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COVID-19 pandemic-related posttraumatic growth in a small cohort of university students: A 1-year longitudinal study

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ABSTRACT

The COVID-19 pandemic has affected all areas of life, with severe potential consequences for people's mental health. Posttraumatic growth (PTG), a positive psychological change that may develop following a traumatic event, in light of the COVID-19 pandemic has only received little attention. The current study aimed to investigate (1) the prevalence of PTG within the context of the COVID-19 pandemic and (2) which psychological aspects predict COVID-19 pandemic-related PTG using a 1-year longitudinal design. A sample of 70 participants completed a survey on COVID-19, posttraumatic stress, emotional well-being, coping styles, determinates of resilience, and PTG at both T1, May 2020, and T2, May 2021. Results reveal moderate levels of PTG for about one in five participants at both T1 and T2 (21% and 23%, respectively). Moreover, PTG at T1 and T2 were moderate to strongly, positively correlated, $r = 0.62$. Posttraumatic stress and social support were found to positively predict PTG at T1, while positive affect and social skills were found to positively predict PTG at both T1 and T2, $\beta s = 0.22$–.52. Implications of the current findings and suggestions for future research are discussed.

1. Introduction

On March 11, 2020, the World Health Organization (WHO) declared the outbreak of the SARS-CoV-2 coronavirus (COVID-19) a global pandemic. At the time of writing, more than 4.5 million lives have been lost as a result, a number that continues to rise every day. The COVID-19 pandemic affects all areas of life, that is, social, financial, cultural, religious, and political, with severe potential consequences for people's mental health (Nicola et al., 2020). Interestingly enough, however, "trauma", let alone "mass trauma", has rarely been used in reference to the ongoing pandemic (Bridgland et al., 2021). When "trauma", "mass trauma" or "posttraumatic stress" is considered, we tend to think of distinct events like car accidents, terrorist attacks, or natural disasters, not yearlong events that affect practically every one of us. That being said, trauma is actually best understood as a rupture in "meaning-making", in other words, a breach in how we see ourselves, others, and the world around us (Davis et al., 2000; Joseph and Linley, 2005). Taking this into consideration, it is easier to comprehend how the COVID-19 pandemic may constitute a potentially traumatic event, perhaps not for all, but certainly for those deeply affected by it. Research investigating the COVID-19 pandemic within the framework of trauma, indeed suggests the pandemic, including the COVID-19 outbreak and corresponding lockdowns, could be considered as a traumatic stressor event capable of eliciting PTSD-like responses and exacerbating other related mental health problems (e.g., anxiety, depression, psychosocial functioning, etc.) (Bridgland et al., 2021; Idsoe et al., 2021; Kalaitzaki, 2021). Moreover, traumatic stress reactions during the pandemic—including intrusive re-experiencing and heightened arousal—are found to be particularly prevalent (Cooke et al., 2020; Lau et al., 2021). One question that remains, however, is to what extent the ongoing COVID-19 pandemic results in not just negative but positive trauma outcomes, often referred to as posttraumatic growth (Tedeschi and Calhoun, 2004).

Posttraumatic growth (PTG) or stress-related growth (SRG) has been defined as "positive psychological change experienced as a result of the struggle with highly challenging life circumstances" (Linley and Joseph, 2004; Tedeschi and Calhoun, 2004 p. 1). It is thought to arise as the result of the meaning-making process that takes place in the aftermath of trauma; for example, the re-assessing one's goals and priorities, re-investing in interpersonal relationships, and an overall greater appreciation of life. Moreover, PTG may have a buffering effect on the negative effects caused by distress and depression following trauma (Silva et al., 2012; Wang et al., 2017). The existence of posttraumatic growth has been documented following a wide range of traumatic

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events, such as war (e.g., Hall et al., 2010; Powell et al., 2003), life-threatening illness (e.g., Bellizzi and Blank, 2006; Leong Abdullah et al., 2015), a terrorist attack (e.g., Butler et al., 2005; Hobfoll et al., 2006), or the loss of a loved one (e.g., Caserta et al., 2009; Drapeau et al., 2019; Moore et al., 2015). While not all people may experience positive personal and psychological changes in the aftermath of trauma, posttraumatic growth is estimated to affect one in two who experienced a traumatic event (Wu et al., 2019). Individual differences in the development of PTG or the overall likelihood of PTG to develop following a traumatic event have been (cautiously) associated with a wide range of psychological factors.

