Posttraumatic growth trajectories among adolescents during COVID-19 pandemic: the role of time-varying stress reactions and systems' satisfaction

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Abstract

The study aims to examine longitudinal trajectories of Post Traumatic Growth (PTG) during the COVID-19 pandemic in a sample of 190 (54.70% female) early adolescents with a mean age of 11.34 years ($SD = 0.82$). The influence of the time-invariant predictor - resilience traits - and time-varying covariates - COVID-19 related stress and systems life satisfaction - on the trajectories was further examined. The latent growth curve analysis showed a significant negative slope, suggesting a linear decline in PTG over time. Pre-pandemic time-invariant predictors did not explain inter-individual variability in PTG, whereas time-varying covariates were significantly associated with short-term PTG variations. In particular, adolescents with higher levels of COVID-19-related stress reported significantly higher PTG scores at each time point, with the effect gradually decreasing over the three waves. In parallel, systems life satisfaction was significantly associated with higher PTG. The findings support the idea of PTG as a potential coping strategy in response to stressful situations and highlight the critical role of stress and systems life resources in triggering growth after a stressful life event.

Several studies have analyzed the impact of the COVID-19 pandemic on the mental health of individuals, especially adolescents (e.g., Kauhanen et al., 2023). The global pandemic caused unprecedented disruption to our daily lives, making it important to analyze the longitudinal trend over time from a dynamic perspective. Growing up in the abnormal circumstances of the COVID-19 pandemic may have challenged the young population. Indeed, adolescence is a transitional period (Dahl et al., 2018), and the singular and collective alterations caused by the pandemic (e.g., national lockdowns, restrictions on interpersonal contacts, distance learning) may have affected adolescents' developmental tasks and trajectories. Longitudinal studies investigating the impact of the pandemic on youths have shown heterogeneous results, highlighting the importance of considering possible interindividual differences in coping with this complex period (e.g., Nocentini et al., 2021a, b).

Alongside trajectories characterized by reactions of psychological distress and maladjustment (e.g., Sabato et al., 2021), there may also be trajectories of stability or adaptive functioning, such as decreasing emotional difficulties and increasing psychological health (e.g., Browning et al., 2021). Indeed, when individuals struggle with stressful events, they may respond with personal growth (i.e., Post-Traumatic Growth; Masten, 2014). Thus, the pandemic may have served some adolescents in their path of maturation by changing their beliefs in a positive way. Looking at positive development following stressful events means understanding the adolescents' growth through their ability to learn from negative situations and investigating on how to optimize their resources (Nocentini et al., 2021a, b). With this in mind, it is also important to reflect on which individual and social factors, both pre-existing and ongoing during the COVID-19 pandemic, may have influenced youths and their

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personal response trajectories to the event. Integrating pre-pandemic functioning with that during the pandemic may help us to understand pathways of adaptation to the stressful event, identifying adolescents who are less affected and those who are more affected by the epidemic emergency and the reasons that may explain these differences (Nocentini et al., 2021a, b).

Given these premises, this study aimed to better understand the Post-Traumatic Growth trajectories (PTG) over time and the role of individual and contextual variables that might influence growth during a stressful life event such as the pandemic.

Trajectories of PTG in early adolescence

According to the functional-descriptive model (Tedeschi & Calhoun, 2004), PTG was defined as the experience of positive change caused by a struggle with highly challenging life crises. Alongside the perspective of Tedeschi and Calhoun (2004), other authors (e.g., Taylor & Armor, 1996) wondered whether PTG might be an illusion, a coping strategy to alleviate emotional distress caused by adverse events. However, research investigating PTG in adolescence and its trajectory still needs to be improved (McElheran et al., 2012). PTG trajectories feed into the process of normative maturation, for example, by promoting qualitative changes in identity status and contributing to a developmental task of the adolescent period (Kilmer et al., 2014). PTG trajectories are important to consider during this developmental period, especially during stressful and sudden events such as the COVID-19 pandemic. Nevertheless, the literature suggested that adolescents deserve special consideration in regard to PTG and were not excluded from the possibility of experiencing positive effects following a potentially adverse event (Meyerson et al., 2011). Therefore, it was important to investigate how much the growth process might have been affected by a stressful life event such as the COVID-19 pandemic.

