# COVID-19 among Chinese high school graduates: Psychological distress, growth, meaning in life and resilience

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## Abstract

This study examined perceived impact of COVID-19 (PIC) on mental health outcomes (anxiety, depression, and posttraumatic growth) and roles of resilience and meaning in life. In October 2020, 430 Chinese high school graduates completed self-report measures. Results showed that 4.4% and 5.8% participants had anxiety and depression symptoms (≥10), respectively, while 13.3% developed posttraumatic growth (≥37.5). Resilience and meaning in life mediated the relationships between PIC and mental health outcomes. These findings underline psychological distress and growth coexisted in COVID-19, while resilience and meaning in life served as important protective factors of mental health.

## Introduction

As a public health emergency of international concern, the 2019 novel coronavirus disease (COVID-19) swept across the whole world at a startling speed. When our investigation was carried out in October 2020, there were still sporadic cases in China though the epidemic situation has been effectively suppressed. It has engendered long-term changes in people's daily lives (Arora and Grey, 2020) and ignited another epidemic of common mental disorders, including anxiety, depression (Bao et al., 2020; Odriozola-González et al., 2020), worry (Zysberg and Zisberg, 2020), fear (Giordani et al., 2020; Jaspal et al., 2020), and posttraumatic stress disorder (Liang et al., 2020). A recent study reported that more than half of the

general population rated the psychological impact of the outbreak as moderate or severe at the early stage of COVID-19 in China (Wang et al., 2020). In 2020, Gaokao, the China's national college entrance exam, was postponed for a month due to the impact of the COVID-19

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epidemic. Besides that, candidates of Gaokao across the country had experienced at least 3 months of home isolation and online classes before Gaokao. Researchers reported that social distancing and school closures during the COVID-19 pandemic may worsen students' existing mental health problems (Clemens et al., 2020; Matias et al., 2020). What kind of psychological journey did they go through during the COVID-19 epidemic? How did they cope with it successfully? In the current study, the above questions will be answered.

Recent studies demonstrate that traumatic events not only bring psychological distress to people, but also provide opportunities for the emergence of positive changes (Kalaitzaki et al., 2020; Tedeschi and Calhoun, 2004). On the one hand, the COVID-19 epidemic undoubtedly has brought people the obvious negative outcomes such as increased levels of anxiety, depression, and post-traumatic stress disorder (Li et al., 2020; Xiong et al., 2020; Zhou et al., 2020). On the other hand, the experience of a traumatic event may facilitate the development of positive changes termed as posttraumatic growth (Kalaitzaki et al., 2020; Tedeschi and Calhoun, 2004), which is manifested by improved relationship to others, new possibilities, personal strength, spiritual change, and appreciation of life (Tedeschi and Calhoun, 1996, 2004). As a psychological construct, posttraumatic growth is defined as enduring positive psychological change resulting from one's struggle with highly challenging life circumstances (Tedeschi and Calhoun, 2004). The COVID-19 epidemic may provide an opportunity to examine the development of posttraumatic growth. However, there are few studies on these COVID-19 related negative and positive outcomes simultaneously.

Abundant research evidence has suggested that resilience may protect individuals against the detrimental effects of traumatic events and offer psychological assets and resources that enable people to effectively cope with the challenges (Kalaitzaki et al., 2020). Defined as the ability to adapt to, or bounce back from, extremely unfavorable circumstances (Carver, 1998), resilience

is an important psychological variable closely related to mental health outcomes. Empirical studies have demonstrated that resilience can help people effectively cope with traumatic events and preserve well-being in clinical settings (Ogińska-Bulik and Zadworna-Cieślak, 2018; Yuan et al., 2018). Recent studies have revealed that individuals with more resilience may experience less anxiety and depression both in COVID-19 patients (Zhang et al., 2020) and in the general population (Ran et al., 2020) during the COVID-19 epidemic. As a personal resource, resilience can directly (Bensimon, 2012; Yu et al., 2013) or indirectly (Ogińska-Bulik and Zadworna-Cieślak, 2018) promote the development of positive growth for people who experienced stressful or traumatic events. Accordingly, this study examined the possible associations between psychological resilience and metal health outcomes among individuals who just experienced Gaokao during the COVID-19 epidemic.

