A Global Experiment on Motivating Social Distancing During the COVID-19 Pandemic

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Abstract

Finding communication strategies that effectively motivate social distancing continues to be a global public health priority during the COVID-19 pandemic. This cross-country, preregistered experiment (n = 25,718 from 89 countries) tested hypotheses concerning generalizable positive and negative outcomes of social distancing messages that promoted personal agency and reflective choices (i.e., an autonomy-supportive message) or were restrictive and shaming (i.e. a controlling message) compared to no message at all. Results partially supported experimental hypotheses in that the controlling message increased controlled motivation (a poorly-internalized form of motivation relying on shame, guilt, and fear of social consequences) relative to no message. On the other hand, the autonomy-supportive message lowered feelings of defiance compared to the controlling message, but the controlling message did not differ from receiving no message at all. Unexpectedly, messages did not influence autonomous motivation (a highly-internalized form of motivation relying on one's core values) or behavioral intentions. Results supported hypothesized associations between people's existing autonomous and controlled motivations and self-reported behavioral intentions to engage in social distancing: Controlled motivation was associated with more defiance and less long-term behavioral intentions to engage in social distancing, whereas autonomous motivation was associated with less defiance and more short- and long-term intentions to social distance. Overall, this work highlights the potential harm of using shaming and pressuring language in public health communication, with implications for the current and future global health challenges.

Significance Statement

Communicating in ways that motivate engagement in social distancing remains a critical global public health priority during the COVID-19 pandemic. This study tested motivational qualities of messages about social distancing (those that promoted choice and agency versus those that were forceful and shaming) in 25,718 people in 89 countries. The autonomy-supportive message decreased feelings of defying social distancing recommendations relative to the controlling message, and the controlling message increased controlled motivation, a less effective form of motivation, relative to no message. Message type did not impact intentions to socially distance, but people's existing motivations were related to intentions. Findings were generalizable across a geographically diverse sample and may inform public health communication strategies in this and future global health emergencies.

A Global Experiment on Motivating Social Distancing During the COVID-19 Pandemic

> The New Zealand government's team opted to take a different route, focusing on the impact on people's daily lives and steps they could take to protect each other […] The messaging was overwhelmingly positive in tone, giving "dos" rather than "don'ts" as well as *reasons why*. Instead of "wash your hands", for instance, the advice was "washing and drying your hands kills the virus" – to underscore individual agency and encourage participation in the national response […] In seeking to foster calm and compassion, New Zealand's messaging was starkly different to that elsewhere. The state of Oregon, for example, ran a campaign with the slogans "Don't accidentally kill someone" and "It's up to you how many people live or die". In the UK, government campaigns have warned "don't let a coffee cost a life" and shown the reproachful faces of people on ventilators: "Look him in the eyes and tell him the risk isn't real."
>
> - The Guardian (February 22, 2021)

To mitigate the spread of the novel coronavirus (COVID-19) pandemic, international bodies, governments, and other stakeholders around the world have been urging, among other practices, social distancing, or maintaining an approximate six foot distance from people who live in other households (1, 2). During the first year of the pandemic, New Zealand emerged as an example of a country that successfully mitigated the spread of COVID-19, which may have been due, in part, to their effective communication strategy (3, 4). Out of all the rules that were enforced to various degrees around the world, those that kept people apart from one another, like cancelling public gatherings and restricting movement, were among the most contested, yet effective, interventions to reduce the spread of COVID-19 (5). Longitudinal cross-national studies found that policies like school closures and stay-at-home orders increased social distancing and were effective in slowing COVID-19 daily confirmed cases (6) and deaths (7). Therefore, motivating engagement in social distancing has been emphasized as a critical global public health priority by researchers (8, 9) and global policy-makers (1) alike.

Motivation science from the framework of self-determination theory can provide insight into why some ways of communicating can motivate behavior change, whereas others, even when well-intentioned, may backfire. Self-determination theory (SDT) (10) has long investigated

the effects of communication style on the quality, quantity, and sustainability of people's motivation to change their behavior. New Zealand's communication strategy as described in the opening quote is one example of an *autonomy-supportive* communication style that helps people understand and endorse the value of the requested behavior. This communication style involves perspective-taking (e.g., acknowledging how difficult it is to alter one's daily life), providing a meaningful rationale (e.g., explaining why social distancing is effective and important for reducing viral spread), and supporting individual agency and ownership in terms of how to respond within the practical constraints of the situation (e.g., offering safe alternatives from which to choose) (11). In contrast, a *controlling* communication style, as illustrated with those used by the state of Oregon and the UK in the opening quote, is characterized by demanding language (e.g., informing people what they should, must, or have to do) and relies on shaming and blaming to motivate behavior change (12). Although some argue that controlling messages are necessary in enforcing adherence in the short-term (13), this adherence declines over time (14). Moreover, controlling messages can have the opposite effect of increasing undesired behaviors and feelings of defiance, or wanting to do the opposite of what is being requested (15, 16). Autonomy-supportive messages, on the other hand, consistently increase adherence in the short- and long-term (14, 17), and reduce feelings of defiance (15, 16).

Over the course of the COVID-19 pandemic, employers, local governments, national governments, and global government groups like the WHO have urged people to take various mitigation actions like social distancing. People have repeatedly defied social distancing recommendations (18, 19); this is not surprising because defiance occurs when people are bombarded with messages to change their behavior and perceive their freedom as restricted (20, 21). This trend of defiance threatens to accelerate viral spread. Thus, establishing whether

different messaging approaches can curb feelings of defiance, and increase adherence to social distancing recommendations, is crucial.

Autonomy-supportive messages about social distancing may be more effective than controlling messages because they promote *autonomous motivation*, or internalizing the value and importance of the requested behavior (e.g., engaging in social distancing to protect their own and others' health). On the other hand, controlling messages about social distancing may be less effective than autonomy-supportive messages because they promote *controlled motivation*, a poorly-internalized form of motivation relying on avoiding punishment, social judgments, and feelings of shame and guilt (e.g., engaging in social distancing to avoid disapproval from others) (10). Across myriad behaviors, autonomous motivation predicts greater behavior change than controlled motivation in the short- and long-term (22).

This experiment investigated whether and how communication strategies, delivered online in short written messages, a low cost and common method of conveying public health recommendations (23), could motivate social distancing. Participants recruited from 89 countries were exposed to an autonomy-supportive message, a controlling message, or no message. We recognized that prior to and during the five months of data collection (from April to September 2020), participants were encountering a high volume of messages about social distancing in their everyday lives that varied widely in how autonomy supportive versus controlling they were. We thus used the "no message" comparison condition to capture participants' motivation as a function of exposure to messages received prior to our experiment. Regardless of prior message exposure, we were interested in the magnitude of effects (even if minimal) resulting from exposure to a new motivational message to inform public health stakeholders about realistic effects they could expect to see if implemented at scale.

