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Hope and post-stress growth during COVID-19 pandemic: The mediating role of perceived stress and the moderating role of empathy

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ABSTRACT

The current study examined the effect of hope on post-stress growth (PSG), how perceived stress may mediate this effect, and lastly how empathy may moderate the various indirect and direct pathways during COVID-19 pandemic. Results from the current study using a large sample of Chinese college students ($N = 1666$) showed that hope was positively associated with PSG while negatively associated with perceived stress, which in turn, was negatively associated with PSG. Empathy magnified the effects of hope on perceived stress and PSG while buffering the effect of perceived stress on PSG. These results suggest that empathy may play a crucial role in increasing desired outcomes and mitigating undesired outcomes.

1. Introduction

COVID-19 has for more than a year forced a large portion of the global population to quickly transition to a new way of life (Peltz, Daks, & Rogge, 2020). The pandemic has incurred significant psychological stress among those affected (Song, 2020). However, findings from positive psychology examining individuals' capacity to be resilient and grow after experiencing diseases and other social crises or trauma (Peterson, Park, Pole, D'Andrea, & Seligman, 2008) yield positive outlooks on society's abilities to persevere through the current COVID-19 pandemic.

Post-stress growth (PSG) is defined as regaining psychological balance and further developing psychological maturity after experiencing stressful or traumatic events (Shi, Cui, Lei, & Zheng, 2013). Researchers have used various alternative terms to express this general phenomenon, the most notable being post-traumatic growth (PTG) (Joseph et al., 2005). Although similar in nature, PSG represents a less intense form of PTG. Many individuals experience some form of trauma across their lifespan. However, for most others, low to mild intensity stressors from daily life are typically more relevant causes of distress. Nonetheless, these individuals may experience similar forms of growth from undergoing generic stressors akin to that of what is seen in PTG, such as developing more hopeful outlooks on life (Salloum, Bjoerke, & Johnco, 2019). The ongoing COVID-19 pandemic provided a unique opportunity to examine the roles of hope and stress as antecedents for PSG under a naturally high stress social ecology.

1.1. Hope and post-stress growth

Hope has been defined as one's perceived ability to accomplish goals (Snyder, 2002) through two interrelated cognitive processes: 1) pathways (i.e., one's perceived ability to create plans to meet goals) and 2) agency (i.e., goal-directed energy; Snyder, 2002). In recent years, hope has increasingly been given attention due to its role in goal attainment that subsequently promotes psychological well-being and the development of PTG (Snyder et al., 1991). Several studies provide credence to this notion, showing that hopeful individuals were more confident in tackling challenges (Fite et al., 2014) and adapted better to stressors (Shanahan, Fischer, & Rand, 2020) and adverse life events (Hullmann, Fedele, Molzon, Mayes, & Mullins, 2014).

Within the context of a social ecology mired by COVID-19, hopeful individuals may be more resilient to stressors and experience greater personal growth as they persevere through ongoing waves of pandemic-related issues. For instance, for university students, hopefulness under the current climate may take on forms of optimism for quick economic recovery from the pandemic and a plentiful job market. Despite the plentiful literature on hope and positive psychological adjustment, however, little research has been done to examine this relation among

Chinese college students who were one of the first groups to have been affected by the COVID-19 pandemic. Based on the analysis of literature, we posit the following hypothesis:

Hypothesis 1.   Hope is positively related to PSG.

1.2. Perceived stress as a mediator

The theory on unravelling determinants and consequences of stress (Dyrbye, Thomas, & Shanafelt, 2005) proposes that perceived stress mediates the relation between personal factors and stress consequences. Crucial in the experience of PSG is the inherent role of how one subjectively experiences *stress* (i.e., perceived stress). Perceived stress refers to the extent to which certain life situations are appraised as being stressful to the individual experiencing it (Heinen, Bullinger, & Koca-levent, 2017) and can stem from multiple sources (Dunn, Iglewicz, & Moutier, 2008). Perceived stress can also subsequently affect various aspects of one's life, such as exacerbating negative physical or physiological outcomes (Tilbrook, 2010).

Herth (1992) previously indicated that maintaining hope not only involves a positive outlook and appraisal of events, but also the desire for interpersonal relationships, engagement in said relationships, and striving for control of emotional responses. As one might expect, hope has been shown to play a significant role in reducing perceived stress (Hirsch & Sirois, 2016). Indeed, recent evidence has alluded that excessive stress beyond one's ability to adequately cope may further exacerbate psychological fatigue and depressive symptoms (Ye et al., 2020). Adaptive personal resources (e.g., hope) can foster the process of appraising stressful events and maintaining a manageable level of stress with which one may grow from (Prati & Pietrantoni, 2009). Thus, we posit the following hypotheses:

Hypothesis 2.   Perceived stress is negatively related to a) hope and b) PSG.

