Predictors of wellbeing during the COVID-19 pandemic: Key roles for gratitude and tragic optimism in a UK-based cohort.

Jessica Mead[1,2,*]

Zoe Fisher[2,3,4]

Jeremy Tree[1]

Paul Wong[5]

Andrew H Kemp[1,*]

[1] Department of Psychology, Swansea University, United Kingdom

[2]Fieldbay, Swansea, United Kingdom

[3]Traumatic Brain Injury Service, Morriston Hospital, United Kingdom

[4]Health and Wellbeing Academy, Swansea University, United Kingdom

[5]Department of Psychology, Trent University, Peterborough, Canada

[*]Corresponding author: Professor Andrew Kemp, a.h.kemp@swansea.ac.uk; Miss Jessica Mead, j.p.mead@swansea.ac.uk

Abstract

Here we examine the impact of the COVID-19 pandemic lockdown on wellbeing among UK-based respondents (N = 133). We explore the extent to which variables across wellbeing domains (physical activity, gratitude, tragic optimism, social support, and nature connection) contribute to wellbeing according to our previously proposed GENIAL model. Wellbeing was significantly reduced compared to both retrospective pre-lockdown measures (d=0.55) and a Scottish sample from 2018 (d=0.39). The regression model, containing wellbeing-related variables along with age, sex, and subjective socioeconomic status, accounted for up to 50% of the variance in wellbeing. While all predictor variables were significantly associated with wellbeing in zero-order correlations, only gratitude and tragic optimism contributed significantly to the regression model. These findings provide the first evidence for the contribution of these positive psychological factors to wellbeing during the COVID-19 lockdown. Implications for wellbeing at a time of great suffering and existential positive psychology (PP2.0) are discussed.

Key Words: Gratitude, Optimism, Wellbeing, COVID-19, GENIAL model, existential positive psychology

Introduction

COVID-19 is a respiratory virus inducing general symptoms such as fever and cough, with more severe cases requiring intubation (Chan et al., 2020; Wang et al., 2020). On March 11th 2020, the World Health Organisation (WHO) declared the COVID-19 outbreak a global pandemic and on March 23rd the UK government declared a nation-wide lockdown requiring citizens to stay at home. Residents were only permitted to leave their household to shop for basic necessities, to exercise once a day, to tend to medical needs, or to travel for work when working from home is not possible. As at August 21st 2020, over 22.7 million cases had been diagnosed globally with more than 794,000 fatalities (GOV.UK, 2020). Beyond threat to life, COVID-19 has caused widespread self-isolation, loss of income, unemployment and delays in treatment for ongoing health conditions as resources are diverted towards managing COVID-19 patients (Spinelli & Pellino, 2020).

Recent publications on the COVID-19 pandemic have raised concerns about the deterioration of mental health (Cullen et al., 2020; Galea et al., 2020; Gunnell et al., 2020; Pfefferbaum & North, 2020). During April and March, the Office for National Statistics (2020) reported a large increase in high anxiety and low life satisfaction among respondents, with main concerns being boredom, loneliness, anxiety, and stress (ONS, 2020). However, a pre-print by Groarke et al. (2020) highlighted some protective factors for loneliness during UK lockdown, including higher levels of social support (OR: 0.92), being married or co-habiting (OR: 0.35) and living with more adults (OR: 0.87). A New Zealand study has also highlighted the protective role of social support during lockdown, with higher levels of community connectedness being associated with lower levels of psychological distress (Sibley et al., 2020).

Researchers have highlighted the importance of wellbeing in protecting against inflammation and reducing the risk of catching the virus (Fancourt & Steptoe, 2020; Vieira et al., 2020) and have therefore argued for the use of self-guided therapeutic and positive psychological approaches to manage wellbeing during self-isolation and social distancing, including physical activity, savouring positive emotions, and optimising positive social resources (Fischer et al., 2020; Holmes et al., 2020; Yamaguchi et al., 2020). Theoretical developments have also emphasised how navigating the challenges of life and the experience of suffering may contribute to sustainable wellbeing (Wong, 2020). It is therefore important to understand the extent to which positive wellbeing factors contribute towards wellbeing during a time of individual and societal suffering.

