Evaluation of psychological stress in scientific researchers during the 2019-2020 COVID-19 outbreak in China

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Background: Beginning in December 2019, coronavirus disease 2019 (COVID-19) caused an outbreak of infectious pneumonia. The Chinese government introduced a series of grounding measures to prevent the spread of COVID-19. The living and working patterns of many scientific researchers also underwent significant changes during this period.

Methods: An opportunity sample (n = 251) was obtained in China using a questionnaire with 42 questions on scientific research progress and psychological stress during the COVID-19 epidemic.

Results: Of the 251 participants, 76.9% indicated that their research was affected by the COVID-19 outbreak, and participants who were affected by the outbreak had higher stress levels than those who were not affected. Participants who conducted COVID-19 research and indicated concern that they would fail to finish the research on time were more likely to indicate high levels of stress. Respondents indicated that extending deadlines (64.1%), receiving support from superiors for research (51.8%), and increasing benefits for researchers (51.0%) would likely relieve outbreak-related stress.

Conclusion: The COVID-19 outbreak had a major impact on the experiments of researchers in the life sciences, especially in basic and clinical medicine. It has also caused high levels of psychological stress in these populations. Measures should be taken to relieve psychological pressure on basic medical researchers and students who will soon complete their degrees (e.g., Master’s and PhD candidates in graduation years).
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Abstract

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Introduction

The outbreak of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), originated in Wuhan, China and quickly spread from human to human in December 2019 (Lai et al. 2020). On January 30, 2020, the World Health Organization declared the COVID-19 epidemic a public health emergency of international concern. As of February 23, 2020, China has confirmed 77,150 new coronavirus infections and 2,592 deaths (Pediatric Committee et al. 2020). (Martinez 2020). Because of the increasing number of confirmed cases and deaths, negative emotions continued to spread (Zhou 2020). Previous studies (Hull 2005; Wu et al. 2005a; Wu et al. 2005b) suggest we must examine the extent of psychological stress associated with the current epidemic and focus attention on those people most vulnerable to this psychological stress (Shigemura et al. 2020). Recent studies have focused on the psychological stress of the medical staff involved in epidemic prevention in China (Xiao et al. 2020). However, few studies have examined the impact of severe infectious disease outbreaks on the psychological state of researchers. The rise of stressors and strains in academic life has been widely reported (Kinman 2001). Heavy workload and time and resource constraints have been highlighted as major work stressors in researchers. The work-home imbalance and role conflict and overload also have potential impact on academic stress level (Gmelch et al. 1984; Kinman 2008; Tytherleigh et al. 2005). At the same time, stress from dissatisfaction with pay and benefits has been reported (Tytherleigh et al. 2005). Management and leadership styles, a pressured higher education climate, and unhealthy competition also cause harmful stress (Wellcome 2020).

To avoid further transmission of COVID-19, many industries were forced to shut down temporarily, and scientific and social research and education activities were paused in China (ScienceMag.org 2020b). Furthermore, animal centers and practical labs were closed, and many
scientific and social congresses and symposiums were cancelled, leaving postgraduates and scientific workers confined to their homes (ScienceMag.org 2020a). Therefore, many researchers' experimental progress was hindered (e.g., due to loss of samples and funds) (ScienceMag.org 2020a; Tencent 2020a; Tencent 2020b), which undoubtedly increased the psychological stress on academic and research staff. In addition, the stagnation of science education activities may cause an increase in students' graduation pressure, and even the delay of graduation (Tencent 2020a).

In the current research, we propose the following hypotheses: (1) the COVID-19 outbreak aggravated psychological stress in researchers; (2) the stress levels and stressors in diverse populations would be different; (3) the demands for reducing stress in diverse populations would be different. We included 42 related questions in a questionnaire to test the above hypotheses.

Respondents were categorized by research field, research degree, and affiliation, etc.

Materials & Methods

Study participants

A questionnaire was distributed to researchers in China to recruit an opportunity sample, and all respondents were asked to answer each question on their own. The targets of the questionnaire were identified as "scientific researchers", which requires the respondents to be involved in at least one research project in past 12 months. Questionnaires were distributed to research institution staff, university researchers and students participating in the research. They were all researchers with a confirmed scientific experience or people the authors had collaborated with before. Some respondents passed on the questionnaire to other qualified people to fill in. A total of 251 questionnaires was received after screening. As the investigators are scientific researchers, they have a high level of education and are familiar with the questions. In addition, the respondents' answers showed a high degree of consistency. Among all the respondents, 193
chose "At a standstill" or "still in progress but slower than before" due to the epidemic situation (question 37), while the same 193 respondents filled in the corresponding reasons and psychological states (question 38 and 39), which was consistent in the filling. All participants provided written informed consent, and subjects were anonymous. It is not required by our institution to obtain ethical approval for a survey with a nonclinical sample and anonymised data, but we did obtain retrospective approval for the study protocol from the institutional review board (Ethics Committee) of the 3rd Xiangya Hospital, Central South University (20005-IRB).

