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Perceived stress and possible stressors in the general public in China during the COVID-19 pandemic

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Summary

\textit{Background.} — The COVID-19 pandemic is spreading worldwide and a study found that front-line medical staff reported high levels of perceived stress during this pandemic. However, some findings indicated that the general public had more psychological problems than front-line medical staff. Therefore, the current study aimed to investigate perceived stress levels and to identify possible stressors affecting the general public in China during the severe stage of COVID-19 pandemic.

\textit{Methodology.} — An anonymous questionnaire survey was conducted online from February 18 to 25, 2020, with 1921 Chinese people aged 18–68 years ($M = 29.28$, $SD = 10.66$).

\textit{Results.} — Most participants reported low to mild perceived stress levels. Moreover, social stressors (e.g., disruption of normal life), rather than physical (e.g., burdened work) or psychological stressors (e.g., worried about self-infection) were the most frequently reported stressors of the general public.

\textit{Conclusion.} — In summary, our findings addressed an ongoing relevant situation affecting nations, communities, and individuals worldwide, and provided suggestions to regulate the perceived stress in the general public.

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Introduction

At present, the 2019 coronavirus disease (COVID-19) still wreaking havoc worldwide. According to a report by the World Health Organization, by April 13 2021, the COVID-19 have infected 136,550,273 individuals worldwide. The rapid spread of the COVID-19 pandemic not only has a serious
impact on people’s physical health, but also poses a severe threat to people’s psychological health, leading to an obvious increase in perceived stress [1–3]. For example, one study measured the stress levels of medical staff in Wuhan from January to February 2020 and found that front-line medical staff reported high levels of perceived stress [4]. Interestingly, some researchers found that vicarious traumatisation scores in the general public were significantly higher than those in front-line nurses in February 2020 [2]. However, another study found that more than half of the general public (67.9%) reported normal stress levels from January to February 2020 [5]. These results indicated a paradox among the general public and suggested that the underlying stressors might have played an important role in perceived stress levels. Although a previous study discussed one possible stressor in medical staff, researchers assumed that wearing heavy protective clothing and protective masks might cause medical staff stress [4]. It is regrettable that none of the studies mentioned above have measured possible stressors in the general public. Therefore, the current study aimed to investigate perceived stress levels and to identify possible stressors in the general public in China during the severe stage of the COVID-19 pandemic.

COVID-19 is a new viral infection which can be spread via human-to-human transmission [5]. Therefore, the general public have been quite worried about either self-infection or family members’ infection [5]. Meanwhile, the pandemic has led to a massive global public health campaign to slow the spread of the virus by increasing hand washing, reducing face touching, wearing masks [6], and even disinfecting all the items that people touched. This burdened work is a stressor for many people. At the same time, to limit the spread of the COVID-19 pandemic and to stop transmission of the virus, the general public was encouraged to practice home-isolation [7], it led to travel restrictions, and living inconveniences. For example, people were not allowed to leave their homes except to conduct necessary activities. What’s more, closures of schools and businesses have compounded negative emotions that individuals experience [8]. Quarantine, loss of usual routine, and reduced social and physical contact with others have frequently been shown to cause stress [9], because it brought about the disruption of normal life. Moreover, as the pandemic has resulted in economic difficulties [6], large and growing financial losses have also been a specific stressor for the public [10].

Previous researchers have divided stressors into three main categories [11]. The first is physical stressors, including physical, chemical, or biological stimuli. The second is psychological stressors, including interpersonal conflicts, frustrations in meeting basic needs and desires, and so on. The third is social stressors that refer to social life contexts or events that create individual lifestyle changes, which the individual is required to adjust or adapt to. These three categories of stressors all have affected the general public during the severe stage of the COVID-19 pandemic. As discussed above, social life contexts that lead to individual lifestyle changes are categorized as social stressors, including disruption of normal life, travel restrictions, and living inconveniences in this study. Psychological frustrations are categorized as psychological stressors, including worried about self-infection and family members’ infection. Increased or deprived physical stimuli are categorized into physical stressors, including economic losses and burdened work.

A recent review of psychological sequelae in samples of quarantined people revealed numerous emotional outcomes, including stress, and stigma associated with quarantine [10]. In the absence of a vaccine during those days, one of the most vital strategies for slowing the pandemic was social distancing. However, distancing clashes with the deep-seated human instinct to connect with others [12]. Since social connection helps people regulate emotions, cope with stress, and remain resilient during difficult times [13–16], social isolation worsens the burden of stress and often has deleterious effects on mental health [17]. From what has been discussed, we hypothesized that social stressors resulting from home-isolation would be the most frequently reported stressors among the general public during the COVID-19 pandemic. Moreover, researchers have found that connection to schools, or a large community may be particularly beneficial to youth [18], and social connection has an important meaning for young people [19]. Since social isolation would worsen younger people’s burden of stress, we assumed that perceived stress levels in younger group would be significantly higher than those of older group.