Hypothesis 3.   Perceived stress mediates the effect of hope on PSG.

1.3. Empathy as a moderator

Empathy is the ability to understand the emotions of others (i.e., cognitive empathy) and share emotional states (i.e., affective empathy) (Jolliffe & Farrington, 2006). Empathy has been regarded as one of the direct predictors of growth (Brockhouse, Msetfi, Cohen, & Joseph, 2011). By utilizing the different strategies of empathy that engage one's cognition (e.g., perspective-taking) and affect (e.g., emotion-regulation), empathic individuals may be more in tune with their surroundings to yield beneficial outcomes (Weisz & Cikara, 2020). As such, empathy is a rudimentary mechanism in promoting adaptive social functioning, such as social cohesion (e.g., Kardos, Leidner, Pléh, Soltész, & Unoka, 2017) and emotional well-being (e.g., Morelli, Lieberman, & Zaki, 2015).

Although one's disposition for hope provides an important basis with which we may examine propensity for stress and PSG, hope itself is fundamentally a malleable construct (Snyder, 2002). Empathy, as a parallel motivated process for shared goal agency (e.g., Weisz & Cikara, 2020), may further facilitate hope's positive benefits in reducing stress and promoting PSG. For instance, under COVID-19, individuals who are steadfast in their position that the pandemic is merely a short-term setback in their pursuit of their long-term goals, thereby maintaining agentic control, may better temper their current stressors. Thus, we posit the following:

Hypothesis 4.   Empathy magnifies the effect of hope on perceived stress.

Empathy, as a fundamental response to emotion, can also increase the expression of positive emotions (Conoley, Pontrelli, Oromendia, Del Carmen Bello, & Nagata, 2015) through different regulatory strategies

such as perspective-taking and emotion regulation (Zaki, 2014). Such responses and expression of positive zeal may assist individuals to better cope with stressful events that subsequently promotes the development of PSG. Empathy composes of different levels (de Waal, 2008); at the core is emotional sharing and at the outermost layer is cognitive regulation. As an individual empathizes with others, regulatory strategies related to perspective-taking enable an individual to better engage with evaluating stressful events from viewpoint of others (Ruby & Decety, 2004), buffering the negative effects of stress (Rueger, Malecki, Pyun, Aycock, & Coyle, 2016). This process may help individuals redefine and understand their own stressful events, explore possible avenues of positive changes, and pursue paths to achieve those changes (i.e., PSG). Thus, we posit the following:

Hypothesis 5.   Empathy buffers the effect of perceived stress on PSG.

Lastly, prior studies have supported the notion that empathy directly and positively predicts PTG (Zhou, Wu, Yang, Wang, & Tian, 2019). As empathy is a mechanism by which one may accept and embrace vulnerability, it may assist in facilitating the PSG process by allowing individuals to be more flexible with their set goals (Brockhouse et al., 2011). Indeed, parallel with the products of hope (e.g., life goals, confidence; Fite et al., 2014), empathy may further magnify the traits necessary for PSG by promoting the individual to broaden their collective goals and perspectives (Brockhouse et al., 2011; Swickert, Hittner, & Foster, 2012). In other words, highly empathetic individuals may be more attuned to utilizing their social surroundings. This is likely to be particularly important in the context of a pandemic as social isolation under government issued stay-at-home orders may make seeking social support a more arduous venture. Thus, we posit the following:

Hypothesis 6.   Empathy magnifies the effect of hope on PSG.

1.4. The present study

Taken together, the current study first examined whether perceived stress mediates the relation between hope and PSG (Fig. 1). Secondly, we also examined the moderating effect of empathy on the indirect (paths *z1* and *z3*) and direct paths (path *z2*) in this model.

2. Method

2.1. Participants

The survey was approved by the ethics committee of the first author's university and all participants provided informed consent. A total of 1694 Chinese college students participated from February 06–15, 2020 (i.e., the first wave of COVID-19 in China). After removing invalid observations (i.e., missing data or other errors), 1666 participants (76.29% female) were included in the final analyses. The sample was composed of mostly first year students (60.73%) while second (25.76%) and third year students (13.51%) comprised the minority. The mean age was 19.18 (SD = 1.53) and 59.92% came from rural areas.

2.2. Research instruments

2.2.1. Hope scale
The Chinese version of the Herth Hope Index (HHI; Herth, 1992) was used to assess participants' levels of hope (Chan, Li, Chan, & Lopez, 2012). The HHI consisted of 12 items (e.g., "I have a positive outlook toward life") across three dimensions measuring hope for 1) the sense of temporality and future, 2) positive readiness and expectancy and 3) interconnectedness with self and others. All items were measured on a 4-point Likert scale (1 = *Strongly disagree*, 4 = *Strongly agree*), α = 0.73.

