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**Articles**

# Enhancing post traumatic growth during the COVID-19 lockdown: the roles of nature relatedness and perceived restorativeness

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## Abstract

*Objective:* Despite the well documented negative outcomes related to traumatic events, people who experience traumatic events may manage the consequences in an adaptive way. This study aims to understand whether nature relatedness perception and the perceived potential of restorativeness related to one's house may explain Post-Traumatic Growth (PTG) in the context of a pandemic.

*Methods:* 308 adults ($M_{age}$ = 35.31; SD= 13.91; 22.7% males) were recruited through an online survey administered during the national lockdown. We administrated measures of post-traumatic stress disorder (PTSD), PTG, perceived restorativeness, and nature relatedness. The study examines how and which dimension of perceived restorativeness and nature relatedness influences dimensions of PTG in a generalized post-traumatic stress disorder population.

*Results:* Controlling for age and gender, we found that different facets of PTG were differently predicted by PTSD, Nature relatedness, and perceived restorativeness. PTSD significantly predicted all dimensions of PTG. In particular, there would be a positive significative correlation between NRS (Nature Relatedness Scale) scores and the specific dimension "being away" of the PRS (Perceived Restorativeness Scale), which would predict the scores of two subcategories of the PTGI (Posttraumatic Growth Inventory). These two variables, "being away" and NRS, appear to be good predictors for assessing posttraumatic growth in specific dimensions of the PTGI.

*Conclusions:* Perceived connection to nature as well as the sensation that one's house is a place where one can escape from daily routine significantly predicted spiritual change and awareness of new possibilities in one's life. Finally, fascination for the place where the individual lived significantly predicted spiritual change.

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## 1. Introduction

The COVID-19 pandemic has been a disruptive experience determining a decisive impact on the lives of people around the world. It presented itself as an unprecedented phenomenon due to the speed of transmission, becoming a global health emergency in a matter of weeks (Wang et al., 2020). The pandemic has been threatening one's own and others' health and disrupted many aspects of daily life in sudden and unexpected ways, also due to the emergency measures taken by governments to stem the risk of contagion. Loss of work, adaptation to online work, domestic confinement, sudden cessation of school, and lack of socialization for children are only few of the implications of the pandemic (Caroppo et al., 2021). People's daily lives and their habits in the professional, relational, and family domains have been turned upside down (Onyeaka et al., 2021).

The literature has shown that covid-19 has different consequences on people's physical and mental health (Balalau et al., 2022; Pokrajac-Bulian et al., 2022). Indeed, according to some studies, these consequences have affected some segments of the population more than others, also highlighting the central role of personality traits on stress levels caused by covid-19(Somma et al., 2019, Somma et al., 2020; Teixeira et al., 2022; Guidotti et al.,2022). Indeed, the literature has shown that COVID-19 caused PTSD in healthcare workers and that the risk factors associated with this consequence include, in addition to professional role, gender and resilience differences (Petito et al., 2022). Other studies have instead analysed the role of social support, passive aggression, avoidance and dissociation on states of fear and anxiety during covid-19 (Gori et al., 2021). A central role during the Covid-19 pandemic was played by the use of e-learning and the internet. According to the literature, the use of the internet during the pandemic helped improve the psychological well-being of those people who experienced feelings of loneliness caused by social isolation, and Generation Z also showed a good emotional adaptation to the e-learning tool (Ranieri et al., 2021; Venuleo et al., 2022). The literature has highlighted that Covid-19 can also be identified as a new type of trauma (Kira et al., 2023).

According to the DSM-5 definition of trauma, determined by direct or indirect exposure to situations that treat life or physical and sexual integrity, several circumstances related to the COVID-19 pandemic (e.g., direct exposure to relatives' loss, media information on pandemic diffusion and related victims, stay-at-home measures) may be considered as potentially traumatic events to which populations have been exposed continuously for at least several months. During this period, individuals' psychological functioning is likely to have been affected in response to this situation.

The particular situation of the pandemic, which has been perceived as a global trauma, can be interpreted as a shared feeling of loss of control experienced during the pandemic. Indeed, according to Myles et al. (2020), in a situation where an individual holds generalized beliefs of "low control" over their own environment, their perception of self-worth would decrease, leading to a state of despair or even depression. To go further, the perception of a decrease in control would have a more significant impact on individuals with a low desire for control compared to those with a strong desire for it. Individuals with a low desire for control might be particularly vulnerable to the negative effects of loss of control and could influence how they react to life's challenges (Myles et al. 2021; Myles et al. 2022). As Myles & Merlo (2022) points out, it could be interesting for clinical purposes to simultaneously strengthen the desire for control, for example, alongside the Behavioral Activation (BA) protocol, that can increase the perception of being at the origin of one's own actions.