Another psychological construct which has been revealed a strong linkage with mental health outcomes is meaning in life. It is defined as an innate drive to find meaning and significance in individuals' lives (Steger et al., 2006). According to Logotherapy Theory, meaning in life is an important psychological protective factor when people face major setbacks (Frankl, 1963; Zhong et al., 2019). Researchers have also argued that finding meaning in life is the primary motivating force for any individual (Frankl, 1988; Lew et al., 2020). Previous studies found that meaning in life had significant positive correlations with well-being and resilience (Doğan et al., 2012; Du et al., 2017). Through pursuing a sense of meaning in life, people confronted with adversities can alleviate psychological distress, such as anxiety (Steger, 2012; Trzebiński et al., 2020), depression (Yang et al., 2019), and suicide ideation (Kleiman and Beaver, 2013), as well as other forms of distress. Our most recent study showed that as a protective factor of mental health, meaning in life served as a mediator during the outbreak of COVID-19 in China (Yu et al., 2020a). Up to now, there are dozens of scales to measure individual meaning in life. According to the core proposition and concept of Logotherapy Theory
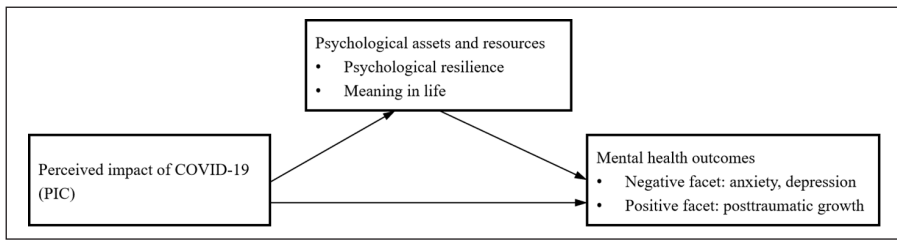
**Figure 1.** Hypothesized framework showing the relationships among perceived impact of COVID-19, psychological assets and resources, and mental health outcomes.

(Frankl, 1963), Chinese version of Life Attitude Profile Scale (LAP-C) was developed (He, 1979). This scale described meaning in life from six aspects: will to meaning, existential fullness, life purpose, life control, suffering acceptance, and death acceptance. In this study, the LAP-C was adopted to comprehensively capture the characteristics of meaning in life and its relationship with mental health outcomes.

As stated by Kalaitzaki et al. (2020), "in both research and intervention, a salutogenic framework should be adopted, aiming at examining and enhancing the factors that help people achieve health and well-being while exposed to stress," therefore, a framework was developed in the current study (see Figure 1) in order to explore effective techniques and strategies for the prevention and treatment of COVID-19 related emotional symptoms and for the emergence of positive changes. We assumed that the COVID-19 epidemic would bring about negative and positive mental health outcomes simultaneously, and as personal psychological assets and resources, psychological resilience and meaning in life serve as mediators between individual perceived impact of COVID-19 (PIC) and mental health outcomes. The research hypotheses are as follows:

Hypothesis 1 (H1): PIC is positively associated with anxiety, depression, and posttraumatic growth.

Hypothesis 2 (H2): Resilience and meaning in life are negatively associated with anxiety and depression, but positively associated with posttraumatic growth.

Hypothesis 3 (H3): Resilience and meaning in life mediate the links between PIC and mental health outcomes (anxiety, depression, and posttraumatic growth).

## Method

### Participants and procedures

This study was approved by the Ethics Committee of Sichuan International Studies University (IRB number: 20200001). All procedures were carried out in accordance with the Declaration of Helsinki. In order to avoid the investigation interference on the candidates before Gaokao, the candidates who passed Gaokao and successfully entered the university were recruited to participate in this investigation, in October 2020 (within 1 month after entering the university). Self-reported measures of background information, perceived impact of the COVID-19 epidemic, psychological distress (anxiety and depression), resilience, meaning in life, and posttraumatic growth were used. Prior to the formal investigation, piloting the questionnaires was conducted among five students in order to check content validity and standardize measurement procedures. These data were not included in the final analysis. In the formal investigation, a cluster sampling technique was used and 449 freshmen were recruited from two departments in one university in Chongqing, China. Of participants, 19 participants with completion time less than 300 seconds were excluded. The final sample for analysis consisted of 430 participants.

