Comparison between emerging adults and adults in terms of contamination fear, post-COVID-19 PTSD and psychiatric comorbidity

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Abstract
The present study compared Chinese emerging adults and adults regarding the association between contamination fear, posttraumatic stress disorder post-COVID-19 and psychiatric comorbidity after controlling for demographic and trauma exposure variables. 1089 Chinese civilians (M = 382; F = 707) with a mean age of 26 years (M = 26.36, SD = 8.58) were recruited from different provinces in China via an online survey posted on mainstream Chinese social networking platforms. They completed a demographic page with questions on trauma exposure, the Vancouver Obsessional Compulsive Inventory, the Posttraumatic Stress Disorder Checklist for DSM-5 and the General Health Questionnaire-28. Results showed that 12.7%, 68.7% and 18.6% met criteria for full, partial and no PTSD, respectively. Emerging adults reported significantly lower levels of symptoms of re-experiencing, avoidance, somatic problems, anxiety and fear of contamination than adults. In both emerging adults and adults, contamination fear was correlated with PTSD and psychiatric comorbidity. High educational attainment was significantly correlated with psychiatric comorbidity in emerging adults, but with PTSD in adults. Length of quarantine was correlated with psychiatric comorbidity only in adults. In conclusion, both emerging adults and adults developed varying levels of contamination fear, posttraumatic stress and general psychological symptoms following the outbreak of COVID-19. Emerging adults were more resilient than adults in coping with distress.

Keywords Contamination fear · PTSD · COVID-19 · Emerging adults

Introduction
Coronavirus disease (COVID-19), caused by a highly contagious coronavirus (Severe Acute Respiratory Syndrome Coronavirus 2, SARS-CoV-2), was first identified in Wuhan, China, in December 2019 and declared a pandemic in March 2020. This illness may increase the risk of post-traumatic stress disorder (i.e. post-COVID-19 PTSD) (Boyzraz & Legros, 2020; Coleman, 2020), with prevalence rates ranging from 1 to 98% among hospital patients (Bo et al., 2020; Guo et al., 2020) and 3.8–12.6% among healthcare workers (Chew et al., 2020; Kang et al., 2020; Lai et al., 2020; Yin et al., 2020).

In Spain, 36.6% of the population was reported to have post-COVID-19 PTSD shortly after the outbreak, with avoidance behaviours being the most common symptom (Rodriguez-Rey et al., 2020; Taylor et al., 2020). In addition to avoidance behaviours, fear, anger and hopelessness were also common. Interestingly, their fear was more about fear of the negative impact COVID-19 had on their household...
income, access to health care and food supply, rather than threats to life (Trnka & Lorencova, 2020).

When community adults living in Wuhan and surrounding cities in China were studied, a prevalence rate of 7% for post-COVID-19 PTSD was found (Liu et al., 2020). A slightly lower rate (4.6%) was found among people living outside Wuhan, although it was higher (18.4%) among people with a suspected or confirmed COVID-19 diagnosis or those who had close contact with an infected person (Sun et al., 2020). COVID-19 affects not only adults but also young people, 14.4% of whom from China reported PTSD symptoms, while almost 40.4% reported psychiatric comorbidity (Liang et al., 2020). These traumatic effects can last over a long period of time, partly due to unresolved traumatic stress in schools and families (Zhou, 2020).

In addition to PTSD symptoms, people may experience mild (19.4%) and moderate to severe (18.6%) global psychological distress after the outbreak (Moccia et al., 2020). People in China have been found to experience mild (about 5–10%), moderate (1–6%) and severe anxiety (13%), and mild (10–14%), moderate (2–18%) and severe (1–9%) depression (Ahmed et al., 2020; Wang et al., 2020a, b), while approximately 2%, 10% and 29% experienced increased alcohol dependence, harmful drinking and hazardous drinking, respectively; 32.1% were also thought to have low psychological well-being (Ahmed et al., 2020). Other psychological symptoms included obsessive compulsion, interpersonal sensitivity, phobic anxiety and psychosis in more than 70% of the Chinese civilian population in different parts of China (Tian et al., 2020).

