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Research Article

Age-based messaging strategies for communication about COVID-19

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Abstract: Responding to the COVID-19 crisis across the world has required a massive and sudden shift in human behaviors, with an end goal of slowing the spread of the disease. Importantly, this type of behavioral change requires messaging from governmental agencies and officials. However, we are uncertain about what types of messages are most influential at inducing behavioral change. In this study, we find that messages highlighting the risk to older adults have little additive power in influencing attitudes and behaviors beyond the effect of a broad informational message. However, messages highlighting risks to younger adults, in addition to risks to older adults, make individuals perceive COVID-19 as a more serious threat, though this effect seems to be limited to areas where infection rates are high.

Keywords: COVID-19, Messaging, Experimental methods, Age

Supplements: Open data, Open materials

The COVID-19 global pandemic has spread quickly, forcing governments across the globe to take drastic and unprecedented actions. Based on recommendations from public health officials[1], these actions have included things like increased handwashing and sanitation, extreme levels of social distancing, employees being required to work from home, and localized and even national-level stay at home orders. Importantly, these measures require buy-in from citizens, and many orders at this point are voluntary – a nationwide quarantine is difficult, if not impossible, to fully enforce, and a truly extreme measure. For example, India has currently enacted a nationwide lockdown, but, given the recency of this measure, there is little evidence to determine the level of compliance with it, or the government's ability to enforce it. Less extreme recommendations, like social distancing, have also proven difficult to enforce, and thus much of the efforts to combat the spread of COVID-19 rely on citizen cooperation with government.

It is imperative, then, that governments provide messages to citizens that are effective at changing their behaviors. Government messaging is important in informing public attitudes and behaviors – in a crisis, the government's message can serve to minimize harm (Coombs, 1995). In natural disasters, government messages should focus on information rather than blame assignment or mitigation (Liu, Lai, & Xu, 2018). Careful messaging from the government can deter a variety of negative social events, beyond crises, including ethnic discrimination (Fang, Guess, & Humphreys, 2019), increasing compliance with government recommendations (McAdams & Nadler, 2005), and decreasing support for separatist movements (Kamena & Utych, 2019). Indeed, in relation to the COVID-19 crisis, initial evidence suggests that, in Italy, government messaging (through observational analyses) is seen as believable and induces compliance, even among those who do not trust the government (Barari et al., 2020).

Given the rapidly developing situation in the United States, we examine how the government can create effective messages to get citizens to comply with precautions to prevent the spread of COVID-

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19, which seems to be especially dangerous for older individuals. Indeed, much of the messaging around the coronavirus has focused on its disproportionate effect on older individuals (Aronson, 2020). Of course, this may not be able to induce behavioral change in younger individuals, which world governments are calling on as necessary to prevent the spread of the virus. Early medical studies (Guan et al., 2020) and media reports[2] indicate that older people (i.e., 60 years or older) are most at risk to experience severe symptoms and/or death from the coronavirus, while younger people are more likely to be asymptomatic or experience mild symptoms. Conventional wisdom would then suggest that younger people may be key factors in spreading the virus if they are continuing to behave as normal. However, messaging focused on effects on older individuals may exacerbate generational divides, and lead to less concern about the virus from younger generations (Aronson, 2020).

In Italy, younger individuals have been shown to be less likely than older Italians to engage in certain preventative behaviors, like keeping social distance and handwashing (Barari et al., 2020). There is some anecdotal evidence in the United States that younger generations may not be taking this threat as seriously as older generations. Despite warnings, numerous college students flocked to warm (and crowded) Florida beaches to celebrate spring break, potentially allowing them to become infected with the virus.[3] In Kentucky, reports emerged of a "coronavirus party" with young people gathering to purposefully ignore state guidance for social distancing, with one of the partygoers later becoming infected.[4] While survey data in the US on COVID-19 is limited, there is some evidence from the Pew Research Center that younger Americans view COVID-19 as a less serious health risk than older Americans (2020). Since early media reports and government messaging of the threat of COVID-19 focused primarily on threats to older individuals, it is possible that younger people assume that they are less likely to contract the virus, or, if they do contract the virus, they are not very likely to become seriously ill. Given that the medical understanding of COVID-19 is rapidly evolving, due to the novel nature of the virus, it is likely that the general population does not adequately understand the threats presented, especially since most of our understanding comes from observing symptomatic cases (McIntosh, 2020).

Additionally, age-based messaging may exacerbate social identity cleavages. While evidence of age-based social identity exists, (Desmette & Gaillard, 2008), it is complicated by differences in chronological age and perceptions of psychological age (Zacher, Esser, Bohlmann, & Rudolph, 2019), and is not among the strongest dimensions of social identity. Importantly, age-based discrimination exists, and this discrimination and negative stereotyping of older individuals may be based in evolutionary psychology (North & Fiske, 2012). Since individuals are less likely to act to benefit social out-groups (Tajfel & Turner, 1979), messaging focused on negative effects for older individuals could have an effect of backfiring when targeted at younger generations, if age-related social identity plays an important role in behavioral change related to COVID-19. Since quick and drastic behavioral change among all members of society is vital to slowing the spread of COVID-19, we argue that it is imperative to find the appropriate messages to disseminate to achieve these goals.

