finding

Fear & anxiety in the time of COVID-19: How they influence behavior

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abstract

The emotional factors that influence adherence to public health guidelines for containing the spread of COVID-19 are poorly understood and are limiting policymakers' ability to elicit compliance. In this article, we report the results of a nationwide survey conducted in April 2020 to gain insight into the relation between emotional stress and adherence to the public health guidelines of the U.S. Centers for Disease Control and Prevention (CDC). We found that levels of anxiety and perceived risk from COVID-19 correlated with adherence to the CDC's recommended cleanliness behaviors, such as handwashing. High anxiety increased individuals' adherence in part by increasing the perceived seriousness of the risk COVID-19 posed to them. Anxiety and perceived risk were not, however, associated with adherence to social distancing guidelines. Our findings highlight a need for more research into the emotional factors that predict public compliance with the CDC's recommendations. The results also indicate that policymakers may need to deliver different messages to promote different COVID-limiting behaviors, such as handwashing and social distancing.

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Adherence to public health recommendations is essential for the success of any country's response to a pandemic, including the COVID-19 outbreak.[1] Emotional responses to a pandemic would be expected to influence such adherence, yet little is known about the extent to which distress has affected the public's compliance with the COVID-19 guidelines issued by the U.S. Centers for Disease Control and Prevention (CDC). This lack of knowledge can significantly limit the ability of policymakers to design interventions that successfully elicit behaviors that can lessen the spread of COVID-19 and other infectious diseases.

In early spring 2020, we suspected that people who felt the most anxious about COVID-19 would adhere more firmly to the CDC's guidelines than would people who were feeling less anxious and that this response would be explained in part by anxiety increasing their sense of personal risk. To explore the associations among anxiety, perceived risk, and adherence, we conducted a national survey in April 2020 in which respondents reported on their anxiety and on their perception of the risks COVID-19 posed, as well as on their compliance with the CDC's recommendations. In this article, we discuss the findings and their implications for policy interventions.

Methods

We administered the survey to adults across the United States through the online survey platform Qualtrics. Participants were not paid to take part in this particular project, but the company offers participation incentives, such as points for taking surveys that can be exchanged for rewards. Our survey was open from April 10 through April 14, 2020, a time window that offered critical insight into respondents' feelings and behavior relatively early in the pandemic's spread in the United States. Because almost all states and U.S. territories were under mandatory stay-at-home orders by that time, we assumed that participants knew that the pandemic was underway and that those who believed behavior change was necessary to limit COVID's spread had started to alter their daily actions.

Nine of the surveyed respondents did not verify their age, which left a total sample of 1,234 participants. As planned, participant characteristics (see Table S1 in the Supplemental Material) were generally representative of the U.S. population as it was described in 2018 by the U.S. Census Bureau.[2] Twenty-two percent of the respondents were unemployed, and 27% reported experiencing food insecurity in the past month. Eleven percent reported a suspected or confirmed infection with COVID-19. Consistent with our assumption that most people in the United States were being personally affected by the pandemic, the vast majority of participants (79%) reported that they were under a mandatory stay-at-home order (at either the state or the local level); only 6% indicated that they were not sure whether a stay-at-home order was in place.

We elicited self-reports of anxiety by using a well-established instrument, the Patient-Reported Outcomes Measurement Information System (PROMIS) short form measure of anxiety.[3] Participants reported how frequently they experienced particular feelings in the preceding seven days by responding to survey items such as "I felt fearful," "My worries overwhelmed me," and "I felt uneasy" using a scale that ranged from 1 = *Never* to 5 = *Always*.

To assess risk perception, we asked participants to rate how serious a health concern they believed COVID-19 was for them personally, for their immediate family, and for the world. The scale ranged from 1 = *Not serious at all* to 4 = *Very serious*.

We collected detailed information on the frequency with which participants engaged in specific behaviors in four domains: cleanliness, social distancing, staying at home, and use of personal protective equipment in the form of masks and gloves. We selected behaviors included in the CDC guidelines,[4] and we preclassified them as being positive (associated with reduced risk of infection) or negative (associated with increased risk of infection). Examples of the positive behaviors included washing hands for at least 20 seconds, standing at least 6 feet away from people when outside

the home, and wearing a mask when in public. Examples of negative behaviors included meeting face-to-face with others, going to someone's home, hugging or touching people who were not part of the individual's household, and inviting friends or family to visit. The self-reported ratings for cleanliness, social distancing, and use of personal protective equipment used a 5-point scale that ranged, depending on the items, from 1 = *Never* or *Not at all* to 5 = *Always* or *Several times a day.* To assess the extent to which people stayed at home, we asked participants how many times they left their house in the last seven days.