Undoubtedly, the profound changes in living habits caused by the pandemic have completely redefined everyday routines and probably led some people to reflect on themselves and their way of interpreting the world. In particular, for some adolescents, this historical moment may have been a practical challenge to their own growth process and, consequently, a stimulus to better define certain aspects of their personality (e.g., Fioretti et al., 2020). This process could help transform the moratorium's natural process into a deeper search for a sense of self (Marcia et al., 2012). For example, studies conducted during the first wave of the pandemic showed that some youths better understood the importance of friendship and family relationships (i.e.,

Relating with others dimension). In contrast, others made time for new or previously neglected activities or reflected on future life goals (i.e., the New Possibilities dimension), became more self-aware (i.e., the Personal Strength dimension), and gained a better understanding of the importance of the little things in life (the Appreciation of Life dimension; e.g., Fioretti et al., 2020).

To date, no studies have examined the longitudinal development of PTG in adolescents during the COVID-19 pandemic. However, we could hypothesize that the pandemic may have facilitated a path of exploration and discovery among adolescents. Given these premises, it was important to analyze the longitudinal changes in adolescents' PTG considering the discontinuity that characterized the COVID-19 pandemic and its different phases. Moreover, in addition to the discontinuity of the period, it is important to consider how the trajectory of PTG is also influenced by several intrapersonal and interpersonal variables that could determine different trends. For these reasons, a longitudinal study using a comprehensive dynamic time-varying model could help to capture possible changes and even small variations in PTG trajectories, thus expanding on short term results.

The role of time-invariant and time-varying predictors in PTG trajectories during adolescence

Tedeschi and Calhoun's (2004) theoretical model suggested that interpersonal variability in the trajectory of PTG response to stressful life events (SLE) was due to the influence of various personal and environmental factors. Personal factors can promote PTG by protecting people from excessive distress or by promoting positive reappraisal and helping to reconstruct new perspectives on life after SLE (Tedeschi & Calhoun, 2004), while environmental factors can provide people with the right support after the event, which is crucial in determining the degree of readiness of the individual to integrate new perspectives (Weiss & Berger, 2010). Based on this model, it is possible to distinguish between the effects of variables that are 'unchanging,' or were already present before our considered lapse of time and have a time-invariant effect on the trajectories, and the role of coexisting factors with a more short-term and potentially time-varying effect on predicted PTG levels.

Considering time-invariant factors, it would be crucial to deepen the role played by personal resilience, a component often used to compare PTG in adulthood and adolescence. Resilience was conceptualized (e.g., Silk et al., 2007) as a personality trait, or rather an individual characteristic that becomes stable over time at a certain age. Tedeschi and Calhoun (2004) suggested that resilient individuals are

more likely to experience PTG. On this premise, it could be assumed that adolescents who were already high in personal resilience before the pandemic had an added protective factor during the pandemic that facilitated adaptive responses to the event. Indeed, the degree of recognition of "up-sides" to the situation was higher in adolescents than in adults. Some authors have suggested that this may be related to many adolescents' high personal resilience, which helps them identify benefits after an adverse event (Tillery et al., 2016). However, PTG and resilience have been theorized as distinct constructs, although PTG has often been conflated with resilience (Westphal & Bonanno, 2007). While resilience refers to maintaining a stable trajectory of health functioning following exposure to SLE (e.g., Luthar, 2003), PTG was not simply a return to baseline functioning. It involved a redefinition of personal core beliefs. Therefore, investigating the relationship between PTG and resilience is an interesting empirical question. A study that deepened the relationship between resilience and PTG in an adult sample with HIV confirmed the differences between these constructs and showed that resilience did not predict PTG over time (Garrido-Hernansaiz et al., 2017). On the contrary, in regard to the pandemic, longitudinal research (Hyun et al., 2021) on young adults found a positive prediction of resilience in PTG. However, there were no studies of this type on adolescent samples during the health emergency.

On the other hand, among the time-varying constructs, it was important to consider COVID-19 related stress. Indeed, as suggested by the literature (e.g., Sabato et al., 2021), stress was an inevitable response which stemmed from the pandemic, and it should be emphasized that individual stress responses may vary depending on the specific period of the health emergency being considered. Indeed, the COVID-19 pandemic is characterized by an uneven pattern which depends on the spread of the virus, which led to continuous changes of the restrictive measures in place. Therefore, it was important to study the role of stress also as a function of specific epidemic moments. In addition, stress was also a component of the PTG process. Indeed, Tedeschi and Calhoun (2004) found that certain levels of personal distress could trigger and maintain the growth process over time. Research about PTG and stress conducted with young populations showed mixed results, demonstrating that the relationship between these aspects had been underresearched and needed further investigation (e.g., Zhen & Zhou, 2022). Studies distinguished different patterns of adolescents' reactions to trauma, where various relationships between stress and PTG were found (Zhen & Zhou, 2022), but others found no association (e.g., Fraus et al., 2021). Regarding the COVID-19 pandemic, research conducted by Zhen & Zhou (2022) on a sample of adolescents had differentiated three models of the associations between PTG and pandemic stress, confirming the high heterogeneity of responses to this event. Moreover, to our knowledge, there were no studies on this issue in Italy.

