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Implicit and Explicit COVID-19 Associations and Mental Health in the United States: A Large-Scale Examination and Replication

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Abstract

Background: Given the sensitive nature of COVID-19 beliefs, evaluating them explicitly and implicitly may provide a fuller picture of how these beliefs vary based on identities and how they relate to mental health.

Objective: Three novel brief implicit association tests (BIATs) were created and evaluated: two that measured COVID-19-as-dangerous (vs. safe) and one that measured COVID-19 precautions-as-necessary (vs. unnecessary). Implicit and explicit COVID-19 associations were examined based on individuals' demographic characteristics. Implicit associations were hypothesized to uniquely contribute to individuals' self-reports of mental health.

Methods: Participants (N=13,413 US residents; April-November 2020) were volunteers for a COVID-19 study. Participants completed one BIAT and self-report measures. This was a preregistered study with a planned internal replication.

Results: Results revealed older age was weakly associated with stronger implicit and explicit associations of COVID-as-dangerous and precautions-as-necessary. Black and Asian individuals reported greater necessity of taking precautions than White individuals (with small-to-medium effects); greater education was associated with greater explicit reports of COVID-19-as-dangerous and precautions-as-necessary with small effects. Replicated relationships between COVID-as-dangerous explicit associations and mental health had very small effects.

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Conclusions: Implicit associations did not predict mental health but there was evidence that stronger COVID-19-as-dangerous explicit associations are weakly associated with worse mental health.

Keywords

COVID-19; implicit associations; mental health; anxiety; depression; United States

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The year 2020 was marked by the spread and resulting casualties of the Coronavirus disease 2019 (COVID-19). According to the Centers for Disease Control (CDC), there were 344,497 total deaths in the United States from COVID-19 by the end of 2020 (CDC, 2021). In addition to the physical symptoms and outcomes of COVID-19, there have also been documented negative effects on mental health (e.g., Salari et al., 2020). Despite these consequences, beliefs about the virus are highly politicized (Hardy et al., 2021), including beliefs about the importance of preventing the spread of the virus and the dangerousness of the virus once someone is infected. Because attitudes about COVID-19 are politicized and sensitive, examining them on both an explicit and implicit level may allow us to understand the fuller picture of how these beliefs vary based on demographic characteristics and mental health. In the current study, we examined associations between COVID-19 beliefs and symptoms of mental health problems given the high levels of stress and uncertainty associated with determining risk from, and appropriate management of, COVID-19. Specifically, three brief implicit association tests (BIATs; Sriram & Greenwald, 2009) were created to examine these implicit beliefs. Two were created that measured COVID-19-as-dangerous (vs. safe) and one measured COVID-19 precautions-as-necessary (vs. unnecessary). These were developed to examine relatively automatic, less consciously controlled associations tied to COVID-19 and their explicit counterparts, and we examined whether these associations predicted current symptoms of anxiety and depression, and emotional well-being.

Implicit Associations

Although there are numerous definitions provided in the literature for implicit associations, we define them as “representations in memory that link a stimulus and an involuntarily activated evaluative outcome and that do not require conscious reflection to influence affect, cognition, or behavior” (Teachman et al., 2019; pg. 124). Although models often emphasized the independence of implicit and explicit cognition (Greenwald et al., 1998), more recent models consider how these representations interact and are interpreted (and reinterpreted) over time. As an example, the iterative reprocessing model (Cunningham & Zelazo, 2007) suggests that initially, with fewer iterations, evaluations are relatively more automatic, but with more iterations over time, these evaluations incorporate additional information and context, and these additional iterations allow for more reflection on the evaluation. Notably, new information can be incorporated at all levels in the iterative process, suggesting that relatively more implicit and relatively more explicit associations can be updated over time. Not only are implicit associations dynamic but they can also be formed relatively quickly; simply encoding information about stimuli have been found to initiate implicit attitude formation (Betsch et al., 2001) and new information about existing attitudes can influence implicit associations outside of conscious awareness immediately (Tucker Smith et al., 2012). This suggests that despite the relatively short period of time between the onset of the pandemic and data collection, implicit attitudes toward the pandemic were likely evident and potentially influencing affect, cognition, or behavior.

Implicit measures that focus on topics about which individuals would want to portray themselves positively (e.g., socially sensitive topics) have demonstrated incremental predictive validity above explicit reports (Kurdi et al., 2019). In the current COVID-19 politicized context, there may be times when individuals are more likely to want to present themselves in a socially desirable manner or may even have difficulty introspecting on the full range of their complex beliefs about the virus. Thus, there may be divergence between self-reported beliefs about COVID-19 (explicit reports) and relatively less consciously controlled, implicit associations about the dangerousness of COVID-19 and the importance of precautions.

In the context of mental health, researchers have largely focused on how implicit associations about specific mental health symptoms relate to self-reported experiencing of those symptoms. For example, implicit associations related to anxiety, depression, alcohol use, and disordered eating relate to disorder-matched, self-reported mental health symptoms in a large, unselected sample of volunteers (Werntz et al., 2016). Moreover, implicit associations tied to drinking relate to levels of drinking alcohol (Lindgren et al., 2018), and death-related implicit associations predict suicidal behaviors (Nock et al., 2010; Sohn et al., 2021). Given the changes in psychological well-being in the wake of the pandemic, we were particularly interested in whether implicit and explicit beliefs specifically tied to COVID-19 would relate to self-reported symptoms of anxiety and depression, in addition to self-reported emotional well-being.

Mental Health during the COVID-19 Pandemic

Compared to early 2019, anxiety and depression were more prevalent during the initial months of the pandemic in the US, with more than one-third of adults screening positive for depressive disorders, anxiety disorders, or both in April and May of 2020 (Twenge & Joiner, 2020). A review of available evidence suggests that this rise may have been most pronounced early in the pandemic (Aknin et al., 2021). COVID-19 also presumably has exacerbated existing mental health concerns. Adults in the US and Canada with current (or past year) anxiety or mood disorders were more likely to self-isolate during the COVID-19 pandemic and reported greater stress associated with self-isolation when compared to adults who did not have a current anxiety or mood disorder (Asmundson et al., 2020).

In a recent examination of political attitudes and COVID-19 beliefs in the US, results revealed that those on the right end of the political spectrum not only exhibited less willingness to wear a mask, receive a vaccine, and lower adherence to COVID-19 regulations, but they also exhibited lower levels of symptoms of anxiety (Hardy et al., 2021). Although speculative, it may be that less strong beliefs about the dangerousness of COVID-19 and the importance of taking precautions are related to better mental health (at least in the short term) because one is not worrying about their health. This would make intuitive sense because it is likely that those who are worried about contracting or spreading the disease would be particularly likely to feel distressed. Support for this hypothesis comes from evidence suggesting that individuals with more pre-existing health conditions (who are more likely to experience adverse health effects from COVID-19 infection) were found to have worse self-reported mental health during the initial phase of the pandemic compared to those with fewer pre-existing health conditions (Zhou et al., 2020).

COVID-19 Associations and Mental Health

In the current study, we examined whether implicit associations tied to COVID-19 relate to measures of mental health. We predict that those who believe more strongly that COVID-19 is dangerous will have worse self-reported mental health because they will be especially concerned about staying safe and healthy. Moreover, we predicted that those individuals who more strongly believe it is important to take precautions against spreading the virus will also have self-reported worse mental health because they will be worrying about the potentially harmful implications of their and others' behaviors. Notably, we use the phrase "worse mental health" simply to refer to higher levels of symptoms, though certainly acknowledge this glosses over important questions about what levels of anxiety and sadness are in fact adaptive in the face of an objective health threat. We are particularly interested in these implicit beliefs about COVID-19 because they are likely elicited frequently (given the pervasiveness of COVID-19 news, discussions, and effects on our day-to-day lives) and likely not always within one's conscious control or awareness. For example, someone who has very strong COVID-19-as-dangerous implicit associations may go through their day automatically thinking "danger!" or feeling on-edge each time they encounter something associated with COVID-19. This continued threat activation likely has a negative influence on mental health and well-being. Because implicit and explicit beliefs can diverge (Nosek, 2007), we are also curious whether implicit associations will also incrementally predict mental health symptoms above and beyond self-reported beliefs about COVID-19. This will allow us to understand whether those beliefs that are relatively less consciously controlled are uniquely related to mental health symptoms during the pandemic.

Current Study and Hypotheses

The goal of the current research was to examine three novel COVID-19 BIATs: two focused on COVID-19-as-dangerous (compared to injuries in one condition and to natural disasters in another) and one focused on COVID-19 precautions-as-necessary (compared to unnecessary). These measures were developed soon after COVID-19 was declared an international pandemic on March 11, 2020 (World Health Organization, 2020). Thus, measures in the current study are limited by available knowledge at the time (e.g., this study was developed during a time when mask-wearing was actively discouraged in the US by the CDC).