See the Supplemental Material for fuller details on our methods, data analyses, and results.

Results

Emotions

Overall, participants reported higher levels of anxiety than were reported in the general population before the COVID-19 pandemic began.[5] Specifically, the survey population's average score on the PROMIS measure of anxiety was 62—one standard deviation (*SD* = 10.5) higher than that of a representative sample of adults before the pandemic began.

The perception of risk varied, although the majority of people saw COVID-19 as at least somewhat of a threat: 37% of participants rated it a very serious health concern to them personally, 25% considered it serious, and 28% said it was somewhat serious; 10% judged the threat to be not at all serious.

Behavior

Participants reported mixed adherence to the cleanliness behavior recommendations. We considered participants to be adherent to all recommended cleanliness behaviors if they responded *Usually* or *Always t*o the three handwashing items in the survey (washing hands after being out in public, washing hands before eating, and washing hands for at least 20 seconds) and responded at least *Daily* to the item about wiping down frequently touched surfaces. Just about half of respondents (48.8%) said they adhered to recommended levels of all *c*leanliness behaviors.

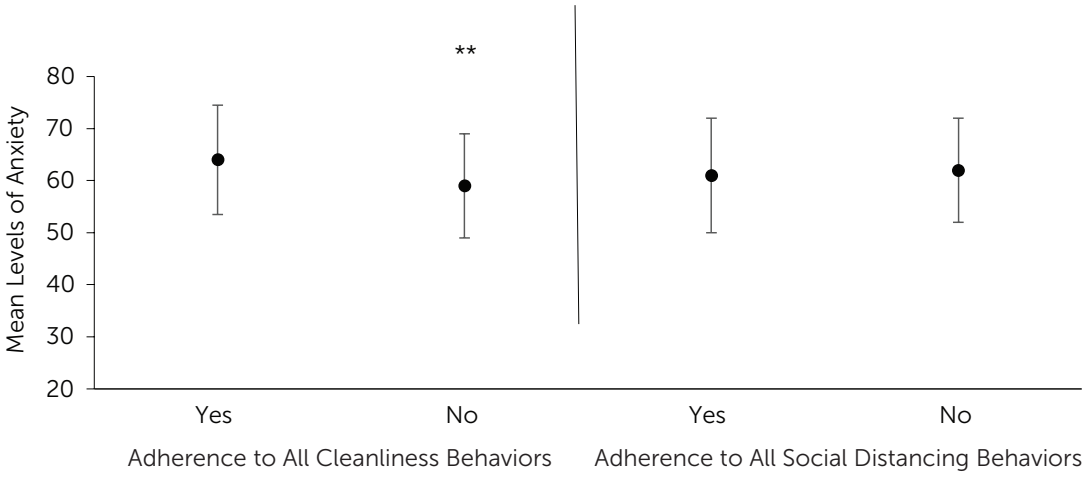
Less than 40% of participants reported adhering to *a*ll social distancing behaviors. We considered participants to be adherent to all social distancing behaviors if they responded *Not at all* when asked how frequently in the past week they had hugged or touched someone outside the household, walked close to someone outside the household, met face-to-face with people who did not live with them, attended gatherings with five or more people, went inside someone else's dwelling, and had friends or family over to visit. Forty percent of participants had at least one person from outside their household enter their home, with almost 3% saying they had five or more individuals enter their home, an action that directly contradicted CDC guidance and many state-level restrictions on social gatherings.

The vast majority of participants (83%) reported leaving their home six or fewer times in the past week, but this number was not a useful measure of adherence to stay-at-home recommendations because it was affected by employment status. Of individuals who reported having left their home, 59.7% reported always staying 6 feet away from others, but only 31.5% reported always wearing a mask. The low mask-wearing figure is striking in that the survey was administered more than a week after the CDC recommended that all individuals wear nonsurgical cloth face covers when out in public.