According to literature, one of the most anticipated consequences after trauma exposure is post-traumatic stress disorder (PTSD), defined as a stress-related disorder that develops as a consequence of the exposure or testimony of a life-threatening traumatic event (Kessler, 2000). Previous studies investigating the consequences of epidemic events shown that the onset of PTSD was among the most frequent consequences, with percentages in general population ranging from 10 to 47.8% (Chamberlain et al., 2021; Mak et al.,2009; Wu et al., 2009). In addition to PTSD, many other negative outcomes are related to the traumatic experience of epidemics such as anxiety (Velotti et al., 2021a ; Velotti et al., 2021b; Desclaux et al., 2017; Di Giovanni et al., 2004; Bai et al., 2004), insomnia (Taquet, et al., 2021; Desclaux et al., 2017; Di Giovanni et al., 2004), depressed mood (Rogier et al., 2021; Di Giovanni et al., 2004; Hawryluck et al., 2004; Taquet, et al., 2021; Liu & Hilton, 2005), addiction (Rogier et al., 2021; Dubey et al., 2020) , and irritability (Panda et al., 2021; Bai et al., 2004; Taquet, et al., 2021).

Beyond the consideration of the array of negatives consequences of the pandemic on mental health, a somewhat contrasting trend should also be noted. This consists in the increase of levels of closeness individuals experienced with nature during the COVID-19 pandemic, which has been interpreted as a positive natural response to trauma leading to increased awareness of the importance of the natural environment (Carrus et al., 2015; Cox et al., 2017; Zang et al., 2021; Soga et al., 2021). In this regard, many temporary "back to nature" phenomena can be observed, ultimately prompting a variety of – somewhat catastrophic – reassessments of the events in light of an ecological perspective. Anecdotal stories of wild animals invading cities have been documented; air, water, and noise pollution indices have decreased significantly (Paital, 2020; Helm, 2020; Yunus et al., 2020), just to name a few examples. Such facts lead a number of

journalists and scientists to express the idea that COVID-19 was part of a 'self-generation plan' of Mother Nature and that containment was a natural levelling strategy used to reorganize the world ecosystem (Dossey, 2020; Paital, 2020). While it is not within the scope of this study to examine this debate, we can hypothesize that this argument was likely to influence trauma elaboration processes, contributing to the formation of a coherent meaning for the experienced catastrophic events. Preliminary evidence supporting the idea that individuals have developed an increased sensitivity to ecological themes during the pandemic has been provided by Google's trends analyses (Rousseau & Deschacht, 2020). In fact, the 'coming-back-to-green' phenomenon emerged in response to restrictive measures and the brake on economic production has been accompanied by an increase in the use of green spaces, particularly in urban areas. For example, nearly half of Brode's (2020) sample reported being more engaged in outdoor activities such as hiking, visiting local parks, and boating/fishing. As noted by Sachs (2020), many people connect to nature more than they have in their entire lives, if ever.

Another point is that during the acute phases of the COVID-19 outbreak several countries implemented social distancing and 'stay-at-home' measures. Consequently, home became for most people the predominant environmental context, being the only place where we slept, eat, socialized, and engaged in recreational activities. Recent studies based on the socio-ecological framework documented that environmental features significantly impact mental health and well-being (Bratman et al., 2019; Kan et al., 2022). During the lock-down, the time spent at home may have fostered the relevance of the relationship between home features and mental health. Supporting this idea, a study conducted by Amerio et al. (2020), during the lockdown, highlighted that poor housing is predictive of depression, stressing the role of views and indoor quality. These promising results call for further research investigating the relationship between home and mental outcomes during forced 'stay-at-home' conditions. Moreover, we may expect home-related experiences to impact mental health not only negatively but also positively.

In addition, as better detailed in the next paragraphs, the two phenomena described (i.e., increased sensitivity to nature and positive impacts of house characteristics) may be framed within the nomological network of the concept of Post Traumatic Growth (Tedeschi & Calhoun, 1995; Tedeschi et al., 1998). This construct corresponds to the way people who experience traumatic events are able to deal with the consequences adaptively, find meaning in what happened past, integrate traumatic memories, and find a new balance in their functioning (Kessler et al., 1995; Pat-Horenczyk & Brom, 2007).