Firstly, the development of PTG has been investigated in light of trauma severity, that is whether the intensity of the experienced trauma is predictive of later PTG. For instance, Park et al. (1996) revealed that the stressfulness of a negative event predicted posttraumatic growth in large samples of college students with trauma experience. In line with that, Butler et al. (2005) found trauma symptomatology in survivors of the 9/11 terrorist attacks to predict both initial PTG levels (9 weeks post-attacks) and PTG levels at follow-up (6.5 months post-attacks). Moreover, Blix et al. (2013) found levels of trauma exposure and posttraumatic stress symptoms to predict posttraumatic growth in a large sample of Norwegians affected by the 2011 Oslo terrorist attack. Similarly, Hall et al. (2010) investigated PTG in Jewish and Arab populations following the 2006 Israeli-Hezbollah war and found PTSS and PTG to be associated, regardless of gender, ethnicity, education, religiosity, self-efficacy, and previous stressful life events. Finally, a 17-year longitudinal study by Dekel et al. (2012) investigating the relationship between PTSD symptomatology and PTG in Israeli ex-prisoners, revealed initial PTSD severity to predict subsequent PTG across time, suggesting growth is facilitated and maintained by endorsement rather than the absence of PTSD symptomatology. That being said, most cross-sectional studies investigating the relationship between PTG and PTSD symptomatology, have failed to reveal a systematic relationship between the two (Zoellner and Maercker, 2006 for a review).

Secondly, the development of PTG has been investigated in light of coping and (perceived) social support following trauma, in other words, how one goes about dealing with the trauma they faced. Schuettler and Boals (2011) investigated positive and negative trauma outcome predictors and found problem-focused coping to be predictive of PTG, while avoidant coping was predictive of PTSD symptomatology. Similarly, Sears et al. (2003) investigated coping in relation to PTG in women with early-stage breast cancer and found positive reappraisal coping at study entry to predict posttraumatic growth 12 months later. Moreover, Caserta et al. (2009) investigated coping in relation to PTG after the loss of a spouse or partner and found loss- and restoration-orientated coping to be associated with stress-related growth or PTG. In addition, Dong et al. (2017) revealed both perceived social support and resilience were associated with PTG in cancer survivors. Finally, a longitudinal study by Scrignaro et al. (2011) on the combined contribution of social support and coping strategies found both support by caregivers and a problem-focused strategy of coping to predict greater PTG at 6 months follow-up. In summary, these findings suggest reappraisal of the trauma or problem-focused coping in general as well as perceived social support and resilience is associated with increased PTG.

Posttraumatic growth during the COVID-19 pandemic has been investigated in a select set of subsamples including discharged COVID-19 patients (Sun et al., 2021; Yan et al., 2021) as well as nurses (Chen et al., 2021; Cui et al., 2021), healthcare workers (Feingold et al., 2022) and therapists (Aafjes-van Doorn et al., 2021) active in the fight against COVID-19. Moreover, subsamples of the general population have been investigated, including caregivers of children (Stallard et al., 2021), young adults (Hyun et al., 2021), and adults (Kalaitzaki, 2021; Northfield and Johnston, 2021; Vazquez et al., 2021). Taken together, these investigations seem to suggest posttraumatic growth as a result of the COVID-19 pandemic (or measures associated with the pandemic such as nation-wide lockdowns and mandatory social distancing) is common (e.g., R. Chen et al., 2021; Stallard et al., 2021; Yan et al., 2021). Unfortunately, all of the above investigations are cross-sectional in nature, evaluating PTG only once, often within the first months since the onset of the pandemic (e.g., Cui et al., 2021; Kalaitzaki, 2021; Sun et al., 2021; Vazquez et al., 2021) or short-term longitudinal in nature, evaluating PTG within the period of 12 weeks (Aafjes-van Doorn et al., 2021). This is a crucial limitation, as PTG is suggested to emerge over a period of time (Tedeschi and Calhoun, 2004; Zoellner and Maercker, 2006). No previous study has investigated posttraumatic growth during the COVID-19 pandemic using a longitudinal design of one year or longer.

The current study aims to investigate (1) the prevalence of posttraumatic growth within the context of the COVID-19 pandemic and (2) which psychological aspects predict COVID-19 pandemic-related positive growth using a 1-year longitudinal design. The COVID-19 pandemic has triggered an array of emotional, physical, and economic issues and, as such, can be understood as a traumatic stressor event capable of eliciting PTSD-like responses, potentially exacerbating other mental health issues in the process (Bridgland et al., 2021). Posttraumatic growth, that is positive change following trauma and adversity, is estimated to affect one in two trauma survivors (Wu et al., 2019). Aspects related to the experienced trauma, such as the intensity of PTSD symptomatology, as well as one's coping style, perceived level of social support, resiliency factors and overall affect, have been associated with individual differences in PTG (Baños et al., 2021; Ogińska-Bulik and Kobylarczyk, 2016; Rzeszutek, 2018; Tedeschi and Calhoun, 2004; Zoellner and Maercker, 2006). Therefore, the current study will investigate the role of posttraumatic stress, coping, resilience, and positive and negative affect specifically, regarding COVID-19 pandemic posttraumatic growth. By understanding what variables help or hinder the development of PTG within the context of the COVID-19 pandemic, public health efforts may be tailored accordingly to aid those currently most affected, minimizing PTSD while constructively fostering PTG as a result.