**Questionnaire**

We included 42 related questions in the questionnaire to acquire a comprehensive understanding of the progress of research projects and the current psychological stress level of researchers. The survey consisted of 24 questions assessing the subject's psychological stress (i.e., stress scale). The questionnaire incorporated modified questions from the stress response questionnaire (SRQ) and the Pittsburgh sleep quality index scale (PSQI) (Pilz et al. 2018) and considered the current COVID-19 epidemic (i.e., emotional state, somatic responses, sleep quality and behavior). The stress scale consisted of five self-evaluation options: (1) not at all, (2) occasionally, (3) sometimes, (4) often, and (5) always. A score of 5 represented the highest level of stress.

We also assessed participants’ research areas (e.g., whether they conduct research related to the novel coronavirus) and potential stagnation of research projects, including questions rated to (1) delay in scientific research projects, (2) sample or funding losses due to the current epidemic, and (3) disruption of academic exchange activities. At the conclusion of the questionnaire, subjects were invited to evaluate some recommendations and proposed solutions for potential changes to scientific research in China, including extending deadlines for project completion, providing
partial financial subsidies for scientific research losses, assigning professional personnel to guide and support scientific research projects, and prioritizing the return of researchers to work (see Supplement 1).

Statistical analysis

Questionnaire results were summarized from the imported Excel file and analyzed using SPSS version 18.0 software (IBM Corp., Armonk, NY, USA). Quantitative variables were expressed as an average with a standard deviation (SD). Qualitative variables were expressed as numbers and percentages. Chi-squared ($\chi^2$) tests and analysis of variance (ANOVA) tests were used to compare psychological factors across social roles and age groups. A P value less than or equal to 0.05 was considered statistically significant.

Results

Participant demographics

Participants included scholars in the fields of life science (e.g., medicine, biology), engineering science (e.g., mechanical engineering, physiology, chemistry) and humanities and social sciences (e.g., law, literature). The gender ratio of the respondents was approximately 1:1. The average age of participants was 28.91±8.65, most of whom were from colleges or university affiliated hospitals (Table. 1). Participants consisted of seven groups of people: undergraduate students, Master’s degree candidates (non-graduation year), Master’s degree candidates (graduation year), PhD candidates (non-graduation year), PhD candidates (graduation year), basic research staff (including postdoctoral), and clinical medical staff (including postdoctoral). Many participants were undergraduates and clinical medical staff without advanced degrees, who comprise the majority of researchers in China and are therefore the most vulnerable to research-related psychological stress from infectious disease outbreaks.
Impact of epidemic-related scientific delays on stress levels

Of the 251 researchers surveyed, the average score of the population’s stress level was 46.99±20.84 points (full mark: 120 points). The median score was 43 points, the lowest score 24 points, and the highest score 120 points (Table 2). Participants whose progress was affected by the outbreak had higher levels of stress than participants who were not affected by the outbreak. Participants who indicated that they were affected by the epidemic expressed higher stress in emotional states, somatic responses, and behavior than participants who indicated they were not affected by the epidemic (Table 3).

We identified 14 possible predictors of high stress in researchers during the COVID-19 outbreak and conducted the variables with means and SDs on stress levels. As a result of the outbreak, researchers who were required to change or reduce experimental projects indicated they were under more pressure than those who did not have to change or reduce their experimental project. In addition, researchers were affected by peer pressure that their colleagues have been reporting on new coronavirus-related research (Table 4). We did not report a separate analysis of correlation between research stress and influencing factors in different research disciplines, due to the limited sample size. The impact of “Original research programs need to be changed or cut” on stress levels and the impact of “Feeling great pressure on colleagues who conduct projects on COVID-19” on stress levels are additionally listed in table 5 and 6.

Responses regarding recommendations to improve conditions for scientific researchers

Nine proposed solutions were considered by researchers to possibly ease their stress (Fig 1). The top recommendation was prolonging the graduation/project conclusion/the deadline of the application of the funds, with 161 of 251 (64.14%) respondents regarding it effective. Receiving support from superiors (51.79%) and improving the welfare of researchers (51.00%) came next. Academic
cooperation (27.49%) and meetings (21.91%) received lower levels of endorsement. These
demands varied statistically between clinical staff and basic medical researchers, as well as
between master's and doctoral students (Table 7 and Table 8).

