Edinburgh Research Explorer

Behind the masks

Journal of Contextual Behavioral Science

Behind the Masks: A Cross-sectional Study on Intolerance of Uncertainty, Perceived Vulnerability to Disease and Psychological Flexibility in Relation to Anxiety and Wellbeing During the COVID-19 Pandemic
--Manuscript Draft--

Highlights

- Effects of COVID-19 on population wellbeing were replicated
- Loneliness and disruption were associated with poorer outcomes
- Cognitive Appraisals were also associated with poorer outcomes
- Psychological Flexibility was associated with better outcomes
- Psychological Flexibility may be a useful model for public health interventions

Behind the Masks: A Cross-sectional Study on Intolerance of Uncertainty, Perceived Vulnerability to Disease and Psychological Flexibility in Relation to Anxiety and Wellbeing During the COVID-19 Pandemic

Rebecca Mallett, Clodagh Coyle, Yingtu Kuang, David T. Gillanders

School of Health in Social Science, University of Edinburgh, Medical School, Teviot Place, Edinburgh EH8 9AG, UK

Author Note

Rebecca Mallett https://orcid.org/0000-0002-3119-6910

David Gillanders https://orcid.org/0000-0003-4071-4211

Correspondence concerning this article should be addressed to:

Rebecca Mallett, School of Health in Social Science, University of Edinburgh, Medical School, Teviot Place, Edinburgh EH8 9AG, UK

R.E.Mallett@sms.ed.ac.uk

Behind the Masks: A Cross-sectional Study on Intolerance of Uncertainty, Perceived Vulnerability to Disease and Psychological Flexibility in Relation to Anxiety and Wellbeing During the COVID-19 Pandemic

1   Abstract

As with previous pandemics, early findings suggest the COVID-19 pandemic and related containment measures are having a negative impact on mental wellbeing. This study compared the contribution of three factors to anxiety and wellbeing during the pandemic in June 2020. These factors were: i) Contextual factors (e.g. exposure to COVID-19, being a key worker, feeling lonely, etc); ii) Cognitive appraisals: perceived vulnerability to disease (PVD) and intolerance of uncertainty (IU); and iii) psychological flexibility (PF). 603 participants aged 18 or older completed an online survey of self-report measures. Hierarchical regression analyses demonstrated PVD, IU and PF predicted state anxiety, and IU and PF predicted mental wellbeing. Some, but not all of the contextual factors also predicted anxiety and wellbeing. The findings support cognitive appraisal theories and the PF model, lending support to an acceptance and commitment therapy (ACT) approach to public health during pandemics.

Keywords: COVID-19; psychological flexibility; cognitive appraisals; uncertainty; perceived vulnerability to disease

2   Introduction

Following the first reported cases in Wuhan, China, in December 2019 (Zhu et al., 2020), COVID-19 has spread rapidly across the globe. At the time of writing, worldwide confirmed infections are over 102m with over 2m deaths (Jan; Johns Hopkins University & Medicine, 2021). The rapid spread of the virus has led to strict containment measures to prevent person-to-person transmission (Anderson et al., 2020). Although a vaccination programme has now begun, social distancing and restrictions on travel, socialising and businesses remain the cornerstones of the pandemic strategy in many parts of the world. However, these measures have the unwanted side-effect of reducing meaningful contact and social support at a time when it is greatly needed (Sanders, 2020).

The most comparable event in recent history, the Severe Acute Respiratory Syndrome (SARS) outbreak of 2002-2003, was found to have a profound and lasting impact on the mental

health of those infected and wider society (Lee et al., 2007; Moldofsky & Patcai, 2011). It is believed that the combined perceived health-risk, mass disruption and isolation caused by the COVID-19 pandemic has the potential for substantial negative mental health outcomes on a worldwide scale (Holmes et al., 2020) and there have been warnings of a parallel pandemic of mental ill-health (Kelly, 2020; Mucci et al., 2020).

A number of cross-sectional studies have reported associations between the COVID-19 pandemic and negative psychological outcomes including anxiety, stress, distress, depression, and post-traumatic stress (Moghanibashi-Mansourieh, 2020; Rossi et al., 2020; Shevlin et al., 2020; Wang et al., 2020). These findings are further supported by longitudinal studies with pre- and during pandemic data showing decreases in wellbeing and increases in anxiety, mental distress and psychopathological symptoms (Kwong et al., 2020; Shäfer et al., 2020; Twenge & Joiner, 2020). In light of these findings, it is important that research is conducted to identify interventions to mitigate against the psychological consequences of such pandemics. Understanding how different stressors and responses to the crisis influence psychological outcomes could help to identify mechanisms that interventions could target. This study aims to compare the contribution of contextual factors, cognitive appraisals and psychological flexibility to anxiety and mental wellbeing during the COVID-19 pandemic.

2.1   Contextual factors

Research relating to previous infectious disease outbreaks and the COVID-19 pandemic has identified a number of contextual factors associated with mental health. Perhaps unsurprisingly, factors relating to COVID-19 symptoms and disease exposure have been found to be associated with negative psychological outcomes including depression, anxiety and stress (Moghanibashi-Mansourieh, 2020; Wang et al., 2020). Whereas, feeling well-informed about the COVID-19 situation is associated with lower anxiety (Jungmann & Witthöft, 2020).

Disruption to daily routine and future plans have been found to have a negative impact on mental wellbeing in previous health crises (Jeong et al, 2016; Mak et al., 2009; Mihashi et al., 2009) and the COVID-19 pandemic (Williams et al., 2020). Additionally, a number of pandemic-related experiences or 'impact events' have been shown to impact mental wellbeing including: trauma experienced by keyworkers (Lee et al., 2007; Wu et al., 2009); loss of income (Shevlin et al., 2020); and being bereaved or unable to care for a loved one who is vulnerable,

unwell or dying (Vigo et al., 2020). Social isolation has been associated with psychological distress during COVID-19 (Boyraz et al., 2020; Smith et al., 2020) and being required to self-quarantine has been associated with post-traumatic stress symptoms, confusion and anger (Brooks, 2020). Conversely, having good social support was positively associated with mental wellbeing during the SARS epidemic in Taiwan (Ko et al., 2006) and during the COVID-19 pandemic (Xiao et al., 2020).

2.2   Psychological factors

2.2.1   Cognitive appraisals

In line with cognitive theories of emotions, stress and coping (Clark & Beck, 2010; Smith & Lazarus, 1993), it is proposed that contextual factors alone will not account for the pandemic's impact on mental wellbeing, and that individual differences in cognitive appraisals will also have an influence. Given COVID-19's high transmissibility and the uncertainty surrounding the pandemic, it is proposed that differences in threat appraisals relating to infectious disease and uncertainty are highly relevant.

2.2.1.1   Intolerance of uncertainty

Intolerance of uncertainty (IU) is "an individual's incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information" (Carleton, 2016, p.31). As such, it is biased cognitive appraisal that occurs when an 'unknown/uncertain' stimulus is interpreted as aversive, leading to a 'fear of the unknown' response (Carleton, 2016). Associations have been found between IU and a range of outcomes (Khawaja, 2011; Saulnier et al., 2019) leading to IU being recognized as a transdiagnostic cognitive vulnerability (Koerner & Dugas, 2008; Mahoney & McEvoy, 2012).

The COVID-19 pandemic has given rise to multiple stressors and a high degree of uncertainty. Research indicates IU can magnify the negative impact of stressors on mental health, including stress, anxiety and depression (Chen & Hong, 2010; Ciarrochi et al., 2005). In the context of COVID-19, IU has been found to moderate the relationships between social isolation and anxiety and mental wellbeing (Smith et al., 2020). IU has also been found to positively correlate with depression, anxiety and stress (Seco Ferreira et al., 2020), and to have both direct and mediated relationships with anxiety and wellbeing (Rettie & Daniels, 2020; Satici et al., 2020). Taha et al. (2014) propose a model where coping strategies and stressor

appraisals mediate the relationship between IU and anxiety. Here the appraisal was an evaluation of a pathogen (H1N1) threat, which has some overlap with PVD in the present study. Interestingly, Mertens et al. (2020) found only a trend, not a significant relationship, between IU and fear of COVID-19 suggesting uncertainty tolerance is not as strongly associated with fear as anxiety.