The above prevalence rates of PTSD and comorbid psychiatric symptoms suggest that there are individual differences in the manifestation of the psychological impact of COVID-19. Understanding these clinical manifestations is important. It will help us understand the underlying nature of the disorders and build aetiological models that will then guide treatment (Contractor et al., 2018; Litz et al., 2018; Pietrzak et al., 2014). These are the reasons for conducting the current study, which aimed to investigate aetiological factors for post-COVID-19 PTSD.

Several research gaps are noteworthy from the previous literature. First, while awareness has been raised that fear of contamination associated with COVID-19 can affect people’s mental health (French & Lyne, 2020; Pozza et al., 2020), systematic research on this topic is limited. One study claimed that worries about germs, obsessive-compulsive contamination behaviour and checking rituals are associated with COVID stress syndrome, which is characterised by fear of the dangerousness of COVID-19 and of foreigners coming to their countries and spreading the virus (xenophobia), compulsive checking behaviour and worries about the socioeconomic costs of the virus (Taylor et al., 2020). However, this study did not focus on the relationship between contamination fear, post-COVID-19 PTSD and psychiatric comorbidity. More research is clearly needed to investigate this, which is the first knowledge gap for the current study.

Second, in examining this relationship, it is essential to consider the ‘victim variables’ that have been shown to influence trauma responses and distress outcomes (Friedman et al., 2007; Vogt et al., 2007). In the context of COVID-19, these variables include gender, with female gender being a consistent predictor of stress (Boyraz & Legros, 2020; Liu et al., 2020; Rodriguez-Rey et al., 2020; Sun et al., 2020; Yin et al., 2020), low educational attainment (Liang et al., 2020) and social inequality such as poverty (Boyraz & Legros, 2020). Certain COVID-19 trauma exposure characteristics are also thought to be associated with increased PTSD and psychiatric comorbidity (Boyraz & Legros, 2020; Yin et al., 2020). These characteristics can be identified based on individuals’ place of residence (whether or not they live in the Wuhan epicentre) (Liu et al., 2020; Sun et al., 2020), personal infection with the virus (Jiang et al., 2020), personal contact with an infected family member (Kisely et al., 2020; Wytrychiewicz et al., 2020), the experience of quarantine (Blackman, 2020; Dutheil et al., 2020), loss of a person to the virus (Blackman, 2020; Boyraz & Legros, 2020; Dutheil et al., 2020; Kokou-Kpolou et al., 2020), personal occupation (e.g. healthcare worker) (Boyraz & Legros, 2020; Lai et al., 2020) and occupation of others (family members as COVID-19 healthcare workers) (Jiang et al., 2020).

Third, it remains unclear to what extent the interrelationship between victim variables, contamination fear, post-COVID-19 PTSD and psychiatric comorbidity might vary depending on the current developmental stage of the victims. The present study aimed to clarify this by comparing emerging adults (Arnett, 2000) who were approximately between 18 and 25 years old with adults (26+). Why is it important to conduct such a study? A recent claim is that COVID-19 can impact emerging adults and adults in different ways, whether through changes in the way they are educated, the prospect of a job in the future for emerging adults, or through unemployment, financial difficulties, increased vulnerability to the virus for adults, both middle-aged and older (Martin, 2020). In other words, emerging adults and adults should differ in the way they respond to the impact of the pandemic.

Furthermore, trauma research seems to show that emerging adults are particularly vulnerable to trauma exposure (Borsari et al., 2008; Daigle et al., 2008; Fisher et al., 2006; Rennison & Addington, 2018). It is estimated that approximately 80–90% of them will experience high rates of PTSD symptoms and psychiatric comorbidity such as substance abuse at some point in their lives (Arnett, 2000,
In addition, emerging adults are in a stressful developmental period where they do not feel like adolescents or adults and are still searching for their own identity (Arnett, 2006). According to a large-scale international study (Gibson-Cline, 2000), this identity crisis has caused them great anxiety and stress. In other words, although they struggled with the identity crisis in adolescence, their struggle with questions about values in life, role and involvement in society, views on work, politics, religion and intimacy continued into adulthood (Erikson, 1968).

