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Cognitions and psychological status of parents about coronavirus disease 2019 (COVID-19)

Abstract: Objective: The aim of this study was to investigate the cognitions, psychological status and their associated factors of pupil's parents in Ezhou City, Hubei Province about COVID-19. **Methods:** A cross-sectional study was used for recruitment the subjects. Data were collected via online questionnaire surveys. The questionnaire included demographic characteristics, depression, anxiety, sleep, and other associated factors about the COVID-19 epidemic. SPSS 25.0 statistical software was used to analyze and estimate the effect of associated factors on the mental health status and sleep quality of the subjects. **Results:** A total of 764 questionnaires were collected, and 90.4% of the participants were more concerned about their children's mental health and learning during the epidemic. 97.0% of the participants knew that the typical symptoms of COVID-19. But only 48.0% believed the epidemic had a bad impact on them. The mental health score of the parents was 87.79±8.91, 51.6% had disordered mental status. Significant differences were found in the age, education, professional background, sleep status, self-thinking of the impact of the epidemic on their life, and the attention to the children's learning conditions for different psychological states (P<0.05). Multiple logistic regression analysis showed that a bad self-perceived impact of the epidemic on life (OR=0.367, 95% CI: 0.272-0.493) were associated with psychological disorders. **Conclusion:** Pupil's parents in Ezhou City were highly concerned with COVID-19 infection, had high awareness and were familiar with the corresponding protective measures. However, priority attention and care should be given to some subjects' who mental disorders might be caused by the epidemic.

Keywords: Pupil's parents; COVID-19; Cognition; Psychological status; Associated factors

INTRODUCTION

Multiple cases of pneumonia with a history of exposure to seafood markets in South China were reported from Wuhan, Hubei Province, in December 2019, and were subsequently confirmed to be an acute respiratory disease caused by a novel coronavirus[1]. On February 11, 2020, the World Health Organization (WHO) officially named it Coronavirus Disease 2019 (COVID- 19)[2]. The

incidence of COVID-19 in China increased rapidly due to factors such as the large population migration before the Chinese New Year[3]. Due to the rapid increase in confirmed cases and deaths, people had been experiencing psychological problems including anxiety and depression[4].

Since the outbreak of COVID-19, the government has taken a series of measures to stop the epidemic. While living at home isolation is an important strategy to break the chain of transmission, WHO had expressed concerns about psychosocial distress of the pandemic. It speculated that new measures such as self-isolation had impacted people's daily activities and livelihood, and might lead to increased loneliness, anxiety, depression, insomnia, alcohol dependence, drug use, and self-injurious or suicidal behaviours[5, 6].

Primary caregivers may face even higher pressure in the pandemic[7]. An online survey of parents' mental state conducted by Johnson et al. after the Norwegian government-sponsored distancing measures were implemented showed that nearly 25% of parents reported anxiety and depression, with mothers, parents with more than one child and parents diagnosed with mental illness reporting higher levels of stress, exhaustion and anger toward their children. Deterioration of the parent-child relationship accounted for 41% of parental stress[8]. In a two-wave longitudinal survey， the cumulative stress experienced by parents during the implementation of the physical distancing protocols decreased as the agreement was phased out[9].To reduce the spread of COVID-19, many countries have put in place lockdown measures, including closing schools. As parents spend more time with their children, parent-child bonding patterns, relationships with partners and family cohesion all affect parents' mental health status[10, 11]. Parents with higher quality marriages and parent-child relationships reported fewer mental health symptoms[12].

In addition, a significant proportion of parents reported a change in work-related or financial issues during the COVID-19 pandemic [13].The phenomenon is even more pronounced among healthcare workers. The overall incidence of mental health problems among healthcare workers during the COVID-19 pandemic is around 40%[14], which is higher than previous studies. Healthcare workers are directly involved in the diagnosis, treatment and care of COVID-19 patients. Many healthcare workers face these challenges in harsh conditions where they lack resources, pay or access to basic personal protective equipment, placing additional stress on them[15]. The COVID-19 epidemic is taking a huge toll on the overall health and mental well-being of healthcare workers[16].

The severity of the COVID-19 infection, uncertainty about how to prevent and control this epidemic,

and information overload might all raise concerns[17]. The COVID-19 pandemic is likely to last a long time, making it necessary to prevent long-term mental health problems. The public's awareness of the prevalence of COVID-19 and precautions affects their level of concern and psychological distress related to the pandemic. Therefore, it is important to understand the public's awareness of COVID-19 at different stages of the pandemic in order to determine what and who to focus their knowledge on. The purpose of this study is to investigate primary school parents' cognition of the COVID-19, parents' psychological status and its influencing factors, to provide theoretical basis for primary school parents' mental health maintenance, psychological intervention and protection[18], and to provide scientific and practical guidance for psychological counseling in the later stage of the epidemic.

METHODS

Research objects

A total of 764 pupil's parents from a primary school in Ezhou City, participated in the questionnaire. 762 valid questionnaires were filled by 530 female and 232 male participants. All subjects gave informed consent.

Research methods

Parents who were from grades 1-6 filled out an online questionnaire on March 18-19, 2022. (questionnaire star, https://www.wjx.cn/jq/63026695.aspx). The study used stratified random sampling, with three classes in each grade randomly selected for the questionnaire. The questionnaire was designed with reference to the latest research findings on COVID-19 at home and abroad, and included: general demographic characteristics, COVID-19 related cognitions (main symptoms, route of infection, isolation time, protective measures, etc.) and psychological status(positive emotions, negative emotions , etc.). Cognitions and psychological status options were given in the questionnaire, which consisted of 4 multiple-choice and 26 single-choice on psychological status. Cognitive responses were scored 1 on the 1-point subtotal scale and 0 on the 0-point response scale; psychological condition titles were defined by degrees of agreement on their options, with 1-5 points, choosing an option to count the corresponding score, and summing up the subtotal scores to give a total score for that category. The levels were stratified according to the overall level of response, in which scores of 20 on the cognitive (< 15 for low cognition and ⩾ 15 for high cognition) and 110 on the attitudinal (< 88 for dysregulation and ⩾ 88 for good mental

health)[19, 20].After completion of the survey we will return standardised answers to the questionnaire in order to educate participants on COVID-19 health.

Quality control

The same IP address could answer the questionnaire only one time. No private information such as names was involved in the questionnaire and sensitive language was avoided. The time of response for each questionnaire was automatically monitored in the web questionnaire back office, and time of response below 100 seconds was regarded as a waste volume.

Data statistics

Statistical analysis was performed using the SPSS 25.0 software. Demographic characteristics were described as continuous and categorical variables. χ^2test and unconditional logistic regression were used to study the factors affecting the psychological status of the parents. The score of psychological status was divided into two categories: disorder and good psychological status. The impact of different demographic characteristics and COVID-19 cognitive level on psychological status was analysed sleep taking psychological status as the dependent variable, demographic characteristics and cognition of COVID-19 as independent variables, using the chi-square test for univariate analysis, and selecting P<0.05 factors for non-conditional Logistic multivariate regression analysis (α enter = 0. 05, α deleted = 0.10). The statistically significant indicators of the chi-square test difference were incorporated into the multivariate model. Logistic regression analysis variable assignment is shown in Supplementary Table S1.

Ethics approval and consent to participates

The study was approved by the Ethics Committees of the Wuhan University of Science and Technology Medical College. The ethical approval number is 2022030101.Informed consent was obtained from all subjects and/or their legal guardian(s). All methods were performed in accordance with the relevant guidelines and regulations.

RESULTS

Basic information

A total of 764 questionnaires were returned in the study, of which 762 were valid, with an effective response rate of 99.7%. The locations of the subjects included 17 provinces (autonomous regions and municipalities), and the top four provinces with the largest number of people were in the

following order: Hubei (729, 95.7%), Guangdong (8, 1.0%), Hebei (4, 0.5%), and Jiangxi (4, 0.5%), as shown in Table 1.

Table 1Demographic characteristics of subjects [n(%)]

Characteristic	Number	Composition ratio (%)
Gender		
male	232	30.4
female	530	69.6
Age group (years old)		
20~30	80	10.5
31~40	509	66.8
41~50	155	20.3
51~60	18	2.4
Marital status		
married	728	95.5
divorced	27	3.5
widowed	7	0.9
Level of Education		
primary school and below	53	7.0
junior high school	405	53.1
high school	232	30.4
university and above	72	9.4
Workplace		
city	246	32.3
suburbs	237	31.1
rural area	279	36.6
Profession		
healthcare worker	5	0.7
non-medical worker	757	99.3

Cognition of COVID-19 related knowledge

The level of cognition includes epidemiological characteristics such as the route of infection of COVID-19, symptoms at COVID-19 onset, and effective measures to prevent infection. The average cognition score of the subjects was 13.72±2.533 points, and 334 people (43.8%) had 15 points and above.

Rate of known epidemiologic characteristics

Subjects who were aware that the main symptoms include fever, anergia, dry cough, and chest tightness accounted for 97.0%, 79.0%, 84.9%, and 78.9%, respectively. 97.5% were aware that face-

to-face conversation with an infected individual without protective measures could lead to COVID-19 spread; 93.6% and 92.9% knew that eating together or taking the bus, respectively, with patients without protective measures could lead to infection; 98.8% were aware that close contacts with a COVID-19 patient required isolation under medical observation for at least 14 days.

Protective measures awareness rate

The awareness rates about "frequent handwashing", "eating cooked food", "rejecting wild animals", "wearing masks out", and "refraining from going outdoors" were 99.3%, 86.7%, 91.1%, 98.8%, and 87.4%, respectively.

Comparison of different populations

The comparison of the awareness rates of infection routes, onset symptoms, medical observation period in case of close contacts, and protective measures among different populations showed that there were significant differences for pupil's parents with different marital status, professional background, and education level ($P< 0.05$, Table 2).

Table 2 The cognition of COVID-19 by different characteristics subjects [n (%)]

Variable	Low cognition	High cognition	x^2	*P*
Gender			0.710	0.400
male	125（53.9%）	107（46.1%）		
female	303（57.2%）	227（42.8%）		
Age (years old)			4.807	0.187
20~30	49（61.3%）	31（38.8%）		
31~40	282（55.4%）	227（44.6%）		
41~50	83（53.5%）	72（46.5%）		
51~60	14（77.8%）	4（22.2%）		
Marital status			6.477	0.039
married	402(55.2%)	326(44.8%)		
divorce	21(77.8%)	6(22.2%)		
widowed	5(71.4%)	2(28.6%)		
Level of education			32.264	<0.001
primary school and below	42(79.2%)	11(20.8%)		
junior high school	248(61.2%)	157(38.8%)		
high school	110(47.4%)	122(52.6%)		
university and above	28(39.4%)	44(60.6%)		
Profession			18.377	0.005
healthcare workers	1（20.0%）	4（80.0%）		
non medical workers	427（62.4%）	330（37.6%）		

Epidemic related information and the children's concern

During the survey period, of the 762 subjects, 74.3% were very concerned about COVID-19, and 25.3% were comparatively concerned. The attitudes of the subjects as parents about their children's learning status during the outbreak were broadly expressed in the following ways: no concern (0.5%), concern (26.8%), active coaching (43.3%), and accompanying the child (29.4%); the following answers were given by the survey subjects about their child's mental health status: concern (67.2%), comparative concern (29.3%), normal (3.3%), and unresponsive (0.3%).

Attitude

Subjects had the following attitudes regarding the epidemic: it caused a very bad impact on oneself (48%), had some bad impact (45.8%), had almost no impact (6.6%), had some positive impact (14.2%), and was very good (1.3%).

Physical activity and sleep status

During the epidemic, the vast majority of subjects exercised at home, and the average daily exercise time was 20~30 minutes, 30~60 minutes, and more than one hour, for 59.6%, 18.9%, and 7.3% of the subjects, respectively. The bedtime in the two weeks before the interview was before 21 o'clock (10%), 21 to 22 o'clock (41.5%), 22 to 23 o'clock (29.4%), 23 to 24 o'clock (8.7%), after midnight (4.2 %), and irregular (6.3%), while overall sleep conditions were very good (37.5%), good (29.3%), common (29.9%), poor (2.6%), and very poor (0.7%).