This issue is considered within the context of our recently proposed theoretical framework of wellbeing (Kemp et al., 2017; Mead et al., 2019), the GENIAL model, which is characterised by a life-course biopsychosocial approach which places individual wellbeing within the context of community and environmental ecosystems.. Accordingly, the present study will target exemplars within each domain of this framework, encompassing individual, community and environment domains. In particular, we focus on the following exemplars: physical activity, optimism, gratitude, social support, and nature connection. We now briefly review the evidence linking each of these exemplars to wellbeing.

Research has demonstrated the positive impact of physical activity on a variety of physical and mental health conditions (Czosnek et al., 2019). Physical activity is thought to be mediated by improvements to vagal nerve functioning (Kemp et al., 2017; Pearson & Smart, 2018) and increased positive affect (Elavsky et al., 2005; Pavey et al., 2015) amongst other factors. A meta-analysis has reported significant associations between leisure time physical activity, positive affect (r = 0.21), and life satisfaction (r = 0.12); effects associated with a small to medium effect size (Wiese et al., 2018). Similarly, a significant correlation has been

reported between psychological wellbeing and exercise frequency (r = .25; Garcia et al., 2012). Gratitude and optimism have also been identified as key positive psychological attributes that contribute to wellbeing, reflecting a 'life orientation' in which one displays appreciation generally and expects future outcomes to be positive (Carver & Scheier, 2014; Wood et al., 2010), respectively.

Together these emotions reflect 'positive psychological experience' that can impact on wellbeing through various routes including strengthening vagal function (Kemp et al., 2017; Kok et al., 2013; Mead et al., 2019), improving social ties (Kok et al., 2013), and broadening an individual's momentary thought-action repertoire (Fredrickson, 2004) Studies have reported small to large correlations between optimism and multiple health factors, such as post-surgical physical quality of life (r = .13), general quality of life (r =.37), mental health (r = .21; (Auer et al., 2016), and subjective wellbeing (r = .54; Duy & Yıldız, 2019). Similarly, gratitude has correlated with various wellbeing factors, including life satisfaction (r = .30; Chen & Kee, 2008) and psychological wellbeing (r ranging from .17 to. 61; Wood et al., 2010). Given these benefits, interventions have now been designed to specifically target improvements in gratitude and optimism (Lai, 2017; Malouff & Schutte, 2017). An alternative focus is the role of tragic optimism (P. Wong, 2019), an important construct to consider during time of crisis. Defined as 'optimism in the face of tragedy' and in spite of the 'tragic triad' (pain, guilt, and death) (Frankl, 1984).

Further to physical activity and positive psychological experience, social support is another critical component of wellbeing. Defined as the perception or experience of being loved, cared for, and valued by others, social support is positively related to wellbeing measures, such as life satisfaction (r = .23) and personal wellbeing (r = .34) (Brajša-Žganec et al., 2018). Conversely, poor social relationships have been shown to increase risk for mortality to a greater extent than well-known risk factors, such as obesity and physical inactivity (Holt-

Lunstad et al., 2010). As previously highlighted, social support already appears to be playing a vital role in protecting wellbeing during the COVID-19 pandemic (Groarke et al., 2020; Sibley et al., 2020).

Another important contributor to health and wellbeing is the extent to which we are connected to the natural environment, a phenomenon known as 'nature connectedness' (Martin et al., 2020). In fact, individuals who spend 2 hours a week in nature display improved wellbeing (White et al., 2019). Interestingly, research during the pandemic in Canada highlighted that among both active and inactive individuals those classified as flourishing indicated greater nature relatedness compared to those who scored low on the scale (Lesser & Nienhuis, 2020). Kuo (2015) highlighted 21 different pathways through which nature may promotes health, including the positive impact of phytoncides (antimicrobial volatile organic compounds), attention restoration and exercise in nature (compared to urban areas). On the basis of the reviewed evidence, immune function was identified as playing a central role through which beneficial effects arose. We have noted previously that vagal function – a core feature of the GENIAL model – plays an upstream neuroimmunoregulatory role (Kemp et al., 2017; Mead et al., 2019) suggesting a common psychophysiological mechanism for wellbeing. Further evidence for the relationship between nature and wellbeing comes from epidemiological research, with strong evidence for a strong association between the quantity of green space surrounding the residence and perceived mental health, general health, and all-cause mortality of the residents (van den Berg et al., 2015). Small to medium effect sizes have been reported between nature connection and eudaimonic wellbeing (r = .24) and hedonic wellbeing (r = .20) (Pritchard et al., 2020). It has even been argued that nature could provide a population-wide strategy for health promotion (Maller et al., 2006) that may also help tackle health inequities (Allen & Balfour, 2014).