2.2.2. Post-stress growth inventory
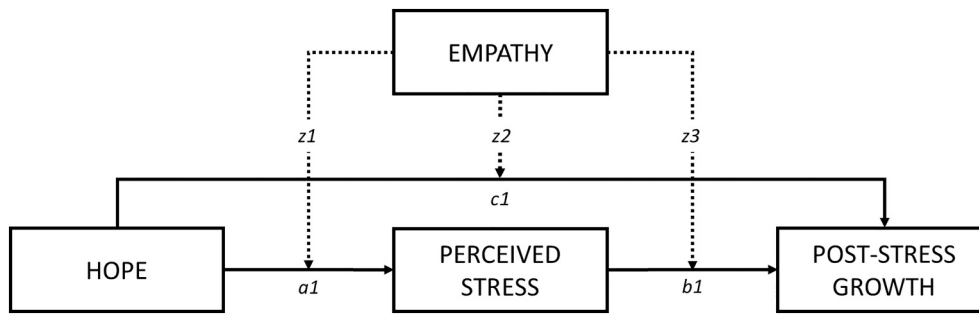The Chinese Post-Stress Growth Inventory (PSGI) was used to

Fig. 1. The conceptual mediated moderation model.

measure PSG (Wu & Fang, 2014). The PSGI consisted of 17 items (e.g., "I've learned to face problems with a positive attitude") across two dimensions: psychological growth and behavioral growth. All responses were measured on a 5-point Likert scale (1 = *Not at all*, 5 = *Exactly like me*), α = 0.96.

2.2.3. Perceived stress scale

The Chinese version (CPSS, Yang & Huang, 2003) of Perceived Stress Scale (PSS, Cohen, Kamarck, & Mermelstein, 1983) was used to measure perceived stress. CPSS consisted of 14 items (e.g., "Feel nervous and stressed") and included two dimensions pertaining to nervousness and feelings of loss of control. All items were measured on a 5-point Likert scale (1 = *Never*, 5 = Always), α = 0.84.

2.2.4. Empathy scale

The Chinese version (Geng, Xia, & Qin, 2012) of the Basic Empathy Scale (Jolliffe & Farrington, 2006) was used to measure empathy. The Chinese revised Basic Empathy Scale consisted of 16 items (e.g., "Seeing others helpless, I would like to help them") and included two dimensions: cognitive empathy and affective empathy. Individuals rated each item on a 5-point Likert scale (1 = *Not at all*, 5 = *Exactly like me*), α = 0.94.

2.3. Data analysis

Tests of normality revealed that the study variables showed no significant deviation from normality (i.e., Skewness < |3.0| and Kurtosis < |10.0|; Kline, 2005). Descriptive statistics were first calculated. PROCESS Models 4 and 59 macro for SPSS were used to test the mediation and moderated mediation models with 5000 random sample bootstrapping confidence intervals (CIs) (Hayes, 2013). All variables were standardized prior to being analyzed.

3. Results

3.1. Preliminary analysis

The Means, *SD*s and Pearson correlations are presented in Table 1. Hope was positively correlated with empathy and PSG. Perceived stress was negatively correlated with hope, PSG, and empathy while PSG was positively correlated with empathy.

Table 1
Descriptive statistics.

	M	*SD*	1	2	3	4
1. Empathy	3.87	0.55	1			
2. Perceived stress	2.65	0.57	−0.20***	1		
3. Hope	2.74	0.40	0.15***	−0.56***	1	
4. Post-stress growth	3.85	0.58	0.56***	−0.47***	0.35***	1

Note: ***p < 0.001.

3.2. Analysis of perceived stress as a mediator

To test the mediating effect of perceived stress (Fig. 1), five linear regression models were run (Table 2). Females tended to show greater stress (Models 2, 4) and PSG (Models 1, 3) compared to males. Hope was negatively related to perceived stress (Models 2, 4) and positively related to PSG (Models 1, 3). PSG was negatively predicted by perceived stress (Models 3, 5). Accordingly, perceived stress mediated the effect of hope on PSG ($a1*b1$ = 0.22, SE = 0.18, 95% CI [0.187, 0.259], $p < 0.001$), accounting for 63.07% of the total effect. All findings supported our given Hypotheses 1–3.

