

World Journal of *Psychiatry*

World J Psychiatry 2023 December 19; 13(12): 973-1144



REVIEW

- 973 Risk factors, preventive interventions, overlapping symptoms, and clinical measures of delirium in elderly patients
Mei X, Liu YH, Han YQ, Zheng CY

ORIGINAL ARTICLE**Case Control Study**

- 985 Diagnostic and prognostic implications of non-high-density lipoprotein cholesterol and homocysteine levels for cognitive impairment in thalamic infarction
Zhu SY, Ge W, Zhang H
- 995 Brain-derived neurotrophic factor, sex hormones and cognitive decline in male patients with schizophrenia receiving continuous antipsychotic therapy
Li J, Xiao WH, Ye F, Tang XW, Jia QF, Zhang XB
- 1005 Haplotype analysis of long-chain non-coding RNA NONHSAT102891 promoter polymorphisms and depression in Chinese individuals: A case-control association study
Li Y, Wang YX, Tang XM, Liang P, Chen JJ, Jiang F, Yang Q, Liang YD

Retrospective Study

- 1016 Efficacy and risk factors for anxiety and depression after mini-incision hip arthroplasty for femoral head osteonecrosis
Yu WX, Hao YQ, Lu C, Li H, Cai YZ
- 1027 Efficacy of enhanced extracorporeal counterpulsation combined with atorvastatin in the treatment of cognitive impairment after stroke
Duan Y, Tang HX
- 1037 Value of Chuanjin Qinggan decoction in improving the depressive state of patients with herpes zoster combined with depression
Wang YN, Shi MM, Zhang JM
- 1046 Impact of an emergency department nursing intervention on continuity of care, self-care, and psychological symptoms
Xu S, Gu YF, Dong AH
- 1053 Effect of cognitive behavior therapy training and psychological nursing on the midwifery process in the delivery room
Shi Q, Wang J, Zhao D, Gu LY
- 1061 Meteorological factors, ambient air pollution, and daily hospital admissions for depressive disorder in Harbin: A time-series study
Hu T, Xu ZY, Wang J, Su Y, Guo BB

- 1079 Analysis of influencing factors and the construction of predictive models for postpartum depression in older pregnant women

Chen L, Shi Y

Observational Study

- 1087 Relationship between nightmare distress and depressive symptoms in Chinese emergency department nurses: A cross-sectional study

Gan QW, Yu R, Lian ZR, Yuan YL, Li YP, Zheng LL

- 1096 Mediating role of physical activity in the relationship between psychological distress and intimate relationships among stroke patients

Luo CY, Jiao P, Tu SM, Shen L, Sun YM

- 1106 Surviving the shift: College student satisfaction with emergency online learning during COVID-19 pandemic

Zhai XY, Lei DC, Zhao Y, Jing P, Zhang K, Han JT, Ni AH, Wang XY

- 1121 Influence of physical education on anxiety, depression, and self-esteem among college students

Fu HY, Wang J, Hu JX

- 1133 Influence of childhood trauma on adolescent internet addiction: The mediating roles of loneliness and negative coping styles

Dong WL, Li YY, Zhang YM, Peng QW, Lu GL, Chen CR

ABOUT COVER

Peer Reviewer of *World Journal of Psychiatry*, Qing-Zhong Wang, PhD, Associate Professor, Institute of Chinese Materia Medica, Shanghai University of Traditional Chinese Medicine, Shanghai 201203, China.
wangqingzhong3@gmail.com

AIMS AND SCOPE

The primary aim of *World Journal of Psychiatry (WJP, World J Psychiatry)* is to provide scholars and readers from various fields of psychiatry with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJP mainly publishes articles reporting research results and findings obtained in the field of psychiatry and covering a wide range of topics including adolescent psychiatry, biological psychiatry, child psychiatry, community psychiatry, ethnopsychology, psychoanalysis, psychosomatic medicine, etc.