To test the effects of public health messages, we conduct an experimental study in the United States. We vary messages between a purely informational message, with no targeted information about threats to different age groups, to messages that provide this information and add information about specific threats to both older and younger Americans. We find that messages highlighting threats to older Americans are, at the very least, no more effective at inducing behavioral or attitudinal change towards COVID-19 than a purely informational message. However, we find some support that, while messaging focused on threats to younger Americans may not induce much behavioral change, it can lead individuals, notably, younger Americans, to perceive COVID-19 as a more serious threat. Because of this, it seems that the government and health organizations should reconsider their messaging – focusing exclusively on threats to older Americans seems ineffective, but highlighting that COVID-19 is also a threat to younger Americans could induce positive change designed to prevent the spread of the coronavirus.

Messaging for COVID-19 Response – An Experimental Study

To test the effects of different types of messaging, we turn to an experimental study conducted on March 23, 2020 via Amazon's Mechanical Turk (Mturk). A total of 1,015 participants were recruited for this study.[5] While Mturk is a convenience, non-probability sample, that tends to be more educated, younger, and more liberal than the U.S. population as a whole,

it tends be more representative of the population than other convenience samples, like student samples (Berinsky, Huber, & Lenz, 2012). This sample's demographics look like other Mturk samples – ages of participants ranged from 18 to 82, with a mean of 38.14. 45% of the sample identify as female, 72% as white, while about 58% have a bachelor's degree or higher. 59% of participants identify as Democrats, 29% as Republicans, and 12% as independents.

It is important to consider the context of the COVID-19 crisis in the United States at this time. The first case in the U.S. was confirmed in Washington on January 21. Although several states confirmed new cases throughout February, the first two weeks of March saw a rapid increase in both the number of confirmed cases and their geographic distribution across states.[6] During this time, President Donald Trump made numerous statements either implying or directly stating that the United States had the spread of COVID-19 under control, statements for which he was later criticized by the media.[7] This federal response was also met with criticism by some state governors, who were quicker to sound the alarm on the severity of the pandemic and its impact on their states.[8] The tone from the White House changed on March 13, when President Trump declared a national emergency, and by March 16, every state governor had followed suit. On March 23, there were a total of 42,152 positive COVID-19 cases in the United States, 3,325 hospitalizations and 471 confirmed deaths.[9]

In the context of news coverage in the United States, COVID-19 was certainly a highly salient event by this time. The U.S. Congress was debating an unprecedented $2 trillion stimulus package in response to COVID-19 at this time and President Donald Trump was holding daily press briefings about the crisis. Additionally, citizens of every state were advised by state and local public health officials to partake in social distancing to limit the spread of the virus, and nine states had taken the additional step of issuing official "stay at home" orders [10], with additional states joining in later days. Although the crisis was clearly the most important news event at this time, the debate over the stimulus package may have heightened its importance as an economic, rather than public health, crisis. While this is an important distinction, we do not expect this to terribly bias our treatment effects. Given that younger Americans are more impacted by the financial aspects of the crisis, such as losing their employment (Pew Research Center, 2020), it is likely that an economic focus may have *already* caused them to take the disease more seriously. Most importantly, since the treatments are focused on health and are randomly assigned, we do not expect that the differences between the treatment and control groups should differ based on public discourse.

After answering a series of demographic questions, participants were randomly assigned to one of five experimental conditions. These include a control group, provided with general recommendations adapted from the Centers for Disease Control's (CDC) COVID-19 website. The text received by the control group reads:

> "You have likely heard of the novel coronavirus, or COVID-19, pandemic that is currently affecting countries across the world. According to CDC guidelines, the best way to avoid illness is to avoid being exposed to the virus. The CDC recommends you take the following steps to protect yourself – wash your hands with soap and water, for at least 20 seconds, regularly; avoid touching your face with unwashed hands; cover your mouth and nose with a tissue or the inside of your elbow when you sneeze or cough; and maintain social distance between yourself and others. Social distancing recommendations include working from home, if possible, and avoiding leaving your home unless absolutely necessary, such as for medical treatment or groceries."

Each of the four treatment groups received this same text, but also received some additional information. Those in the "older" treatment groups received this text after the general recommendations – the "older" treatment received only the non-bolded text, while the "older, extreme" treatment received the additional bolded sentence:

> "Coronavirus complications are worst for older adults (those over the age of 65) and those with compromised immune systems. Even if you don't fall into these groups, the CDC recommends that you take the above actions to help limit the spread of COVID-19. **If you do not take these recommended actions, you may be responsible for killing others with the disease.**"

The "younger" treatment groups received the same informational text as the control group, and also received this additional paragraph – the "younger" treatment received only the non-bolded text, while the "younger, extreme" treatment received the addit-