2. Methods

2.1. Participants

A total of 70 English-speaking, university students participated at both T1, May 2020, during a nationwide lockdown, and at T2, May 2021, one year later. Seven identified as male (10%), 61 as female (87%) and as 2 non-binary (3%). Age ranged between 18 and 37 ($M = 22.14$, $SD = 3.05$) as measured at T1. The majority of the sample was Dutch (65%), the remaining participants originated from Europa, North and South America, or the Middle East.

2.2. Procedure

The present study is part of a larger research project looking at coping and resilience. All study protocols were in accordance with the ethical standards of the ethical committee of the [edited out for blind review]. Participant recruitment was set up through the university's recruitment facility. Individual informed consent was obtained prior to participation. Data was collected using a self-administered, online survey available in English. All participants completed the PTSD Checklist – Civilian Version (Weathers et al., 1993), the Positive and Negative Affect Schedule (Watson et al., 1988), the Scale of Protective Factors (Ponce-Garcia et al., 2015), and the Brief Coping Orientation to Problems Experienced inventory (Carver et al., 1989; Carver, 1997) at T1, and the Posttraumatic Growth Inventory (Tedeschi and Calhoun, 1996) at both T1 and T2.

Table 1
Intercorrelations for all primary variables with posttraumatic growth at T1 and T2.

	1	2	3	4	5	6	7	8	9	10	11	12
1. PCL-C	1.00											
2. PAS	−0.18	1.00										
3. NAS	**0.65**[b]	−0.14	1.00									
4. SPF-S	0.02	0.16	−0.16	1.00								
5. SPF-SS	−0.20	**0.30**[a]	**−0.26**[a]	**0.35**[b]	1.00							
6. SPF-P	0.05	0.22	0.07	.17	.13	1.00						
7. SPF-G	−0.07	**0.35**[b]	−0.18	**0.30**[a]	.15	**0.42**[b]	1.00					
8. BC-PF	−0.07	**0.38**[b]	0.03	.11	**0.27***	**0.35**[b]	**0.43**[b]	1.00				
9. BC-AV	**0.48**[b]	**−0.30**[a]	**0.53**[b]	−0.19	−0.36	0.07	−0.49	**−0.26**[a]	1.00			
10. BC-AE	.06	.19	.17	.01	0.09	−0.15	.15	**.39**[b]	0.10	1.00		
11. PTG-1	**0.26**[a]	**0.46**[b]	.07	**0.36**[b]	**0.41**[b]	0.11	.11	.07	−0.03	0.02	1.00	
12. PTG-2	.17	**0.34**[b]	.08	**0.38**[b]	**0.25**[a]	**0.26**[a]	.21	0.16	−0.13	−0.04	**0.62**[b]	1.00
M	35.86	26.94	23.84	22.54	22.66	22.17	22.59	11.80	9.66	16.89	47.96	49.57
Mdn	34.50	26.00	23.00	24.00	24.00	23.00	23.00	12.00	8.50	16.50	43.00	48.50
SD	12.52	7.69	7.82	4.99	5.11	5.03	4.25	4.15	4.29	4.00	17.92	16.82
Min	18	13	11	9	10	9	12	2	2	7	22	21
Max	66	48	46	30	29	30	30	21	21	25	93	82
α	.91	.86	.88	.89	.89	.87	.84	.73	.74	.52	.94	.93

PCL-C = PTSD Checklist – Civilian Version; PAS = Positive Affect Scale; NAS = Negative Affect Scale; SPF = Scale of Protective Factors; SPF-SS = Social Support; SPF-S = Social Skills; SPF-P = Planning Behavior; SPF-G = Goal Efficacy; BC = Brief COPE; BC-PF = problem-focused coping; BC-AV = avoidant coping; BC-AE = active emotional coping; PTG = Posttraumatic Growth Inventory.
[a] $p < 0.05$ (2-tailed).
[b] $p < 0.01$ (2-tailed).

2.3. Materials

2.3.1. PTSD checklist–civilian version

The PTSD Checklist – Civilian Version (PCL-C; Weathers et al., 1993) is a self-report questionnaire developed to assess posttraumatic stress symptoms. The PCL-C includes 17 items, each focusing on one or more key symptoms of PTSD as experienced through the COVID-19 pandemic within the last month. Example items include, "Repeated, disturbing memories, thoughts, or images regarding COVID-19?", or "Avoid thinking about or talking about COVID-19 or avoid having feelings related to it?". Each item employs a 5-point Likert scale, ranging from 1, "*Not at all*" to 5 "*Extremely*". Items are summed to create a total severity score (ranging from 17 to 85), with higher total severity scores indicating more PTSD-related symptomatology.