### 1.1 COVID-19 and Post Traumatic Growth

The PTG construct differs from the concept of resilience. Resilience corresponds to personal characteristics that allow people to manage adversity well, it refers to the ability not to be damaged by the very stressful circumstances of the event in question. Resilience has been specially studied in children who manage to remain psychologically healthy despite very difficult circumstances (Rutter, 1987; Werner, 1989). In contrast, PTG refers to a change that goes beyond pre-traumatic adaptations. This concept corresponds to a qualitative transformation of functioning, it is not only a quality of resistance but influences perception and thought (Kan et al., 2022) it influences cognitive mechanisms and can lead to changes in how we process information, perceive events, and think about situations. Indeed, instead of ruminating on what happened, why it happened, and how it happened, PTG processes productively reframe the traumatic event(s), confronting these crucial questions with a style of organized thinking that fosters a sense of increased control (Addington et al., 2016). From this perspective, the construction of a coherent narrative including a temporal continuity between the pre-event, the event, and the post-event, is supposed to underline the process of "taking into account the lesson of the struggle" (Calhoun & Tedeschi, 2013) PTG develops through the experience of a positive change, an improvement that occurs following a difficult traumatic event, and manifests through modifications in different areas of life, such as skills and competencies (Elder & Clipp, 1989), self-confidence (Carver, 1998), relationships with others (Fromm et al., 1996) and appreciation of life in general. Indeed, perceiving one's own agency in actions is a protective factor against the onset of depressive symptoms (Myles et al. 2022). Staying aligned with the principles of parsimony (Myles and Johnson 2023), we can deduce that one of the factors underlying post-traumatic growth could be related to cognitive reorganization associated with recognizing being at the origine of a positive change after experiencing a traumatic event. This cognitive shift and sense of agency may contribute to a deeper understanding of the experience, a new perspective on one's capabilities and growth following trauma.

It is a multi-dimensional construct with each of its components leading the individual to follow new and relevant life paths, develop spirituality and existential awareness, and increase one's sense of self-efficacy (Tedeschi & Calhoun, 1996).

PTG emerges as a crucial topic to address at the time of the COVID-19 outbreak. Indeed, it has been shown to mitigate the negative consequences of stressful events on mental health (Addington & Fry, 1986). Importantly, previous studies have suggested that individuals who developed elevated PTG levels after a stressful event were more mentally resilient to similar

successive stressful events (e.g., exposure to violence during war, (Kunst et al., 2010). This implication is potentially relevant because the stressful circumstances related to the COVID-19 phenomenon (e.g., confinement, social distancing, economic uncertainty, and health-related stress) are likely to be chronic. Therefore, we need to identify the mechanisms that can cushion, with long-term effects, the negative consequences of the epidemic. In turn, we need to know which variables explain the PTG in order to provide useful empirical evidence that can guide institutional policies.

The growing interest in the post-traumatic growth construct has led to an examination of the various factors that may contribute to growth. Research hypothesizes that among these there are some more obvious aspects, such as the levels of post traumatic distress and the support of the social network, and others less obvious, such as the environment and the ability to derive restorativeness from it (Brooks et al., 2017; Finstad et al., 2021; Kyutoku et al., 2021). As suggested in the first section of this Introduction, two psychological variables are likely to account for PTG levels during the pandemic namely the level of connection to nature and the subjective experience of the capacity of one's home to provide psychological benefits.

Nature relatedness (NR) identifies the subjective sense of the connection that people have with the natural environment (Nisbet et al. 2009). The construct encompasses the affective, cognitive, and experiential aspects of individuals' connection to nature and led to the creation of methodological tools for investigating the processes underlying environmental concerns and behaviours. Past research evidenced the positive influence of the natural environment on three emotional states, namely anger, fear, and positive affects (Ulrich et al., 1991; Zuckerman, 1977; Ulrich, 1979). For instance, experimental studies confirmed the role of exposure to nature in the restoration process from psychological stress and fatigue, qualifying it as a coping strategy (Hartig et al., 2003; Ulrich et al., 1991). This potential of the natural environment would lie in its capacity to produce positive changes in emotional states and to act as a moderator between stress and elicited negative emotions (Kaplan, 1995). Some of this evidence even led some authors to advise the watching of documentaries on nature during the COVID-19 lock-down to reduce stress levels (Young-Mason, 2020).

There are several reasons for asserting that NR is a potential variable accounting for PTG during the pandemic. First, NR is thought to be associated with greater coping and emotion regulation capacities (e.g., mindfulness) that are likely to buffer the disruptive psychological effects of a stressful event (Huynh, 2017; Pritchard et al.,2020). However, this would explain why individuals with higher NR should experience fewer negative outcomes, but it does not fully

explain why they should experience higher PTG. Following the assertion of Dunn (2019) that states that stressful events "change the way we live and relate to both the human and non-human world […] we need to re-imagine and respect the things we value", we may speculate that people who have developed the value of being connected to nature during COVID-19 would experience higher levels of spiritual change (a component of PTG). Indeed, the process of change in spirituality may have been even more enhanced in individuals with high NR that see in nature a superior entity. The relationship of humans with nature is central in several religions and is a highly spiritually connoted topic (Zabaniotou, 2020). Finally, compared to the phenomenon of return to green, we can think that this phenomenon may have led to the discovery of new possibilities offered by daily life, that is a central component of PTG.