The mental health status and influencing factors of the pupil's parents under the epidemic

The mental health of the pupil's parents

The mental health score of the pupil's parents was 87.79±8.913. According to the scoring standard, 393 (51.6%) had a disordered mental state, and 369 (48.4%) had a good mental state. The chi-square test was used to compare the psychological status of people with different characteristics, and the results showed that age, education level, professional background, sleep status, the degree of the impact of the epidemic on life, and attention to children's learning have different effects on the psychological status of the interviewees. Significant differences (P<0.05) can be seen in Table 3.

Table 3 Psychological status of people with different characteristics

Variable	Mental health disorder	Good mental health	χ^2	*P*

Gender				
male	111 （47.8%）	121 （52.2%）	1.858	0.173
female	282 （53.2%）	248（46.8%）		
Age group (years old)				
20~30	46 （57.5%）	34(42.5%)	8.744	0.033
31~40	274 （53.8%）	235(46.2%)		
41~50	64 （41.3%）	91 (58.7%)		
51~60	9（50.0%）	9 (50.0%)		
Marital status				
married	374（51.4%）	354 （48.6%）	0.271	0.874
divorce	15 （55.6%）	12（44.4%）		
widowed	4（57.1%）	3 （42.9%）		
Level of education				
primary school and below	36 （67.9%）	17 （32.1%）	12.869	0.012
junior high school	220 （54.3%）	185（45.7%）		
high school	105（45.3%）	127（54.7%）		
university and above	32（44.4%）	40 （55.6%）		
Sleep condition				
well	114（39.9%）	172（60.1%）	38.218	<0.001
better	115（51.6%）	108（48.4%）		
general	143 （62.7%）	85（37.3%）		
poor	16 （80.0%）	4 （20.0%）		
very bad	5 （100%）	0 （0%）		
Self-perceived level of impact of the epidemic on life				
very bad effect	236 （64.5%）	130 （35.5%）	46.970	<0.001
A little bad effect	152（43.6%）	197（56.4%）	16.591	<0.001
almost no effect	18（36.0%）	32（64.0%）	5.197	0.023

Mental health status influencing factors

Multiple logistic regression analysis was performed with mental health status as the dependent variable (1 = poor mental status and 2 = good mental status), and age, education level, professional background, sleep, self-perceived level of impact of the epidemic on life, and concern about the child's learning situation as independent variables. The results obtained from the logistic regression analysis (Table 4) showed that a very bad self-perceived level of impact of the epidemic on life (or = 0.362, 95% CI: 0.270-0.485, $P< 0.001$) and a little bad self-perceived level of impact of the

epidemic on life (or = 0.367, 95% CI: 0.272-0.493, $P < 0.001$) were associated with psychological disorders.

Table 4 The results of logistic regression analysis

Variable	Control group	β	S.E.	*P*	OR	95.0% CI
Age (years old)						
41~50	20~30	0.951	0.300	0.002	2.589	1.437-4.662
Level of education						
junior	primary and	0.700	0.335	0.037	2.014	1.044-3.886
high school	below	1.022	0.345	0.003	2.779	1.413-5.468
university		0.964	0.405	0.017	2.623	1.186-5.801
Self-perceived level of impact of the epidemic on life						
very bad effect	not selected	-1.017	0.150	0.000	0.362	0.270-0.485
A little bad effect		-1.004	0.151	0.000	0.367	0.272-0.493

DISCUSSION

In this study, 43.8% of subjects had a high knowledge rate about COVID-19, of which the awareness rate of pupil's parents with a higher education level was significantly higher than that with a lower education level. At the same time, well-educated parents had better mental health during the pandemic than poorly educated parents. A possible explanation is that the higher cultural literacy of the parents confers better access or understanding of the epidemic and related health information. Among the participants, the awareness rate of parents of medical workers was higher than that of non-medical workers. Due to occupational requirements, medical workers have a greater chance to be exposed to COVID-19 than other occupational groups. Therefore, they can timely understand the epidemic and morbidity characteristics of COVID-19 and master effective protective measures[21]. It is important to understand the characteristics of the epidemic in a timely manner and adopt targeted strategies to effectively prevent and control the spread of the disease to reduce people's negative emotions and panic[22, 23].

A hospital survey showed that the overall awareness rate of healthcare workers about COVID-19 was higher than 90%[24]. A correct grasp of the basic knowledge of COVID-19 prevention and control can effectively ensure the treatment capacity of medical institutions, which is of great significance for protecting oneself from infection and preventing nosocomial infection. In addition,

it has been suggested that healthcare workers, especially fever clinics and isolation wards, experienced mild to moderate depression during the epidemic [24]. Healthcare workers in epidemic prevention and control positions have serious psychological problems, but in this study, the difference in mental health status between healthcare workers and non- healthcare workers is not statistically significant, which may be because the research subjects included in this study are less engaged in healthcare work (6.6%), leading to inaccurate statistical results.

After the COVID- 19 outbreak, More than half (51.6%) of the participants' mental state was negatively affected, mainly in aged 20 to 30 years (57.5%), and with primary school education and below (67.9%), and those who were badly influenced by the epidemic. The multivariate logistic regression study showed that "believing that the epidemic has a negative impact on life" was an independent risk factor for poor mental health status. A longitudinal study in the Netherlands showed that during the lockdown, parents had to home school their children, work remotely and worry excessively about the pandemic, their negative emotions (depression, anxiety, hostility and interpersonal sensitivity) are significantly increased， but decreased over time [25]. This suggested that it was very important to strengthen control measures, restore the normal productive life order as soon as possible, and communicate confidence to the public during the epidemic, to help the public face the crisis.

The most recent 2-weeks bedtime during the survey was 21-22 o'clock(41.5%), 22-23 o'clock (29.4%), and 23-24 o'clock (8.7%), 3.3% of participants had sleep disturbances. Research has shown a correlation between mental health and sleep quality[26, 27]. Some studies believe that quarantining people at home due to COVID-19 will affect their mental state and sleep quality in different degrees[28].

During the epidemic, the vast majority of pupil's parents (90.4%) had high concerns about their children's learning and mental health. The learning of the children was actively provided or accompanied by the parents in 43.3% and 29.4% of cases, respectively. Parents who are concerned about their children's academic status have better mental health, suggesting that parents can ease their anxiety by focusing on their children's learning. A study in France suggests that training programs for parents through telephone consultations and online meetings during the pandemic can effectively help parents regulate their emotions and guide their children correctly[29]. High parental involvement and acceptability are important factors that affect the outcome of treatment. Therefore,

in the special period when face-to-face education is not possible, targeted communication and guidance for parents through online education is conducive to the formation of positive interaction between the behaviors, attitudes and effects of parents' participation.[30].

Since January 2020, the National Health Commission of China had issued several guidelines for the intervention on emergency psychological crises, established a psychological assistance line, and developed a web-based mental health education platform for the COVID-19 epidemic [31, 32].These measures had all contributed to the relief of psychological distress and psychological harm among the public, but challenges remained[33]. This study provides a rapid assessment of public cognition and psychological status during COVID-19 and may provide a basis for governments to develop targeted health education and behavioural intervention strategies. The sample size was large to accurately reflect the mental health status of the pupil's parents during COVID-19.

By including a large number of samples, this study can accurately reflect the mental health status of parents of students during COVID-19 , assess parents' awareness of COVID-19, and provide a basis for the government to formulate targeted health education and behavioral intervention strategies. The results of this study lead to the following recommendations: (1)Attention should be paid to vulnerable groups, such as the elderly, women, medical personnel, and people with lower school education; attention should also be paid to people's social activities and family conditions[34]. (2)In our study，it provided information on prevention, treatment, and control of COVID-19 and to avoid the dissemination of false information. (3) To provide authoritative psychological assessment procedures and online psychotherapy. (4) To reduce psychological distress through cognitive training and to encourage and educate individuals with higher negative cognitive processing biases to use emotion regulation strategies that separate attention from negative emotions in the event of anxiety or depression to maintain and promote their mental health[31, 35] (5) It is important to pay more attention to the mental health status of the pupil's parents during the epidemic, encourage the positive role of new media in the epidemic, promote psychological interventions related measures, and establish social stress psychological prevention and control strategies [36, 37].

Strengths and Limitations

As far as we know, this is the first cross-sectional study to analyze the cognitions and psychological status of pupil’s parents in Ezhou City about the COVID-19. Moreover, the survey covers a representative sample of rural primary schools, which can better reflect parents' cognitive and

psychological status. Both of these provide valuable clues for follow-up research and taking surveillance and control measures accordingly for our subjects.

This study also has several limitations. First, this is a cross-sectional study that can only speculate about the factors that affect parents' awareness and mental health status of COVID-19, and cannot determine causation. Second, our study only investigated rural primary school, and whether the results can be extrapolated to urban school needs further study. Third, the assessment of mental state did not use standard psychometric scales, resulting in no comparison of other studies of the same type. Fourth, future research needs to base up on more large survey sample in individual level, such as the attitudes and cognitive of "stay at home mom" and the "working mother".

CONCLUSION

In this study, we found that the pupil's parents in Ezhou City were highly concerned with COVID-19 infection, and had high awareness and were familiar with the corresponding protective measures. However, some of the subjects' mental disorders may have been caused by the pandemic, with varying levels of impact depending on factors such as age, education, occupation and concern for the child's learning status. Therefore, on the one hand, authorities should promptly carry out online health education for the different stages of the epidemic of new infectious diseases such as COVID-19, and resolutely implement epidemic prevention measures, to restore normal life order as soon as possible and protect the mental health of parents. On the other hand, parents should also improve their awareness of diseases and pay more attention to their physical and mental health.

The Supplementary form, Ethical Review Form, and Statement of Editing have been submitted to the Editorial Department as supplementary materials.

Conflicts of interest

The authors declare no conflicts of interest in this study.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author upon reasonable request.

References

[1] Chang Jinghui, Yuan Yuxin, Wang Dong. Mental health status and its influencing factors among college students during the epidemic of COVID-19 [J]. South Med Univ, 2020,40(2):171-176.(in chinese)

[2] National Health Commission of the People's Republic of China. epidemic notification [EB/OL]. [2023/5/30]. http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml.

[3] Roychowdhury D. 2019 Novel Coronavirus Disease, Crisis, and Isolation[J]. Front Psychol, 2020,11:1958.

[4] Fu H, Wang H, Xi X, et al. Database of epidemic trends and control measures during the first wave of COVID-19 in mainland China[J]. Int J Infect Dis, 2021,102:463-471.

[5] Diamond R, Willan J. Coronavirus disease 2019: achieving good mental health during social isolation[J]. Br J Psychiatry, 2020,217(2):408-409.

[6] WHO. Coronavirus disease (COVID-19)[EB/OL]. [2023/5/30]. https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

[7] Achterberg M, Dobbelaar S, Boer O D, et al. Perceived stress as mediator for longitudinal effects of the COVID-19 lockdown on wellbeing of parents and children[J]. SCIENTIFIC REPORTS, 2021,11(1).

[8] Johnson M S, Skjerdingstad N, Ebrahimi O V, et al. Parental stress, anxiety and depression among parents during the government-initiated physical distancing measures following the first wave of COVID-19[J]. STRESS AND HEALTH, 2022,38(4):637-652.

[9] Johnson M S, Skjerdingstad N, Ebrahimi O V, et al. Mechanisms of parental distress during and after the first COVID-19 lockdown phase: A two-wave longitudinal study[J]. PLOS ONE, 2021,16(6).

[10] Jiao W Y, Wang L N, Liu J, et al. Behavioral and Emotional Disorders in Children during the COVID-19 Epidemic[J]. JOURNAL OF PEDIATRICS, 2020,221:264.

[11] Stevanovic D, Basay B K, Basay O, et al. COVID-19 pandemic-related aspects and predictors of emotional and behavioural symptoms in youth with pre-existing mental health conditions: results from Georgia, Lithuania, Romania, Serbia, and Turkey[J]. NORDIC JOURNAL OF PSYCHIATRY, 2022,76(7):515-522.

[12] DeMontigny F, Gervais C, Pierce T, et al. Perceived Paternal Involvement, Relationship Satisfaction, Mothers' Mental Health and Parenting Stress: A Multi-Sample Path Analysis[J]. FRONTIERS IN PSYCHIATRY, 2020,11.