Three research aims were supported by this design. First, we aimed to determine the extent to which brief, written autonomy-supportive and controlling messages differentially affect motivation, feelings of defiance, and behavioral intentions to follow social distancing recommendations. We did not track social distancing adherence over time due to varied resources across the many data collection labs and opted to measure behavioral intentions (both short- and long-term) for social distancing instead. Behavioral intentions, or plans to perform a behavior (24), are a key determinant of behavioral adherence and a common outcome for health behavior interventions (24, 25). A second aim was to determine whether the differential effects of autonomy-supportive and controlling messages generalize across a geographically diverse sample (26). Finally, we aimed to test associations between motivations to follow social distancing recommendations with feelings of defiance and behavioral intentions. Recent longitudinal research in Belgium and the UK suggests that people can simultaneously hold autonomous and controlled motivations for following COVID-19-related recommendations (e.g., hand-washing, social distancing, mask wearing), but only autonomous motivation predicted greater adherence over time; controlled motivation either did not relate or predicted lower adherence over time (27, 28). This global sample allows us to test the generalizability of these differential associations between autonomous and controlled motivation and indicators of adherence to social distancing recommendations, independent of the messaging effects we observe. Finding predictors of defiance and intentions to socially distance that generalize across a global sample, whether it is from experimental messages or from participants' existing motivations for social distancing, is critical for informing the best routes of intervention.

Our hypotheses and data analysis plan were preregistered prior to data collection at https://osf.io/2u6xs/.

Hypothesis 1: Compared to the controlling message, those in the autonomy-supportive message and no-message conditions will report a) higher internalized motivation to socially distance, b) lower feelings of defiance, and c) higher short-term (one-week) and long-term (six-month) intentions to socially distance. In other words, we expected the autonomy-supportive message to have benefits over the controlling message, and the controlling message to have worse outcomes compared to no message at all.

Hypothesis 2: Autonomous motivation for social distancing will be associated with a) lower feelings of defiance, and greater short-term (one-week) and long-term (six-months) intentions to socially distance, while controlled motivation will b) have inverse associations with defiance and behavioral intentions.

Results

Descriptive Statistics

Descriptive statistics for all variables analyzed in this study, including correlations among variables, are presented in *Table 1*. *Figure 1* shows the final samples used in analyses after data exclusions (see *Supplemental Information* for a description). *Figure 2* shows distributions of study variables, indicating that on average, participants were already following social distancing to a high degree, they intended to continue following recommendations in the future, they already highly endorsed the value of the recommendations, and they reported feeling very little defiance about these recommendations.

Confirmatory Analyses

Given the large sample size in this study, confirmatory analyses were preregistered with a specified region of practical equivalence to aid interpretation of statistically significant but small effects. We specified that a hypothesis would be supported if an effect and its 95% confidence

interval was fully outside of the null interval of d = -0.050 to 0.050 (equivalent to partial r [r_p] = -0.025 to 0.025). If an effect and its 95% confidence interval overlap with the null interval, it would not be considered practically meaningful, and the hypothesis would not be supported. This cutoff was informed by d = |0.05| as our smallest effect size of interest.[1]

Results reported in the text focus on partial *r*s (r_p) for random-intercept models (see *Table 2* for a more complete reporting of the statistics; *Table 3* presents these models adding in random slopes for predictor variables). See *Supplemental Information* for additional analyses.[2]

Hypothesis 1

See *Figure 3* for a visualization of confirmatory effects for Hypothesis 1.

Autonomous and Controlled Motivation. Across all message conditions, autonomous motivation was high (see *M* and *SD* in *Table 1*). We did not find evidence that the autonomy-supportive message condition yielded higher autonomous motivation than the controlling message condition, r_p = .034, 95% CI [.022, .046], nor did we find evidence that those in the no-message condition reported higher autonomous motivation than the controlling message condition, r_p = -.012, 95% CI [-.024, .001].

Across all message conditions, controlled motivation was moderate. Those in the no-message condition showed lower controlled motivation than those in the controlling message condition, r_p = -.096, 95% CI [-.108, -.084]. However, we did not find evidence of a difference in

[1]We deviated from our preregistration in that we report partial *r*s (r_p) instead of Cohen's *d* because our planned analyses produced r_p; reporting r_p also makes results easier to compare with previous findings related to health media campaigns.

[2] We reran the main analyses controlling for baseline adherence and COVID-19 cases per million on the day of data collection in that country, finding the same pattern of results as confirmatory analyses. We report these analyses in Table S4 in *Supplemental Information* and focus the text on confirmatory analyses without these exploratory covariates.

controlled motivation between the autonomy-supportive message and controlling message conditions, r_p = -.027, 95% CI [-.039, -.015].

Feelings of Defiance. Across conditions, feelings of defiance were low. The autonomy-supportive message led to lower feelings of defiance than the controlling message, r_p = -.064, 95% CI [-.076, -.052]. However, we did not find a difference between the no-message and the controlling message conditions, r_p = -.003, 95% CI [-.015, .009].

Short- and Long-Term Behavioral Intentions. People generally intended to socially distance in the next week and intended to continue socially distancing for the majority of the next six months. The autonomy-supportive message condition did not yield differences in one-week social distancing intentions from the controlling message condition, r_p = .009, 95% CI [.001, .021], nor did the no-message condition, r_p = .017, 95% CI [.005, .029]. Similarly, the autonomy-supportive message condition did not yield differences in social distancing intentions in the next six months from the controlling message condition, r_p = -.010, 95% CI [-.023, -.001], nor did the no-message condition, r_p = -.001, 95% CI [-.014, .012]). Thus, we did not find that conditions differed in short- or long-term behavioral intentions to socially distance.

Hypothesis 2

Feelings of Defiance. As expected, autonomous motivation predicted lower feelings of defiance (r_p = -.522, 95% CI [-.530, -.513]). Additionally, controlled motivation predicted higher feelings of defiance (r_p = .222, 95% CI [.211, .234]).

Short- and Longer-Term Behavioral Intentions. Autonomous motivation was associated with greater intentions to socially distance in the next week, r_p = .433, 95% CI [.423, .442], whereas controlled motivation was not related to short-term behavioral intentions, r_p = -.006, 95% CI [-.018, .012]. Autonomous motivation was positively associated with behavioral

intentions to socially distance in the next six months, r_p = .465, 95% CI [.456, .474], whereas controlled motivation was negatively associated with longer-term behavioral intentions, r_p = -.102, 95% CI [-.115, -.090].

Exploratory Analyses

We conducted exploratory analyses using the same analytical approach to test our hypotheses on a subsample of participants who took the study within the first month of their country enacting lockdowns and other policies enabling social distancing (n = 1,981; see *Table 4*).[3] The rationale for this analysis was to examine whether the effects of our manipulation might be larger early-on in the pandemic. In this analysis, we also included a covariate – country's total cases per million – to test for the possibility that the country-specific incidence rate may predict motivation, feelings of defiance, and behavioral intentions. Results showed evidence for an additional experimental effect: the autonomy-supportive message increased autonomous motivation to engage in social distancing relative to the controlling message, r_p = .117, 95% CI [.073, .160]. The effect of the controlling message increasing controlled motivation to engage in social distancing relative to no message remained, r_p = -.107, 95% CI [-.151, -.064]. We also observed a larger effect of the autonomy-supportive message eliciting lower feelings of defiance than the controlling message in this subsample, r_p = -.217, 95% CI [-.258, -.175]. Just as in the full sample, we did not find evidence of a difference between the controlling and no-message conditions on defiance, nor did we find condition differences on short or long-term behavioral intentions. With respect to our exploratory covariate, we found that country-specific incidence

[3] We conducted exploratory analyses prior to peer review that focused on countries with available data in April, 2020. These analyses found the same pattern of results and are described in prior preprint versions: https://psyarxiv.com/n3dyf/.

rate correlated with greater intentions for social distancing in the next six months, r_p = .445, 95% CI [.410, .479].