INDEXING/ABSTRACTING

The *WJP* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports/Science Edition, PubMed, PubMed Central, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for *WJP* as 3.1; IF without journal self cites: 2.9; 5-year IF: 4.2; Journal Citation Indicator: 0.52; Ranking: 91 among 155 journals in psychiatry; and Quartile category: Q3.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Yu-Xi Chen*; Production Department Director: *Xu Guo*; Editorial Office Director: *Jia-Ping Yan*.

NAME OF JOURNAL

World Journal of Psychiatry

ISSN

ISSN 2220-3206 (online)

LAUNCH DATE

December 31, 2011

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Ting-Shao Zhu, Panteleimon Giannakopoulos

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2220-3206/editorialboard.htm>

PUBLICATION DATE

December 19, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

Observational Study

Surviving the shift: College student satisfaction with emergency online learning during COVID-19 pandemic

Xiao-Yan Zhai, Dong-Chuan Lei, Yan Zhao, Peng Jing, Kun Zhang, Ji-Ting Han, Ai-Hua Ni, Xue-Yi Wang

Specialty type: Psychiatry**Provenance and peer review:**

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind**Peer-review report's scientific quality classification**Grade A (Excellent): 0
Grade B (Very good): B
Grade C (Good): C, C, C
Grade D (Fair): 0
Grade E (Poor): 0**P-Reviewer:** Masaru T, Hungary;
Soriano-Ursúa MA, Mexico; Sujita
Kumar Kar, India**Received:** August 13, 2023**Peer-review started:** August 13,
2023**First decision:** October 10, 2023**Revised:** November 2, 2023**Accepted:** December 4, 2023**Article in press:** December 4, 2023**Published online:** December 19,
2023**Xiao-Yan Zhai**, Institute of Mental Health of Hebei Medical University, Department of Clinical Psychology, Hebei General Hospital, Shijiazhuang 050051, Hebei Province, China**Dong-Chuan Lei**, Sculpture Institute, Hebei Academy of Fine Arts, Shijiazhuang 050700, Hebei Province, China**Yan Zhao**, Department of Pathogenic Biology, Hebei Medical University, Shijiazhuang 050017, Hebei Province, China**Peng Jing, Ai-Hua Ni**, Department of Clinical Psychology, Hebei General Hospital, Shijiazhuang 050051, Hebei Province, China**Kun Zhang**, Basic Medical College, Hebei Medical University, Shijiazhuang 050017, Hebei Province, China**Ji-Ting Han**, Department of Media Art, Shijiazhuang Information Engineering Vocational College, Shijiazhuang 052160, Hebei Province, China**Xue-Yi Wang**, Institute of Mental Health of Hebei Medical University, Psychiatric Department of the First Hospital of Hebei Medical University, Shijiazhuang 050031, Hebei Province, China**Corresponding author:** Xue-Yi Wang, PhD, Chief Doctor, Institute of Mental Health of Hebei Medical University, Psychiatric Department of the First Hospital of Hebei Medical University, No. 89 Donggang Road, Shijiazhuang 050031, Hebei Province, China. 070@hebmu.edu.cn**Abstract****BACKGROUND**

The coronavirus disease 2019 (COVID-19) epidemic disrupted education systems by forcing systems to shift to emergency online learning. Online learning satisfaction affects academic achievement. Many factors affect online learning satisfaction. However there is little study focused on personal characteristics, mental status, and coping style when college students participated in emergency online courses.

AIM

To assess factors related to satisfaction with emergency online learning among college students in Hebei province during the COVID-19 pandemic.

METHODS

We conducted a cross-sectional survey of 1600 college students. The collected information included demographics, psychological aspects of emergent public health events, and coping style. Single factor, correlation, and multiple linear regression analyses were performed to identify factors that affected online learning satisfaction.