As environmental variables may also influence PTG, it was important to consider social support and satisfaction, as shown in previous studies on this topic (e.g., Xie & Kim, 2022). Satisfaction or perceived support in relation to key reference systems (e.g., family, school, and friends) was another factor that could have influenced PTG trajectories according to the different phases of the pandemic (i.e., time-varying). As stated by Tedeschi and Calhoun (2004), in relation to PTG, social support and satisfaction should be protective during stressful events. However, the changes in the social and individual environment caused by the pandemic could have affected the buffering role played by the main social systems, such as family and school. Therefore, it is important to understand how much the satisfaction of the main reference systems, which were most affected during the pandemic (e.g., family and school), may have influenced PTG. Indeed, school and family are two important systems that play a primary role during early adolescence, and they were also the environments most affected by COVID-19. School is where adolescents spend most of their time. It is not only educational, but also a relational place that strengthens peer ties. The Italian school system faced significant challenges during the COVID-19 pandemic due to the implementation of remote learning. The remote learning approach was first introduced for grade 7 schools at the start of the pandemic and continued into 2021. Its implementation was contingent on the spread of the virus and alternated with traditional in-person education. On the other hand, as far as the family is concerned, young people tend to try to distance themselves from their parents during adolescence. The lockdown led to increased parental control and supervision and forced families to reorganize their routines. Nevertheless, Italian results showed adolescents to be experiencing average levels of stability in family well-being from pre-COVID to June 2020 (Nocentini et al., 2022). This led to the hypothesis that PTG is nurtured by family support and satisfaction. To our knowledge, no studies have investigated the role of satisfaction with the main system in influencing adolescents' PTG during the pandemic. However, a recent study (Xie & Kim, 2022) found a positive relationship between social support and PTG in a sample of young adults, but did not differentiate between different support systems, and Hyun et al. (2021) found that family connectedness can predict PTG. With these premises, it was crucial to explore the longitudinal development of adolescents' experiences of growing up during a highly stressful period such as the COVID-19 pandemic and the role of time-invariant and time-varying factors in influencing PTG.

The current study

The objective of this study is threefold: Firstly, to analyze the univariate change in PTG over three-time points, beginning from grade 7 (i.e., first wave assessed in 2020) and ending in grade 9 (i.e., three waves assessed in 2022); secondly, to investigate the influence of a time-invariant predictor related to internal resilience at baseline on the growth factor; and thirdly, to examine the alteration of univariate growth due to the time-varying effect of stress related to COVID-19, and satisfaction related to family and school systems. The study will control for time-invariant predictors. Specifically, we hypothesized that adolescents may have experienced PTG during the two years of the pandemic, in line with the results presented in the scientific literature (Masten, 2014). However, given the debate about PTG as a possible illusion and the limited knowledge about it at a young age, we needed to be more agnostic about the direction of PTG trajectories. This was also why we decided to use a longitudinal design in order to discuss the theoretical issues related to the concept of 'illusory growth' to alleviate emotional distress and whether PTG in adolescence reflects actual growth versus normative development (Kilmer et al., 2014).

Furthermore, in line with the theoretical model (e.g., Tedeschi & Calhoun, 2004) and the aim of investigating inter-individual differences in response to SLE, we hypothesized the protective role of personal and environmental factors in promoting PTG over time.

Overall, the design will be particularly informative for the study of PTG in adolescence after the pandemic for two reasons. First, the literature has mainly focused on mental health and pandemic stress-related outcomes in adolescents (Branje, 2023), defining the adolescent phase as one of the most affected by the pandemic. This study could shed light on this picture using a different outcome. Secondly, monitoring the annual impact of the pandemic over the years could reveal important insights into the typical or atypical adaptation of adolescents over time, compared to developmental trajectories in other catastrophic events.

