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## The impact of psychological strengths on Veteran populations' mental health trajectories during the COVID-19 pandemic

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### Abstract

**Purpose:** Mental health trajectories during the COVID-19 pandemic have been examined in Veterans with tenuous social connections, i.e., those with recent homelessness (RHV) or a psychotic disorder (PSY), and in control Veterans (CTL). We test potential moderating effects on these trajectories by psychological factors that may help individuals weather the socio-emotional challenges associated with the pandemic (i.e., 'psychological strengths').

**Methods:** We assessed 81 PSY, 76 RHV, and 74 CTL over 5 periods between 05/2020 – 07/2021. Mental health outcomes (i.e., symptoms of depression, anxiety, contamination concerns, loneliness) were assessed at each period, and psychological strengths (i.e., a composite score based on tolerance of uncertainty, performance beliefs, coping style, resilience, perceived stress) were assessed at the initial assessment. Generalized models tested fixed and time-varying effects of a composite psychological strengths score on clinical trajectories across samples and within each group.

**Results:** Psychological strengths had a significant effect on trajectories for each outcome ( $ps < .05$ ), serving to ameliorate changes in mental health symptoms. The timing of this effect varied across outcomes, with early effects for depression and anxiety, later effects for loneliness, and sustained effects for contamination concerns. A significant time-varying effect of psychological

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Statements and Declarations

The authors declare that they have no conflict of interest.

strengths on depressive symptoms was evident in RHV and CTL, anxious symptoms in RHV, contamination concerns in PSY and CTL, and loneliness in CTL ( $p$ s < .05).

**Conclusion:** Across vulnerable and non-vulnerable Veterans, presence of psychological strengths buffered against exacerbations in clinical symptoms. The timing of the effect varied across outcomes and by group.

### Keywords

Resilience; COVID-19; Stress; Adaptive coping; Intolerance of uncertainty; Defeatist performance beliefs; Psychosis; Homelessness

## Introduction

The COVID-19 pandemic has been an unprecedented and lengthy stressor that has directly impacted and disrupted nearly all aspects of daily life, including physical and mental health, social relationships, work/school, personal finances, and the economy. Moreover, the pandemic has been associated with a great deal of uncertainty; uncertainty about the virus itself (e.g., etiology, transmission, management) and about the potential consequences of the pandemic for individuals and their families (e.g., duration and extent of lockdowns and restrictions, health-related concerns, social isolation, economic impacts, etc.). In addition, navigating evolving guidance and recommendations from city, county, state, and federal government officials, as well as increased social unrest during the pandemic, presented additional challenges during this period. The overarching aim of this longitudinal study (VA RR&D # D1875-F) was to gain a better understanding of the effects of this major stressor on Veterans, particularly for Veteran populations who may be especially vulnerable to the negative impacts of the pandemic due to preexisting tenuous ties to their community (i.e., Veterans with psychosis, Veterans with recent homelessness) [1–5]. One question was whether there were factors that might help to buffer against the negative impact of the pandemic (i.e., a moderation effect), including psychological strengths (e.g., tolerance of uncertainty, perceived stress and stress-coping capacity, coping style, performance beliefs), as this information could be used to assist vulnerable Veterans during future challenges. Thus, the aim of the current analyses was to test whether psychological strengths exerted fixed and/or time-varying moderating effects on mental health trajectories over the course the pandemic among three groups of Veterans. Given that the factors that contribute to psychological strengths are potentially modifiable through psychosocial interventions, the current analyses have the potential to inform intervention science efforts by providing targets to increase capacity for resilience and adaptive responding in Veterans facing acute and enduring stressful events.

For this project, we tracked mental health outcomes over a 15-month period, including symptoms of depression, generalized anxiety, concerns about contamination, and loneliness. We assessed these outcomes longitudinally in three groups of Veterans: Veterans with psychosis (PSY), Veterans with recent homelessness (RHV), and control Veterans (CTL) [4,5]. At the beginning of the study, we also assessed several ‘psychological strengths’ that could potentially help Veterans weather the storm of the mental health impact of the COVID-19 pandemic and social distancing, and the associated disruptions to daily life,

relationships, and routines. The factors included stress coping capacity [6], coping style, and level of perceived stress [7]. We also assessed tolerance of uncertainty. Difficulty tolerating uncertainty and fearfulness of the unknown is a vulnerability factor for a variety of emotional disorders [8,9], and one's ability to tolerate uncertainty may be an especially salient psychological strength for navigating major stressors such as the pandemic. Finally, drawing from the serious mental illness (SMI) literature, we assessed the beliefs that the Veterans held about themselves regarding their ability to successfully perform goal-directed behaviors (i.e., 'defeatist performance beliefs'), a key psychological predictor of clinical symptoms and community functioning among individuals with SMI [10–12].

In previous publications, we delineated trajectories for the mental health outcomes in the three groups of Veterans [4,5], however these analyses did not consider the potential impact of psychological strengths on the trajectories. Briefly, we observed an initial rapid increase in symptoms of depression, general anxiety, and contamination concerns, followed by a gradual return to pre-COVID baseline levels over the follow-up period. Return to baseline levels occurred more rapidly for depressive and anxious symptoms compared to contamination concerns. Moreover, the groups differed in how quickly symptoms improved, with PSY, and occasionally RHV, exhibiting an unexpectedly faster recovery compared to CTL. Loneliness remained relatively stable throughout the follow-up period. The focus for this paper was to examine the potential moderating effect of psychological strengths on the mental health trajectories (i.e., as a covariate), across the entire sample and within each group separately, over the study period. We predicted that higher levels of psychological strengths at baseline would positively impact the trajectories of clinical symptoms during the course of the pandemic, indicating that level of psychological strengths at baseline would serve to moderate changes in symptoms relative to pre-COVID baseline level. Specifically, we predicted significant time-varying effects of psychological strengths to emerge during the early stage of the pandemic, serving to moderate the large exacerbations of clinical symptoms we previously reported in this sample during that period [5].

## Method

Details about recruitment and procedures for this longitudinal project are fully described elsewhere [4,5]. Briefly, data collection occurred in five assessment periods between May 2020 – July 2021: an initial assessment ("Initial", May-July 2020) and four separate follow-up assessments ("Follow-Up 1", August-October 2020; "Follow-Up 2", October-November 2020; "Follow-Up 3", January-February 2021; "Follow-Up 4", April-July 2021). At the initial assessment, in addition to providing ratings about current mental health symptoms, participants were also asked to provide retrospective ratings on the clinical measures prior to the start of the pandemic (i.e., "pre-COVID estimate"). Mental health symptom data from the Initial and Follow-Up assessments 1 through 4 have previously been published [4,5], but these papers did not include data on the effect of psychological strengths, a potential moderator of clinical trajectories and the focus of the current analyses. All recruitment and study procedures were approved by the VA Greater Los Angeles Institutional Review Board.