**Table 1.** Socio-demographic and psychological characteristics of participants (*n* = 430).

| Characteristics | *n* | % |
|---|---|---|
| Gender | | |
| Male | 83 | 19.3 |
| Female | 347 | 80.7 |
| Experienced medical isolation for at least 14 days | | |
| Yes | 98 | 22.8 |
| No | 332 | 77.2 |

| Characteristics | Mean | S.D. |
|---|---|---|
| Age | 18.51 | 0.91 |
| Perceived impact of COVID-19 (PIC) | 8.30 | 2.72 |
| Physical health | 1.15 | 0.45 |
| Emotion | 2.01 | 0.98 |
| Learning | 2.67 | 1.05 |
| Daily life | 2.47 | 1.02 |
| Meaning in life | 67.89 | 8.62 |
| Will to meaning | 12.65 | 1.83 |
| Existential fullness | 8.92 | 2.66 |
| Life purpose | 11.30 | 2.18 |
| Life control | 11.74 | 1.99 |
| Suffering acceptance | 12.22 | 2.10 |
| Death acceptance | 11.06 | 2.36 |
| Resilience | 20.15 | 3.61 |
| Posttraumatic growth | 28.65 | 10.00 |
| Spiritual change | 6.21 | 2.34 |
| Relationship to others | 6.15 | 2.30 |
| Personal strength | 5.87 | 2.29 |
| New possibilities | 5.43 | 2.25 |
| Appreciation of life | 5.00 | 2.08 |
| Anxiety | 4.09 | 3.18 |
| Depression | 4.34 | 3.77 |

Table 1 presents participants' socio-demographic and psychological characteristics. The ages of participants ranged from 15 to 22 years (Mean = 18.51, *S.D.* = 0.91). Among them, there were 83 male students (19.3%) and 347 female students (80.7%). All participants reported no history of serious psychiatric or neurological illness and no one were infected with the COVID-19 virus. During the outbreak of the COVID-19 epidemic, all the participants experienced home isolation and online study for more than 3 months, then passed Gaokao in July. There were 98 students in this study who reported that they had experienced medical isolation for at least 14 days during the COVID-19 epidemic because of contact with infected people or travel to high-risk areas.

Prior to the commencement, the purpose and contents of this study were explained to all participants. After the informed consent, a set of online self-reported questionnaires was administered to all participants.

## Study measures

*Perceived impact of COVID-19 (PIC).* The self-designed scale of perceived impact of the COVID-19 epidemic was used. Participants were asked to evaluate their perceived impact of the COVID-19 epidemic on themselves from four aspects (physical health, emotion, learning, and daily life) on a 5-point Likert-type scale from 1 (no impact) to 5 (a great impact). For example, "Please assess the impact of the COVID-19 epidemic on your physical health." The Cronbach's alpha coefficient for the PIC scale was 0.74 in the current study.

*Meaning in life.* Chinese version of Life Attitude Profile Scale (LAP-C) developed by He (1979) was adopted to measure individual perceived meaning in life. The original scale consists of 39 items and six dimensions: will to meaning (e.g. "Over my lifetime, I have felt a strong urge to find myself"), existential fullness (e.g. "I feel that some element which I can't quite define is missing from my life"), life purpose (e.g. "I have discovered a satisfying life purpose"), life control (e.g. "My accomplishments in life are largely determined by my own efforts"), suffering acceptance (e.g. "Suffering helps people understand the true meaning of life"), and death acceptance (e.g. "I am unprepared and scare about death"). Participants were asked to rate the items on a 5-point Likert-type scale from strongly disagree (1) to strongly agree (5). It has demonstrated adequate reliability and validity in Mainland Chinese (Li et al., 2018). In this current study, 18 items (three representative items for each dimension) were selected from

the original scale to investigate individuals' meaning in life at present. In the present study, the Cronbach's alpha coefficient for the total scale was 0.82 in this sample.