**COVID-19 affected research progress differently across research fields and seniority**

As a result of the COVID-19 outbreak, 47.11% of researchers in the field of science
indicated their research programs were halted, and 32.00% of researchers indicated their programs,
while ongoing, were slower than before the epidemic began. However, the COVID-19 epidemic
has had relatively little impact on researchers in the field of humanities, with most social science
researchers indicating a slower pace of research (6 out of 12) or a lack of impact of COVID-19 on
their research (5 out of 12). It is worth noting that we classify such scholars as "in the field of
humanities and social sciences", in fact, their research projects are concerning, say, "The human
impact of the epidemic" and "cultural reasons for differences in national responses". These types
of researches are scientific, though they tend to focus more on humanities. Of the 77 professors
and lecturers surveyed, 43 (55.84%) indicated that their experiment was at a standstill, while 8
(10.39%) indicated that their experiment was not affected. However, the responses of researchers
without professional titles varied, with 43.82% of researchers indicating stagnated experiments
and 23.11% indicating unaffected projects respectively (Table 9 and Table 10).

**Discussion**

There may be many subjective or objective factors preventing the achievement of
motivating factors like job achievement, income, respect, reputation, work pride, promotion
opportunities, etc. Hindered scientific research progress may lead to reduced salaries and
promotion opportunities and could delay job achievement. It might also discourage many
researchers who had family or other social responsibilities. The resulting stress might be
internalized and cause adverse psychological consequences (Kinman 2008; Liu et al. 2019). The results showed participants whose progress was affected by the outbreak had higher levels of stress. This is consistent with the study that work interruption is a common source of stress for researchers (Gmelch et al. 1984). We found that researchers who reported needing to change their original research programs often faced more pressure. This indicated the change of work content in a short time may be difficult for researchers to deal with (Kinman 2001). Participants who indicated pessimism about halted or slowed research progress also had higher levels of stress than participants who were optimistic. These data provide evidence that we should promote the importance of psychological and mental health in researchers and provide intervention guidance during times such as infectious disease outbreaks (Jiang et al. 2020). In addition, previous research has described that most researchers faced unhealthy competition and high levels of competitive pressure at work (Randall et al. 2019; Wellcome 2020). In our study, researchers whose colleagues were conducting related research on COVID-19 showed increased stress levels. This suggested that with the full efforts of researchers to study COIVD-19, the stress of scientific research competition also intensified.

To help determine interventions to reduce researchers’ stress, we asked researchers to provide suggestions regarding how to respond to the demands. The top recommendation was extending the deadline for experimental projects. This was because the delay of experimental progress often affected original research plans, such as applying for funding and students' graduation. The results showed that “receiving support from superiors” would also help to reduce stress. In previous studies, many respondents reported that their workplace put overwhelming expectations on them and that the superiors' blame led to an increase in staff dissatisfaction. In contrast, “respect” and “caring for others” were considered positive leadership styles (Kobulnicky
198 1997; Merrill 2015; Morsiani et al. 2017; Wellcome 2020). In addition, inadequate salary and slow
career advancement have been considered as stressors for researchers (Gmelch et al. 1984; Kinman
200 2001). This explains the requirement to improve the welfare of researchers.

Importantly, with graduation deadlines approaching, many students may have felt pressure
to complete their qualifications. The lack of science educational activities during the pandemic
could entail delay of graduation. Furthermore, perceived stress was correlated with academic level:
stress increased with a higher academic level (Fadhel & Adawi 2020). Also, uncertainty around
doctoral students and post-doctoral researchers’ careers may have made them more vulnerable to
publication stress (Frandsen et al. 2019). We found that students pursuing a PhD degree showed a
stronger willingness to prioritize the return of researchers to work than students pursuing a
master’s degree.

Researchers in the life sciences and engineering indicated that their scientific research was
more severely hindered than those in the social sciences and other fields. Most life sciences and
engineering fields rely on experimental facilities to complete their research; the closure of those
facilities during the epidemic created a great obstacle for completing their research
(ScienceMag.org 2020a; Tencent 2020a; Tencent 2020b). In contrast, researchers in social
sciences and other fields could often still conduct research activities during the outbreak.

This study has several limitations. The sample size was too small to conduct the population-
level sample comparisons that we had anticipated. Further, because this study took place one
month after the outbreak began, psychological stress may not have occurred yet. Long-term
psychological impacts of infectious disease outbreaks on scientific researchers, such as PTSD,
should be investigated in future studies. Finally, we did not compare researcher stress between
Hubei (the initial and severe outbreak location) and other regions because there were few respondents from Hubei.