2.2.1.2 *Perceived vulnerability to disease*

Perceived vulnerability to disease (PVD) refers to an appraisal of vulnerability to infectious disease. This study uses Duncan et al.'s (2009) model comprising two dimensions: perceived vulnerability to infectious disease; and germ aversion (emotional discomfort in the presence of perceived pathogens). PVD is concerned with how likely a person thinks they are to contract an infectious disease; how serious they believe the health outcomes would be and how comfortable they are in a perceived infection risk situation. An evolutionary understanding of PVD suggests it is part of the behavioural immune system, a behavioural defence mechanism used to avoid pathogens (Park et al., 2003; Schaller & Park, 2011).

In the context of an H1N1 influenza outbreak, Wheaton et al. (2012) found a tendency to overestimate the likelihood and severity of contamination, synonymous with high PVD, was a significant predictor of anxiety. Research relating to the COVID-19 pandemic has found associations between PVD and general anxiety (Makhanova & Shepherd, 2020) and a relationship between PVD and traumatic stress mediated by COVID-19 worries and social isolation (Boyraz et al., 2020). It is proposed that those with higher PVD appraisals will overinterpret the severity and likelihood of COVID-19 infection, triggering the behavioural immune system, leading to increased anxiety, avoidant behaviour and social withdrawal (Asmundson & Taylor, 2020).

2.2.2 Psychological Flexibility

Psychological flexibility (PF) is a person's ability to be aware of what is influencing them from both external and internal factors, to adopt an open and non-defensive stance towards those stimuli, and to engage in actions that move them closer to their own freely chosen valued goals, even in the presence of aversive stimuli (Hayes et al., 2006). PF has been found to be both negatively associated with anxiety, depression and psychological distress (Masuda & Tully, 2012) and to have a moderating effect on the psychological outcomes of daily stressors

and threatening life events (Gloster et al., 2017). It has been proposed that PF may be an antidote to anxiety-induced rigidity brought about as a response to COVID-19 related threats (Presti et al., 2020). Supporting this, PF was found to predict wellbeing (Dawson & Golijani-Moghaddam, 2020) during the pandemic. PF has also been found to moderate the relationships between social isolation and depression and anxiety (Smith et al., 2020), COVID-19 risk factors and mental health difficulties (Pakenham et al., 2020) and stress from COVID-19 and psychological distress within family systems (Daks et al., 2020).

Acceptance and Commitment Therapy (ACT) aims to increase PF through six key processes: acceptance; cognitive defusion, being present; self as concept; valued living; and committed action. As a 'third-wave' cognitive-behavioural therapy (Hayes, 2004) ACT builds on CBT approaches, but has greater emphasis on acceptance and the function, not the content, of dysfunctional thoughts and feelings. Empirical evidence supports PF as a target for change. For example, PF was found to be a significant mediator in the treatment of anxiety and depression (Ruiz, 2010). Looking specifically at health anxiety in a clinical sample, Hoffmann et al. (2014) found increased PF was significantly associated with reduced symptoms from pre- to post-ACT-intervention and at 6-month follow-up. Finally, a study by the World Health Organisation found a self-help program based on ACT fostered PF and reduced distress among displaced refugees (Tol et al., 2020). PF therefore presents a promising contender for both understanding how individuals cope with adversity as well as offering a potential focus for interventions in order to improve wellbeing.

2.3   The present study

The literature demonstrates the COVID-19 pandemic is a time of heightened anxiety and reduced mental wellbeing and, to some extent, this can be attributed to contextual factors. Research also shows PVD and IU are associated with higher anxiety and lower mental wellbeing during the pandemic, and that PF is associated with higher wellbeing and lower anxiety. To date, no study has brought together the full array of contextual factors being considered here alongside the three psychological factors IU, PVD and PF. The aim of this research is to explore the extent to which contextual factors, biased cognitive appraisals, and psychological flexibility are associated with anxiety and mental wellbeing during COVID-19.

2.4 Hypotheses

1. Contextual factors relating to increased social isolation, loneliness, disruption to daily routines and future plans, being ill-informed about COVID-19, and higher COVID-19 exposure (e.g. being a keyworker) will be associated with higher state anxiety and lower mental wellbeing

2. Higher intolerance of uncertainty and perceived vulnerability to disease will be associated with higher state anxiety and lower mental wellbeing

3. Higher psychological flexibility will be associated with lower state anxiety and higher mental wellbeing

3 3. Method

3.1 Procedure

Sponsorship was gained from the [name removed for blinding purposes] and ethical approval granted by the Clinical Psychology Ethics Committee. A recruitment advert was shared publicly via the researchers' personal and professional social media accounts, with repeated posts and requests to re-share. The advert linked directly to an anonymous survey on the JISC Survey platform. Before starting the survey, participants were asked to read a participant information page and give informed consent confirming they had read and understood the participant information and agreed to take part. Participants were required to be 18 years or older and there was no restriction on participant location. The survey comprised of the following questionnaires: demographic information; contextual factors; mental wellbeing; state anxiety; situational loneliness; intolerance to uncertainty, perceived vulnerability to disease and psychological flexibility. On completion (taking approximately 15 minutes), participants were thanked and given information on accessing the summary of findings and how to access mental health support.

3.2 Statistical power and sample size

Using Green's (1991) guide to estimating required sample sizes for regression analysis, an expected medium effect size, 26 predictor variables and a power of .80 (α = .05) a minimum of 258 participants were required.

3.3 Measures

In addition to demographic variables (see Table 1), the following measures were completed:

1. COVID-19 Contextual Factors

A series of self-report items were developed for this study to capture COVID-19 contextual factors including: being a keyworker; future plans and financial security; infection status and exposure; family and friends' infection status and exposure, recent bereavement; adherence to public health measures and frequency of leaving home and contact with other people (see supplementary information for items in full). The latter two contextual factors were also used to categorize participants as having minimal, low, medium or high contact with others for analysis.

Two measures relating to loneliness were included. The first a measure of situational loneliness using the 5-item social loneliness subscale of the Social and Emotional Loneliness Scale for Adults short-form (SELSA-S; DiTommaso et al., 2004). Although a psychological factor, in this study social loneliness is positioned as a contextual factor as it was used to measure the individual's current situation in terms of meaningful social contact. The second loneliness measure was created for this study and was a 1-item self-report measure of perceived increased loneliness compared to before the pandemic, answered on a five-point Likert scale of agreement: "I feel more lonely now than before the pandemic".

2. Intolerance of uncertainty

IU was measured using the short form Intolerance of Uncertainty Scale (IUS-12; Carleton et al., 2007). This 12-item version of the original IUS (Freeston et al., 1994) measures reactions to ambiguous situations, uncertainty and future events. The IUS-12 has a stable two-factor structure: prospective anxiety (fear and anxiety based on future events) and inhibitory anxiety (uncertainty inhibiting action or experience) (Carleton et al., 2007). All 12 items are

scored from 1 (*not at all characteristic of me*) to 5 (*entirely characteristic of me*). The IUS-12 has been found to have excellent internal consistency of $\alpha = .93$ for the full scale and good internal consistency for subscale scores $\alpha = .89$ (prospective IU) and $\alpha = .89$ (inhibitory IU) (Carleton et al., 2013). For this sample the full scale had $\alpha = .92$ and subscale scores $\alpha = .86$ (prospective IU) and $\alpha = .88$ (inhibitory IU).

3. Perceived vulnerability to disease

Perceived vulnerability to infectious disease was measured using the Perceived Vulnerability to Disease Questionnaire (PVDQ; Duncan et al., 2009). The PVDQ is comprised of two subscales: Perceived Infectability and Germ Aversion. All items are scored from 1 (*strongly disagree*) to 7 (*strongly agree*) with higher scores indicating higher perceived vulnerability. The PVDQ has demonstrated good internal consistency $\alpha = .82$ for all items and the subscale Perceived Infectability subscale ($\alpha = .87$), and adequate internal consistency for the Germ Aversion subscale ($\alpha = .74$) (Duncan et al., 2009). For this sample, all items had $\alpha = .80$ and the subscales had $\alpha = .81$ (Perceived Infectability) and $\alpha = .88$ (Germ Aversion).

4. Psychological flexibility

The Comprehensive Assessment of Acceptance and Commitment Therapy Processes (CompACT; Francis et al., 2016) was developed as a general measure of psychological flexibility processes as conceptualised in ACT (Hayes et al., 2006). The CompACT has demonstrated a stable three factor model comprised of: openness to experience; behavioural awareness; and valued action (Francis et al., 2016). All 23 items are scored from 0 (*strongly disagree*) to 6 (*strongly agree*). Higher total scores indicate higher psychological flexibility. The CompACT has demonstrated excellent internal consistency for all items $\alpha = .91$, and good to excellent internal consistency for each of the subscales, openness to experience $\alpha = .90$; behavioural awareness $\alpha = .87$; and valued action $\alpha = .90$ (Francis et al, 2016). For this sample, all items had $\alpha = .89$ and the subscales had $\alpha = .82$ (openness to experience), $\alpha = .82$ (behavioural awareness) and $\alpha = .88$ (valued action).