Method

Participants and procedure

The participants were part of a longitudinal research project funded by the "Con I Bambini Fundation" in which the University was the impact evaluator. All procedures were approved by the Institutional Review Board of the University of Florence. The project, which started in the school year 2019–2020, aimed to reduce educational poverty and dropouts in medium-low socioeconomic Italian schools (2 from low SES, 4 from medium-low SES). Six different comprehensive Italian schools (i.e., Grade 7 and Grade 8) participated in the study. The school principal and the class council required preliminary approval to obtain informed consent. Consent forms were distributed to students' families, to inform them about the project and request consent for their child to participate in the research. Student participation was contingent upon parental consent.

Four surveys were administered, the first in January/February 2020 (T0), before the first COVID-19 outbreak in Italy, the second in May/June 2020 (T1) after the COVID-19 lockdown, the third in May/June 2021 (T2), and the final one in May/June 2022 (T3)[1]. At T0 the data collection occurred both in person and online, while for the other three waves, data collection occurred online (i.e., not in person) through a digital collection mode (i.e., link).

The sample included 190 adolescents (54.7% female), that participated at least at one of the two-time points, aged between 10 and 14 years old (M_{age}=11.34 years, SD=0.82). Specifically, at T0 participated 89 students, at T1 participated 107 students, at T2 participated 111 students, and at T3 participated 139 students. The retention rate between consecutive assessments ranged between 58% and 84% (88% between T1 and T3). Specifically, of the 89 participants at T0, 65 participated at T1 and 78 at T3. Of 107 participants at T1, 62 participated at T2; and of 111 participants at T2, 93 participated at T3.

Regarding personal experiences with COVID-19, both in terms of the participants' infection and the infection of those around them, we found that at T1 (i.e., after the COVID-19 lockdown) only 1.9% of participants had been diagnosed, 18.7% knew someone who was infected (e.g., friends or family members), and 79.4% reported never having had any direct or indirect experience with COVID-19.

To compare participants with and without missing data, Little's (1988) Missing Completely at Random (MCAR) tests were performed. Although the test emerged to be significant, ($\chi2$ (72)=94.607, p=.038), the normed χ^2/df, of the value of 1.31, suggested that data were likely missing at random (Bollen, 1989). Missing data were handled using the Full Information Maximum Likelihood estimation (FIML, Acock, 2005) that allows retaining cases with missing data, therefore avoiding potentially biased parameter estimates through pairwise or listwise deletion (Schafer & Graham, 2002).

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[1] The decision to implement the survey at these specific times was based on the different phases of the pandemic in Italy; 2020 was characterized by a lockdown and several restrictive measures, while 2021 was characterized by various dispositions depending on the spread of infections in different cities and regions, with measures being relaxed and eased towards the end of the year. Finally, 2022 was characterized by a relaxation of restrictive measures until the end of the health emergency in April.

Measures

The experience of positive changes was assessed through eight items rated on a six-point Likert scale ranging from 1 (*'no change'*) to 6 (*'very important change'*) of Post-Traumatic Growth Inventory for Children-Revised (PTGI- C-R; Kilmer et al., 2009) adapted to the pandemic context (e.g., the questionnaire was introduced by a short explanation referred to the pandemic and each item was preceded by the following sentence: "Thinking about what has changed since the COVID-19 pandemic began…").

The PTGI-C-R assessed the presence of post-traumatic growth in children in the following five dimensions: relating to others (i.e., "I have learned how wonderful people are"; "I feel closer to people"), personal strengths (i.e., "I have more confidence in myself"; "I feel more able to cope with difficulties"), appreciation of life (i.e., "I appreciate each new day more"; "I appreciate my life more"), new possibilities (i.e., "I see that there are opportunities that I thought were impossible before."; "I feel capable of doing better things in life."), and spiritual change ("I understand how God works better"; "My faith/belief in God is stronger"). In this study, the spirituality dimension was not included, given that researchers reported its high variability across cultural groups as a function of their religiosity (versus secularism), primary faith-based values, and broader cultural values (Hafstad et al., 2011). The average score between the four subscales was used. The scale was administered from T1 to T3, and the internal consistency (McDonald's omega, ω) of the four domains ranged between .89 and .93 across three-time points.

Time-invariant covariate

The internal resilience was assessed through seventeen items rated on a four-point Likert scale ranging from 1 (*'not at all true'*) to 4 (*'very much true'*) of Resilience Youth Development Module (RYDM; Constantine & Bernard, 2001). The internal assets subscales of the scale measure personal strengths associated with healthy and successful development including cooperation and communication (e.g., "I can do most things if I try"), empathy (e.g., "I feel bad when someone's feelings are hurt"), problem-solving (e.g., "I know where to look for help when I have a problem"), self-awareness (e.g., "I understand my moods and feelings"), self-efficacy (e.g., "I am able to solve my problems"), and goals and aspirations (e.g., "I have goals and plans for the future"). The participants had to indicate the degree to which each item in the module applies to them. The average score between the subscales was used at the baseline. The internal consistency (McDonald's omega, ω) was .86 at the baseline.