3.3. Analysis of empathy as a moderator

Model 4 (Table 2) examined the moderation effect of empathy on path *a1* while Model 5 examined the moderation effect on paths *b1* and *c1* (Fig. 1). Results showed a significant, negative interaction between hope and empathy on perceived stress (Model 4). The interaction effect is visually plotted in Fig. 2A. Simple slope tests revealed that hope had a significant negative effect on perceived stress in high- and low-level empathy. The effect of hope on perceived stress was weaker for college students with low levels of empathy (b_{simple} = −0.48, t = −17.11, $p < 0.001$) than for those with high levels of empathy (b_{simple} = −0.58, t = −22.64, $p < 0.001$).

Empathy positively interacted with both perceived stress and hope

Table 2
Linear regression models.

Predictors	Model 1 (PSG)	Model 2 (PS)	Model 3 (PSG)	Model 4 (PS)	Model 5 (PSG)
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Gender	0.11* [0.00, 0.22]	0.11* [0.01, 0.20]	0.15*** [0.05, 0.26]	0.14** [0.05, 0.24]	0.03 [−0.06, 0.12]
Hope	0.35*** [0.31, 0.40]	−0.56*** [−0.60, −0.52]	0.13*** [0.08, 0.18]	−0.53*** [−0.57, −0.49]	0.10*** [0.06, 0.15]
Perceived stress			−0.40*** [−0.45, −0.35]		−0.31*** [−0.36, −0.27]
Empathy				−0.13*** [−0.17, −0.09]	0.47*** [0.43, 0.51]
Hope × Emp				−0.05** [−0.09, −0.02]	0.05** [0.02, 0.09]
Per.Str × Emp					0.05** [0.02, 0.09]
R^2	0.12	0.32	0.23	0.34	0.45
F	116.42***	390.61***	165.67***	212.37***	223.88***

Note: Gender was dummy coded as 1 = *male*, 2 = *female*; *p < 0.05, **p < 0.01, ***p < 0.001; Emp = Empathy; PS = Perceived Stress; lower bound 95% CI for Gender in Model 1 = 0.0004.
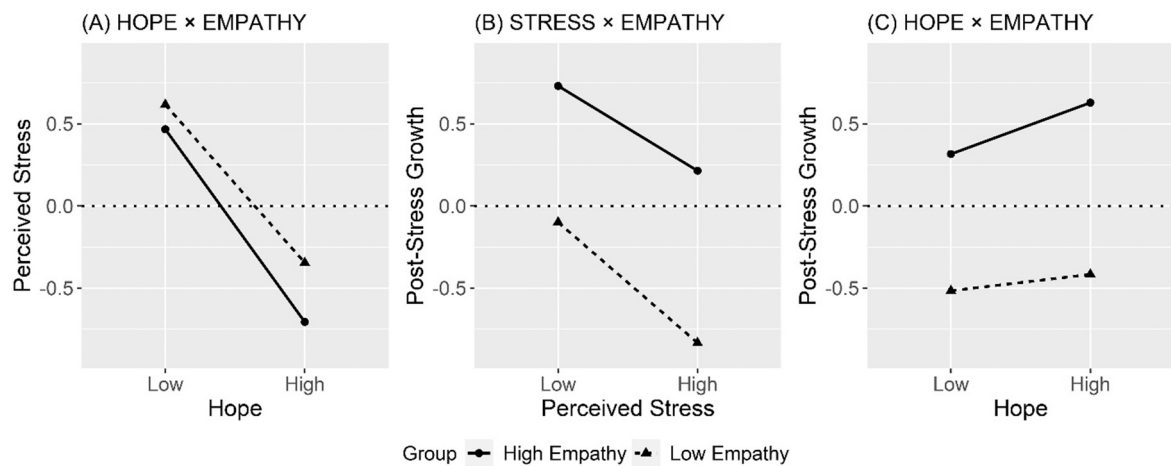
Fig. 2. Interaction graphs.

(Model 5) in predicting PSG (Fig. 2B–C). Simple slope tests showed that perceived stress had a significant negative effect on PSG in those with both low- ($b_{simple} = -0.36$, $t = -12.19$, $p < 0.001$) high-levels of empathy ($b_{simple} = -0.26$, $t = -8.92$, $p < 0.001$). However, the effect is noticeably smaller among those with high levels of empathy, indicating a buffering effect of empathy (Fig. 2B). Lastly, simple slope tests showed that hope had a significant predictive effect on PSG for in those with high- ($b_{simple} = 0.15$, $t = 5.30$, $p < 0.001$) but not low-level empathy ($b_{simple} = 0.05$, $t = 1.69$, $p = 0.092$), indicating a partial enhancing effect (Fig. 2C).