5. Anxiety

The Current Anxiety Level Measure (CALM; Marris et al., 2017) was used to measure state anxiety. State anxiety was chosen over trait anxiety as we were interested in the response to the COVID-19 pandemic. CALM consists of 16 items asking participants to rate the extent

to which each statement applies in the current moment from 0 (*not at all*) to 4 (*extremely*). Higher scores indicate a higher level of state anxiety. The CALM has strong concurrent validity ($r = .90$, $p = .001$) with the state dimension of the well-established and validated State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983), suggesting CALM can accurately measure state anxiety (Marris et al., 2017). For this sample CALM showed excellent internal reliability with $\alpha = .96$.

6. Mental wellbeing

The Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) is a 7-item scale used to measure mental wellbeing. It is a shorter version of the 14-item Warwick-Edinburgh Mental Well-being Scale (WEMWBS; Stewart-Brown et al., 2009) developed to monitor mental wellbeing in the general population. The scale covers feeling and functioning aspects of mental wellbeing and items are scored from 1 (*none of the time*) to 5 (*all of the time*). Higher scores indicate higher mental wellbeing. Internal validity of the WEMWBS has been demonstrated as good to excellent ($\alpha = .89$ to $.91$; Tennant et al., 2007). For this sample the SWEMWBS had $\alpha = .84$.

3.4   Recruitment

A convenience sample of 609 participants completed the survey between 22nd and 29th June 2020. One participant was excluded for selecting the lowest response to every item, suggestive of a non-attentive responder. Missing data for five participants were identified and classed as missing completely at random (MCAR) using guidance from Tabachnick and Fidell's (2014). Being MCAR and less than 1% of the sample from a large data set, exclusion of these cases was not seen to introduce bias. This resulted in a total sample of 603.

3.5   Data analyses

Preliminary analysis confirmed there were no violations of assumptions. Data analyses were conducted using SPSS (Version 25; IBM Corp, 2017). Descriptive statistics were calculated for demographic variables, contextual factors and psychological scales.

Analyses were carried out to determine relationships between demographic and COVID-19 contextual variables with the outcome variables. This included correlation analysis for continuous variables and t-tests and ANOVAS for categorical variables. Demographic variables and COVID-19 contextual variables significantly associated with the outcome variables at p < .01 were carried forward to the regression analyses as control and predictor variables. Correlation analyses (Pearson's r) were run to identify relations between the six psychological measures (IUS-12, PVDQ, COMPACT, SELSA-S, CALM and SWEMWBM).

Two hierarchical multiple regression analyses were run for the outcome variables state anxiety and mental wellbeing to determine the total variance predicted by the models and the unique contribution of each predictor. Control variables were entered in the first step, followed by COVID-19 contextual factors, and finally cognitive appraisals and PF.

4   4. Results

4.1   Sample characteristics

Of the 603 participants, 80% were female and 20% male. Participants were aged 18 to 82, with the majority (54%) in the age bracket 18–34. The majority (61%) were employed, and 20% were students. Most participants were from the United Kingdom (79%). Table 1 outlines the demographic data. Tables 2 and 3 present the contextual factor descriptive statistics. Of interest, 27% of participants had been required to self-isolate, 32% had a close friend or family member who had COVID-19 (or symptoms) and 8% reported a close friend or family member needed hospital treatment. 12% of the participants reported they were receiving treatment or support for a mental health difficulty, of which 35% reported their mental health difficulty had remained the same, 57% worse and 8% better. Table 4 presents descriptive statistics for the psychological measures.

4.2   Covariate analysis

Age had a moderate negative correlation with anxiety ($r = -.30$ $p < .001$) and a small positive correlation with mental wellbeing ($r = .26$, $p < .001$). For mental wellbeing, male participants scored significantly higher (M: 22.12, SD: 3.78) than female participants (M: 20.97, SD: 3.42), $t_{599} = 3.204$, $p = .001$. For anxiety, female participants scored significantly

higher (M: 16.24, SD: 13.14) than male participants (M: 10.36, SD: 10.12), t_{599} = -5.31, $p <$ .001. For those with an existing mental health difficulty, anxiety scores were significantly higher (M: 25.03, SD: 15.00 vs' M: 13.59, SD: .513, t_{601} = - 6.41, $p < .001$. Wellbeing scores were significantly lower for those with existing mental health difficulty (M: 19.10; SD: 2.64 vs' M: 21.51, SD: 3.53, t_{601} = 7.119, $p < .001$.

4.3   Hypothesis analyses

4.3.1   Contextual factors

Participants who reported greater anxiety also reported greater agreement with: their daily routines having been disrupted ($F_{(4,598)}$ = 4.435, p = .002); their plans for the future affected ($F_{(4,598)}$ = 9.189, $p < .001$); feeling lonelier ($F_{(4,598)}$ = 26.323, $p < .001$); and losing income ($F_{(4,598)}$ = 6.964, $p < .001$). Participants who reported lower anxiety also reported greater agreement with feeling well-informed about COVID-19 ($F_{(4,598)}$ = 6.690, $p < .001$); having a higher frequency of external contact ($F_{(3,599)}$ = 4.947, p = .002); and having good social support ($F_{(4,598)}$ = 15.451, $p < .001$).   Additionally, those who had been required to self-isolate were found to have higher anxiety (M:17.88, SD: 13.41) than those who had not (M: 14.02, SD: 12.43), t_{601} = -3.307, p = .001.

Participants who reported lower wellbeing also reported greater agreement with: their daily routines having been disrupted ($F_{(4,598)}$ = 5.099, $p < .001$); their plans for the future affected ($F_{(4,598)}$ = 6.146, $p < .001$); feeling lonelier ($F_{(4,598)}$ = 31.325, p $< .001$) and losing income ($F_{(4,598)}$ = 3.648, p = .006). Participants who reported higher wellbeing also reported greater agreement with: feeling well-informed about COVID-19 ($F_{(4,598)}$ = 5.638, $p < .001$), having good social support ($F_{(4,598)}$ = 26.546, $p < .001$) and having a higher frequency of external contact ($F_{(3,599)}$= 4.244, p = .006). Additionally, keyworkers had significantly higher wellbeing (M: 22.01, SD: 3.61) than non-keyworkers (M: 20.84, SD: 3.42), t_{601} = - 3.807, p $<.001$.

4.3.2   Correlation analysis

Table 5 shows Pearson's correlation coefficients between the psychological measures as consistent with hypotheses. A large positive correlation was found between IU and state anxiety and a moderate negative correlation was found between IU and mental wellbeing. A

moderate positive correlation was found between PVD and state anxiety and a small to moderate negative correlation between PVD and mental wellbeing. A large negative correlation was found between PF and state anxiety and a large positive correlation was found between PF and mental wellbeing. Finally, there was a medium positive correlation between situational loneliness and state anxiety and a moderate negative correlation between situational loneliness and mental wellbeing.

4.3.3   Regression analysis

4.3.3.1   *Prediction of anxiety*

Hierarchical regression results are displayed in Table 6. Gender, age and mental health difficulty were entered in Step 1 and accounted for 17.5% of the variance in anxiety. The addition of COVID-19 contextual factors in Step 2 significantly improved the model, accounting for an additional 19.6% of the variance. After entry of the CompACT, PVDQ and IUS-12 measures in Step 3, the final model accounted for 48.7% of the variance in anxiety, significantly further improving the model and accounting for an additional 11.6% of the variance.

Both situational loneliness (β = .148, p < .001) and increased loneliness (β = .128, p < .001) made significant contributions. Both disruption to daily routine (β = .068, p < .05) and impact on future plans (β = .084, p < .05) made smaller but significant positive contributions. As expected, being well-informed about COVID-19 was a significant negative predictor of anxiety (β = -.075, p < .05). As hypothesised, both types of cognitive appraisals were significant predictors of anxiety. IU (β = .237, p < .001) was found to make a larger contribution than PVD (β = .141, p < .001). Finally, PF was a significant negative predictor of anxiety (β = -.134, p < .001).

4.3.3.2   *Prediction of wellbeing*

Hierarchical regression results are displayed in Table 7. Gender, age and mental health difficulty were entered in Step 1 and accounted for 11.5% of the variance in mental wellbeing. The addition of the COVID-19 contextual factors in Step 2 significantly improved the model, accounting for an additional 28% of the variance. After entry of CompACT, PVDQ and IUS-

12 measures in Step 3, the final model accounted for 46.5% of the variance, significantly improving the model and accounting for an additional 7% of the variance in mental wellbeing.