*Psychological resilience.* The 6-item Brief Resilience Scale was used to assess the ability to bounce back or recover from stress (Smith et al., 2008). For example, "I tend to bounce back quickly after hard times." It was scored on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). The higher the score, the stronger the resilience ability is. The scale presented adequate psychometric properties in the original and Chinese versions (Fung, 2020; Smith et al., 2008). The Cronbach's alpha coefficient for this scale was 0.75 in our sample.

*Anxiety.* The 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) was used to assess how often, over the past 2 weeks, an individual has been bothered by the anxiety symptoms of GAD (Qu and Sheng, 2015; Spitzer et al., 2006). For example, "Feeling nervous, anxious or on edge." The answers were rated on a 4-point scale from 0 (not at all) to 3 (nearly every day). According to the study by Spitzer et al. (2006), a GAD-7 score $\geqslant 10$ indicates the presence of clinically relevant anxiety symptoms. The GAD-7 has been demonstrated adequate reliability and validity among the Chinese sample (Qu and Sheng, 2015). The Cronbach's alpha coefficient for GAD-7 was 0.88 in this study.

*Depression.* The 9-item Patient Health Questionnaire (PHQ-9) is a self-administered depression module of the Patient Health Questionnaire (Kroenke et al., 2001; Lai et al., 2010; Zhang et al., 2013). For example, "Little interest or pleasure in doing things." It is a criterion-based instrument originally developed for depression screening in primary care. Participants were asked to rate their depression symptoms in the past 2 weeks on a 4-point Likert scale from 0 (not at all) to 3 (nearly every day). According to the study by Kroenke et al. (2001),

a PHQ-9 score $\geqslant 10$ indicates the presence of clinically relevant depression symptoms. Good reliability and validity of PHQ-9 in Chinese adults have been confirmed (Lai et al., 2010; Zhang et al., 2013). The Cronbach's alpha coefficient for PHQ-9 was 0.87 in our sample.

*Posttraumatic growth.* The short form of the Posttraumatic Growth Inventory (PTGI-SF) (Cann et al., 2010) is a 10-item measure of positive changes for those who have experienced adverse or traumatic events. The scale consists of five dimensions: relationship to others (e.g. "I have a greater sense of closeness with others"), new possibilities (e.g. "I established a new path for my life"), personal strength (e.g. "I discovered that I'm stronger than I thought I was"), spiritual change (e.g. "I have a better understanding of spiritual matters"), and appreciation of life (e.g. "I have a greater appreciation for the value of my own life"). Each dimension has two items. Participants were asked to rate the items on a 6-point Likert-type scale from 0 (no change) to 5 (experienced this change to a very great degree). According to previous studies (Jin et al., 2014; Zoellner and Maercker, 2006), total scores above the 75th percentile are considered to have probable posttraumatic growth. Therefore, the total scores of PTGI-SF above 37.5 were considered to indicate a moderate level of posttraumatic growth in this study. This scale has been proved to have good reliability and validity in Chinese people (Yu et al., 2018). The Cronbach's alpha coefficient for this scale was 0.93 in our sample.

## Data analysis

The significance of the multicollinearity problems among main study variables was tested in our study. Results showed that the maximum value of VIF was 2.53, less than the cut-off VIF value of 10 as recommended (Neter et al., 1985). Consequently, it indicated that there was no multicollinearity in this study. Descriptive statistics was used to describe the characteristics of individuals' perceived impact of COVID-19 (PIC), psychological resilience, meaning in

**Table 2.** Correlations among the study variables ($n = 430$).

| | PIC | Meaning in life | Resilience | Posttraumatic growth | Anxiety |
|---|---|---|---|---|---|
| Meaning in life | −0.22** | – | – | – | – |
| Resilience | −0.26** | 0.52** | – | – | – |
| Posttraumatic growth | 0.10* | 0.46** | 0.23** | – | – |
| Anxiety | 0.31** | −0.32** | −0.50** | 0.01 | – |
| Depression | 0.30** | −0.32** | −0.46** | 0.03 | 0.75** |