Lastly, an additional construct that may have enhanced PTG during the pandemic is home-related restorativeness. The construct of perceived restorativeness is likely to give a psychological explanation of why experiencing home would account for mental outcomes. It has been developed within the framework of environmental psychology, which highlighted how some environments are able to promote the 'recovery' of resources and energies, since environmental conditions play a fundamental role in stress-related mechanisms: they can be both stressful factors, challenging human adaptive abilities, but also coping strategies, contributing to the re-establishment of a balance between environmental demands and individual resources (Berto, 2014). The Attention Restoration Theory (ART; Kaplan, 1995) and the Stress Recovery Theory (SRT; Ulrich, 1983) argue that places vary in their capacity to restore from psychophysiological stress and that this capacity derives from different components. For instance, a specific place would be perceived as more restorative if it provides a sensation of escape or 'being away' that relieves from daily stress. Also, the perceived presence of coherence in organizing the place and elements eliciting spontaneous selective attention are thought to contribute to the restorative capacity of a specific place. Finally, the opportunities provided by the place that allow the individual to pursue own interests and inclinations is a central feature that renders a place especially restorative. Noteworthy, the restorative capacity of a specific place is not an objective feature but a subjective experience. Therefore, we may speculate that inter-individual differences in the perceived restorativeness of own home have been likely to account for mental health outcomes (e.g., PTG) during the COVID-19 lockdown.

Altogether, a number of potential reasons exist to hypothesize that both the perceived restorativeness of one's home and the levels of nature relatedness would longitudinally predict PTG related to the COVID-19 lockdown above and beyond the role played by PTSD. However, to our knowledge, no empirical data on the topic is available. Therefore, we conducted a study

aiming to test this hypothesis and bring preliminary evidence that may guide institutional policies aiming to increase the psychological resilience of populations during future outbreaks.

## 2. Methods

### 2.1 Participants and Procedure

An online survey was created and disseminated through a convenience sample three days before the end of the national lockdown related to the COVID-19 emergency. As the survey was performed online, the presentation of the study aims and scopes has been delivered with a cover letter. Also, a detailed explanation of information related to anonymity and privacy was presented. Upon taking part in the study, participants subscribed an online informed consent. After this initial phase, participants were asked to fill a battery of self-report questionnaires. This empirical procedure complies with the official ethical guidelines of the American Psychological Association and has received the approval of the Ethic Board of the Department of Dynamic and Clinical Psychology, University of Rome, Sapienza [N. 0000808 - 10/09/2020].

The procedure allowed the recruitment of 308 adults ($M_{age}$ = 35.31; *SD*= 13.91; 70 males; 22.7% males). 44.3% of them (136 participants) obtained at least a college degree, with nearly half of the sample (47%; 141 participants) reported a yearly income inferior to 36.000 €. Also, 23% of participants (106 participants) were not involved in any romantic relationship and only 24.4% of the sample (75 participants) reported to be parents.

### 2.2 Measures

The battery of self-report questionnaires evaluated the following areas:

**Demographic characteristics** through the creation of a questionnaire asking for information such as age, gender, and economical income.

**PTSD symptomatology related to the COVID-19 outbreak** has been assessed through the National Stressful Events Survey PTSD Short Scale (NSESSS), a 9 items self-report questionnaire developed by LeBeau et al. (2014). The participant is asked to answer each item on a 5-point Likert scale ranging from 0 (*Not at All*) to 4 (*Extremely*). Higher total scores correspond to higher severity of PTSD symptoms. We adapted the version of this instrument asking the participant to answer while keeping in mind only stressful events related to the COVID-19 pandemic. The Cronbach's alpha coefficient calculated for this tool reached .88. the instrument has good convergent and discriminatory validity (LeBeau et al.,2014).

The extent to which individuals experiment **Post Traumatic Growth** through the use of the Post Traumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996; Prati & Pietrantoni, 2014). This is a 21 items self-report questionnaire asking the participant to answer on a 6-point Likert scale ranging from 0 (*I did not experience this change as a result of my crisis*) to 5 (*I experienced this change to a very great degree as a result of my crisis*). The instrument was slightly adapted for the purpose of the study, asking the participant to indicate for each of the statements the degree to which this change occurred in your life as a result of the COVID-19 crisis. This instrument provides a scores for five distinct dimensions namely *Relating to Others*, *New Possibilities*, *Personal strength*, *Spiritual Change,* and *Appreciation of Life*. In this study, the tool confirmed its good psychometric proprieties with Cronbach's alpha coefficients ranging from .75 (*Spiritual Change*) to .91 (*Appreciation of Life*). Indeed, it has good construct validity (Prati & Pietrantoni, 2014).