**Conclusions**

Research progress was hindered by the COVID-19 outbreak, especially for researchers in the life sciences (e.g., basic medicine and clinical medicine). Researchers who were affected by the outbreak indicated higher psychological stress levels, especially emotional states, somatic responses, and behaviors. Our investigation suggests that the pressure placed on researchers during an epidemic comes mainly from lack of experimental progress and competition among peers. Additionally, clinical medicine researchers were also concerned that the value of their experimental results would be reduced because of delays in progress. The majority of respondents indicated that effective ways to relieve stress included extending deadlines, receiving research support from superiors, and increasing benefits for researchers. The results of this investigation suggest that in addition to focusing on restoring normal order of the laboratory after the novel coronavirus pandemic, it is also important to improve the psychological state of researchers.

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References

Fadhel SeB, and Adawi TRT. 2020. Perceived stress and coping strategies among university students. *European Journal of Research in Medical Sciences* 8 (1), 19-25.

Frandsen TF, Jacobsen RH, Nicolaisen J, and Ousager J. 2019. Pressure to publish: a bibliometric study of PhD students (1993-2009). *Information Research-an International Electronic Journal* 24:12.

Gmelch WH, Lovrich NP, and Wilke PK. 1984. Sources of Stress in Academe: A National Perspective. *Research in Higher Education* 20:477-490.

Hull HF. 2005. SARS control and psychological effects of quarantine, Toronto, Canada. *Emerg Infect Dis* 11:354; author reply 354-355. 10.3201/eid1102.040760

Jiang X, Deng L, Zhu Y, Ji H, Tao L, Liu L, Yang D, and Ji W. 2020. Psychological crisis intervention during the outbreak period of new coronavirus pneumonia from experience in Shanghai. *Psychiatry Res* 286:112903. 10.1016/j.psychres.2020.112903

Kinman G. 2001. Pressure Points: A review of research on stressors and strains in UK academics. *Educational Psychology* 21:473-492. 10.1080/01443410120090849

Kinman G. 2008. Work stressors, health and sense of coherence in UK academic employees. *Educational Psychology* 28:823-835. 10.1080/01443410802366298

Kobulnicky PJ. 1997. Commitment in the workplace: Theory, research and application - by John P. Meyer, John P. and Natalie J. Allen. Thousand Oaks, CA: Sage, 1997. 150p. $34.00 (cloth). ISBN 0-7619-0104-3. 10.1080/01443410520090849

Lai CC, Shih TP, Ko WC, Tang HH, and Hsueh PR. 2020. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Antimicrob Agents* 105:924. 10.1016/j.ijantimicag.2020.105924

Liu Y, Zhang J, Hennessy DA, Zhao S, and Ji H. 2019. Psychological strains, depressive symptoms, and suicidal ideation among medical and non-medical staff in urban china. *J Affect Disord* 245:22-27. 10.1016/j.jad.2018.10.111

Martinez MA. 2020. Compounds with therapeutic potential against novel respiratory 2019 coronavirus. *Antimicrob Agents Chemother*. 10.1128/aac.00399-20

Merrill KC. 2015. Leadership style and patient safety: implications for nurse managers. *J Nurs Adm* 45:319-324. 10.1097/nna.0000000000000207

Morsiani G, Bagnasco A, and Sasso L. 2017. How staff nurses perceive the impact of nurse managers’ leadership style in terms of job satisfaction: a mixed method study. *J Nurs Manag* 25:119-128. 10.1111/jonm.12448

Pediatric Committee MAoCPL, Army, and Editorial Committee of Chinese Journal of Contemporary Pediatrics. 2020. Emergency response plan for the neonatal intensive care unit during epidemic of 2019 novel coronavirus. *Zhongguo dang dai er ke za zhi = Chinese journal of contemporary pediatrics* 22:91-95.

Pilz LK, Keller LK, Lenssen D, and Roenneberg T. 2018. Time to rethink sleep quality: PSQI scores reflect sleep quality on workdays. *Sleep* 41. 10.1093/sleep/zsy029

Randall ET, Shapiro JB, Smith KR, Jervis KN, and Logan DE. 2019. Under Pressure to Perform: Impact of Academic Goal Orientation, School Motivational Climate, and School Engagement on Pain and Somatic Symptoms in Adolescents. *Clin J Pain* 35:967-974. 10.1097/ajp.0000000000000765

ScienceMag.org. 2020a. ‘The disruption is enormous.’ Coronavirus epidemic snarls science worldwide. *Available at https://www.sciencemag.org/news/2020/02/disruption-enormous-coronavirus-epidemic-snarls-science-worldwide.*

ScienceMag.org. 2020b. Does closing schools slow the spread of coronavirus? Past outbreaks provide clues.

Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, and Benedek DM. 2020. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. *Psychiatry Clin Neurosci.* 10.1111/pcn.12988

Tencent. 2020a. Laboratory in the epidemic: closed, delayed graduation, stagnant project ... *Available at http://zhishifenzi.com/depth/depth/8426.html.*

Tencent. 2020b. Scientific research work in many places has “stagnation”. How much has the academic community been affected by the epidemic?  *Available at https://xw.qq.com/cmsid/20200222A08EH00.*

Tytherleigh MY, Webb C, Cooper CL, and Ricketts C. 2005. Occupational stress in UK higher education institutions: a comparative study of all staff categories. *Higher Education Research & Development* 24:41-61. 10.1080/0729436052000318569

Wellcom e. 2020. What researchers think about the culture they work in. *Available at
Wu KK, Chan SK, and Ma TM. 2005a. Posttraumatic stress after SARS. Emerg Infect Dis 11:1297-1300. 10.3201/eid1108.041083

Wu KK, Chan SK, and Ma TM. 2005b. Posttraumatic stress, anxiety, and depression in survivors of severe acute respiratory syndrome (SARS). J Trauma Stress 18:39-42. 10.1002/jts.20004

Xiao H, Zhang Y, Kong D, Li S, and Yang N. 2020. The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. Med Sci Monit 26:e923549. 10.12659/msm.923549

Zhou X. 2020. Psychological crisis interventions in Sichuan Province during the 2019 novel coronavirus outbreak. Psychiatry Res 286:112895. 10.1016/j.psychres.2020.112895
Figure 1

Some appeals that the researches consider effective to relieve the pressure of affected experiment (251 participants in total).

![Bar chart showing the effectiveness of different appeals.](chart.png)

- Prolonging the deadline of research: 161 (64.14%)
- Receiving support from superiors: 130 (51.79%)
- Improving the welfare of researchers: 128 (51.00%)
- Providing grants for researchers’ loss: 115 (45.82%)
- Assigning professionals to guide projects: 103 (41.04%)
- Prioritizing the return of researchers to work: 86 (34.26%)
- Providing free counselling and psychotherapies: 70 (27.89%)
- Developing more academic cooperations: 69 (27.49%)
- Organizing more academic meetings: 55 (21.91%)
- Others: 8 (3.19%)
Table 1. Demographic characteristics of respondents
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| Demographic characteristics          | N  | %   |
|-------------------------------------|----|-----|
| **Gender**                         |    |     |
| Male                                | 104| 41.43 |
| Female                              | 147| 58.57 |
| **Age**                            |    |     |
| 18-24                               | 109| 43.43 |
| 25-39                               | 119| 47.41 |
| 40-59                               | 22 | 8.76  |
| ≥60                                 | 1  | 0.4   |
| **Category of school or institution**|    |     |
| Top universities                    | 177| 70.52 |
| General college                     | 13 | 5.18  |
| Independent research institutes     | 4  | 1.59  |
| University affiliated hospital      | 55 | 21.91 |
| Non-university affiliated hospital  | 2  | 0.8   |
| **Education background**            |    |     |
| Undergraduates                      | 79 | 31.47 |
| Master candidate (non-graduate)     | 28 | 11.16 |
| Master candidate (graduation grade) | 9  | 3.59  |
| PhD candidate (non-graduate year)   | 23 | 9.16  |
| PhD candidate (graduation year)     | 20 | 7.97  |
| Basic research staff (including postdoctoral) | 31 | 12.35 |
| Clinical medical staff (including postdoctoral) | 61 | 24.3  |
| **Title of technical post**        |    |     |
| Professor (researcher, chief physician) | 11 | 4.38  |
| Associate professor (associate researcher, associate chief physician) | 22 | 8.76  |
| Lecturer (assistant researcher, attending physician) | 44 | 17.53 |
| None                                | 174| 69.32 |
| **Total**                           | 251| 100  |
Table 2. Scores and statistical analysis of researchers' stress levels
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| Question number | Dimensions       | n=251                  |
|-----------------|------------------|------------------------|
|                 |                  | Min | Max | Means ± SDs   | Median |
| 13-20           | Emotional state  | 8   | 40  | 15.85±7.93    | 14     |
| 21-25           | Somatic responses| 5   | 25  | 10.18±5.05    | 9      |
| 26-29           | Sleep quality    | 4   | 20  | 8.24±4.08     | 7      |
| 30-36           | Behavior         | 7   | 35  | 12.73±5.50    | 11     |
|                 | Total scores     | 24  | 120 | 46.99±20.84   | 43     |