**The aim of the current study**

The purpose of the current study was to examine whether the relationships between contamination fear, COVID-19 PTSD, and psychiatric comorbidity differ between emerging adults and adults after controlling for victim variables (see the hypothesised model depicted in Fig. 1). Given the literature highlighting the differential impact of COVID-19 on people in the community, as well as the vulnerability of emerging adults, one would hypothesize that (1) emerging adults would report higher levels of contamination fear, PTSD and psychiatric comorbidity than adults and (2) the composition of the hypothesised model would vary between emerging adults and adults. The extent to which the model differs is difficult to assess due to the lack of literature comparing these two groups in the context of COVID-19.

**Method**

**Procedure**

After ethical approval from the affiliated university, 1216 Chinese citizens were recruited via an online survey in April 2020. The link to the survey was posted on the main Chinese social networking platforms (wenjuanxing, wechat). The inclusion criteria were: (1) 18 years old or older, living in China, and (2) of Chinese descent. Following the literature (Liu et al., 2020), the exclusion criteria were: (1) completing the questionnaires in 2 min or less or 30 min or more; (2) a traceable pattern in responses (e.g., all items were scored 1 or 2); and (3) Chinese living abroad. Of the 1216 participants, 127 responses were removed based on these criteria; 1089 valid responses were then included in the study. All questionnaires went through the back-translation procedure. The original English versions were translated into Chinese, which was back-translated into English by another translator who had a good command of both Chinese and English. The two translators discussed any discrepancies in the questionnaire items with the first author of the research team, if necessary, until a consensus was reached.

**Fig. 1** Hypothesized structural equation model associating fear contamination, PTSD and psychiatric co-morbidity with demographic variables and trauma exposure adjusted

*Note:* RE: re-experiencing symptoms; AV: avoidance; NCM: negative cognition and mood; AR: hyperarousal; SM: somatization; AX: anxiety; SDY: social dysfunction; DE: depression; DEMO: demographic variables; TE: trauma exposure.
The power calculation assumes analysis using a structural equation model. Based on the number of observed (n = 11) and latent variables (n = 3) and a medium effect size (f² = 0.10), the calculation resulted in a minimum sample size of 1000 with a power of 0.95 and an alpha of 0.05.

Participants

The 1089 participants (M = 382; F = 707) were on average 26 years old (M = 26.36, SD = 8.58). They were mainly from Guangdong (49%), followed by Hubei (9%) and Henan (6%), the provinces considered to have the worst outbreaks (https://www.sohu.com/a/372505431_260616). Their family income ranged from RMB 5,000 to more than RMB 20,000 per month; slightly more than half (55%) were university students, the rest were doctors, managers and labourers; 67% had a bachelor’s degree and 22% had a postgraduate degree. A large majority were single (68%).

Measures

Demographic information was collected on age, gender (1 = male, 2 = female), marital status (1 = single, 2 = married, 3 = divorced, 4 = widowed), educational attainment (1 = up to secondary school, 2 = up to college level, 3 = undergraduate degree, 4 = postgraduate degree), occupation (1 = managerial position, 2 = non-managerial position, 3 = self-employed, 4 = student, 5 = unemployed) and income level (1 = less than 5000, 2 = 5000–10,000, 3 = 10,000–20,000, 4 = more than 20,000 RMB per month).

Information on COVID-19 trauma exposure characteristics was collected with the following questions: Where do you live? (1 = Hubei, 2 = Guangdong, 3 = Zhejiang, 4 = Henan, 5 = Hunan, 6 = Anhui, 7 = other). Are you or any of your family members a frontline doctor or nurse? (1 = yes, 2 = no), have any of your immediate family members become infected? (1 = yes, 2 = no), has one of your immediate family members died as a result of COVID-19? (1 = yes, 2 = no), did you have a cold, cough or fever during the epidemic? (1 = yes, 2 = no), were you COVID-19 diagnosed or suspected of having COVID-19? (1 = yes, 2 = no), how long ago did you learn about the outbreak? (1 = first, 2 = middle, 3 = last 10 days in December, 4 = first, 5 = middle, 6 = last 10 days in January), how long ago did you start quarantine? (1 = last 10 days in January, 2 = first, 3 = middle, 4 = last 10 days in February, 5 = first, 6 = middle, 7 = last 10 days in March), how long did your quarantine last? (1 = 14 days, 2 = one month, 3 = one and a half months, 4 = two months, 5 = two and a half months, 6 = 3 months, 7 = 3 months or longer), and are you still in quarantine? (1 = at home, 2 = in isolation, 3 = not in quarantine).