PIC: perceived impact of COVID-19.
*$p < 0.05$. **$p < 0.01$.

life, psychological distress (anxiety and depression), and posttraumatic growth. Pearson correlation analyses were carried out to describe the associations of study variables. Independent sample $t$-test was conducted to test the effects of gender and medical isolation on the psychological variables. According to previous literature (Cohen, 1988), the effect size was calculated with Cohen's $d$. Structural equation modeling (SEM) was adopted to examine the mediating roles of psychological resilience and meaning in life between PIC and mental health outcomes (anxiety, depression, and posttraumatic growth). A non-significant chi-square and values greater than 0.90 for the GFI, IFI, and CFI, were considered acceptable. SRMR and RMSEA values less than 0.05 were indicative of good fit (Browne and Cudeck, 1992). According to previous literature (Kraemer and Blasey, 2004), all continuous variables were centered in order to increase interpretability of the mediation model. Data analyses were performed with SPSS 24.0 and AMOS 20.0.

## Results

### Descriptive statistics

Mean scores and standard deviations of main study measures are presented in Table 1. Participants' scores on the GAD-7 and the PHQ-9 were $4.09 \pm 3.18$ and $4.34 \pm 3.77$, respectively. According to the clinical scoring standards ($\geq 10$), there were 19 students (4.4%) reporting anxiety symptoms and 25 students (5.8%) reporting depression symptoms. 76

participants (13.3%, total score of PTGI-SF $\geqslant$ 37.5) were considered to have posttraumatic growth. The characteristic of PIC was examined from four aspects (physical health, emotion, learning, and daily life). The results showed that the most severely affected aspect was learning, followed by daily life > emotion > physical health. Mean scores of the six factors of meaning in life from high to low were as follows: will to meaning > suffering acceptance > life control > life purpose > death acceptance > existential fullness. Besides that, mean scores of the five subscales of posttraumatic growth from high to low were as follows: spiritual change > relationship to others > personal strength > new possibilities > appreciation of life.

### Correlation analyses

Correlation analyses were performed to examine possible associations among PIC, meaning in life, resilience, posttraumatic growth, anxiety, and depression (see Table 2). Results showed that PIC was negatively related to meaning in life and resilience ($ps < 0.01$), while it was positively related to posttraumatic growth, anxiety, and depression ($ps < 0.05$). Meaning in life and resilience were positively associated with posttraumatic growth, but negatively associated with anxiety and depression ($ps < 0.01$). However, no significant association was found between anxiety and posttraumatic growth as well as between depression and posttraumatic growth ($ps > 0.05$). Accordingly, our hypotheses H1 and H2 in the present study were well supported.
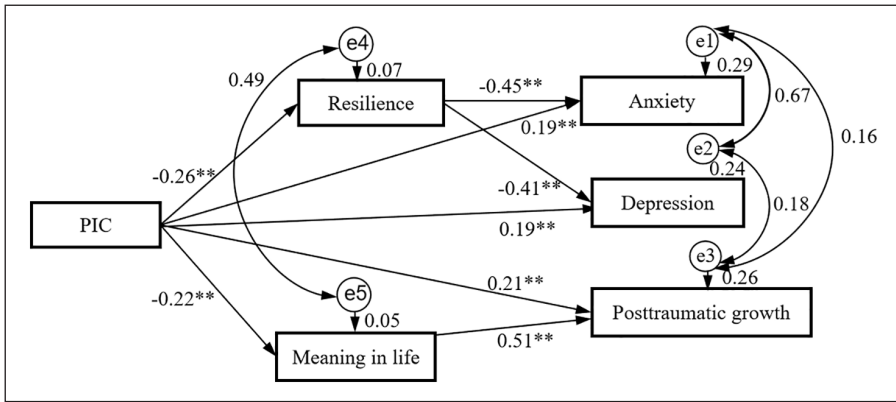
**Figure 2.** The first mediation model showing the relationships among PIC, resilience, meaning in life, and mental health outcomes.
PIC: perceived impact of COVID-19.
**p < 0.01.