While the above factors are discussed as independent contributors to wellbeing, they are all interrelated components of a wider framework (GENIAL) and have been found to promote each other to some degree (Chen & Kee, 2008; Dadvand et al., 2016; Elavsky et al., 2005; Holt-Lunstad et al., 2010; Kok et al., 2013; Petersen et al., 2019). The nation-wide, lockdown associated with the COVID-19 pandemic in the UK provided a unique opportunity to explore the impact on and contributors to wellbeing during a time of great suffering, the focus of Second Wave Positive Psychology (PP 2.0), also described as existential positive psychology (Wong, in press.;Wong et al., 2020). Encompassing individual, community and environmental factors, it was predicted that physical activity, gratitude, tragic optimism, social support, and nature connection would significantly contribute toward wellbeing. In addition to this, it was predicted that the mean wellbeing score would be significantly lower among the current general population sample, compared to previous samples. It was also predicted that scores on wellbeing, physical activity, social support, and nature connection would significantly decrease during lockdown (time point 2) compared to scores prior to lockdown (time point 1) due to the reported impact on mental health and environmental restrictions. However, it was hypothesised that gratitude and tragic optimism levels would remain stable as these have been considered to be trait-like orientations to life.

Method

Participants

A total of 137 UK residents participated, including 108 females and 29 males, with a mean age of 33.33 (Std. 13.11), ranging from 18- to 68-years.

Measures

At the time this study was carried out, it was not clear how long the lockdown rules would remain in place. This time constraint heightened the urgency of recruiting a sufficient number of participants for regression analysis within a short period of time. Limitations were therefore imposed on the length of chosen measures to ensure that the time taken to complete the survey maximised potential recruitment and did not lead to participant drop-out. The measures discussed below were administered twice to the participants, once referring to their experience before the pandemic started and again referring to their experience during the previous two weeks.

Physical Activity

A single item was used to measure physical activity both before and during lockdown, in which participants were asked how physically active they had been. on a 5-point Likert-type scale from a value of 1 (not at all active) to 5 (extremely active). A single item to measure physical activity has several advantages including brevity and parsimony, and have been shown to be both reliable and valid (Gill et al., 2012; O'Halloran et al., 2020; Portegijs et al., 2017)

Gratitude

The Gratitude Questionnaire-Six-Item Form (GQ-6) (Mccullough et al., 2002) is a six-item questionnaire based on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). Items 3 and 6 are reversed scored, then all scores are added to provide a total score (out of 42). The GQ-6 has relatively high internal consistency (Cronbach's alpha ranging from .76 to .87), convergent validity *(*r = .33, p < .01; Mccullough et al., 2002) and temporal validity (r = .59 and.73 for two samples; Wood et al., 2008). Discriminant validity was indicated by the factorial independence of the GQ-6 from measures of related constructs, these being life

satisfaction (*r* = .53), vitality (*r* = .46), happiness (*r* = .50), optimism (*r* = .51), and hope (*r* = .67; Mccullough et al., 2002).

Tragic Optimism

The Life Acceptance Measure (LAM; Wong, 2019) is a 9-item measure with statements on a 5-point Likert scale (1 being strongly disagree and 5 being strongly agree). The scores are added, and a total is provided (out of 45). The measure of tragic optimism, as opposed to measures for 'traditional' optimism, is arguably more appropriate during the COVID-19 pandemic as it allows for the presence of the tragic triad during measurement.

Social Support

The Multidimensional Scale of Perceived Social Support (MSPSS) is a 12-item scale designed to measure perceived social support from family, friends, and a 'special person' (Zimet et al., 1988). The measure uses a 7-point Likert scale, ranging from 1 (very strongly disagree) to 7 (very strongly agree). Scores are added and a total is provided (out of 84). The scale has proven to have good internal reliability, with Cronbach's alpha ranging from .84 to .92, and has proven to have moderate to strong factorial validity and construct validity (Zimet et al., 1988, 1990).