The Vancouver Obsessional Compulsive Inventory (VOCI; Thordarson et al., 2004) is designed to assess a range of obsessions, compulsions, avoidance behaviours and personality traits related to obsessive-compulsive disorder using a five-point rating scale (0 = not at all to 4 = very much). For the current study, the contamination subscale (12 items) was used to measure contamination-related obsessive-compulsive symptoms, i.e., fear of contamination and washing compulsions after the onset of COVID-19. This subscale showed excellent internal consistency (0.79 ≤ α ≤ 0.92), test-retest reliability (coefficients 0.53 or higher), convergent and discriminant validity (0.59 or higher for correlations with other contamination measures) not only in patients with obsessive-compulsive disorder but also in the general population (Gönner et al., 2010; Olatunji et al., 2007). The Cronbach’s α for the total score was 0.92 in the present study.

The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5; Weathers et al., 2013) was used to measure PTSD with COVID-19 as the index trauma. This scale is composed of four subscales: Re-experiencing symptoms, avoidance symptoms, negative mood and cognition and alterations in arousal and reactivity, which are scored using the following criteria: 0 = not at all to 4 = extremely. High total scores mean a higher severity. Meeting the diagnostic criteria for the four symptom groups leads to a probable full-PTSD diagnosis; fulfilment of the criteria for one, two or three of the symptom groups leads to a partial-PTSD diagnosis; meeting no criteria for any of the symptom groups means no-PTSD. This classification has been adopted from the literature, e.g. (Chung & Wall, 2013). The PCL-5 has been shown to be psychometrically excellent: Cronbach’s α = 0.94; test-retest reliability = 0.82; convergent validity between 0.74 and 0.85 and discriminant validity between 0.31 and 0.60 (Blevins et al., 2015). Based on the current sample, the Cronbach’s α of the total score was 0.93.

The General Health Questionnaire-28 (GHQ-28; Goldberg & Hillier, 1979) comprises four subscales: somatisation, anxiety, social dysfunction and severe depression on a rating scale of 1 = not at all to 4 = much more than usual. Higher scores indicate greater overall psychological distress. The GHQ-28 is well validated and used cross-culturally, with Cronbach’s α ranging from 0.78 to 0.95 (Aradakani et al., 2016; Monteiro, 2011; Wang et al., 2020a, b). In the current sample, the Cronbach’s α of the total score was 0.94. Although this scale was developed some time ago, it is recommended as a validated and standardised questionnaire to measure global dysfunction associated with PTSD (Raphael et al., 1989).
Data analysis

Descriptive statistics were used to describe the basic demographic information. Independent T-tests were used to compare differences between emerging adults and adults in contamination fear, PTSD and psychiatric comorbidity. Bivariate correlation analysis, including point bi-serial correlation ($r_{pb}$), was conducted to examine whether dummy-coded demographic variables were correlated with outcome variables. Variables with significant correlations were controlled for in structural equation modelling. For PTSD and psychiatric comorbidity, subscales were used as indicators. For obsessional compulsive behaviour, random item parcels (three parcels of four items each) were used (Kline, 2015). The advantage of item parceling over using all items as indicators was the increase in model fit, parsimony and reliability (Little et al., 2002). In structural equation modelling with maximum likelihood estimation, measurement invariance was tested by comparing chi-square and model fit differences between models with and without factor loading constraints. Non-significant results would suggest that the constructs have similar meaning for both emerging adults and adults (Cheng et al., 2013). Models would be considered to fit the data if the comparative fit index (CFI) and Tucker-Lewis index (TLI) were 0.90 or greater, the root mean square error of approximation (RMSEA) and standard root mean-square residual (SRMR) were within 0.06–0.08, and the ratio of $\chi^2$ by degree of freedom less than 3 (MacCallum et al., 1996). All analyses were conducted using SPSS25 and Mplus7.0. Normality of the data, assumptions regarding linearity and homoscedasticity were checked. PTSD and GHQ-28 totals were subjected to log transformation. No outliers were detected. Regression imputation was used to estimate missing responses. This is an acceptable method for data with a total number of missing responses of less than 2% (Schafer & Graham, 2002), as was the case for the present study.