Table 1
Descriptive Statistics for Dependent Variables

	Mean	s.d.	N	Min	Max
Wash 1	5.35	1.32	1,011	0	6
Wash 2	5.23	1.44	997	0	6
Cover Cough	5.47	1.20	1,008	0	6
Work from Home	4.60	2.04	839	0	6
Federal Regulation	5.17	1.32	1,008	0	6
State Regulation	5.24	1.27	1,009	0	6
World	4.14	1.08	1,010	0	5
USA	4.08	1.09	1,009	0	5
State	3.83	1.18	1,010	0	5

Table 2
Messaging and Behaviors - Full Sample

	Wash Hands 1	Wash Hands 2	Cover Cough	Work from Home	Federal Regulation	State Regulation
Older	0.048	0.144	-0.035	-0.360	-0.310*	-0.299*
	(0.131)	(0.144)	(0.120)	(0.222)	(0.131)	(0.127)
Older, Extreme	0.081	0.163	0.015	0.046	-0.087	-0.201
	(0.131)	(0.144)	(0.120)	(0.224)	(0.131)	(0.126)
Younger	0.145	0.065	-0.062	0.006	-0.123	-0.172
	(0.131)	(0.145)	(0.120)	(0.222)	(0.131)	(0.126)
Younger, Extreme	-0.016	0.087	-0.120	0.002	-0.136	-0.143
	(0.131)	(0.145)	(0.120)	(0.225)	(0.132)	(0.127)
Constant	5.294***	5.136***	5.513***	4.661***	5.300***	5.408***
	(0.093)	(0.102)	(0.085)	(0.159)	(0.093)	(0.090)
N	1,011	997	1,008	839	1,008	1009
R^2	0.002	0.002	0.002	0.006	0.006	0.006

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are OLS coefficients with standard errors in parentheses. P-values are calculated using the Holm correction for multiple testing.

ional bolded sentence:

> "Coronavirus complications are worst for older adults (those over the age of 65) and those with compromised immune systems, the long- and short-term effects on other individuals are unknown. Many individuals under the age of 44 are hospitalized from complications related to COVID-19, and, because the virus is new, the CDC does not have information about long-term health effects of contracting the disease. **If you do not take these recommended actions, you may be responsible for your own early death.**"

Choosing wording for these experimental treatments was difficult. In a setting where testing of mechanisms was more important, we would ideally focus on tightly controlled variation. However, given the important real-world implications of messaging related to COVID-19, we chose to sacrifice some testing of mechanisms to better mirror real-world discussion. Since individuals are likely highly aware of the threats of COVID-19 to older Americans, it seemed unlikely that a treatment focusing solely on a threat to younger Americans would be believable, so we decided to incorporate the threat to younger Americans as additional information, rather than replacing infor-

mation about threats to older Americans. We chose to mirror information that was being propagated in the news media by governmental actors, such as the CDC and other public health officials, to the best of our ability – we noticed a heavy focus on threats to older Americans, and risks created towards these groups, in messaging, and decided that a natural extension would be focusing on a different age group to test if this messaging was effective.

After reading these experimental treatments, participants were asked how likely they were, over the next month, to take specific actions – washing their hands after using the bathroom, washing their hands after leaving their home, covering their mouth when they sneeze or cough, working from home, and following federal government and state government recommendations about staying home. They responded to these questions on a seven-point scale from extremely unlikely (0) to extremely likely (6). We additionally asked respondents how serious of a health problem they think COVID-19 is for three areas: the world, the United States, and their state. They responded on a six-point scale, ranging from not at all serious (0) to very serious (5).[11] Descriptive statistics for these variables are available in Table 1 below.

As shown in Table 1, individuals across the sample were very likely to note that they were willing to abide by these regulations. In this instance, it may be difficult to *increase* behavioral intention with messaging, but there were still non-trivial numbers of respondents in the sample indicating they were unlikely to take these actions.[12] Importantly, with levels this high, it is possible that poor messaging could *decrease* intentions to abide by these regulations, which would be counter to the goals of the message. Table 2[13] demonstrates how messaging influences these behavioral intentions.

As shown in Table 2[14], there appears to be little effect of the experimental treatments on behavioral intention for the full sample. The only instance where we see effects are for the "older" treatment making individuals slightly *less* likely to follow both federal and state regulations, compared to the control group. This effect, though, is muted and not statistically distinguishable from zero, when the extreme form of the older adults message is used. Of course, there is reason to expect that this varies based on age – for younger respondents, the older adults treatment represents a threat to *others*, while the younger adults treatment represents a threat to oneself. To this end, we examine whether any effects of messaging persist for the younger adults in our sample, by re-estimating these effects only for individuals age 40 or younger. This age was chosen because of generational breakdowns – those under 40 encompass millennials (24-40) and generation Z (18-23). These results are presented in Table 3.

Here, we see some effect of messaging, though they too are limited. Focusing messaging on older Americans makes younger participants less likely to say they will follow federal government recommenddations compared to the general information control group. These effects again are muted, and do not reach statistical significance, when the extreme language is added. Interestingly, messaging related to risks for *younger* Americans also decreases willingness to follow state and federal regulations, but these effects do not reach statistical significance when accounting for multiple testing, and again these effects are muted when the extreme language is added. Importantly, this study is sufficiently powered, even within the subgroup of participants under the age of 40, to detect effects of roughly 1/3 of a scale point, on the 7-point behavioral intention scale (i.e., 5.5 percentage points).