## Participants

The selection criteria for the study were broad and based on review of medical records and chart diagnoses (or absence of diagnoses) obtained from the VA computerized patient record system (CPRS). Veterans in the PSY group had a psychotic disorder diagnosis (other than substance-induced psychosis). Veterans in the RHV group had a history of homelessness and placement in housing within the past 12 months through the Housing and Urban Development – Veteran Affairs Supportive Housing (HUD-VASH) voucher program. History of psychosis was not exclusionary for this group, and a small subset of RHV participants ( $n = 8$ ) had a psychotic disorder diagnosis. For the CTL Veterans, history of a psychotic disorder and/or evidence of homelessness based on CPRS review were exclusionary. A total of 956 potentially eligible individuals were identified in the Los Angeles area and were contacted by phone by research staff. Following a brief description of the study, a total of 231 participants ( $n = 81$  PSY,  $n = 76$  RHV,  $n = 74$  CTL) provided informed consent to participate in the study. Retention of subjects at each follow-up assessment was good and ranged from 88% at Follow-up 1 ( $n = 203$ ) to 68% at Follow-up 4 ( $n = 158$ ) [5]. The study assessments were conducted by clinically-trained interviewers ( $n = 10$ ) via telephone. Characteristics of the three participant groups are presented in Table 1.

## Measures

The study measures administered to all participants are listed in Table 2. The specific measures were selected because they are reliable and valid self-report assessments of the constructs of interest and are widely used in psychological research. The psychometric properties for each measure are described in the original articles (see Table 2 for citations). For mental health factors, we assessed symptoms of depression, generalized anxiety, obsessive-compulsive thoughts (behaviors related to germs and contamination), and loneliness. For all measures, higher scores indicate worse symptom severity. For psychological strengths, we assessed five factors: self-reported ability to tolerate uncertainty, stress coping capacity, coping style, perceived stress burden, and defeatist performance beliefs. Because coping style was categorized as either adaptive or maladaptive, we calculated the proportion of adaptive coping to total coping strategies endorsed (i.e.,  $\frac{\text{adaptive coping}}{\text{(adaptive coping + maladaptive coping)}}$ ) for each participant. Descriptive statistics for the mental health measures and psychological strengths measures for each group and assessment point are in Table 1. The clinical measures were assessed at all time points, while the psychological strengths were assessed at the Initial assessment and Follow-Up assessments 2 & 4.

## Data Analyses

First, we used principal components analysis (PCA) to guide reduction of the psychological strengths data to preserve degrees of freedom in subsequent analyses of the clinical trajectories. For ease of interpretation, prior to PCA the scoring direction for Intolerance of Uncertainty Scale (IUS), Perceived Stress Scale (PSS), and Dysfunctional Attitudes Scale (DAS) were reversed so that higher scores were always better (i.e., better tolerance for uncertainty, a lower level of perceived stress, fewer defeatist performance beliefs). Briefly, for the PCA of Initial assessment data, a single component with eigenvalue  $> 1$  was

extracted. The component explained 57% of the common variance. All five psychological strengths measures loaded onto this single component, with each measure loading roughly equally on the component (i.e., component loadings  $\sim .70$  for each measure). Similar results were obtained from analyses for follow-up assessments 2 and 4 (i.e., single component with eigenvalue  $> 1$ , roughly equal loadings across measures, etc.). Thus, we created a single index of psychological strengths for the initial assessment and follow-up assessments 2 and 4, which was calculated as the mean of  $z$  scores for the five measures (using the mean and standard deviation of each measure at the Initial assessment in the  $z$  score calculation). We then tested whether the psychological strength score changed across assessment periods. The fixed effect of assessment number was significant indicating change over assessment periods ( $F(2, 351) = 2.32, p = .003$ ), which was attributable to higher scores at Follow-up 4 compared to the Initial assessment (mean difference =  $-.12$ ,  $se = .03, p < .001$ ). Scores on the psychological strengths index did not significantly change between the Initial assessment and Follow-up 2 (mean difference =  $-.06$ ,  $se = .03, p = .07$ ) and between Follow-up 2 and 4 (mean difference =  $-.06$ ,  $se = .04, p = .10$ ). For subsequent analyses we assessed fixed and time-varying effects of the index of psychological strengths from the initial assessment (baseline) on mental health outcomes.

Given that we were interested in the trajectories in mental health outcomes over time and potential moderation of the clinical trajectories by initial level of psychological strengths, we analyzed the data using time varying coefficient models (VCM) using the generalized additive models (GAM) structure via the *mgcv* package version 1.8–34 [13] implemented in R version 4.0.5 [14]. With VCM, smoothed functions for the shape of the trajectories over time are fit, and both the linear and non-linear aspects of the data can be modeled without pre-specification of anticipated patterns (e.g., linear, quadratic, etc.). We fit a series of VCMs with each of the clinical factors as the outcome. Models were first fit to the entire sample, with main and time-varying effects of group, psychological strengths, followed by separate analyses for each of the three groups of Veterans, with a time-varying  $y$ -intercept and main and time-varying effects of psychological strengths. All models included a subject-specific time-varying random effect to account for correlations between multiple measurements per subject. For each model, we evaluated whether the mental health outcome varied over time, and the group and psychological strengths have significant main and time-varying effects on the mental health trajectories.

The data were analyzed as change relative to the pre-COVID estimate. We calculated change scores for each clinical measure at each assessment point relative to the pre-COVID value. Specifically, we calculated the number of days elapsed for each assessment relative to the pre-COVID assessment period, which was set to March 1, 2020 (prior to the first stay-at-home order in California). The data were centered so that everyone had a score of zero for each outcome measure on March 1. The number of days elapsed since March 1, 2020 was used as a predictor in the models rather than follow-up assessment number given that the windows for the follow-up assessments were broad. To summarize, for the GAM analyses the independent variables were time (days since March 1, 2020), group (PSY, RHV, CTL), and baseline psychological strengths index score, and the dependent variables were change scores in the mental health outcomes (e.g., PHQ-9, GAD-7, DOCS, ULS) relative to the pre-COVID value.

## Results

Before turning to the results regarding moderation of trajectories we will briefly review the overall patterns we identified previously [5]. For depressive symptoms there was an increase in depressive symptoms during the early phase of the pandemic relative to pre-COVID baseline levels in all three groups. Notably, the PSY group exhibited a more rapid recovery than RHV and CTL, who took longer to return to baseline levels. Similarly, for general anxiety symptoms all three Veteran groups exhibited an initial increase in symptoms relative to the pre-COVID baseline period during the early months of the pandemic. The RHV and PSY groups returned to baseline more quickly than the CTL group, who exhibited a persistent elevation in anxious symptoms throughout the study period. Regarding OCD-like symptoms, all three groups exhibited an initial exacerbation of concerns about contamination early in the pandemic. While the OCD-like symptoms gradually declined over time in all three groups, they persisted longer in the CTL group relative to PSY. Loneliness did not significantly change over the course of the study in RHV or CTL but did decline for PSY. However, there were no significant group differences for the trajectories. Thus, the general pattern for depressive, anxious, and OCD-like symptoms was an initial worsening of mental health symptoms compared to pre-COVID baseline during the early stages of the pandemic, followed by a gradual improvement as the pandemic wore on. The groups differed in terms of how quickly symptoms improved, with PSY, and occasionally RHV, exhibiting an unexpectedly faster recovery compared to CTL. Next, we will turn to moderation of the clinical trajectories by initial level of psychological strengths, first across the entire sample, then separately by group.