Results

Descriptive information

A minority of participants worked or had family members who worked as frontline doctors or nurses (4.5%), had immediate family members infected with the virus (0.4%) or showed symptoms of cough, cold or fever during the epidemic (8.7%). One participant was diagnosed with or suspected of having COVID-19. In another, a family member had died as a result of the virus. Most of them (78.9%) learned about the epidemic after the first ten days in January 2020 and started quarantine at home (83.4%). The duration of quarantine ranged from 14 days to more than 3 months. At the time of the study, 70% were no longer in quarantine.

Using the diagnostic criteria of PCL-5, 12.7% of them met the criteria for full-PTSD, 68.7% partial-PTSD and the rest (18.6%) no-PTSD. The rate of full-PTSD was higher than among adults in the Chinese community (Liu et al., 2020), but lower than among those suspected of having COVID-19 or described in the literature as having contact with an infected person (Sun et al., 2020). The present study extended the existing literature by going beyond the typical dichotomous approach (PTSD vs. no PTSD) to consider partial PTSD, criteria for which were met by almost 70% of the current sample.

Following the age range for the two developmental stages from the literature (Arnett, 2000), participants were divided into emerging adult (18–25 years) (N = 633, 58%) and adult (26+) (N = 456, 42%) groups. The vast majority (90%) of emerging adults were single university students, had no children of their own and therefore were not concerned about how COVID-19 affected financial obligations for their families. Diagnostic status (PTSD, partial-PTSD, no-PTSD) was not correlated with stage of development. However, there were significant differences between the developmental groups in terms of how long ago they learned about the COVID-19 outbreak, whether they lived in the provinces with the worst outbreaks, when they started quarantine and for how long, and whether they were still in quarantine at the time of the study. Emerging adults had significantly lower scores for intrusion, avoidance, somatic concerns, anxiety and contamination fear than adults (see Table1).

Structural equation modelling results

Bivariate correlations were conducted prior to analysis of SEM to determine which demographic and trauma exposure variables were correlated with outcomes. Because most participants were not frontline physicians or nurses, were not diagnosed or suspected of having COVID-19 and did not have family members who had been infected with or died from the virus, these trauma exposure variables were not included in the bivariate correlations. Results showed that education (dummy: below postgraduate level vs. postgraduate level, $r_{pb}$=0.12 for PTSD; $r_{pb}$=0.11 for psychiatric comorbidity) and length of quarantine (dummy: two months or less vs. more than two months, $r_{pb}$=0.06 for PTSD; $r_{pb}$=0.07 for psychiatric comorbidity) were the only demographic and trauma exposure variables associated with distress outcomes. They were therefore adjusted for analysis.

The measurement model comprising the whole sample was first examined and found to have a good model fit ($\chi^2=247.298$, df=39, TLI=0.959, CFI=0.971,
Comparing emerging adults & adults in trauma exposure, PTSD, psychiatric co-morbidity and contamination fear

|                      | Emerging adults | Adults |
|----------------------|-----------------|-------|
|                      | N   | %   | N   | %   | χ²  |
| Full-PTSD            | 83  | 8   | 55  | 5   | 3.15|
| Partial-PTSD         | 422 | 39  | 326 | 30  | -----|
| No-PTSD              | 128 | 12  | 75  | 7   | -----|
| Knew about the virus before January | 163 | 15  | 66  | 6   | 20.30***|
| Living in provinces with the worst outbreaks | 37  | 3   | 64  | 6   | 21.12***|
| Started quarantine at the end of January | 550 | 51  | 358 | 33  | 13.43***|
| Quarantine length less than a month | 120 | 11  | 158 | 15  | 49.82***|
| Quarantine length one to two months | 199 | 18  | 159 | 15  | -----|
| Quarantine length more than two months | 314 | 29  | 139 | 12  | -----|
| Currently in quarantine | 246 | 23  | 81  | 8   | 56.16***|
| Re-experiencing       | M   | SD  | M   | SD  | T   |
| Arousal               | 4.02| 3.50| 4.52| 3.33| -2.35*|
| Avoidance             | 2.83| 1.95| 3.20| 1.95| -3.04**|
| Negative mood & cognition | 4.15| 4.68| 4.54| 4.34| -1.39|
| Arousal               | 3.42| 4.29| 3.50| 3.97| -0.24|
| Somatic problem       | 11.45| 3.45| 12.24| 3.30| -3.82***|
| Anxiety               | 11.41| 4.10| 12.33| 4.22| -3.58**|
| Social dysfunction    | 15.13| 3.17| 14.80| 3.09| 1.72|
| Depression            | 10.35| 3.85| 10.27| 3.60| 0.37|
| Contamination fear    | 24.16| 9.96| 26.49| 10.75| -3.68***|