First, we examined whether COVID-19 implicit and explicit associations vary by demographic characteristics (age, gender, race, ethnicity, and education) to allow us to better understand how beliefs about COVID-19 may vary based on background and identities. These analyses were exploratory. Second, we tested whether implicit and explicit associations relate to self-reported symptoms of anxiety and depression, and emotional well-being. If there is a relationship and it is linear, we predicted that stronger COVID-19-as-dangerous (compared to both natural disasters and bodily injuries) and COVID-19 precautions-as-necessary implicit associations will be related to worse self-reported mental health. If the relationships are nonlinear, we predicted that strong COVID-as-dangerous and COVID-precautions-as-necessary implicit associations would be related to worse self-reported mental health, and that moderate COVID-as-dangerous implicit associations may be more adaptive so would not necessarily relate to measures of mental health. Third, we tested whether implicit associations predict mental health difficulties above and beyond explicit reports. We hypothesized that implicit associations would incrementally predict self-reported mental health above and beyond explicit reports.

This research was conducted on the public website Project Implicit Health, which is a research and education website that allows visitors to participate in ongoing research studies and learn more about their own implicit associations tied to physical and mental health. The COVID-19 measures were launched soon after the pandemic started (April 2020), and the current project focuses on the first seven months of data collection. Given the large sample size, we opted for an internal replication design for the study. Hypotheses and analytic plan for the first sample were preregistered prior to data analysis (https://osf.io/5c9gq/?view_only=9ae25454376e44c987035955263b35ed), and then following analyses of the first sample, hypotheses and a plan for analysis was preregistered for the replication sample (https://osf.io/ftv9z/?view_only=9f5feb57ecce4d3493c5d99e4f6f3d0f). [Note: preregistrations have identifying information about authors]

Method

Participants

Between April 1, 2020 and November 1, 2020, 49,249 individuals clicked on the “COVID-19: Do you implicitly associate COVID-19 with danger? Do you think the precautions are reasonable?” task on Project Implicit Health (www.ProjectImplicitHealth.com). Volunteers come to the site for a number of reasons, including to complete an assignment for school or work, because they are interested after reading about the site in the media, or because a friend or coworker recommended visiting the site. To ensure participants are at least 18-years-old, they must type in their age prior to informed consent. Data was collected from all of those who accessed the study (N=49,249). Of those who accessed the study, 19,955 (40.5%) did not enter an age prior to the informed consent and 1454 (2.9%) reported an age below 18 years; both groups were not allowed to complete the study. Thirty-two (0.1%) individuals who reported an age 100-years-old or older at the beginning of the study were permitted to participate, however their data were cut prior to analyzing the data given concerns about the validity of their age reports. This resulted in 27,542 participants (see Online Supplement A for detailed information on data cleaning). Of those participants, we selected only individuals who reported the “United States” as their residence for the current study, n=13,413. We limited the sample to individuals who indicated United States as their country of residence to reduce this aspect of sample heterogeneity given the unique political climate during the pandemic (consistent with our preregistration). In the final sample, 12,796 (95.4%) participants were also US citizens; the remaining 617 participants were US residents but not citizens. See Table 1 for sample characteristics. This study was approved by the University of Virginia's Institutional Review Board (#2304).

Measures

Demographics—Demographic information was collected from participants, including gender, ethnicity, race, education, country of citizenship, country of residence, and zip codes. Age collected prior to informed consent was used for analyses.

Implicit associations—Implicit cognitions related to COVID-19 were measured using three BIATs (Sriram & Greenwald, 2009). The Implicit Association Test (IAT; (Greenwald et al., 1998) and related variants (e.g., the Brief Implicit Association Test, or BIAT; (Sriram & Greenwald, 2009) are relatively more indirect measures of the relative association strengths between concepts; these measures assess the speed at which someone categorizes exemplars from various categories (Greenwald et al., 2022). BIATs were used for this study because the BIAT is shorter than the IAT, which reduces participant burden, and it does not require an explicitly labeled comparison category (though it is still a relative measure). Moreover, the BIAT is more commonly used than the SC-IAT (Karpinski & Steinman, 2006) and has good psychometric properties (Bar-Anan & Nosek, 2014).

The *dangerous* (dangerous, unsafe, risky, harmful), *harmless* (harmless, safe, peaceful, gentle), and *COVID-19* (Coronavirus, fever, shortness of breath, coughing) stimuli were consistent across both COVID-as-dangerous BIATs. The first set of background stimuli used *accidental injuries* (accident, broken bone, injuries, falling) as the comparison category for COVID-19, and the second used *natural disasters* (volcano, hurricane, earthquake, tornado) as the comparison category. Accidental injuries were chosen as a comparison category given that they are also a bodily threat that individuals may encounter. Natural disasters were chosen because those are threats on a larger scale that a population may encounter (rather than at an individual level). We were interested in whether the BIATs with two different comparison categories (each capturing different aspects of the scope and nature of the threat posed by COVID-19) would relate differently to our other variables of interest. The third BIAT assessed implicit association strength between *COVID-19 precautions* (wash hands, physical distance, stay home, disinfect surfaces, wear a mask) and *overreaction* (overreaction, hype, myth, hysteria) vs. *necessary* (necessary, important, needed, essential), and the comparison category was *driving precautions* (drive carefully, wear seatbelt, watch the road, check fuel level). Driving precautions was selected as a comparison because, like *COVID-19 precautions,* it captured recommended actions individuals could take to prevent harm.

The study launched on April 1, 2020—three weeks after COVID-19 was declared an international pandemic. Exemplars for *dangerous* and *harmless* were chosen by members of the core research team identifying synonyms and discussing ease of categorization; we were careful to select words that were relatively similar in length and familiarity. *COVID-19* exemplars were chosen based on available information about the virus at the time; *fever*, *shortness of breath, coughing* were the central symptoms discussed in the news at the time. *Natural disasters* exemplars (*volcano, hurricane, earthquake, tornado*) were chosen as serious, noteworthy natural disasters that were likely to affect a large number of individuals; however these are rather different from COVID-19 in that they are limited geographically in terms of their influence. *Noninfectious injuries* (*accident, broken bone, injuries, falling*) were chosen as common injuries that individuals face. *COVID-19 precautions* were selected based on CDC recommendations at the start of the pandemic in the US. *Driving precautions* were selected as a comparison category given that they are strong recommendations given to most individuals, individuals can choose whether to follow the recommendations, and they capture recommended actions that people can take to prevent harm to themselves or others, akin to the CDC recommendations for COVID at the time. Exemplars for this category were chosen based on common driving precautions, while aiming to select exemplars that were similar in length to the COVID-19 precautions (i.e., multiple words). Exemplars for *overreaction* (*overreaction, hype, myth, hysteria*) and *necessary* (*necessary, important, needed, essential*) were again selected as common synonyms for the category words. When selecting the stimuli, we wanted to be sure that the exemplars were similar in length to the COVID-19 exemplars so that individuals were less likely to sort based on physical characteristics of the exemplars (e.g., length of exemplars/number of letters on the screen).

These decisions emerged from conversations with the research team as COVID-19 was gaining international attention in February and March 2020. The research team (including clinical, health, and social psychologists) has extensive experience developing health- and mental health-related implicit tasks, though we were of course limited by the knowledge and recommendations available at the time (e.g., masks were not initially recommended for the public). We elected to launch the study fairly rapidly (relying on best practices to make design decisions, rather than doing full pilot validation studies) given the timeliness of the evolving health threat.

During the IAT task, the participant sorted stimuli as they appeared one-at-a-time at the center of the screen as to whether the word *belonged* or *did not belong* to one of the superordinate categories presented. As an example, in the Injury- and Natural Disaster-BIATs, participants would see the categories *dangerous* and *COVID-19* presented together at the top center of the screen. As exemplar words from each of those categories (in addition to words from the *harmless* and *natural disasters* or *accidental injuries* categories, respectively) appeared, participants would press the "I" key if the word belonged to one of the presented categories, or the "E" key if the word did not belong. In the next block, *harmless* and *COVID-19* would be presented together at the top of the screen, and again participants would sort exemplars into whether they belong or do not belong to either of the superordinate categories. There were eight alternating blocks, with a total of 160 trials per task. Mean reaction time differences across the blocks based on pairing were used to calculate a D score (Nosek et al., 2014), which indicated the relative implicit association strength. More positive scores on the Injury- and Natural Disaster-BIATs indicated stronger COVID-19-as-dangerous (vs. COVID-19-as-harmless) implicit associations; more positive scores on the Precaution-BIAT indicated a stronger COVID-19 precautions-as-necessary (vs. precautions-as-overreactions) implicit association strength. D scores can range from −2 to

2, and a score of 0 represents similar reaction times to sorting stimuli across blocks, which suggests no bias in implicit associations.

BIAT internal consistency.: Internal consistencies were calculated only for participants with valid *D* scores and did not include extreme outliers, see Data Analytic Plan below. Reliability for BIATs can be scored by examining the correlation between the first and second pairs of BIAT response blocks (blocks with the same pairings) (Nosek et al., 2014). When using this method, correlation strengths were low: .35 for the Injury-BIAT, .38 for the Natural Disaster-BIAT, and .39 for the Precaution-BIAT. When using the Cronbach's alpha feature in SPSS between the *D* scores for the first and second pairs of response blocks, scores were higher; Cronbach's alpha was .54 for the Injury-BIAT, .51 for the Natural Disaster-BIAT, and .56 for the Precaution-BIAT, which is fairly typical for BIATs and better than many reaction time measures (Bar-Anan & Nosek, 2014), albeit lower than many explicit measures.