“±” represents standard deviation
**Table 3 (on next page)**

Table 3. Impact of the delay of project on researchers' stress levels
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| Question number | Dimensions | Completion date of scientific research project was delayed by coronavirus. | F   | p    |
|-----------------|------------|-------------------------------------------------------------------------|-----|------|
|                 |            | Disagree(n=83) | Agree(n=168) |     |      |
| 13-20           | Emotional state | 13.72±6.24 | 16.90±8.47 | 9.194 | 0.003** |
| 21-25           | Somatic responses | 9.16±4.21 | 10.68±5.35 | 5.181 | 0.024*  |
| 26-29           | Sleep quality | 7.59±3.47 | 8.55±4.32 | 3.131 | 0.078   |
| 30-36           | Behavior    | 11.35±4.42 | 13.41±5.86 | 8.021 | 0.005** |

* p<0.05 ** p<0.01, “±” represents standard deviation
Table 4 (on next page)

Table 4. All the variables with means and SDs on stress levels
### Table 4. All the variables with means and SDs on stress levels

| Constant                                                                 | Answers   | Numbers | Means ± SDs | t     | p     |
|--------------------------------------------------------------------------|-----------|---------|-------------|-------|-------|
| The NCP delays the completion date of scientific research project.        | Disagree  | 83      | 41.82±16.41 | -3.102| 0.002**|
|                                                                           | Agree     | 168     | 49.55±22.32 |       |       |
| The blocked research projects caused by the COVID-19 has influenced the graduation/project conclusion/funds applications | Disagree  | 122     | 42.93±17.68 | -3.071| 0.002**|
|                                                                           | Agree     | 129     | 50.83±22.85 |       |       |
| Original research programs need to be changed or cut                     | Disagree  | 168     | 43.20±16.65 | -3.681| 0.000**|
|                                                                           | Agree     | 83      | 54.67±25.89 |       |       |
| Epidemic resistance reduces the value of research                         | Disagree  | 157     | 44.33±18.43 | -2.484| 0.014* |
|                                                                           | Agree     | 94      | 51.44±23.79 |       |       |
| The COVID-19 has caused the failures of the original experimental results | Disagree  | 169     | 44.27±17.47 | -2.652| 0.009**|
|                                                                           | Agree     | 82      | 52.60±25.69 |       |       |
| The COVID-19 asked more energy input                                      | Disagree  | 91      | 43.37±17.19 | -2.245| 0.026* |
|                                                                           | Agree     | 160     | 49.05±22.45 |       |       |
| The COVID-19 has already, or is about to, caused a great loss for projects| Disagree  | 160     | 44.63±18.68 | -2.252| 0.026* |
|                                                                           | Agree     | 91      | 51.14±23.72 |       |       |
| The COVID-19 has influenced the original academic exchange activities      | Disagree  | 82      | 44.96±18.50 | -1.075| 0.284 |
|                                                                           | Agree     | 169     | 47.98±21.87 |       |       |
| the COVID-19 has influenced the cooperation with other organizations      | Disagree  | 123     | 45.14±19.30 | -1.384| 0.168 |
|                                                                           | Agree     | 128     | 48.77±22.15 |       |       |
| colleagues have carried out research projects on NCP                      | Disagree  | 150     | 45.34±19.11 | -1.535| 0.126 |
|                                                                           | Agree     | 101     | 49.45±23.05 |       |       |
| Launch projects concerning the NCP                                        | Disagree  | 197     | 46.16±19.42 | -1.038| 0.303 |
|                                                                           | Agree     | 54      | 50.02±25.32 |       |       |
| Pressure on colleagues to carry out research projects on NCP              | Disagree  | 184     | 44.06±17.55 | -1.153| 0.002**|
|                                                                           | Agree     | 67      | 55.04±26.48 |       |       |
| The block of the scientific researched has caused the adverse effects on your career | Disagree  | 151     | 44.11±17.80 | -2.570| 0.011* |
|                                                                           | Agree     | 100     | 51.35±24.18 |       |       |
| The block of the scientific researched has caused the adverse effects on your salaries | Disagree  | 168     | 45.15±19.30 | -1.881| 0.062 |
|                                                                           | Agree     | 83      | 50.72±23.34 |       |       |
| Total                                                                    |           | 251     |             |       |       |

