miscoordination for descriptive norms and injunctive norms. For example, if a survey taker's responses perfectly coincided with the University-level modal response, their level of miscoordination would equal 0. The summary statistics of this constructed descriptive and injunctive norm miscoordination by political affiliation is located in Table A4 in the Appendix.

Figure 8: Descriptive Norm Miscoordination Distribution - Weighted




[21] Our results are robust to the specification were we use the observed modal response to calculate miscoordination instead of the weighted modal response.

Figure 9: Injunctive Norm Miscoordination Distribution - Weighted




To visualize the changes in norm miscoordination over time and by political affiliation, Figure 8 and Figure 9 plot the histogram of descriptive norm miscoordination and injunctive norm miscoordination, respectively. In Figure 8, we see a clear shift to the right in the distribution of descriptive norm miscoordination for Democrats. In Figure 9 we see a rightward shift in the injunctive norm miscoordination for Democrats as well (left panel). However, for Republicans the visual analysis shows neither a dramatic nor uniform shift in miscoordination for either the descriptive or injunctive norms.

Paired signed-rank test on miscoordination across waves (Table 6) show that Republicans do not have significant change in miscoordination between waves. Republicans have no significant difference between waves for descriptive norm miscoordination and only a slight increase in injunctive norm miscoordination between waves 2 and 3. For Democrats, we see that miscoordination is increasing over our survey window from wave 1 to wave 3 for both the descriptive and injunctive norm. Independents display a similar pattern to Democrats, in that they increase miscoordination for both indices between waves 1 and 2. In between waves 2 and 3, however, descriptive norm miscoordination decreases slightly and injunctive norm miscoordination does not significantly change.

In short, Democrat and Independents' level of miscoordination changes across each wave whereas Republican's level of miscoordination remains fairly stable.[22] The fact that Republicans

[22]We find this same pattern when we test for differences in the distribution of miscoordination over time and across

do not show significant change in miscoordination suggests that the level differences in precautionary behavior of Republicans, and the correlations between beliefs about the descriptive norm and the stringency index, do not arise because Republicans become unsure of the norms.

Table 6: Sign-Rank Test by Political Affiliation

| Norm Miscoordination | Wave 1 vs 2 | Wave 2 vs 3 | Wave 1 vs 3 |
|---|---|---|---|
| *Panel A: Democrat* | | | |
| Descriptive | -3.051*** | 0.10 | -2.414** |
| | (0.00) | (0.92) | (0.02) |
| Injunctive | -0.347 | -3.61*** | -3.630*** |
| | (0.73) | (0.00) | (0.00) |
| *Panel B: Republican* | | | |
| Descriptive | 0.317 | 1.41 | 1.425 |
| | (0.76) | (0.16) | (0.16) |
| Injunctive | 0.730 | -2.11* | -1.276 |
| | (0.47) | (0.03) | (0.21) |
| *Panel C: Independent* | | | |
| Descriptive | -4.418*** | 1.90* | -2.874*** |
| | (0.00) | (0.06) | (0.00) |
| Injunctive | -2.995*** | -1.10 | -3.993*** |
| | (0.00) | (0.27) | (0.00) |

Note: Z-statistics and exact p-values are reported. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We use a Tobit model, with censoring at 0 (no miscoordination) and 3 (maximum miscoordination), to test for correlations between changes in miscoordination and the stringency index. The results of this regression are found in Table 7. Columns (2) and (4) contain stringency index and party affiliation interaction terms which allows for heterogeneous effects of the stringency index on miscoordination. We find no differences in injunctive norm miscoordination by party affiliation in response to the stringency index, as seen by the linear combination test in column (2) ($\beta = 0.00$, $p > 0.1$). However, we see that for descriptive norm miscoordination, Republicans increase miscoordination by 0.01 percentage points given a 1 percent increase in the stringency index in comparison to Democrats. This is given by the linear combination test in column (4). As

party affiliation, as demonstrated by the results of the Kolmogorov-Smirnov tests. The results of these tests are contained in Table A5 in the Appendix

such, we have mild evidence that for Republicans, norm coordination on what others *should* do decreases given higher COVID-19 restrictions.