Situational loneliness (β = -.183, p <.001) and increased loneliness (β = -.172, p < .001) both made significant contributions to the model. For factors relating to social interaction, only good social support made a significant contribution (β = .474, p < .01). Disruption to daily routine (β = - .108, p < .01) and impact on future plans (β = - .068, p < .05) both made significant contributions to the model. However, loss of income did not make a significant contribution and being a keyworker had the opposite to expected effect (being a key worker was associated with greater rather than poorer wellbeing). As expected, being well-informed about COVID-19 made a significant positive contribution to the model (β = .073, p < .05). From the cognitive appraisals, only IU was a significant negative predictor of mental wellbeing (β = -.083, p < .05). Finally, as expected, PF was associated with higher mental wellbeing as a significant positive predictor (β = .257, p < .001), and made the largest unique contribution to the final model.

All assumptions of normality, linearity, multicollinearity and homoscedasticity were met. Durbin-Watson statistics of 1.96 (anxiety) and 2.00 (wellbeing) suggested the assumption of homogeneity of variance was met. Variance inflation factor (VIF), tolerance statistics were all within accepted ranges (Field, 2018). All cases had Cook's distance less than 1 and leverage values and Mahalanobis distances within the acceptable range for the model (Field, 2018).

4.4   Additional analyses

As shown in Table 4, mean scores for this sample were compared to normative or comparable samples. IU and PVD were both significantly higher than comparable samples (Carleton et al., 2007; Duncan et al., 2009). For PVD, t_{2358} = 6.032, p < .0001, with a small effect size (d = .35). For IU, $t_{1,419}$ = 6.552, p < .0001, with a small effect size (d = .25). Mental wellbeing was significantly lower than normative data (Warwick Medical School, 2016), t_{7797} = 14.681, p < .0001, with a small effect size (d = .33). Finally, situational loneliness was lower in this sample than in a comparable sample (DiTommaso et al., 2004), although not statistically significantly.

5. Discussion

This research explored the extent to which contextual factors, cognitive appraisals (IU and PVD) and PF were associated with anxiety and mental wellbeing during the COVID-19 pandemic. Some, but not all of the contextual factors had the hypothesized associations with anxiety and wellbeing. As expected, situational loneliness and increased loneliness since the pandemic significantly predicted lower mental wellbeing and higher anxiety. This is consistent with research associating loneliness with a range of psychological difficulties (Wang et al., 2018). In line with Xiao et al. (2020), having good social support during the pandemic positively predicted mental wellbeing. As expected, greater disruption to daily routine significantly predicted lower wellbeing and higher anxiety, the latter is consistent with previous research (Mihashi et al., 2009), as did the extent to which future plans were impacted. Feeling well-informed about COVID-19 was associated with reduced anxiety and increased wellbeing.

Interestingly, the contextual factors: recent bereavement; loss of income; responsibility for others; living alone; low external contact and having to self-isolate; were not found to be significant predictors of higher anxiety or lower wellbeing. That having to self-isolate was not a significant predictor is surprising given previous research (Brooks, 2020) and suggests people in this sample, at that time (June 2020) were not as negatively impacted by self-quarantine during COVID-19 as expected (e.g. Mucci et al., 2020; Vinkers et al., 2020). Another interesting finding was that being a keyworker was associated with enhanced wellbeing, contrary to the hypothesised negative relationship and contradicting previous research (Lee et al., 2007; Wu et al., 2009).

Individual differences in cognitive appraisals were found to be significantly associated with anxiety and to some extent mental wellbeing. As hypothesised and consistent with previous findings (Duncan et al., 2009; Wheaton et al., 2012), higher levels of PVD predicted higher state anxiety. Unexpectedly, PVD was not found to be a significant predictor of wellbeing. As hypothesised, higher IU was associated with both higher state anxiety and lower mental wellbeing. This is consistent with findings that IU is both directly related to anxiety (Rettie & Daniels, 2020) and can moderate the impact of social isolation and stressors on anxiety (Chen & Hong, 2010; Ciarrochi et al., 2005; Smith et al., 2020). This difference between IU and PVD's ability to predict both mental wellbeing and anxiety suggests IU has broader psychological implications than PVD.

As hypothesised, PF predicted lower anxiety and higher mental wellbeing. This is consistent with previous findings that higher psychological flexibility is associated with a range of positive psychological outcomes (Hayes et al., 2006) and a protective factor moderating the impact of daily stressors and threatening life events for depression, anxiety and life satisfaction (Gloster et al., 2017). This finding is also consistent with a number of recent studies relating to COVID-19 and psychological outcomes. These studies found PF to have direct effects on wellbeing (Dawson & Golihani-Moghaddam, 2020) and a moderating role on the effect of social isolation on depression and anxiety (Smith et al., 2020), and COVID-19 risk factors on mental health difficulties (Pakenham et al., 2020). The current study supports these findings through replication and extends them by contrasting these variables with other predictors to establish their relative associations with anxiety and wellbeing.

5.1   Theoretical implications

Cognitive accounts of anxiety describe how anxiety is the outcome of a threat appraisal where threat is perceived alongside an inability to cope with it (Smith & Lazarus, 1993; Clark & Beck, 2010). Our findings that PVD and IU predict anxiety are consistent with these models as PVD and IU are threat appraisals based on biased assumptions and beliefs about perceived infectability and outcomes of infection (Duncan et al., 2009) and the threat of experiencing uncertainty (Carleton, 2016).

Supporting theories of PF (Kashdan & Rottenberg, 2010), we found increased PF negatively predicted state anxiety and positively predicted mental wellbeing. The negative contribution of PF to anxiety does not contradict cognitive accounts of anxiety. Arch and Craske (2008) describe how PF processes (cognitive defusion, acceptance) are applied to coping with threat-related thoughts. It is proposed that these processes are likely to be applied to secondary appraisals and reappraisals, moderating feedback into the cognitive system that would otherwise perpetuate maladaptive anxiety (Clark & Beck, 2010). PF's ability to predict mental wellbeing may also explain its association with lower anxiety as negative affectivity is recognised as a vulnerability to anxiety (Clark & Beck, 2010), therefore higher mental wellbeing may provide a better mode for dealing with threats during the pandemic.

5.2 Clinical implications

Ongoing risk of infection and containment measures make it difficult, if not impossible to target most contextual factors for change. One exception is feeling well-informed about the COVID-19 situation, which could be targeted with clear public messaging. Psychological factors, on the other hand, can be targeted for change during the pandemic. Our findings support cognitive appraisal theories typically associated with cognitive behavioural therapy (CBT). Interventions based on this framework should help people to more accurately appraise the likelihood of contracting the virus whilst also framing susceptibility as being influenced by an ability to engage in public health behaviours (e.g. hand washing, limiting contact with others). Additionally, in an uncertain context, focussing on what is certain, that is our capacity to control our own behaviour in the service of protecting ourselves and those around us, may help reduce some of the uncertainty. Likewise, helping people to become more able to tolerate uncertainty would also be a useful intervention strategy and CBT has been shown to be effective at manipulating IU (Ladouceur et al., 2000).

This psychological factor may also cross over into interventions based on ACT and it is proposed that ACT may be a more suitable therapeutic approach for the COVID-19 context. Firstly, ACT's transdiagnostic approach can be applied to any difficult thought or feeling arising in an ever-changing situation like the pandemic. Secondly, unlike traditional CBT, ACT does not aim to challenge or change the content of cognitive appraisals or their underlying assumptions or beliefs. This may be beneficial when there are real threats that individuals have little control over. Thirdly, many of the defusion exercises from ACT teach a person to see thoughts as mental events and alter how influential they are, a technique which could be repurposed towards living more effectively with uncertainty. Finally, ACT aims to go beyond the removal of pathology through the development PF towards greater value-based living, leading to greater mental wellbeing (Herbert et al., 2015). This is supported by our finding that PF predicted mental wellbeing.

We propose the transdiagnostic nature of ACT makes it highly suitable for society-wide intervention, an idea explored and supported by Gloster et al. (2017) and Levin et al. (2016). This intervention, perhaps web-based given distancing restrictions, could be preventative as well as therapeutic.