Time-varying covariates

COVID-19 related stress was assessed through six items rated on a five-point Likert scale ranging from 1 (*'not at all'*) to 5 (*'a lot'*) of the Impact of Event Scale-6 (IES-6; Thoresen et al., 2010). This scale was composed of three subscales that assessed different stress symptoms that may have occurred during the previous seven days: intrusion (i.e., "Several things kept making me think about the virus and the pandemic"; "I thought about the virus and the pandemic even though I did not want to"), avoidance (i.e., "I stayed away from news related to the virus and the pandemic", "I tried not to think about the virus") and hyperarousal (i.e., "I had problems concentrating"; "I felt disturbed"). The average score was used, with higher scores indicating more levels of COVID-19 stress. The scale was administered at T1, T2, and T3 and the internal consistency (McDonald's omega, ω) of the three domains ranged between.50 and.69 across time points.

Family and school satisfaction was assessed through the Multidimensional Students' Life Satisfaction Scale (MSLSS; Zappulla et al., 2014). This scale was composed of 38 items rated on a three-point Likert scale ranging from 1 ("not true") to 3 ("completely true"). The scale assessed satisfaction across five distinct domains, including family (six items, e.g., "I like spending time with my parents"), friends (nine items, e.g., "My friends will help me if I need it"), neighborhood (eight items, e.g., "I like my neighbors"), school (eight items, e.g., "School is interesting"), and self (seven items, e.g., "I am a nice person"). Specifically, in this study, only the family and school systems were included. The average score of these two subscales was used as a unique score indicating more levels of family and school satisfaction. The internal consistency (McDonald's omega, ω) ranged, across time points, between 0.82 and 0.92.

Data analysis

All the analyses were conducted with Mplus 8.0 (Muthèn & Muthèn, 2018). Latent Growth Curve Analysis (LGCA; e.g., Duncan & Duncan, 1994) was used to estimate and predict the longitudinal development of PTG. The variables observed repeatedly within this frame can be used to estimate the unobserved underlying trajectory defined by two latent growth factors: the intercept and the slope. Univariate LGCMs allow an examination of the initial level of a target outcome (i.e., the intercept), its rate of linear change or trends (i.e., the slope), and the association between the initial level of the outcome and its rate of change (i.e., the correlation between the intercept and the slope). In the current study, the factor loading of the PTG variable was fixed at 1.0 to represent the starting point of the trajectory, while

Table 1 Correlation table between study variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. RYDM T0	-									
2. PTG T1	0.30*	-								
3. PTG T2	0.14	0.31*	-							
4. PTG T3	0.22	0.24*	0.40***	-						
5. COVID-19 T1	−0.21	0.31***	−0.05	−0.13	-					
6. COVID-19 T2	−0.12	0.12	0.12	−0.15	0.36**	-				
7. COVID-19 T3	−0.03	0.19	−0.19	0.17	0.18	0.43***	-			
8. Family and school satisfaction T1	0.53***	0.37***	0.42***	0.18	−0.01	−0.07	−0.04	-	-	
9. Family and school satisfaction T2	0.35**	0.15	0.37***	0.27*	−0.28*	−0.29**	−0.34***	0.54***		
10. Family and school satisfaction T3	0.45***	0.14	0.23*	0.28***	−0.21	−0.21*	−0.21*	0.51***	0.69***	-
Mean	3.22	3.83	3.62	3.34	2.71	2.49	2.44	2.51	2.36	2.39
SD	0.49	1.22	1.29	1.33	0.79	0.81	0.92	0.33	0.46	0.38

RYDM means resilience

$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

Table 2 Fit indices for unconditional, time-invariant and time-varying models

Models	χ^2	df	p	CFI	RMSEA	SRMR
1. Unconditional model PTG	0.154	1	0.695	1.000	0.000	0.010
2. Time Invariant model	1.171	2	0.557	1.000	0.000	0.034
3. Time-Varying model	22.669	14	0.066	0.906	0.057	0.052

the three terms of each latent slope variable were fixed at 0, 1 and 2 for T1, T2 and T3 respectively. First, to examine the growth of PTG over time, a univariate unconditional growth model was estimated (model 1). A conditional model was then estimated, extending the unconditional model to include the effects of a time-invariant variable (i.e., internal resilience) on the intercept and slope. The latent growth factors were regressed on the time-invariant variable. Finally, the model was extended to test the direct effects of time-varying covariates (i.e., COVID-19 related stress and family and school satisfaction) on PTG (model 3). Each repeated measure of PTG was regressed on the respective time-specific covariates.