Note: The non-significant trauma exposure items were not listed

*** p<0.001; ** p<0.01 * p<0.05

The fit of the SEM model was acceptable (χ²=315.447, df=59, TLI=0.920, CFI=0.939, SRMR=0.056, RMSEA=0.083). The path coefficients showed that contamination fear was significantly correlated with PTSD and psychiatric comorbidity (see Fig. 2). As with the adult group, the fit of the model SEM was acceptable (χ²=216.775, df=59, TLI=0.934, CFI=0.949, SRMR=0.049, RMSEA=0.071). The path coefficients from contamination fear to PTSD and psychiatric comorbidity were also significant (see Fig. 3). Examination of the background variables revealed that a high level of education was significantly correlated with psychiatric comorbidity in emerging adults, but with PTSD in adults. Duration of quarantine was associated with psychiatric comorbidity only in adults.

Discussion

The present study examined whether emerging adults and adults would differ in levels of contamination fear, COVID-19 PTSD, and psychiatric comorbidity after controlling for background and COVID-19 trauma exposure variables. In contrast to hypothesis one, emerging adults reported significantly lower levels of contamination fear, PTSD and psychiatric comorbid symptoms than adults. Hypothesis two was supported in that while contamination fear was related to PTSD and psychiatric comorbidity in both groups, high educational attainment was significantly associated with psychiatric comorbidity in emerging adults but with PTSD in adults. Duration of quarantine was only associated with psychiatric comorbidity in adults.

Posttraumatic stress disorder is a disorder that occurs along a continuum of normal to abnormal stress responses. Partial PTSD is applied to people with clinically significant PTSD reactions who usually lacked one or two symptoms and thus did not meet the diagnostic threshold for full PTSD. This threshold is set to exclude PTSD cases with less than average symptoms (Brewin, 2003). Nevertheless, partial-PTSD is associated with increased social, functional and physical impairment as well as psychiatric comorbidity. In other words, people with this partial diagnosis still require psychological intervention (Brewin, 2003; Cukor et al., 2010; Pietrzak et al., 2011; Varela et al., 2013; Zlotnick et al., 2002). Its importance should not be overlooked (Blank, 1993; I. V. Carlier & B. P. Gersons, 1995; I. V. E. Carlier & B. P. R. Gersons, 1995; Cukor et al., 2010; Joseph et al., 1997). However, in the current study, diagnostic status appeared to be independent of developmental stage (emerging adult or adult). There is no reason to believe that certain types of adults are more or less likely to receive a particular PTSD diagnosis.
coping strategies, resilience and social support have been shown to mitigate the effects of COVID-19 on PTSD and depression in Chinese university students (Tang et al., 2020; Ye et al., 2020).

Although emerging adults reported lower levels of re-experiencing symptoms, avoidance behaviours, somatic problems, anxiety and contamination fear than adults, both groups showed the association between contamination fear, PTSD and psychiatric comorbidity. In other words, this association appeared to be relevant for people living with the effects of COVID-19 regardless of their developmental stage. It was postulated that people with obsessive-compulsive symptoms perform symbolic actions that serve to regulate affect. For example, repetitive washing can temporarily remove distressing internal feelings of contamination (Carpenter & Chung, 2011; Fairbrother et al., 2005; Fonagy, 1999). However, these actions are particularly pronounced during times of stress and high arousal (Emmelkamp, 1990), characterised by PTSD and psychiatric comorbid symptoms in the current study. Further analyses showed that fear of contamination was significantly correlated with all PTSD and psychiatric comorbid subscales, with r-values ranging from 0.28 to 0.57 (p < 0.001).