5.3   Limitations

The cross-sectional study design prevented causal inferences being made and self-report measures may have introduced subjective bias affecting accuracy and reliability. However, anonymity may have mitigated against perceived social desirability bias. The use of social media for recruitment of a convenience sample means it is unlikely to be representative of the public more widely. Therefore, the findings remain tentative and need replication in a more randomly selected sample. Additionally, few participants were recruited from outside the UK and Ireland, limiting conclusions about country of residence. Another potential weakness may come from the use of a current-state anxiety measure as people may be less likely to complete an online survey at a time when they are feeling highly anxious. Therefore, reported anxiety levels may be lower than anxiety experienced throughout the day or week.

Given the uniqueness of the COVID-19 situation, selection of predictor and outcome variables relied on logical and theoretical reasoning as well as previous research. Therefore, observed relationships may in practice be reversed or bidirectional. Further, the contextual factors were not standardised measures, but were face valid, designed to capture aspects of the context that we considered likely to influence wellbeing and anxiety at this time. Despite these limitations, both models were significant, and a broad range of predictor variables were investigated, covering both contextual and psychological factors.

6   6. Conclusion

The findings of this study suggest contextual factors, cognitive appraisals and psychological flexibility are associated with state anxiety and mental wellbeing during the COVID-19 pandemic. Contextual factors related to loneliness and disruption made the largest contributions to anxiety and mental wellbeing. Biased cognitive appraisals of uncertainty predicted both anxiety and wellbeing, whereas biased cognitive appraisals relating to the threat of infection predicted only anxiety. As many of the pandemic-related contextual factors are outside of our control and stressors are present across multiple domains of life, the transdiagnostic approach of ACT and its emphasis on acceptance, defusion and valued action suggest it could be a useful lens to develop large scale interventions to support mental wellbeing during a public health crisis such as a pandemic. This is supported by our finding that psychological flexibility (a capability developed through ACT) was a negative predictor

of anxiety and the largest unique predictor of mental wellbeing. Further research could address the development and trialling of an ACT intervention aimed at increasing psychological flexibility in the general population.

7   References

Anderson, R. M., Heesterbeek, H., Klinkenberg, D., & Hollingsworth, T. D. (2020). How will country-based mitigation measures influence the course of the COVID-19 epidemic? *The Lancet,* 395(10228), 931-934. https://doi.org/10.1016/S0140-6736(20)30567-5

Arch, J. J., & Craske, M. G. (2008). Acceptance and commitment therapy and cognitive behavioral therapy for anxiety disorders: Different treatments, similar mechanisms? *Clinical psychology: Science and practice*, *15*(4), 263-279. https://doi.org/10.1111/j.1468-2850.2008.00137.x

Asmundson, G. J., & Taylor, S. (2020). How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know. *Journal of Anxiety Disorders*, *71*, 102211. https://doi.org/10.1016/j.janxdis.2020.102211

Boyraz, G., Legros, D. N., & Tigershtrom, A. (2020). COVID-19 and traumatic stress: The role of perceived vulnerability, COVID-19-related worries, and social isolation. *Journal of Anxiety Disorders*, 76, 102307. https://doi.org/10.1016/j.janxdis.2020.102307

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet*. https://doi.org/10.1016/S0140-6736(20)30460-8

Carleton, R. N. (2016). Into the unknown: A review and synthesis of contemporary models involving uncertainty. *Journal of anxiety disorders*, *39*, 30-43. https://doi.org/10.1016/j.janxdis.2016.02.007

Carleton, R. N., Norton, M. P. J., & Asmundson, G. J. (2007). Fearing the unknown: A short version of the Intolerance of Uncertainty Scale. *Journal of anxiety disorders*, *21*(1), 105117. https://doi.org/10.1016/j.janxdis.2006.03.014

Carleton, R. N., Fetzner, M. G., Hackl, J. L., & McEvoy, P. (2013). Intolerance of uncertainty as a contributor to fear and avoidance symptoms of panic attacks. *Cognitive behaviour therapy*, *42*(4), 328-341. https://doi.org/10.1080/16506073.2013.792100

Chen, C. Y., & Hong, R. Y. (2010). Intolerance of uncertainty moderates the relation between negative life events and anxiety. *Personality and Individual Differences*, *49*(1), 49-53. https://doi.org/10.1016/j.paid.2010.03.006

Ciarrochi, J., Said, T., & Deane, F. P. (2005). When simplifying life is not so bad: The link between rigidity, stressful life events, and mental health in an undergraduate population. *British Journal of Guidance & Counselling*, *33*(2), 185-197. https://doi.org/10.1080/03069880500132540

Clark, D. A., & Beck, A. T. (2010). *Cognitive therapy of anxiety disorders: Science and practice*. Guilford Press.

Daks, J. S., Peltz, J. S., & Rogge, R. D. (2020). Psychological flexibility and inflexibility as sources of resiliency and risk during a pandemic: Modeling the cascade of COVID-19 stress on family systems with a contextual behavioral science lens. *Journal of Contextual Behavioral Science*, *18*, 16-27. https://doi.org/10.1016/j.jcbs.2020.08.003

Dawson, D. L., & Golijani-Moghaddam, N. (2020). COVID-19: Psychological flexibility, coping, mental health, and wellbeing in the UK during the pandemic. *Journal of contextual behavioral science*, *17*, 126-134. https://doi.org/10.1016/j.jcbs.2020.07.010

DiTommaso, E., Brannen, C., & Best, L. A. (2004). Measurement and validity characteristics of the short version of the social and emotional loneliness scale for adults. *Educational and Psychological Measurement*, *64*(1), 99-119. https://doi.org/10.1177/0013164403258450

Duncan, L. A., Schaller, M., & Park, J. H. (2009). Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. *Personality and Individual differences*, *47*(6), 541-546. https://doi.org/10.1016/j.paid.2009.05.001

Field, A. (2018). Discovering Statistics Using IBM SPSS Statistics 5th ed.

Francis, A. W., Dawson, D. L., & Golijani-Moghaddam, N. (2016). The development and validation of the Comprehensive assessment of Acceptance and Commitment Therapy processes (CompACT). *Journal of Contextual Behavioral Science*, *5*(3), 134-145. https://doi.org/10.1016/j.jcbs.2016.05.003

Freeston, M. H., Rhéaume, J., Letarte, H., Dugas, M. J., & Ladouceur, R. (1994). Why do people worry? *Personality and individual differences*, *17*(6), 791-802. https://doi.org/10.1016/0191-8869(94)90048-5

Gloster, A. T., Meyer, A. H., & Lieb, R. (2017). Psychological flexibility as a malleable public health target: Evidence from a representative sample. *Journal of Contextual Behavioral Science*, *6*(2), 166-171. https://doi.org/10.1016/j.jcbs.2017.02.003

Green, S. B. (1991). How many subjects does it take to do a regression analysis. *Multivariate behavioral research*, *26*(3), 499-510. https://doi.org/10.1207/s15327906mbr2603_7

Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies. *Behavior therapy*, *35*(4), 639-665. https://doi.org/10.1016/S0005-7894(04)80013-3

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour research and therapy*, *44*(1), 1-25. https://doi.org/10.1016/j.brat.2005.06.006

Herbert, J. D., Forman, E. M., & Hitchcock, P. (2015). Defining, Distinguishing, and Common Features. *The Wiley handbook of Contextual Behavioral Science*, 287.

Hoffmann, D., Halsboe, L., Eilenberg, T., Jensen, J. S., & Frostholm, L. (2014). A pilot study of processes of change in group-based acceptance and commitment therapy for health anxiety. *Journal of contextual behavioral science*, *3*(3), 189-195. https://doi.org/10.1016/j.jcbs.2014.04.004

Holmes, E. A., O'Connor, R. C., Perry, V. H., Tracey, I., Wessely, S., Arseneault, L., Ballard, C., Christensen, H., Cohen Silver, R., Everall, I., Ford, T., John, A., Kabir, T., King, K., Madan, I., Michie, S., Przybylski, A.K., Shafran, R., Sweeney, A., ... Bullmore, E. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *The Lancet Psychiatry*. https://doi.org/10.1016/S2215-0366(20)30168-1

IBM Corp. Released 2017. IBM SPSS Statistics for Macintosh, Version 25.0. Armonk, NY: IBM Corp.