The levels of **Nature Relatedness** have been measured through the Nature Relatedness Scale 6 items (NRS-6; Nisbet & Zelenski, 2013). This instrument asks the participant to answer on a 5-point Likert scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*) and provides an evaluation of the extent by which the individual feels connected with nature. In this study, the scale showed a good internal consistency index (α= .84) and a good temporal stability (Nisbet & Zelenski, 2013).

The extent by which participants perceived their home (i.e., the place where they spent the lockdown) as restorative has been measured through the administration of the **Perceived Restorativeness Scale** (PRS; Hartig et al., 1997; Pasini et al. 2009). This 26-items self-report questionnaire explores the extent to which a specific place (in this study the home where the individual stayed during the lockdown) matches with 26 descriptions on a 7-point Likert scale ranging from 0 (*Not at all*) to 6 (*Completely*). The instrument provides four scores related to four dimensions of the perceived restorativeness namely *Being Away*, *Fascination*, *Coherence* and *Compatibility*. The instrument showed a good reliability with Cronbach's alpha coefficients ranging from .75 (*Coherence*) to .89 (*Fascination*) and good content validity (Pasini et al. 2009).

### 2.3 Statistical Analyses

Analyses were performed with the SPSS v.23 software for Windows. Descriptive analyses were carried out (See Table 1). In particular, frequencies, percentages, means, standard deviations and Cronbach's alpha coefficients were computed. In addition, the skewness and kurtosis values of each continuous variable were inspected to ensure that these were comprised in the range indicating normal distribution (George & Mallery, 2010). Then, *r*-Pearson correlation coefficients were calculated to estimate the associations between all continuous variables

measured. Lastly, the hypotheses of the study were tested performing hierarchical multiple linear regressions. Results were considered statistically significant with an alpha value being <.05. Data used for the study is available at the following link:

https://github.com/GuyonneRogier/Nature.git.

**Table 1**. Means and standard deviations of the variables measured in the study.

| | | Mean | Std. Deviation |
|---|---|---|---|
| **NSESSS** | | 10.76 | 7.89 |
| **PTGI** | **Appreciation of Life** | 7.37 | 3.96 |
| | **Spiritual Change** | 1.99 | 2.35 |
| | **Personal strength** | 8.11 | 5.58 |
| | **New Possibilities** | 9.81 | 6.17 |
| | **Relating to Others** | 13.45 | 8.58 |
| | **Compatibility** | 35.58 | 11.85 |
| **PRS** | **Coherence** | 17.19 | 5.49 |
| | **Fascination** | 20.89 | 11.26 |
| | **Being Away** | 8.90 | 7.54 |
| Nature Relatedness Scale | | 19.42 | 4.95 |

*Note*: NSESSS: National Stressful Events Survey PTSD Short Scale; PTGI: Post Traumatic Growth Inventory; PRS: Perceived Restorativeness Scale.

## 3. Results

### 3.1 Correlations between variables

First, bivariate *r*-Pearson correlations coefficients between all variables involved in the study were calculated. PTSD scores were all positively and significantly associated with PTGI dimensions with coefficients ranging from .12 ($p$=.028; *Spiritual Change*) to .25 ($p$<.001; *Appreciation of Life*). Then, the matrix correlation between PTGI and PRS dimensions were explored (see Table 2). Results showed that the PRS dimension *Being away* was positively and significantly correlated with all the dimensions of the PTGI and that the dimension *Fascination* of the PRS was positively and significantly related to all the subscales of the PTGI except for the *Relating to Others* one. No other significant associations between PTGI and PRS scales were observed. Finally, the estimation of correlations coefficients between the NRS scores and the PTGI and PRS dimensions highlighted that NRS was positively and significantly associated with

the *Being Away* dimension of the PRS as well as with the *New Possibilities* and *Spiritual Change* subscales of the PTGI.

**Table 2**. Correlations between main variables of the study.

| | PTSD | Away | Fascination | Coherence | Compatibility | NRS | Others | Possibilities | Strength | Spiritual | Life |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PTSD | - | | | | | | | | | | |
| Away | -.07 | - | | | | | | | | | |
| Fascination | -.20** | .57** | - | | | | | | | | |
| Coherence | -.19** | -.01 | .15* | - | | | | | | | |
| Compatibility | -.27** | .35** | .58** | .07 | - | | | | | | |
| NRS | .06 | .03 | .18* | .09 | .02 | - | | | | | |
| Others | .20** | .13* | .11 | -.05 | .05 | .08 | - | | | | |
| Possibilities | .17** | .22** | .17** | -.05 | .09 | .15* | .76** | - | | | |
| Strength | .13* | .16* | .13* | -.03 | .06 | .06 | .74** | .80** | - | | |
| Spiritual | .12* | .16* | .19* | .01 | .02 | .21** | .52** | .56** | .55** | - | |
| Life | .26** | .18* | .14* | -.02 | .05 | .06 | .72** | .72** | .68** | .47** | - |

*Note:* PTSD: Post Traumatic Stress Disorder scale; NRS: Nature Relatedness Scale; *<.05; ** $p$<.001.