Thus, using this alternative lens through which to test for the impact of policy on behavior and perceptions, we find weak evidence that stringency measures impacted our variables of interest. Whether we look at the direct effect of stringency measures on behavior and norms, such as in Table 2, or the indirect effect on shared understanding (coordination) as seen in Table 7, we see little impact of stringency measures. However, we do find that Republicans are sensitive to beliefs about what others are doing and that increases in the stringency index lead to greater miscoordination in beliefs about others' behavior.

Table 7: Relationship between Miscoordination and Stringency Index

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Inj. Norm Miscoordination | | Desc. Norm Miscoordination | |
| Precautionary Behavior Index | -0.00 | -0.00 | -0.00 | -0.00 |
| | (-1.87) | (-1.83) | (-1.66) | (-1.70) |
| Stringency Index | 0.00 | 0.00 | 0.00 | 0.00 |
| | (1.33) | (0.63) | (0.77) | (0.22) |
| Injunctive Norms Index | -0.02*** | -0.02*** | | |
| | (-37.40) | (-37.41) | | |
| Descriptive Norms Index | | | -0.02*** | -0.02*** |
| | | | (-26.66) | (-26.61) |
| Democrat | 0.02 | -0.14 | 0.04 | -0.07 |
| | (0.97) | (-1.33) | (1.39) | (-0.54) |
| Republican | 0.05 | -0.00 | 0.03 | -0.51* |
| | (1.43) | (-0.00) | (0.57) | (-2.23) |
| Stringency Index x Dem. | | 0.00 | | 0.00 |
| | | (1.53) | | (0.84) |
| Stringency Index x Rep. | | 0.00 | | 0.01* |
| | | (0.28) | | (2.41) |
| Observations | 1855 | 1855 | 1855 | 1855 |
| $\frac{\partial P(Y)}{\partial Dem.} = \frac{\partial P(Y)}{\partial Rep.}$ | -0.03 | -0.15 | 0.01 | 0.45** |
| | (0.37) | (0.42) | (0.81) | (0.04) |
| $\frac{\partial P(Y\|Dem.)}{\partial StringencyIndex} = \frac{\partial P(Y\|Rep.)}{\partial StringencyIndex}$ | | 0.00 | | -0.01** |
| | | (0.55) | | (0.04) |
| Vuong Statistic | | -0.16 | | -0.63 |
| | | (0.87) | | (0.53) |

Note: All columns contain controls. Controls include college, race, major choice, risk tolerance, political party, motivation for precautionary behavior, survey wave and state indicators. Estimation includes survey respondent random coefficients. Coefficients are reported with t-statistics in parentheses. Colinear observations are dropped. The linear combination of marginal effects is reported with p-values in parentheses underneath. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

# 6 Discussion and conclusion

COVID-19 presents a major personal, social and economic challenge, and responding to it has required rapid behavior change as well as the development and adaptation of social norms. In this

paper we used survey and incentivized measures of behavior and norms to track behavior and norm change over the course of 2020 in a population of undergraduate students.

We find evidence that precautionary behavior and norms are correlated; that behavior and norms are changing over time and doing so differently for Republicans, Democrats and Independents. Unfortunately, what we observe is an overall decline in both precautionary behavior and a weakening of norms. Unpacking those trends, we find a more nuanced story. Republicans are engaging in less precautionary behavior, but they are also more responsive to beliefs about the descriptive norm (what others are doing).

We also provide evidence that stringency measures had a weak and potentially negative effect on behavior. Whether we look at the direct effect of stringency measures on behavior and norms, or indirectly through shared understanding (coordination), we see little impact of stringency measures. However, Republicans are sensitive to beliefs about what others are doing and an increases in the stringency index is associated with greater miscoordination in beliefs about others' behavior.