Jeong, H., Yim, H. W., Song, Y. J., Ki, M., Min, J. A., Cho, J., & Chae, J. H. (2016). Mental health status of people isolated due to Middle East Respiratory Syndrome. *Epidemiology and health*, *38*. https://doi.org/10.4178/epih.e2016048

Johns Hopkins University & Medicine (Producer). (2021). *Coronavirus Resource Center* 31/01/2021 https://coronavirus.jhu.edu

Jungmann, S. M., & Witthöft, M. (2020). Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety?. *Journal of Anxiety Disorders*, 102239. https://doi.org/10.1016/j.janxdis.2020.102239

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical psychology review*, *30*(7), 865-878. https://doi.org/10.1016/j.cpr.2010.03.001

Kelly, B. D. (2020). Covid-19 (Coronavirus): challenges for psychiatry. *British Journal of Psychiatry*, 1-6. https://doi.org/10.1192/bjp.2020.86

Khawaja, N. G., & McMahon, J. (2011). The relationship of meta-worry and intolerance of uncertainty with pathological worry, anxiety, and depression. *Behaviour Change*, *28*(4), 165-180. https://doi.org/10.1375/bech.28.4.165

Ko, C. H., Yen, C. F., Yen, J. Y., & Yang, M. J. (2006). Psychosocial impact among the public of the severe acute respiratory syndrome epidemic in Taiwan. *Psychiatry and Clinical Neurosciences*, *60*(4), 397-403. https://doi.org/10.1111/j.1440-1819.2006.01522.x

Koerner, N., & Dugas, M. J. (2008). An investigation of appraisals in individuals vulnerable to excessive worry: The role of intolerance of uncertainty. *Cognitive Therapy and Research*, *32*(5), 619-638. https://doi.org/10.1007/s10608-007-9125-2

Kwong, A. S. F., Pearson, R. M., Adams, M. J., Northstone, K., Tilling, K., Smith, D., FawnsRitchie, C., Bould, H., Warne, N., Zammit, S., Gunnell, D. J., Moran, P., Micali, N., Reichenberg, A., Hickman, M,. Rai, D., Haworth, S., Campbell, A., Altschul, D., … Timpson, N.J. (2020). Mental health during the COVID-19 pandemic in two longitudinal UK population cohorts. *medRxiv*. https://doi.org/10.1101/2020.06.16.20133116

Ladouceur, R., Dugas, M. J., Freeston, M. H., Léger, E., Gagnon, F., & Thibodeau, N. (2000). Efficacy of a cognitive–behavioral treatment for generalized anxiety disorder: Evaluation in a controlled clinical trial. *Journal of consulting and clinical psychology*, *68*(6), 957. https://doi.org/10.1037/0022-006X.68.6.957

Lee, A. M., Wong, J. G., McAlonan, G. M., Cheung, V., Cheung, C., Sham, P. C., Chu, C., Wong, P., Tsang, K.W.T., & Chua, S. E. (2007). Stress and psychological distress among SARS survivors 1 year after the outbreak. *The Canadian Journal of Psychiatry*, *52*(4), 233240. https://doi.org/10.1177/070674370705200405

Levin, M. E., Lillis, J., & Biglan, A. (2016). The potential of community-wide strategies for promoting psychological flexibility. *The Wiley Handbook of Contextual Behavioral Science*, 483-495.

Mahoney, A. E., & McEvoy, P. M. (2012). A transdiagnostic examination of intolerance of uncertainty across anxiety and depressive disorders. *Cognitive Behaviour Therapy*, *41*(3), 212-222. https://doi.org/10.1080/16506073.2011.622130

Mak, I. W. C., Chu, C. M., Pan, P. C., Yiu, M. G. C., & Chan, V. L. (2009). Long-term psychiatric morbidities among SARS survivors. *General hospital psychiatry*, *31*(4), 318-326. https://doi.org/10.1016/j.genhosppsych.2009.03.001

Makhanova, A., & Shepherd, M. A. (2020). Behavioral immune system linked to responses to the threat of COVID-19. *Personality and Individual Differences*, *167*, 110221. https://doi.org/10.1016/j.paid.2020.110221

Marris, M., Sladyk, K., St Pierre, B., & Coverly Dey, E. (2017). Reliability and Validity of the Current Anxiety Level Measure. *Occupational Therapy in Mental Health*, *33*(4), 386-393. https://doi.org/10.1080/0164212X.2017.1312662

Masuda, A., & Tully, E. C. (2012). The role of mindfulness and psychological flexibility in somatization, depression, anxiety, and general psychological distress in a nonclinical college sample. *Journal of Evidence-Based Complementary & Alternative Medicine*, *17*(1), 66-71. https://doi.org/10.1177/2156587211423400

Mertens, G., Gerritsen, L., Duijndam, S., Salemink, E., & Engelhard, I. M. (2020). Fear of the coronavirus (COVID-19): Predictors in an online study conducted in March 2020. *Journal of Anxiety Disorders*, 102258. https://doi.org/10.1016/j.janxdis.2020.102258

Mihashi, M., Otsubo, Y., Yinjuan, X., Nagatomi, K., Hoshiko, M., & Ishitake, T. (2009). Predictive factors of psychological disorder development during recovery following SARS outbreak. *Health Psychology*, *28*(1), 91. https://doi.org/10.1037/a0013674

Moghanibashi-Mansourieh, A. (2020). Assessing the anxiety level of Iranian general population during COVID-19 outbreak. *Asian journal of psychiatry*, 102076. https://doi.org/10.1016/j.ajp.2020.102076

Moldofsky, H., & Patcai, J. (2011). Chronic widespread musculoskeletal pain, fatigue, depression and disordered sleep in chronic post-SARS syndrome; a case-controlled study. *BMC neurology*, *11*(1), 37. https://doi.org/10.1186/1471-2377-11-37

Mucci, F., Mucci, N., & Diolaiuti, F. (2020). Lockdown and isolation: Psychological aspects of COVID-19 pandemic in the general population. *Clinical Neuropsychiatry:Journal of Treatment Evaluation*, *17*(2), 63-64. https://doi.org/10.36131/CN20200205

Norton, P. J., Sexton, K. A., Walker, J. R., & Ron Norton, G. (2005). Hierarchical model of vulnerabilities for anxiety: Replication and extension with a clinical sample. *Cognitive Behaviour Therapy*, *34*(1), 50-63. https://doi.org/10.1080/16506070410005401

Pakenham, K. I., Landi, G., Boccolini, G., Furlani, A., Grandi, S., & Tossani, E. (2020). The moderating roles of psychological flexibility and inflexibility on the mental health impacts of COVID-19 pandemic and lockdown in Italy. *Journal of contextual behavioral science*, *17*, 109-118. https://doi.org/10.1016/j.jcbs.2020.07.003

Park, J. H., Faulkner, J., & Schaller, M. (2003). Evolved disease-avoidance processes and contemporary anti-social behavior: Prejudicial attitudes and avoidance of people with physical disabilities. *Journal of Nonverbal behavior*, *27*(2), 65-87. https://doi.org/10.1023/A:1023910408854

Presti, G., Mchugh, L., Gloster, A., Karekla, M., & Hayes, S. C. (2020). The dynamics of fear at the time of COVID-19: a contextual behavioral science perspective. *Clinical Neuropsychiatry*, *17*(2). https://doi.org/10.36131/CN20200206

Rettie, H., & Daniels, J. (2020). Coping and tolerance of uncertainty: Predictors and mediators of mental health during the COVID-19 pandemic. *American Psychologist.* Advance online publication. *http://dx.doi.org/10.1037/amp0000710*

Rossi, R., Socci, V., Talevi, D., Mensi, S., Niolu, C., Pacitti, F., Di MArco, A., Rossi, A., Siracusano, A., & Di Lorenzo, G. (2020). COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy. *Frontiers in psychiatry*, 11, 790. https://doi.org/10.3389/fpsyt.2020.00790

Ruiz, F. J. (2010). A review of Acceptance and Commitment Therapy (ACT) empirical evidence: Correlational, experimental psychopathology, component and outcome studies. *International Journal of Psychology and Psychological Therapy*, *10*(1), 125-162.