Discussion

Public health communications play a critical role in managing health emergencies, including during pandemics, to motivate people to engage in behaviors like hand washing, mask wearing, vaccine uptake, and social distancing (26). Here, we tested motivational qualities (autonomy-supportive vs. controlling) of messages about social distancing in individuals recruited across 89 countries. The aim was to identify empirically-supported communication strategies that can be generalized cross-culturally to inform public health practices not only in this but also in future global health emergencies.

We found evidence for two experimental effects: 1) The controlling, pressuring message increased controlled motivation to follow recommendations out of guilt and fear of social punishment more than the messages to which participants had been previously exposed, and 2) The autonomy-supportive message that promoted agency and ownership lowered feelings of defiance relative to the controlling message. Furthermore, exploratory analyses focusing on message delivery early-on in the pandemic (i.e., within the first month after countries instituted lockdowns and other policies urging social distancing) found a third effect: compared to the controlling message, the autonomy-supportive message increased autonomous motivation, or internalizing the value of social distancing. The experimental effects are small according to Cohen's benchmarks (29), but they were in line with effect sizes observed in a meta-analysis of health messaging campaigns, average r = .09, 95% CI [.07, .10], rs ranging from .04 – .15. Notably, this meta-analysis (30) found that effects tend to be smaller for media campaigns motivating avoidance behaviors (e.g., average effect size for smoking cessation media campaigns

was r = .03, 95% CI [.02, .04]), which could explain the small effect sizes we found when motivating people to avoid gathering with others.

However, we did not find evidence for effects of either autonomy-supportive or controlling messages on short- or long-term intentions to follow social distancing recommendations. We consider several possibilities that may contribute to the lack of messaging effects on behavioral intentions. First, it could be due to a ceiling effect of adherence to social distancing recommendations, making it difficult to increase adherence that is already very high. Second, by the time data collection started in mid-April 2020, participants had already been exposed to hundreds, if not thousands, of messages promoting social distancing with varying motivational content. As a result, the potential impact of a single message on people's short-term and long-term intentions to engage in social distancing may be negligible relative to a context where participants were exposed to a new health message for the first, and potentially only, time. As well, the 'dosage' of our intervention - one brief (two minute) written message - is likely less effective than receiving autonomy support during an intervention that might last weeks or months (17). Asking people to alter their daily lives to abstain from social interactions might require more time and effort than the brief online message we provided. Finally, there may be complex factors preventing social distancing (e.g., maintaining one's livelihood, traveling to care for sick relatives) that may require tangible, economic interventions before messages can have an impact (31).

Compared to the experimental effects of motivational messages, people's existing motivations for social distancing were better predictors of behavioral intentions, fully supporting Hypothesis 2. In particular, those who reported higher motivation driven by the value and importance of social distancing expressed greater behavioral intentions to engage in social

distancing in both the short-term and long-term. Conversely, following social distancing rules out of guilt and fear of social punishment correlated with lower long-term behavioral intentions. Further, exploratory analyses focused on the first wave of the pandemic found that higher daily cases were associated with greater long-term intentions to socially distance.

Taken together, results suggest that intentions to adhere to social distancing recommendations were explained more by people's existing motivations and perceptions of viral risk than the messages used in this study. From this data, we can conclude only that autonomy-supportive versus controlling aspects of messages urging social distancing mattered in terms of affecting public sentiments toward social distancing (e.g., increasing feelings of defiance), but not people's intention to carry it out. Even so, public sentiment plays a key role in supporting public health measures and in the effectiveness of managing health emergencies (32, 33).

Design Limitations and Future Directions

First, due to convenience sampling methods, distributions of study variables suggest that our sample was highly autonomously motivated, already engaged in social distancing, and had very low feelings of defiance. Therefore, our results may not be generalizable to those who might have resisted social distancing or those who lived in areas where social distancing rules were not imposed. Additionally, we did not investigate whether message type (autonomy-supportive or controlling) might be more or less effective in influencing outcomes as a function of its source/communicator (e.g., expertise; trustworthiness) (34, 35), cultural context (e.g., individualistic-collectivistic; democratic-authoritarian; cultural tightness-looseness; interpersonal distance preferences) (36–38), local or national infection rates or legal restrictions (6). For example, a recent study by Gelfand et al. (37) suggests that countries that score higher on cultural tightness show lower death rates compared to countries with looser cultures, which tend

to be less strict about norm deviance. As such, it seems plausible that cultural tightness vs. looseness may impact how motivational messages are interpreted, and this should be investigated in future work. Although the current study aimed to identify generalizable benefits and harms of different motivational communication styles, we encourage researchers to use this dataset and the larger PSACR dataset (https://osf.io/gvw56/) to examine these and other questions.

Conclusions

We conclude that in a public health context, autonomy-supportive messages have some benefits over controlling messages for motivation and feelings of defiance (though we did not find evidence that messages mattered for people's behavioral intentions). Messaging effects on motivation and feelings of defiance observed in this study were small, but they likely have meaningful real-world impacts when accumulated across time and global populations (39, 40), whereas their effect on intentions to comply with social distancing recommendations likely do not. The strength of the manipulation used in this study is the ease and efficiency of producing and digitally disseminating these brief messages that can reach a large number of people in a short amount of time. Findings may have similar applications for other public health behavioral recommendations including mask wearing, hand-washing, self-quarantining after exposure, and vaccination, for which evidence of defiance has also been observed (41). Readers seeking further guidance for applying self-determination theory to motivate COVID-19 related behavioral recommendations may also review Martela et al. (42) and Bradshaw et al. (43). Finally, while SDT principles for strategic communication likely apply to motivating other behaviors of interest to public health stakeholders, communications aimed at modifying behavior should be evaluated on many dimensions, including ease of implementation and sustainability of impacts, such as

with the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework (44).

This study represents a major undertaking and truly international collaboration, involving the coordination of labs in 89 different countries and collecting a total sample of 25,718 participants. The strongest findings from this research support the generalizability of meaningful and differential relations between people's existing motivations on public health compliance intentions, suggesting benefits of cultivating autonomous motivation and limiting controlled motivation. The effects of messages were more modest: the controlling message increased feelings of defiance relative to the autonomy-supportive message, and increased controlled motivation - a less optimal form of motivation associated with lower intentions to socially distance - relative to no message. This research, including the cross-national sample and transparent reporting of materials and data (https://osf.io/fc9y7/), can help advance future research and applications of evidence-based health communication on a global scale for the current COVID-19 pandemic and for future public health crises.