Furthermore, our results suggest that a social-norms-based approach, as discussed in Van Bavel et al. 2020, can be an effective but not a particularly fast tool for dealing with the pandemic. Specifically, our observation window was eight months (April 2020 through November 2020), but in our regression results reported in Table 4, lagged injunctive norms had a smaller (or one might say, slower) effect on changing precautionary behavior (a 7 point change in each wave) than one might conclude if reviewing the literature on injunctive norms and behavior.

While our sample is restricted to current and recent students at three universities, we expect that its conclusions have general validity. Because our participants are relatively young and well-educated, they are likely to be aware of events and policy changes, and so likely to be a relatively responsive subset of the population. In addition, as college students, they have many social contacts, and so may be more aware than the average population of developments and changes in norms. If their response is limited or slow, then the general population is likely to be even more so.

Future work remains to be done to identify the relative impact of policies designed to curb behavior through changes in attitudes (such as perceptions of what is appropriate) and their heterogeneous impact. In the case where rapid behavior change is demanded, policies aimed at changing observable behavior (with, for example, enforcement) are going to be more effective but may come at cost (political or otherwise). Policies aimed at changing minds take longer, but can bear fruit.

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# A Appendix Tables

Table A1: Summary Means for Morbidity and Mortality Across all Waves

| | Prairie View Texas A&M | | Rice | | Texas A&M | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Mean | N | Mean | N | Mean | N | Mean | N |
| Cases (Wave 1) | 2740.10 | 57 | 2404.00 | 486 | 1565.50 | 75 | 2333.30 | 618 |
| | (3195.86) | | (3741.55) | | (2189.48) | | (3549.23) | |
| Deaths (Wave 1) | 80.09 | 57 | 82.66 | 486 | 47.78 | 75 | 78.19 | 618 |
| | (116.42) | | (208.29) | | (60.54) | | (189.48) | |
| Cases (Wave 2) | 34517.70 | 56 | 27724.20 | 485 | 23657.10 | 75 | 27846.60 | 616 |
| | (26422.14) | | (29087.78) | | (24614.56) | | (28415.04) | |
| Deaths (Wave 2) | 713.60 | 56 | 662.40 | 485 | 413.80 | 75 | 636.80 | 616 |
| | (771.30) | | (860.06) | | (499.90) | | (820.08) | |
| Cases (Wave 3) | 61922.80 | 57 | 106395.20 | 488 | 27720.50 | 76 | 92684.70 | 621 |
| | (73064.43) | | (66430.54) | | (47725.60) | | (70543.25) | |
| Deaths (Wave 3) | 1075.50 | 57 | 2004.80 | 488 | 436.30 | 76 | 1727.50 | 621 |
| | (1290.50) | | (1284.46) | | (855.88) | | (1356.08) | |

Table A2: Summary Means for the Precautionary, Injunctive and Descriptive Norm Indices