### 3.2 Regression analyses

To test the role of both PRS and NRS in the prediction of PTGI levels we performed five multiple linear regression analyses considering the five dimensions of PTGI as dependent variables. As predictive factors we entered gender and age in the first steps, PTSD scores in the second steps, and both NRS scores and PRS dimensions in the final steps. Results are fully displayed in Table 3. Regarding the *Relating to others* dimension of the PTGI, we found that only PTSD scores significantly and positively of this variable's levels. In contrast, the *New possibilities* subscale of the PTGI was positively and significantly predicted by PTSD levels, NRS scores, and the *Being Away* dimension of the PRS. However, when using the Bonferroni correction for multiple comparison, only PTSD remains a significant predictor. In addition, the *Personal strengths* subscale of the PTGI was found to be significantly predicted only by Age (negatively) and PTSD levels (positively). Of note, PTSD was no more a significant predictor when adjusting statistical threshold according to the Bonferroni correction for multiple comparison. Also, PTSD scores,

NRS levels, and scores obtained on the *Fascination* subscale of the PRS were found to positively and significantly predict the *Spiritual Change* scores of the PTGI. However, only the NRS scores remains a significant predictor when applying the Bonferroni correction for multiple comparisons. Finally, the results of the last regression analyses showed that the *Appreciation of life* dimension of the PTGI was significantly and negatively predicted by age but significantly and positively predicted by PTSD scores and the levels of the *Being Away* dimension of the PRS. Again, when correcting for multiple comparisons with the Bonferroni method, *Being Away* was no more a statistically significant predictor.

**Table 3.** Hierarchical multiple regressions predicting post traumatic growth levels.

| | **Relating to others** | | **New possibilities** | | **Personal strength** | | **Spiritual change** | | **Appreciation of life** | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Model 1* | $R^2$= .12 ; $p$ = .132 | | $R^2$= .07 ; $p$ = .482 | | $R^2$= .13 ; $p$ = .068 | | $R^2$= .04 ; $p$ = .746 | | $R^2$= .19 ; $p$ = .005 | |
| | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** |
| **Constant** | 14.62 | <.001 | 10.79 | <.001 | 8.74 | <.001 | 2.00 | .006 | 8.97 | <.001 |
| **Age** | -.06 | .064 | -.03 | .235 | -.04 | .040 | .01 | .560 | -.05 | .001 |
| **Gender** | .64 | .591 | .05 | .950 | .61 | .429 | -.13 | .681 | .14 | .796 |
| *Model 2* | $R^2$= .22 ; $p$ = .003 | | $R^2$= .17; $p$ = .027 | | $R^2$= .17; $p$ = .037 | | $R^2$= .14; $p$ = .130 | | $R^2$= .29; $p$ <.001 | |
| | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** |
| **Constant** | 12.55 | <.001 | 9.48 | <.001 | 8.00 | <.001 | 1.60 | .031 | 7.79 | <.001 |
| **Age** | -.04 | .226 | -.02 | .531 | -.04 | .094 | .01 | .307 | -.04 | .016 |
| **Gender** | .11 | .925 | -.28 | .745 | .42 | .589 | -.24 | .470 | -.16 | .760 |
| **PTSD** | .21 | .001 | .13 | .006 | .07 | .079 | .04 | .025 | .12 | <.001 |
| *Model 3* | $R^2$= .29; $p$ = .001 | | $R^2$= .34; $p$ <.001 | | $R^2$= .27; $p$ = .005 | | $R^2$= .32; $p$ <.001 | | $R^2$= .38; $p$ <.001 | |
| | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** | ***ß*** | ***p*** |
| **Constant** | 7.98 | .033 | 4.73 | .074 | 5.00 | .040 | -.03 | .975 | 5.45 | .001 |
| **Age** | -.07 | .064 | -.04 | .107 | -.06 | .021 | < -.01 | .791 | -.05 | .002 |
| **Gender** | .07 | .951 | -.30 | .720 | .35 | .646 | -.21 | .505 | -.29 | .579 |
| **PTSD** | .22 | .001 | .14 | .003 | .09 | .047 | .04 | .037 | .14 | <.001 |
| **NRS** | .14 | .180 | .17 | .021 | .08 | .224 | .09 | .002 | .03 | .502 |
| **Being Away** | .09 | .242 | .14 | .016 | .08 | .105 | .03 | .174 | .07 | .048 |
| **Fascination** | .07 | .242 | .05 | .238 | .05 | .276 | .04 | .019 | .05 | .106 |
| **Coherence** | -.04 | .702 | -.04 | .548 | -.01 | .908 | -.01 | .773 | .03 | .525 |
| **Compatibility** | .02 | .638 | .02 | .623 | .01 | .748 | -.02 | .235 | .01 | .778 |

*Note:* PTSD: Post Traumatic Disorder scale; NRS: Nature Relatedness Scale.