Anxiety & Adherence

As Figure 1 shows, individuals who adhered to all cleanliness behaviors reported higher levels of anxiety (M = 64, SD = 10.5) than did individuals who did not adhere to all of those behaviors (M = 59, SD = 10) (for the difference between the means, 95% CI [5.9, 3.6], $p < .001$). (For information about the statistical terms used in this article, see note A.) However, we saw no significant difference in anxiety levels between individuals adhering to all social distancing behaviors (M = 61, SD = 11) versus those who did not (M = 62, SD = 10; p = .114). Likewise, we found no relationship between anxiety and the number of times people left their house

Figure 1. Comparison of mean self-reported anxiety levels between U.S. adults who did or did not adhere to CDC recommended behaviors designed to reduce the spread of COVID-19



Note. CDC = U.S. Centers for Disease Control and Prevention. Anxiety was measured using the Patient-Reported Outcomes Measurement Information System short form measure of anxiety. Anxiety is reported in standard scores; that is, the raw data were adjusted so that they could be compared with data from the general population, which is represented as having a mean anxiety score of 50 (*SD* = 10). Error bars indicate 1 standard deviation above and below the mean. Anxiety predicted cleanliness behaviors but not social distancing.

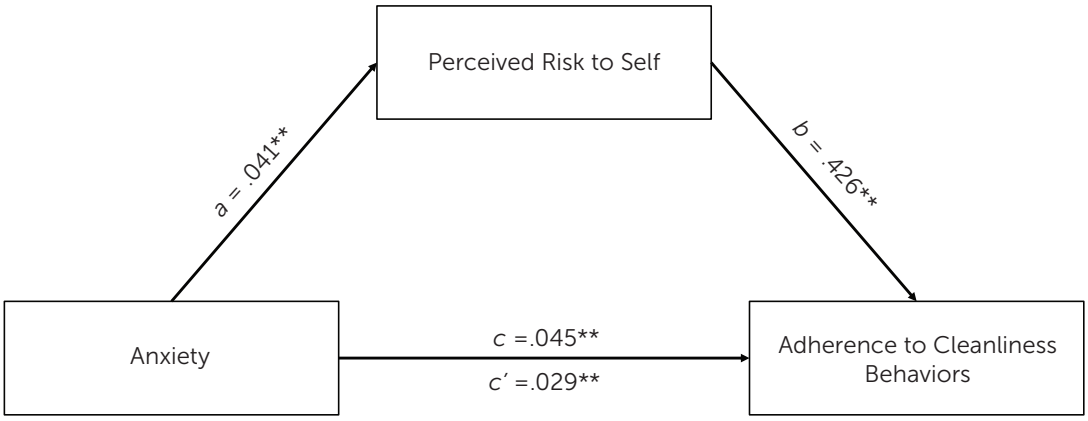
$^{**}p < .001$.

(Spearman's $\rho = -.03$) or between anxiety and the number of people who entered their home (Spearman's $\rho = -.08$). Anxiety did not strongly predict the donning of masks or gloves: the correlations between anxiety and the frequency of wearing personal protective equipment inside and outside the home were small to moderate (Spearman's ρs = .11 and .29, respectively).

We used mediation analyses to explore the mechanism by which high anxiety might lead to enhanced compliance with cleanliness recommendations; such analyses can help explain why certain relationships show up between variables. We found that increased anxiety predicted increased perceptions of personal risk. Moreover, as the perception of risk increased, so did participants' likelihood of reporting that they usually or always washed their hands before eating, washed their hands after being out in public, performed the ablutions for at least 20 seconds, and wiped down frequently touched surfaces in their homes daily. That is, to some extent, greater anxiety led to greater compliance by increasing the perception of risk. In more technical terms, when the relative effects of perceived risk and anxiety were dissected in the mediation analysis, the degree of influence predicted by anxiety alone decreased, which is a sign that perceived risk accounted for the difference. In other words, perceived risk partially mediated the relation between anxiety and adherence. See Figure 2 for the data and a diagram of the relationships.