| | Wave 1 | | Wave 2 | | Wave 3 | | Total | N/wave |
|---|---|---|---|---|---|---|---|---|
| *Panel A: All* | | | | | | | | |
| Precautionary Behavior Index | 86.03 | | 91.03 | | 87.20 | | 88.09 | 653 |
| | (17.99) | | (17.15) | | (20.85) | | (18.84) | |
| Injunctive Norms Index | 79.65 | | 75.72 | | 73.97 | | 76.44 | 653 |
| | (17.38) | | (15.79) | | (13.00) | | (15.67) | |
| Descriptive Norms Index | 70.95 | | 60.23 | | 53.73 | | 61.64 | 653 |
| | (20.21) | | (21.76) | | (20.36) | | (21.96) | |
| *Panel B: Democrats* | | | | | | | | |
| Precautionary Behavior Index | 87.24 | 373 | 93.03 | 373 | 89.76 | 373 | 90.01 | 1,119 |
| | (16.60) | | (14.02) | | (17.94) | | (16.42) | |
| Injunctive Norms Index | 80.52 | 373 | 75.90 | 373 | 73.79 | 373 | 76.74 | 1,119 |
| | (17.71) | | (16.15) | | (13.11) | | (16.01) | |
| Descriptive Norms Index | 72.06 | 373 | 62.70 | 373 | 54.72 | 373 | 63.16 | 1,119 |
| | (20.68) | | (21.57) | | (20.53) | | (22.08) | |
| *Panel C: Republicans* | | | | | | | | |
| Precautionary Behavior Index | 75.38 | 52 | 80.38 | 52 | 71.15 | 52 | 75.64 | 156 |
| | (21.19) | | (25.20) | | (32.28) | | (26.72) | |
| Injunctive Norms Index | 73.29 | 52 | 76.50 | 52 | 70.30 | 52 | 73.36 | 156 |
| | (20.90) | | (14.87) | | (15.20) | | (17.29) | |
| Descriptive Norms Index | 63.25 | 52 | 55.13 | 52 | 50.00 | 52 | 56.13 | 156 |
| | (20.35) | | (22.11) | | (21.95) | | (22.03) | |
| *Panel D: Independents* | | | | | | | | |
| Precautionary Behavior Index | 86.26 | 195 | 89.64 | 195 | 86.97 | 195 | 87.62 | 585 |
| | (18.38) | | (19.30) | | (20.12) | | (19.30) | |
| Injunctive Norms Index | 79.89 | 195 | 75.95 | 195 | 75.27 | 195 | 77.04 | 585 |
| | (15.47) | | (15.15) | | (12.05) | | (14.43) | |
| Descriptive Norms Index | 71.05 | 195 | 56.81 | 195 | 52.25 | 195 | 60.04 | 585 |
| | (19.39) | | (21.46) | | (20.10) | | (21.82) | |

Note: Summary statistics, means and standard deviations in parentheses, of behavior and norms for those who completed all three waves.

Table A3: Kolmogorov Smirnov Test on Precautionary Behavior and Norm Indices

| | Wave 1 & 2 | | Wave 2 & 3 | | Wave 1 & 3 | |
|---|---|---|---|---|---|---|
| | Difference | p-value | Difference | p-value | Difference | p-value |
| *Panel A: All* | | | | | | |
| Precautionary Behavior | 0.2037 | 0.0000 | 0.0980 | 0.0038 | 0.1057 | 0.0014 |
| Injunctive Norm | 0.1623 | 0.0000 | 0.1011 | 0.0025 | 0.2634 | 0.0000 |
| Descriptive Norm | 0.2037 | 0.0000 | 0.1118 | 0.0006 | 0.3109 | 0.0000 |
| *Panel B: Democrat* | | | | | | |
| Precautionary Behavior | 0.2198 | 0.0000 | 0.0858 | 0.1284 | 0.1340 | 0.0025 |
| Injunctive Norm | 0.2091 | 0.0000 | 0.1072 | 0.0274 | 0.3164 | 0.0000 |
| Descriptive Norm | 0.1984 | 0.0000 | 0.1528 | 0.0003 | 0.3164 | 0.0000 |
| *Panel C: Republican* | | | | | | |
| Precautionary Behavior | 0.2885 | 0.0264 | 0.1538 | 0.5696 | 0.1923 | 0.2914 |
| Injunctive Norm | 0.1538 | 0.5696 | 0.1538 | 0.5696 | 0.1346 | 0.7337 |
| Descriptive Norm | 0.1731 | 0.4173 | 0.0962 | 0.9698 | 0.1923 | 0.2914 |
| *Panel D: Independent* | | | | | | |
| Precautionary Behavior | 0.1590 | 0.0145 | 0.1026 | 0.2566 | 0.0564 | 0.9156 |
| Injunctive Norm | 0.1282 | 0.0811 | 0.1026 | 0.2566 | 0.2256 | 0.0001 |
| Descriptive Norm | 0.2667 | 0.0000 | 0.0923 | 0.3771 | 0.3385 | 0.0000 |