The model summaries for the entire sample are presented in Table 3, and Figures depicting the mental health trajectories (Figure 1a – 4b) and the time-varying effect of psychological strengths on the clinical trajectories (Figures 1b – 4b) are presented below. For depressive symptoms, the fixed effect for psychological strengths was not significant ( $p = .31$ ), indicating that psychological strengths at the initial assessment did not exert a constant impact on the overall trajectory for depressive symptoms. However, the time-varying effect was significant ( $t = 2.85, p = .01$ ), indicating that the impact of psychological strengths on change in depressive symptoms varied over time (i.e., more impactful at certain time points and less impactful at other time points). Specifically, higher levels of psychological strengths were associated with smaller changes in depressive symptoms relative to baseline early in the pandemic (see Figure 1b and Table 3), indicated where the curve and confidence band drops below the zero line in Figure 1b. Because depressive symptoms were increasing across groups at this stage of the pandemic, the finding indicates that psychological strengths served to buffer against this increase. Examining each group separately, the time-varying effect observed in the combined sample was significant in RHV ( $t = 3.83, p = .004$ ) and PSY ( $t = 2.97, p = .05$ ), but was not statistically significant in CTL ( $p = .13$ ) (see Supplemental Materials).

For symptoms of general anxiety, the fixed effect for psychological strengths was not significant ( $p = .27$ ), indicating that psychological strengths at the initial assessment did not exert a constant impact on the overall trajectory for anxious symptoms. However, the time-varying effect was significant ( $t = 3.83, p = .002$ ), indicating that the impact of

psychological strengths on the change in symptoms of general anxiety varied over time. As we observed for depressive symptoms, higher levels of psychological strengths were associated with smaller changes in the level of anxious symptoms early in the pandemic (see Figure 2b and Table 3). As with depression, this moderation occurred during an *increase* in anxious symptoms across groups suggesting that psychological strengths ameliorated the increase of anxious symptoms early in the pandemic. Examining each group separately, the time-varying effects observed in the overall sample appear to be primarily driven by the RHV group ( $t = 3.08, p = .05$ ), as time-varying effects were not statistically significant in PSY ( $p = .11$ ) or CTL ( $p = .27$ ).

For contamination concerns, the fixed effect for psychological strengths was significant ( $t = -3.70, p < .001$ ), indicating that psychological strengths at the initial assessment had a time-invariant impact on the overall trajectory for these symptoms. Specifically, psychological strengths were associated with smaller changes in contamination concerns relative to baseline. The time-varying effect was also significant ( $t = 4.90, p < .001$ ), indicating that in addition to the constant effect, the impact of psychological strengths on OCD-like symptoms varied over time. Inspection of the curve (Figure 3b) suggests that higher levels of psychological strengths was associated with smaller changes in contamination concerns throughout the assessment period, but also served to buffer an initial increase in symptoms early in the pandemic. At the group level, a significant fixed effect was evident in CTL and PSY ( $p = .02$ ), but not in RHV ( $p = .18$ ). A significant time-varying effect was evident in the CTL ( $t = 3.03, p = .03$ ) and a marginal effect was evident in PSY ( $t = 2.00, p = .09$ ), but not RHV ( $p = .37$ ).

For loneliness, the fixed effect for psychological strengths was significant ( $t = -2.28, p = .02$ ), indicating that psychological strengths at the initial assessment exerted a time-invariant effect on the overall trajectory for loneliness symptoms. The time-varying effect was marginally significant ( $t = 2.37, p = .06$ ), reflecting a tendency for the impact of psychological strengths on loneliness trajectories to vary over time. Specifically, higher levels of psychological strengths were associated with smaller changes from baseline levels of loneliness later in the pandemic. Fixed and time-varying effects were evident in CTL ( $p = .009$ ), but not PSY or RHV ( $p = .40$ ).

## Discussion

The aim of this paper was to examine the potential moderating effect of psychological factors on mental health symptom trajectories in putatively vulnerable Veteran groups and control Veterans over the first 18 months of the COVID-19 pandemic. We predicted that higher levels of ‘psychological strengths’ (i.e., adaptive coping skills, greater stress coping capacity, lower levels of perceived stress, lower defeatist beliefs, greater ability to tolerate uncertainty) at the initial assessment would help buffer the negative psychological impact of the pandemic and the associated disruptions to daily routines and relationships. Consistent with our predictions, greater psychological strengths were generally associated with smaller exacerbations in symptom severity from pre-COVID baseline levels of symptoms.



Notably, we observed different impacts of psychological strengths over time for the different mental health outcomes that also varied by group. The timing of the effect of psychological strengths on changes in depressive and generalized anxiety symptoms coincided with the large exacerbation of these symptoms early in the pandemic [5]. Thus, higher levels of psychological strengths served to ameliorate heightened emotional distress as Veterans navigated the early days of the pandemic. The impact of psychological strengths was relatively constant for loneliness, which remained fairly stable throughout the study period. For contamination concerns, we observed both fixed and time-varying effects of psychological strengths.

Contamination concerns increased sharply early in the pandemic and slowly declined to pre-COVID baseline levels over the course of several months. Increased awareness of potential for contamination and adoption of mitigation strategies to curb virus transmission (e.g., frequent hand washing, mask wearing, sanitizing shared surfaces, physical distancing, etc.) represents an adaptive response during a pandemic, and thus an increase in these types of thoughts and behaviors is normative and to be expected. However, obsessive-compulsive features exist on a continuum [15], and *preoccupation* with concerns about contamination and engagement in avoidance behaviors consistent with obsessive compulsive symptoms can be distressing and impairing [16]. Here, psychological strengths served to buffer an initial increase in contamination concerns, but also exerted a sustained impact throughout the study period.

The components of the psychological strengths index represent modifiable treatment targets and are well-suited for psychosocial interventions. Indeed, psychosocial treatments currently available through the VA Healthcare System address these components. For example, intolerance of uncertainty and discomfort with ambiguity may be responsive to mindfulness-based and cognitive-behavioral interventions through cultivation of acceptance and emotion regulation skills [17,18]. Similarly, through identification and remediation of maladaptive cognitions and cognitive biases, cognitive-behavioral therapy (CBT) can modify appraisal of stress and defeatist performance beliefs [19–21]. Moreover, CBT incorporates psychoeducation and skills training components that can shore up stress coping capacity and promote adoption of adaptive coping strategies [22]. Reliable, valid, and brief self-report measures are readily available to assess each aspect of the psychological strengths index, and we encourage clinicians to incorporate these measures into routine mental health care to identify individualized treatment targets to shore up capacity for resilience.

The 15-month follow-up period for this study permitted assessment of initial reactions to the COVID-19 pandemic first as an acute stressor in the early stage of the pandemic and then as a sustained (and still ongoing) stressor. Data from our previous study demonstrated that the early mental health impact of the pandemic differed from the sustained impact, and that specific mental health outcomes showed different patterns over time [5]. Similarly, the current analyses indicate that initial level of psychological strengths exerted protective effects that differed over time and across mental health outcomes. Thus, initial and sustained mental health responses were distinct, and psychological strengths provided distinct protective effects for these periods. While the COVID-19 is a unique stressor in

many respects, these data underscore the importance of psychological strengths for adaptive response to other significant acute and chronic stressors Veterans may face.