Explicit associations—Participants rated the extent to which they explicitly associate the concepts from the BIATs, described above. Semantic differential items (e.g., Ranganath & Nosek, 2008) were 9-point Likert-type items. Participants who completed the Injury-BIAT or Natural Disaster-BIAT were asked to explicitly rate "To what extent do you think of COVID-19 as dangerous or safe?," and "To what extent do you think of natural disasters as dangerous or safe?," or "To what extent do you think of accidental injuries as dangerous or safe?" based on the comparison category in the BIAT. Response options ranged from *extremely safe* (1) to *extremely dangerous* (9). In the Precaution-BIAT condition, participants answered "To what extent do you think of the COVID-19 precautions governments are requiring/recommending (e.g., social distancing, staying home, washing hands) as necessary or overreactions? They are…" and "To what extent do you think of the safe driving precautions governments require/recommend (e.g., driving carefully, wearing a seatbelt, watching the road) as necessary or overreactions? They are..." using a scale from *complete overreactions* (1) to *completely necessary* (9). Cronbach's α for two-item explicit scales were .58 (Natural Disaster), .53 (Injury), and .60 (Precaution). We speculate that the Cronbach's alpha for the two-item explicit scales is somewhat low because individuals held differing attitudes on the two items presented. For example, low Cronbach's alpha suggests that participants did not rate the dangerousness of COVID-19 and natural disasters similarly. It is also harder to have a reliable measure when there are so few items.

In all three conditions, differences between responses were calculated to create a relative explicit association score to mirror the BIAT's relative structure. Scores can range from −8 to 8, with a score of 0 representing no bias in explicit associations between concepts. Higher scores represent stronger COVID-19-as-dangerous (vs. COVID-19-as-harmless) explicit associations in the Natural Disaster and Injury conditions; higher scores represent greater COVID-19 precautions-as-overreaction (versus COVID-19 precautions-as-necessary) explicit associations.

Mental Health

Depression and anxiety.: Depression and anxiety were measured using the Patient Health Questionnaire-4 (PHQ-4; Kroenke et al., 2009). This measure assesses depression and anxiety with two questions for each domain. A sum of the anxiety items and depression items represent the anxiety and depression subscales, respectively. This brief measure has strong psychometric properties (Löwe et al., 2010). The anxiety and depression subscales were only calculated for those who completed both items from each subscale. Cronbach's α for all four items was .85, suggesting good internal consistency in the current sample.

COVID-19's perceived effect on emotional well-being.: We asked participants: "COVID-19 is affecting people in different ways. Please indicate in what ways the following areas of your life have been disrupted as a result of COVID-19: Emotional well-being (e.g., anxiety/sadness/stress/worry)." Response options were on a seven-point Likert-type scale from *extreme positive change* (7) to *extreme negative change* (1), with greater responses indicating better well-being in response to COVID-19.

Procedure

Following informed consent, participants completed tasks in a randomized order: demographic questions; mental health questions; explicit associations; and BIATs. Participants were randomly assigned to one of the BIAT conditions. Participants received the explicit association items that corresponded to the BIAT they completed. Participants could leave the study at any point, which resulted in missing data. Participants who completed the study were fully debriefed and were given the option to view their BIAT results.

Data Analytic Plan

Data were downloaded on November 1, 2020 (data collection is still ongoing as of the writing of this manuscript). All BIATs were scored following current scoring recommendations (Nosek et al., 2014) by the second author using R (R Core Team, 2013). There were 3804 Natural Disaster-, 3732 Injury-, and 3380 Precaution-BIAT scores calculated. Per Nosek et al.'s scoring recommendations, scores were excluded from analyses if a participant responded to more than 10% of trials faster than 400ms, if more than 30% of trials were incorrect, and/or if the participant completed fewer than 150 of 160 trials during the task. This resulted in 518 (13.6%) of Natural Disaster-BIAT scores, 655 (17.6%) of Injury-BIAT scores, and 899 (26.6%) of Precaution-BIAT scores being removed from the dataset.[1] Note that these exclusion rates are higher than previously-reported BIAT scores on Project Implicit Health (Werntz et al., 2016), which we suspect was due to the complexity of the associations and comparison categories being measured. Given this, additional analyses

[1]In the natural disaster condition, 550 (9.0%) had greater than 10% of trials faster than 400ms; in the injury condition 588 (9.6%), and in the precaution condition 695 (12.0%) had greater than 10% of trials faster than 400ms. In the natural disaster condition, 632 (12.8%) participants had error rates greater than 30%; in the injury condition, 846 (17.3%), and in the precaution condition, 1677 (32.2%) had error rates greater than 30%. In the natural disaster condition, 11 (.2%) participants, in the injury condition, 18 (.4%), and in the precaution condition, 595 (11.4%) participants with D scores had fewer than 150 (of the 160) trials for the BIAT. D scores were removed for individuals with greater than 10% of trials faster than 400ms, overall error rate greater than 30%, and/or if they completed fewer than 150 trials of the task. This resulted in 669 (13.6%) scores removed from the natural disasters condition, 877 (17.9%) scores removed from the injury condition, and 1943 (37.3%) scores removed from the precaution condition.

to examine error rates by stimulus and by category pairings for all three BIATs are reported in the Results.

One percent of participants did not report gender (*n*=154), 2.3% did not report education (*n*=314), 1.7% did not report race (*n*=227), 1.6% did not report ethnicity (*n*=227), and 12.1% either did not report their zip code or reported a zip code that could not be translated into a state (*n*=1619). Given that age was used to screen participants, all participants in the final dataset had a reported age. Other missing data were: 7.8% of participants did not have an explicit association response (*n*=1046), 7.7% did not complete PHQ-4 anxiety questions (*n*=1034), 7.7% did not complete PHQ-4 depression questions (*n*=1032), and 10.1% did not answer the emotional well-being question (*n*=1355).

Participants with missing data were retained in the data; pairwise deletion was used in the case of missing variables. Prior to performing analyses, variables were checked for normality and outliers. BIAT scores and mental health measures had acceptable skewness and kurtosis and were normally distributed based on visual inspection of Q-Q plots. Median absolute deviation (MAD; Leys et al., 2013) was used to identify and remove outliers; 14 (0.1%) injury BIAT scores, 15 (0.1%) natural disaster BIAT scores, and 9 (0.2%) precaution BIAT scores were removed based on results of MAD analyses. The semantic differential scores were positively kurtotic (scores > 1.9)[2]. The first author attempted square root, log-10, and natural log transformations on the natural disaster and precaution explicit scores (given they were both >3.9) to examine whether this would normalize the variables. Transformations increased skew and kurtosis, so the semantic differential scores were not transformed. Zip codes for spatial lag analyses were converted to states using the zipcodeR package for R (Rozzi, 2020) (see Online Supplement B).

Analyses included a planned internal replication; prior to data analysis, data were randomly split into one of two datasets (50% and 50%, following Glenn et al., 2017). Data and code are available online at https://osf.io/z9y6u/files/ (not blind for review).

Preregistered analyses for first and replication samples—We preregistered our data analysis plan prior to analyzing data (https://osf.io/5c9gq/?view_only=9ae25454376e44c987035955263b35ed). Planned descriptive analyses included examining: correlation strengths between implicit and explicit associations; relationships between implicit and explicit associations with demographic variables (age, gender, race, ethnicity, and education). Correlations were used to examine whether implicit and explicit associations related to age. *T*-tests were used to examine whether implicit and explicit associations varied based on ethnicity (Hispanic/Latinx vs. not Hispanic/Latinx). One-way ANOVAs were used to examine whether implicit and explicit associations varied by gender, race, and education. When analyzing the explicit associations, non-parametric tests were used (i.e., Spearman correlation, Kruskal-Wallis one-way ANOVA, and Mann-Whitney test) because of their non-normality; all other analyses were parametric tests.[3]

[2]With the exception of the question “To what extent do you think of accidental injuries as dangerous or safe,” all explicit items had extreme kurtosis; all explicit items were positively skewed. No transformations were made given these items were only used in descriptive analyses and correlations were examined with BIATs. Spearman correlations were used for all correlations with BIATs (see Table 3) for consistency.

We predicted that there would be relationships between COVID-19 BIATs and self-reported mental health symptoms (anxiety, depression, change in emotional well-being since COVID-19), and we were interested in exploring whether those relationships were linear or non-linear. Next, we examined incremental predictive validity of BIAT scores above explicit COVID-19 associations. We hypothesized that BIAT scores would incrementally predict mental health variables above and beyond explicit reports. For the hierarchical linear regression, Step 1 included explicit associations predicting mental health symptoms; Step 2 added BIATs as an incremental predictor. If significant incremental predictive validity emerged, we planned to add time (since COVID-19 declared as an international pandemic on March 11, 2020) and space (spatial lag) to the models to examine whether adding those to the models would improve model fit. COVID-19 is an evolving health threat, and throughout the data collection, the virus affected individuals in different locations in distinct ways over time (e.g., prevalence, hospitalization and death rates have varied dramatically as a function of region and date). For example, when a surge hit a particular community, those community members' implicit associations tied to the dangerousness of COVID-19 may have strengthened to be more danger-oriented than they were before the surge. To control for this in analyses, we used the individual's geographic location (i.e., zip code transformed to the participant's state) and the date that they completed the test as covariates.