Of course, while behavioral intention is important, general attitudes towards the threat of COVID-19 may be important as well, as viewing the threat seriously may be an important factor in undertaking behaviors designed to reduce the spread of the virus. The behaviors we examine are either already well publicized, or general. If new specific recommendations occur, it is likely that individuals who take the threat more seriously should be more likely to follow them, especially as they are likely to be more restrictive than the behaviors we asked about in this study. We turn to analyses of the perceptions of seriousness variables. We analyze these results for both the full sample (columns 1-3) and only those under the age of 40 (columns 4-6) in Table 4.

Here, we see a different effect of messaging. Effects of the treatments are generally positive, for the younger adults treatments – highlighting that COVID-19 is also a threat to younger adults, making individuals perceive the threat as greater than the control group. This effect especially persists amongst the youngest respondents in the dataset. Focusing exclusively on older adults has no statistically significant impact on perceptions of threat. While these effects are small, it suggests that messaging about threats to younger individuals can make the threat of COVID-19 seem more serious, especially amongst younger individuals, even if it does not induce intentions towards behavioral change.

Table 4
Messaging and Perceptions of Seriousness of Disease

	Full Sample			Millennials and Generation Z Only		
	World	USA	State	World	USA	State
Older	-0.035	-0.050	-0.088	-0.007	-0.018	-0.081
	(0.108)	(0.108)	(0.117)	(0.128)	(0.130)	(0.144)
Older, Extreme	0.063	0.084	0.166	0.101	0.069	0.139
	(0.107)	(0.108)	(0.117)	(0.124)	(0.125)	(0.139)
Younger	0.187	0.158	0.269*	0.217	0.161	0.279
	(0.107)	(0.108)	(0.117)	(0.128)	(0.129)	(0.143)
Younger, Extreme	0.173	0.257*	0.279*	0.239	0.315*	0.326*
	(0.107)	(0.108)	(0.117)	(0.130)	(0.131)	(0.146)
Constant	4.065***	3.985***	3.701***	4.070***	3.986***	3.690***
	(0.076)	(0.076)	(0.083)	(0.088)	(0.089)	(0.099)
N	1,010	1,009	1,010	668	667	668
R^2	0.007	0.010	0.015	0.009	0.013	0.017

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are OLS coefficients with standard errors in parentheses. Columns 1-3 include the full sample, while columns 4-6 include only Millennial and Generation Z respondents. P-values are calculated using the Holm correction for multiple testing.

Table 5
Messaging and Perceptions of Seriousness of Disease – High vs. Low Infection States

	Highly Affected States		Less Affected States			
	World	USA	World	USA	World	USA
Older	0.222	0.217	0.229	-0.203	-0.225	-0.317
	(0.160)	(0.165)	(0.171)	(0.144)	(0.143)	(0.154)
Older, Extreme	0.391**	0.325*	0.545***	-0.136	-0.064	-0.067
	(0.163)	(0.168)	(0.175)	(0.141)	(0.140)	(0.151)
Younger	0.428**	0.398**	0.541***	0.031	0.003	0.082
	(0.160)	(0.165)	(0.172)	(0.143)	(0.142)	(0.153)
Younger, Extreme	0.408**	0.547***	0.633***	0.023	0.070	0.040
	(0.161)	(0.166)	(0.173)	(0.143)	(0.142)	(0.153)
Constant	3.921***	3.831***	3.688***	4.152***	4.080***	3.710***
	(0.116)	(0.119)	(0.124)	(0.100)	(0.099)	(0.107)
N	402	402	403	608	607	607
R^2	0.0248	0.0299	0.0454	0.0071	0.0080	0.0135

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are OLS coefficients with standard errors in parentheses. P-values are calculated using the Holm correction for multiple testing.

However, this presents an interesting disconnect between attitudes and behaviors – why does messaging about threats to younger individuals make people *less* likely to follow recommendations from the government, but *more* likely to view the disease as serious? To this end, we look at these effects moderated by levels of infection in one's state. We consider states to be highly infected if they have over the mean level of cases on March 23 of 810 – this includes California, Florida, Illinois, Louisiana, Michigan, New Jersey, New York, and Washington. All other states are considered "low infection" states. These analyses are pr-

esented in Table 5.

Here, we see that the positive effects of the "younger" treatment appear only in states with high levels of infection – in states with low levels of infection, the effects are statistically indistinguishable from zero, and substantively small. Additionally, the extreme version of the "older" treatment provides an increase in threat perception of highly impacted states, as well. This suggests that messaging may rely on an activation of threat[15] – when threat levels are high in one's state, talking about threats in extreme ways, or threats to a greater portion of the population, may make the threat seem more serious than just dry CDC recommendations. This suggests a different way that messages can be targeted – rather than focusing on simply age, perhaps we should also consider level of potential threat in a local area in how to change attitudes. However, we find little behavioral intention differences between those in high and low infection states, except those in high infection states showing no treatment effects on following state recommendations. This, though, is perhaps because they view their states as taking aggressive action.