2.3.2. The positive and negative affect schedule

The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988), is a self-report questionnaire developed to assess positive and negative feelings and emotions as experienced within a discrete period. The PANAS includes two 10-item subscales: a Positive Affect Scale (PAS) and Negative Affect Scale (PAS). Example items include, "Active", "Determined" and "Enthusiastic" and "Afraid"., "Jittery", Upset", respectively. Each item employs a 5-point Likert scale, ranging from 1, "*Not at all*" to 5 "*Extremely*". Items are grouped and summed per subscale (ranging from 10 to 50), with higher scores indicating more positive or negative affect, respectively.

2.3.3. The scale of protective factors

The Scale of Protective Factors (SPF-24; Ponce-Garcia et al., 2015) is a self-report questionnaire developed to assess protective factors shown to be important determinates of resilience. The SPF-24 includes four six-item subscales: Social Support (SPF-SS), Social Skills (SPF-S), Planning Behavior (SPF-P), and Goal Efficacy (SPF-G). Example items for each subscale include, "My friends and/or family, are supportive of one another.", "I am good at making new friendships.", "I am confident in my ability to think out and plan.", and "I am confident in my ability to succeed.". Each item employs a 5-point Likert scale, ranging from 1, "*Disagree*", to 5, "*Agree*". Items are grouped and summed per subscale (ranging from 5 to 30), with higher scores indicating more relative ability of that protective factor.

2.3.4. Brief coping orientation to problems experienced inventory

The Brief Coping Orientation to Problems Experienced inventory (Brief-COPE; Carver et al., 1989; Carver, 1997) is a self-report questionnaire developed to assess an array of coping strategies. The Brief-COPE includes 28 items, thus forming 14 two-item subscales. In line with Schnider et al. (2007), three higher-order factors were constructed: (a) problem-focused coping (BC-PF: active coping planning, religion, instrumental support); (b) avoidant coping (BC-AC: denial, substance abuse, self-blame, distraction, behavioral disengagement); and (c) active emotional coping (BC-AE: venting, positive reframing, emotional support, humor, acceptance). Example items include, "I try to get help and advice from other people", "I say to myself this isn't real", and "I make jokes about it". Each item is rated on a 4-point Likert scale, ranging from 0, "I don't do this" to 3 "I do this a lot". Items are grouped and summed per subscale, with higher scores indicating more frequent use of that coping style.

2.3.5. Posttraumatic growth inventory

The Posttraumatic Growth Inventory (PTG-I; Tedeschi and Calhoun, 1996) is a self-report questionnaire developed to assess perceptions of positive life change associated with stressful life events. The PTG-I includes 21 items, each referring to change that may have occurred in relation to distinct life domains such as one's relationship to others, new possibilities, personal strength, spirituality, and one's appreciation of life. Example items include, "I have a greater sense of closeness with others," "I discovered that I'm stronger than I thought I was," and "I can better appreciate each day". Each item employs a 6-point Likert scale, ranging from 0 "*Not at all*" to 5 "*Extremely*". Items are summed to create a total score (ranging from 0 to 105), with higher total scores indicating greater levels of PTG. In line with previous research (Husson et al., 2017; Rodríguez-Rey and Alonso-Tapia, 2017), total scores between 63 and 84 were deemed to represent moderate levels of PTG, while scores of 85 or greater were deemed to represent high levels of PTG.

2.4. Data-Analysis

The current study aims to investigate (1) the prevalence of posttraumatic growth within the context of the COVID-19 pandemic and (2) what predicts COVID-19 pandemic-related positive growth using a 1-year longitudinal design. To investigate the prevalence of posttraumatic growth within the context of the COVID-19 pandemic at T1

Table 2
Summary of Hierarchical Regression Analysis for Variables predicting PTG at T1 and T2.