Materials and method

Participants

A total of 2023 Chinese people were recruited from online in the study. Among them, 102 participants were excluded, including 13 unhealthy participants (e.g., influenza), one suspected case of COVID-19, one recovered case of COVID-19, and 87 first-line workers, resulting in a final sample of 1921 participants. Ages of participants ranged from 18 to 68 years old (M = 29.28, SD = 10.66). Close to half of the participants had a bachelor’s degree (46.6%). Most participants reported no contact with confirmed or suspected cases (85.4%) and a high level of attention to COVID-19 (71.9%). Most participants had not returned to work at the time of the study (87%), and nor had their family members (71.1%).

Demographic variables

Demographic variables included age, education, attention to COVID-19, contact with confirmed or suspected cases, and participants or their family members had returned to work or not. Education variable included 6 levels of primary school and below, lower secondary school, upper secondary school, college, bachelor’s degree, master’s degree, and above. Participants were asked to fill in specific numbers for the age variable and rate their attention to COVID-19 from 1 (little) to 5 (extreme). Other demographic variable items had possible answers of "yes" or "no."

Perceived stress and possible stressors

Perceived stress over the prior month was assessed using the 10-item Perceived Stress Scale (PSS) [20]. The PSS assesses the extent to which individuals believe their lives are overloaded, unpredictable, and uncontrollable (e.g., In the last
month, how often have you found that you could not cope with all the things that you had to do)?. Participants rated the items on a 5-point Likert scale (0 = never, 4 = very often), with higher scores indicating higher perceived stress. Cronbach’s α for the present study was 0.82.

Stressors were presented as seven single-choice items in a random order and participants were asked to indicate whether they experience those stressors by choosing “yes” or “no.” They were required to choose all the stressors that they perceived, there’s no quantitative limitation. Seven stressors were divided into three categories. Social stressors included disruption of normal life, travel restrictions, and living inconveniences. Psychological stressors included worried about self-infection and worried about family members’ infection. Physical stressors included economic losses and burdened work.

Procedure

The study was approved by the review board of a local university. Anonymous questionnaires were conducted via an online survey platform—“SurveyStar”—from February 18 to 25, 2020, a period during which the pandemic remained severe (the number of existing confirmed cases ranged from 45,604 to 57,805). All participants provided written informed consents and received 5 yuan (about 0.7) after completing the questionnaire as a compensation for participating in the survey.

Statistical analysis

Descriptive statistics were calculated for demographic variables and involved frequencies (%) for categorical variables. Linear regression analysis was used to analyze individual differences in perceived stress, followed by logistic regression analysis to estimate the predictive effect of the demographic variables on the possible stressors. Data were considered statistically significant when \( p < 0.05 \). Analyses were performed using IBM SPSS Statistic 22.0.

Results

Perceived stress

Participants’ mean perceived stress and the distribution of scores were illustrated in Fig. 1A. Most participants (82.9%) reported low to mild perceived stress, with scores ranging from 10 to 25. Table 1 showed individual differences in perceived stress. Participants who had been in contact with confirmed or suspected cases (\( \beta = 0.89, 95\% \text{ CI} = [0.19, 1.60] \)), were currently practicing home-isolation (\( \beta = -1.28, 95\% \text{ CI} = [-2.01, -0.54] \)), and who reported lower extent of attention to COVID-19 (\( \beta = -0.39, 95\% \text{ CI} = [-0.72, -0.06] \)), were likely to report higher levels of perceived stress. Results also showed that younger participants tended to have higher perceived stress levels (\( r = -0.183, p < 0.01 \)). Other demographic variables did not predict perceived stress levels.

Possible stressors

Reported stressors

The stressors reported were listed in Fig. 1B. More than half of the participants reported disruption of normal life as a stressor (52%). The top three reported stressors were disruption of normal life, travel restrictions, and living inconveniences, which were all categorized as social stressors. Moreover, psychological stressors (e.g., worried about self-infection) were more frequently reported than physical stressors. Last, only a few participants reported physical stressors (e.g., burdened work).