We deviated slightly from our preregistration in three ways: 1) we could not calculate a correlation between the danger-related BIATs (given the BIATs were collected between subjects) so this test was omitted. 2) We moved analyses conducted with the first half of the data examining the relationships between BIATs and a set of COVID-19 history, behaviors, and beliefs to Online Supplements C, D, and E and did not replicate these tests in the second half of the data because the COVID-19 history, behaviors, and beliefs questions were inconsistent (i.e., some referred to wearing masks while others did not, which was a function of when the items were created relative to recommendations at the time). Because these questions were not directly relevant to our main outcomes of interest (mental health), they were moved to the online supplement and not included in the replication analyses. 3) Based on reviewer feedback, we examined additional correlations between BIATs and each explicit question to examine how explicit attitudes about COVID-19 that were *not* relative to the comparison question related to implicit association measures.

Replication analyses were preregistered (https://osf.io/ftv9z/?view_only=9f5feb57ecce4d3493c5d99e4f6f3d0f) prior to conducting analyses. These were planned based on results from the first sample findings and overarching goal of the manuscript.

Results

Descriptive statistics for measures are listed in Table 2. Given large sample sizes, we used p<.01 for significance tests. Unless otherwise noted, analyses were performed in SPSS version 27 by the first author.

[3]Initial analyses were conducted with parametric tests but based on a reviewer's suggestion to better account for skewness, we re-analyzed the appropriate variables using non-parametric tests.

Correlations Between Implicit and Explicit Associations and Strength of Associations

All BIAT mean *D* scores were positive, indicating general implicit associations of COVID with danger and of COVID precautions with being necessary. Mean explicit injury scores were positive, indicating that people self-reported COVID as being more dangerous than injury, but Natural Disaster and Precaution explicit scores were negative, indicating general implicit associations of COVID-19 as less dangerous than natural disasters and COVID-19 precautions an overreaction compared to driving precautions. Consistent with preregistered hypotheses, there were very small positive correlations between implicit and explicit associations (see Table 3). In the replication sample, correlation strengths between BIATs and explicit associations were significant but very small: r_ss=.11 (injury), .17 (natural disasters), and .11 (precautions) (*p*s<.001). In exploratory analyses, significant correlations emerged between the explicit COVID-19 questions (dangerousness of COVID-19 and the necessity of precautions) and BIATs; there were no significant correlations with the explicit comparison questions. Stronger explicit beliefs that COVID-19 is dangerous were related to stronger implicit COVID-as-dangerous associations. Stronger explicit beliefs that COVID-19 precautions are necessary were related to stronger implicit precautions-as-necessary associations. These results were replicated in the second sample with similar correlation strengths.

Implicit and Explicit Associations' Relationship with Demographic Characteristics

Table 3 contains descriptive statistics and results of analyses. Statistics for the replication sample are available from the first author. There were no significant differences in any associations as a function of ethnicity (Hispanic vs. not Hispanic); this was replicated in the second sample.

All implicit and explicit associations were weakly associated with age, such that older age related to stronger COVID-as-dangerous and COVID precautions-as-necessary implicit and explicit associations. This was replicated with similar direction and magnitudes in the second sample. The only significant differences among genders and races emerged when comparing explicit COVID precautions-as-necessary associations. Men had weaker explicit associations compared to non-binary individuals. Individuals indicating multiple racial backgrounds had stronger explicit associations compared to Black and Asian individuals; White individuals had stronger explicit associations when compared to Black and Asian individuals. In the replication sample, no significant differences emerged across comparisons of gender (which did not replicate the significant differences in explicit COVID precautions-as-necessary). There were two differences that emerged in the replication sample for racial differences; there was a significant omnibus Kruskal-Wallis one-way ANOVA for explicit COVID-as-dangerous (compared to natural disasters) associations, but after adjusting for multiple comparisons, no significant differences emerged between races. In addition, the significant differences between individuals with multiple racial backgrounds and Asian and Black individuals did not replicate (though the results comparing White individuals and Black and Asian individuals did replicate).

Implicit COVID-as-dangerous implicit associations (both versions) significantly varied by education, with individuals with advanced degrees exhibiting stronger implicit associations compared to individuals with a high school degree and some college education. In the replication sample, individuals with an advanced degree exhibited stronger implicit COVID-as-dangerous (compared to injuries) associations when compared to individuals with a high school degree, but not those with some college education. The COVID-as-dangerous (compared to natural disasters) implicit associations did not vary as a function of education in the replication sample. Although not significant in the first sample, the implicit COVID precautions-as-necessary associations were significantly different based on education in the replication sample. When examining explicit COVID-as-dangerous (compared to injuries) in the first sample, no significant differences emerged by education; however, in the replication sample significant differences emerged. Significant differences in both samples emerged when comparing explicit COVID-as-dangerous (compared to natural disasters) associations; however significant differences emerged across different groups in the replication sample (individuals with an advanced degree showed stronger explicit associations when compared to individuals with a high school degree, some college, and a bachelor's degree). Significant explicit COVID precautions-as-necessary differences emerged based on education in both samples, while in the replication sample individuals with an advanced degree and individuals with a bachelor's degree had stronger explicit associations compared to individuals with some college education.

Across age, gender, race, and ethnicity comparisons, results largely replicated in the second sample. Although some significant differences did emerge based on these demographics, effect sizes were small. Results based on education were less reliable, with the replication sample showing notable differences from the first sample.

Linear and Nonlinear Relationships Among Implicit Associations, Explicit Associations, and Mental Health

Using SPSS's curve estimation feature, the relationships between each implicit and explicit score and the three mental health variables (anxiety on the PHQ-4, depression on the PHQ-4, and change in emotional well-being since COVID-19 started) were estimated to examine whether a linear, quadradic, or cubic relationship best fit the data. A total of 18 tests were run (3 implicit and 3 explicit associations by 3 mental health variables). Scatterplots of significant relationships that were replicated are available in the Online Supplement F.

COVID-as-dangerous implicit and explicit associations when comparing to accidental injuries.—Among each of the six relationships estimated between the association measures and mental health variables, only one curve estimation emerged as significant: stronger explicit associations were related to worse emotional well-being using a linear model, $F(1, 2027)=18.11$, $p<.001$, $\beta=-.09$ (99% CI [−.13, −.03]), $R^2_{adjusted}=.01$.

In the replication sample, explicit associations significantly predicted anxiety using a linear model (not replicating the first sample, $F[1, 1977]=11.87$, $p=.001$, $\beta=.07$ (99% CI [.02, .16]), $R^2_{adjusted}=.01$) and emotional well-being change using a linear model (replicating the first sample, $F[1, 1938]=8.68$, $p=.003$, $\beta=-.07$ (99% CI [−.11, −.01]), $R^2_{adjusted}=.00$). These results suggest that stronger explicit associations were related to greater anxiety and worse emotional well-being.

COVID-as-dangerous implicit and explicit associations when comparing to natural disasters.—Among each of the six relationships estimated between the association measures and mental health variables, only two curve estimations emerged as significant: stronger explicit associations predicted worse depressive symptoms, $F(1, 2053)=9.46$, $p=.002$, $\beta=.07$ (99% CI [.01, .15]), $R^2_{adjusted}=.00$, and worse emotional well-being using linear models, $F(1, 2040)=13.46$, $p<.001$, $\beta=-.08$ (99% CI [−.13, −.02]), $R^2_{adjusted}=.01$.

In the replication sample, explicit associations significantly predicted anxiety using a linear model (not replicating the first sample, $F[1, 2046]=13.81$, $p<.001$, $\beta=.08$ (99% CI [.03, .18]), $R^2_{adjusted}=.01$), depression using a linear model (replicating the first sample, $F[1, 2046]=10.02$, $p=.002$, $\beta=.07$ (99% CI [.02, .15]), $R^2_{adjusted}=.01$), and emotional well-being change using a linear model (replicating the first sample, $F[1, 1993]=6.80$, $p=.009$, $\beta=-.06$ (99% CI [−.11, .00]), $R^2_{adjusted}=.00$). The results suggest that stronger explicit associations were related to greater anxiety and depression, and worse emotional well-being.

COVID precautions-as-necessary implicit and explicit associations.— Precaution-BIAT scores had a significant quadradic relationship with depression scores (with linear also in the model, $F[2, 1202]=5.28$, $p=.005$, $\beta=-.19$ (99% CI [−.86, .48]), $R^2_{adjusted}=.01$). Self-reported depressive symptoms were lowest for individuals with both strong COVID-19 precautions-as-necessary and strong driving precautions-as-necessary implicit associations. Stronger explicit scores had a significant linear relationship with anxiety symptoms ($F[1, 1838]=7.11$, $p=.008$, $\beta=.06$ (99% CI [.00, .11]), $R^2_{adjusted}=.00$). BIAT scores did not relate to anxiety or change in emotional well-being and explicit scores did not relate to depression symptoms or change in emotional well-being.