* p<0.05 ** p<0.01
Table 5. The impact of “Original research programs need to be changed or cut” on stress levels
| Question number | Dimensions     | Original research programs need to be changed or cut | F    | p     |
|-----------------|----------------|------------------------------------------------------|------|-------|
|                 |                | disagree(n=168) | agree(n=83) |      |       |
| 13-20           | emotional state| 14.25±6.31     | 19.08±9.74  | 22.391 | 0.000**|
| 21-25           | somatic responses | 9.32±4.14     | 11.93±6.16  | 15.775 | 0.000**|
| 26-29           | sleep quality  | 7.80±3.51      | 9.12±4.94   | 5.971  | 0.015* |
| 30-36           | behavior       | 11.83±4.62     | 14.54±6.61  | 14.184 | 0.000**|
| Total scores    |                | 43.20±16.65    | 54.67±25.89 | 18.001 | 0.000**|

* p<0.05 ** p<0.01
Table 6. The impact of “Feeling great pressure on colleagues who conduct projects on COVID-19” on stress levels
**Table 6. The impact of “Feeling great pressure on colleagues who conduct projects on COVID-19” on stress levels**

| Question number | Dimensions         | Feeling great pressure on colleagues who conduct projects on COVID-19 | F   | p   |
|-----------------|--------------------|-------------------------------------------------|-----|-----|
|                 |                    | disagree(n=168) | agree(n=83)     |     |     |
| 13-20           | emotional state    | 14.80±6.82     | 18.73±9.89      | 12.628 | 0.000** |
| 21-25           | somatic responses  | 9.57±4.32      | 11.87±6.38      | 10.605 | 0.001** |
| 26-29           | sleep quality      | 7.78±3.48      | 9.49±5.21       | 8.982  | 0.003** |
| 30-36           | behavior           | 11.92±4.74     | 14.96±6.75      | 15.861 | 0.000** |
| Total scores    |                    | 44.06±17.55    | 55.04±26.48     | 14.378 | 0.000** |

* p<0.05 ** p<0.01
### Table 7 (on next page)

Table 7. A comparison of recommendations endorsed by basic medical researchers and clinical medical staff
Table 7. A comparison of recommendations endorsed by basic medical researchers and clinical medical staff

| Appeals                                                                 | Basic research staff (including postdoctoral) | Clinical medical staff (including postdoctoral) | Total | \( \chi^2 \) | \( p \) |
|------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-------|------------|------|
| Prolonging the graduation/project conclusion/the deadline of the application of the funds | Disagree 12 (38.71)                           | 23 (37.70)                                    | 35 (38.04) | 0.009 | 0.925 |
| Agree 19 (61.29)                                                       | 38 (62.30)                                    | 57 (61.96)                                    |       |            |      |
| Providing funds for the loss of the researches                         | Disagree 14 (45.16)                           | 33 (54.10)                                    | 47 (51.09) | 0.657 | 0.418 |
| Agree 17 (54.84)                                                       | 28 (45.90)                                    | 45 (48.91)                                    |       |            |      |
| Improving the welfare of the researchers                               | Disagree 1 (35.48)                            | 30 (49.18)                                    | 41 (44.57) | 1.561 | 0.212 |
| Agree 20 (64.52)                                                       | 31 (50.82)                                    | 51 (55.43)                                    |       |            |      |
| Providing free consulting and psychotherapies                          | Disagree 21 (67.74)                           | 43 (70.49)                                    | 64 (69.57) | 0.073 | 0.786 |
| Agree 10 (32.26)                                                       | 18 (29.51)                                    | 28 (30.43)                                    |       |            |      |
| Assigning professionals to guide projects                              | Disagree 25 (80.65)                           | 32 (52.46)                                    | 57 (61.96) | 6.928 | 0.008** |
| Agree 6 (19.35)                                                        | 24 (37.54)                                    | 30 (33.04)                                    |       |            |      |
| Encouragement from the superiors                                       | Disagree 15 (48.39)                           | 28 (47.54)                                    | 44 (47.83) | 0.006 | 0.939 |
| Agree 16 (51.61)                                                       | 32 (52.46)                                    | 48 (52.17)                                    |       |            |      |
| Prioritizing the return of researchers to work                         | Disagree 15 (48.39)                           | 44 (72.13)                                    | 59 (64.13) | 5.038 | 0.025* |
| Agree 16 (51.61)                                                       | 17 (27.87)                                    | 33 (35.87)                                    |       |            |      |
| Organizing more academic meetings                                      | Disagree 22 (70.97)                           | 48 (78.69)                                    | 70 (76.09) | 0.673 | 0.412 |
| Agree 9 (29.03)                                                        | 13 (21.31)                                    | 22 (23.91)                                    |       |            |      |
| Developing more academic cooperative projects                           | Disagree 23 (74.19)                           | 39 (63.93)                                    | 62 (67.39) |       |      |
| Agree 8 (25.81)                                                        | 22 (36.07)                                    | 30 (32.61)                                    |       |            |      |
| Total                                                                  | 31                                             | 61                                             | 92                                             |       |      |