Nature Connection

Previous questionnaires have focused on either contact with (Largo-Wight et al., 2011) or connection to nature (Mayer & Frantz, 2004; Nisbet & Zelenski, 2013). We argue that both are important for wellbeing although the inclusion of existing measures would lengthen the questionnaire. For brevity, a measure was created and named 'Nature Connection', acknowledging both physical and psychological connection to nature. The statements are (1) 'I feel I spend enough time in nature', (2) 'I wish I could spend more time in nature', (3) 'I feel disconnected from nature', and (4) 'I am often immersed in nature'. Responses ranged

from 1 (strongly disagree) to 5 (strongly agree). Respondents were informed that the term nature referred to green spaces (such as parks, forests, gardens, fields) and blue spaces (such as lakes, rivers, the sea). Items 2 and 3 were reversed scored, then all items were added, and a total was provided (out of 20).

Wellbeing

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) is a 14-item measure on a 5-point Likert scale (1-5) that measures subjective and psychological wellbeing (Tennant et al., 2007). The measure had a Cronbach's alpha score of 0.89 (student sample) and 0.91 (population sample) and correlated with other measures of mental health and wellbeing. Test-retest reliability was 0.83 at one week. Scores were added and totalled (out of 70). The current data was compared with data from the 2018 Scottish Health Survey (N = 4,810 adults) (Cheong et al., 2018).

Covariates

It is important to account for socioeconomic status (SES), age, and gender, as all these are well-known influencers of wellbeing (World Health Organisation & Calouste Gulbenkian Foundation, 2014). The MacArthur Scale of Subjective Social Status (SSS) is a measure to capture subjective social status across indicators of socioeconomic position (Adler et al., 2000). It has a greater sensitivity when assessing SES compared to questions on income and/or education level, as some respondents may not feel comfortable disclosing this information. Also, assessing income as an index of SES is arguably not a valid approach during COVID-19 as many people are put on furlough or made redundant. Furthermore, the MacArthur Scale of SSS has previously predicted health and wellbeing better than objective measures of SES (Singh-Manoux et al., 2005).

Design & Procedure

The research protocol was considered and approved by the psychology department ethics committee at Swansea University before data collection began. Using a cross-sectional design, data collection commenced on April 8th, 16 days after lockdown was introduced in the UK, and ceased on May 23rd, lasting 45 days. Participants accessed an online link to the questionnaire which was hosted on Qualtrics. Participants were informed of questionnaire content and consent was either provided via a tick box or assumed if the participant completed the entire questionnaire. The first part of the questionnaire focused on demographic items and subjective physical activity. Following this, respondents were presented with remaining measures in random order, asking them to reflect on their experiences before the pandemic began. These measures were the GQ-6, MSPSS, WEMWBS, LAM, UCLA-Loneliness 3-item scale (Hughes et al., 2004) and Nature Connection. Following this, respondents were presented with the measures again in random order and asked to reflect on their experiences during the previous 2 weeks. Finally, participants were presented with a measure of post-traumatic growth (Tedeschi & Calhoun, 1996) – not a focus of the present study – and debriefed.

Statistical Analysis Method

Participants who were not based in the UK or did not provide age or gender were removed from all potential analyses to minimise sample heterogeneity. In addition to this, one participant was removed for completing the questionnaire within an extremely short period of time (304 seconds), suggesting invalid responses. Further participants were not included in specific analyses if they had any missing values on the measures of interest for that test, meaning sample size differed slightly between tests. Statistical tests were conducted using SPSS. A one-sample t-test was carried out to compare the wellbeing data with previous UK-based samples. For the regression, SES and physical activity were converted into dummy variables. For SES, “low” was determined as a score of 0-4, “middle” was determined as a