RESULTS

Descriptive findings indicated that 62.9% (994/1580) of students were satisfied with online learning. Factors that had significant positive effects on online learning satisfaction were online learning at scheduled times, strong exercise intensity, good health, regular schedule, focusing on the epidemic less than one hour a day, and maintaining emotional stability. Positive coping styles were protective factors of online learning satisfaction. Risk factors for poor satisfaction were depression, neurasthenia, and negative coping style.

CONCLUSION

College students with different personal characteristics, mental status, and coping style exhibited different degrees of online learning satisfaction. Our findings provide reference for educators, psychologists, and school administrators to conduct health education intervention of college students during emergency online learning.

Key Words: COVID-19; Emergency online learning; Online learning satisfaction; College students; Mental status; Coping style; Distance education; Psychiatric status

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: We evaluated satisfaction with online learning and its associated factors, specifically demographic variables, mental status, and coping style of Chinese college students who participated in emergency online courses during the coronavirus disease 2019 pandemic. Little study has been focused on online acceptance of education. Our findings provide reference for educators, psychologists, and school administrators to conduct health education intervention.

Citation: Zhai XY, Lei DC, Zhao Y, Jing P, Zhang K, Han JT, Ni AH, Wang XY. Surviving the shift: College student satisfaction with emergency online learning during COVID-19 pandemic. *World J Psychiatry* 2023; 13(12): 1106-1120

URL: <https://www.wjgnet.com/2220-3206/full/v13/i12/1106.htm>

DOI: <https://dx.doi.org/10.5498/wjpv13.i12.1106>

INTRODUCTION

The SARS-CoV-2 [hereafter referred to as coronavirus disease 2019 (COVID-19)] pandemic disrupted the educational, economic, and social systems of many countries[1]. To reduce the spread of the virus, countries adopted diverse control strategies such as lockdown and social distancing. COVID-19 hampered education by disrupting student learning goals in many disciplines[2]. The Chinese Ministry of Education suggested “suspending classes without suspending learning”. Students across the nation were required to stay at home, and emergency online learning was widely practiced in February 2020[3]. College students urgently turned to distance education to minimize the pandemic’s negative impacts on health[4]. Teachers and students were suddenly thrust into an unplanned, unwanted, uncharted, online learning experiment during COVID-19-mandated confinement. This transition increased workload, altered curricula, and eliminated hands-on experiences. In online education, students had to act more autonomously and take more responsibility for their learning[5]. Students from various backgrounds and places were required to adapt to new environmental, technological, and psychological learning conditions that may have affected academics[4,6,7]. The COVID-19 pandemic impacted a cascade of detrimental effects on college student academic performance[8]. Online learning may have been an approach to ensure student knowledge and practice in this special period, although consideration of student satisfaction is mandatory to improve academics[9].

Learning satisfaction reflects how students view their learning experiences, a crucial indicator of online learning effectiveness that is related to academic achievement[10]. The effect of online learning quality on student performance was strongly mediated by satisfaction with online learning, and ensuring student satisfaction can increase the academic success of both the institution and the student[11]. Surveys of online learning satisfaction during the COVID-19 pandemic show conflicting results. Yekefallah *et al*[10] reported that 59% of college students had poor satisfaction with online learning. Arain *et al*[12] found that the level of satisfaction was only 30% among medical students. Wilhelm *et al*[13] found that undergraduate students reported lower levels of learning, engagement, and confidence with the course materials during remote teaching compared with the face-to-face portion of the class. Conversely, Eansor *et al*[14] showed that online learning had high satisfaction levels, and student knowledge scores and self-confidence were raised because of rich online educational resources and the ability to support asynchronous and synchronous communication between students and teachers and between the students themselves[15]. These differing findings make it necessary to clarify satisfaction with online learning and factors that affect satisfaction to provide effective and targeted interventions for academics and mental and physical health.