T1	*b*	*SE b*	*b*	*t*	*p*	*R*	R^2	ΔR^2
Step 1						.257	.066	.066
Constant	34.757	6.367		5.459	.000			
PCL-C	.368	.168	.257	2.194	.032			
Step 2						.582	.339	.273
Constant	.587	9.621		.061	.952			
PCL-C	.627	.190	.438	3.303	.002			
PANAS+	1.203	.237	.516	5.069	.000			
PANAS-	−0.316	.302	−0.138	−1.044	.301			
Step 3						.703	.494	.155
Constant	−26.296	14.135		−1.860	.068			
PCL-C	.591	.175	.413	3.371	.001			
PANAS+	1.060	.236	.455	4.488	.000			
PANAS-	−0.088	.287	−0.038	−0.306	.761			
SPF-S	.779	.366	.217	2.130	.037			
SPS-SS	1.039	.360	.296	2.889	.005			
SPS-G	−0.530	.461	−0.126	−1.151	.254			
SPS-P	−0.113	.364	−0.032	−0.309	.758			
T2	*b*	*SE b*	*b*	*t*	*p*	*R*	R^2	ΔR^2
Step 1						.169	.029	.029
Constant	41.426	6.096		6.795	.000			
PCL-C	.227	.161	.169	1.414	.162			
Step 2						.412	.170	.141
Constant	16.233	10.120		1.604	.113			
PCL-C	.341	.200	.254	1.706	.093			
PANAS+	.834	.250	.381	3.340	.001			
PANAS-	−0.056	.318	−0.026	−0.177	.860			
Step 3						.550	.303	.133
Constant	−17.216	15.572		−1.106	.273			
PCL-C	.249	.193	.185	1.289	.202			
PANAS+	.624	.260	.285	2.397	.020			
PANAS-	.138	.317	.064	.437	.663			
SPF-S	1.004	.403	.298	2.494	.015			
SPS-SS	.326	.396	.099	.822	.414			
SPS-G	−0.114	.508	−0.029	−0.224	.823			
SPS-P	.465	.401	.139	1.160	.250			

PTG = Posttraumatic Growth Inventory; PCL-C = PTSD Checklist – Civilian Version; PANAS+ = Positive Affect Scale; PANAS- = Negative Affect Scale; SPF = Scale of Protective Factors; SPF-SS = Social Support; SPF-S = Social Skills; SPF-P = Planning Behavior; SPF-G = Goal Efficacy.

and T2, descriptive statistics for PTG-I at T1 and T2 were evaluated. In addition, a simple correlation analysis and a paired sample *t*-test, looking PTG-I at both T1 and T2, were conducted. To investigate what predicts COVID-19 pandemic-related PTG, as measured by the PTG-I, at either T1 or T2, two hierarchical multiple regressions were conducted. In line with our hypotheses, two hierarchical multiple regression were set up to include, in order, the following predictors (also see Materials):

1) Trauma-experience as measured by the PCL-C severity score
2) Positive and negative mood as measured by the two PANAS subscales
3) Determinates of resilience as measured by the four SPF subscales
4) Use of coping style as measured by the three second-order Brief-COPE subscales

Analyses were conducted using IBM Statistics SPSS 27.0. There was no missing data, no evidence of univariate or multivariate outliers, or skewness, or kurtosis, and our correlation matrix indicated *r* values below .70, suggesting low multicollinearity risk (see Table 1; Tabachnick and Fidell, 2012). All hierarchical multiple regression assumptions were met. As the intercorrelation matrix revealed the Brief-COPE did not correlate with PTG-I at either time point ($r \leq |.16|$; Krehbiel, 2004), the Brief-COPE was not included in either hierarchical regressions.

3. Results

Basic descriptive statistics for each subscale and all intercorrelations between the multiple regression variables are reported in Table 1.

Firstly, to investigate the prevalence of posttraumatic growth within the context of the COVID-19 pandemic at T1 and T2, descriptive statistics for PTG-I at T1 and T2 were evaluated. PTG-I at T1 and PTG-I at T2 were strongly, positively correlated, $r(70) = 0.62$, $p < .001$. A Paired Samples Test comparing PTG-I at T1 ($M = 47.96$, $SD = 17.92$) and PTG-I at T2 ($M = 49.57$, $SD = 16.82$), revealed no significant difference ($t(69) = -0.89$, $p = .378$. Moderate levels of PTG (≥ 63) were reported by 21% at T1 and 23% at T2, while high levels of PTG (≥ 85) were only reported by 3% at T1, not at T2.

Next, to investigate what predicts COVID-19 related PTG at T1, as measured by the PTG-I May 2020, a first three-step hierarchical multiple regression was conducted (see Table 2). First, PCL-C was entered into step 1 of the equation. The step 1 equation was significant, explaining 5% of the variance, $F(1, 68) = 4.82$, $p = .032$. PCL-C ($b^* = 0.26$) emerged as contributing positively and uniquely to the variance in PTG-I at T1. Next, both subscales of the PANAS, PAS and NAS were entered into step 2. The step 2 equation was significant, explaining 34% of the variance, $F(3, 66) = 11.28$, $p < .001$. The addition of the variable to the model resulted in a significant increase in R^2, $R^2 = 0.34$ (adjusted $R^2 = 0.31$, $\Delta R^2 = 0.27$), $\Delta F(2, 66) = 13.61$, $p < .001$. Specifically, PCL-C ($b^* = 0.44$) and PAS ($b^* = 0.52$) emerged as contributing positively and uniquely to the variance in PTG-I at T1. Finally, all four SPF factors were entered into step 3. The step 3 equation was significant, explaining 50% of the variance, $F(7, 62) = 8.64$, $p < .001$. The addition of the variables to the model resulted in a significant increase in R^2, $R^2 = 0.49$ (adjusted $R^2 = 0.44$, $\Delta R^2 = 0.16$), $\Delta F(4, 62) = 4.74$, $p = .002$. Moreover, PCL-C ($b^* = 0.41$), PAS ($b^* = 0.46$), SPF-S ($b^* = 0.22$), and SPF-SS ($b^* = 0.30$) emerged as contributing positively and uniquely to the variance in PTG-I at T1.