score of 5 or 6, and “high” was determined as a score of 7-10. For physical activity, a score of 1 or 2 was classed as “low”, 3 was classed as “moderate”, and 4 or 5 was classed as “high”. The reference variable for SES and physical activity was “low SES” and “low physical activity”, respectively. A two-step, hierarchal, linear regression was conducted using the enter method to assess if the predictor variables significantly predicted wellbeing during the lockdown, while controlling for age, gender, and subjective SES. In addition to this, paired t-tests were conducted to investigate changes in the above variables from time point 1 (retrospective pre-lockdown) to time point 2 (during lockdown). Effect sizes (*d* and *r*) and Bayes factors are reported to illustrate the size of the effect and degree of support for the null and alternative hypothesis. Effect sizes are described as either small (*d* = 0.2, *r*=0.1), medium (d = 0.5, *r*=0.3), or large (d = 0.8, *r*=0.5) based on benchmarks suggested by Cohen (1988). Bayes factors were determined using the Summary Statistics module in JASP version 0.13.1 (Ly et al., 2018). Non-informative default priors were used (Cauchy prior width = 0.707 for t-tests and r scale covariates = 0.354 for the linear regression) and robustness plots were inspected to confirm degree of evidence obtained. BF ranges from 0 to infinity and a value of 1 expresses equal support for the null and alternative hypotheses. BF values provide useful information in relation to the odds of the one hypothesis over an another. Thus, a BF_{10} of five would indicate that data are five times more likely under the alternative hypothesis than they are under the null. By contrast, a BF_{01} of five would indicate that data are five times more likely under the null hypothesis than they are under the alternative. A classification scheme for interpreting Bayes Factors (Jeffreys, 1961; Lee & Wagenmakers, 2013; Wagenmakers et al., 2018) is used such that values of 1 to 3 correspond with anecdotal evidence, values of 3 to 10 as moderate evidence, values of 10 to 30 as very strong evidence, while values exceeding 100 reflect extreme evidence in support of the null (BF_{01}) or alternative (BF_{10}) hypothesis.

Results

Descriptive statistics

The characteristics of the sample population (N = 137) are presented in table 1.

Table 1: Characteristics of sample

Characteristics	Category	N
Gender	Female	108
	Male	29
Age	18-27	63
	28-37	30
	38-47	15
	48-57	21
	58-68	8
The presence of a physical health condition	Yes	27
	No	108
	Did not answer	2
The presence of a mental health condition	Yes	22
	No	113
	Did not answer	2

The presence of COVID-19 symptoms	Yes	9
	No	128
Physical Health	Poor	6
	Fair	30
	Good	43
	Very Good	43
	Excellent	15
Mental Health	Poor	13
	Fair	41
	Good	50
	Very Good	25
	Excellent	8
Subjective Social Status	0-4	25
	5-6	52
	7-10	59

Comparison of sample to general population

A one-sample t-test was performed using the data from 133 participants. The mean wellbeing score was compared with a Scottish general population sample from 2018 (N = 4,810 adults) (Cheong et al., 2018). Results highlighted a significant difference in wellbeing between the current (M = 45.89, Std = 9.08) and previous samples (M = 49.4, Std = 8.96), $t(132) = -4.46$, p

= .000; d = 0.39, BF_{10} = 851, representing a small to medium effect size (Cohen, 1988), and providing extreme evidence in support of the alternative hypothesis. The average wellbeing score of the current sample was 3.51 less than the general population sample from 2018.

Within-subject comparison

Paired t-tests were carried out to compare the difference in scores between time point 1 (a retrospective pre-pandemic assessment of wellbeing and related variables) and time point 2 (during lockdown). Results highlighted that wellbeing and social support significantly reduced during lockdown (see table 2 below), whereas levels of physical activity, gratitude, tragic optimism, and nature connection did not significantly differ between time point 1 and 2. Inspection of Bayes factors indicate extreme evidence for the alternative hypothesis for wellbeing, while only anecdotal support is provided for social support. Moderate evidence in support of the null hypothesis is provided for gratitude, tragic optimism, and nature connection variables.