Discussion

These findings suggest that government messaging could play a role in encouraging people to act to stop the spread of coronavirus, but in nuanced and perhaps unexpected ways. We generally find that messaging about threats to older Americans have no positive effects on behavioral or attitudinal change, especially among younger Americans. When effects are statistical significant, or when they at least approach it, these effects are *negative* in direction – that is, this shows that the added information of the older adults treatments is, if anything, less effective at encouraging behavioral change than the pure control message. This suggests that, at least when targeting messages towards younger Americans, a focus on threats to older adults could potentially be counterproductive.

However, focusing messaging on threats to *younger* adults does seem to have some positive benefit. While there is little evidence it induces behavioral change, messaging highlighting that COVID-19 also poses health risks to younger adults does have a positive effect on perceptions of the seriousness of the disease – when people are exposed to additional information about threats to younger adults, they believe the disease is more serious than when they are not. Of course, a trade-off here is that this messaging seems to make it less likely that individuals will follow state and federal regulations, but an extreme message seems to mute these effects. This is particularly important given that younger people are still at risk of contracting and spreading COVID-19, so they represent a target population that may be key to containing the pandemic.

Of course, this study has limitations – perhaps more than usual, given the rapid nature of the data collection along with the rapidly evolving nature of the problem. Importantly, the "extreme" version of the treatments adds a level beyond extremity – for the older Americans treatment, the extreme version focuses on pro-social motives, while for the younger Americans treatment, it focuses on self-serving motives. While the extreme and non-extreme versions differ in magnitude of effects, they generally work in the same direction. We encourage scholars to be cautious in reading too much into the mechanisms underlying *what* is happening with the extreme treatments. However, we find that the "extreme" version of the treatments tends to generally mute negative (or, non-compliant) intentions, and accentuate positive (or, compliant) attitudes towards seriousness of the threat. Given the variation between the older and younger treatments in target of threat, this provides some suggestive evidence that extremity of the message is doing some work here. Additionally, the "younger" treatment mentions the effects on older Americans, but *adds* the potential risk that younger Americans might face – therefore, it is important to conclude that messages *only* about threats to older Americans seem ineffective, but *adding* information about threats to younger Americans might mitigate that effect.

Additionally, we are limited by only examining behavioral intentions, rather than actual behaviors. It is likely that, given the high amount of social pressure to act to combat COVID-19 in the United States, social desirability may bias self-reports of behavioral intention upwards. We have attempted to mitigate this by providing a scale, which would allow variation between *levels* of a socially desirable response, compared to a simple yes or no question, but social desirability bias may still be at play. Future research would do well to observe actual behaviors in response to messages. Finally, these results focus on the United States. It is unclear how they would generalize to other contexts. For instance, in other countries, there may be greater (or lesser) norms of respect for elders than in the United States, or there may be differing norms on self-reliance vs. focusing on communal benefits. We expect these results are more likely to generalize to

areas with similar cultures and social norms to the United States – important work still needs to be conducted in areas with different cultural norms.

Those spreading messages about COVID-19 with an intention to change behavior, then, should likely not focus on threats to older adults, especially when trying to induce behavioral change in younger citizens. There is mixed evidence on effects for messages about younger adults – they seem likely to view the threat as more serious, but also seem a bit less likely to say they will follow state and federal recommendations. However, there is no impact of messaging on more concrete behaviors, such as working from home and taking individual health actions, like washing hands and covering coughs. Additionally, these effects seem driven by residents of areas where the disease is already serious.

Importantly, there is greater variation in the sample for perceptions of threat than on individual behavioral intention. Many people in the sample are very likely to follow public health recommendations related to COVID-19, regardless of the message they received, which suggests they are already engaging in these behaviors and/or that a simple informational message is enough to encourage them to do so. If the goal is to raise the profile of COVID-19 as a serious threat, it appears that messaging about the risks to younger Americans can be effective, but this may be limited in scope. However, we find that a purely informational message is at least as good at creating behavioral change as messages targeted towards age groups, even exclusively among younger Americans. This suggests that government agencies should carefully evaluate their messages, and take care to not exacerbate social cleavages if their goal is to induce behavioral change.

Conclusion

This research begins to answer the call to increase the use of quantitative, experiment-based methodologies within the field of nonprofit management. Across two experiments, we offer insights that extend our understanding of the implications of varying diversity frames for stakeholder perceptions of nonprofit organizations while beginning to inform how diversity frames offer divergent signals to underrepresented and non-underrepresented community stakeholders.