Influence of demographic variables on stressors

The influence of demographic variables on the social stressors were shown in Table 2. People with younger age (\( \text{OR} = 0.96, 95\% \text{ CI} = [0.96, 0.97] \)), higher educational level (\( \text{OR} = 1.21, 95\% \text{ CI} = [1.11, 1.32] \)), those not returning to work (\( \text{OR} = 2.87, 95\% \text{ CI} = [2.12, 3.87] \)), having family members who did not return to work (\( \text{OR} = 1.29, 95\% \text{ CI} = [1.04, 1.59] \)), and those who paid more attention to COVID-19 (\( \text{OR} = 1.17, 95\% \text{ CI} = [1.03, 1.33] \)) were more likely to report the stressor of disruption of normal life. Similarly, people with younger age (\( \text{OR} = 0.98, 95\% \text{ CI} = [0.97, 0.99] \)), higher educational level (\( \text{OR} = 1.10, 95\% \text{ CI} = [1.01, 1.20] \)), and those not returning to work (\( \text{OR} = 1.45, 95\% \text{ CI} = [1.10, 1.91] \)) were more likely to report the stressor of travel restrictions. In addition, people with higher educational levels were more likely to report the living inconveniences stressor (\( \text{OR} = 1.12, 95\% \text{ CI} = [1.02, 1.22] \)).
Table 1  Demographic variables and perceived stress.

| Variables                              | n (%)     | Perceived stress | r     | p     |
|----------------------------------------|-----------|------------------|-------|-------|
|                                        |           |                  | R²    | AR²   | B (95% CI) |
| Age                                    | 1921      |                  |       |       |            |
| Education                              |           |                  |       |       |            |
| Primary school and below               | 25 (1.3)  | 0.001            | 0.00  | 0.10  | (-0.31 to 0.10) |
| Lower secondary school                 | 115 (6.0) |                  |       |       |            |
| Upper secondary school                 | 188 (9.80)|                  |       |       |            |
| College                                | 217 (11.3)|                  |       |       |            |
| Bachelor’s degree                      | 896 (46.6)|                  |       |       |            |
| Master’s degree and above              | 480 (25)  |                  |       |       |            |
| Contact with confirmed or suspected cases |         |                  |       |       |            |
| Yes                                    | 280 (14.6)| 0.003            | 0.89  | 0.013 | (0.19 to 1.60) |
| No                                     | 1641 (85.4)|                |       |       |            |
| Return to work or not                  |           |                  |       |       |            |
| Yes                                    | 250 (13)  | 0.006            | -1.28 | 0.001 | (-2.01 to -0.54) |
| No                                     | 1671 (87) |                  |       |       |            |
| Family members return to work or not   |           |                  |       |       |            |
| Yes                                    | 556 (28.9)| 0.001            | 0.44  | 0.112 | (-0.10 to 0.99) |
| No                                     | 1365 (71.1)|               |       |       |            |
| Attention to COVID-19                  |           |                  |       |       |            |
| Little                                 | 10 (0.5)  | 0.003            | -0.39 | 0.020 | (-0.72 to -0.06) |
| Occasional                             | 107 (5.6) |                  |       |       |            |
| Ordinary                               | 423 (22)  |                  |       |       |            |
| Very much                              | 1134 (59) |                  |       |       |            |
| Extreme                                | 247 (12.9)|                  |       |       |            |

CI: confidence interval. **p < 0.01.

For the psychological stressors, older age (OR = 1.02, 95% CI = [1.01, 1.03]), returning to work (OR = 0.48, 95% CI = [0.36, 0.63]), having family members who already returned to work (OR = 0.71, 95% CI = [0.58, 0.88]), and higher attention to COVID-19 (OR = 1.34, 95% CI = [1.18, 1.53]) predicted the reporting of being worried about self-infection. In addition, people who had already returned to work (OR = 0.62, 95% CI = [0.47, 0.83]), or whose families had returned to work (OR = 0.55, 95% CI = [0.44, 0.68]), and those who paid more attention to COVID-19 (OR = 1.16, 95% CI = [1.01, 1.34]) were more likely to report the stressor of being worried about family members’ infection.

For the physical stressors, younger age (OR = 0.98, 95% CI = [0.97, 0.99]), lower educational level (OR = 0.66, 95% CI = [0.60, 0.73]), and having family members not returning to work (OR = 1.40, 95% CI = [1.08, 1.81]) predicted the reporting of economic losses. Moreover, younger people were more likely to report the stressor of burdened work (OR = 0.98, 95% CI = [0.96, 1.00]).