Materials and Methods

This study was one of three studies in the Psychological Science Accelerator COVID-19 Rapid Project (PSACR; see https://psyarxiv.com/x976j/ for details about logistics and additional measures administered). Through the Psychological Science Accelerator (PSA) (45), the methodological approach, measures, and analytic strategy received extensive feedback from co-authors and external reviewers before data collection began.

Participants

Through the PSACR project, data were collected from approximately 186 labs[4] across 88 autonomous regions and countries (PSA network labs). Additionally, data from 26 labs across 17 countries (with one non-overlapping country) were collected from self-determination theory (SDT) network labs (invited through the SDT listserv).[5] Participating labs recruited participants via local university subject pools or relied on social media posts and emails to invite those in their personal networks to participate. Additionally, our sample also included 5,304 additional participants recruited through semi-representative panels (quota matched to the general population in terms of sex and age) from the following countries: Austria, China, Egypt, Japan, Kenya, Mexico, Nigeria, Romania, Russia, South Africa, South Korea, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States (with approximately 270 participants per country, on average). Participants' compensation differed depending on how they were recruited and which lab recruited them. As such, some participants received payments, others received course credit at their university, and some did not receive compensation (for more details on recruitment and compensation, see https://psyarxiv.com/x976j/).

After data exclusions (see *Figure 1*), our final sample was 25,718 participants across 89 countries, representing all inhabited continents. See *Supplemental Information Table S1,* for a list of sample sizes corresponding to each country. Of the total sample, 63.3% identified as female (n = 16,273), 33.6% identified as male (n = 8,636), 1.1% indicated that male and female categories did not fit for them (n = 288), and 2% preferred not to respond. The age of the sample ranged between 18 and 89 with a mean age of 37 years (SD = 15.6).

[4] This reflects the number of labs that the PSACR has ethics documentation for data collection; it is possible that a small number of labs may have collected data for another PSACR study (001 or 002) but not ours (003).
[5] All PSA and SDT researchers made at least two contributions to the study (data collection, study design, translation efforts, analysis, reviewing code, study administration, or writing) and approved the manuscript's submission in order to be included as coauthors. Please see the contribution statement for each author's contribution.

Experimental Manipulation

Participants were randomly assigned to an autonomy-supportive message condition, a controlling message condition, or a no-message condition. The autonomy-supportive and controlling message conditions presented comparable information about social distancing, including its definition, its implications for public health during the COVID-19 outbreak, and neutral, informative behavioral recommendations. Alongside this basic content, both messages contained theory-based motivational elements shown in prior manipulations to influence motivation (15, 46). Specifically, those in the *autonomy-supportive message* condition read an article that provided (a) perspective taking (e.g., acknowledging how difficult it is to alter one's daily life), (b) a meaningful rationale (e.g., explaining why social distancing is effective and important for slowing transmission), and (c) a sense of having choice over one's own behavior within the practical constraints of the situation. In comparison, those in the *controlling message* condition read an article that paired information with coercion, shame, and pressure, including the use of demanding language such as 'should' and 'must'. Finally, those in the *no-message* condition did not read any message; instead, they directly responded to the outcome measures.

Measures

For all multi-item measures, items were reverse scored where appropriate, and then combined into composites for our variables. Per the preregistration, if a composite variable did not have acceptable reliability ($\omega_{total} > .70$), we retained items with corrected item-total correlations exceeding .30 (see *Table 1*). The wording of outcome items differed slightly depending on condition. In the autonomy-supportive and controlling message conditions, items referred to "social distancing recommendations in this article", while in the no-message condition, items referred to "social distancing recommendations" (not tied to an article).

Autonomous and Controlled Motivation

Following random assignment to see an autonomy-supportive message, a controlling message, or no message, participants completed a measure of their motivation to follow social distancing recommendations. This measure was adapted from a previous measure of Perceived Locus of Causality (47, 48) for the behavior of social distancing. Participants responded to the prompt "I plan to follow social distancing recommendations [in this article] because" with four autonomous and four controlled reasons for doing so. Example items assessing autonomous motivation included "the recommendations reflect my values" and "it is personally important to me to follow them." Example items assessing controlled motivation included "because others would disapprove of me if I did not" and "I would feel guilty if I did not follow the recommendation." The items were paired with a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). Autonomous and controlled motivation items were aggregated into two separate variables for analyses as both scales showed good reliability (autonomous motivation: $\omega = .90$; controlled motivation: $\omega = .77$).

Feelings of Defiance

Feelings of defiance were measured with four items adapted from Vansteenkiste et al. (49). Items measured feelings of defiance about "recommendations [in this article] on social distancing, or staying home as much as possible" and were rated on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). The items were: "make me feel like I want to do exactly the opposite", "feel aggravating", "feel like an intrusion", and "make me want to resist attempts to influence me". These items showed good reliability ($\omega = .89$).

Short-Term and Long-Term Behavioral Intentions

Intentions were measured at a more abstract level of actions (e.g., "following recommendations to participate in social distancing") as well as at a lower and more concrete level of actions (e.g., "avoid gatherings with friends") as both contribute to goal pursuit (see review by Freund & Hennecke (50)). Our behavioral intention items were adapted from Armitage and Conner (51) and Flannelly and colleagues (52), following an adaptation by McGarrity and Huebner (53), to assess participants' intentions for social distancing. Items assessing short-term intentions asked participants how likely they would be to "follow the recommendation to participate in social distancing" and avoid "gatherings with friends", "going to crowded areas", "taking non-essential shopping trips" in the next week. The response scale ranged from 1 = *extremely unlikely* to 7 = *extremely likely*. The scale showed good reliability for all 4 items combined ($\omega = .88$). The measure for long-term intentions asked "assuming the guidelines [described in the article] last for six months, how long do you intend on avoiding the following in-person places and activities", and the list of activities included: "restaurants", "gatherings with friends", "traveling", "going in crowded areas", "non-essential shopping trips", "getting a haircut or going to the salon", and "going to the gym or fitness classes." These items were rated in one-week increments using a dropdown menu from 0 to 24 weeks. An average score was calculated for all seven items as they showed good reliability ($\omega = .92$).

Demographic Information

Demographics assessed by both PSA and SDT labs were age, gender, education, and country. The PSACR general survey (https://osf.io/ecba8/) also collected additional demographic and background variables related to COVID-19 beyond the scope of this study.

Design and Procedure

All data collection labs followed the ethical guidelines of their institutions. Guidelines

for Internet-based data collection were followed where applicable (54). Each lab (a) received ethical approval from their local Institutional Review Board (IRB), (b) gained approval through Ashland University's Human Subject's Review Board (for the PSA labs) or through Illinois Institute of Technology's IRB (for the SDT labs), or (c) did not require local IRB approval for data collection. All participants provided informed consent before entering the study.

Participants completed the study online between mid-April 2020 and the end of September 2020. Data was collected using *formr* (55) for PSACR labs and Qualtrics for SDT labs. Some participants completed our study along with another PSACR experiment in random order; order was recorded to examine potential carryover effects. For more information about study design, translations, and measures of baseline social distancing adherence and perceived control used for the manipulation check see *Supplemental Information*.