Table 2: Paired t-test results

	N	Mean (before/after)	Standard deviation (before/after)	*t*	P value	*d*	BF_{10}	BF_{01}
Wellbeing	127	50.45/45.72	7.88/9.17	6.01	.000	0.55	572176	1.75e-06
Physical Activity	136	3.32/3.15	.93/1.05	1.68	.095	0.17	0.375	2.67
Gratitude	127	33.26/33.54	5.59/6.22	-.67	.505	0.05	0.123	8.143

Tragic Optimism	126	33.36/33.84	5.05/5.15	-1.34	.184	0.09	0.237	4.222
Social Support	127	66.02/64.79	14.13/14.52	2.29	.024	0.09	1.22	0.82
Nature Connection	128	12.15/11.78	3.14/3.33	1.00	.321	0.11	0.16	6.25

Predicting wellbeing

A hierarchical, linear regression was performed using data from 123 participants. There was a significant linear relationship between the outcome variable (wellbeing) and each predictor variable, therefore meeting the assumption of linearity. The histogram and p-p plot of standardised residuals indicated that the outcome variable (wellbeing) was normally distributed and the scatterplot of residuals highlighted that the data was homoscedastic.

An analysis of standardised residuals was carried out on the data, which showed that the data contained no outliers (Std. Residual Min = -2.18, Std. Residual Max = 2.28). Tests to assess the assumption of collinearity indicated that multicollinearity was not a concern, with the highest VIF value being 2.11 and the lowest Tolerance value being .47. The data met the assumption of independent errors (Durbin-Watson value = 2.41) and the assumption of non-zero variances.

With all assumptions met, a two-step, multiple, hierarchical, linear regression was conducted to see if physical activity, gratitude, tragic optimism, social support, and nature connection predicted wellbeing, whilst controlling for age, gender, and SES. The descriptive statistics and correlations are provided in table 3 and table 4 below.

Table 3: Mean and Standard Deviation of variables.

Measure	Mean	Standard Deviation
Wellbeing	45.83	8.84
Physical Activity	3.10	1.04
Gratitude	33.38	6.43
Tragic Optimism	34.00	5.26
Social Support	64.82	14.40
Nature Connection	11.82	3.47

Table 4: Zero-order correlations amongst wellbeing variables

	Wellbeing	Physical Activity	Gratitude	Tragic Optimism	Social Support	Nature Connection
Wellbeing	1.00	.31**	.63**	.54**	.46**	.36**
Physical Activity	.31**	1.00	.30**	.13	.23**	.37**
Gratitude	.63**	.30**	1.00	.52**	.45**	.22**
Tragic Optimism	.54**	.13	.52**	1.00	.39**	.32**
Social Support	.46**	.23**	.45**	.39**	1.00	.18*
Nature Connection	.36**	.37**	.22**	.32**	.18*	1.00

* = P < .05

** = P < .01

Results indicated that level 1, containing only the control variables (age, sex, SES), was significant, $F(4,118) = 2.62$, $p = .038$, $R^2 = .08$, R^2 Adjusted = .05. However, SES was the only variable to significantly contribute toward this model. The addition of the predictor

variables (level 2) significantly improved the model, F change (6,112) = 18.85, $p < .000$, R^2 Change = .46, R^2 = .54, R^2 Adjusted = .5, BF_{10} = 4.094e+11. Inspection of the Bayes Factor revealed extreme evidence for the full model relative to that with only control variables.

The analysis highlighted that gratitude and tragic optimism were the only variables to contribute significantly to the model. No other predictor and control variables significantly contributed to the model. The results from the t-tests are presented below. The standardised beta values highlighted that gratitude was the most influential variable in the model.

Table 5: Results from the t-tests

	t	P value	Standardised Beta value
Gratitude	4.65	.000	.39
Tragic Optimism	2.62	.010	.21
Social Support	1.88	.062	.14
Nature Connection	1.90	.060	.14
Physical Activity (moderate)	.83	.408	.07
Physical Activity (high)	1.06	.291	.09

Discussion

The aim of the present study was to examine the impact of the COVID-19 lockdown on wellbeing and to examine the influence of key variables of interest on a reliable and valid measure of wellbeing. As expected, we reported a significant reduction in wellbeing in our UK-based sample compared with a previous sample, a finding associated with a small to medium effect size. This finding was further supported in a within-subject comparison of data

comparing wellbeing during versus a retrospective pre-pandemic assessment. The full regression model accounted for up to 50% of the variance in wellbeing, a strong finding in psychological science.