## The effects of gender and medical isolation

Independent sample *t*-test indicated that male students reported higher levels of depression than female students with a small effect size (5.33 ± 4.47 vs 4.10 ± 3.55, $t = 2.67$, $p < 0.05$, Cohen's $d = 0.30$), while no gender difference was found in PIC ($t = 0.58$, $p = 0.56$), meaning in life ($t = 0.13$, $p = 0.90$), resilience ($t = 1.71$, $p = 0.09$), posttraumatic growth ($t = 0.80$, $p = 0.43$), and anxiety ($t = 1.02$, $p = 0.31$). It was also found that the students who had experienced medical isolation reported higher levels of posttraumatic growth with a small effect size (31.43 ± 8.21 vs 27.83 ± 10.03, $t = 3.16$, $p < 0.01$, Cohen's $d = 0.39$) than others without medical isolation experience, while no significant difference was found in other variables for students with or without medical isolation experience.

## Mediation analyses

To explore the impacts of COVID-19 on anxiety, depression, and posttraumatic growth and test whether resilience and meaning in life serve as mediators, tests for mediation were conducted by AMOS 20.0. In this model, three

pathways did not reach significance: resilience -> posttraumatic growth ($b = 0.10$, $p = 0.47$), meaning in life -> anxiety ($b = 0.02$, $p = 0.18$), and meaning in life -> depression ($b = 0.04$, $p = 0.06$). Thus, these non-significant pathways were deleted and the adjusted model was recalculated. As illustrated in Figure 2, the excellent model fit was obtained. The results indicated that PIC had direct and indirect impacts on anxiety and depression through resilience, while it also exhibited direct and indirect impacts on posttraumatic growth via meaning in life. Resilience had negative impacts on anxiety and depression, but no significant impact on posttraumatic growth. Meanwhile, meaning in life exhibited a positive impact on posttraumatic growth, but no significant impact on anxiety and depression. Considering the significant associations among resilience, meaning in life, and posttraumatic growth, a chained mediation model was constructed and analyzed.

As illustrated in Figure 3, the excellent model fit was obtained with a non-significant chi-square of 3.954 ($df = 3$, $p = 0.266$). The goodness-of-fit indices of the mediation model were as follows: GFI = 0.997, AGFI = 0.979, CFI = 0.999, SRMR = 0.022, and RMSEA = 0.027. These results revealed that PIC had direct positive impacts on anxiety ($b = 0.19$),
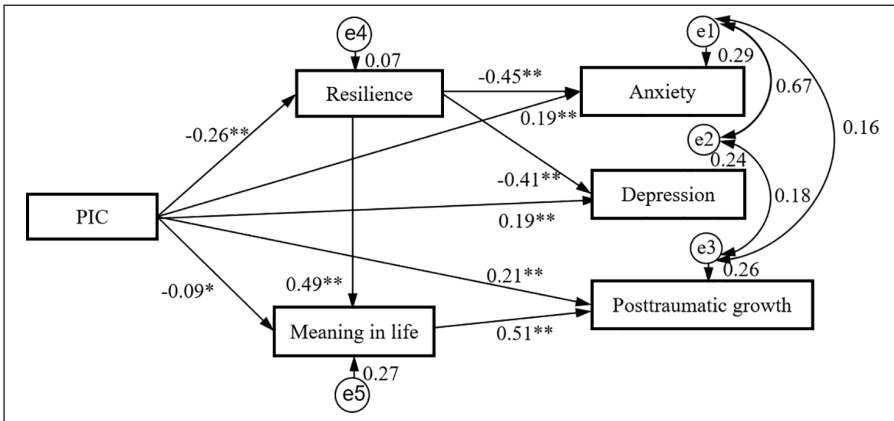
**Figure 3.** The chained mediation model showing the relationships among PIC, resilience, meaning in life, and mental health outcomes.
PIC: perceived impact of COVID-19.
$*p < 0.05.**p < 0.01.$