## 4. Discussion

Considering the role of both perceived restorativeness and connection to nature, this study aimed to empirically test an explanation model of PTG within the context of the COVID-19 pandemic. The results observed allowed us to highlight how both the levels of nature relatedness and the levels of specific dimensions of perceived restorativeness positively and significantly account for some aspects of PTG, controlling for the portion of variance already explained by PTSD symptomatology.

The results of correlational analyses and regression analyses indicates that in the pandemic context the relationship with nature plays a key role in dealing with psychologically stressful conditions, clearly contributing to PTG levels. Faced with the confinement due to COVID-19 epidemic, nature relatedness seems to have been not only as a protective correlate – in line with the work of Grahn & Stigsdotter (2003) who identified a causal relationship between accessibility (and therefore the possibility of use) of green spaces and the stress levels of individuals, understood as fatigue, irritation, and a general feeling of being chased, harassed and stressed – but also as a determining associated variable in the transformation of the stressful experience in a chance of growth for the individual. Indeed, there are numerous studies in the literature that show how contact with nature is presented as a factor that acts, in particular, positively on individuals' stress levels, but more generally brings numerous beneficial effects (Berman et al., 2008, 2012; Li, 2010; White et al., 2013; Perrins et al., 2021). Contact with nature enhances people's well-being and has beneficial effects on mental health (Astell-Burt, et al., 2019; Maund et al., 2019). Indeed, levels of perceived connection to nature were found to be positively correlated and positively account for two dimensions of PTG, namely *Spiritual change* and *New Possibilities*.

NR may have been associated with the spiritual dimension of PTG for several reasons. First, the relationship with nature is, at least partially, spiritual in its nature. Indeed, most existing religions include philosophical considerations towards the human-nature relationship (Zabaniotou, 2020). Therefore, elevated levels of NR may predict a higher capacity to engage in spiritual coping. There is evidence in favour of spirituality being a mediating factor in the relationship with nature (Kamitsis et. al., 2013). This would be a relevant result, as this coping strategy has been shown to have a protective role in relation to a number of outcomes. Moreover, future studies may want to investigate the relationship (and potential overlap) between nature connectedness and spiritual coping. Regarding the reason why NR was associated with and accounts for PTG in its spiritual dimension in the context of the pandemic,

some interpretations can be formulated. Indeed, we may think that widely shared narratives interpreting the COVID-19 outbreak as a punishment or at least a strategic plan of 'Mother Nature', depicted as a superior and transcendental entity, influenced this process. In that way, these narratives may have provided to individuals new meanings to make sense of such overwhelming and stressful events. In other words, nature may have constituted the explanation that helped the disrupted minds to find a feeling of coherence and unity of themselves in the world in spite of the pandemic. Such predisposition may have enhanced the human-nature connection, and fostered in turn individuals' spiritual capacity to cope with stress and PTSD.

In particular, the spiritual change dimension refers more widely to individual awareness concerning the meaning of existence, regardless of religious tradition (Huguelet & Koenig, 2009). It is possible to hypothesize that, in the context of confinement, the power of nature to give people a restful experience (Kaplan & Talbot, 1983) has led many to rethink in a more intimate way the meaning and the ways in which they live their existence and consequently to experience post traumatic growth in this area, rather than in other areas such as *Appreciation of Life*, *Personal Strength,* or *Relating to Others*.

Then, NR was correlated and predicted PTG also in its dimension of new possibilities for life. Indeed, a higher frequentation of green areas is likely to be associated with NR. In fact, according to Rugel et al. (2019), a greater presence of green areas in urban areas increases people's psychological well-being. However, in our study, we did not measure the effective accessibility to natural environments but only the subjective experience of relationship with nature. These two aspects are likely to interact in the prediction of PTG. This issue should be better explored in future studies. In addition, we may have expected a predictive role of NR on appreciation for life because this dimension of PTG appears in some aspect similar with mindfulness abilities that in turn are in turn associated with NR. This result stresses the complex nature of the construct investigated and call for future research exploring the role of mediating variables as such as mindfulness or emotion regulation capacities.