Maximum Likelihood (ML) estimation was used for all models. Model fit was evaluated with the Maximum Likelihood Ratio Test Statistic (χ^2), the Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). Recommended cut-off points for these measures are 0.08 (Browne & Crudeck, 1993) or 0.06 (Hu & Bentler, 1998) for RMSEA, 0.90 or 0.95 for CFI and TLI (Bollen, 1989), and 0.08 or 0.06 for SRMSR (Hu & Bentler, 1998).

Results

Table 1 reports bivariate correlations, means, and standard deviations for all study variables.

Unconditional model of post-traumatic growth

First, as shown in Tables 2 and 3, the unconditional univariate LGCA was tested for PTG (i.e., Model 1). Results showed that the intercept of PTG was positive and significant, while the slope was negative and significant, suggesting, on average, a linear decrease of post-traumatic growth over time. Additionally, the intercept variance showed a tendency towards significance, suggesting the presence of interindividual differences in the initial levels of PTG Instead, the variance of the slope was not significant, indicating no interindividual differences in the rate of change (i.e., trajectories) in PTG. Finally, the correlation between the intercept and the slope was not significant.

Conditional growth model: time-invariant covariate and time-varying covariates

In the unconditional model (i.e., Model 1), we added the time-invariant covariate (i.e., Model 2). Specifically, as a time-invariant covariate, we considered the levels of internal resilience at the baseline (i.e., T0). As we can see from Table 3, previous resilience did not affect the intercept and slope of PTG.

The predictive value of time-specific variables such as COVID-19 related stress and family and school satisfaction were evaluated by adding time-varying covariates to the previous model (see Model 3 and Fig. 1). As we can see from Table 3, participants with higher levels of COVID-19-related stress reported significantly higher levels of

Table 3 Growth curve parameters of unconditional model (model 1 in Table 2) and effects of time-invariant and time-varying predictors on growth curve parameters in the conditional model (model 2 and model 3 in Table 2)

	Unconditional Model	
	i PTG	s PTG
Mean (Unstandardized)	3.862***	-.259**
Variance (Unstandardized)	.609†	.218
	Estimate	
Correlation i-s PTG		-.304
	Conditional Model With Time–Invariant Covariate	
	i PTG	s PTG
RYDM T0	.350 †	.010
	Conditional Model With Time–Varying Covariates	
	PTG (T1)	PTG (T2)	PTG (T3)
COVID-19 T1	.351***		
COVID-19 T2		.292***	
COVID-19 T3			.249***
Family and school satisfaction T1	.255*		
Family and school satisfaction T2		.342***	
Family and school satisfaction T3			.263**

RYDM means Resilience. The estimates in the unconditional model are unstandardized and standardized in the conditional model

*$p < .05$; **$p < .01$; ***$p < .001$

† $< .07$; † $< .055$

post-traumatic growth each time, with an estimate that declined progressively over time (T1: $\beta = 0.351$; $p < .001$; T2: $\beta = 0.292$; $p = .001$.; T3: $\beta = 0.249$; $p = .001$). Similarly, participants with higher levels of family and school support

also reported significantly higher levels of post-traumatic growth each time, with an estimate higher at T2 ($\beta = 0.342$; $p < .001$) compared to T1($\beta = 0.255$; $p = .012$) and T3 ($\beta = 0.263$; $p = .002$).

Discussion

This study contributed to the current literature by deepening the trajectories of PTG during the two years of the pandemic, examining the time-invariant role of resilience in influencing the PTG trajectory and the alteration of this due to the time-varying effect of COVID-19 related stress and systems' life satisfaction (i.e., family and school).