Notes

1. https://www.cdc.gov/coronavirus/2019-ncov/index.html
2. https://www.npr.org/sections/coronavirus-live-updates/2020/03/22/819846180/study-calculates-just-how-much-age-medical-conditions-raise-odds-of-severe-covid
3. https://www.politico.com/news/2020/03/21/spring-breakers-coronavirus-140609
4. https://www.cnn.com/2020/03/24/health/kentucky-coronavirus-party-infection/index.html
5. Participants were required to be located in the United States and have a 97% or greater approval rating on Mturk. Additionally, participants had to pass a screening question which consisted of doing a simple addition problem and following instructions, to reduce the prevalence of bots, or automated responses, in the dataset.
6. https://www.nytimes.com/article/coronavirus-timeline.html
7. https://www.nytimes.com/2020/03/15/opinion/trump-coronavirus.html
8. https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2020/03/20/governors-leapfrog-feds-on-coronavirus-response
9. https://covidtracking.com/us-daily/
10. https://edition.cnn.com/2020/03/23/us/coronavirus-which-states-stay-at-home-order-trnd/index.html
11. Question texts are available in the Appendix.
12. Histograms of each dependent variable are available in the Appendix.
13. All results are robust to a few different modeling specifications. In the appendix, we include ordered logit models. To address the skewed nature of the data, we include models that compare individuals who take the most favorable response (extremely likely or very serious) coded as 1, compared to all other responses coded as 0. Results are substantively and statistically similar under each of these specifications.
14. Since this is an experiment, we include only the treatments as independent variables in analyses. Including controls for demographic factors – a-

ge, gender, income, employment status, partisanship, ideology, and race – do not substantively or statistically change the results for any analysis.

15. No significant differences emerge between highly affected and other states within the control group only, suggesting that the messaging may indeed activate threat.

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Appendix

Appendix A

Question Text

Over the text month, how likely are you to…
Wash your hands for at least 20 seconds after using the bathroom?
Wash your hands for at least 20 seconds after leaving your home?
Cover your mouth with the inside of your elbow when you sneeze or cough?
Work from home?
Follow federal government recommendations about staying home?
Follow state government recommendations about staying home?

Response scale: Extremely unlikely (0), moderately unlikely (1), slightly unlikely (2), neither likely nor unlikely (3), slightly likely (4), moderately likely (5), extremely likely (6)

How serious of a health problem do you think the COVID-19 virus is for…
The world?
The United States?
Your state?

Response scale: Not at all serious (0), a little serious (1), slightly serious (2), somewhat serious (3), serious (4), very serious (5)

Appendix B

Supplemental Analyses

Table B1
Messaging and Behaviors - Full Sample (ordered logit)

	Wash Hands 1	Wash Hands 2	Cover Cough	Work from Home	Federal Regulation	State Regulation
Older	-0.071	0.107	-0.047	-0.339*	-0.508***	-0.516***
	(0.205)	(0.203)	(0.226)	(0.205)	(0.193)	(0.199)
Older, Extreme	0.129	0.204	0.140	0.053	-0.225	-0.370*
	(0.211)	(0.205)	(0.232)	(0.212)	(0.195)	(0.201)
Younger	0.302	0.185	-0.057	-0.003	-0.185	-0.314
	(0.216)	(0.207)	(0.224)	(0.209)	(0.197)	(0.201)
Younger, Extreme	0.061	0.123	-0.063	0.041	-0.166	-0.253
	(0.211)	(0.205)	(0.226)	(0.213)	(0.198)	(0.204)
cut1	-3.777***	-3.352***	-4.073***	-2.257***	-4.081***	-4.432***
	(0.256)	(0.224)	(0.284)	(0.177)	(0.256)	(0.286)
cut2	-3.088***	-2.841***	-3.458***	-1.870***	-3.526***	-3.660***
	(0.206)	(0.193)	(0.232)	(0.167)	(0.214)	(0.221)
cut3	-2.687***	-2.462***	-3.094***	-1.676***	-3.026***	-3.196***
	(0.187)	(0.177)	(0.211)	(0.163)	(0.188)	(0.196)

cut4	-2.325***	-1.976***	-2.603***	-1.186***	-2.468***	-2.613***
	(0.174)	(0.162)	(0.190)	(0.157)	(0.168)	(0.174)
cut5	-1.702***	-1.439***	-2.047***	-0.862***	-1.699***	-1.940***
	(0.159)	(0.152)	(0.174)	(0.154)	(0.152)	(0.159)
cut6	-0.736***	-0.540***	-1.095***	-0.280*	-0.483***	-0.698***
	(0.148)	(0.144)	(0.160)	(0.151)	(0.142)	(0.147)
N	1011	997	1008	839	1008	1009
R^2	0.0017	0.0005	0.0006	0.0022	0.0030	0.0031

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are ordered logit coefficients with standard errors in parentheses.