[13] Thorell L B, Skoglund C, de la Peña A G, et al. Parental experiences of homeschooling during the COVID-19 pandemic: differences between seven European countries and between children with and without mental health conditions[J]. Eur Child Adolesc Psychiatry, 2022,31(4):649-661.

[14] Saragih I D, Tonapa S I, Saragih I S, et al. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: A systematic review and meta-analysis[J]. International Journal of Nursing Studies, 2021,121:104002.

[15] Mitike G, Nigatu F, Wolka E, et al. Health system response to COVID-19 among primary health care units in Ethiopia: A qualitative study[J]. PLOS ONE, 2023,18(2).

[16] Lee B E C, Ling M, Boyd L, et al. The prevalence of probable mental health disorders among

hospital healthcare workers during COVID-19: A systematic review and meta-analysis[J]. Journal of Affective Disorders, 2023,330:329-345.

[17] Xiang Y T, Yang Y, Li W, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed[J]. Lancet Psychiatry, 2020,7(3):228-229.

[18] Li W, Yang Y, Liu Z H, et al. Progression of Mental Health Services during the COVID-19 Outbreak in China[J]. Int J Biol Sci, 2020,16(10):1732-1738.

[19] Fitzgerald A, Konrad S. Transition in learning during COVID-19: Student nurse anxiety, stress, and resource support[J]. Nurs Forum, 2021,56(2):298-304.

[20] Wang X, Hegde S, Son C, et al. Investigating Mental Health of US College Students During the COVID-19 Pandemic: Cross-Sectional Survey Study[J]. J Med Internet Res, 2020,22(9):e22817.

[21] Arpacioglu S, Gurler M, Cakiroglu S. Secondary Traumatization Outcomes and Associated Factors Among the Health Care Workers Exposed to the COVID-19[J]. Int J Soc Psychiatry, 2021,67(1):84-89.

[22] Nwagbara U I, Osual E C, Chireshe R, et al. Knowledge, attitude, perception, and preventative practices towards COVID-19 in sub-Saharan Africa: A scoping review[J]. PLoS One, 2021,16(4):e249853.

[23] Zhan S, Yang Y Y, Fu C. Public's early response to the novel coronavirus-infected pneumonia[J]. Emerg Microbes Infect, 2020,9(1):534.

[24] Mitike G, Nigatu F, Wolka E, et al. Health system response to COVID-19 among primary health care units in Ethiopia: A qualitative study[J]. PLOS ONE, 2023,18(2).

[25] Achterberg M, Dobbelaar S, Boer O D, et al. Perceived stress as mediator for longitudinal effects of the COVID-19 lockdown on wellbeing of parents and children[J]. Sci Rep, 2021,11(1):2971.

[26] Zhang Y T, Huang T, Zhou F, et al. Correlation between Anxiety, Depression, and Sleep Quality in College Students[J]. Biomed Environ Sci, 2022,35(7):648-651.

[27] Luo L, Zhang Y, Huang T, et al. A description of the current status of chronic fatigue syndrome and associated factors among university students in Wuhan, China[J]. FRONTIERS IN PSYCHIATRY, 2023,13.

[28] Meherali S, Punjani N, Louie-Poon S, et al. Mental Health of Children and Adolescents Amidst COVID-19 and Past Pandemics: A Rapid Systematic Review[J]. Int J Environ Res Public Health, 2021,18(7).

[29] Maurice V, Didillon A, Purper-Ouakil D, et al. Adapting a parent training program to the COVID-19 crisis in a mental health care setting in France[J]. Encephale, 2022,48(3):354-358.

[30] He S, Shuai L, Wang Z, et al. Online Learning Performances of Children and Adolescents With Attention Deficit Hyperactivity Disorder During the COVID-19 Pandemic[J]. Inquiry, 2021,58:1448324503.

[31] Liu S, Yang L, Zhang C, et al. Online mental health services in China during the COVID-19 outbreak[J]. Lancet Psychiatry, 2020,7(4):e17-e18.

[32] National Administration of Disease Control and Prevention. A circular on the issuance of guidelines for psychological assistance hotlines during the prevention and control of the novel coronavirus pneumonia epidemic [EB/OL]. [2023/5/30]. http://www.nhc.gov.cn/jkj/s3577/202002/f389f20cc1174b21b981ea2919beb8b0.shtml.

[33] Dong L, Bouey J. Public Mental Health Crisis during COVID-19 Pandemic, China[J]. Emerg

Infect Dis, 2020,26(7):1616-1618.

[34] Jiang W, Liu X, Zhang J, et al. Mental health status of Chinese residents during the COVID-19 epidemic[J]. BMC Psychiatry, 2020,20(1):580.

[35] Li H, Wang S, Zhong F, et al. Age-Dependent Risks of Incidence and Mortality of COVID-19 in Hubei Province and Other Parts of China[J]. Front Med (Lausanne), 2020,7:190.

[36] Alaazi D A, Salami B, Gabriel Ojakovo O, et al. Mobilizing communities and families for child mental health promotion in Canada: Views of African immigrants[J]. Children and Youth Services Review, 2022,139:106530.

[37] Li M, Zhang J, Jiang C, et al. The Neural Correlates of the Recognition of Emotional Intensity Deficits in Major Depression: An ERP Study[J]. Neuropsychiatr Dis Treat, 2023,19:117-131.

Title Page

Cognitions and psychological status of parents about coronavirus disease 2019 (COVID-19) [1]

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Jing Cheng conceived and designed the study. Lei Wang offered key support to the online survey and Honghui Gan, Yutong Zhang drafted the paper and finalized the manuscript, and Change Xiong, Yaqi Xu, Lu He, Lin Lv and Shuliu Pan performed the study, Jianbo Zhan instructed the survey. All authors contributed to discussions and the writing of the manuscript.

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Table S1 Logistic regression analysis variable assignment table

Variables	Assignment
Age	1 = 20~30 years, 2 = 31~40 years, 3=41~50 years,4 = 51~60 years
Level of education	1 = primary school and below, 2=junior high school, 3= highschool,4=college, 5=Master's and above
The extent to which the outbreak affected life was self-identified	
very adverse effects	0 = not selected, 1 = selected
a little bit bad affect	
little effect	
Concerns about the child's learning status	1=indifferent,2=concerned,3=actively 4 = accompanying the child
Current state of physical health	1 = very healthy, 2 = good, 3 = General

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Knowledge of coronavirus disease 2019 (COVID-19) and the psychological status of parents: A retrospective survey in Wuhan, Hubei

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Knowledge of coronavirus disease 2019 (COVID-19) and the psychological status of parents: A retrospective survey in Wuhan, Hubei [1]

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Abstract: Objective: During the coronavirus disease 2019 (COVID-19) pandemic, many parents faced heightened stress, anxiety and depression due the local and global COVID-19 mitigation measures and lockdowns. In this study, elementary school parents in Ezhou, Wuhan, were surveyed to assess their mental health and associated factors, with the aim of formulating recommendations for the protection of parental mental health. **Methods:** Online surveys were used to collect data for this cross-sectional study. The survey assessed demographic characteristics, knowledge of COVID-19 infections and prevention, depression, anxiety, sleep, and other associated factors following the COVID-19 pandemic. Chi-square tests and unconditional logistic regression were used to examine the factors affecting the psychological status of parents. **Results:** A total of 764 participants completed the online survey. Overall, 90.4% of the participants were concerned about their children's mental health and learning during the pandemic. Additionally, 97.0% were aware of the typical symptoms of COVID-19. Only 48.0% of participants felt the pandemic negatively impacted their lives. The average psychological status score among parents was 87.79±8.91, with 51.6% showing signs of high psychological distress. Significant differences in psychological status were linked to age, education, professional background, sleep status, personal views on the pandemic's impact, and concern for children's learning ($P<0.05$). Multiple logistic regression analysis revealed that a negative perception of the pandemic's impact on one's life (OR=0.367, 95% CI: 0.272-0.493) was associated with psychological distress. **Conclusion:** Parents of school children in Ezhou City have a good knowledge base on COVID-19 infection and have a high awareness of the corresponding protective measures. However, priority attention and care should be given to individuals who have experienced mental distress in relation to the pandemic.

Keywords: Parents; COVID-19;Psychological status; Associated factors

Strengths and limitations of this study:

Strengths:

1. This is the first cross-sectional study to analyse the COVID-19 knowledge and psychological status of parents in Ezhou City. A representative sample of rural primary schools was selected for recruitment, offering a generalized sample to reflect parents' psychological status and knowledge levels.

2. These findings offer valuable guidance for follow-up research and the development of surveillance and control measures in the future.

Limitations:

1. Given the cross-sectional nature of this study, we can only speculate about the factors that affect parents' knowledge and psychological status; causation cannot be implied.
2. This study only investigated rural primary schools; caution should be adopted when generalizing the results to parents in urban schools.
3. Standard psychometric scales were not used to assess parents' psychological status. Thus, the results cannot be compared with other similar studies.

INTRODUCTION

In December 2019, multiple cases of pneumonia with a history of exposure to seafood markets in South China were reported in Wuhan, Hubei Province. These individuals were subsequently confirmed to have an acute respiratory disease caused by a novel coronavirus[1]. On February 11, 2020, the World Health Organization (WHO) officially named it Coronavirus Disease 2019 (COVID-19)[2]. The incidence of COVID-19 in China increased rapidly due to factors such as widespread population migration before the Chinese New Year[3]. Due to the rapid increase in confirmed cases and deaths, the population has experienced psychological problems such as anxiety and depression[4].

Since the outbreak of COVID-19, the government has adopted a series of measures to stop the pandemic. While home isolation is an important strategy to break the chain of transmission, the WHO has expressed concerns about psychosocial distress associated with such measures. Authors have speculated that these new measures, such as self-isolation, have impacted people's daily activities and livelihoods, and might lead to increased loneliness, anxiety, depression, insomnia, alcohol dependence, drug use and self-injurious or suicidal behaviours[5, 6].

Primary caregivers may have faced even higher pressure during the pandemic[7]. An online survey by Johnson et al. that examined parents' mental states after the Norwegian government-sponsored distancing measures were implemented showed that nearly 25% of parents reported anxiety and depression, with mothers, parents with more than one child, and parents diagnosed with mental

illness reporting higher levels of stress, exhaustion and anger toward their children. Deterioration of the parent-child relationship accounted for 41% of parental stress[8]. In a two-wave longitudinal survey, the cumulative stress experienced by parents during the implementation of physical distancing protocols decreased as the measures were phased out[9]. To reduce the spread of COVID-19, many countries put lockdown measures in place, including closing schools. As parents spent more time with their children, parent-child bonding patterns, relationships with partners and family cohesion all affected parents' mental health status[10, 11]. Parents with higher-quality marriages and parent-child relationships reported fewer mental health symptoms[12]. In addition, a significant proportion of parents reported work-related or financial issues during the COVID-19 pandemic[13]. The impacts of COVID-19 were even more pronounced among healthcare workers. The overall incidence of mental health problems among healthcare workers during the COVID-19 pandemic was reported to be around 40%[14]. Healthcare workers are directly involved in the diagnosis, treatment and care of COVID-19 patients, during the pandemic and to the current day. Many healthcare workers continue to face these challenges in harsh conditions where there is a lack of resources, pay, and access to basic personal protective equipment, placing additional stress on these individuals[15]. Thus, the COVID-19 pandemic has taken a huge toll on the overall health and mental well-being of healthcare workers[16].

The severity of COVID-19 infection, uncertainty about how to prevent and control the pandemic, and information overload are all likely to be of concern to the community[17]. Arguably, the COVID-19 pandemic will have long-lasting economic, social, and policy implications, and there is a need to mitigate the long-term mental health problems experienced as a result of this pandemic. The public's awareness of the prevalence of COVID-19 infection and the associated precautions may affect their level of concern and psychological distress related to the pandemic. Thus, the purpose of this study was to investigate primary school parents' understanding of COVID-19, their psychological status, and the related influencing factors, in order to provide a theoretical basis for mental health maintenance, psychological intervention and protection[18] among this group. These findings will also provide scientific and practical guidance for the provision of psychological counselling following the pandemic.