The LGCA revealed a significant linear decline in PTG over time. This decline was found to be influenced by time-varying factors such as stress related to COVID-19 and satisfaction with family and school systems. The initial high levels of PTG may represent an immediate coping strategy to deal with the impact of the pandemic, which, however, did not reflect subsequent, authentic growth. In this sense, when the pandemic began, PTG might have allowed youths to manage the initial stress and improve their functional status after the SLE (Magrin et al., 2007). This result was in line with the concept of PTG as a positive illusion capable of maintaining unrealistically optimistic beliefs in response to highly stressful or threatening situations (Taylor & Armor, 1996). Accordingly, Zoellner and Maercker (2006) recognized distorted and self-deceptive cognitive processes as
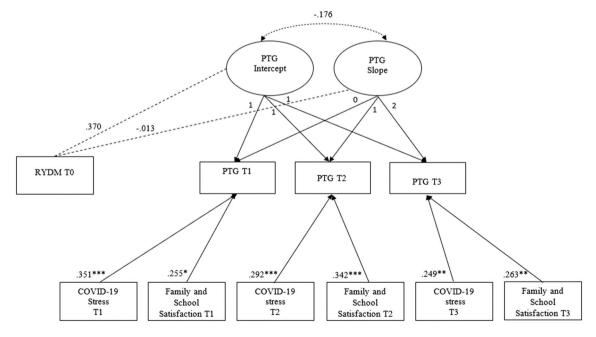

Fig. 1 Effects of time-invariant and time-varying predictors on the multivariate growth of PTG (Model 3). *Note.* RYDM means Resilience. *$p < .05$; **$p < .01$; ***$p < .001$

one of the possible aspects of PTG, in which growth directs the individual to overcome the adverse event.

Concerning the time-invariant, we explored the role of resilience traits in predicting the growth of PTG over time. In line with studies conducted on the adult population (e.g., Garrido-Hernansaiz et al., 2017), our results found that resilience did not predict adolescents' PTG over time, confirming that the two constructs involved different processes. Indeed, while resilient early adolescents had personal beliefs that mitigate emotional distress, youths who experienced PTG after a disruptive event experimented with a challenge of their assumptive core beliefs (Tedeschi & Calhoun, 2004). Thus, we could hypothesize that resilient youth had adequate personal resources to cope with the challenges caused by the pandemic and these were sufficient to manage any emotional distress. This could explain why resilience did not trigger adolescents' PTG during the pandemic.

As regards the role of time-varying variables, we examined the extent to which COVID-19 related stress and family and school satisfaction affected the PTG at each wave. Findings showed that early adolescents with higher levels of COVID-19 related stress reported significantly higher PTG scores, at each time, with an effect that gradually declined across the three waves. In line with Tedeschi and Calhoun's (2004) theoretical model of PTG, stress played an essential role in triggering the growth and maintaining it over time, confirming that distress and PTG do coexist. This also suggested that the two processes might involve similar mechanisms (Tedeschi & Calhoun, 2004). However, the effect of pandemic stress on PTG was stronger at T1 during the first months of the pandemic. Indeed, in the context of the COVID-19 outbreak, the sudden and rapid change in daily routine and the uncertainty of the emergency led young people to experience a high degree of stress, and this conducted them to exhibit PTG as an illusion, which was functional in coping with the situation and any related negative emotions (Zhen & Zhou, 2022). This may have been supported by the progressively decreasing levels of PTG during the pandemic years, disconfirming the consolidation of positive changes.

On the other hand, the main reference life systems satisfaction was significantly associated with higher levels of PTG over time too. Our findings supported the important role played by adolescents' proximal systems (i.e., family and the school system) in predicting PTG at each time point. These systems performed a buffering function for the highly stressful context of the COVID-19 pandemic, as confirmed by other studies in the literature (Nocentini et al., 2022). Although studies conducted in the adult population highlighted the importance of supportive social environments in the PTG process, both in general and during the COVID-19 pandemic (e.g., Hyun et al., 2021), the scientific literature

on the role of systems' satisfaction for youth showed mixed results (Kilmer et al., 2014). Specifically, while studies about this topic during the health emergency are still lacking, other research showed that results appear to vary with the source of support, suggesting that system satisfaction, whether from family (Kimhi et al., 2009), teachers, or peers (Yu et al., 2010), might be associated with PTG. In line with these, our results showed the importance of main reference systems satisfaction in promoting and supporting youth PTG. Indeed, findings showed that youths' response to trauma and their coping strategies were significantly influenced by satisfaction with the main system (i.e., family and school). This result could be explained by our sample being composed of early adolescents. Although teens tend to distance themselves from their parents during this period of life, in the context of the various limitations and of the age under study (i.e., the first phase of adolescence), the family as well as the school played a protective role. Indeed, it was possible that even if distanced education might have affected the concept school as a place for relationships and emotional sharing (Fioretti et al., 2020), it might have also facilitated students to organize their study time better, promoting their autonomy and self-management. This was linked to the fact that, during childhood and adolescence, routines play an essential role in fostering the security necessary for autonomy and self-definition (Fioretti et al., 2020).