Table B2
Messaging and Behaviors – Millennials and Generation Z (ordered logit)

	Wash Hands 1	**Wash Hands 2**	**Cover Cough**	**Work from Home**	**Federal Regulation**	**State Regulation**
Older	-0.235	-0.036	-0.070	-0.400	-0.678***	-0.601**
	(0.245)	(0.240)	(0.272)	(0.250)	(0.236)	(0.244)
Older, Extreme	0.152	0.288	-0.006	-0.077	-0.299	-0.459*
	(0.249)	(0.240)	(0.265)	(0.245)	(0.231)	(0.239)
Younger	0.211	0.224	0.038	-0.225	-0.480**	-0.576**
	(0.258)	(0.250)	(0.274)	(0.250)	(0.237)	(0.244)
Younger, Extreme	0.042	0.233	-0.055	0.148	-0.212	-0.317
	(0.259)	(0.252)	(0.276)	(0.267)	(0.248)	(0.254)
cut1	-3.820***	-3.630***	-4.107***	-2.372***	-4.124***	-4.179***
	(0.311)	(0.298)	(0.348)	(0.213)	(0.305)	(0.309)
cut2	-3.068***	-2.913***	-3.307***	-1.956***	-3.597***	-3.738***
	(0.245)	(0.236)	(0.268)	(0.199)	(0.258)	(0.269)
cut3	-2.579***	-2.508***	-2.974***	-1.761***	-3.101***	-3.299***
	(0.217)	(0.213)	(0.245)	(0.194)	(0.226)	(0.239)
cut4	-2.185***	-1.968***	-2.531***	-1.319***	-2.523***	-2.630***
	(0.201)	(0.191)	(0.223)	(0.186)	(0.202)	(0.210)
cut5	-1.586***	-1.331***	-1.942***	-0.954***	-1.705***	-1.899***
	(0.186)	(0.176)	(0.204)	(0.181)	(0.183)	(0.191)
cut6	-0.680***	-0.463***	-1.044***	-0.331*	-0.536***	-0.753***
	(0.176)	(0.168)	(0.189)	(0.177)	(0.171)	(0.178)
N	668	661	667	565	666	667
R^2	0.0025	0.0019	0.0002	0.0032	0.0057	0.0051

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are ordered logit coefficients with standard errors in parentheses.

Table B3
Messaging and Perceptions of Threat (ordered logit)

	Wash Hands 1	Wash Hands 2	Cover Cough	Work from Home	Federal Regulation	State Regulation
Older	-0.035	-0.053	-0.120	0.059	0.045	-0.071
	(0.187)	(0.185)	(0.181)	(0.229)	(0.226)	(0.221)
Older, Extreme	0.054	0.078	0.178	0.107	0.068	0.182
	(0.185)	(0.183)	(0.179)	(0.217)	(0.216)	(0.211)
Younger	0.240	0.191	0.332*	0.412*	0.265	0.394*
	(0.186)	(0.184)	(0.181)	(0.231)	(0.226)	(0.220)
Younger, Extreme	0.294	0.455**	0.452**	0.381*	0.534**	0.509**
	(0.187)	(0.186)	(0.184)	(0.231)	(0.229)	(0.225)
cut1	-4.237***	-4.300***	-4.046***	-4.533***	-4.546***	-4.119***
	(0.302)	(0.312)	(0.283)	(0.431)	(0.431)	(0.360)
cut2	-3.284***	-3.176***	-2.802***	-3.359***	-3.175***	-2.716***
	(0.212)	(0.205)	(0.184)	(0.268)	(0.250)	(0.217)
cut3	-2.294***	-2.276***	-1.696***	-2.277***	-2.311***	-1.664***
	(0.163)	(0.162)	(0.146)	(0.196)	(0.197)	(0.173)
cut4	-1.241***	-1.046***	-0.598***	-1.187***	-1.012***	-0.528***
	(0.140)	(0.137)	(0.133)	(0.166)	(0.163)	(0.156)
cut5	0.204	0.372***	0.814***	0.196	0.404**	0.829***
	(0.134)	(0.133)	(0.134)	(0.158)	(0.158)	(0.158)
N	1010	1009	1010	668	667	668
R^2	0.0020	0.0036	0.0045	0.0032	0.0042	0.0049

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are ordered logit coefficients with standard errors in parentheses. Columns 1-3 include the full sample, while columns 4-6 include only Millennial and Generation Z respondents.

Table B4
Messaging and Behaviors - Full Sample (Extremely likely vs. all other responses)

	Wash Hands 1	Wash Hands 2	Cover Cough	Work from Home	Federal Regulation	State Regulation
Older	-0.126	0.073	-0.013	-0.338	-0.529***	-0.514**
	(0.211)	(0.209)	(0.229)	(0.219)	(0.203)	(0.206)
Older, Extreme	0.130	0.170	0.191	0.046	-0.271	-0.365*
	(0.215)	(0.210)	(0.234)	(0.222)	(0.203)	(0.206)
Younger	0.302	0.224	-0.044	-0.010	-0.182	-0.324
	(0.220)	(0.212)	(0.227)	(0.220)	(0.203)	(0.207)
Younger, Extreme	0.100	0.125	-0.013	0.054	-0.138	-0.225
	(0.215)	(0.210)	(0.229)	(0.224)	(0.204)	(0.209)
Constant	0.738***	0.546***	1.065***	0.281*	0.490***	0.693***
	(0.151)	(0.147)	(0.162)	(0.157)	(0.146)	(0.150)
N	1011	997	1008	839	1008	1009
R^2	0.0035	0.0010	0.0011	0.0040	0.0055	0.0051

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are logit coefficients with standard errors in parentheses.