Sanders, R. (2020). ESSS Outline: Covid-19, social isolation and loneliness. *Iriss*. https://doi.org/10.31583/esss.20200422

Satici, B., Gocet-Tekin, E., Deniz, M. E., & Satici, S. A. (2020). Adaptation of the Fear of COVID-19 Scale: Its association with psychological distress and life satisfaction in Turkey. *International Journal of Mental Health and Addiction*, 1. https://doi.org/10.1007/s11469-020-00294-0

Saulnier, K. G., Allan, N. P., Raines, A. M., & Schmidt, N. B. (2019). Depression and intolerance of uncertainty: relations between uncertainty subfactors and depression dimensions. *Psychiatry*, *82*(1), 72-79. https://doi.org/10.1080/00332747.2018.1560583

Schäfer, S., Sopp, R., Schanz, C., Staginnus, M., Göritz, A. S., & Michael, T. (2020). Impact of COVID-19 on public mental health and the buffering effect of sense of coherence. *OSF Preprints*. https://doi.org/10.31219/osf.io/4ptfz

Schaller, M., & Park, J. H. (2011). The behavioral immune system (and why it matters). *Current directions in psychological science*, *20*(2), 99-103. https://doi.org/10.1177/0963721411402596

Seco Ferreira, D. C., Oliveira, W. L., Costa Delabrida, Z. N., Faro, A., & Cerqueira-Santos, E. (2020). Intolerance of uncertainty and mental health in Brazil during the Covid-19 pandemic. *Suma Psicológica*, *27*(1), 62-69. http://dx.doi.org/10.14349/sumapsi.2020.v27.n1.8

Shevlin, M., McBride, O., Murphy, J., Miller, J. G., Hartman, T. K., Levita, L., Mason, L., Martinez, A., McKay, R., Stocks, T. V. A., Bennett, K. M., Hyland, P., Karatzias, T., & Bentall, R. P. (2020). Anxiety, Depression, Traumatic Stress and COVID-19-related Anxiety in the UK

General Population During the COVID-19 Pandemic. *BJPsych Open, 6*(6), E125. https://doi.org/10.1192/bjo.2020.109

Smith, B. M., Twohy, A. J., & Smith, G. S. (2020). Psychological inflexibility and intolerance of uncertainty moderate the relationship between social isolation and mental health outcomes during COVID-19. *Journal of Contextual Behavioral Science*, *18*, 162-174. https://doi.org/10.1016/j.jcbs.2020.09.005

Smith, C. A., & Lazarus, R. S. (1993). Appraisal components, core relational themes, and the emotions. *Cognition & Emotion*, *7*(3-4), 233-269. https://doi.org/10.1080/02699939308409189

Spielberger, C. D. (1983). Manual for the State-Trait Anxiety Inventory STAI (form Y) (" self evaluation questionnaire").

Stewart-Brown, S., Tennant, A., Tennant, R., Platt, S., Parkinson, J., & Weich, S. (2009). Internal construct validity of the Warwick-Edinburgh mental well-being scale (WEMWBS): a Rasch analysis using data from the Scottish health education population survey. *Health and quality of life outcomes*, *7*(1), 15. https://doi.org/10.1186/1477-7525-7-15

Tabachnick, B., & Fidell, L. (2014). Using multivariate statistics (International edition of sixth ed., Pearson custom library). Harlow, Essex: Pearson Education Limited.

Taha, S., Matheson, K., Cronin, T., & Anisman, H. (2014). Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic. *British Journal of Health Psychology*, *19*(3), 592-605. https://doi.org/10.1111/bjhp.12058

Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., & Stewart-Brown, S. (2007). The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. *Health and Quality of life Outcomes*, *5*(1), 63. https://doi.org/10.1186/1477-7525-5-63

Tol, W. A., Leku, M. R., Lakin, D. P., Carswell, K., Augustinavicius, J., Adaku, A., ... & Musci, R. J. (2020). Guided self-help to reduce psychological distress in South Sudanese female refugees in Uganda: a cluster randomised trial. *The Lancet Global Health*, *8*(2), e254-e263. https://doi.org/10.1016/S2214-109X(19)30504-2

Twenge, J.M. & Joiner, T.E. (2020). Mental distress among U.S. adults during the COVID-19 pandemic. *Journal of Clinical Psychology*, 76(12), 2170–2182. https://doi.org/10.1002/jclp.23064

Vigo, D., Patten, S. B., Pajer, K., Krausz, M., Taylor, S., Rush, B., ... Yatham, L. N. (2020). Mental health of communities during the COVID- 19 pandemic. *Canadian Journal of Psychiatry*, 65. https://doi.org/10.1177/0706743720926676

Vinkers, C. H., van Amelsvoort, T., Bisson, J. I., Branchi, I., Cryan, J. F., Domschke, K., Howes, O., Manchia, M., Pinto, L., de Quervain, D., Schmidt, M. V. & van der Wee, N. (2020). Stress resilience during the coronavirus pandemic. *European Neuropsychopharmacology, 35, 12-16.* https://doi.org/10.1016/j.euroneuro.2020.05.003

Wang, J., Mann, F., Lloyd-Evans, B., Ma, R., & Johnson, S. (2018). Associations between loneliness and perceived social support and outcomes of mental health problems: a systematic review. *BMC psychiatry*, *18*(1), 156. https://doi.org/10.1186/s12888-018-1736-5

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., Choo, F. N., Tran, B., Ho, R., Sharma, V. J. & Ho, C. (2020). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, behavior, and immunity*. https://doi.org/10.1016/j.bbi.2020.04.028

Warwick Medical School (2016). Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS:

User guide – Version 2. NHS Health Scotland. https://warwick.ac.uk/fac/sci/med/research/platform/wemwbs/using/register/resources

Wheaton, M. G., Abramowitz, J. S., Berman, N. C., Fabricant, L. E., & Olatunji, B. O. (2012). Psychological predictors of anxiety in response to the H1N1 (swine flu) pandemic. *Cognitive Therapy and Research*, *36*(3), 210-218. https://doi.org/10.1007/s10608-011-9353-3

Williams, S. N., Armitage, C. J., Tampe, T., & Dienes, K. (2020). Public perceptions and experiences of social distancing and social isolation during the COVID-19 pandemic: a UKbased focus group study. *BMJ Open* 2020;10:e039334. https://doi.org/10.1101/2020.04.10.20061267

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., Liu, X., Fuller, C. J., Susser, E., Lu, J. & Hoven, C. W. (2009). The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *The Canadian Journal of Psychiatry*, *54*(5), 302-311. https://doi.org/10.1177/070674370905400504

Xiao, H., Zhang, Y., Kong, D., Li, S., & Yang, N. (2020). Social Capital and Sleep Quality in Individuals Who Self-Isolated for 14 Days During the Coronavirus Disease 2019 (COVID19) Outbreak in January 2020 in China. *Medical science monitor: international medical journal of experimental and clinical research*, *26*, e923921. https://doi.org/10.12659/MSM.923921

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., Zhao, X., Huang, B., Shi, W., Lu, R., Niu, P., Zhan, F., Ma, X., Wang, D., Xu, W., Wu, G., Gao, G. F., & Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine*. https://doi.org/10.1056/NEJMoa2001017

Tables

Table 1

Participant demographic data (n = 603)

Characteristic	N	%
Gender		
Male	118	20
Female	483	80
Other	1[a]	<1
Prefer not to say	1	<1
Age		
18-24	135	22
25-34	194	32
35-44	82	14
45-55	66	11
55-64	86	14
65 -74	33	6
75+	7	1
Occupation		
Student (full-time)	117	19
Student (part-time)	6	1
Employed (full-time)	290	48
Employed (part-time)	80	13
Unemployed	27	5
Other	83	14
Country of residence		
UK–England	150	25
UK–Northern Ireland	178	30
UK–Scotland	136	22
UK–Wales	13	2
Ireland	47	8
China	28	5
United States	22	4
Other European	11	1
Other Worldwide	18	3

a. One participant recorded preferred gender as non-binary

Table 2

COVID-19 contextual factors (n = 603)

	Yes (%)	No (%)
Variable		
Lives alone	89 (15)	514 (85)
Keyworker[a]	186 (31)	417 (69)
Responsibility for others	256 (42)	347 (58)
Required to self-isolate	161 (27)	442 (73)
Friends/family positive symptoms	196 (32)	407 (68)
Friends/family hospital treatment	50 (8)	553 (92)
Recently bereaved	68 (11)[b]	535 (89)
Mental health treatment/support	66 (13)	526 (87)

a: Keyworker: providing an essential service; b: due to COVID-19: 35%;

Table 3

Contextual factors scored on a 5-point scale

Variable	Mean	SD
Frequency over past week		
Spent time with friends/family	3.17	1.04
Left house to exercise	3.25	1.17
Left house for food or medicine	2.66	.907
Well-informed about COVID-19	3.57	1.03
Extent agree with statement		
Followed government advice	4.35	.72
Daily routine disrupted	4.24	.88
Plans for future affected	4.02	1.04
Good level of social support	3.91	.876
Increased loneliness	2.95	1.21
Lost income or likely to	2.74	1.48