Strengths of this study include the relatively large sample of Veterans, the relatively rapid deployment of remote assessments following the onset of the COVID-19 pandemic, the use of repeated assessments over a 15-month follow-up period, and good retention of research participants over time. A limitation of the study was reliance on self-report information as well as a retrospective assessment of pre-pandemic symptom severity. Moreover, the assessment battery used in this study was not exhaustive, and it is possible that important factors that contribute to one's capacity for resilience were not assessed. In addition, it is possible that alternative measures of the included constructs may have yielded different results. The current analyses evaluated the time-varying impact of the initial level of psychological strengths on mental health outcomes. Thus, changes in psychological strengths over time, e.g., perhaps an increase or growth in psychological strengths response to the challenges associated with the pandemic [23], and the impact of such changes on mental health outcomes remains an open question. Moreover, the current analyses did not examine the relative contribution of each component of the psychological strengths index for moderation of clinical trajectories. While each component contributed equally to the index score, it is possible that some components exert stronger moderating effects than others, or that some components are particularly important for certain clinical outcomes and less important for others. This is a question for future research. The current sample were predominantly male and in middle to late adulthood, and it is unknown how generalizable the findings would be for women and/or younger adults. Moreover, Veterans represent a specialized population with distinct prior experiences (e.g., military training and service) and access to programs and benefits (e.g., comprehensive health care, social programs, housing programs, financial supports, etc.) that are not always available to civilian populations. It is possible that these factors may influence response to the pandemic as well as capacity for resilience. Finally, we acknowledge that in addition to the notable differences across the three groups of Veterans, considerable heterogeneity likely exists within each group regarding the clinical trajectories, initial levels of psychological strengths, and the moderating impact of psychological on clinical trajectories. While the current analyses can speak to overall effects across the entire sample and whether similar patterns were observed for each group individually, further work examining individual differences and predictors of individual trajectories may be informative.

In conclusion, in this large sample of Veterans we observed the moderating impact of psychological strengths on mental health outcomes over the course of the COVID-19 pandemic. Across the entire sample, psychological strengths buffered against exacerbations in clinical symptoms, including depressive symptoms, anxiety, contamination concerns, and loneliness. The timing of the effect varied across outcomes; psychological strengths protected against initial exacerbation of depression and anxiety early in the pandemic, exerted an influence on contamination concerns throughout the pandemic, and influenced loneliness later in the pandemic. The factors that contributed to the psychological strengths index are potentially modifiable through psychosocial interventions, and thus represent a treatment target to increase capacity for resilience and growth in Veterans.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