Finally, to investigate what predicts COVID-19 related PTG at T2, as measured by the PTG-I May 2021, a second three-step hierarchical

Table 3
Summary of Post-Hoc Hierarchical Regression Analysis for Variables predicting PTG at T2.

T1	*b*	*SE b*	*b*	*t*	*p*	*R*	R^2	ΔR^2
Step 1						.617	381.	.381
Constant	21.789	4.583		4.755	.000			
PTG at T1	.579	.090	.617	6.466	.000			
Step 2						.617	.381	.000
Constant	21.383	5.880		3.637	.001			
PTG at T1	.577	.093	.614	6.175	.000			
PCL-C	.015	.134	.011	.111	.912			
Step 3						.623	.388	.007
Constant	15.917	8.759		1.817	.074			
PTG at T1	.539	.112	.574	4.807	.000			
PCL-C	.003	.187	.002	.015	.988			
PANAS+	.186	.255	.085	.730	.468			
PANAS-	.114	.278	.053	.410	.683			
Step 4						.672	.452	.064
Constant	−3.813	14.301		−0.267	.791			
PTG at T1	.510	.125	.543	4.076	.000			
PCL-C	−0.052	.188	−0.039	−0.278	.782			
PANAS+	.083	.268	.038	.312	.756			
PANAS-	.183	.283	.085	.647	.520			
SPF-S	.607	.373	.180	1.629	.108			
SPS-SS	−0.204	.377	−0.062	−0.541	.591			
SPS-G	.156	.458	.040	.341	.734			
SPS-P	.523	.359	.156	1.457	.150			

PTG = Posttraumatic Growth Inventory; PCL-C = PTSD Checklist – Civilian Version; PANAS+ = Positive Affect Scale; PANAS- = Negative Affect Scale; SPF = Scale of Protective Factors; SPF-S =Social Skills; SPF-SS =Social Support; SPF-G =Goal Efficacy; SPF-P =Planning Behavior.

multiple regression was conducted (see Table 2). First, PCL-C was entered into step 1 of the equation. The step 1 equation was not significant, explaining only 3% of the variance, $F(1, 68) = 2.00, p = .162$ of variance in PTG-I at T2. Next, both subscales of the PANAS, PAS and NAS, were entered into step 2. The step 2 equation was significant, explaining 17% of the variance, $F(3, 66) = 4.51, p = .006$. The addition of the variable to the model resulted in a significant increase in R^2, $R^2 = 0.17$ (adjusted $R^2 = 0.13$, $\Delta R^2 = 0.14$), $\Delta F(2, 66) = 5.62$, $p = .006$. Interestingly, only PAS ($b^* = 0.38$) emerged as contributing positively and uniquely to the variance in PTG-I at T2. Finally, all four SPF factors were entered into step 3. The step 3 equation was significant, explaining 30% of the variance, $F(7, 62) = 3.85$, $p = .002$. The addition of the variable to the model resulted in a significant increase in R^2, $R^2 = 0.30$ (adjusted $R^2 = 0.22$, $\Delta R^2 = 0.13$), $\Delta F(4, 62) = 2.95, p = .027$. Moreover, only PAS ($b^* = 0.29$) and SPF-S ($b^* = 0.30$) emerged as contributing positively and uniquely to the variance in PTG-I at T2. Note, PTG at T1 was not included in the hierarchical regression to predict PTG at T2, as the aim of the study was to investigate what *psychological factors* could predict PTG at T1 and T2. Additional post-hoc analysis with PTG at T1 in step 1 of the equation reveals a significant effect explaining 38% of the variance, $F(1, 68) = 41.81$, $p < .001$. Subsequent steps in the hierarchical regression were not significant ($ps > 0.14$). For more details, see Table 3.

4. Discussion

The current study aimed to investigate (1) the prevalence of posttraumatic growth within the context of the COVID-19 pandemic and (2) which psychological factors predict COVID-19 pandemic-related posttraumatic growth using a 1-year longitudinal design. A sample of 70 university students completed a survey on COVID-19, posttraumatic stress, emotional well-being, coping styles, determinates of resilience, and posttraumatic growth at both T1, May 2020, and T2, May 2021. Results reveal moderate levels of PTG for about one in five participants at both T1 and T2 (21% and 23%, respectively). Moreover, PTG at T1 and T2 were strongly, positively correlated ($r(70) = 0.62$, $p < .001$). Posttraumatic stress and social support were found to positively predict PTG at T1, while positive affect and social skills were found to positively predict PTG at both T1 and T2.