Discussion
The current study investigated perceived stress levels in the general public during the most severe stage of the COVID-19 pandemic in China. Results showed 82.9% of the participants reported low to mild level of perceived stress with scores ranging from 10 to 25. This is consistent with results of previous research that concluded that 92% of the general public experienced low stress during the early stage of COVID-19 [5]. Furthermore, Zhang et al. found a mild stressful impact on local Chinese residents during the severe stage of COVID-19 pandemic [21]. During the same period, people in Spanish reported lower stress level than Chinese, on account of the Spanish people still had not realized the pandemic’s scope in their own territory in the first few days of the pandemic in Spain [22]. In Colombia, 15% of the participants reported high level of perceived stress associated with COVID-19 [23]. Moreover, a nationwide survey among Italians reported 27.2% (16.2 million people) experienced high to extremely high stress levels during the pandemic [24].

The current study also found that perceived stress levels were significantly predicted by variables such as contact with confirmed or suspected cases, attention to COVID-19, whether one had returned to work or not, and age. As COVID-19 is mainly transmitted through respiratory and close contact [5], results showed that contact with confirmed or suspected cases was significantly associated with higher perceived stress. In addition, during the period when COVID-19 spread rapidly, the majority of the general public were staying at home in home-isolation [2], thus, they had more time to gather information about the pandemic through the internet and media [25]. People who paid more attention to event-related information about COVID-19 often stayed informed about the current situation [26], which could reduce their perceived stress. Moreover, people who either did not return to work or were younger
Table 2  Logistic regression analysis of the three categories of possible stressors and the predictor variables.

| Predictors                  | Social stressors          | Psychological stressors                      | Physical stressors          |
|-----------------------------|---------------------------|----------------------------------------------|-----------------------------|
|                             | Disruption of normal life| Worried about self-infection                 | Economic losses             |
|                             | Travel restrictions       | Worried about family members’ infection      | Burdened work               |
|                             | Living inco-             |                                              |                             |
|                             | veniences                 |                                              |                             |
|                             |                            |                                              |                             |
| OR (95%CI)                  | OR (95%CI)                | OR (95%CI)                                  | OR (95%CI)                  |
|                             | P                         | P                                            | P                           |
|                             | P                         | P                                            | P                           |
| Age                         | 0.96 (0.96 to 0.97)       | 1.02 (1.01 to 1.03)                         | 0.98 (0.97 to 0.99)         |
|                             | < 0.001                   | < 0.001                                     | 0.001                       |
| Education                   | 1.21 (1.11 to 1.32)       | 1.05 (0.96 to 1.15)                         | 0.66 (0.60 to 0.73)         |
|                             | < 0.001                   | 0.296                                       | < 0.001                     |
| Contact with confirmed or   | 1.27 (0.97 to 1.66)       | 0.87 (0.66 to 1.04)                         | 0.87 (0.64 to 1.07)         |
| suspected cases             | 0.086                     | 0.302                                       | 0.70 (0.64 to 1.26)         |
| Return to work or not       | 2.87 (2.12 to 3.87)       | 0.48 (0.36 to 0.63)                         | 0.62 (0.60 to 1.16)         |
|                             | < 0.001                   | < 0.001                                     | 0.001                       |
| Family members return to    | 1.29 (1.04 to 1.59)       | 0.48 (0.36 to 0.63)                         | 0.62 (0.60 to 1.16)         |
| work or not                 | 0.018                     | 0.36 (0.27 to 0.55)                         | 0.001                       |
| Attention to COVID-19       | 1.17 (1.03 to 1.33)       | 1.04 (0.85 to 1.27)                         | 0.55 (0.44 to 0.68)         |
|                             | 0.011                     | 0.72 (0.58 to 0.88)                         | < 0.001                     |
|                             | (0.90 to 1.14)            | 1.27                                        |                             |
|                             |                             |                                             | 1.40 (0.86 to 1.88)         |
|                             |                             |                                             | 0.012                       |
|                             |                             |                                             | 1.27 (1.81)                 |
|                             |                             |                                             | 0.230                       |
|                             |                             |                                             | 0.84 (1.88)                 |
|                             |                             |                                             | 0.126                       |

CI: confidence interval.
reported higher perceived stress. Since the social stressors largely affected younger people, and social connection has an important meaning for young people [19], it is not surprising that perceived stress resulted from people’s inability to return to normal life.