depression ($b=0.19$), and posttraumatic growth ($b=0.21$), while it had indirect effects on anxiety ($b=0.11$), depression ($b=0.12$), and posttraumatic growth ($b=-0.11$) through resilience and meaning in life. Meanwhile, PIC revealed significant direct impacts of $-0.26$ on resilience and $-0.09$ on meaning in life. It also revealed an indirect impact of $-0.13$ on meaning in life via resilience. Resilience only exhibited an indirect impact on posttraumatic growth ($b=0.25$) through meaning in life.

That is, resilience and meaning in life served as mediators between PIC and mental health outcomes. Meanwhile, resilience mediated the relationship between PIC and meaning in life, and meaning in life mediated the relationship between resilience and posttraumatic growth. Of note, PIC had a positive impact on posttraumatic growth totally. However, it exhibited a negative impact on posttraumatic growth indirectly. Therefore, our hypothesis H3 in the present study was partially supported.

## Discussion

The current study investigated the impact of the COVID-19 epidemic on positive and negative mental health outcomes among Chinese fresh high school graduates who just experienced Gaokao. It was found that among the four aspects (physical health, emotion, learning, and daily life), participants' learning was affected most severely by the epidemic, which lie in the fact that they prepared for Gaokao during the COVID-19 epidemic. School closures and the examination delay inevitably had a great impact on their learning. Their daily lives were also impacted seriously due to home isolation. In contrast, emotion and physical health were less influenced. The scores of GAD-7 and PHQ-9 revealed that the prevalence of clinically anxiety (4.4%) and depression (5.8%) among Chinese fresh high school graduates were lower than other student (Liu et al., 2020) and adolescent populations (Zhou et al., 2020) during the COVID-19 epidemic. Independent sample *t*-test showed that male students reported higher levels of depression than females, which well agree with a recent finding that males were more severely psychologically affected by the COVID-19 epidemic (Yu et al., 2020b). This phenomenon can be explained by the fact that males are less likely to use social resources and seek external advice when they encounter stress and frustration (Addis and Mahalik, 2003).

In this study, 13.3% participants were considered to develop posttraumatic growth. Although it was lower than that of earthquake

survivors in China (Jin et al., 2014), positive changes of fresh high school graduates in the COVID-19 epidemic should still be noticed. Positive changes in spiritual change and relationship to others were more obvious than other factors. This phenomenon was closely related to the anti-epidemic process in China. For the sake of the well-being of others, countless medical staff, policeman, community workers, volunteers et al. sacrificed their holidays, even their own health and lives, fighting in the front line of the epidemic (Chen et al., 2020; Zaka et al., 2020). Although ordinary citizens were not infected by the virus, they also responded positively to the government's call, voluntarily kept proper social distancing, and isolated themselves at home for slowing the COVID-19 spread (Somma et al., 2020; Tang et al., 2020). People's hearts were closely together and there was a will of the whole people to support individuals go through that difficult period. During the epidemic, they felt the mutual support among people and the spirits of courage to overcome difficulties, therefore, it is not difficult to understand these positive changes reported by participants. Independent sample t-test revealed that those who had experienced medical isolation reported higher levels of posttraumatic growth than other students without medical isolation, though they did not report more PIC, anxiety, and depression. The possible explanation is that medical isolation may offer them more time and space to be alone and ruminate which is helpful to rebuild inner harmony and promote the development of positive changes (Lew et al., 2020).

Resilience scores of this sample were not different from those of Chinese university undergraduates in another study ($20.15 \pm 3.61$ vs $19.85 \pm 3.31$, $t=1.73$, $p=0.09$) (Fung, 2020). Among six dimensions of meaning in life, will to meaning and suffering acceptance scored higher, and existential fullness scored lower. This indicated that participants in our study had strong willingness to seek meaning and accept the psychological distress brought about by the epidemic, whereas they still lacked sense of fullness and purpose in their life. It was consistent with a previous finding that the level of presence of meaning is lower than that of search for meaning among Chinese university students during the COVID-19 epidemic (Yu et al., 2020b).