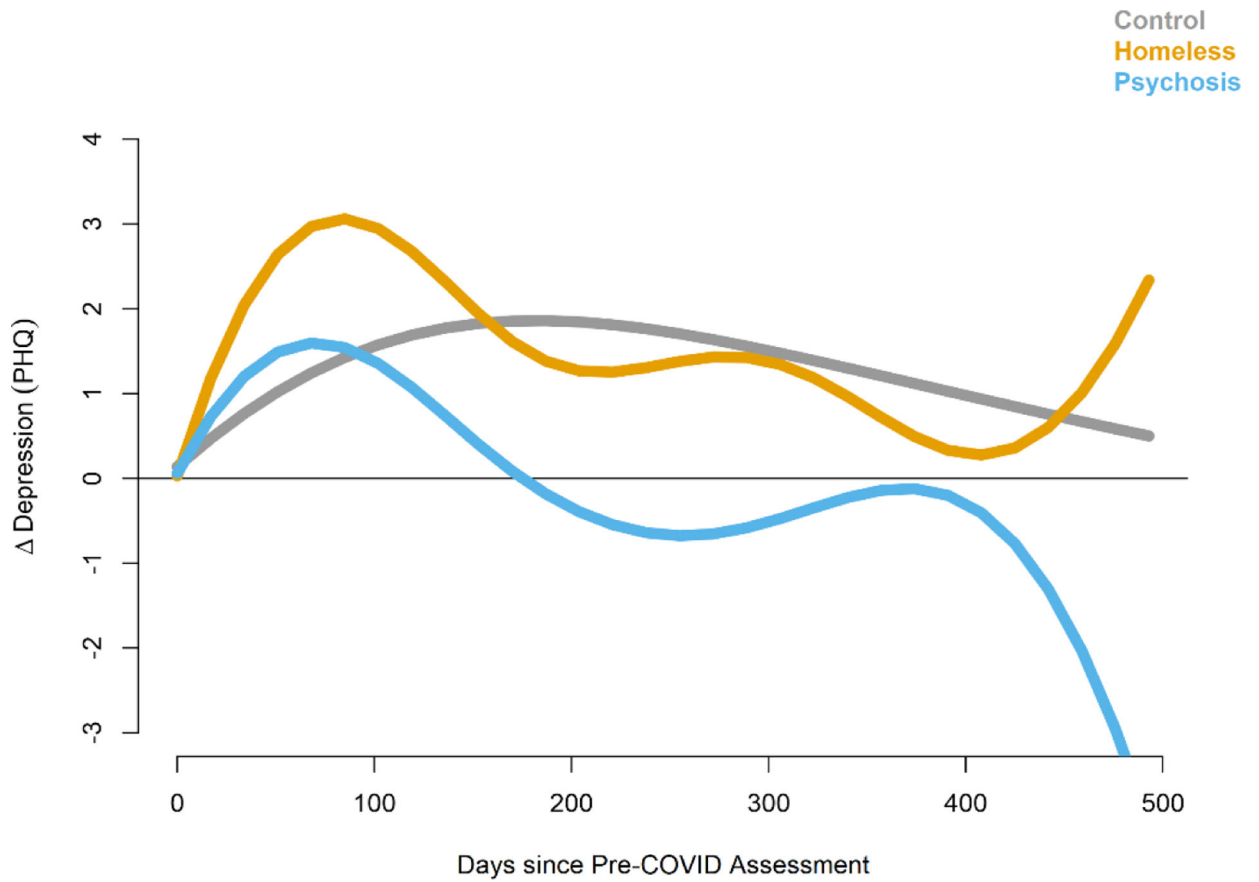
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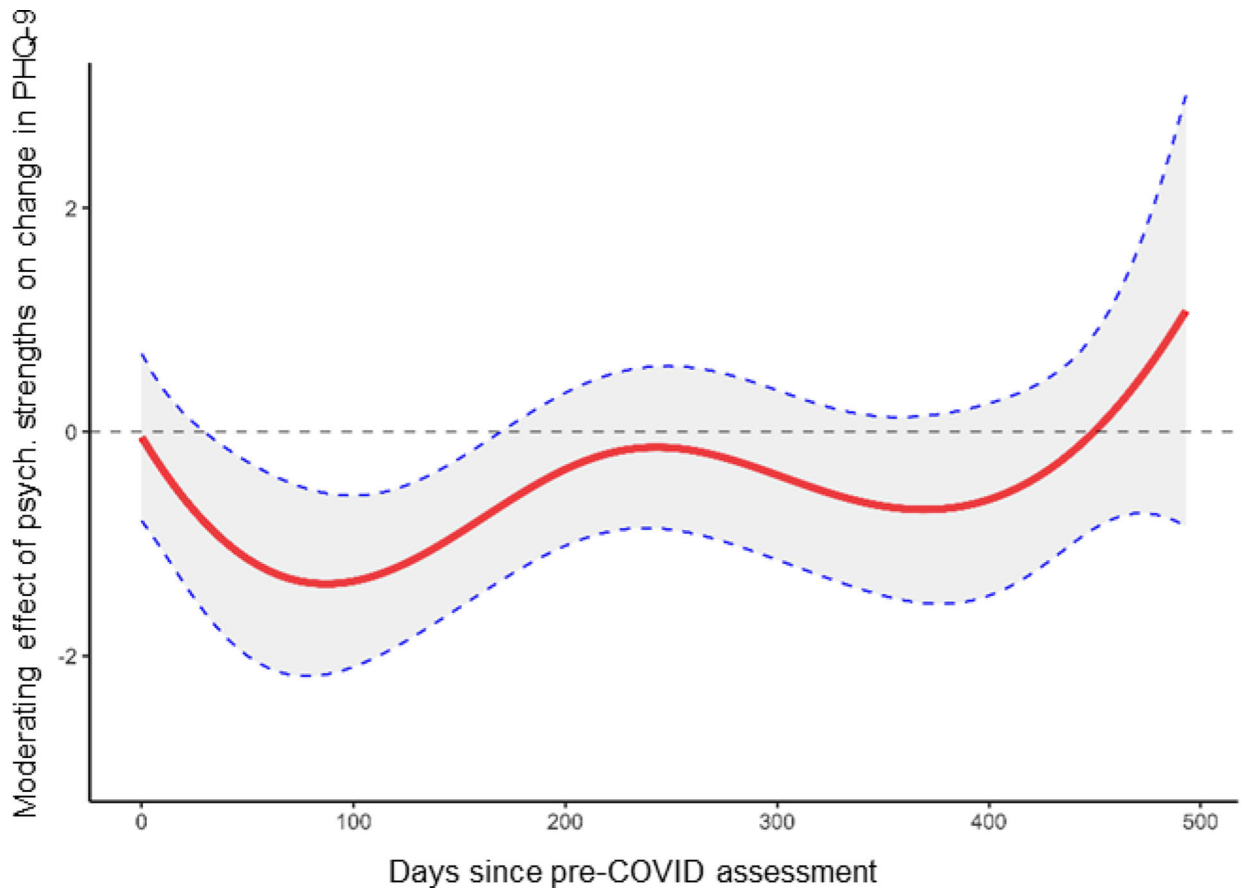
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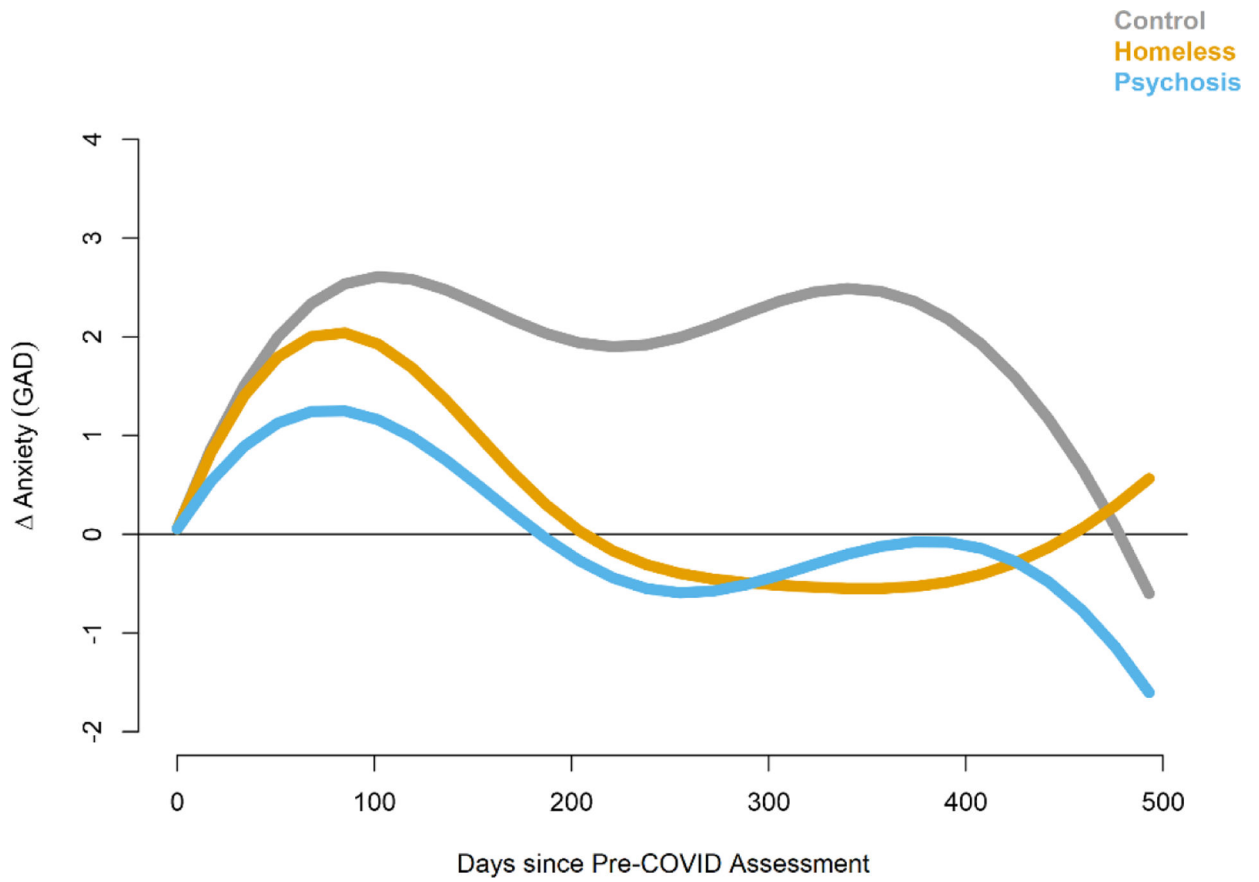
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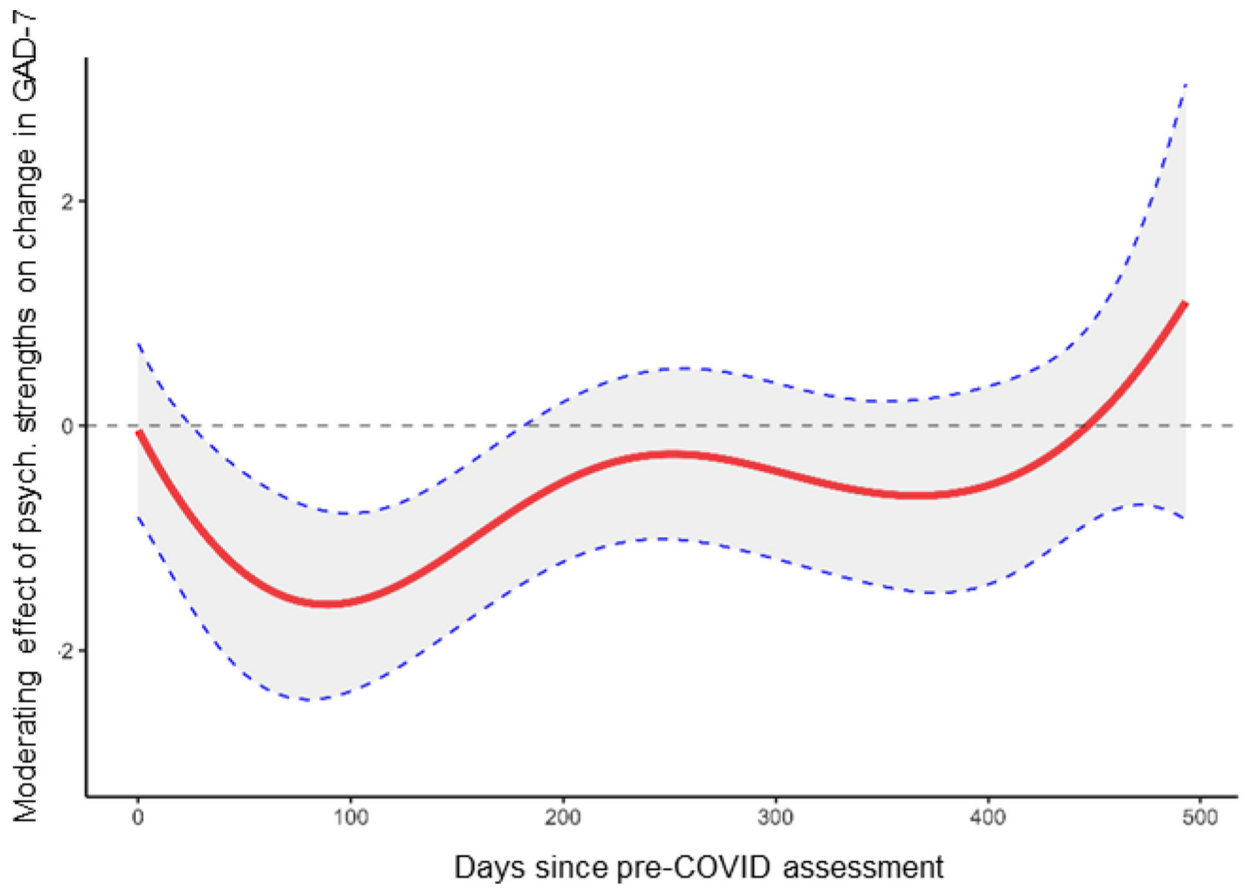
**Figure 1a.** Smoothed curves depicting change in PHQ-9 score relative to pre-COVID baseline. Scores above the zero-line indicate an increase in symptom severity, scores below the zero line indicate a decrease in symptom severity.