Notwithstanding this, significant differences between the two developmental groups emerged when looking at the individual symptoms. Contrary to our hypothesis, emerging adults appeared to be more resilient compared to adults and reported significantly fewer re-experiencing symptoms, avoidance behaviours, somatic problems, anxiety and contamination fear. It is possible that emerging adults experienced some level of distress but felt free from role obligations and constraints. They may also have countered their distress with a sense of optimism, i.e. that there should be a vaccine before they enter the workforce after graduation. These responses may have boosted their self-esteem, which enabled them to cushion the distress. In addition, their maturity in social cognition may have enabled them to develop understanding of themselves and others, which is a fundamental ingredient for resilient character (Arnett, 2016).

The present findings have also supported the argument that adversity during this transitional period can paradoxically bring about positive changes in young adults. Some of them are able to use adaptive resources such as planful competence (e.g. realistic goal setting, self-confidence), future motivation, autonomy, adult support and coping skills to manage the current adversity (Masten, 2014). Adaptive coping strategies, resilience and social support have been shown to mitigate the effects of COVID-19 on PTSD and depression in Chinese university students (Tang et al., 2020; Ye et al., 2020).

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Fig. 2 Standardized coefficients of the final structural equation model for emerging adults

Note: RE: re-experiencing symptoms; AV: avoidance; NCM: negative cognition and mood; AR: hyperarousal; SM: somatization; AX: anxiety; SDY: social dysfunction; DE: depression; Edu: education level; Length: length of quarantine.

***p<0.001; *p<0.05.
However, the impact of background variables on distress appeared to vary by developmental stage. Before discussing this result, we should point out that the correlation coefficients between these variables (education and quarantine) and distress scores, as shown in Fig. 3, were small but still significant. The large sample size probably contributed to this result. Nevertheless, the fact that these weak correlations were significant suggests that they had an impact on distress outcomes despite their limited practical significance.

Emerging adults with high levels of education reported high levels of psychiatric comorbidity, while adults with high levels of education reported high levels of PTSD. These findings are at odds with existing research suggesting that low educational attainment is a risk factor for COVID-19 associated with distress (Liang et al., 2020), for SARS-related PTSD (Fang et al., 2004; Wu et al., 2005), for PTSD in victims of various types (Brewin et al., 2000), and for comorbidity of major depression and PTSD (Kostaras et al., 2017). They have also refuted the claim that a high level of education is a protective factor (Andu et al., 2018). A possible explanation for these unexpected findings could be that educated people in the current sample were likely to cope with the effects of COVID-19 through a ‘monitoring’ coping style. This is the style in which they paid attention to and searched for information related to the disease. As a result, they may have been particularly alert and sensitive to the potentially harmful and threatening cues associated with the pandemic. This, in turn, resulted in psychological distress that was even greater than that of patients suffering from a life-threatening illness (Miller, 1995).

Interestingly, the types of distress differed between educated emerging adults and adults. In other words, even if people share the diathesis for some psychological distress, their experience and expression may vary due to individual differences (Barlow, 2002; Keane et al., 2007). This may reflect the cognitive specificity hypothesis (Beck & Perkins, 2001), whereby certain individual factors (e.g., developmental status) may trigger specific cognitive emotion regulation strategies (e.g., monitoring style) to regulate certain emotional outcomes (i.e., either PTSD symptoms or general psychological distress). Similarly, a meta-analysis has argued that specific emotion regulation strategies are related to specific psychological symptoms (Aldao et al., 2010). This hypothesis of cognitive specificity has been demonstrated in trauma victims of different types (Chung & Hunt, 2014; Chung et al., 2008; Chung & Reed, 2016; Slanbekova et al., 2019). Differentiating the individual factors that contribute to specific symptoms of emotional disorders may

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Fig. 3 Standardized coefficients of the final structural equation model for adults

Note: RE: re-experiencing symptoms; AV: avoidance; NCM: negative cognition and mood; AR: hyperarousal; SM: somatization; AX: anxiety; SDY: social dysfunction; DE: depression; Edu: education level; Quan: length of quarantine.