Table 4

Descriptive statistics for psychological measures

Variable	Possible range	This sample					Norm/comparative	
		Min	Max	Mean	SD	α	Mean	SD
Predictor variables:								
SELSA-S Soc.	7–35	5	33	11.94	6.16	.86	12.1	6.0
IUS – Total	12–60	12	60	29.28	10.15	.92	25.85	9.45
Prospective anxiety	7–35	7	35	18.34	6.03	.86	2.81	.91
Inhibitory anxiety	5–25	5	25	10.93	4.77	.88	2.18	.85
PVDQ – Total	15–105	20	99	58.76	14.53	.80		
PVDSQ (item level)	1–7	1	7	3.91	2.05		3.51	1.10
Perceived Infectability	7–49	7	49	24.62	9.03	.85		
Germ Aversion	8–56	10	56	34.13	9.14	.72		
CompACT total	0–138	21	136	84.45	20.32	.89	97.83	3.81
Openness to Experience	0–60	2	60	32.08	11.22	.82		
Behavioural Awareness	0–30	0	30	17.20	6.79	.82		
Valued Action	0–48	0	48	35.17	8.11	.88		
Outcome variables:								
SWEMWBS	7.00–35.00	7.00	35.00	21.20	3.52	.84	23.61	3.90
CALM Anxiety	0–64	0	60	15.05	12.80	.96	*unavailable*	

PVDQ: Perceived Vulnerability to Disease Questionnaire, SELSA-S Soc: Social and Emotional Loneliness Sale for Adults (short-form) Social subscale, CompACT: Comprehensive assessment of Acceptance and Commitment Therapy Processes, CALM: Current Anxiety Level Measure, SWEMWBS: Short Warwick-Edinburgh Mental Wellbeing Scale.

Table 5

Correlations between psychological measures

	1	2	3	4	5	6
1. IUS-12	1					
2. PVDQ	.32**	1				
3. SELSA-S Soc	.16**	.22**	1			
4. CompACT	-.58**	-.32**	.22**	1		
5. CALM	.53**	.37**	.33**	-.50**	1	
6. SWEMWBS	-.41**	-.25**	-.39**	.52**	-.57**	1

All correlations are Pearson's *r*: n = 603; ** Correlation is significant at the 0.01 level (2-tailed).

PVDQ: Perceived Vulnerability to Disease Questionnaire, SELSA-S Soc: Social and Emotional Loneliness Sale for Adults (short-form) Social subscale, CompACT: Comprehensive assessment of Acceptance and Commitment Therapy Processes, CALM: Current Anxiety Level Measure, SWEMWBS: Short Warwick-Edinburgh Mental Wellbeing Scale.

Table 6

Hierarchical regression analysis for variables predicting state anxiety

Variable	β	t	P	R	R^2	ΔR^2	F	P
Step 1				.42	.18	.18	44.40	<.001
Gender	.11	2.870	.004					
Age	-.26	-7.003	<.001					
Mental health difficulty	.27	7.135	<.001					
Step 2				.61	.37	.20	28.97	<.001
Gender	.13	3.987	<.001					
Age	-.23	-6.725	<.001					
Mental health difficulty	.18	5.359	<.001					
Self-isolated	.10	2.838	.005					
External contact	-.01	-.341	.733					
Well-informed	-.09	-2.772	.006					
Daily routine disruption	.06	1.669	.096					
Future plans impacted	.12	3.226	.001					
Good social support	-.03	-.751	.453					
Increased loneliness	.19	5.253	<.001					
Lost income	.07	2.141	.033					
SELSA-S soc	.22	5.863	<.001					
Step 3				.70	.49	.12	37.15	<.001
Gender	.12	3.819	<.001					
Age	-.12	-3.531	<.001					
Mental health difficulty	.94	2.957	.003					
Self-isolated	.05	1.628	.104					
External contact	-.02	-.752	.452					
Well-informed	-.08	-2.452	.014					
Daily routine disruption	.07	2.006	.045					
Future plans impacted	.08	2.558	.011					
Good social support	-.02	-.501	.617					
Increased loneliness	.13	3.798	<.001					
Lost income	.06	1.864	.063					
SELSA-S soc	.15	4.237	<.001					
CompACT	-.13	-3.328	.001					
IUS-12	.24	6.137	<.001					
PVDQ	.14	4.369	<.001					

PVDQ: Perceived Vulnerability to Disease Questionnaire, SELSA-S Soc : Social and Emotional Loneliness Sale for Adults (short-form) Social subscale, CompACT: Comprehensive assessment of Acceptance and Commitment Therapy processes, CALM: Current Anxiety Level Measure, SWEMWBS: Short Warwick-Edinburgh Mental Wellbeing Scale.

Table 7

Hierarchical regression analysis for variables predicting wellbeing

Variable	β	t	P	R	R^2	ΔR^2	F	P
Step 1				.34	.12	.12	25.88	<.001
Gender	-.07	-1.831	.068					
Age	.23	6.009	<.001					
Mental health difficulty	-.20	-5.220	<.001					
Step 2				.63	.40	.28	32.05	<.001
Gender	-.10	-2.961	.003					
Age	.20	6.009	<.001					
Mental health difficulty	-.10	-3.020	.003					
Key worker	.13	3.840	<.001					
External contact	-.01	-.432	.666					
Well-informed	.09	2.610	.009					
Daily routine disruption	-.10	-2.680	.008					
Future plans impacted	-.09	-2.526	.012					
Good social support	.14	3.784	<.001					
Increased loneliness	-.21	-5.968	<.001					
Lost income	-.02	-.436	.663					
SELSA-S soc.	-.25	-6.867	<.001					
Step 3				.68	.47	.07	34.01	<.001
Gender	-.10	-3.087	.002					
Age	.11	3.230	.001					
Mental health difficulty	-.02	-.626	.532					
Keyworker	.10	3.234	.001					
External contact	.01	.112	.911					
Well-informed	.07	2.316	.021					
Daily routine disruption	-.11	-3.118	.002					
Future plans impacted	-.07	-2.027	.043					
Good social support	.12	3.293	.001					
Increased loneliness	-.17	-5.003	<.001					
Lost income	-.01	-.105	.916					
SELSA-S soc	-.18	-5.139	<.001					
CompACT	.26	6.250	<.001					
IUS-12	-.08	-2.097	.036					
PVDQ	-.03	-.799	.425					

PVDQ: Perceived Vulnerability to Disease Questionnaire, SELSA-S Soc: Social and Emotional Loneliness Sale for Adults (short-form) Social subscale, CompACT: Comprehensive assessment of Acceptance and Commitment Therapy Processes, CALM: Current Anxiety Level Measure, SWEMWBS: Short Warwick-Edinburgh Mental Wellbeing Scale.

COVID-19 Contextual Measures

Item	Response scale
<u>Situation</u>	
1. Do you live alone?	Yes/no
2. Do you consider yourself a keyworker?	Yes/no
3. Do you have responsibility for others?	Yes/no
<u>Infection status</u>	
4. Over the last few weeks have you had to self-isolate because of any of the below reasons: • You displayed symptoms of Covid-19 • Someone in your household displayed symptoms • You are in the vulnerable category • Someone in your household is in the vulnerable category	Yes/no
5. Have any of your close friends or family outside of your household displayed symptoms of or been confirmed to have covid-19?	Yes/no
6. Have any of your close friends or family had to have hospital treatment due to Covid19 infection?	Yes/no
<u>Bereavement</u>	
7. Have any of your close friends or family passed away recently (either due to Covid-19 or other cause)	Yes/no
If yes, is their death due to Covid-19?	Yes/no
<u>Mental Health</u>	
8. Are you currently receiving treatment or support for a mental health difficulty?	Yes/no
If yes, has the pandemic had an impact on this mental health difficulty?	No - it's the same Yes - it has been worse Yes - it has been better
<u>External contact</u>	
9. In the last week how often have you: *a. Spent time with friends or family that you don't live with, using the telephone or video call?* *b. Left the house to exercise?* *c. Left the house to get food or medicines?*	1 - not at all 2 - once 3 - once every few days 4 - once a day 5 - several times a day
<u>Understanding and impact of COVID-19</u>	
To what extent do you agree with the follow statements: a. *I feel well informed about the Covid-19 situation in my country* b. *I have followed government advice for my country (e.g., social/physical distancing, shielding, handwashing)* c. *My daily routine has been disrupted* d. *My plans for the future have been affected* e. *I have a good level of social support* f. *I feel more lonely now than before the pandemic* g. *I have lost income or will likely lose income as a result of the Covid-19 situation*	1 - strongly disagree 2 - disagree 3 - neither agree nor disagree 4 - agree 5 - strongly agree

The authors have no financial relationships to declare.

The authors declare no conflict of interest.