Correlation and SEM analyses showed that perceived impact of COVID-19 (PIC) was negatively related to meaning in life and resilience ($ps < 0.01$), indicating that painful experiences had adverse effects on personal inner resources. Nevertheless, high levels of meaning in life and resilience increase resistance to stress and trauma and possess a positive impact on mental health (Nowicki et al., 2020; Ran et al., 2020), therefore, meaning in life and resilience were positively associated with posttraumatic growth, while negatively associated with anxiety and depression. Furthermore, posttraumatic growth was not related to anxiety and depression, which underscores the idea that positive and negative changes are relatively independent and may co-occur in the context of COVID-19. It confirms the fact that psychological distress and growth coexisted for individuals experiencing stressful or traumatic events (Schroevers et al., 2011; Yu et al., 2014). The results also showed that psychological assets and resources did play a vital role in maintaining and improving mental health and stability during the COVID-19 epidemic.

The chained mediation model revealed that PIC had a complex relationship with posttraumatic growth. On the one hand, PIC had a positive and direct impact on posttraumatic growth, confirming that stress and/or trauma are necessary for the emergency of positive growth (Tedeschi and Calhoun, 2004). On the other hand, by reducing their psychological resilience and meaning in life, PIC exhibited a negative impact on posttraumatic growth and a positive impact on anxiety and depression which indicated that psychological resilience and meaning in life are salutogenic to mental health (Aliche et al., 2019; Yu et al., 2013). Meanwhile, meaning in life emerged as a mediator in the relationship between psychological resilience and posttraumatic growth, which is in line with a previous finding that resilience can help people understand the value of life, find new meaning, determine their life priorities, and achieve

spiritual well-being (Üzar-Özçetin and Hiçdurmaz, 2019). Accordingly, this study fills a part of the present knowledge gap by demonstrating that psychological distress and growth coexisted in the context of COVID-19. In addition, the contribution of resilience and meaning in life to positive and negative mental health outcomes was found to be above and beyond the impact of COVID-19. Furthermore, it was proved that psychological resilience and meaning in life carried the impact of COVID-19 on positive and negative mental health outcomes.

Nevertheless, several shortcomings of this study should be noted. Firstly, the cross-sectional design limits its ability to infer the causal relationship among main study variables. For example, there may be an inverse relationship between PIC and mental health, whereby individuals with less anxiety and depression may be inherently less likely to perceive the impact of COVID-19, while those who had higher levels of anxiety and depression may be more likely to be disturbed. Therefore, further longitudinal investigation is necessary. Secondly, the high school graduates who successfully passed Gaokao and entered the university were recruited in this study. According to a previous study (Chapman, 2011), students who had passed the examination had better mental health scores than those who had failed the examination. Thus, those who failed in the examination should deserve the attention of mental health specialists as well. Thirdly, the pressures from the COVID-19 epidemic and Gaokao were intertwined, so it is difficult to distinguish the impacts of these two things on participants in this study. Fourthly, as noticed by researchers (O'Connor and Evans, 2020), whether participants' COVID-19 reltated information were honestly disclosed or not may affect the objectivity of our results. Finally, the small sample size may limit the generalization of the results. Therefore, the findings obtained in this study need to be further verified in other populations. Despite these limitations, current findings clarified the pathway how COVID-19 exhibits the impacts on positive and negative mental health outcomes. Our results showed that COVID-19 has not only brought about anxiety and depression symptoms, but also offered individuals the opportunity to develop positive changes in several aspects such as spiritual change and relationship to others. In addition, resilience and meaning in life were found to serve as mediators and act as important protective factors of mental health outcomes. These findings suggested that psychological resilience training and the promotion of meaning in life can effectively prevent the occurrence of emotion symptoms and promote the emergence of positive growth, which may offer guidance on professional counseling and psychological interventions for individuals suffering from COVID-19-related threat and pressure.

## Declaration of conflicting interests

## Funding

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