Because we did not find a relationship between anxiety and adherence to social distancing recommendations, we could not run a mediation analysis involving anxiety, perceived risk, and social distancing. However, we did explore further whether perceived risk for oneself, one's immediate family, or the world predicted social distancing. We found statistically significant correlations, but the effect sizes were so small that measuring perceived risk on any of these dimensions did not improve predictions of whether people would practice social distancing. We also found that being under a stay-at-home order did not correlate with social distancing: individuals who were and were not under a stay-at-home order reported similar levels of adherence.

Figure 2. Anxiety's effects on adherence to cleanliness behaviors as mediated by an individual's perceived risk from COVID-19



Indirect effect (ab) = .017 (*95% Bootstrap CI:* .012–.023)

Note. A mediation analysis of data from a national sample of U.S. adults demonstrated that self-reported anxiety increased self-reported compliance with the U.S. Centers for Disease Control and Prevention's cleanliness guidelines in part by increasing people's perception that COVID-19 posed a serious personal risk to them. The numbers on the plots indicate how much a change in one variable accounted for a change in another variable. The pathway *c* = .045 is the *total effect*, an estimate of the effect of anxiety on adherence when the role of perceived risk is not included in the model. The adjusted pathway *c'* = .029 represents the *direct effect*, the effect on adherence attributed to anxiety alone when the influence of perceived risk is included in the model and controlled for. The .017 *indirect effect* is an estimate of the pathway that runs from anxiety through perceived risk to adherence. The 95% bootstrap confidence interval for the indirect effect is [.012, .023]; it is the interval that resulted when the test was run repeatedly to ensure the stability of the estimates.
**$p < .001$.

Discussion & Implications for Policy

To our knowledge, this is one of the first national explorations of how anxiety and perceived risk might be associated with adherence to CDC-recommended guidelines for minimizing the spread of COVID-19. Only a small number of participants indicated that they adhered to all of the cleanliness and social distancing behaviors suggested by the CDC in April 2020.[4] This level of disregard is striking in self-reports because investigators always expect to see some inflation of reported compliance: respondents tend to provide answers that enhance their image of themselves as responsible members of society (a phenomenon termed *social desirability bias)*. We found that more individuals said they adopted handwashing and disinfecting guidelines than adopted social distancing guidelines, such as limiting hugging and home visitors. Although it is somewhat surprising that people would engage more in one prevention approach than in another, this pattern is similar to results found in other cohorts and using different data collection methods during the same time period at local[6] and national levels.[7]

Our results support the hypothesis that anxiety and perceived risk from COVID-19 could motivate people to adhere to cleanliness guidelines, such as by washing their hands and disinfecting surfaces. As shown in our mediation analysis, anxiety levels largely tracked with how seriously people viewed COVID-19 as a threat to themselves, and this association facilitated compliance with cleanliness guidelines. This pattern is similar to associations found during the H1N1 influenza pandemic in 2009.[8] It suggests that highlighting personal risk may assist policymakers in their efforts to convince the public to increase cleanliness behaviors.

In contrast, anxiety and perceived risk were not related to adherence to social distancing guidance during a time when most individuals were under mandatory stay-at-home orders. This finding indicates that leaning on anxiety and fear of COVID-19 may not help policymakers move the needle on social distancing.

The lack of a correlation between anxiety and social distancing could have a number of explanations. Close social relationships often reduce anxiety,[9] which in turn, could hinder people's motivation to change or curtail socializing during stressful times. In other words, during a pandemic, individuals might seek out contact with people close to them even though repeated face-to-face interactions could increase the likelihood of perpetuating the outbreak. In addition, even for people who have a high level of anxiety and believe that COVID-19 is a serious threat to them personally, social distancing may be hard to implement. Barriers to full social distancing could include having a job that requires working outside of the home, having a living situation that makes it hard to avoid others who are not social distancing, or being homeless. Finally, some individuals who are able to social distance may refuse to do so because they feel it limits their personal freedom.[10] After the H1N1 outbreak, focus groups revealed that even hypothetical social distancing measures were not well received by the public and that trust in the authorities who issued the guidelines was vital to adherence to and adoption of these behaviors.[11] Although Americans complied with the CDC's guidelines imperfectly in early spring, their significant changes in behavior ultimately helped to reduce infection rates.[12] This change, however, came with emotional costs[13] (such as anxiety, depression, loneliness, and panic) and economic costs (such as business[14] and school closures[15]). If the pandemic continues for another year or two, the emotional and financial burdens on families are likely to grow larger and become an even greater barrier to adherence to social distancing recommendations.[16]