METHODS

Participants

This study used stratified whole-cluster sampling to randomly select three elementary schools within Ezhou City. An online survey was administered to the parents of students in one or two classes in grades 1-6, respectively, of each school. The inclusion criteria included: (1) parent or legal guardian of a primary school student or a person directly responsible for the child's education; and (2) able to operate a computer or smartphone to complete the survey. Only one representative from each family was allowed to participate and surveys with incomplete data were considered invalid and were excluded.

Screening questionnaire

Surveys were distributed to parents of children in grades 1-6 of elementary school. The surveys were distributed by teachers on March 18-19, 2022, after the students returned to school (questionnaire star, https://www.wjx.cn/jq/63026695.aspx).

The survey assessed general demographic characteristics, COVID‐19-related knowledge (main symptoms, infection route, isolation duration, protective measures) and psychological status (positive and negative emotions). Among them, the questions related to COVID‐19 knowledge were designed with reference to the latest research results on COVID-19 locally and abroad and the COVID-19 prevention and control policy of Ezhou City during the study period. One point is awarded for a correct answer to the question, no points for an incorrect answer. The scores were then summed to obtain an overall score for COVID-19 knowledge. This variable was then stratified into high knowledge (scores greater than or equal to 15) and low knowledge (scores less than 15). The measurement of psychological status was adapted based on the Depression Anxiety and Stress Scale (DASS-21), Symptom Checklist-90 (SCL-90), Meaning in Life Questionnaire (MLQ), Self-Anxiety Scale (SAS), Self-Rating Depression Scale (SDS). The questions related to psychological status were scored on a five-point scale. The scores were summed to obtain a total score for psychological status. This total score was then stratified into high psychological distress (scores less than 88) and low psychological distress (scores greater than or equal to 88)[19, 20].

Quality control

The same IP address could complete the survey only one time. No private information, such as participant names, was collected during the survey and sensitive language was avoided. The time

taken to answer each question was monitored in the background, and those who answered the questionnaire within 100 seconds were considered invalid.

Statistical analysis

Statistical analysis was performed using SPSS 25.0 software. The chi-square test and unconditional logistic regression were used to study the factors affecting the psychological status of the participants. As described above, psychological status was stratified into two levels: low psychological distress and high psychological distress. The impact of different demographic characteristics and COVID-19 understanding on psychological status was analysed taking psychological status as the dependent variable and the demographic characteristics and COVID-19 understanding variables as independent variables. Factors that were statistically significant in the chi-square univariate analyses (i.e., $P<0.05$) were included in the non-conditional logistic multivariate regression analysis (α enter = 0. 05, α deleted = 0.10). The variable assignment for the logistic regression analysis is shown in Supplementary Table S1.

Ethics approval

This study was approved by the Ethics Committees of Wuhan University of Science and Technology Medical College. The ethical approval number is 2022030101. Informed consent was obtained from all participants. All methods were performed in accordance with the relevant guidelines and regulations.

Patient and Public Involvement

No patient involved.

RESULTS

Basic information

A total of 764 questionnaires were returned, among which, 762 were valid, with an effective response rate of 99.7%. The locations of the participants included 17 provinces (autonomous regions and municipalities); the top four provinces with the largest numbers of participants were as follows: Hubei (729, 95.7%), Guangdong (8, 1.0%), Hebei (4, 0.5%) and Jiangxi (4, 0.5%), as shown in table1.

Table 1 Basic demographic characteristics of parents in Ezhou

Characteristic	Number	Composition ratio (%)
Gender		
male	232	30.4
female	530	69.6
Age group (year)		
20~30	80	10.5
31~40	509	66.8
41~50	155	20.3
51~60	18	2.4
Marital status		
married	728	95.5
divorced	27	3.5
widowed	7	0.9
Level of Education		
primary school and below	53	7.0
junior high school	405	53.1
high school	232	30.4
university and above	72	9.4
Workplace		
city	246	32.3
suburbs	237	31.1
rural area	279	36.6
Profession		
healthcare worker	5	0.7
non-medical worker	757	99.3

COVID-19-related knowledge

The level of COVID-19-related knowledge included knowledge of the epidemiological characteristics of COVID-19, such as the route of infection, symptoms at onset and effective measures to prevent infection. The average COVID-19 knowledge score was 13.72±2.533 points. A total of 334 participants (43.8%) had scores of 15 or above.

Knowledge of COVID-19 symptoms and protocols

The rates of knowledge of the main symptoms of COVID-19, i.e., fever, anergia, dry cough and chest tightness, were 97.0%, 79.0%, 84.9% and 78.9%, respectively. Further, 97.5% of participants

were aware that face-to-face conversation with an infected individual without protective measures could lead to COVID-19 spread; 93.6% and 92.9% knew that eating together or taking the bus, respectively, with patients without protective measures could lead to infection; and 98.8% were aware that close contacts with a COVID-19 patient required isolation under medical observation for at least 14 days.

Knowledge of protective measures

The rates of knowledge of the need for "frequent handwashing", "eating cooked food", "rejecting wild animals", "wearing masks out" and "refraining from going outdoors" were 99.3%, 86.7%, 91.1%, 98.8%, and 87.4%, respectively.

Comparison of different sub-groups

A comparison of the rates of knowledge on infection routes, onset symptoms, medical observation period in the case of close contacts, and protective measures among different sub-groups revealed significant differences as a function of marital status, professional background and education level ($P< 0.05$, Table 2).

Table 1 The cognition of COVID-19 by different characteristics subjects [n (%)]

Variable	Low cognition	High cognition	x^2	P
Gender			0.710	0.400
male	125（53.9%）	107（46.1%）		
female	303（57.2%）	227（42.8%）		
Age (years old)			4.807	0.187
20~30	49（61.3%）	31（38.8%）		
31~40	282（55.4%）	227（44.6%）		
41~50	83（53.5%）	72（46.5%）		
51~60	14（77.8%）	4（22.2%）		
Marital status			6.477	0.039
married	402(55.2%)	326(44.8%)		
divorce	21(77.8%)	6(22.2%)		
widowed	5(71.4%)	2(28.6%)		
Level of education			32.264	<0.001
primary school and below	42(79.2%)	11(20.8%)		
junior high school	248(61.2%)	157(38.8%)		
high school	110(47.4%)	122(52.6%)		
university and above	28(39.4%)	44(60.6%)		
Profession			18.377	0.005
healthcare workers	1（20.0%）	4（80.0%）		

Non medical workers	427（62.4%）	330（37.6%）

Attitudes of parents towards COVID-19

Overall, 74.3% of participants were very concerned about COVID-19 and 25.3% were comparatively concerned. When asked about their concern in relation to their children's learning status during the pandemic, the responses were as follows: no concern (0.5%), concern (26.8%), active coaching (43.3%) and accompanying the child (29.4%). When asked about their concern about their child's mental health status due to the pandemic, the responses were as follows: concern (67.2%), comparative concern (29.3%), normal (3.3%) and unresponsive (0.3%).

Perception of the COVID-19 pandemic

When asked about the impact of the COVID-19 pandemic, the participants' responses were as follows: it caused a very bad impact on oneself (48%), some bad impact (45.8%), almost no impact (6.6%), some positive impact (14.2%), very good impact (1.3%).

Physical activity and sleep status

The vast majority of participants reported that they exercised at home; the average daily exercise time was 20-30 minutes for 59.6% of participants, 30-60 minutes for 18.9% of participants, and more than one hour for 7.3% of participants. The participants' bedtimes in the two weeks prior to the survey were as follows: before 21:00 (10%), 12:00-22:00 (41.5%), 22:00-23:00 (29.4%), 23:00-00:00 (8.7%), after 00:00 (4.2%) and irregular bedtime (6.3%). The overall sleep condition as reported by the participants were as follows: very good (37.5%), good (29.3%), common (29.9%), poor (2.6%) and very poor (0.7%).

The psychological status and factors influencing the psychological status of parents

The average psychological status score was 87.79±8.913. According to the stratification, 393 (51.6%) were experiencing high psychological distress, and 369 (48.4%) were experiencing low psychological distress. The chi-square test indicated that the psychological status of individuals varied as a function of age, education level, professional background, sleep status, the degree of the impact of the pandemic on life, and concern for the effects of the pandemic on the learning of children. The findings (P<0.05) are presented in Table 3.

Table 2 Psychological status of people with different characteristics

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Variable	Mental health disorder	Good mental health	χ^2	*P*
Gender				
male	111 （47.8%）	121 （52.2%）	1.858	0.173
female	282 （53.2%）	248（46.8%）		
Age group (years old)				
20~30	46 （57.5%）	34(42.5%)		
31~40	274 （53.8%）	235(46.2%)	8.744	0.033
41~50	64 （41.3%）	91 (58.7%)		
51~60	9（50.0%）	9 (50.0%)		
Marital status				
married	374（51.4%）	354 （48.6%）		
divorce	15 （55.6%）	12（44.4%）		
widowed 4 （57.1%）3 （42.9%）			0.271	0.874
Level of education				
primary school and below	36 （67.9%）	17 （32.1%）		
junior high school	220 （54.3%）	185（45.7%）		
high school	105（45.3%）	127（54.7%）	12.869	0.012
university and above	32（44.4%）	40 （55.6%）		
Sleep condition				
well	114（39.9%）	172（60.1%）		
better	115（51.6%）	108（48.4%）		
general	143 （62.7%）	85（37.3%）		
poor	16 （80.0%）	4 （20.0%）	38.218	<0.001
very bad	5 （100%）	0 （0%）		
Self-perceived level of impact of the epidemic on life				
very bad effect	236 （64.5%）	130 （35.5%）	46.970	<0.001
			16.591	<0.001
			5.197	0.023
A little bad effect	152（43.6%）	197（56.4%）		
almost no effect	18（36.0%）	32（64.0%）		

214 **Factors influencing psychological status**

215 Multiple logistic regression analysis was performed with psychological status as the dependent
216 variable (1 = high psychological distress and 2 = low psychological distress), and age, education
217 level, professional background, sleep, self-perceived level of impact of the epidemic on life, and

concern about the child's learning situation as independent variables. The results (Table 4) showed that a very bad self-perceived level of impact of the epidemic on life (OR = 0.362, 95% CI: 0.270-0.485, $P< 0.001$) and a somewhat bad self-perceived level of impact of the epidemic on life (OR = 0.367, 95% CI: 0.272-0.493, $P < 0.001$) were associated with high psychological distress.

Table 3 The results of logistic regression analysis

Variable	β	S.E.	*P*	OR	95% CI
Age (year)					
20~30	Ref				
41~50	0.951	0.300	0.002	2.589	1.437-4.662
Level of education					
primary and below	Ref				
junior	0.700	0.335	0.037	2.014	1.044-3.886
high school	1.022	0.345	0.003	2.779	1.413-5.468
university	0.964	0.405	0.017	2.623	1.186-5.801
Self-perceived level of impact of the epidemic on life					
almost no effect	Ref				
very bad effect	-1.017	0.150	0.000	0.362	0.270-0.485
A little bad effect	-1.004	0.151	0.000	0.367	0.272-0.493

Note 1 S.E., standard error; Ref, reference; OR, odds ratio; CI, confidence interval; *P*, p-value.

DISCUSSION

In this study, 43.8% of participants had a high level of knowledge of COVID-19, among which, those with a higher level of education had a higher knowledge level. At the same time, well-educated participants had a better psychological status than those with a lower education level. This may be because a higher cultural literacy level offers better access to information or understanding of information related to COVID-19.

Further, medical workers had higher knowledge levels than non-medical workers. Due to their occupational requirements, medical workers have a greater chance of being exposed to COVID-19 than other occupational groups. Therefore, they have a greater understanding of the pandemic and the morbidity characteristics of COVID-19 and are better able to understand and adopt protective measures[21]. It is important to understand the characteristics of the pandemic and adopt timely targeted strategies to effectively prevent and control the spread of the disease in order to reduce the

experience of negative emotions and panic[22, 23]. A hospital survey showed that the overall awareness rate of healthcare workers in relation to COVID-19 was higher than 90%[24]. Comprehensive basic knowledge of COVID-19 prevention and control can effectively ensure the treatment capacity of medical institutions, which is of great significance for protecting individuals from infection and preventing nosocomial infection. In addition, it has been suggested that healthcare workers, especially those in fever clinics and isolation wards, have experienced mild to moderate depression during the pandemic[24]. Healthcare workers in pandemic prevention and control positions have experienced serious psychological problems; however, in this study, the difference in psychological status between healthcare workers and non-healthcare workers was not statistically significant. This may be because there were few participants in this study engaged in healthcare work (6.6%), leading to inaccurate statistical results.