The bias-corrected percentile bootstrap analyses further showed that the indirect effect of hope on post-stress growth via perceived stress was moderated by empathy. Specifically, for those with high empathy, the indirect effect of hope on post-stress growth was significant ($\beta = 0.15$, $SE = 0.03$, 95% CI = [0.10, 0.21]) and slightly stronger for those with low empathy ($\beta = 0.18$, $SE = 0.03$, 95% CI = [0.12, 0.23]). Results showed that all three moderating pathways ($z1$–3) in Fig. 1 were significant, supporting Hypotheses 4–6.

4. Discussion

Our findings supported our hypotheses about the significant effects as well as the direction of effects. The study provided a unique opportunity to interpret the results within the context of the ongoing pandemic. Firstly, although females typically tended to report greater PSG than their male counterparts, consistent with prior findings (Vishnevsky, Cann, Calhoun, Tedeschi, & Demakis, 2010), our results also showed that females tended to report greater perceived stress. Thus, while there may be gender differences regarding the mechanisms used in promoting PSG, such as social support (Swickert et al., 2012), our findings suggest that differences in PSG may partly stem from females simply having more stress 'opportunities' for PSG. However, as elevated levels of stress can inhibit PSG, future research may be necessary to examine the extent to which females, compared to males, are at greater risk of their stressors becoming debilitating than adaptive.

4.1. Mediating effect of perceived stress

Results showed that perceived stress partially mediated the relation between hope and PSG, supporting our initial conjecture that hope is negatively related to stress, which in turn, is positively associated with PSG. These findings generally parallel prior literature (e.g., Hirsch & Sirois, 2016) and provide a positive outlook that hopeful college students may be able to self-regulate and mitigate stress (Ruby & Decety, 2004). By these means, this process may help students redefine stressful events and achieve PSG while pursuing meaningful goals (Shanahan

et al., 2020). Accordingly, we found evidence that excessive stress negatively impacted PSG, consistent with prior findings (Xu & Wu, 2014). As college students are typically in their late adolescence to young adulthood, they often lack the coping strategies to adequately manage the stressors of unexpected events, such as the COVID-19 pandemic. Thus, the threshold for when stressors exceed the available psychological resources to mitigate negative stress consequences may be lower than what one may expect in an older adult population.

Under the context of COVID-19, although the introduction of various vaccines provides a positive outlook for the imminent future, the rather capricious nature of the virus necessitates individuals to remain resilient. To this effect, those who are hopeful and remain so for the duration of the pandemic may be better equipped to not only mitigate the stressors stemming from any sudden or erratic developments of the virus but also may fare better in the long-term post-pandemic. This is particularly the case given our finding that hope remains a significant, positive predictor of PSG even after controlling for perceived stress.

4.2. The moderating effect of empathy

Empathy moderated the effect of hope on perceived stress as well as the effects of both hope and stress on PSG. In line with our hypothesis, the greater the empathy, the more hope was negatively associated with perceived stress. Given that cognitive and affective empathy may be related but utilize different strategies to achieve differential effects (e.g., Weisz & Zaki, 2018), we examined the constructs independently (Appendix Table A). The moderation effects, however, remained robust suggesting that cognitive and affective empathy likely both yield desired outcomes. Thus, we provide the following implications and discussion of the results referring to empathy as a collective, aggregate construct.

Although hope itself was a negative correlate of stress, the interaction effect suggests that hope can be coupled with empathy to best mitigate experiencing greater stress. Secondly, the more empathy one had, the smaller the negative effect of stress on PSG, consistent with our hypothesis and what would be expected given the literature (Ruby & Decety, 2004; Rueger et al., 2016). Lastly, empathy also bolstered the positive effect of hope on PSG, supporting our last hypothesis. Across all three indirect and direct paths, empathy provided clear benefits for promoting the positive outcomes of hope and buffering the negative outcomes of stress. Empathy may provide numerous benefits for individuals to further broaden their perspectives and scope of goals by being more in tune with their own vulnerability as well as viewing their issues from multiple angles.

Most notably, under the current climate of the pandemic, targeted interventions for addressing specific COVID-19 concerns as well as its peripheral consequences (e.g., concerns regarding the economy and job

market) may be useful in promoting PSG in the long-term. Further, as the pandemic has widely affected the majority of the global population in some manner or another, interventions for empathy may be especially conducive to increasing collective goal pursuit among those affected, motivating a shared sense of agency. The current study, however, did not specifically tailor the measured constructs to COVID-19 and thus requires additional research. That is, although COVID-19 related stressors are likely embedded within domain-general measures of perceived stress, the extent to which the current model can be generalized to the COVID-19 pandemic may require further validation.