Regarding the perceived restorativeness of home, our study brought interesting results, evidencing that this variable was correlated and predictive of several dimensions of PTG, namely spiritual change, appreciation of life, and new possibilities. We found that the *Being away* dimension predicted both the *New possibilities* and *Appreciation of Life* dimensions of PTG whereas the *Fascination* subscale predict *Spiritual change*. To perceive one's home - despite experiencing as a jail during the COVID-19 lockdown - as a place that is highly compatible with own interests and inclinations may easily foster the process of reinventing one's life, developing new interests,

and discovering new life paths. Also, as expressed in a recent systematic review (Caroppo et al, 2021), for most people, COVID-19 resulted in a dramatic change of daily routine with a potential reduction of frenetic and high-pressure lifestyle. The literature on this subject presents what happened following Covid- 19 often in a negative light (Caroppo et al, 2021), but on the basis of our findings, to stay in a place that is perceived as restorative may allow to appreciate this opportunity that in turn would lead to a more mindful attitude towards the transient positive events of the existence.

As a whole, we found that both NR and perceived restorativeness of home are correlated with and predictive of PTG in a context of lockdown, social distancing, and pandemic outbreak. Because PTG is likely to be one of the most powerful mechanisms underlying resilience, future research should aim to replicate and extend our results to provide useful empirical evidences that orientate policy. For instance, accessibility to urban green areas is known to be uneven and this kind of spatial discrimination may, as suggested by our results, lead to mental health inequalities. Also, we should study and test solutions to elicit NR among young populations in order to increase their psychological resilience. Finally, the replication of our results may lead institutions to make recommendations aiming to increase the perceived restorativeness of home in populations that have been isolated for a long time, such as maintaining remote work opportunities.

**5. Limitations and future directions**

Although carefully conducted, this study is not exempt from limits. First, the study is cross-sectional in its nature and for this reason we must be careful in making causal inferences based on the results obtained. Moreover, the coefficients of determination in regression analyses were often low so that the predictive power of our examined factor may be only secondary to other not investigated variables. More specific measures of PTSD symptoms such as dissociation may have increased the predictive power of our model (Saggino et al., 2020). Secondly, the study was conducted on a community sample, therefore caution should be exercised in generalizing our results and in considering them directly applicable to clinical populations. It is not yet known whether the relationships between the constructs analysed could be different or could be influenced by other specific variables in clinical populations that underwent the traumatic event. Thirdly, since most of the sample is composed of Italian citizens, there might be cultural components that have not been evaluated which may play a role within the relationship between nature relatedness, perceived restorativeness, and post traumatic growth. Another limitation to keep in mind when appreciating the relevance of the results with respect to the confirmation of

our theory-driven hypotheses is related to the large sample size. Indeed, some of the observed associations, albeit statistically significant, were low in strength. As evidenced by Meehl (1990) some of these associations may be due to crud factors such as the similarity in the measures' format (i.e., self-report questionnaire). Therefore, future studies may want to replicate our results in medium-size sample too and/or identify conditions in which the strengths of the observed relationships are potentiated. Finally, it is important to bear in mind that it concerns the difficulty of diagnosing PTSD because as expressed by Scull (2021), research at present is still very limited with respect to and the element of diagnosis still presents itself as strongly phenomenological and a contentious point.

## 6. Conclusions

Globally, our results indicate the need to deepen the study of the effects of the COVID-19 pandemic, as well as the effects of preventive measures to contain contagion, as a very interesting context to study and analyse the dynamics related to the effects of a large-scale traumatic event. The hope is therefore that the components of post traumatic growth can be further explored in the future by using a longitudinal approach to assess whether the relationships identified remain constant over time or change, or by replicating the study in different cultural contexts to explore whether post traumatic growth may be connected to cultural factors. In line with this study, after considering that NR and Perceived restorativeness of home are predicters of PTG, it could be interesting in a future prospective to investigate the relationship between external variables that may enhance the PTG and internal psychological variables that may prove a fertile soil for PTG, so to promote them on a large scale during specific traumatic events.

## Authors' Contribution

G.R. and P.V. made significant contribution to the conception and design of the study, to the synthesis and interpretation of data; S.BZ., R.A. and C.W. provided the acquisition of data and gave significant contribution to draft part of the manuscript; L.P. and P.V.. revised the manuscript for intellectual content and gave the final approval of the manuscript to be submitted. All authors contributed to the article and approved the submitted version.

## Ethics Committee Approval

This study was approved by the of the Department of Dynamic and Clinical Psychology, University of Rome, Sapienza University Ethics Committee (Approval No. 0000808 Date: 10/09/2020).

**Informed Consent**

Written informed consent was obtained from all participants who participated in this study.

**Declaration of Interests**

The authors have no conflicts of interest to declare.

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