**Figure 1b.** Effect of psychological strengths index on change in PHQ-9 score relative to pre-COVID baseline. Areas where the curve and the confidence band fall below the zero line indicate periods where the initial level of psychological strengths were associated with smaller changes from the pre-COVID baseline.

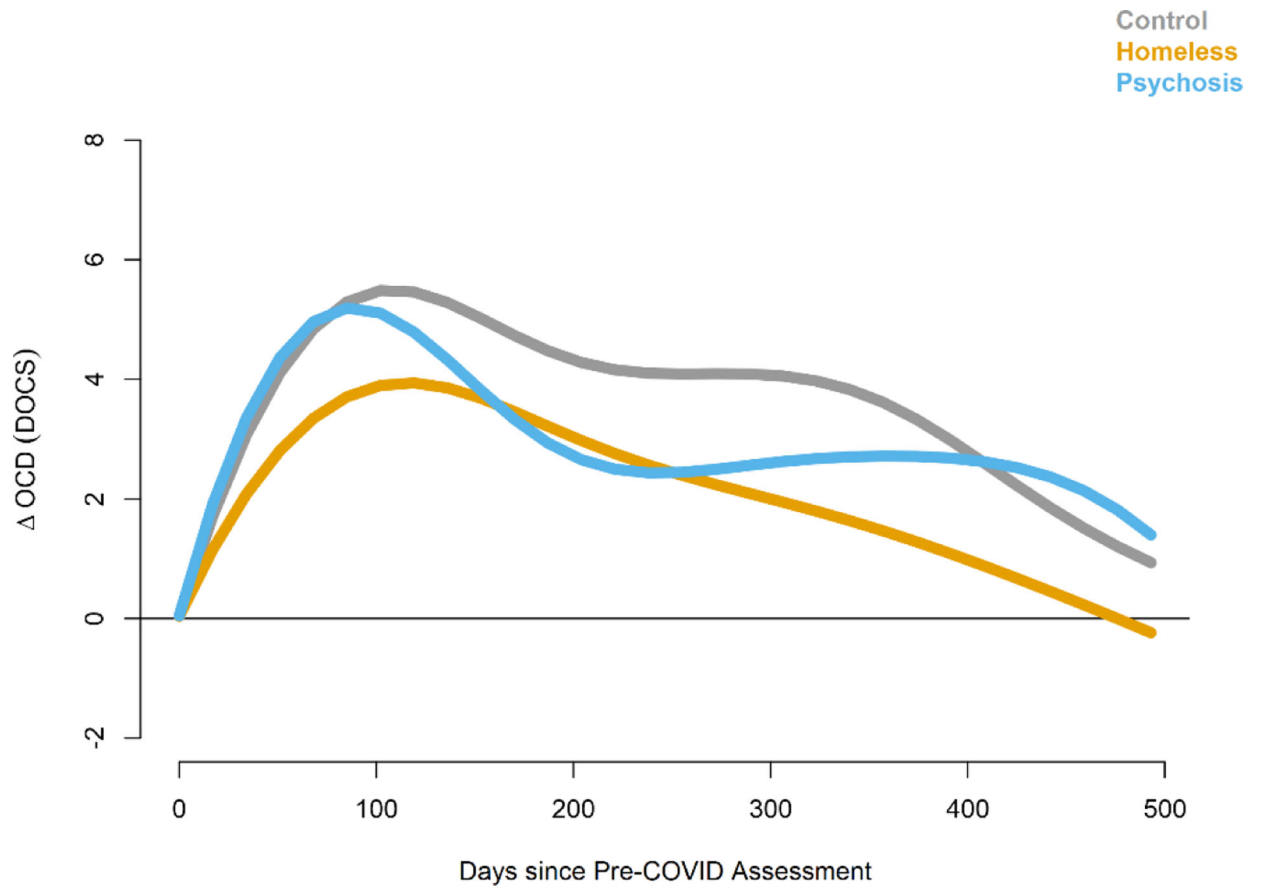


**Figure 2a.** Smoothed curves depicting change in GAD-7 score relative to pre-COVID baseline. Scores above the zero-line indicate an increase in symptom severity, scores below the zero line indicate a decrease in symptom severity.