Further, the difficulties in executing effective interventions to reap the benefits of empathy and hope amid an isolated state of society remains to be addressed. For college students, short online workshops, books, articles, and classes on improving values of hope and empathy may be viable alternatives to in-person interventions to best weather out the pandemic while promoting PSG. For teachers and parents, options may include creating a positive psychological environment for students to share collective goals or engaging students in taking multiple perspectives to tackling obstacles and challenges. However, it is also worth examining whether different interventions may yield varied positive outcomes. For instance, countries like China and South Korea have largely been effective in containing the spread of COVID-19. On the other hand, countries like the United Kingdom and the United States have experienced multiple waves of the virus in increasingly severe magnitudes. For those in countries still experiencing large waves of COVID-19, interventions for hope may be especially needed whereas those in countries that have been successful in containing the virus may examine avenues of research on post-COVID-19 growth.

4.3. Limitations and future directions

Several constraints exist for the current study. The cross-sectional nature of the study limits causal inference and future research may utilize experimental and/or longitudinal designs to further test the given model. This is important given that PSG may better manifest sometime after the stressful event. Although our study was conducted amid an ongoing pandemic, the study did not specifically measure variables related to COVID-19. Future research may opt to measure COVID-19 specific stressors and examine PSG when the pandemic passes. Given the dynamic development of the pandemic, PSG after short-term or acute stress response may also yield noteworthy findings.

5. Conclusion

In summary, although further research is needed, this study represents an important step in exploring how hope may be related to PSG among Chinese college students. The results show that perceived stress serves as one mechanism by which hope is associated with PSG. Interaction effects provide positive implications showing that it may be coupled with hope to further mitigate the onset of stress while promoting PSG. Future research can help the field design targeted interventions for tackling specific areas of concern, such as the COVID-19 pandemic, as well as future issues to come.

CRediT authorship contribution statement

Yangxiu Hu: Conceptualization, Investigation, Methodology, Validation, Formal analysis, Writing – original draft, Writing – review & editing, Data curation, Resources, Supervision, Project administration. **Baojuan Ye:** Conceptualization, Investigation, Methodology, Validation, Formal analysis, Writing – original draft, Writing – review & editing, Data curation, Resources. **Hohjin Im:** Writing – original draft, Writing – review & editing, Software, Visualization, Resources.

Acknowledgments

Appendix A

Table A
Examining effects of affective & cognitive empathy.

	Model 1 (PS)	Model 2 (PS)	Model 3 (PSG)	Model 4 (PSG)
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Gender	0.12* [0.03, 0.22]	0.13* [0.03, 0.22]	0.11* [0.01, 0.20]	0.06 [−0.03, 0.15]
Hope	−0.54*** [−0.58, −0.50]	−0.54*** [−0.58, −0.50]	0.11*** [0.06, 0.15]	0.11*** [0.06, 0.15]
Cog. Empathy	−0.11*** [−0.15, −0.07]		0.41*** [0.37, 0.44]	
Hope × Cog. Empathy	−0.05** [−0.08, −0.01]		0.05* [0.01, 0.09]	
Aff. Empathy		−0.10*** [−0.14, −0.06]		0.42*** [0.39, 0.46]
Hope × Aff. Empathy		−0.03 [−0.07, −0.002]		0.04* [0.003, 0.08]
PS			−0.33*** [−0.38, −0.29]	−0.33*** [−0.38, −0.29]
PS × Cog. Empathy			0.07** [0.09, 0.10]	
PS × Aff. Empathy				0.06** [−0.03, −0.10]
R^2	0.34	0.33	0.41	0.42
F	209.09***	205.97***	194.667***	203.04***

Note: *p < 0.05, **p < 0.01, ***p < 0.001; PS = Perceived stress; PSG = Post-stress Growth.

References

Brockhouse, R., Msetfi, R. M., Cohen, K., & Joseph, S. (2011). Vicarious exposure to trauma and growth in therapists: The moderating effects of sense of coherence, organizational support, and empathy. *Journal of Traumatic Stress, 24*(6), 735–742. https://doi.org/10.1002/jts.20704.

Chan, K. S., Li, H. C., Chan, S. W., & Lopez, V. (2012). Herth hope index: Psychometric testing of the Chinese version. *Journal of Advanced Nursing, 68*(9), 2079–2085. https://doi.org/10.1111/j.1365-2648.2011.05887.x.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385–396. https://doi.org/10.2307/2136404.

Conoley, C. W., Pontrelli, M. E., Oromendia, M. F., Del Carmen Bello, B., & Nagata, C. M. (2015). Positive empathy: A therapeutic skill inspired by positive psychology. *Journal of Clinical Psychology, 71*(6), 575–583. https://doi.org/10.1002/jclp.22175.

de Waal, F. B. (2008). Putting the altruism back into altruism: The evolution of empathy. *Annual Review of Psychology, 59*(1), 279–300. https://doi.org/10.1146/annurev.psych.59.103006.093625.