In the replication sample, the Precaution-BIAT did not significantly relate to depression, which does not replicate findings from the first sample. Stronger explicit associations did significantly predict anxiety using a linear model (replicating the first sample, $F[1, 1833]=8.89$, $p=.003$, $\beta=.07$ (99% CI [.01, .13]), $R^2_{adjusted}=.01$), depression using a linear model (not replicating the first sample, $F[1, 1835]=8.24$, $p=.004$, $\beta=.07$ (99% CI [.01, .11]), $R^2_{adjusted}=.00$), and emotional well-being change using a quadradic model when linear, quadradic, and cubic predictors are in the model (not replicating the first sample, $F[3, 1805]=4.77$, $p=.003$, $\beta=.10$ (99% CI [.09, .11]), $R^2_{adjusted}=.01$). Stronger explicit associations were related to greater anxiety and depression; and more extreme explicit associations were related to worse emotional well-being.

Implicit associations adding incremental predictive validity to explicit associations in predicting mental health symptoms: Although the BIATs did not reliably predict mental health symptoms on their own so would be unlikely to show incremental prediction, we nonetheless include these analyses as described in the preregistration to be thorough. Results suggested that implicit associations did not incrementally predict any mental health outcomes even when controlling for explicit associations, space (geographic location), and time (days since COVID-19 was declared a pandemic). For additional information, see Online Supplement G.

BIAT Error Rates

Given the unusually high exclusion rates for the COVID-19-precautions-as-necessary BIAT (37.3%) compared to the other two BIATs (Natural Disasters: 13.6%; Injury: 17.9%) and to previously-published error rates on two other platforms (Project Implicit: around 10%; Amazon's MTurk: around 20%; see Conway et al., 2019), we examined the error rates by category pairings and individual stimuli.[4] Results revealed that the category pairings of precautions-as-an-overreaction in the Precaution-BIAT had higher error rates compared to the other pairings. The precautions-as-an-overreaction mean error rate was 27.28% while the precautions-as-necessary mean error rate was 15.31%. The other category pairings mean error rates ranged from 14.11% to 22.23%. When examining the mean error rates by stimulus in the Precaution-BIAT, the *necessary* exemplars (necessary, important, needed, essential) had the highest mean error rates, ranging from 26.82% to 28.68%. *Overreaction* exemplars (overreaction, hype, myth, hysteria) also had high mean error rates, ranging from 23.90% to 27.08%. These were followed by the *driving precautions* (drive carefully, wear seatbelt, watch the road, check fuel level), ranging from 16.27% to 22.00%. The *COVID-19 precautions* (wash hands, physical distance, stay home, disinfect surfaces, wear a mask) had the lowest mean error rates in this BIAT, ranging from 13.88% to 15.01%.

Exploratory Analyses

Exploratory analyses examining COVID-19-precautions-as-necessary implicit associations, mental health variables, and age were conducted in the first sample only, see Online Supplement H.

Discussion

In the current study, we examined both implicit and explicit beliefs about the dangerousness of COVID-19 and the necessity of taking precautionary behaviors tied to limiting the spread of COVID-19. To gain a more nuanced understanding of these beliefs, we examined whether implicit and explicit associations varied as a function of individual demographic characteristics. We also examined whether implicit associations tied to COVID-19 related to individuals' current anxiety and depression symptoms, as well as their relative change in emotional well-being during an international pandemic.

On average, individuals implicitly associated COVID-19 with danger and precautions as necessary, relative to their comparison categories (i.e., injuries, natural disasters, and driving precautions). Individuals also explicitly associated COVID-19 with being more dangerous than injuries but less dangerous than natural disasters. Individuals also explicitly associated COVID-19 precautions with being less necessary than driving precautions. This suggests that although individuals explicitly report that natural disasters are more dangerous than COVID-19, on an implicit level, they automatically associate COVID-19 with more danger. This discrepancy also appeared for the Precaution-BIAT. Overall, stronger implicit associations in the direction of COVID-19-as-dangerous may suggest that during a novel and salient stressor (i.e., COVID-19), individuals automatically associate that stressor with

[4]We would like to thank an anonymous reviewer for this suggestion.

danger and taking precautions, even if that diverges from their more reflective and deliberate reports of the relative danger of the threat. However, future work can examine whether this finding holds for other types of implicit tasks (e.g., standard IAT).

In general, categories that have clear and distinct dimensions produce stronger (Nosek, 2005) and more easily interpretable results (e.g., insect vs. flowers is better than insect vs. non-words; Brendl et al., 2001). During IATs, participants often use a heuristic of recoding one category as positive and another as negative (Meissner & Rothermund, 2015). However, our COVID-19 contrast categories were intentionally also negative (accidental injury, natural disasters) or just as important to prevent (driving deaths) to reduce the likelihood that effects would simply be due to valence differences; therefore, we expect that the specific evaluation of COVID-19 and its social salience and risks likely impacted how participants classified stimuli.

Beliefs about COVID-19 and their Relationship to Demographic Variables

There were some reliable differences in implicit and explicit associations based on demographic characteristics, however there were no reliable effects tied to gender identity or ethnicity. There were weak positive associations with age, such that older (vs. younger) age was associated with stronger implicit and explicit COVID-19-as-dangerous and precautions-as-necessary associations. Given that COVID-19 is especially dangerous to older individuals (Applegate & Ouslander, 2020), older adults in this study may have especially internalized the health threat. That said, evidence from early in the pandemic suggests that older adults exhibited better emotional well-being compared to younger adults even when facing similar pandemic-related stressors (Carstensen et al., 2020). Together, these findings suggest that beliefs about the dangerousness of COVID-19 do not necessarily correspond directly to worse emotional well-being. It is possible that older adults can grapple with a novel threat to their health while still effectively maintaining emotional well-being.

In the current samples, Black and Asian individuals explicitly rated COVID-19 precautions as relatively more necessary than did White individuals. Research on the probability of wearing a mask to prevent the spread of COVID-19 based on gender and race in the US revealed that Asian men were the most likely group to wear a mask (with White men the least likely to wear a mask; Hearne & Niño, 2021). Although speculative, one possible explanation for Asian individuals taking precautionary measures especially seriously may be that they are aware of the potential lethality of a novel infection based on experiences with or knowledge about the SARS outbreak in 2003 (Li & Liu, 2021), which had a particularly large effect in some Asian communities. Another explanation for Asians employing strong precautionary measures may tie to the disturbing rise in anti-Asian racism in the US during the study period, with 39% of Asian Americans reporting that others act as if they are uncomfortable around them, likely because COVID-19 is believed to have started in China (Ruiz et al., 2020).

There were also inconsistent small effects of education, with individuals with an advanced degree having stronger explicit COVID-19-as-dangerous (compared to natural disasters) and precautions-as-necessary explicit associations compared to individuals with fewer years of education. In the current study, small, reliable findings suggested that individuals with an advanced degree held stronger COVID-as-dangerous (compared to injuries) implicit associations compared to some groups with less education. However, these findings did not replicate across tasks; no significant differences emerged in either sample for the COVID-as-dangerous (compared to natural disasters) task. Although we do not wish to over-interpret null results, social desirability and limits on introspection may affect whether individuals are willing or able to disclose their beliefs about the dangerousness of COVID-19. It may be that individuals share similar levels of implicit associations tied to the threat of COVID-19 regardless of level of education, however those with more education may wish to present or think of themselves as following the science and interpreting COVID-19 as more dangerous. An important future direction will be to examine whether political beliefs are related to both implicit and explicit COVID-19 associations, especially given that the pandemic quickly became highly politicized.

It is important to note that results comparing implicit and explicit associations by demographics for the most part were small in effect size. This is consistent with another examination of large samples of implicit and explicit mental health associations and demographics collected at this demonstration site (Werntz et al., 2016). We do not want to overinterpret the results, and the practical significance of these findings will need to be evaluated over time. Notably, some small effects can have substantial consequences (Götz et al., 2022; Lipsey et al., 2012). For example, Götz and colleagues (2022) describe how small effects can be particularly meaningful when examined over time or in large populations, or how small interventions can have critical public health significance.

Implicit associations did not predict self-reported mental health

We expected that COVID-19 implicit associations would predict current symptoms of anxiety and depression, as well as changes in emotional well-being, over and above explicit associations, but across analyses, implicit associations did not relate to mental health variables.

Instead, results suggested that stronger COVID-19-as-dangerous explicit associations related to worse self-reported emotional well-being since the onset of the pandemic. These results were replicated across both samples and using both comparison categories (natural disasters and injuries), suggesting a relatively robust finding. Although believing that COVID-19 is dangerous may be protective to physical health (encouraging yourself to stay away from others during the pandemic), this finding suggests that associating COVID-19 with danger is related to poorer emotional well-being. However, it may also be the case that individuals with poorer mental health associate any threat with greater danger compared to those with better mental health. Striking the right balance between maintaining physical safety, while not chronically worrying about the danger of the virus, is likely very challenging during a relatively ambiguous health threat. Results also suggest that stronger explicit beliefs about COVID-19 precautions-as-necessary were associated with greater anxiety in both samples. Importantly, these results do not necessarily suggest that believing precautions are necessary relates to pathological levels of anxiety, and the temporal nature of the precautions-as-necessary/anxiety relationship is unknown. To clarify, individuals with greater anxiety prior to the pandemic could perceive taking precautions to limit the spread of a deadly infection as relatively more important than those individuals with lower levels of anxiety before the pandemic. Or, individuals who believe that taking precautions is necessary could be experiencing greater levels of anxiety in the face of the novel health threats. Future work should examine the time course of precautions-as-necessary beliefs and mental health symptoms.