Posttraumatic stress has been investigated in relation to PTG by several scholars previously (e.g., Butler et al., 2005; Dekel et al., 2012; Hall et al., 2010; Park et al., 1996). The current results found PTSS to be associated with PTG at T1 and T2, yet only to predict PTG at T1, not T2. Tedeschi and Calhoun (1996, 2004) initially suggested that it is stress-induced by traumatic events that stimulate individuals to challenge and (re-)construct (existing) schema and assumptions, which then results in positive changes. Some previous research investigating the relationship between PTSS and PTG indeed revealed a positive relationship between trauma severity (Park et al., 1996), trauma symptomatology (Butler et al., 2005) or levels of trauma exposure (Blix et al., 2013) and PTG, regardless of gender, ethnicity, education, religiosity, self-efficacy and previous stressful life events (Hall et al., 2010). PTG can be considered the outcome of a psychological struggle post-trauma, and therefore PTSS could be expected to play a positive role in the emergence of PTG. More recently, Yan and colleagues (Yan et al., 2021) found PTSD to positively predict PTG in discharged COVID-19 patients. That being said, the majority of cross-sectional studies investigating the relationship between PTG and PTSD symptomatology, have failed to reveal a systematic relationship between the two (Zoellner and Maercker, 2006). Interestingly, Chen et al. (2015) investigated the bidirectional relationship between PTSS and PTG, that is PTSS predicting PTG and PTG predicting PTSS, and found PTG at 12 months to negatively predict PTSS at 18 months, highlighting how growth may play a role in reducing long-term PTSS. Taking the results from Chen and colleagues into consideration may explain the current results specifically concerning the role of PTG at T1 and its moderating effect on the predictive value of PTSS at T2 on PTG at T2, as revealed by additional post-hoc analysis. It could be argued that the presence of PTG at T1 potentially reduces harmful PTSS at T2 and thus reducing its effect on PTG at T2. However, future investigation into the (bidirectional) relationship between PTG and PTSS seems warranted.

Positive and negative affect, that is positive and negative feelings and emotions as experienced within a discrete period, has rarely been investigated in light of PTG. In the current study, positive, and not negative affect, was found to be one of the psychological factors that predicts PTG strongly and positively at both T1 and T2. Two previous studies may shed light on the relationship between affect and PTG. First, Sears et al. (2003) investigated coping in relation to PTG in women with early-stage breast cancer and found positive reappraisal coping at study entry to predict posttraumatic growth 12 months later. Secondly,

Vazquez et al. (2021) investigated the role of core beliefs about the world and others in relation to PTG. Interestingly enough, they found that positive core beliefs, such as primal beliefs about a good world, openness to the future, and identification with humanity, were indeed associated with PTG (while negative core beliefs were associated with PTS). While positive reappraisal and positive core beliefs are distinct from self-reported positive affect, these three findings might point in the direction of an important commonality, where one proves able to retain a positive outlook despite the challenging circumstances and as such, suggest positive experiences, and not just psychological struggles, may prove a discernable source or facilitator of growth in terms of relating to others, seeing new possibilities, recognizing personal strengths, and a deeper appreciation of life (also see Gulliver et al., 2010; Khanjani et al., 2017).

Determinates of resilience such as one's social skills, perceived social support, ability to plan, and a goal-orientated nature, have -in part- been investigated in light of PTG previously. The current results shine a light on the importance of psychological factors such as perceived social support and one's social skills as determinates of resilience and thus associated with PTG. Specifically, perceived social support positively predicted PTG at T1. This may be because T1 was recorded early in the pandemic and individuals may have employed this protective factor as a short-term strategy, turning to one's support systems to alleviate or temper the potential isolation. Interestingly, Dong et al. (2017) investigated both perceived social support and general resilience in relation to PTG in a sample of colorectal cancer survivors and found resilience to play a mediating role between perceived social support and PTG. Similar findings, in particular related to perceived support, have been reported by Drapeau et al. (2019) studying predictors of PTG in adults bereaved by suicide and by Hobfoll et al. (2006) investigating PTG following the 9/11 terrorist attacks. Moreover, Finstad et al. (2021) conducted a narrative review on the positive aspects of trauma and concluded resilience, both at the level of the individual and the level of the organization, is key in the development of PTG following trauma.