Dunn, L. B., Iglewicz, A., & Moutier, C. (2008). A conceptual model of medical student well-being: Promoting resilience and preventing burnout. *Academic Psychiatry, 32* (1), 44–53. https://doi.org/10.1176/appi.ap.32.1.44.

Dyrbye, L. N., Thomas, M. R., & Shanafelt, T. D. (2005). Medical student distress: Causes, consequences, and proposed solutions. *Mayo Clinic Proceedings, 80*(12), 1613–1622. https://doi.org/10.4065/80.12.1613.

Fite, P. J., Gabrielli, J., Cooley, J. L., Haas, S. M., Frazer, A., Rubens, S. L., & Johnson-Motoyama, M. (2014). Hope as a moderator of the associations between common risk factors and frequency of substance use among Latino adolescents. *Journal of Psychopathology and Behavioral Assessment, 36*(4), 653–662. https://doi.org/10.1007/s10862-014-9426-1.

Geng, Y., Xia, D., & Qin, B. (2012). The basic empathy scale: A Chinese validation of a measure of empathy in adolescents. *Child Psychiatry and Human Development, 43*(4), 499–510. https://doi.org/10.1007/s10578-011-0278-6.

Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis. *Journal of Educational Measurement, 51*(3), 335–337. https://doi.org/10.1111/jedm.12050.

Heinen, I., Bullinger, M., & Kocalevent, R. D. (2017). Perceived stress in first year medical students - associations with personal resources and emotional distress. *BMC Medical Education, 17*(1), 1–14. https://doi.org/10.1186/s12909-016-0841-8.

Herth, K. (1992). Abbreviated instrument to measure hope: Development and psychometric evaluation. *Journal of Advanced Nursing, 17*(10), 1251–1259. https://doi.org/10.1111/j.1365-2648.1992.tb01843.x.

Hirsch, J. K., & Sirois, F. M. (2016). Hope and fatigue in chronic illness: The role of perceived stress. *Journal of Health Psychology, 21*(4), 451–456. https://doi.org/10.1177/1359105314527142.

Hullmann, S. E., Fedele, D. A., Molzon, E. S., Mayes, S., & Mullins, L. L. (2014). Posttraumatic growth and hope in parents of children with cancer. *Journal of Psychosocial Oncology, 32*(6), 696–707. https://doi.org/10.1080/07347332.2014.955241.

Jolliffe, D., & Farrington, D. P. (2006). Development and validation of the basic empathy scale. *Journal of Adolescence, 29*(4), 589–611. https://doi.org/10.1016/j.adolescence.2005.08.010.

Joseph, S., Linley, P. A., Andrews, L., Harris, G., Howle, B., Woodward, C., & Shevlin, M. (2005). Assessing positive and negative changes in the aftermath of adversity: Psychometric evaluation of the changes in outlook questionnaire. *Psychological Assessment, 17*(1), 70–80. https://doi.org/10.1037/1040-3590.17.1.70.

Kardos, P., Leidner, B., Pléh, C., Soltész, P., & Unoka, Z. (2017). Empathic people have more friends: Empathic abilities predict social network size and position in social network predicts empathic efforts. *Social Networks, 50*, 1–5. https://doi.org/10.1016/j.socnet.2017.01.004.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). Guilford Press.

Morelli, S. A., Lieberman, M. D., & Zaki, J. (2015). The emerging study of positive empathy. *Social & Personality Psychology Compass, 9*(2), 57–68. https://doi.org/10.1111/spc3.12157.

Peltz, J. S., Daks, J. S., & Rogge, R. D. (2020). Mediators of the association between covid-19-related stressors and parents' psychological flexibility and inflexibility: The roles of perceived sleep quality and energy. *Journal of Contextual Behavioral Science, 17*. https://doi.org/10.1016/j.jcbs.2020.07.001.

Peterson, C., Park, N., Pole, N., D'Andrea, W., & Seligman, M. E. (2008). Strengths of character and posttraumatic growth. *Journal of Traumatic Stress, 21*(2), 214–217. https://doi.org/10.1002/jts.20332.

Prati, G., & Pietrantoni, L. (2009). Optimism, social support, and coping strategies as factors contributing to posttraumatic growth: A meta-analysis. *Journal of Loss & Trauma, 14*(5), 364–388. https://doi.org/10.1080/15325020902724271.

Ruby, P., & Decety, J. (2004). How would you feel versus how do you think she would feel? A neuroimaging study of perspective-taking with social emotions. *Journal of Cognitive Neuroscience, 16*(6), 988–999. https://doi.org/10.1162/0898929041502661.