Table B5
Messaging and Behaviors - Millennials and Generation Z
Extremely likely vs. all other responses)

	Wash Hands 1	Wash Hands 2	Cover Cough	Work from Home	Federal Regulation	State Regulation
Older	-0.324	-0.073	-0.067	-0.357	-0.694***	-0.643**
	(0.253)	(0.250)	(0.276)	(0.266)	(0.249)	(0.253)
Older, Extreme	0.137	0.286	0.011	-0.076	-0.345	-0.492**
	(0.254)	(0.247)	(0.269)	(0.258)	(0.241)	(0.246)
Younger	0.170	0.271	0.045	-0.230	-0.491**	-0.597**
	(0.263)	(0.257)	(0.278)	(0.266)	(0.248)	(0.253)
Younger, Extreme	0.064	0.247	-0.030	0.261	-0.139	-0.301
	(0.263)	(0.259)	(0.279)	(0.277)	(0.254)	(0.259)
Constant	0.704***	0.459***	1.033***	0.302	0.537***	0.768***
	(0.178)	(0.172)	(0.191)	(0.185)	(0.175)	(0.180)
N	668	661	667	565	666	667
R^2	0.0055	0.0041	0.0002	0.0074	0.0107	0.0098

Notes: p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are logit coefficients with standard errors in parentheses.

Table B6
Messaging and Perceptions of Seriousness of Disease
(Very serious vs. all other responses)

	Full Sample			**Millennials and Generation Z Only**		
	World	USA	State	World	USA	State
Older	0.020	-0.045	-0.195	0.163	0.062	0.045
	(0.200)	(0.203)	(0.217)	(0.245)	(0.248)	(0.264)
Older, Extreme	0.002	0.041	-0.015	0.046	0.050	0.089
	(0.200)	(0.202)	(0.213)	(0.236)	(0.239)	(0.254)
Younger	0.199	0.172	0.267	0.476*	0.274	0.428*
	(0.199)	(0.201)	(0.209)	(0.245)	(0.245)	(0.256)
Younger, Extreme	0.269	0.360*	0.407*	0.357	0.431*	0.503*
	(0.200)	(0.200)	(0.208)	(0.247)	(0.248)	(0.259)
Constant	-0.190	-0.340**	-0.738***	-0.211	-0.382**	-0.834***
	(0.142)	(0.143)	(0.151)	(0.168)	(0.170)	(0.183)
N	1010	1009	1010	668	667	668
R^2	0.0023	0.0039	0.0081	0.0060	0.0047	0.0076

Notes: * p < .05, ** p < .01, *** p < .001 (two-tailed test). Table entries are logit coefficients with standard errors in parentheses. Columns 1-3 include the full sample, while columns 4-6 include only Millennial and Generation Z respondents.

Figure B1
Histograms of Behavioral Intention Variables

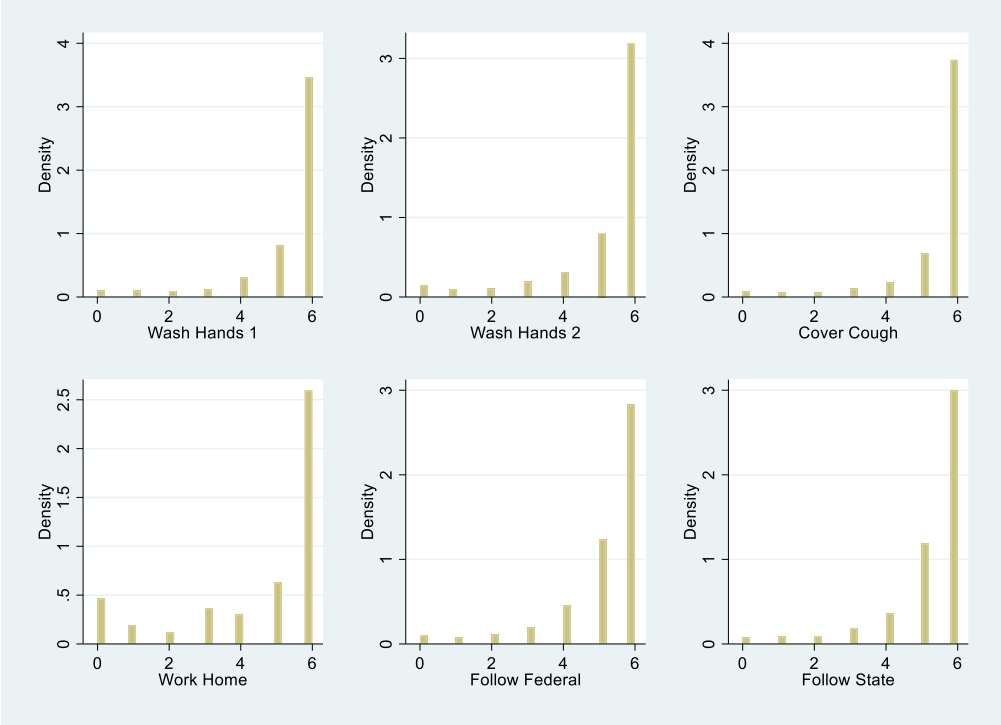

Figure B2
Histograms of Attitudinal Variables