Limitations and conclusions

This study did not examine a representative sample of any one group. The current sample consisted of a large number of volunteers to the Project Implicit Health website who were interested in learning about their implicit associations tied to COVID-19 during the first seven months of the COVID-19 pandemic (and self-selected into the study after reading "COVID-19: Do you implicitly associate COVID-19 with danger? Do you think the precautions are reasonable?"). Despite this limitation, the large sample size allowed us to perform an internal replication to examine whether the results from our preregistered analyses would replicate. This study was limited by using a cross-sectional approach so individual-level change over time could not be examined. We also acknowledge there was a large number of tests conducted without correcting alpha levels for number of tests. Finally, it is possible that strong implicit associations may not have fully formed in the short time period between the onset of COVID-19 and data collection; however, the timeframe is unlikely to explain the results given that prior research has found that implicit associations can form very rapidly (Cone et al., 2021; Cone et al., 2017) and COVID was so dominant in people's minds, the news, etc. when the data collection occurred.

In the Precaution-BIAT, we also had to exclude an exceptionally large number of participants' data, given the high error rates in responding to stimuli during the task. Exploratory analyses of mean error rates of category pairings and individual stimuli revealed that participants had a particularly difficult time when pairing the overreaction and COVID-19 precautions categories, and the stimuli within the necessary and overreaction categories had the highest error rates. Notably, the high error rates were spread across multiple stimuli in the Precaution-BIAT, making it unlikely that a coding error or problematic item(s) can explain the high error rates on this task. Instead, we might speculate that at the early point in the pandemic when this data collection occurred, individuals were unsure of what precautions were necessary versus overreactions to an evolving health threat and constantly changing safety recommendations. Future work could examine whether error rates for these same stimuli and pairings have become smaller over time, which might suggest that ways of limiting the spread of COVID-19 have become more automated and stable over time. Another related possibility is that the necessary vs. overreaction contrast was confusing to people given that, at times, the COVID-19 precautions listed were required while, at other times, the precautions were a personal choice, so there were two potential meanings of necessary (i.e., precautions are necessary because I've been told by my government/employer/school to do them vs. I personally think the precautions are needed). It is possible this created confusion for participants that would not have been present for the other BIATs, which used the dangerous vs. safe contrast. Regardless, given these high error rates, results of the Precaution-BIAT should be interpreted with caution.

Contrary to hypotheses, implicit associations tied to COVID-19 did not incrementally predict mental health over explicit associations. Past research has found that implicit associations play an important role in predicting explicit reports when implicit associations are measured for concepts that may be socially sensitive or otherwise undesirable to report (Greenwald et al., 2009; Kurdi et al., 2019). Although beliefs about COVID-19 (and the strategies to mitigate associated risk) are highly politicized (Hardy et al., 2021), individuals may not be motivated to portray themselves as holding specific beliefs about COVID-19 in an online, anonymous survey.

The current study found that implicit and explicit associations related to COVID-19-as-dangerous and precautions-as-necessary varied as a function of age, race, and education. Although implicit associations were not incrementally predictive of self-reported anxiety, depression, and change in emotional well-being since the onset of the pandemic, future work should continue to examine how beliefs about health-related threats affect individuals' well-being.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data availability statement:

Data, code, and preregistrations are available at https://osf.io/z9y6u/?view_only=00b323dd797f49dd959ff46d98120827

References

Aknin L, Neve J-ED, Dunn E, Fancourt D, Goldberg E, Helliwell J, Jones SP, Karam E, Layard R, Lyubomirsky S, Rzepa A, Saxena S, Thornton E, VanderWeele T, Whillans A, Zaki J, Caman OK, & Amour YB (2021). Mental health during the first year of the COVID-19 pandemic: a review and recommendations for moving forward. Perspectives on Psychological Science.

Applegate WB, & Ouslander JG (2020). COVID-19 Presents High Risk to Older Persons. Journal of the American Geriatrics Society, 68(4), 681–681. 10.1111/jgs.16426 [PubMed: 32154911]

Asmundson GJG, Paluszek MM, Landry CA, Rachor GS, McKay D, & Taylor S (2020). Do pre-existing anxiety-related and mood disorders differentially impact COVID-19 stress responses and coping? Journal of anxiety disorders, 74, 102271–102271. 10.1016/j.janxdis.2020.102271 [PubMed: 32673930]

Bar-Anan Y, & Nosek BA (2014). A comparative investigation of seven indirect attitude measures. Behavior Research Methods, 46(3), 668–688. 10.3758/s13428-013-0410-6 [PubMed: 24234338]

Betsch T, Plessner H, Schwieren C, & Gütig R (2001). I Like it but I Don't Know Why: A Value-Account Approach to Implicit Attitude Formation. Personality and Social Psychology Bulletin, 27(2), 242–253. 10.1177/0146167201272009

Brendl CM, Markman AB, & Messner C (2001). How do indirect measures of evaluation work? Evaluating the inference of prejudice in the Implicit Association Test [doi:10.1037/0022-3514.81.5.760]. American Psychological Association.

Carstensen LL, Shavit YZ, & Barnes JT (2020). Age Advantages in Emotional Experience Persist Even Under Threat From the COVID-19 Pandemic. Psychological Science, 31(11), 1374–1385. 10.1177/0956797620967261 [PubMed: 33104409]

Centers for Disease Control and Prevention. (2021). Trends in Number of COVID-19 Cases and Deaths in the US Reported to CDC, by State/Territory. Retrieved January 14 from https://covid.cdc.gov/covid-data-tracker/#trends_totalandratedeaths

Cone J, Flaharty K, & Ferguson MJ (2021). The Long-Term Effects of New Evidence on Implicit Impressions of Other People. Psychological Science, 32(2), 173–188. 10.1177/0956797620963559 [PubMed: 33428852]

Cone J, Mann TC, & Ferguson MJ (2017). Changing our implicit minds: How, when, and why implicit evaluations can be rapidly revisedElsevier Academic Press.

Conway MA, O'Shea B, Redford L, Pogge G, Klein RA, & Ratliff KA (2019). Can Carelessness Be Captured? Assessing Careless Responding in Attitudes Toward Novel Stimuli. Social Cognition, 37(5), 468–498. 10.1521/soco.2019.37.5.468

Cunningham WA, & Zelazo PD (2007). Attitudes and evaluations: A social cognitive neuroscience perspective. Trends in Cognitive Sciences, 11(3), 97–104. 10.1016/j.tics.2006.12.005 [PubMed: 17276131]

Glenn JJ, Werntz AJ, Slama SJ, Steinman SA, Teachman BA, & Nock MK (2017). Suicide and self-injury-related implicit cognition: A large-scale examination and replication. Journal of Abnormal Psychology, 126(2), 199–211. 10.1037/abn0000230 [PubMed: 27991808]

Götz FM, Gosling SD, & Rentfrow PJ (2022). Small Effects: The Indispensable Foundation for a Cumulative Psychological Science. Perspectives on Psychological Science, 17(1), 205–215. 10.1177/1745691620984483 [PubMed: 34213378]

Greenwald AG, Brendl M, Cai H, Cvencek D, Dovidio JF, Friese M, Hahn A, Hehman E, Hofmann W, Hughes S, Hussey I, Jordan C, Kirby TA, Lai CK, Lang JWB, Lindgren KP, Maison D, Ostafin BD, Rae JR, Ratliff KA, Spruyt A, & Wiers RW (2022). Best research practices for using the Implicit Association Test. Behavior Research Methods. 10.3758/s13428-021-01624-3

Greenwald AG, McGhee DE, & Schwartz JLK (1998). Measuring individual differences in implicit cognition: The implicit association test. Journal of Personality and Social Psychology, 74(6), 1464–1480. 10.1037/0022-3514.74.6.1464 [PubMed: 9654756]

Greenwald AG, Poehlman TA, Uhlmann EL, & Banaji MR (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. Journal of Personality and Social Psychology, 97(1), 17–41. 10.1037/a0015575 [PubMed: 19586237]

Hardy LJ, Mana A, Mundell L, Neuman M, Benheim S, & Otenyo E (2021). Who is to blame for COVID-19? Examining politicized fear and health behavior through a mixed methods study in the United States. PLOS ONE, 16(9), e0256136. 10.1371/journal.pone.0256136 [PubMed: 34469453]

Hearne BN, & Niño MD (2021). Understanding How Race, Ethnicity, and Gender Shape Mask-Wearing Adherence During the COVID-19 Pandemic: Evidence from the COVID Impact Survey. Journal of Racial and Ethnic Health Disparities. 10.1007/s40615-020-00941-1

Karpinski A, & Steinman RB (2006). The single category implicit association test as a measure of implicit social cognition. J Pers Soc Psychol, 91(1), 16–32. 10.1037/0022-3514.91.1.16 [PubMed: 16834477]

Kroenke K, Spitzer RL, Williams JBW, & Löwe B (2009). An Ultra-Brief Screening Scale for Anxiety and Depression: The PHQ–4. Psychosomatics, 50(6), 613–621. 10.1016/S0033-3182(09)70864-3 [PubMed: 19996233]

Kurdi B, Seitchik AE, Axt JR, Carroll TJ, Karapetyan A, Kaushik N, Tomezsko D, Greenwald AG, & Banaji MR (2019). Relationship between the Implicit Association Test and intergroup behavior: A meta-analysis. American Psychologist, 74(5), 569–586. 10.1037/amp0000364 [PubMed: 30550298]

Leys C, Ley C, Klein O, Bernard P, & Licata L (2013). Detecting outliers: Do not use standard deviation around the mean, use absolute deviation around the median [doi:10.1016/j.jesp.2013.03.013]. Journal of Experimental Social Psychology, 49(4), 764–766. 10.1016/j.jesp.2013.03.013

Li X, & Liu H (2021). A Study of the High Acceptance Level of Asian Americans for COVID-19 Vaccination. Academia Letters. 10.20935/AL1470

Lindgren KP, Baldwin SA, Olin CC, Wiers RW, Teachman BA, Norris J, Kaysen D, & Neighbors C (2018). Evaluating Within-Person Change in Implicit Measures of Alcohol Associations: Increases in Alcohol Associations Predict Increases in Drinking Risk and Vice Versa. Alcohol and Alcoholism, 53(4), 386–393. 10.1093/alcalc/agy012 [PubMed: 29506082]

Lipsey MW, Puzio K, Yun C, Herbert AA, Steinka-Fry K, Cole MW, Roberts M, Anthony KS, & Busick MD (2012). Translating the statistical representation of the effects of education interventions into more readily interpretable forms. I. o. E. Services.