Consistent with our hypothesis, social stressors (e.g., disruption of normal life), rather than physical (e.g., burdened work) or psychological stressors (e.g., worried about self-infection) were the most frequently reported stressors by the general public. To effectively stop transmission of the virus, the general public were encouraged to practice home-isolation, which affected aspects of their lifestyle related to mental health [21], and caused considerable inconveniences. Specifically, holiday periods were postponed and school closures were extended to reduce the number of new COVID-19 cases [27]. In addition, since the COVID-19 pandemic caused delays in academic activities [28], people with younger age and higher educational levels were more likely to report social stressors such as disruption of normal life, travel restrictions, and living inconveniences.

Psychological stressors were another important category of stressors identified during the COVID-19 pandemic. Even though appropriate protective methods (wearing masks, washing hands) can reduce the possibility of viral infection, the general public were still quite worried about either self-infection or family members’ infection [5]. In regard to this negative emotion-related stressor, age was a significant predictor, because health authorities and governments have continuously warned older people that they are at a higher risk of more serious and possibly fatal illness associated with COVID-19 [29]. Besides, since staying at home with one’s family seems to be a safer way to prevent illness [2], people who had already returned to work or whose family members returned to work have more risk of infection. In addition, because close contact settings (e.g., gatherings/people-intensive occasions) can lead to cluster infections in families [5], someone in the family going out to work could potentially increase the psychological stressor of being worried about family members’ infection.

Notably, only a few people reported the physical stressors, such as burdened work and economic losses. Although previous studies suggested that stress in medical staff was caused by physical factors, such as the uncomfortable feeling of wearing heavy protective clothing and the breathlessness of wearing protective masks [4], the current study suggested that the general public perceived different stressors. Some people reported economic losses as a stressor. As the COVID-19 pandemic has had economic effects, more than half of the people (52.86%) reported having no steady family income [28], especially those whose family members have not returned to work.

Although well-planned and organized, the current study still has several limitations. First, given the limited available resources and time-sensitivity of the COVID-19 severe stage, we adopted an anonymous internet questionnaire survey, which might have sampling bias and did not perfectly reflect the actual pattern of the general population. Second, the current survey was conducted at the early stage of the pandemic, and participants mainly from Sichuan, Chongqing and Henan, so the results need to be generalized with caution. Then, the possible stressors examined in the current study only represented typical stressors for a specific time period (i.e., during the severe stage of COVID-19 pandemic). Caution is therefore needed in generalizing the results to the daily life of the general public. Besides, that only one country was examined, and countries with individualistic cultural background might have different patterns of the perceived stress, future research could compare collectivistic and individualistic countries.

To summarize, this study examined perceived stress and identified possible stressors in the general public during the COVID-19 severe stage in China. Based on these investigations, the current study provided the following suggestions to regulate the perceived stress in the general public. Firstly, scientific knowledge about COVID-19 should be advised to public. Next, local governments should pay more attention to younger and workers, providing them with a safe working environment. Then, psychological stress was also influenced by availability of local medical resources, efficiency of the regional public health system [7], so the public health service systems should be strengthened. Moreover, since applying stress management techniques (e.g. cognitive restructuring, problem-solving, self-instruction) in an intervention can effectively alter perceived threat and self-efficacy and ultimately lead to lower perceived stress [30], the psychological assistance system should be established in time to against the great disaster of people’s mental health.

Conclusion

The current study suggested that the general public in China experienced low to mild levels of perceived stress during the COVID-19 pandemic, and social stressors (e.g., disruption of normal life, travel restrictions), rather than physical (e.g., burdened work) or psychological stressors (e.g., worried about self-infection), were the most frequently reported stressors. Our findings provided suggestions to regulate the perceived stress in the general public.

Ethics approval

The study was approved by the review board of the Faculty of Psychology, Southwest University (No. IRB20200218).

Human and animal rights

The authors declare that the work described has been carried out in accordance with the Declaration of Helsinki of the World Medical Association revised in 2013 for experiments involving humans as well as in accordance with the EU Directive 2010/63/EU for animal experiments.

Informed consent and patient details

The authors declare that they obtained a written informed consent from the patients and/or volunteers included in the article and that this report does not contain any personal information that could lead to their identification.
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Authors' contributions

Conception and design: Juan Yang, Mengning Zhang.

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Analysis and interpretation of data: Mengning Zhang, Yadong Liu.

Drafting of the manuscript: Mengning Zhang, Xiaolin Zhao, Juan Yang.

Critical revision of the manuscript for important intellectual content: Juan Yang.

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Disclosure of interest

The authors declare that they have no competing interest.

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