Analytic Plan

Modelling Approach

All analyses were conducted in R (Version 1.3.1056). To account for the nested structure of the data, we used mixed-effects models in the statistical package *lme4* (version 1.1-21) (56). In testing Hypothesis 1, the controlling message condition served as the reference group and was compared to the autonomy-supportive and no-message conditions. For Hypothesis 2, controlled and autonomous motivation were entered as simultaneous predictors.

We focus on random intercept models in the text. We estimated models with and without random slopes, with nearly identical results (see *Tables 2 and 3*). The equation of the random intercept models is as follows:

$$Y_{iC} = \beta_0 + \beta_1 \cdot NoMessage_{iC} + \beta_2 \cdot AutonomySupportive_{iC} + u_{0C} + e_{iC}$$

In this equation, each observation is clustered within grouping variable *c* (country).

$\beta_0$is the overall intercept for reference group (the controlling message condition) and u_{0C} is the random effect of the intercept. The fixed effects include $\beta_1$and β_2, which are the slopes representing the difference between the no-message condition and the autonomy-supportive message condition, respectively, and the controlling message condition.

We used the *TOSTER* package (version 0.3.4) (57) to illustrate fixed effects and their 95% CIs (see *Figure 3*) and calculated partial *r* (r_p) values (standardized effect sizes) using the *r2beta* function in *r2glmm* (version 0.1.2) (58).

Exploratory Analyses

Data collection launched in April 2020 and continued through September 2020. We speculated that communication strategies urging social distancing might have been more impactful early-on in our data collection period, before message fatigue, or exhaustion from prolonged exposure to social distancing messages, set in (21). Thus, we explored message effects among those who completed the study within 30 days of their country first enacting policies aimed at promoting social distancing. To identify those participants, we used the publicly available dataset, *Our World in Data* (59). From this dataset, we extracted two types of information. First, we extracted stringency index data from the Oxford COVID-19 Government Response Tracker (60) to identify when there was the steepest increase in lockdowns and other policies aimed at social distancing (e.g., school closures) within two consecutive weeks. This happened in March and early April for all countries available in our sample. We restricted the sample in exploratory analyses to those who completed the study within the first 30 days after their country's rise in these policies. Second, we extracted data that came from the COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (61) on the incidence rate in a country (cases per million to account for population

differences) at the time participants completed the study. We defined country-specific incidence rate as a covariate in exploratory analyses, allowing us to test the possibility that motivation, feelings of defiance, and behavioral intentions to socially distance would be predicted by case numbers in that country. Together, this analytic approach provided a more sensitive test of a country's unique pandemic experience during its first wave. Because some countries had small amounts of data during this early time period, we only included random intercepts but not random slopes for these analyses.

Open Science Statement

The preregistration, materials, analytic plan, data, and code for this study are openly available on the Open Science Framework (OSF) website at this link: https://osf.io/fc9y7/.

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Table 1
Reliabilities, means, standard deviations, and correlations with confidence intervals

Variable	*Alpha/ Omega*	*ICC*	*M*(*SD*)	Condition *M* (*SD*)								
				C	NM	AS	1	2	3	4	5	6
1. Baseline adherence	.88/.91	0.15	5.24 (1.60)	5.22 (1.62)	5.26 (1.60)	5.23 (1.59)						
2. Perceived control [a]	.67/.67	0.04	3.79 (1.72)	4.15 (1.78)	3.76 (1.67)	3.46 (1.63)	-.13** [-.14, -.12]					
3. Autonomous motivation	.96/.97	0.14	6.02 (1.18)	6.01 (1.21)	5.96 (1.22)	6.09 (1.10)	.38** [.37, .39]	-.35** [-.36, -.34]				
4. Controlled motivation	.71/.77	0.10	4.53 (1.42)	4.68 (1.42)	4.34 (1.45)	4.58 (1.38)	.10** [.09, .11]	.11** [.10, .12]	.28** [.27, .29]			
5. Defiance	.91/.93	0.05	2.71 (1.60)	2.79 (1.68)	2.79 (1.58)	2.54 (1.53)	-.22** [-.24, -.21]	.52** [.51, .53]	-.47** [-.48, -.47]	.04** [.03, .05]		
6. Intention to social distance next 1 week	.91/.93	0.13	5.57 (1.53)	5.54 (1.54)	5.60 (1.53)	5.56 (1.52)	.57** [.57, .58]	-.16** [-.17, -.15]	.46** [.45, .47]	.14** [.13, .16]	-.28** [-.29, -.26]	
7. Intention to social distance next 6 months [b]	.90/.92	0.09	17.51 (6.74)	17.61 (6.77)	17.56 (6.68)	17.37 (6.79)	.39** [.38, .40]	-.28** [-.30, -.27]	.47** [.46, .48]	.05** [.03, .06]	-.41** [-.42, -.40]	.43** [.42, .44]

Note. N = 25,718; *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014).
Condition: C = Controlling; NM = No message, AS = Autonomy-supportive.
** $p < .001$
[a] Only two items were included for this variable: "...try to pressure people", and "...aren't very sensitive to people's needs". The original 3-item measure yielded alpha = .55 and omega = .62. We preregistered that if alpha or omega < .70, the composite would only include items with corrected item-total correlations above 0.30. See more details in *Supplemental Information*.
[b] Excluding erroneous data

Table 2

Random intercept-only models testing confirmatory effects of experimental conditions (Hypothesis 1) and autonomous and controlled motivation (Hypothesis 2) on outcomes

							95% CI around r_p			Variance of
Outcome	**term**	***B***	***SE***	***t***	***df***	r_p	**Lower**	**Upper**	***p***	**random effects**
Autonomous motivation Hypothesis 1	Controlling (intercept)	6.00	0.06	106.56	75.38	.048	.036	.061	<.001	0.192
	vs. No message	-0.04	0.02	-2.09	25648.68	-.012	-.024	.001	.036	
	vs. Autonomy-supportive	0.10	0.02	5.83	25645.52	.034	.022	.046	<.001	
Controlled motivation Hypothesis 1	Controlling (intercept)	4.56	0.06	78.20	77.04	.099	.087	.112	<.001	0.198
	vs. No message	-0.34	0.02	-16.25	25645.61	-.096	-.108	-.084	<.001	
	vs. Autonomy-supportive	-0.09	0.02	-4.51	25641.64	-.027	-.039	-.015	<.001	
Defiance Hypothesis 1	Controlling (intercept)	2.77	0.05	55.77	70.20	.073	.061	.085	<.001	0.127
	vs. No message	-0.01	0.02	-0.45	25412.13	-.003	-.015	.009	.656	
	vs. Autonomy-supportive	-0.25	0.02	-10.50	25406.32	-.064	-.076	-.052	<.001	
Defiance Hypothesis 2	Intercept	6.19	0.07	93.51	290.93	.523	.515	.532	<.001	0.113
	Autonomous motivation	-0.75	0.01	-94.61	25338.81	-.522	-.530	-.513	<.001	
	Controlled motivation	0.23	0.01	36.05	25416.45	.222	.211	.234	<.001	
Intention to avoid 1w Hypothesis 1	Controlling (intercept)	5.40	0.07	75.76	74.21	.017	.007	.030	<.001	0.298
	vs. No message	0.06	0.02	2.92	25234.47	.017	.005	.029	.004	
	vs. Autonomy-supportive	0.03	0.02	1.55	25230.80	.009	.001	.021	.121	
Intention to avoid 1w Hypothesis 2	Intercept	1.98	0.07	27.92	209.14	.446	.437	.456	<.001	0.169
	Autonomous motivation	0.58	0.01	75.36	25253.05	.433	.423	.442	<.001	
	Controlled motivation	-0.01	0.01	-0.98	25265.99	-.006	-.018	.012	.327	
Intention to avoid 6m Hypothesis 1*	Controlling (intercept)	17.16	0.27	64.16	71.51	.012	.003	.025	<.001	3.994
	vs. No message	-0.01	0.10	-0.10	24603.91	-.001	-.014	.012	.923	
	vs. Autonomy-supportive	-0.17	0.10	-1.69	24599.23	-.010	-.023	-.001	.091	
Intention to avoid 6m Hypothesis 2*	Intercept	2.48	0.29	8.69	292.32	.466	.457	.475	<.001	2.087
	Autonomous motivation	2.76	0.03	80.00	24521.60	.465	.456	.474	<.001	
	Controlled motivation	-0.45	0.03	-16.01	24605.03	-.102	-.115	-.090	<.001	