In summary, in light of the theoretical model presented (Tedeschi & Calhoun, 2004), the study demonstrated the importance of paying attention to inter-individual differences in the developmental trajectories of PTG and how this variability in response to stressful life events can be explained by personal and environmental characteristics that may influence adolescents' ability to respond adaptively and functionally to SLE. In general, it seemed that PTG decreased over time, suggesting that the higher levels recorded immediately after the event might be illusory. However, adolescents with higher stress levels or satisfaction and support from main systems had personal and environmental factors that could maintain PTG over time. Consistent with Tedeschi and Calhoun (2004), our results showed that a certain stress level is required to trigger the PTG process, and only adolescents with this characteristic experienced growth. In contrast, adolescents with pre-event resilience traits did not appear to be more likely to experience growth, contributing to research exploring the relationship between PTG and resilience and confirming the conceptual distinction between the two constructs (e.g., Clay et al., 2009). Furthermore, the literature has highlighted the important role of support in promoting PTG. Indeed, even in our study, only adolescents who perceived greater satisfaction with their life systems were likely to experience PTG;

conversely, adolescents who perceived less satisfaction with their life systems appeared less likely to experience PTG, highlighting the important protective role played by adolescents' proximal systems.

Understanding short and long-term mechanisms of change in posttraumatic growth might suggest implications about whether a clinician can facilitate this process (Tedeschi & Calhoun, 2013). The results emphasize the importance of resilient processes during the pandemic, while those of pre-pandemic vulnerability are less salient. In particular, clinicians should address high initial levels of emotional distress in order to activate a PTG process, providing the kind of support that can help make this manageable during the first period of the pandemic (Tedeschi & Calhoun, 1995). Adolescents have to be sufficiently perturbed by the pandemic to trigger and maintain the growth process over time. However, the process of cognitive engagement, cognitive processing, and cognitive change, narrative reconstruction cannot be activated when the level of emotional distress is too high. Besides, as indirect processes, clinicians and healthcare professionals should promote and strengthen the support that traditional family and school systems can provide to adolescents, particularly in the early phase of the pandemic. The structuring of selective and indicated interventions in public health services aimed at families at risk or at families seeking support should ensure a timely help, fostering a re-organization of the system. In addition, the school system should activate a psychological support service for teachers and families from the first pandemic phase.

Strengths, limitations, and future directions

This study had some strengths, including the use of a prospective design able to grasp the longitudinal trajectories of adolescents' PTG during the two years of the COVID-19 pandemic. Furthermore, the research helped to better understand the effects of the health emergency on young people and the role of PTG in adolescents since the theoretical model had been conceptualized on adults. Despite these strengths, the current study also presented some limitations. First, the small sample involved only adolescents from Grades 6 to 8. This could make it difficult to generalize the results to the entire youth population. In this regard, future studies could deepen the trend of PTG after the COVID-19 pandemic by including older high schoolers from different economic and cultural backgrounds. Second, the study examined PTG during the pandemic. Tedeschi and Calhoun (2004) denoted that PTG does not focus on changes in the immediate after-event when people could instinctively react to the experience; rather, it focuses on long-term transformations. Third, the use of self-reporting and individual-level measures was focused solely on youths. Moreover,

regarding PTG, this kind of test only indicates possible positive changes, which could involve the risk of a bias of positive responses, threatening the validity of the reports (Park & Lechner, 2006). Also, self-report measures could imply a mentally demanding procedure for the subject that may make it challenging to provide authentic answers (Jayawickreme & Black, 2014). In this regard, future studies could use mixed methods, including quantitative and qualitative change measures, to delve further into this topic.

Finally, an interesting line of future investigation could complement research on PTG with the concept of sensitivity to environmental influences (Lionetti et al., 2019; Pluess et al., 2018), according to which those with low levels of environmental sensitivity are less (or not affected) by the pandemic, while those with higher levels are more affected by the pandemic but also by enriching contexts (Lionetti et al., 2022; Dragone et al., 2024; Nocentini et al., 2018). In line with this perspective, we can hypothesize that only adolescents affected but not overwhelmed by the stress of the pandemic might experience growth. Future studies could test whether environmental sensitivity may moderate the post-traumatic growth process. The most sensitive adolescents might initially be affected by the pandemic, but with the support of the main systems they might benefit from the process triggered by the initial stress, not be overwhelmed, and begin a process of growth and enrichment.

Declarations

Ethics approval Informed consent was obtained from the parents of the students involved in the study.
All procedures were approved by the Institutional Review Board of the University of Florence.

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

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