More than half (51.6%) of the participants reported that their psychological status was negatively affected by the pandemic. The majority of these participants were aged between 20 and 30 years (57.5%) and had a primary school education or below (67.9%). The multivariate logistic regression analysis showed that the perception that the pandemic has had a negative impact on life was an independent risk factor for high psychological distress. One review indicated that parents suffered more psychological stress during the pandemic than non-parents and parents were twice as likely to self-harm[25]. This phenomenon largely stems from the inability of healthcare providers, teachers, childcare staff and extracurricular instructors to offer support during the pandemic lockdown. Consequently, parents were compelled to assume full responsibility for their children's upbringing, resulting in significant economic, psychological and physical stress[26-28]. A longitudinal study in the Netherlands demonstrated that during the lockdown, parents homeschooled their children, worked remotely and worried excessively about the pandemic; their negative emotions (depression, anxiety, hostility and interpersonal sensitivity) were significantly increased but decreased over time[29]. Jarvers et al.[30] conducted surveys on the mental health status of parents of preschool children preceding (T1), during (T2) and after (T3) a pandemic-induced lockdown. The findings revealed pronounced increments in depressive and anxiety symptoms among parents at T1 and T2, with these symptoms persisting at elevated levels into T3. These findings highlight the sustained effect of the pandemic on mental health. Moreover, Jarvers and colleagues posited that

psychological manifestations of stress and anxiety in parents could adversely influence the mental state of their children, with low parental education serving as a salient contributing factor. These findings are consistent with the findings of the current study, highlighting the critical need to closely monitor parental mental health during and following the pandemic and its potential repercussions for children's psychological development. Similarly, Li et al.[31] recommend that parents of elementary and adolescent children should refrain from exhibiting excessive worry in front of their children and should actively seek out information related to the pandemic.

In the current study, 3.3% of participants reported sleep disturbances. Research has shown a correlation between mental health and sleep quality[32, 33]. Some studies have suggested that quarantining people at home due to COVID-19 affects the mental state and sleep quality of individuals to different degrees[34]. Further, the vast majority of participants (90.4%) had high concerns about their children's learning and mental health following the pandemic. During the pandemic, the learning of children was actively provided by or accompanied by the parents in 43.3% and 29.4% of cases, respectively. Parents who were concerned about their children's academic status had a better psychological status, which indicates that parents who are aware of their children's academic status are less prone to anxiety and depression. A study in France suggested that training programs for parents through telephone consultations and online meetings during the pandemic effectively helped parents regulate their emotions and guide their children correctly[35]. High parental involvement and acceptability are important factors that affect the outcomes of treatment. Therefore, when face-to-face education is not possible, targeted communication and guidance for parents through online education is conducive to positive behaviours and attitudes among parents.[36]. Following the outbreak of the COVID-19 pandemic, the National Health Commission of China issued several guidelines for intervention in the case of emergency psychological crises, established a psychological assistance line, and developed a web-based mental health education platform for COVID-19[37, 38]. These measures have contributed to the relief of psychological distress and psychological harm among the public, but challenges remain[39]. The findings of this study offer an overview of the public's understanding of COVID-19 and their related psychological status and may provide a basis for governments to develop targeted health education and behavioural intervention strategies. The sample size for this study was large enough to accurately reflect the psychological

status of parents immediately after the COVID-19 pandemic.

The following recommendations are made based on the findings of this research: (1)Attention should be paid to vulnerable groups, such as the elderly, women, medical personnel, and people with lower education levels; attention should also be paid to people's social activities and family conditions[40]. (2) Authoritative psychological assessment procedures and online psychotherapy should be provided to parents. (3) Education on COVID-19 should be offered to reduce psychological distress and individuals with higher negative cognitive processing biases should be encouraged and educated to use emotion regulation strategies that separate attention from negative emotions in the event of anxiety or depression in order to maintain and promote their mental health[37, 41] (4) It is important to pay more attention to the psychological status of parents, encourage the positive role of new media during the aftermath of the pandemic, promote psychological interventions and related measures, and establish social stress prevention and control strategies [42, 43].

CONCLUSION

In this study, parents of students in Ezhou City had a high knowledge level of COVID-19 infection and had a high awareness of the corresponding protective measures. However, some parents experienced high psychological distress following the pandemic, with the level of psychological distress varying as a function of age, education, occupation and concern for children's learning status. Therefore, authorities should carry out online health education for the different stages of the pandemic and should resolutely implement pandemic prevention measures to restore life to normal as best as possible and protect the mental health of parents. Further, relevant departments must establish a long-term mental health management system to ensure continuous attention to and effective intervention for mental health problems.

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Author contributions

Jing Cheng conceived and designed the study. Lei Wang offered key support to the online survey and Honghui Gan, Yutong Zhang drafted the paper and finalized the manuscript, and Change Xiong, Yaqi Xu, Lu He, Lin Lv and Shuliu Pan performed the study, Jianbo Zhan instructed the survey. Jing Cheng is the guarantor. All authors contributed to discussions and the writing of the manuscript.

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Conflicts of interest

The authors declare no conflicts of interest in this study. The study was approved by the Ethics Committees of the Wuhan University of Science and Technology Medical College. Online written consents were obtained from all participants involved in the study.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author, CHENG, upon reasonable request.

References

[1] Chang Jinghui, Yuan Yuxin, Wang Dong. Mental health status and its influencing factors among college students during the epidemic of COVID-19 [J]. South Med Univ, 2020,40(2):171-176.(in chinese)

[2] PRC National Health Commission. 疫情通报 [EB/OL]. [2023-05-30]. http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml.

[3] Roychowdhury D. 2019 Novel Coronavirus Disease, Crisis, and Isolation[J]. Front Psychol, 2020,11:1958.

[4] Fu H, Wang H, Xi X, et al. Database of epidemic trends and control measures during the first wave of COVID-19 in mainland China[J]. Int J Infect Dis, 2021,102:463-471.

[5] Diamond R, Willan J. Coronavirus disease 2019: achieving good mental health during social isolation[J]. Br J Psychiatry, 2020,217(2):408-409.

[6] WHO. Coronavirus disease (COVID-19)[EB/OL]. [2023-05-30]. https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

[7] Achterberg M, Dobbelaar S, Boer O D, et al. Perceived stress as mediator for longitudinal effects of the COVID-19 lockdown on wellbeing of parents and children[J]. SCIENTIFIC REPORTS, 2021,11(1).

[8] Johnson M S, Skjerdingstad N, Ebrahimi O V, et al. Parental stress, anxiety and depression among parents during the government-initiated physical distancing measures following the first wave of COVID-19[J]. STRESS AND HEALTH, 2022,38(4):637-652.

[9] Johnson M S, Skjerdingstad N, Ebrahimi O V, et al. Mechanisms of parental distress during and after the first COVID-19 lockdown phase: A two-wave longitudinal study[J]. PLOS ONE, 2021,16(6).

[10] Jiao W Y, Wang L N, Liu J, et al. Behavioral and Emotional Disorders in Children during the COVID-19 Epidemic[J]. JOURNAL OF PEDIATRICS, 2020,221:264.

[11] Stevanovic D, Basay B K, Basay O, et al. COVID-19 pandemic-related aspects and predictors of emotional and behavioural symptoms in youth with pre-existing mental health conditions: results from Georgia, Lithuania, Romania, Serbia, and Turkey[J]. NORDIC JOURNAL OF PSYCHIATRY, 2022,76(7):515-522.

[12] DeMontigny F, Gervais C, Pierce T, et al. Perceived Paternal Involvement, Relationship Satisfaction, Mothers' Mental Health and Parenting Stress: A Multi-Sample Path Analysis[J]. FRONTIERS IN PSYCHIATRY, 2020,11.

[13] Thorell L B, Skoglund C, de la Peña A G, et al. Parental experiences of homeschooling during the COVID-19 pandemic: differences between seven European countries and between children with and without mental health conditions[J]. Eur Child Adolesc Psychiatry, 2022,31(4):649-661.

[14] Saragih I D, Tonapa S I, Saragih I S, et al. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: A systematic review and meta-analysis[J]. International Journal of Nursing Studies, 2021,121:104002.

[15] Mitike G, Nigatu F, Wolka E, et al. Health system response to COVID-19 among primary health care units in Ethiopia: A qualitative study[J]. PLOS ONE, 2023,18(2).

[16] Lee B E C, Ling M, Boyd L, et al. The prevalence of probable mental health disorders among hospital healthcare workers during COVID-19: A systematic review and meta-analysis[J]. Journal of Affective Disorders, 2023,330:329-345.

[17] Xiang Y T, Yang Y, Li W, et al. Timely mental health care for the 2019 novel coronavirus outbreak

is urgently needed[J]. Lancet Psychiatry, 2020,7(3):228-229.
[18] Li W, Yang Y, Liu Z H, et al. Progression of Mental Health Services during the COVID-19 Outbreak in China[J]. Int J Biol Sci, 2020,16(10):1732-1738.
[19] Fitzgerald A, Konrad S. Transition in learning during COVID-19: Student nurse anxiety, stress, and resource support[J]. Nurs Forum, 2021,56(2):298-304.
[20] Wang X, Hegde S, Son C, et al. Investigating Mental Health of US College Students During the COVID-19 Pandemic: Cross-Sectional Survey Study[J]. J Med Internet Res, 2020,22(9):e22817.
[21] Arpacioglu S, Gurler M, Cakiroglu S. Secondary Traumatization Outcomes and Associated Factors Among the Health Care Workers Exposed to the COVID-19[J]. Int J Soc Psychiatry, 2021,67(1):84-89.
[22] Nwagbara U I, Osual E C, Chireshe R, et al. Knowledge, attitude, perception, and preventative practices towards COVID-19 in sub-Saharan Africa: A scoping review[J]. PLoS One, 2021,16(4):e249853.
[23] Zhan S, Yang Y Y, Fu C. Public's early response to the novel coronavirus-infected pneumonia[J]. Emerg Microbes Infect, 2020,9(1):534.
[24] Whaley G L, Pfefferbaum B. Parental Challenges During the COVID-19 Pandemic: Psychological Outcomes and Risk and Protective Factors[J]. Curr Psychiatry Rep, 2023,25(4):165-174.
[25] Gadermann A C, Thomson K C, Richardson C G, et al. Examining the impacts of the COVID-19 pandemic on family mental health in Canada: findings from a national cross-sectional study[J]. BMJ Open, 2021,11(1):e42871.
[26] Patrick S W, Henkhaus L E, Zickafoose J S, et al. Well-being of Parents and Children During the COVID-19 Pandemic: A National Survey[J]. Pediatrics, 2020,146(4).
[27] Freisthler B, Gruenewald P J, Tebben E, et al. Understanding at-the-moment stress for parents during COVID-19 stay-at-home restrictions[J]. Soc Sci Med, 2021,279:114025.
[28] Achterberg M, Dobbelaar S, Boer O D, et al. Perceived stress as mediator for longitudinal effects of the COVID-19 lockdown on wellbeing of parents and children[J]. Sci Rep, 2021,11(1):2971.
[29] Jarvers I, Ecker A, Schleicher D, et al. Impact of preschool attendance, parental stress, and parental mental health on internalizing and externalizing problems during COVID-19 lockdown measures in preschool children[J]. PLoS One, 2023,18(2):e281627.
[30] Li X, Zhou S. Parental worry, family-based disaster education and children's internalizing and externalizing problems during the COVID-19 pandemic[J]. Psychol Trauma, 2021,13(4):486-495.
[31] Zhang Y T, Huang T, Zhou F, et al. Correlation between Anxiety, Depression, and Sleep Quality in College Students[J]. Biomed Environ Sci, 2022,35(7):648-651.
[32] Luo L, Zhang Y, Huang T, et al. A description of the current status of chronic fatigue syndrome and associated factors among university students in Wuhan, China[J]. FRONTIERS IN PSYCHIATRY, 2023,13.
[33] Meherali S, Punjani N, Louie-Poon S, et al. Mental Health of Children and Adolescents Amidst COVID-19 and Past Pandemics: A Rapid Systematic Review[J]. Int J Environ Res Public Health, 2021,18(7).
[34] Maurice V, Didillon A, Purper-Ouakil D, et al. Adapting a parent training program to the COVID-19 crisis in a mental health care setting in France[J]. Encephale, 2022,48(3):354-358.
[35] He S, Shuai L, Wang Z, et al. Online Learning Performances of Children and Adolescents With Attention Deficit Hyperactivity Disorder During the COVID-19 Pandemic[J]. Inquiry, 2021,58:1448324503.