Löwe B, Wahl I, Rose M, Spitzer C, Glaesmer H, Wingenfeld K, Schneider A, & Brähler E (2010). A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. J Affect Disord, 122(1–2), 86–95. 10.1016/j.jad.2009.06.019 [PubMed: 19616305]

Meissner F, & Rothermund K (2015). The insect-nonword IAT revisited: Dissociating between evaluative associations and recoding [doi:10.1027/1864-9335/a000220]. Hogrefe Publishing.

Nock MK, Park JM, Finn CT, Deliberto TL, Dour HJ, & Banaji MR (2010). Measuring the suicidal mind: Implicit cognition predicts suicidal behavior [doi:10.1177/0956797610364762]. Psychological Science, 21, 511–517. 10.1177/0956797610364762 [PubMed: 20424092]

Nosek BA (2005). Moderators of the Relationship Between Implicit and Explicit Evaluation. Journal of Experimental Psychology: General, 134(4), 565–584. 10.1037/0096-3445.134.4.565 [PubMed: 16316292]

Nosek BA (2007). Implicit-explicit relations. Current Directions in Psychological Science, 16(2), 65–69. 10.1111/j.1467-8721.2007.00477.x

Nosek BA, Bar-Anan Y, Sriram N, Axt J, & Greenwald AG (2014). Understanding and Using the Brief Implicit Association Test: Recommended Scoring Procedures. PLOS ONE, 9(12), e110938. 10.1371/journal.pone.0110938 [PubMed: 25485938]

R Core Team. (2013). R: A language and environment for statistical computing. In R Foundation for Statistical Computing. http://www.R-project.org/

Ranganath KA, & Nosek BA (2008). Implicit attitude generalization occurs immediately; explicit attitude generalization takes time. Psychological Science, 19(3), 249–254. 10.1111/j.1467-9280.2008.02076.x [PubMed: 18315797]

Rozzi G (2020). zipcodeR: Data & Functions for Working with ZIP Codes. In (Version 0.2.0) https://github.com/gavinrozzi/zipcodeR/

Ruiz NG, Horowitz J, & Tamir C (2020). Many Black and Asian Americans Say They Have Experienced Discrimination Amid the COVID-19 Outbreak. https://www.pewsocialtrends.org/wp-content/uploads/sites/3/2020/07/PSDT_07.01.20_racism.covid_Full.Report.pdf

Salari N, Hosseinian-Far A, Jalali R, Vaisi-Raygani A, Rasoulpoor S, Mohammadi M, Rasoulpoor S, & Khaledi-Paveh B (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. Globalization and health, 16(1), 57. 10.1186/s12992-020-00589-w [PubMed: 32631403]

Sohn MN, McMorris CA, Bray S, & McGirr A (2021). The death-implicit association test and suicide attempts: a systematic review and meta-analysis of discriminative and prospective utility. Psychological Medicine, 1–10. 10.1017/s0033291721002117

Sriram N, & Greenwald AG (2009). The brief implicit association test. Experimental Psychology, 56(4), 283–294. 10.1027/1618-3169.56.4.283 [PubMed: 19439401]

Teachman BA, Clerkin EM, Cunningham WA, Dreyer-Oren S, & Werntz A (2019). Implicit Cognition and Psychopathology: Looking Back and Looking Forward. Annual Review of Clinical Psychology, 15(1), 123–148. 10.1146/annurev-clinpsy-050718-095718

Tucker Smith C, Ratliff KA, & Nosek BA (2012). Rapid Assimilation: Automatically Integrating New Information with Existing Beliefs. Social Cognition, 30(2), 199–219. 10.1521/soco.2012.30.2.199

Twenge JM, & Joiner TE (2020). U.S. Census Bureau-assessed prevalence of anxiety and depressive symptoms in 2019 and during the 2020 COVID-19 pandemic. Depression and Anxiety, 37(10), 954–956. 10.1002/da.23077 [PubMed: 32667081]

Werntz AJ, Steinman SA, Glenn JJ, Nock M, & Teachman BA (2016). Characterizing Implicit Mental Health Associations across Clinical Domains. Journal of Behavior Therapy and Experimental Psychiatry, 52, 17–28. 10.1016/j.jbtep.2016.02.004 [PubMed: 26962979]

World Health Organization. (2020). Listing of WHO's response to COVID-19. World Health Organization. https://www.who.int/news/item/29-06-2020-covidtimeline

Zhou Y, Macgeorge EL, & Myrick JG (2020). Mental Health and Its Predictors during the Early Months of the COVID-19 Pandemic Experience in the United States. International Journal of Environmental Research and Public Health, 17(17), 6315. 10.3390/ijerph17176315 [PubMed: 32877985]

Table 1.

Sample characteristics

	Sample 1(*N*=6744)	Replication Sample (*N*=6669)
Mean (SD) age in years	34.85 (14.69)	35.05 (14.69)
Gender		
Male	2041 (30.3%)	1918 (28.8%)
Female	4558 (67.6%)	4604 (69.0%)
Non-binary or other identity	68 (1.0%)	70 (1.0%)
Not reported	77 (1.1%)	77 (1.2%)
Education		
Less than high school degree	110 (1.6%)	82 (1.2%)
High school degree	622 (9.2%)	605 (9.1%)
Some college	2094 (31.0%)	2058 (30.9%)
Bachelor's degree	2093 (31.0%)	2081 (31.2%)
Advanced degree	1662 (24.6%)	1692 (25.4%)
Not reported	163 (2.4%)	151 (2.3%)
Ethnicity		
Hispanic or Latino	733 (10.9%)	760 (11.4%)
Not Hispanic or Latino	5603 (83.1%)	5506 (82.6%)
Unknown	298 (4.4%)	286 (4.3%)
Not reported	110 (1.6%)	117 (1.8%)
Race		
Black or African American	533 (7.9%)	503 (7.5%)
Asian	466 (6.9%)	476 (7.1%)
White	4876 (72.3%)	4760 (71.4%)
Multiple selections	327 (4.8%)	334 (5.0%)
Other or unknown	432 (6.4%)	479 (7.2%)
Not reported	110 (1.6%)	117 (1.8%)

Table 2.

Descriptive statistics for implicit associations, explicit associations, and mental health variables

	Sample 1		Replication Sample	
	n	***m*(*sd*) or %**	***n***	***m*(*sd*) or %**
Implicit Associations				
Injury-BIAT	1560	0.20 (0.34)	1503	0.19 (0.36)
Natural disaster-BIAT	1652	0.22 (0.33)	1619	0.19 (0.33)
Precaution-BIAT	1217	0.43 (0.35)	1255	0.44 (0.34)
Explicit Associations				
Injury relative assessment	2038	.70 (1.45)	1956	.65 (1.46)
COVID-19 is dangerous	2050	7.31 (1.29)	1969	7.29 (1.33)
Injuries are dangerous	2039	6.61 (1.27)	1957	6.64 (1.26)
Natural disaster relative assessment	2041	−.36 (1.32)	2030	−.36 (1.31)
COVID-19 is dangerous	2041	7.32 (1.35)	2031	7.33 (1.34)
Natural disasters are dangerous	2042	7.68 (1.06)	2030	7.69 (1.06)
Precaution relative assessment	1841	−.73 (1.91)	1841	−.63 (1.76)
COVID-19 precautions are necessary	1841	7.55 (2.08)	1841	7.63 (1.98)
Driving precautions are necessary	1843	8.28 (1.32)	1841	8.26 (1.34)
Mental Health				
PHQ Anxiety Score	6232	1.74 (1.71)	6147	1.71 (1.68)
Positive anxiety screen	1540	22.8%	1487	22.3%
PHQ Depression Score	6230	1.33 (1.53)	6151	1.28 (1.5)
Positive depression screen	1084	16.1%	1001	15.0%
Change in emotional well-being	6086	2.93 (1.25)	5972	2.96 (1.24)

Table 3.