The main finding here highlights the key roles of optimism and gratitude during a time of great suffering, a starting point for existential positive psychology (PP2.0) (Wong et al., 2020; Wong, 2011; Wong, 2019). Prior research has already demonstrated that tragic optimism and existential gratitude are critical components for a positive psychology of suffering (Wong, 2019) and for helping people to survive and grow through adversities and trauma (Wong, 2020). For example, Leung (2019) showed that tragic optimism provides a conceptual roadmap for clinicians to help trauma survivors accept their traumatic experiences, and affirm the meaningful and virtuous aspects of their lives. Wong showed that clients can be helped by suggesting to them that their trauma could be a blessing in disguise and that we can always be grateful for the gift of life (Wong, 2020). That is why Uppal (2020) and Wong (2020) suggest that tragic optimism and existential gratitude are needed during COVID-19 and post-pandemic world.

Further to our main finding relating to optimism and gratitude, we also observed social support to display a large zero-order correlation with wellbeing, although it did not contribute significantly to the model. Similarly, physical activity and nature connection displayed moderately-sized correlations but did not contribute significantly to the model. The observed positive associations between the predictor variables and wellbeing are congruent with previous research (Auer et al., 2016; Brajša-Žganec et al., 2018; Heo & Lee, 2010; Pritchard et al., 2020; Wiese et al., 2018; Wood et al., 2010), although effect sizes of the present data are larger than previous research.

It is possible that the lack of significant contribution of physical activity, social support, and nature connection to the regression model may be due to inter-relationships between these variables during the context of lockdown. For instance, prior research has highlighted the inter-relationships between these variables under normal circumstances, with social support and physical activity partly mediating the relationship between nature exposure and health (Dadvand et al., 2016). We suggest that nature may have provided a context within which social support and physical activity was experienced during lockdown. While these variables contributed to the model in terms of variation in wellbeing (evident by zero-order correlations and beta values), they did not independently contribute to the model. It remains to be determined whether this is specific to the context of lockdown or whether it is more general phenomenon as prior research has not previously accounted for all the variables we examine here when focusing on wellbeing. Repeating the current study once lockdown has been lifted would help to clarify this situation.

Several limitations of the present study are worth noting. The first limitation concerns the context within which the research was conducted, by which we refer to the regulations and restrictions associated with UK lockdown. Such conclusions may not be applicable to countries where lockdown was either more restrictive or relaxed. However, results are still useful in that they highlight the contributors to wellbeing in the face of adversity. The second limitation concerns the use of certain measures that have not been validated, i.e. measures for physical activity, tragic optimism, and nature connection. Regarding physical activity, previous studies have highlighted the reliability and validity of other single-item measures (Milton et al., 2011; Schechtman et al., 1991). Support for the validity of the current measure comes from the significant correlation between physical activity and wellbeing (r = .31), a larger correlation than the previously reported relationship between physical activity and psychological wellbeing (r = .25; Garcia et al., 2012). Similarly, the correlation between

tragic optimism and wellbeing (r = .54) was comparable to prior research on other measures of optimism and wellbeing (r = .54; (Duy & Yıldız, 2019). Additionally, the correlation between tragic optimism and gratitude (r = .52) was comparable to prior research on optimism and gratitude (r = .51; (Mccullough et al., 2002). Similarly, the correlation between nature connection and wellbeing (r = .36) was stronger than previous research focused on eudaimonic and hedonic wellbeing (r = .24 and r = .20, respectively; Pritchard et al., 2020), providing some support for the use of the current measure.

To our knowledge this is the first study to investigate the collective contribution of physical activity, gratitude, tragic optimism, social support, and nature connection to wellbeing, exemplar variables from our GENIAL model. The present finding is also the first empirical research to support the importance of existential positive psychology (PP2.0) of accepting the dark side of life with optimism and gratitude. We therefore support proposals for the application of positive psychological approaches that target gratitude and tragic optimism in particular in order to manage wellbeing during self-isolation and social distancing (Fischer et al., 2020; Holmes et al., 2020; Yamaguchi et al., 2020) and periods of adversity more generally. A move towards more holistic models of health that extends the limited aims of the medical model by seeking to build wellbeing -rather than a reduction of illbeing - is necessary for sustainable wellbeing among entire populations. A key component of such models includes supporting people to build positive emotions, including tragic optimism and gratitude. A replication of this study would be beneficial to highlight whether physical activity, nature connection, and social support would independently contribute to a regression model when such factors may be experienced more independently from one another.

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