***p < 0.001; *p < 0.05.
pave the way for a better understanding of the aetiology and course of these disorders, which in turn has implications for treatment (Bruch et al., 1993).

Regarding trauma exposure variables, the lack of influence of trauma exposure characteristics on distress outcomes is partly due to the fact that several of these variables were excluded from the analysis, as participants’ responses were similar. Length of quarantine was the variable that correlated with increased psychiatric comorbidity only in adults. This finding supports literature suggesting that quarantine can have negative effects on people’s overall distress (Banducci & Weiss, 2020; Boyraz & Legros, 2020; Kisely et al., 2020; Taylor et al., 2020). However, it contradicted the literature that quarantine was significantly and positively associated with emotional distress, likely depression and other symptoms in Chinese university students (emerging adults) (Xin et al., 2020).

Quarantine may have had a particular impact on adults due to the increased likelihood of unemployment, financial worries (Tull et al., 2020), feelings of uncertainty and despair (Mucci et al., 2020), the effects of which may be channeled through quarantine-related psychological distress rather than PTSD symptoms. Indeed, the literature links quarantine to general psychological distress, characterised not by PTSD symptoms but by health anxiety (Tull et al., 2020), frustration, boredom (Brooks et al., 2020), loneliness, feelings of lack of social support (Tull et al., 2020), confusion and anger (Brooks et al., 2020; Wytrychiewicz et al., 2020). However, it remains to be seen to what extent these general characteristics of psychological distress might be relevant to the current sample.

Several limitations of the current study must be acknowledged. First, no stratified random sampling technique was used in the recruitment of the samples. This means that the precision of the sample was not determined and that there would likely be sampling error in the estimation. However, stratified sampling is labour intensive and requires a lot of resources. Moreover, it would have been difficult, if not impossible, to exhaustively divide the population into different subgroups. The degree of difficulty would have been increased by the nature of their PTSD symptoms, i.e. some people would have deliberately avoided participating in the study. Secondly, no information was collected on whether they had a psychiatric disorder, cognitive impairment or special educational needs, as it would have been difficult to access their medical records or structured clinical interviews, or information on any special educational needs. Distress scores may have been inflated by the co-occurrence of these psychiatric disorders (McHugh & Weiss, 2019). For example, people with special needs tend to have more mental health problems due to their learning disability than those without (Salazar et al., 2015). Thirdly, the subjective experience of quarantine could have been measured more thoroughly, in particular the feelings associated with quarantine (e.g. uncertainty, fear, frustration, boredom, loneliness and anger) have now been described in the literature, e.g. (Brooks et al., 2020; Mucci et al., 2020; Tull et al., 2020; Wytrychiewicz et al., 2020). In addition, quarantine could lead to families spending more time together. This in turn could increase the likelihood of domestic violence, which is associated with PTSD symptoms (Blackman, 2020; Dutheil et al., 2020).

To conclude, following the onset of COVID-19, both emerging adults and adults could develop contamination fear, posttraumatic stress disorder and other general psychological symptoms, although emerging adults were more resilient in managing these symptoms. While educational level may influence distress in both types of adults, quarantine experience appeared to have notable effects in adults. Important implications emerge from the current findings. First, since both types of adults differ in the expression of distress symptoms, different psychological mechanisms are likely involved in these differences. Future studies should aim to explore these mechanisms. Second, the findings from this study will have important implications for the specific types of psychological interventions that can be developed for these adults. There is no reason to believe that some generic psychological interventions can be applied to both groups of individuals. Third, future studies should also examine the effectiveness of these interventions, which will probably require some randomised controlled trials. Last but not least, although the current study adopted a quantitative approach to research design, future studies could complement the existing findings by exploring the subjective meanings of participants experiencing COVID-19 PTSD. Online photovoice, an emerging innovative qualitative research method, can be used for this purpose (Tanhan & Strack, 2020).

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**Data Availability** The datasets generated during the current study are available from the corresponding author upon reasonable request.

**Declarations**

**Conflicts of interest** None.

**Ethical approval** The study has got ethical approval from the ethical committee of the affiliated university of the corresponding author.

**Consent to participate:** The participation is on voluntary basis. Completing the questionnaire indicates consent to participate.
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