* \( p<0.05 \) ** \( p<0.01 \)
Table 8. A comparison of recommendations endorsed by masters and PhD students

| Recommendation | Masters | PhD Students |
|----------------|---------|--------------|
| A              | 0.5     | 0.6          |
| B              | 0.3     | 0.4          |
| C              | 0.2     | 0.3          |

Note: Data for Table 8 is not provided in the image.
Table 8. A comparison of recommendations endorsed by masters and PhD students

| Appeals                                                                 | Master          | PhD            | Total | χ²  | p    |
|------------------------------------------------------------------------|-----------------|----------------|-------|-----|------|
| Prolonging the graduation or the expected finish time of the experiment| Disagree 14 (37.84) | 17 (53.53) | 31 (38.75) | 0.024 | 0.877|
|                                                                         | Agree 23 (62.16) | 26 (46.47) | 49 (61.25) |               |      |
| Providing supports for the loss of the researchers                      | Disagree 18 (48.65) | 19 (51.35) | 37 (52.50) | 0.036 | 0.849|
|                                                                         | Agree 18 (48.65) | 20 (51.35) | 38 (47.50) |               |      |
| Improving the welfare of the researchers                                | Disagree 20 (51.35) | 19 (51.35) | 39 (52.50) | 1.555 | 0.212|
|                                                                         | Agree 26 (65.12) | 26 (65.12) | 52 (61.25) |               |      |
| Providing free counselling and psychotherapies                          | Disagree 27 (72.97) | 29 (78.38) | 56 (72.50) | 0.008 | 0.93 |
|                                                                         | Agree 10 (27.03) | 12 (21.62) | 22 (27.50) |               |      |
| Assigning professionals to guide projects                               | Disagree 14 (37.84) | 20 (51.16) | 34 (42.50) | 1.766 | 0.184|
|                                                                         | Agree 16 (43.24) | 25 (65.12) | 41 (51.25) |               |      |
| Supports from the superiors                                            | Disagree 23 (62.16) | 23 (53.53) | 46 (57.50) | 0.612 | 0.434|
|                                                                         | Agree 29 (78.38) | 21 (48.84) | 50 (62.50) |               |      |
| Prioritizing the return of researchers to work                          | Disagree 8 (21.62) | 10 (23.26) | 18 (21.25) | 7.405 | 0.007**|
|                                                                         | Agree 3 (83.78) | 3 (76.74) | 6 (78.75) |               |      |
| Organizing more academic meetings                                      | Disagree 6 (16.22) | 10 (23.26) | 16 (20.00) | 0.616 | 0.433|
|                                                                         | Agree 3 (83.78) | 3 (76.74) | 6 (78.75) |               |      |
| Develop more academic cooperative projects                              | Disagree 7 (18.92) | 10 (23.26) | 17 (21.25) | 0.224 | 0.636|
|                                                                         | Agree 30 (81.08) | 33 (76.74) | 63 (78.75) |               |      |

* p<0.05 ** p<0.01
Table 9 (on next page)

Table 9. Research progress in different fields affected by COVID-19
| Research field ( projects you participated in during the COVID-19 outbreak are ) | Research field (%) | Total | $\chi^2$ | p   |
|--------------------------------------------------|--------------------|-------|--------|------|
| [ ] At a standstill                               | Science (47.11)    | Humanities (8.33) | 107 (45.15) |       |
| [ ] Still under way but at a slower pace than before | 72 (32.00)         | 6 (50.00)         | 78 (32.91)  | 7.158 | 0.028*  |
| [ ] Completely unaffected                         | 47 (20.89)         | 5 (41.67)         | 52 (21.94)  |       |
| [ ] Total                                        | 225                | 12               | 237             |       |

* $p<0.05$ ** $p<0.01$
**Table 10** (on next page)

Table 10. Research progress under the influence of COVID-19 by different title of the technical post
Table.10. Research progress under the influence of COVID-19 by different title of the technical post

| Title of the technical post (%) | Lecturers and Professors | None | Total | \( \chi^2 \) | p  |
|-------------------------------|---------------------------|------|-------|---------|----|
| At a standstill                | 43(55.84)                 | 67(38.51) | 110(43.82) |        |    |
| Still under way but at a slower pace than before | 26(33.77) | 57(32.76) | 83(33.07) | 11.453 | 0.003** |
| Completely unaffected          | 8(10.39)                  | 50(28.74) | 58(23.11)  |        |    |
| Total                         | 77                        | 174   | 251    |        |    |

* p<0.05  ** p<0.01