Table A4: Summary Statistics of Norm Miscoordination

| | Wave 1 | | Wave 2 | | Wave 3 | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Obvs | Mean | Obvs | Mean | Obvs | Mean | Obvs |
| *Panel A: All* | | | | | | | | |
| Desc. Norm Mis. | 0.628 | 633 | 0.744 | 633 | 0.701 | 633 | 0.691 | 1,899 |
| | (0.49) | | (0.46) | | (0.50) | | (0.49) | |
| Inj. Norm Mis. | 0.439 | 633 | 0.462 | 633 | 0.559 | 633 | 0.487 | 1,899 |
| | (0.42) | | (0.39) | | (0.49) | | (0.44) | |
| *Panel B: Democrats* | | | | | | | | |
| Desc. Norm Mis. | 0.623 | 369 | 0.712 | 369 | 0.701 | 369 | 0.679 | 1,107 |
| | (0.50) | | (0.46) | | (0.49) | | (0.48) | |
| Inj. Norm Mis. | 0.449 | 369 | 0.457 | 369 | 0.551 | 369 | 0.486 | 1,107 |
| | (0.43) | | (0.41) | | (0.47) | | (0.44) | |
| *Panel C: Republicans* | | | | | | | | |
| Desc. Norm Mis. | 0.837 | 51 | 0.810 | 51 | 0.680 | 51 | 0.776 | 153 |
| | (0.51) | | (0.50) | | (0.48) | | (0.50) | |
| Inj. Norm Mis. | 0.608 | 51 | 0.497 | 51 | 0.771 | 51 | 0.625 | 153 |
| | (0.49) | | (0.35) | | (0.60) | | (0.50) | |
| *Panel D: Independents* | | | | | | | | |
| Desc. Norm Mis. | 0.585 | 213 | 0.782 | 213 | 0.706 | 213 | 0.691 | 639 |
| | (0.46) | | (0.46) | | (0.51) | | (0.48) | |
| Inj. Norm Mis. | 0.382 | 213 | 0.462 | 213 | 0.523 | 213 | 0.455 | 639 |
| | (0.38) | | (0.37) | | (0.47) | | (0.41) | |

Note: The average level of miscoordination by descriptive and injunctive norm elicitation question for those who completed all three waves. Standard deviations are reported in parentheses.

Table A5: Kolmogorov-Smirnov of Norm Miscoordination by Party

| | Wave 1 & 2 | | Wave 2 & 3 | | Wave 1 & 3 | |
|---|---|---|---|---|---|---|
| Norm Miscoordination | Diff | p-value | Diff | p-value | Diff | p-value |
| *Panel A: All* | | | | | | |
| Descriptive | 0.179*** | (0.00) | 0.065 | (0.14) | 0.114*** | (0.00) |
| Injunctive | 0.054 | (0.32) | 0.077** | (0.05) | 0.114*** | (0.00) |
| *Panel B: Democrat* | | | | | | |
| Descriptive | 0.195*** | (0.00) | 0.049 | (0.77) | 0.146*** | (0.00) |
| Injunctive | 0.033 | (0.99) | 0.095* | (0.07) | 0.100** | (0.05) |
| *Panel C: Republican* | | | | | | |
| Descriptive | 0.078 | (1.00) | 0.157 | (0.56) | 0.176 | (0.41) |
| Injunctive | 0.098 | (0.97) | 0.294** | (0.02) | 0.216 | (0.19) |
| *Panel D: Independent* | | | | | | |
| Descriptive | 0.219*** | (0.00) | 0.099 | (0.30) | 0.120 | (0.13) |
| Injunctive | 0.151** | (0.03) | 0.078 | (0.60) | 0.130** | (0.08) |

Note: The combined Kolmogorov-Smirnov statistic is reported with p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

# B Appendix Figures

Figure B1: Histogram of Precautionary Behavior Index