Relationships among BIATs and explicit associations with demographic variables in Sample 1

	Injury		Natural Disaster		Precaution	
BIAT-explicit correlation	**r_s(1551)=.14, CI [.07, .21], *p*<.001**		**r_s(1643)=.14, CI [.08, .21], *p*<.001**		**r_s(1215)=.14, [.07, .22], *p*<.001**	
BIAT-explicit COVID-19 question correlation	**r_s(1555)=.19, CI[−.26, −.13], *p*<.001**		**r_s(1643)=.15, CI[−.21, −.08], *p*<.001**		**r_s(1209)=.16, CI[.08, .23], *p*<.001**	
BIAT-explicit comparison question correlation	r_s(1552)=.01, CI[−.07, .06], *p*=.843		r_s(1644)=.01, CI[−.07, .06], *p*=.799		r_s(1210)=.04, CI[−.04, .11], *p*=.201	
Demographic characteristics	**BIAT**	**Explicit**	**BIAT**	**Explicit**	**BIAT**	**Explicit**
Age	**r_p(1558)=.16, CI [.10, .23], *p*<.001**	**r_s(2152)=.08, CI [.02, .13], *p*<.001**	**r_p(1650)=.12, CI [.05, .18], *p*<.001**	**r_s(2155)=.18, CI [.12, .23], *p*<.001**	**r_p(1219)=.17, CI [.10, .24], *p*<.001**	**r_s(1903)=.06, CI [.00, .12], *p*<.01**
Gender	*F*(2, 1546)=.22, *p*=.806 , η_p^2=.00	*H*(2)=.35, *p*=.840	*F*(2, 1631)=.84, *p*=.431, η_p^2=.00	*H*(2)=3.80, *p* = .149	*F*(2, 1202)=1.48, *p*=.229, η_p^2=.00	***H*(2)=10.17, *p*<.01 Male < non-binary/other, p_{adj} <.01, *r*=−.11**
Male	*n*=463 (*m*=.20, CI [.16, .24], *sd*=.33)	*n*=676 (*mdn* = .00)	*n*=420 (*m*=.24, CI [.20, .28], *sd*=.34)	*n*=610 (*mdn* = .00)	*n*=333 (*m*=.41, CI [.36, .46], *sd*=.34)	***n*=577 (*mdn* = .00)**
Female	*n*=1069 (*m*=.20, CI [.17, .23], *sd*=.34)	*n*=1440 (*mdn* = 1.00)	*n*=1198 (*m*=.21, CI [.19, .24], *sd*=.33)	*n*=1503 (*mdn* = .00)	*n*=856 (*m*=.45, CI [.42, .48], *sd*=.35)	***n*=1285 (*mdn* = .00)**
Nonbinary/other	*n*=17 (*m*=.15, CI [−.07, .36], *sd*=.27)	*n*=23 (*mdn* = 1.00)	*n*=16 (*m*=.24, CI [.02, .45], *sd*=.32)	*n*=19 (*mdn* = .00)	*n*=16 (*m*=.42, CI [.20, .65], *sd*=.27)	***n*=20 (*mdn* = .00)**
Race	*F*(4, 1542)=2.66, *p*=.031, η_p^2=.01	*H*(4)=9.08, *p*=.059	*F*(4, 1627)=1.26, *p*=.283, η_p^2=.00	*H*(4)=11.78, *p*=.019	*F*(4, 1193)=.57, *p*=.688, η_p^2=.00	***H*(4)=47.30, *p*<.001 Black > Multiple, p_{adj} <.01, *r*=−.21 Asian > Multiple, p_{adj} <.001, *r*=−.33 Black > White, p_{adj} <.01, *r*=−.09 Asian > White, p_{adj} <.001, *r*=−.15**
Black/African American	*n*=87(*m*=.23, CI [.14, .33], *sd*=.33)	*n*=165 (*mdn* = 1.00)	*n*=87 (*m*=.23, CI [.14, .32], *sd*=.41)	*n*=156 (*mdn* = .00)	*n*=68 (*m*=.42, CI [.32, .53], *sd*=.35)	***n*=161 (*mdn* = .00)**
Asian	*n*=116 (*m*=.14, CI [.06, .23], *sd*=.29)	*n*=156 (*mdn* = .00)	*n*=105 (*m*=.21, CI [.13, .30], *sd*=.30)	*n*=135 (*mdn* = .00)	*n*=84 (*m*=.41, CI [.32, .51], *sd*=.37)	***n*=132 (*mdn* =.00)**
White	*n*=1171 (*m*=.21, CI [.18, .24], *sd*=.34)	*n*=1548 (*mdn* = 1.00)	*n*=1270(*m*=.23, CI [.20, .25], *sd*=.32)	*n*=1596 (*mdn* = .00)	*n*=929 (*m*=.44, CI [.41, .47], *sd*=.34)	***n*=1373 (*mdn* = .00)**

	Injury		Natural Disaster		Precaution	
Multiple races selected	n=83 (m=.12, CI [.02, .21], sd=.34)	n=113 (mdn = 1.00)	n=83 (m=.18, CI [.09, .27], sd=.32)	n=102 (mdn = .00)	n=57 (m=.39, CI [.27, .51], sd=.38)	**n=84 (mdn = .00)**
Other/Unknown	n=90(m=.17, CI [.07, .26], sd=.34)	n=146 (mdn = .50)	n=87 (m=.16, CI [.07, .25], sd=.33)	n=134 (mdn = .00)	n=60(m=.48, CI [.36, .60], sd=.35)	**n=121 (mdn = .00)**
Ethnicity	t(1491)=−.60, p=.550, d=−.05 (CI [−.25, .16]) *mean difference*=−.02, CI [−.09, .05]	U=222273.50, z=−1.41, p=.158	t(1566)=−1.28, p=.202., d=−.10 (CI [−.32, .11]) *mean difference*=−.03, CI [−.10, .03]	U=207098.50, z=−.86, p=.391	t(1162)=.74, p=.461, d=.08 (CI [−.20, .36]) *mean difference*=−.04, CI [−.07, .12]	U=141838.50, z=−1.56, p=.119
Hispanic/Latinx	n=177 (m=.18, sd=.33)	n=266 (mdn = 1.00)	n=168 (m=.19, sd=.31)	n=239 (mdn = .00)	n=94 (m=.46, sd=.33)	n=189 (mdn = .00)
Not Hispanic/ Latinx	n=1316 (m=.20, sd=.34)	n=1763 (mdn = 1.00)	n=1400(m=.23, sd=.33)	n=1791 (mdn = .00)	n=1070 (m=.43, sd=.35)	n=1602 (mdn = .00)
Education	**F(4, 1532)=7.59, p<.001, η_p^2=.02**	H(4)=11.39, p=.022	**F(4, 1613)=4.82, p=.001, η_p^2=.01**	**H(4)=34.12, p<.001 Bachelor's > High school, p_{adj} <.01, r=−.12 Advanced > High school, p_{adj} <.001, r=−.16 Bachelor's > some college, p_{adj} <.01, r=−.10 Advanced > some college, p_{adj} <.001, r=−.13**	F(4, 1189)=1.67, p=.154, η_p^2=.01	**H(4)=28.92, p<.001 Advanced > Some college, p_{adj} <.001, r=−.13**
Less than high school degree	**n=20 (m=.05, CI [−.15, .24], sd=.33)**	n=36 (mdn = .00)	**n=15 (m=.28,** CI [.06, .43], **sd=.30)**	**n=32 (mdn = .00)**	n=13 (m=.39, CI [.14, .64], sd=.35)	**n=30 (mdn = −.50)**
High school graduate	**n=117 (m=.09,** CI [.01, .17], **sd=.34)[a]**	n=198 (mdn = 1.00)	**n=139 (m=.16,** CI [.08, .23], **sd=.30)[a]**	**n=207 (mdn = .00)**	n=79 (m=.37, CI [.27, .47], sd=.38)	**n=164 (mdn = .00)**
Some college education	**n=458 (m=.18,** CI [.14, .22], **sd=.34)[a]**	n=682 (mdn = .00)	**n=486 (m=.20,** CI [.16, .23], **sd=.33)[a]**	**n=658 (mdn = .00)**	n=362 (m=.41, CI [.37, .46], sd=.36)	**n=630 (mdn = .00)**
Bachelor's degree	**n=509 (m=.20,** CI [.16, .24], **sd=.34)**	n=655 (mdn = 1.00)	**n=556 (m=.22,** CI [.18, .25], **sd=.33)**	**n=685 (mdn = .00)**	n=414 (m=.45, CI [.40, .49], sd=.35)	**n=593 (mdn = .00)**
Advanced degree	**n=433 (m=.25,** CI [.21, .30], **sd=.33)[b]**	n=544 (mdn = 1.00)	**n=422 (m=.27,** CI [.23, .31], **sd=.33)[b]**	**n=518 (mdn = .00)**	n=326 (m=.46, CI [.41, .51], sd=.34)	**n=444 (mdn = .00)**

Note. Results in bold are significant at p<.01. Confidence intervals are at 99% and are reported where appropriate. Analyses comparing gender, race, and education were one-way ANOVAs (BIATs) and Kruskal-Wallis one-way ANOVAs (explicit). Analyses comparing ethnicity were t-tests (BIATs) and Mann-Whitney U tests (explicit). Superscripts with different letters represent significantly different means at the p<.01 level. Post hoc Mann-Whitney U results report differences in average ranks with effect sizes.