[36] Liu S, Yang L, Zhang C, et al. Online mental health services in China during the COVID-19 outbreak[J]. Lancet Psychiatry, 2020,7(4):e17-e18.

[37] National Administration of Disease Control and Prevention. A circular on the issuance of guidelines for psychological assistance hotlines during the prevention and control of the novel coronavirus pneumonia epidemic [EB/OL]. [2023/5/30]. http://www.nhc.gov.cn/jkj/s3577/202002/f389f20cc1174b21b981ea2919beb8b0.shtml.

[38] Dong L, Bouey J. Public Mental Health Crisis during COVID-19 Pandemic, China[J]. Emerg Infect Dis, 2020,26(7):1616-1618.

[39] Jiang W, Liu X, Zhang J, et al. Mental health status of Chinese residents during the COVID-19 epidemic[J]. BMC Psychiatry, 2020,20(1):580.

[40] Li H, Wang S, Zhong F, et al. Age-Dependent Risks of Incidence and Mortality of COVID-19 in Hubei Province and Other Parts of China[J]. Front Med (Lausanne), 2020,7:190.

[41] Alaazi D A, Salami B, Gabriel Ojakovo O, et al. Mobilizing communities and families for child mental health promotion in Canada: Views of African immigrants[J]. Children and Youth Services Review, 2022,139:106530.

[42] Li M, Zhang J, Jiang C, et al. The Neural Correlates of the Recognition of Emotional Intensity Deficits in Major Depression: An ERP Study[J]. Neuropsychiatr Dis Treat, 2023,19:117-131.

Table S1 Logistic regression analysis variable assignment table

Variables	Assignment
Age	1 = 20~30 years, 2 = 31~40 years, 3=41~50 years,4 = 51~60 years
Level of education	1 = primary school and below, 2=junior high school, 3= highschool,4=college, 5=Master's and above
Self-perceived level of impact of the epidemic on life	0 =almost no effect, 1 = very bad effect, 2=a little bad effect
Concerns about the child's learning status	1=indifferent, 2=concerned, 3=actively 4 = accompanying the child
Current state of physical health	1 = very healthy, 2 = good, 3 = General

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Knowledge of coronavirus disease 2019 (COVID-19) and the psychological status of parents: A retrospective survey in Wuhan, Hubei [1]

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Abstract: Objective: During the coronavirus disease 2019 (COVID-19) pandemic, many parents faced heightened stress, anxiety and depression due the local and global COVID-19

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mitigation measures and lockdowns. **Design:** This study is a cross-sectional study. **Setting:** This study used stratified whole-cluster sampling to randomly select three elementary schools within Ezhou City. **Participants:** An online survey was administered to the parents of students in one or two classes in grades 1-6, respectively, of each school. Among them, males account for 30.4% and females account for 69.6%. The inclusion criteria included: (1) parent or legal guardian of a primary school student or a person directly responsible for the child's education; and (2) able to operate a computer or smartphone to complete the survey. Only one representative from each family was allowed to participate and surveys with incomplete data were considered invalid and were excluded. **Results:** A total of 764 participants completed the online survey. Overall, 90.4% of the participants were concerned about their children's mental health and learning during the pandemic. Additionally, 97.0% were aware of the typical symptoms of COVID-19. Only 48.0% of participants felt the pandemic negatively impacted their lives. The average psychological status score among parents was 87.79±8.91, with 51.6% showing signs of high psychological distress. Significant differences in psychological status were linked to age, education, professional background, sleep status, personal views on the pandemic's impact, and concern for children's learning ($P<0.05$). Multiple logistic regression analysis revealed that a negative perception of the pandemic's impact on one's life (OR=0.367, 95% CI: 0.272-0.493) was associated with psychological distress. **Conclusion:** Parents of school children in Ezhou City have a good knowledge base on COVID-19 infection and have a high awareness of the corresponding protective measures. However, priority attention and care should be given to individuals who have experienced mental distress in relation to the pandemic.

Keywords: Parents; COVID-19; Psychological status; Associated factors

Strengths and limitations of this study:

Strengths:

1. This study is the first cross-sectional analysis of parents' knowledge and psychological status of COVID-19 in Ezhou.
2. The study provides a broad sample that reflects the psychological status and knowledge level of parents.

Limitations:

1. We can only speculate about the factors that affect parents' knowledge and psychological status; causation cannot be implied.

2. Standard psychometric scales were not used to assess parents' psychological status, so the results cannot be compared with other similar studies.

INTRODUCTION

In December 2019, multiple cases of pneumonia with a history of exposure to seafood markets in South China were reported in Wuhan, Hubei Province. These individuals were subsequently confirmed to have an acute respiratory disease caused by a novel coronavirus[1]. On February 11, 2020, the World Health Organization (WHO) officially named it Coronavirus Disease 2019 (COVID-19)[2]. The incidence of COVID-19 in China increased rapidly due to factors such as widespread population migration before the Chinese New Year[3]. Due to the rapid increase in confirmed cases and deaths, the population has experienced psychological problems such as anxiety and depression[4].

Since the outbreak of COVID-19, the government has adopted a series of measures to stop the pandemic. While home isolation is an important strategy to break the chain of transmission, the WHO has expressed concerns about psychosocial distress associated with such measures. Authors have speculated that these new measures, such as self-isolation, have impacted people's daily activities and livelihoods, and might lead to increased loneliness, anxiety, depression, insomnia, alcohol dependence, drug use and self-injurious or suicidal behaviours[5, 6].

Primary caregivers may have faced even higher pressure during the pandemic[7]. An online survey by Johnson et al. that examined parents' mental states after the Norwegian government-sponsored distancing measures were implemented showed that nearly 25% of parents reported anxiety and depression, with mothers, parents with more than one child, and parents diagnosed with mental illness reporting higher levels of stress, exhaustion and anger toward their children. Deterioration of the parent-child relationship accounted for 41% of parental stress[8]. In a two-wave longitudinal survey, the cumulative stress experienced by parents during the implementation of physical distancing protocols decreased as the measures were phased out[9]. To reduce the spread of COVID-19, many countries put lockdown measures in place, including closing schools. As parents spent

more time with their children, parent-child bonding patterns, relationships with partners and family cohesion all affected parents' mental health status[10, 11]. Parents with higher-quality marriages and parent-child relationships reported fewer mental health symptoms[12]. In addition, a significant proportion of parents reported work-related or financial issues during the COVID-19 pandemic[13]. The impacts of COVID-19 were even more pronounced among healthcare workers. The overall incidence of mental health problems among healthcare workers during the COVID-19 pandemic was reported to be around 40%[14]. Healthcare workers are directly involved in the diagnosis, treatment and care of COVID-19 patients, during the pandemic and to the current day. Many healthcare workers continue to face these challenges in harsh conditions where there is a lack of resources, pay, and access to basic personal protective equipment, placing additional stress on these individuals[15]. Thus, the COVID-19 pandemic has taken a huge toll on the overall health and mental well-being of healthcare workers[16].

The severity of COVID-19 infection, uncertainty about how to prevent and control the pandemic, and information overload are all likely to be of concern to the community[17]. Arguably, the COVID-19 pandemic will have long-lasting economic, social, and policy implications, and there is a need to mitigate the long-term mental health problems experienced as a result of this pandemic. The public's awareness of the prevalence of COVID-19 infection and the associated precautions may affect their level of concern and psychological distress related to the pandemic. Thus, the purpose of this study was to investigate primary school parents' understanding of COVID-19, their psychological status, and the related influencing factors, in order to provide a theoretical basis for mental health maintenance, psychological intervention and protection[18] among this group. These findings will also provide scientific and practical guidance for the provision of psychological counselling following the pandemic.

METHODS

Participants

This study used stratified whole-cluster sampling to randomly select three elementary schools within Ezhou City. An online survey was administered to the parents of students in one or two classes in grades 1-6, respectively, of each school. The inclusion criteria included: (1) parent or legal guardian of a primary school student or a person directly responsible for the child's education;

and (2) able to operate a computer or smartphone to complete the survey. Only one representative from each family was allowed to participate and surveys with incomplete data were considered invalid and were excluded.

Screening questionnaire

Surveys were distributed to parents of children in grades 1-6 of elementary school. The surveys were distributed by teachers on March 18-19, 2022, after the students returned to school (questionnaire star, https://www.wjx.cn/jq/63026695.aspx).

The survey assessed general demographic characteristics, COVID‐19-related knowledge (main symptoms, infection route, isolation duration, protective measures) and psychological status (positive and negative emotions). Among them, the questions related to COVID‐19 knowledge were designed with reference to the latest research results on COVID-19 locally and abroad and the COVID-19 prevention and control policy of Ezhou City during the study period. One point is awarded for a correct answer to the question, no points for an incorrect answer. The scores were then summed to obtain an overall score for COVID-19 knowledge. This variable was then stratified into high knowledge (scores greater than or equal to 15) and low knowledge (scores less than 15). The measurement of psychological status was adapted based on the Depression Anxiety and Stress Scale (DASS-21), Symptom Checklist-90 (SCL-90), Meaning in Life Questionnaire (MLQ), Self-Anxiety Scale (SAS), Self-Rating Depression Scale (SDS). The questions related to psychological status were scored on a five-point scale. The scores were summed to obtain a total score for psychological status. This total score was then stratified into high psychological distress (scores less than 88) and low psychological distress (scores greater than or equal to 88)[19, 20].

Quality control

The same IP address could complete the survey only one time. No private information, such as participant names, was collected during the survey and sensitive language was avoided. The time taken to answer each question was monitored in the background, and those who answered the questionnaire within 100 seconds were considered invalid.

Statistical analysis

Statistical analysis was performed using SPSS 25.0 software. The chi-square test and unconditional logistic regression were used to study the factors affecting the psychological status of the

participants. As described above, psychological status was stratified into two levels: low psychological distress and high psychological distress. The impact of different demographic characteristics and COVID-19 understanding on psychological status was analysed taking psychological status as the dependent variable and the demographic characteristics and COVID-19 understanding variables as independent variables. Factors that were statistically significant in the chi-square univariate analyses (i.e., $P<0.05$) were included in the non-conditional logistic multivariate regression analysis (α enter = 0. 05, α deleted = 0.10). The variable assignment for the logistic regression analysis is shown in Supplementary Table S1.

Ethics approval

This study was approved by the Ethics Committees of Wuhan University of Science and Technology Medical College. The ethical approval number is 2022030101. Informed consent was obtained from all participants. All methods were performed in accordance with the relevant guidelines and regulations.

Patient and Public Involvement

The study was approved by the Ethics Committees of the Wuhan University of Science and Technology Medical College. The ethical approval number is 2022030101. Informed consent was obtained from all subjects and/or their legal guardian(s).

RESULTS

Basic information

A total of 764 questionnaires were returned, among which, 762 were valid, with an effective response rate of 99.7%. The locations of the participants included 17 provinces (autonomous regions and municipalities); the top four provinces with the largest numbers of participants were as follows: Hubei (729, 95.7%), Guangdong (8, 1.0%), Hebei (4, 0.5%) and Jiangxi (4, 0.5%), as shown in table1.