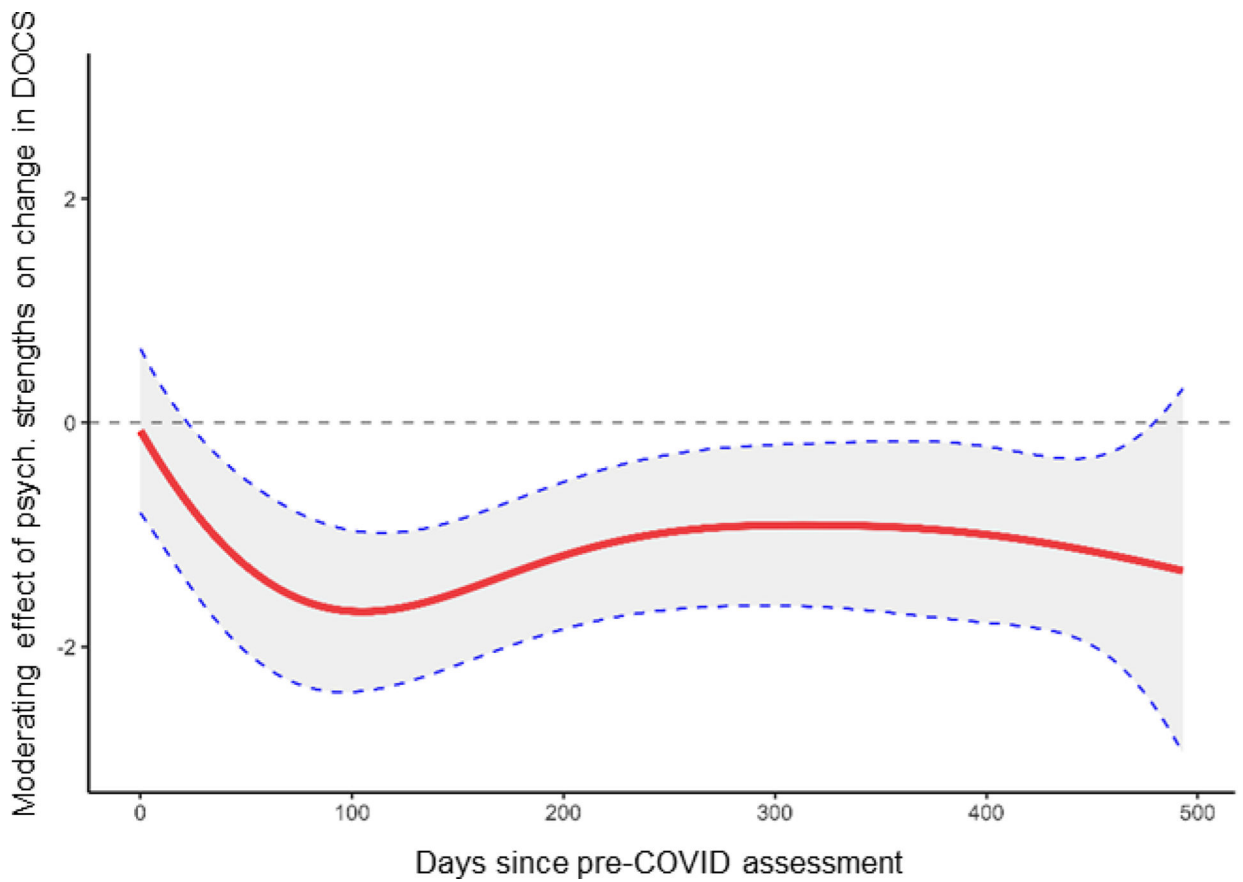


**Figure 2b.** Effect of psychological strengths index on change in GAD-7 score relative to pre-COVID baseline. Areas where the curve and the confidence band fall below the zero line indicate periods where the initial level of psychological strengths were associated with smaller changes from the pre-COVID baseline.