Rueger, S. Y., Malecki, C. K., Pyun, Y., Aycock, C., & Coyle, S. (2016). A meta-analytic review of the association between perceived social support and depression in childhood and adolescence. *Psychological Bulletin, 142*(10), 1017–1067. https://doi.org/10.1037/bul0000058.

Salloum, A., Bjoerke, A., & Johnco, C. (2019). The associations of complicated grief, depression, posttraumatic growth, and hope among bereaved youth. *Omega, 79*(2), 157–173. https://doi.org/10.1177/0030222817719805.

Shanahan, M. L., Fischer, I. C., & Rand, K. L. (2020). Hope, optimism, and affect as predictors and consequences of expectancies: The potential moderating roles of perceived control and success. *Journal of Research in Personality, 84*, 103903. https://doi.org/10.1016/j.jrp.2019.103903.

Shi, G., Cui, L., Lei, L., & Zheng, R. (2013). Stress, affect and resilience in college students [Chinese]. *Chinese Mental Health Journal, 27*(9), 703–708.

Snyder, C. R. (2002). Hope theory: Rainbows in the mind. *Psychological Inquiry, 13*, 249–275. https://doi.org/10.1207/S15327965PLI1304_01.

Snyder, C. R., Harris, C., Anderson, J. R., Holleran, S. A., Irving, L. M., Sigmon, S. T., Yoshinobu, L., Gibb, J., Langelle, C., & Harney, P. (1991). The will and the ways: Development and validation of an individual-differences measure of hope. *Journal of Personality and Social Psychology, 60*(4), 570–585. https://doi.org/10.1037/0022-3514.60.4.570.

Song, M. (2020). Psychological stress responses to COVID-19 and adaptive strategies in China. *World Development, 136*, 105107. https://doi.org/10.1016/j.worlddev.2020.105107.

Swickert, R., Hittner, J., & Foster, A. (2012). A proposed mediated path between gender and posttraumatic growth: The roles of empathy and social support in a mixed-age sample. *Psychology, 3*(12), 1142–1147. https://doi.org/10.4236/psych.2012.312A168.

Tilbrook, A. J. (2010). Neuropeptides, stress-related. *Encyclopedia of Stress*, 903–908. https://doi.org/10.1016/B978-012373947-6.00735-2.

Vishnevsky, T., Cann, A., Calhoun, L. G., Tedeschi, R. G., & Demakis, G. J. (2010). Gender differences in self-reported posttraumatic growth: A meta-analysis. *Psychology of Women Quarterly, 34*(1), 110–120. https://doi.org/10.1111/j.1471-6402.2009.01546.x.

Weisz, E., & Cikara, M. (2020). Strategic regulation of empathy. *Trends in Cognitive Sciences.*. https://doi.org/10.1016/j.tics.2020.12.002.

Weisz, E., & Zaki, J. (2018). Motivated empathy: A social neuroscience perspective. *Current Opinion in Psychology, 24*, 67–71. https://doi.org/10.1016/j.copsyc.2018.05.005.

Wu, S., & Fang, W. (2014). Development of the undergraduates' post-stress growth questionnaire [Chinese]. *Chinese Mental Health Journal, 28*(10), 772–777. https://doi.org/10.3969/j.issn.1000-6729.2014.10.009.

Xu, J., & Wu, W. (2014). Work satisfaction and posttraumatic growth 1 year after the 2008 Wenchuan earthquake: The perceived stress as a moderating factor. *Archives of Psychiatric Nursing, 28*(3), 206–211. https://doi.org/10.1016/j.apnu.2013.12.006.

Yang, T., & Huang, H. (2003). An epidemiological study on psychological stress of urban residents in social transformation [Chinese]. *Chinese Journal of Epidemiology, 9*, 11–15.

Ye, B., Zhou, X., Im, H., Liu, M., Wang, X. Q., & Yang, Q. (2020). Epidemic rumination and resilience on college students' depressive symptoms during the COVID-19 pandemic: The mediating role of fatigue. *Frontiers in Public Health, 8*, 560983. https://doi.org/10.3389/fpubh.2020.560983.

Zaki, J. (2014). Empathy: A motivated account. *Psychological Bulletin, 140*(6), 1608–1647. https://doi.org/10.1037/a0037679.

Zhou, X., Wu, X., Yang, X., Wang, W., & Tian, Y. (2019). Emotional expression and cognitive reappraisal mediate the relation between empathy and posttraumatic growth amongst adolescents after Ya'an earthquake [Chinese]. *Psychological Science, 42*(6), 1321–1331. https://doi.org/10.16719/j.cnki.1671-6981.20190607.