Table 1 Basic demographic characteristics of parents in Ezhou

Characteristic	Number	Composition ratio (%)
Gender		
male	232	30.4
female	530	69.6

Age group (year)		
20~30	80	10.5
31~40	509	66.8
41~50	155	20.3
51~60	18	2.4
Marital status		
married	728	95.5
divorced	27	3.5
widowed	7	0.9
Level of Education		
primary school and below	53	7.0
junior high school	405	53.1
high school	232	30.4
university and above	72	9.4
Workplace		
city	246	32.3
suburbs	237	31.1
rural area	279	36.6
Profession		
healthcare worker	5	0.7
non-medical worker	757	99.3

COVID-19-related knowledge

The level of COVID-19-related knowledge included knowledge of the epidemiological characteristics of COVID-19, such as the route of infection, symptoms at onset and effective measures to prevent infection. The average COVID-19 knowledge score was 13.72±2.533 points. A total of 334 participants (43.8%) had scores of 15 or above.

Knowledge of COVID-19 symptoms and protocols

The rates of knowledge of the main symptoms of COVID-19, i.e., fever, anergia, dry cough and chest tightness, were 97.0%, 79.0%, 84.9% and 78.9%, respectively. Further, 97.5% of participants were aware that face-to-face conversation with an infected individual without protective measures could lead to COVID-19 spread; 93.6% and 92.9% knew that eating together or taking the bus, respectively, with patients without protective measures could lead to infection; and 98.8% were aware that close contacts with a COVID-19 patient required isolation under medical observation for at least 14 days.

Knowledge of protective measures

The rates of knowledge of the need for "frequent handwashing", "eating cooked food", "rejecting wild animals", "wearing masks out" and "refraining from going outdoors" were 99.3%, 86.7%, 91.1%, 98.8%, and 87.4%, respectively.

Comparison of different sub-groups

A comparison of the rates of knowledge on infection routes, onset symptoms, medical observation period in the case of close contacts, and protective measures among different sub-groups revealed significant differences as a function of marital status, professional background and education level ($P< 0.05$), as shown in table 2.

Table 1 The cognition of COVID-19 by different characteristics subjects [n (%)]

Variable	Low cognition	High cognition	x^2	P
Gender			0.710	0.400
male	125（53.9%）	107（46.1%）		
female	303（57.2%）	227（42.8%）		
Age (years old)			4.807	0.187
20~30	49（61.3%）	31（38.8%）		
31~40	282（55.4%）	227（44.6%）		
41~50	83（53.5%）	72（46.5%）		
51~60	14（77.8%）	4（22.2%）		
Marital status			6.477	0.039
married	402(55.2%)	326(44.8%)		
divorce	21(77.8%)	6(22.2%)		
widowed	5(71.4%)	2(28.6%)		
Level of education			32.264	<0.001
primary school and below	42(79.2%)	11(20.8%)		
junior high school	248(61.2%)	157(38.8%)		
high school	110(47.4%)	122(52.6%)		
university and above	28(39.4%)	44(60.6%)		
Profession			18.377	0.005
healthcare workers	1（20.0%）	4（80.0%）		
Non medical workers	427（62.4%）	330（37.6%）		

Attitudes of parents towards COVID-19

Overall, 74.3% of participants were very concerned about COVID-19 and 25.3% were comparatively concerned. When asked about their concern in relation to their children's learning

status during the pandemic, the responses were as follows: no concern (0.5%), concern (26.8%), active coaching (43.3%) and accompanying the child (29.4%). When asked about their concern about their child's mental health status due to the pandemic, the responses were as follows: concern (67.2%), comparative concern (29.3%), normal (3.3%) and unresponsive (0.3%).

Perception of the COVID-19 pandemic

When asked about the impact of the COVID-19 pandemic, the participants' responses were as follows: it caused a very bad impact on oneself (48%), some bad impact (45.8%), almost no impact (6.6%), some positive impact (14.2%), very good impact (1.3%).

Physical activity and sleep status

The vast majority of participants reported that they exercised at home; the average daily exercise time was 20-30 minutes for 59.6% of participants, 30-60 minutes for 18.9% of participants, and more than one hour for 7.3% of participants. The participants' bedtimes in the two weeks prior to the survey were as follows: before 21:00 (10%), 12:00-22:00 (41.5%), 22:00-23:00 (29.4%), 23:00-00:00 (8.7%), after 00:00 (4.2%) and irregular bedtime (6.3%). The overall sleep condition as reported by the participants were as follows: very good (37.5%), good (29.3%), common (29.9%), poor (2.6%) and very poor (0.7%).

The psychological status and factors influencing the psychological status of parents

The average psychological status score was 87.79±8.913. According to the stratification, 393 (51.6%) were experiencing high psychological distress, and 369 (48.4%) were experiencing low psychological distress. The chi-square test indicated that the psychological status of individuals varied as a function of age, education level, professional background, sleep status, the degree of the impact of the pandemic on life, and concern for the effects of the pandemic on the learning of children. The findings (P<0.05) are presented in Table 3.

Table 3 Psychological status of people with different characteristics

Variable	Mental health disorder	Good mental health	χ^2	*P*
Gender				
male	111 （47.8%）	121 （52.2%）	1.858	0.173
female	282 （53.2%）	248（46.8%）		
Age group (years old)				
20~30	46 （57.5%）	34(42.5%)		

31~40	274 （53.8%）	235(46.2%)	8.744	0.033
41~50	64 （41.3%）	91 (58.7%)		
51~60	9（50.0%）	9 (50.0%)		
Marital status				
married	374（51.4%）	354 （48.6%）		
divorce	15 （55.6%）	12 （44.4%）	0.271	0.874
widowed	4（57.1%）	3 （42.9%）		
Level of education				
primary school and below	36 （67.9%）	17 （32.1%）	12.869	0.012
junior high school	220 （54.3%）	185（45.7%）		
high school	105（45.3%）	127（54.7%）		
university and above	32（44.4%）	40 （55.6%）		
Sleep condition				
well	114（39.9%）	172（60.1%）		
better	115（51.6%）	108（48.4%）	38.218	<0.001
general	143 （62.7%）	85（37.3%）		
poor	16 （80.0%）	4（20.0%）		
very bad	5 （100%）	0（0%）		
Self-perceived level of impact of the epidemic on life				
very bad effect	236 （64.5%）	130 （35.5%）	46.970	<0.001
A little bad effect	152（43.6%）	197（56.4%）	16.591	<0.001
almost no effect	18（36.0%）	32（64.0%）	5.197	0.023

Factors influencing psychological status

Multiple logistic regression analysis was performed with psychological status as the dependent variable (1 = high psychological distress and 2 = low psychological distress), and age, education level, professional background, sleep, self-perceived level of impact of the epidemic on life, and concern about the child's learning situation as independent variables. The results showed that a very bad self-perceived level of impact of the epidemic on life (OR = 0.362, 95% CI: 0.270-0.485, $P<$ 0.001) and a somewhat bad self-perceived level of impact of the epidemic on life (OR = 0.367, 95% CI: 0.272-0.493, $P < 0.001$) were associated with high psychological distress. As shown in table 4.

Table 2 The results of logistic regression analysis

Variable	β	S.E.	*P*	OR	95% CI
Age (year)					

20~30	Ref				
41~50	0.951	0.300	0.002	2.589	1.437-4.662
Level of education					
primary and below	Ref				
junior	0.700	0.335	0.037	2.014	1.044-3.886
high school	1.022	0.345	0.003	2.779	1.413-5.468
university	0.964	0.405	0.017	2.623	1.186-5.801
Self-perceived level of impact of the epidemic on life					
almost no effect	Ref				
very bad effect	-1.017	0.150	0.000	0.362	0.270-0.485
A little bad effect	-1.004	0.151	0.000	0.367	0.272-0.493

Note 1 S.E., standard error; Ref, reference; OR, odds ratio; CI, confidence interval; *P*, p-value.

DISCUSSION

In this study, 43.8% of participants had a high level of knowledge of COVID-19, among which, those with a higher level of education had a higher knowledge level. At the same time, well-educated participants had a better psychological status than those with a lower education level. This may be because a higher cultural literacy level offers better access to information or understanding of information related to COVID-19.

Further, medical workers had higher knowledge levels than non-medical workers. Due to their occupational requirements, medical workers have a greater chance of being exposed to COVID-19 than other occupational groups. Therefore, they have a greater understanding of the pandemic and the morbidity characteristics of COVID-19 and are better able to understand and adopt protective measures[21]. It is important to understand the characteristics of the pandemic and adopt timely targeted strategies to effectively prevent and control the spread of the disease in order to reduce the experience of negative emotions and panic[22, 23]. A hospital survey showed that the overall awareness rate of healthcare workers in relation to COVID-19 was higher than 90%[24]. Comprehensive basic knowledge of COVID-19 prevention and control can effectively ensure the treatment capacity of medical institutions, which is of great significance for protecting individuals from infection and preventing nosocomial infection. In addition, it has been suggested that healthcare workers, especially those in fever clinics and isolation wards, have experienced mild to moderate depression during the pandemic[24]. Healthcare workers in pandemic prevention and

control positions have experienced serious psychological problems; however, in this study, the difference in psychological status between healthcare workers and non-healthcare workers was not statistically significant. This may be because there were few participants in this study engaged in healthcare work (6.6%), leading to inaccurate statistical results.

More than half (51.6%) of the participants reported that their psychological status was negatively affected by the pandemic. The majority of these participants were aged between 20 and 30 years (57.5%) and had a primary school education or below (67.9%). The multivariate logistic regression analysis showed that the perception that the pandemic has had a negative impact on life was an independent risk factor for high psychological distress. One review indicated that parents suffered more psychological stress during the pandemic than non-parents and parents were twice as likely to self-harm[25]. This phenomenon largely stems from the inability of healthcare providers, teachers, childcare staff and extracurricular instructors to offer support during the pandemic lockdown. Consequently, parents were compelled to assume full responsibility for their children's upbringing, resulting in significant economic, psychological and physical stress[26-28]. A longitudinal study in the Netherlands demonstrated that during the lockdown, parents homeschooled their children, worked remotely and worried excessively about the pandemic; their negative emotions (depression, anxiety, hostility and interpersonal sensitivity) were significantly increased but decreased over time[29]. Jarvers et al.[30] conducted surveys on the mental health status of parents of preschool children preceding (T1), during (T2) and after (T3) a pandemic-induced lockdown. The findings revealed pronounced increments in depressive and anxiety symptoms among parents at T1 and T2, with these symptoms persisting at elevated levels into T3. These findings highlight the sustained effect of the pandemic on mental health. Moreover, Jarvers and colleagues posited that psychological manifestations of stress and anxiety in parents could adversely influence the mental state of their children, with low parental education serving as a salient contributing factor. These findings are consistent with the findings of the current study, highlighting the critical need to closely monitor parental mental health during and following the pandemic and its potential repercussions for children's psychological development. Similarly, Li et al.[31] recommend that parents of elementary and adolescent children should refrain from exhibiting excessive worry in front of their children and should actively seek out information related to the pandemic.

In the current study, 3.3% of participants reported sleep disturbances. Research has shown a correlation between mental health and sleep quality[32, 33]. Some studies have suggested that quarantining people at home due to COVID-19 affects the mental state and sleep quality of individuals to different degrees[34]. Further, the vast majority of participants (90.4%) had high concerns about their children's learning and mental health following the pandemic. During the pandemic, the learning of children was actively provided by or accompanied by the parents in 43.3% and 29.4% of cases, respectively. Parents who were concerned about their children's academic status had a better psychological status, which indicates that parents who are aware of their children's academic status are less prone to anxiety and depression. A study in France suggested that training programs for parents through telephone consultations and online meetings during the pandemic effectively helped parents regulate their emotions and guide their children correctly[35]. High parental involvement and acceptability are important factors that affect the outcomes of treatment. Therefore, when face-to-face education is not possible, targeted communication and guidance for parents through online education is conducive to positive behaviours and attitudes among parents.[36]. Following the outbreak of the COVID-19 pandemic, the National Health Commission of China issued several guidelines for intervention in the case of emergency psychological crises, established a psychological assistance line, and developed a web-based mental health education platform for COVID-19[37, 38]. These measures have contributed to the relief of psychological distress and psychological harm among the public, but challenges remain[39]. The findings of this study offer an overview of the public's understanding of COVID-19 and their related psychological status and may provide a basis for governments to develop targeted health education and behavioural intervention strategies. The sample size for this study was large enough to accurately reflect the psychological status of parents immediately after the COVID-19 pandemic.