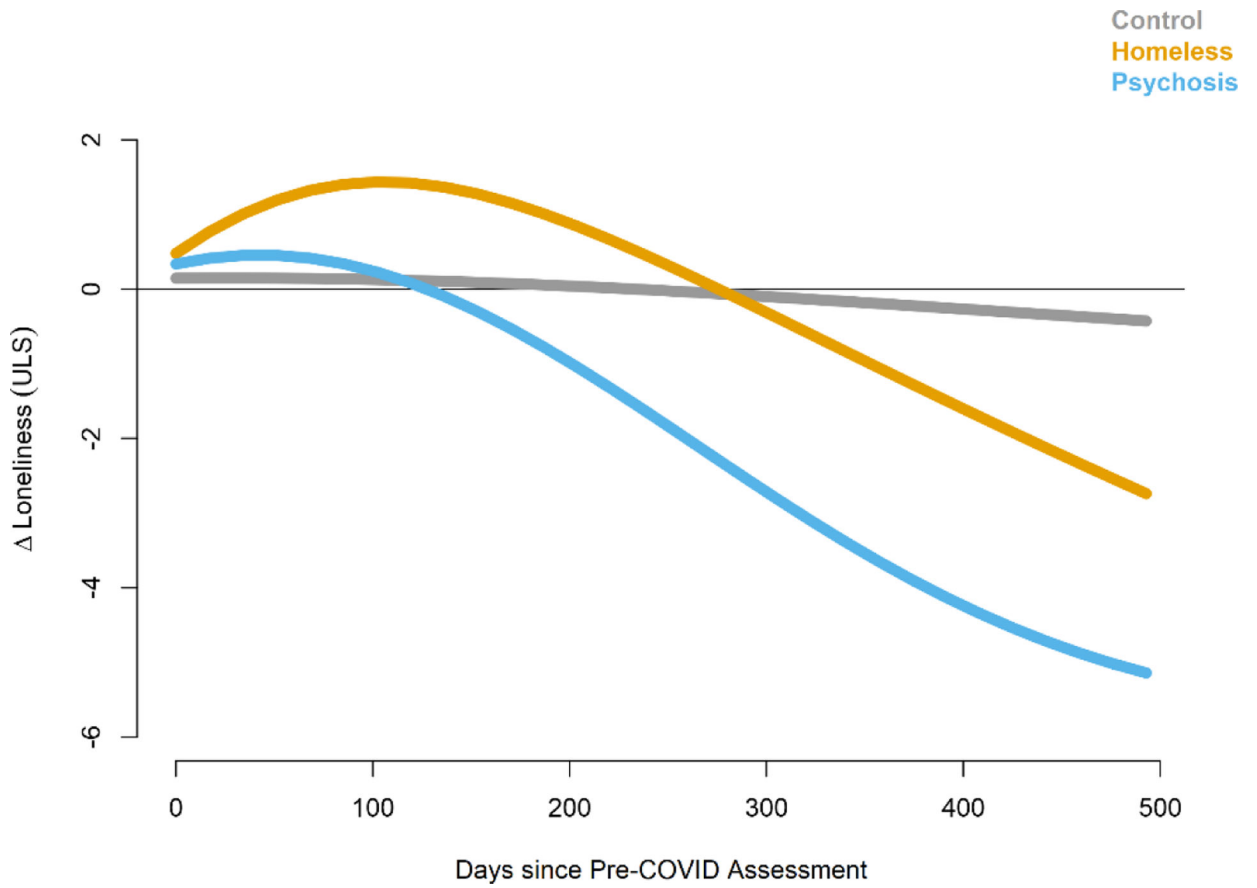




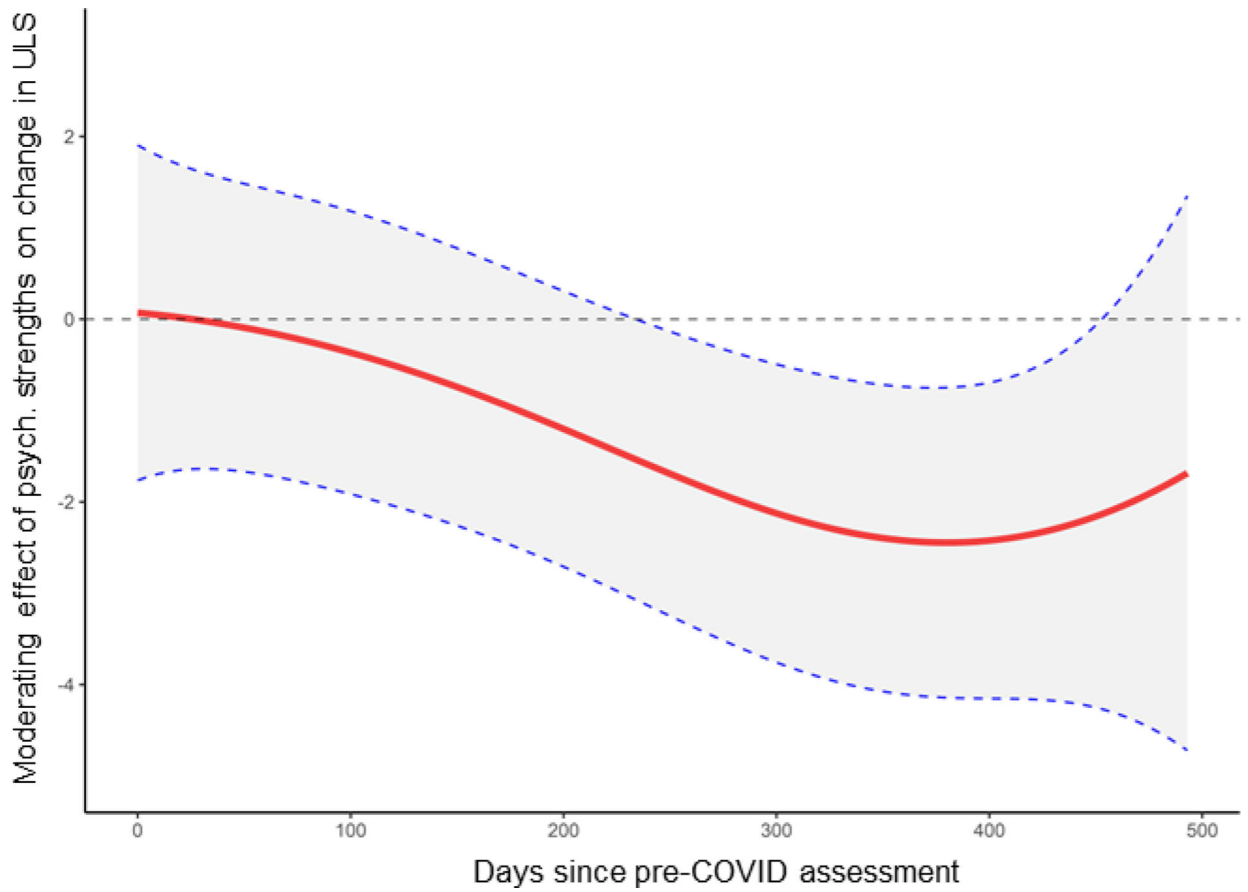
**Figure 3a.** Smoothed curves depicting change in DOCS score relative to pre-COVID baseline. Scores above the zero-line indicate an increase in symptom severity, scores below the zero line indicate a decrease in symptom severity.



**Figure 3b.** Effect of psychological strengths index on change in DOCS score relative to pre-COVID baseline. Areas where the curve and the confidence band fall below the zero line indicate periods where the initial level of psychological strengths were associated with smaller changes from the pre-COVID baseline.



**Figure 4a.** Smoothed curves depicting change in ULS score relative to pre-COVID baseline. Scores above the zero-line indicate an increase in symptom severity, scores below the zero line indicate a decrease in symptom severity.



**Figure 4b.** Effect of psychological strengths index on change in ULS score relative to pre-COVID baseline. Areas where the curve and the confidence band fall below the zero line indicate periods where the initial level of psychological strengths were associated with smaller changes from the pre-COVID baseline.

**Table 1.** Sample characteristics and descriptive statistics for psychological strengths at Initial assessment.

	PSY ( <i>n</i> = 81)	RHV ( <i>n</i> = 76)	CTL ( <i>n</i> = 74)	Statistic ( <i>F</i> or $\chi^2$ )
Age (year)	54.4 (9.8)	51.6 (12.5)	56.5 (9.5)	$F_{(2,228)} = 4.03, p = \mathbf{0.019}$ CTL > RHV
Gender (M:F)	72:9	66:10	63:11	$\chi^2_{(2)} = 0.485, p = 0.785$
Ethnicity (Hispanic:Non-Hispanic)	16:63	21:55	19:55	$\chi^2_{(2)} = 1.23, p = 0.541$
Race (Black:White:Other)	40:29:10	34:31:9	28:38:8	$\chi^2_{(4)} = 3.47, p = 0.482$
Intolerance of uncertainty scale	33.26 (9.75)	36.47 (9.87)	32.64 (10.23)	$F_{(2,227)} = 3.22, p = \mathbf{0.04}$ CTL, PSY < RHV
Connor-Davidson resilience scale—10	26.79 (7.44)	28.11 (7.08)	28.54 (7.33)	$F_{(2,227)} = 1.22, p = 0.30$
Perceived stress scale	20.70 (8.91)	23.82 (10.54)	20.74 (10.25)	$F_{(2,227)} = 2.36, p = 0.10$
Dysfunctional attitudes scale (defeatist performance beliefs)	38.27 (16.10)	38.69 (16.53)	34.35 (16.67)	$F_{(2,227)} = 1.59, p = 0.21$
Brief coping orientation to problems experienced inventory (adaptive/total coping strategies)	0.66 (0.06)	0.65 (0.06)	0.66 (0.06)	$F_{(2,227)} = 1.66, p = 0.19$
Psychological strengths index	0.00 (0.60)	- 0.10 (0.65)	0.12 (0.67)	$F_{(2,227)} = 2.23, p = 0.11$

**Table 2.**

Study measures.

<b>Mental health outcomes</b>	<b>Measure</b>	<b>Scoring</b>	<b>Interpretation</b>
Depression	Personal Health Questionnaire – 9 (PHQ-9) [24]	0–27	Higher scores indicate greater severity of depressive symptoms
Anxiety	Generalized Anxiety Disorder – 7 (GAD-7) [25]	0–21	Higher scores indicate greater severity of anxious symptoms
Contamination concerns	Dimensional Obsessive-Compulsive Scale – Category 1 concerns about germs and contamination (DOCS) [26]	0–20	Higher scores indicate greater severity of contamination concerns
Loneliness	UCLA Loneliness Scale (ULS) [27]	0–60	Higher scores indicate greater loneliness
Psychological strengths	Measure	Scoring	Interpretation
Tolerance of uncertainty	Intolerance of Uncertainty Scale (IUS) [28]	12–60	Higher scores indicate greater intolerance of uncertainty
Stress coping capacity	Connor-Davidson Resilience Scale (CD-RISC 10) [27]	0–40	Higher scores indicate greater stress coping capacity
Perceived stress	Perceived Stress Scale (PSS) [29]	0–56	Higher scores indicate higher burden of perceived stress
Performance beliefs	Dysfunctional Attitudes Scale, Defeatist Performance Beliefs subscale (DAS) [30]	15–105	Higher scores indicate greater severity of defeatist beliefs
Adaptive coping style	Brief Coping Orientation to Problems Experienced Inventory, adaptive and maladaptive strategies (Brief COPE) [31]	0–1	Higher scores indicate greater relative use of adaptive coping strategies (adaptive strategies/total strategies)

Main and time-varying effects of psychological strengths from time-varying coefficient model fit to the entire sample.

**Table 3.**

Outcome variable	Estimate (SE)	t or F-value	p-value
Model 1: Depression (PHQ-9)			
Main effect psych. strengths	-.316 (.313)	-1.012	.312
Time-varying effect psych. strengths		2.845	<b>.012</b>
Model 2: Anxiety (GAD-7)			
Main effect psych. strengths	-.031 (.329)	-1.095	.274
Time-varying effect psych. strengths		3.830	<b>.002</b>
Model 3: Contamination concerns (DOCS)			
Main effect psych. strengths	-1.139 (.308)	-3.695	<b>.0002</b>
Time-varying effect psych. strengths		4.910	<b>.001</b>
Model 4: Loneliness (ULS)			
Main effect psych. strengths	-1.687 (.739)	-2.283	<b>.023</b>
Time-varying effect psych. strengths		2.373	.056