Note. SE, standard error; *df,* degrees of freedom; *B*s are unstandardized coefficients; r_p is the partial standardized effect size for each coefficient; *CI,* Confidence Interval; *1w*, 1 week; *6m*, 6 months; *Excluding erroneous data*;*

N = 25,718; Controlling: *n* = 8,368; No message: *n* = 8,790; Autonomy-supportive: *n* = 8,560; The controlling message was the reference group; We report three decimal places for r_p and its CI since our interval null is r_p = -.025 to .025, and two decimals for all other values.

Table 3

Maximal models testing the confirmatory effect of experimental conditions (Hypothesis 1) and autonomous and controlled motivation (Hypothesis 2) on outcomes, only using countries with a sample size of 210 or above

							95% CI around r_p			Variance of
Outcome	**term**	***B***	***SE***	***t***	***df***	r_p	**Lower**	**Upper**	***p***	**random effects**
Autonomous motivation Hypothesis 1	Controlling (intercept)	5.99	0.08	73.98	34.83	.046	.034	.060	<.001	0.222
	vs. No message	-0.03	0.03	-1.25	23.71	-.012	-.024	-.001	.224	0.012
	vs. Autonomy-supportive	0.10	0.03	3.50	26.29	.033	.020	.046	<.001	0.013
Controlled motivation Hypothesis 1	Controlling (intercept)	4.66	0.08	59.55	34.52	.097	.085	.110	<.001	0.204
	vs. No message	-0.33	0.03	-11.97	19.88	-.094	-.107	-.082	<.001	0.007
	vs. Autonomy-supportive	-0.10	0.02	-3.93	25.08	-.027	-.040	-.014	.001	0.003
Defiance Hypothesis 1	Controlling (intercept)	2.79	0.06	46.37	32.80	.064	.052	.077	<.001	0.111
	vs. No message	-0.04	0.06	-0.69	33.19	-.011	-.024	-.001	.495	0.100
	vs. Autonomy-supportive	-0.24	0.06	-3.69	33.50	-.060	-.073	-.047	.001	0.114
Defiance Hypothesis 2[a]	(intercept)	5.98	0.19	32.14	31.66	.518	.510	.527	<.001	1.041
	Autonomous motivation	-0.74	0.03	-24.60	34.05	-.515	-.524	-.506	<.001	0.027
	Controlled motivation	0.26	0.02	11.71	32.28	.244	.232	.256	<.001	0.015
Intention to avoid 1w Hypothesis 1[a]	Controlling (intercept)	5.37	0.09	60.95	34.61	.016	.006	.030	<.001	0.260
	vs. No message	0.06	0.03	1.82	20.54	.015	.002	.028	.083	0.011
	vs. Autonomy-supportive	0.05	0.02	2.04	521.12	.013	.001	.026	.042	0.000
Intention to avoid 1w Hypothesis 2[a]	(intercept)	2.19	0.20	10.71	34.58	.426	.416	.437	<.001	1.313
	Autonomous motivation	0.55	0.03	16.65	34.90	.414	.404	.424	<.001	0.034
	Controlled motivation	-0.01	0.01	-1.54	12.78	-.011	-.024	-.001	.147	0.000
Intention to avoid 6m Hypothesis 1[a]**	Controlling (intercept)	17.26	0.33	52.09	34.63	.007	.002	.022	<.001	3.521
	vs. No message	0.07	0.12	0.59	20.83	.004	-.013	.017	.561	0.097
	vs. Autonomy-supportive	-0.05	0.15	-0.32	17.70	-.003	-.016	.013	.755	0.248
Intention to avoid 6m Hypothesis 2[a]**	(intercept)	3.36	0.83	4.02	29.92	.454	.444	.464	<.001	20.704
	Autonomous motivation	2.69	0.13	21.18	29.64	.453	.444	.463	<.001	0.474
	Controlled motivation	-0.49	0.07	-7.32	28.65	-.111	-.124	-.099	<.001	0.112

Note. SE, standard error; *df,* degrees of freedom; *B*s are unstandardized coefficients; r_p is the partial standardized effect size for each coefficient; *CI,* Confidence Interval; *1w*, 1 week; *6m*, 6 months; *Excluding erroneous data; *N = 23,554;* Controlling: *n* = 7,688; No message: *n* = 8,059; Autonomy-supportive: *n* = 7,807; The controlling message was the reference group; We report three decimal places for r_p and its CI since our interval null is r_p = -.025 to .025, and two decimals for all other values.

Table 4

Random intercept-only models testing Hypothesis 1, the effects of condition on outcome variables for sample of participants who completed surveys within 30 days since their country's rise in restrictions