Our work provides evidence that articulating personal risk may enhance the effectiveness of messages that urge adherence to cleanliness recommendations but likely will have little impact on social distancing. Our findings also highlight the limitations of current interventions that focus on the danger that COVID-19 poses to individuals. Like others before us,[17] we propose deeper qualitative work on this topic as an important next step in identifying interventions that may better remove barriers to and actively promote social distancing among Americans. Such work would include interviews with individuals and families about the factors that influence whether they adhere to public health recommendations. These interviews will probably need to be ongoing to capture changes that occur with time and world events.

Our study has a number of strengths and limitations worth noting. We developed the survey on the basis of existing high-quality questionnaires, thereby providing support for its validity and allowing us to compare results from our sample with results from past surveys administered to representative samples of Americans. Our design was also preregistered along with a detailed analysis plan to further enhance its validity. We collected data during a unique time in the pandemic that allowed us to capture individuals' behaviors during early stages of the United States' response, before pandemic fatigue and the politicization of responses set in.

One limitation is that our sample differed from the general U.S. population in that it skewed young and had more middle-class participants. These differences are important for two reasons. First, the reported risk at the time of the study was represented as being lower for younger individuals. Second, the higher incomes of the middle-class participants could have enabled our population to exercise more choice over how much they practiced social distancing than was true of people who live in low-income communities. In addition, our study was cross-sectional, providing a snapshot of emotions and behaviors at one point in time. Thus, we were unable to look at changes in anxiety levels and adherence to recommendations; it will be important for researchers conducting future studies to examine such changes.

Conclusions

By early October 2020, the worldwide number of confirmed cases of COVID-19 had reached nearly 36 million, with over 7 million cases in the United States alone.[18] Continued research into the public's developing response to COVID-19 is vital, as was the case with the SARS outbreak in 2003.[19] In light of the finding that anxiety and

perceived risk from COVID-19 promoted handwashing and related cleaning activities but did not motivate survey participants to follow social distancing guidelines, policymakers will need to gain a deeper understanding of the emotional factors that can prompt individuals to restrict their social activities. This understanding is critical if public health messages are to succeed in changing the public's behavior along multiple dimensions as the fight to control the pandemic continues.

In the meantime, our findings and other research suggest actions that should be taken now and refined in light of the findings of future studies. The first is to continue to develop communications that inform people about the serious personal risk posed by the virus, although clearly this tack alone is insufficient. We also recommend that policymakers monitor emotional reactions to communications and dissect when the messages are helpful and when they are counterproductive. Further, it is extremely important for policymakers and information sources to foster a sense of trust, especially when asking individuals to make significant changes to their personal behavior. Finally, we recommend that policymakers recognize that different approaches and messages may well be needed to improve the public's adherence to different guidelines, such as the need for hand hygiene and the need to practice social distancing.

endnote

A. Editors' note to nonscientists: For any given data set, the statistical test used—such as the chi-square (χ^2), the *t* test, or the *F* test—depends on the number of data points and the kinds of variables being considered, such as proportions or means. An *r* value or a Spearman's ρ represents the correlation between two variables; values can range from –1 to 1, with 0 indicating no correlation, 1 indicating a perfect positive relationship, and –1 indicating a perfect inverse relationship. The *p* value of a statistical test is the probability of obtaining a result equal to or more extreme than would be observed merely by chance, assuming there are no true differences between the groups under study (this assumption is referred to as the *null hypothesis)*. Researchers traditionally view $p < .05$ as the threshold of statistical significance, with lower values indicating a stronger basis for rejecting the null hypothesis. Standard deviation is a measure of the amount of variation in a set of values. Approximately two-thirds of the observations fall between one standard deviation below the mean and one standard deviation above the mean. Standard error uses standard deviation to determine how precisely one has estimated a true population value from a sample. For instance, if one were to take enough samples from a population, the sample mean ± 1 standard error would contain the true population mean around two-thirds of the time. A 95% confidence interval for a given metric indicates that in 95% of random samples from a given population, the measured value will fall within the stated interval.

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