Interestingly, the current study revealed that the extent to which one feels skilled at interacting with others, that is able to socialize, make (new) friends, start a conversation, was one of the psychological factors predictive of PTG. While this effect may generalize to other traumatic events where PTG may develop, it is possible that this finding is specific to the current study, investigating PTG in light of the COVID-19 pandemic. Previous studies investigating the impact of the COVID-19 pandemic on social interaction and communication have shown significant changes in social interaction and communication, above all in terms of online communication and interaction (Chou et al., 2020; Wong et al., 2021). Specifically, the restrictions surrounding COVID-19 have greatly influenced social interactions resulting in significant changes to regular face-to-face/online conversations, physical distance, face masks, or other types of screens to keep others at a safe distance (Nicola et al., 2020; Viner et al., 2020). This has led to an increase in the importance and extent to which one feels skilled at interacting with others, meaning able to socialize, to make (new) friends, to start a conversation and so on. Moreover, the current study demonstrates that having the feeling of being socially skilled leads to PTG. This relationship might be explained by these two concepts being connected by the similar elements contained in the notions of "*Starting new conversations*" and "*Interacting with others*" (SPF-24; Social Skills) and "*I have a greater sense of closeness with others*" and "*Learned a great deal about how wonderful people are*." (PTG-I). With that in mind, adequate social interpersonal skills may never have been as important with regard to mental health as during this pandemic.

In closing, it could be argued that the COVID-19 pandemic has indeed created a situation that necessitated changes (growth) in the core elements contained in the notions of PTG in terms of exploring and identifying novel ways to live such as video conferencing, distance working, and online shopping for groceries (PTG-I; New Possibilities) and by being successful in these endeavors, has quite possibly lead to a greater ability to connect with others within the confines of COVID-19 regulations (PTG-I; Relating to Others), a reevaluation of one's abilities to do this (PTG-I; Personal Strength) thus culminating into a higher level of gratitude for one life when taking the context of a global pandemic into account (PTG-I; Appreciation of Life). Having said this, the current study also supports the notion that growth is dependent on the confidence one has in their social skills (SPF; Social Skills), positive affect (PAS), and the number of posttraumatic stress symptoms one experienced during the COVID-19 pandemic (PCL-C), illustrating the complex set of psychological mechanisms involved PTG.

Some limitations and strengths should be considered when interpreting or generalizing the current results. Firstly, the current study employed a small (mainly female) convenience sample of 70 university students taking part in the study in return for course credit. As such, the current study may lack representability or be subject to (bidirectional) response bias. In fact, some students might have participated in this study to use it as a manner to deal with their specific positive or negative feelings or as a means to cope with the pandemic. Non-response may be due to lack of time, task overload, or wanting to avoid everything related to the COVID-19 pandemic. Demographic variables such as participants' relationship or employment status or their religious orientation were not assessed. Nor was past or current psychopathology or the use of self-help or mental health services. Secondly, the current study investigated PTG using a self-report questionnaire, rather than more objective measures of growth or change. While using self-report questionnaires is not uncommon for trauma research, in fact, research on trauma and its impact on mental health typically relies on self-reports, self-report can be subject to recall bias (e.g., Frissa et al., 2016; Southwick et al., 1997; Wessely et al., 2003). In addition to that, scholars have raised concern regarding the extent to which self-report PTG represents actual growth (e.g., Frazier et al., 2009), although several recent studies have revealed that PTG was indeed significantly related to actual enhancement or adjustment (Gunty et al., 2011; Ransom et al., 2008).

That being said, the current study also has important strengths to consider. Previous research investigating PTG in light of the COVID-19 pandemic, though limited in numbers, have all been cross-sectional in nature, evaluating PTG right at the onset of the pandemic (e.g., Cui et al., 2021; Kalaitzaki, 2021; Sun et al., 2021; Vazquez et al., 2021) or short-term longitudinal in nature, evaluating PTG within the period of 12 weeks (Aafjes-van Doorn et al., 2021). The current study is the first to date to investigate PTG in light of the COVID-19 pandemic using a 1-year longitudinal design and a wide range of potentially important predictors. This should be considered an important strength, as PTG is suggested to emerge over a period of time (Tedeschi and Calhoun, 2004; Zoellner and Maercker, 2006). In addition, this study was also the first to investigate the role of positive and negative affect on PTG, shedding new light on the (long-term) development of PTG. Future research should focus on the role of positive affect and its potential connection to the notion of reappraisal coping (Sears et al., 2003) as well as, the notion of core beliefs (Vazquez et al., 2021). By investigating which variables help or hinder the development of PTG in light of the COVID-19 pandemic, and not just at "first impact", insights are offered that may guide public health agencies, policymakers, or practitioners to develop tailored-based practices and intervention for the current pandemic as well as future traumatic events (Tamiolaki and Kalaitzaki, 2020).

CRediT authorship contribution statement

Ruth Van der Hallen: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft. **Brian P. Godor:** Conceptualization, Investigation, Data curation, Writing – review & editing.

Declaration of Competing Interest

The authors report no conflict of interest. The data that support the

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