							95% CI around r_p			Variance of
		B	***SE***	***t***	***df***	r_p	**Lower**	**Upper**	***p***	**random effects**
Autonomous motivation	Controlling (intercept)	6.35	0.07	92.55	3.07	.120	.082	.167	<.001	0.003
	vs. No message	0.07	0.04	1.68	1976.40	.038	.003	.081	.094	
	vs. Autonomy-supportive	0.24	0.05	5.24	1980.63	.117	.073	.160	<.001	
	Covariate: Total cases per million	-2.78E-06	4.26E-05	-0.07	2.39	.003	.001	.051	.953	
Controlled motivation	Controlling (intercept)	4.97	0.24	20.91	5.43	.123	.085	.170	<.001	0.068
	vs. No message	-0.36	0.07	-4.89	1976.52	-.107	-.151	-.064	<.001	
	vs. Autonomy-supportive	-0.23	0.08	-2.92	1977.58	-.064	-.108	-.021	.004	
	Covariate: Total cases per million	1.01E-04	1.49E-04	0.68	6.97	.064	.020	.108	.519	
Defiance	Controlling (intercept)	2.66	0.09	29.17	2.23	.227	.188	.270	.001	0.004
	vs. No message	-0.42	0.07	-5.83	1955.26	-.130	-.173	-.087	<.001	
	vs. Autonomy-supportive	-0.74	0.07	-9.84	1960.96	-.217	-.258	-.175	<.001	
	Covariate: Total cases per million	1.10E-04	5.49E-05	2.01	1.51	.074	.030	.118	.222	
Intention to avoid next 1w	Controlling (intercept)	6.44	0.06	104.98	0.94	.070	.037	.120	.008	0.001
	vs. No message	0.04	0.06	0.75	1929.64	.017	.001	.062	.451	
	vs. Autonomy-supportive	0.10	0.06	1.66	1943.00	.038	.003	.082	.097	
	Covariate: Total cases per million	7.05E-05	3.49E-05	2.02	0.52	.059	.015	.103	.433	
Intention to avoid next 6m	Controlling (intercept)	15.71	2.07	7.59	5.91	.445	.411	.479	<.001	14.316
	vs. No message	-0.38	0.22	-1.75	1893.51	-.029	-.074	-.002	.080	
	vs. Autonomy-supportive	-0.25	0.23	-1.10	1892.62	-.018	-.063	-.001	.273	
	Covariate: Total cases per million	3.08E-03	8.80E-04	3.50	45.63	.445	.410	.479	.001	

Note. SE, standard error; *df,* degrees of freedom; *B*s are unstandardized coefficients; r_p is the partial standardized effect size for each coefficient; *CI,* Confidence Interval; *1w*, 1 week; *6m*, 6 months; *Excluding erroneous data*;*

N = 1,981; Controlling: *n* = 600; No message: *n* = 760; Autonomy-supportive: *n* = 621; The controlling message was the reference group; We report three decimal places for r_p and its CI since our interval null is r_p = -.025 to .025, and two decimals for all other values.