The following recommendations are made based on the findings of this research: (1)Attention should be paid to vulnerable groups, such as the elderly, women, medical personnel, and people with lower education levels; attention should also be paid to people's social activities and family conditions[40]. (2) Authoritative psychological assessment procedures and online psychotherapy should be provided to parents. (3) Education on COVID-19 should be offered to reduce psychological distress and individuals with higher negative cognitive processing biases should be

encouraged and educated to use emotion regulation strategies that separate attention from negative emotions in the event of anxiety or depression in order to maintain and promote their mental health[37, 41] (4) It is important to pay more attention to the psychological status of parents, encourage the positive role of new media during the aftermath of the pandemic, promote psychological interventions and related measures, and establish social stress prevention and control strategies [42, 43].

As far as we know, this is the first cross-sectional study to analyse the COVID-19 knowledge and psychological status of parents in Ezhou City. Moreover, a representative sample of rural primary schools was selected for recruitment, offering a generalized sample to reflect parents ' psychological status and knowledge levels.

This study also has several limitations. First, this is a cross-sectional study that can only speculate about the factors that affect parents' awareness and mental health status of COVID-19, and cannot determine causation. Second, our study only investigated rural primary school, and whether the results can be extrapolated to urban school needs further study. Third, the assessment of mental state did not use standard psychometric scales, resulting in no comparison of other studies of the same type.

CONCLUSION

In this study, parents of students in Ezhou City had a high knowledge level of COVID-19 infection and had a high awareness of the corresponding protective measures. However, some parents experienced high psychological distress following the pandemic, with the level of psychological distress varying as a function of age, education, occupation and concern for children's learning status. Therefore, authorities should carry out online health education for the different stages of the pandemic and should resolutely implement pandemic prevention measures to restore life to normal as best as possible and protect the mental health of parents. Further, relevant departments must establish a long-term mental health management system to ensure continuous attention to and effective intervention for mental health problems.

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Author contributions

Jing Cheng conceived and designed the study. Lei Wang offered key support to the online survey and Honghui Gan, Yutong Zhang drafted the paper and finalized the manuscript, and Change Xiong, Guiping Wang, Can Mei, Linwanyue Chen, Yaqi Xu, Lu He, Lin Lv and Shuliu Pan performed the study, Jianbo Zhan instructed the survey. Jing Cheng is the guarantor. All authors contributed to discussions and the writing of the manuscript.

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Conflicts of interest

The authors declare no conflicts of interest in this study. The study was approved by the Ethics Committees of the Wuhan University of Science and Technology Medical College. Online written consents were obtained from all participants involved in the study.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author, CHENG, upon reasonable request.

References

[1] Chang Jinghui, Yuan Yuxin, Wang Dong. Mental health status and its influencing factors among college students during the epidemic of COVID-19 [J]. South Med Univ, 2020,40(2):171-176.(in chinese)

[2] PRC National Health Commission. Epidemic notification [EB/OL]. [2023-05-30]. http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml. (In Chinese)

[3] Roychowdhury D. 2019 Novel Coronavirus Disease, Crisis, and Isolation[J]. Front Psychol, 2020,11:1958.

[4] Fu H, Wang H, Xi X, et al. Database of epidemic trends and control measures during the first wave of COVID-19 in mainland China[J]. Int J Infect Dis, 2021,102:463-471.

[5] Diamond R, Willan J. Coronavirus disease 2019: achieving good mental health during social isolation[J]. Br J Psychiatry, 2020,217(2):408-409.

[6] WHO. Coronavirus disease (COVID-19)[EB/OL]. [2023-05-30]. https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

[7] Achterberg M, Dobbelaar S, Boer O D, et al. Perceived stress as mediator for longitudinal effects of the COVID-19 lockdown on wellbeing of parents and children[J]. SCIENTIFIC REPORTS, 2021,11(1).

[8] Johnson M S, Skjerdingstad N, Ebrahimi O V, et al. Parental stress, anxiety and depression among parents during the government-initiated physical distancing measures following the first wave of COVID-19[J]. STRESS AND HEALTH, 2022,38(4):637-652.

[9] Johnson M S, Skjerdingstad N, Ebrahimi O V, et al. Mechanisms of parental distress during and after the first COVID-19 lockdown phase: A two-wave longitudinal study[J]. PLOS ONE, 2021,16(6).

[10] Jiao W Y, Wang L N, Liu J, et al. Behavioral and Emotional Disorders in Children during the COVID-19 Epidemic[J]. JOURNAL OF PEDIATRICS, 2020,221:264.

[11] Stevanovic D, Basay B K, Basay O, et al. COVID-19 pandemic-related aspects and predictors of emotional and behavioural symptoms in youth with pre-existing mental health conditions: results from Georgia, Lithuania, Romania, Serbia, and Turkey[J]. NORDIC JOURNAL OF PSYCHIATRY, 2022,76(7):515-522.

[12] DeMontigny F, Gervais C, Pierce T, et al. Perceived Paternal Involvement, Relationship Satisfaction, Mothers' Mental Health and Parenting Stress: A Multi-Sample Path Analysis[J]. FRONTIERS IN PSYCHIATRY, 2020,11.

[13] Thorell L B, Skoglund C, de la Peña A G, et al. Parental experiences of homeschooling during the COVID-19 pandemic: differences between seven European countries and between children with and without mental health conditions[J]. Eur Child Adolesc Psychiatry, 2022,31(4):649-661.

[14] Saragih I D, Tonapa S I, Saragih I S, et al. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: A systematic review and meta-analysis[J]. International Journal of Nursing Studies, 2021,121:104002.

[15] Mitike G, Nigatu F, Wolka E, et al. Health system response to COVID-19 among primary health care units in Ethiopia: A qualitative study[J]. PLOS ONE, 2023,18(2).

[16] Lee B E C, Ling M, Boyd L, et al. The prevalence of probable mental health disorders among hospital healthcare workers during COVID-19: A systematic review and meta-analysis[J]. Journal of Affective Disorders, 2023,330:329-345.

[17] Xiang Y T, Yang Y, Li W, et al. Timely mental health care for the 2019 novel coronavirus outbreak

is urgently needed[J]. Lancet Psychiatry, 2020,7(3):228-229.
[18] Li W, Yang Y, Liu Z H, et al. Progression of Mental Health Services during the COVID-19 Outbreak in China[J]. Int J Biol Sci, 2020,16(10):1732-1738.
[19] Fitzgerald A, Konrad S. Transition in learning during COVID-19: Student nurse anxiety, stress, and resource support[J]. Nurs Forum, 2021,56(2):298-304.
[20] Wang X, Hegde S, Son C, et al. Investigating Mental Health of US College Students During the COVID-19 Pandemic: Cross-Sectional Survey Study[J]. J Med Internet Res, 2020,22(9):e22817.
[21] Arpacioglu S, Gurler M, Cakiroglu S. Secondary Traumatization Outcomes and Associated Factors Among the Health Care Workers Exposed to the COVID-19[J]. Int J Soc Psychiatry, 2021,67(1):84-89.
[22] Nwagbara U I, Osual E C, Chireshe R, et al. Knowledge, attitude, perception, and preventative practices towards COVID-19 in sub-Saharan Africa: A scoping review[J]. PLoS One, 2021,16(4):e249853.
[23] Zhan S, Yang Y Y, Fu C. Public's early response to the novel coronavirus-infected pneumonia[J]. Emerg Microbes Infect, 2020,9(1):534.
[24] Whaley G L, Pfefferbaum B. Parental Challenges During the COVID-19 Pandemic: Psychological Outcomes and Risk and Protective Factors[J]. Curr Psychiatry Rep, 2023,25(4):165-174.
[25] Gadermann A C, Thomson K C, Richardson C G, et al. Examining the impacts of the COVID-19 pandemic on family mental health in Canada: findings from a national cross-sectional study[J]. BMJ Open, 2021,11(1):e42871.
[26] Patrick S W, Henkhaus L E, Zickafoose J S, et al. Well-being of Parents and Children During the COVID-19 Pandemic: A National Survey[J]. Pediatrics, 2020,146(4).
[27] Freisthler B, Gruenewald P J, Tebben E, et al. Understanding at-the-moment stress for parents during COVID-19 stay-at-home restrictions[J]. Soc Sci Med, 2021,279:114025.
[28] Achterberg M, Dobbelaar S, Boer O D, et al. Perceived stress as mediator for longitudinal effects of the COVID-19 lockdown on wellbeing of parents and children[J]. Sci Rep, 2021,11(1):2971.
[29] Jarvers I, Ecker A, Schleicher D, et al. Impact of preschool attendance, parental stress, and parental mental health on internalizing and externalizing problems during COVID-19 lockdown measures in preschool children[J]. PLoS One, 2023,18(2):e281627.
[30] Li X, Zhou S. Parental worry, family-based disaster education and children's internalizing and externalizing problems during the COVID-19 pandemic[J]. Psychol Trauma, 2021,13(4):486-495.
[31] Zhang Y T, Huang T, Zhou F, et al. Correlation between Anxiety, Depression, and Sleep Quality in College Students[J]. Biomed Environ Sci, 2022,35(7):648-651.
[32] Luo L, Zhang Y, Huang T, et al. A description of the current status of chronic fatigue syndrome and associated factors among university students in Wuhan, China[J]. FRONTIERS IN PSYCHIATRY, 2023,13.
[33] Meherali S, Punjani N, Louie-Poon S, et al. Mental Health of Children and Adolescents Amidst COVID-19 and Past Pandemics: A Rapid Systematic Review[J]. Int J Environ Res Public Health, 2021,18(7).
[34] Maurice V, Didillon A, Purper-Ouakil D, et al. Adapting a parent training program to the COVID-19 crisis in a mental health care setting in France[J]. Encephale, 2022,48(3):354-358.
[35] He S, Shuai L, Wang Z, et al. Online Learning Performances of Children and Adolescents With Attention Deficit Hyperactivity Disorder During the COVID-19 Pandemic[J]. Inquiry, 2021,58:1448324503.

[36] Liu S, Yang L, Zhang C, et al. Online mental health services in China during the COVID-19 outbreak[J]. Lancet Psychiatry, 2020,7(4):e17-e18.

[37] National Administration of Disease Control and Prevention. A circular on the issuance of guidelines for psychological assistance hotlines during the prevention and control of the novel coronavirus pneumonia epidemic [EB/OL]. [2023/5/30]. http://www.nhc.gov.cn/jkj/s3577/202002/f389f20cc1174b21b981ea2919beb8b0.shtml.

[38] Dong L, Bouey J. Public Mental Health Crisis during COVID-19 Pandemic, China[J]. Emerg Infect Dis, 2020,26(7):1616-1618.

[39] Jiang W, Liu X, Zhang J, et al. Mental health status of Chinese residents during the COVID-19 epidemic[J]. BMC Psychiatry, 2020,20(1):580.

[40] Li H, Wang S, Zhong F, et al. Age-Dependent Risks of Incidence and Mortality of COVID-19 in Hubei Province and Other Parts of China[J]. Front Med (Lausanne), 2020,7:190.

[41] Alaazi D A, Salami B, Gabriel Ojakovo O, et al. Mobilizing communities and families for child mental health promotion in Canada: Views of African immigrants[J]. Children and Youth Services Review, 2022,139:106530.

[42] Li M, Zhang J, Jiang C, et al. The Neural Correlates of the Recognition of Emotional Intensity Deficits in Major Depression: An ERP Study[J]. Neuropsychiatr Dis Treat, 2023,19:117-131.

Table S1 Logistic regression analysis variable assignment table

Variables	Assignment
Age	1 = 20~30 years, 2 = 31~40 years, 3=41~50 years,4 = 51~60 years
Level of education	1 = primary school and below, 2=junior high school, 3= highschool,4=college, 5=Master's and above
Self-perceived level of impact of the epidemic on life	0 =almost no effect, 1 = very bad effect, 2=a little bad effect
Concerns about the child's learning status	1=indifferent, 2=concerned, 3=actively 4 = accompanying the child
Current state of physical health	1 = very healthy, 2 = good, 3 = General