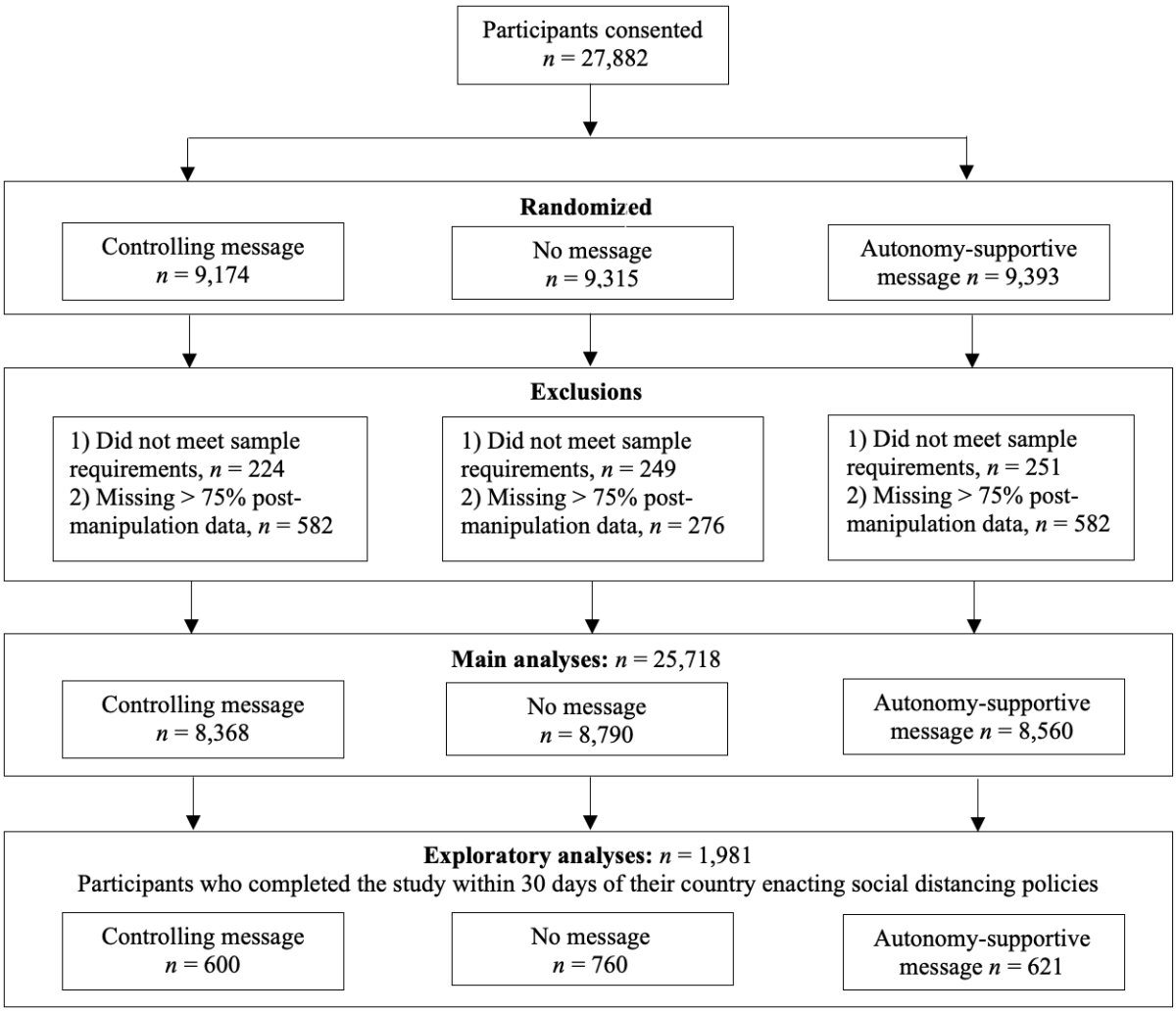

Figure 1. Flow chart delineating the final samples used in analyses

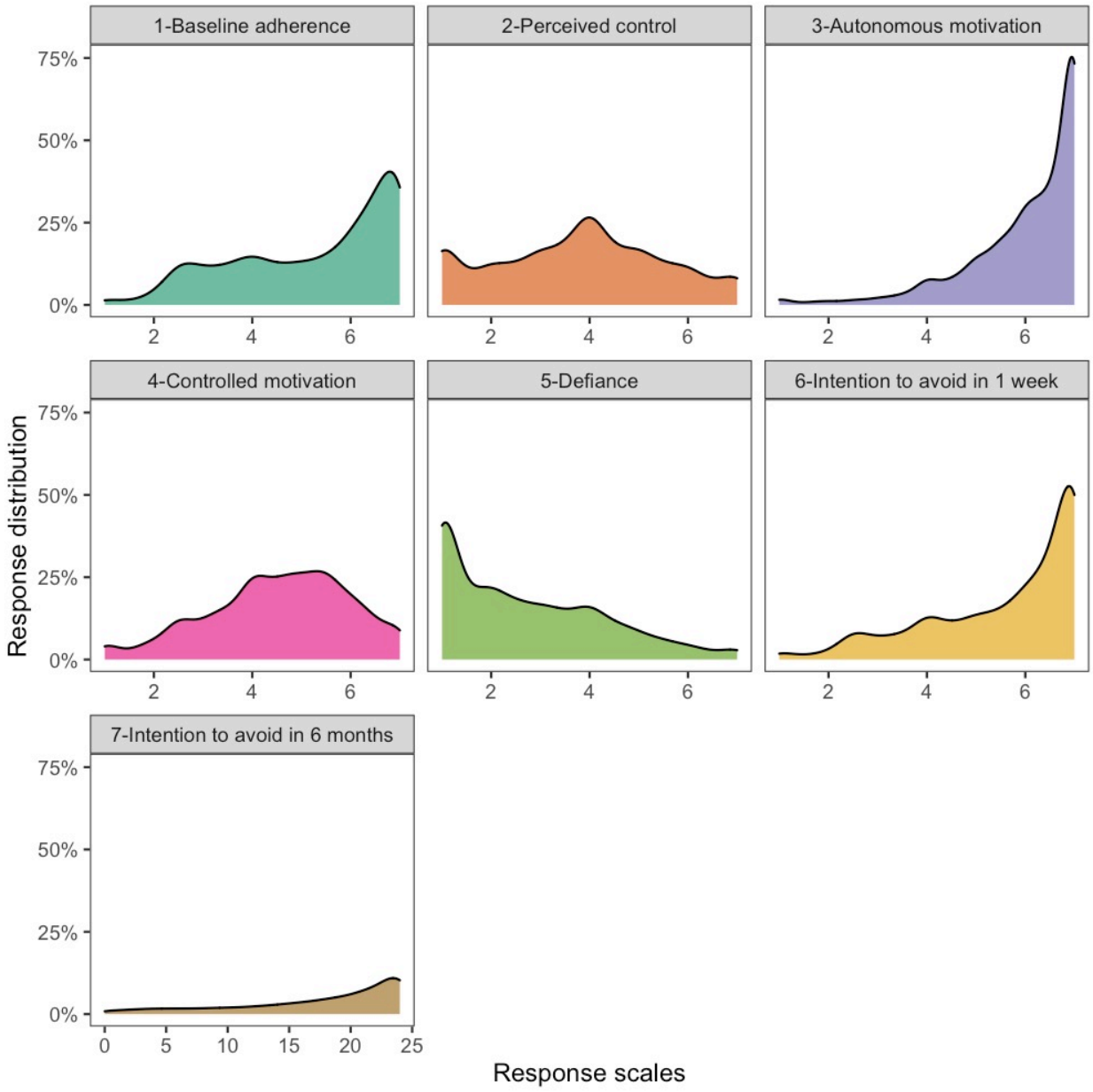

Figure 2. Data distributions for all study variables (y axis indicates proportion of sample and x axis indicates response scales)

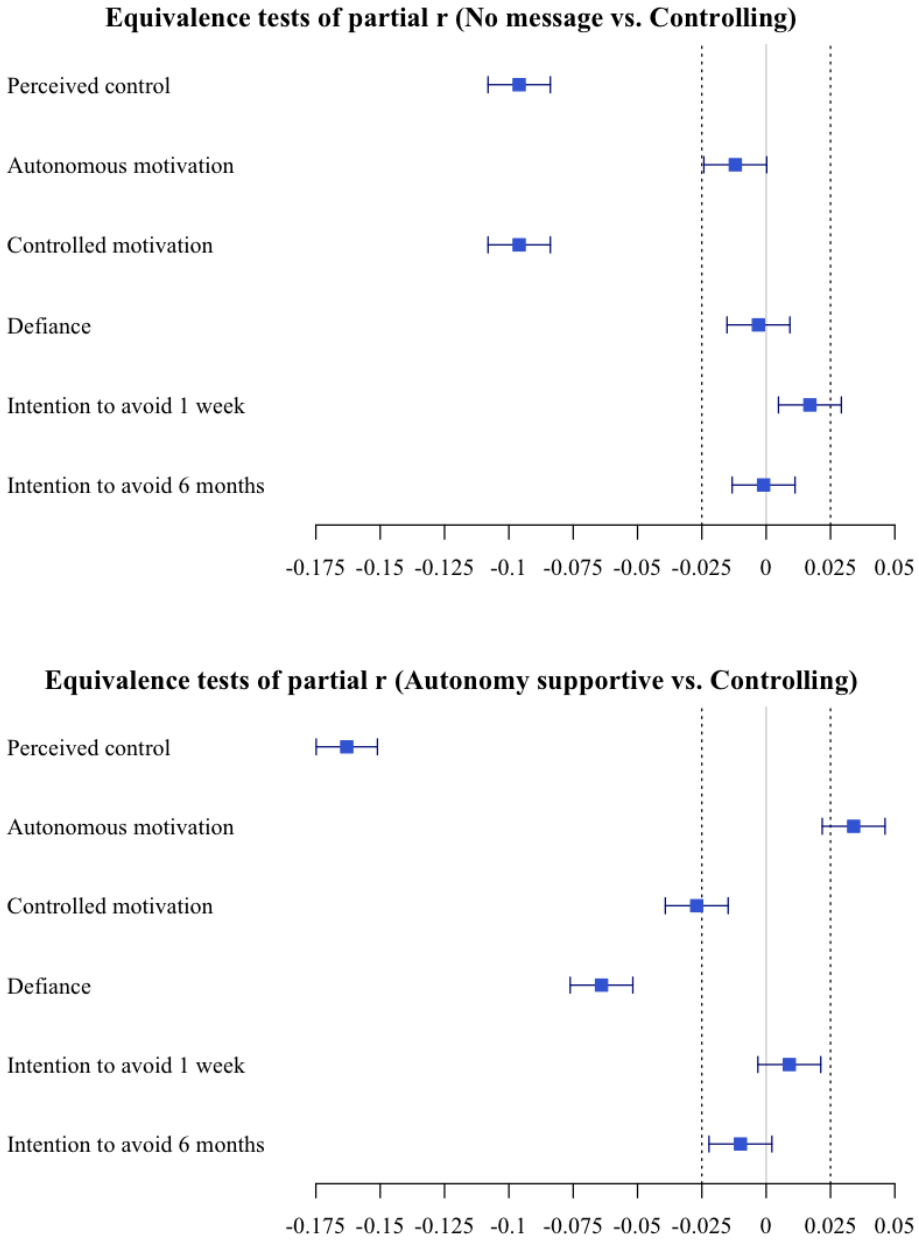

Figure 3. Illustrating confirmatory effects testing Hypothesis 1.
Note. Effect sizes are drawn from intercept-only models in Table 2 (n = 25,718). Values to the left of 0 indicate that no message (or the autonomy-supportive message) yielded lower scores on outcomes than the controlling message. Values to the right of 0 indicate that no message (or the autonomy-supportive message) yielded higher scores on those outcomes than the controlling message. The square represents the observed effect size and the whisker represents the 95% confidence interval (CI); if the effect and its 95% CI falls outside the dotted lines (the interval null of r_p = -.025 to .025), the effect is considered practically meaningful.