Student factors, instructor performance, system quality, and course evaluations all affect online learning satisfaction. Mohammed *et al*[16] found that student factors and system quality were the main elements that influenced student satisfaction. Online learning satisfaction during the COVID-19 lockdown has been assessed by self-efficacy and teacher attitude towards technology integration[17], the interaction between learners and content and lecturers and learners[18], higher education teacher emotional experiences[19], internet connectivity[20], curriculum arrangement[16], and learning environment[21]. Furthermore, the COVID-19 pandemic and related restrictions could impact mental health; college students and young adults had a high prevalence of anxiety, depression, sleep problems, and suicidal ideation[22]. Ionescu *et al*[23] reported that the higher the psychopathology scores, the less online learning satisfaction. Self-directed learning was negatively associated with negative emotions[24]. In addition, University period is a critical time for shaping a student's personality and developing talents; college students have unique psychological characteristics[25]. However, it is not clear which personal characteristics (demographic variables) and which emotions, *e.g.*, depression, fear, neurasthenia, compulsive anxiety or hypochondria, exerted important effects in online learning satisfaction early in the epidemic. Furthermore, coping style is a cognitive and behavioral feature that individuals adopt when facing stressful situations and events. Coping style has a positive and a negative dimension[26]. Positive coping helps individuals to actively manage adversity, which involves asking for advice and finding solutions to adjust to stressors quickly and maintain mental well-being. Negative coping includes social withdrawal and avoidance. Negative coping can increase anxiety and depression and increase the degree of procrastination, which have a negative effect on academic performance [27]. Positive coping is a protective factor for mental health[28]. Nevertheless, factors associated with emergency online learning satisfaction such as coping style have not been adequately defined for the specific pandemic period. Thus, we measured the influence of different characteristics of college students, their psychological state and coping style on their learning satisfaction. Our findings will provide references for colleges to conduct accurate mental health education for students and ensure student satisfaction with online courses. Also, our findings provide understanding of the challenges to fostering a productive learning environment threatened by epidemic outbreak and economic uncertainty.

MATERIALS AND METHODS

Study design

This study was a cross-sectional investigation. An online questionnaire was generated by Wenjuanxing. Wenjuanxing is a web-based, widely used, open questionnaire platform which was developed by the Changsha Ranxing Information and Technology Limited Company. A General Information questionnaire, Psychological questionnaire for Emergent Events of Public Health, and a Simplified Coping Style Questionnaire (SCSQ) were used to measure online satisfaction with learning and associated factors, particularly personal characteristics, mental status, and coping style.

Participants and data collection

Study participants were undergraduates from four colleges and universities, Hebei Medical University, Hebei Normal University, Hebei Academy of Fine Arts, and Shijiazhuang Information Engineering Vocational College. Convenience sampling was used to select participants. Data collection was conducted between March 23, 2020 and April 9, 2020. Because of the pandemic, the students remained at home in different cities and received electronic questionnaires by WeChat. The questionnaire was distributed by school administrators or teachers.

Ethics statement

The study protocol was approved by the Ethics Committee of Hebei General University and complied strictly with ethical requirements. Ethics Review No. (2020) scientific ethics No. (30). All participants provided prior informed consent. Participants were informed that they were free to withdraw at any time. Participants were asked to respond on their own merits and complete survey items in accordance with standardized guidelines. Participant identities were anonymous.

General information questionnaire

The questionnaire was designed to investigate mainly demographic and sociological data, *i.e.*, gender, age, current role, grade, nationality, family location, academic year, monthly household income, parents' education, online status, average daily time paying attention to the epidemic, and whether bored at home for long time. In addition, online learning satisfaction, exercise intensity, and health status scores during the epidemic were rated 1-10 from "very dissatisfied or weak or poor" to "very satisfied, strong, good". Satisfaction scores were defined as poor (1-3), general (4-6), and good (7-10) for online courses.

Psychological Questionnaire for Emergent Events of Public Health

Mental status was assessed with Psychological Questionnaire for Emergent Events of Public Health[29]. This questionnaire is composed of 25 items of five subscales, depression, neurasthenia, fear, compulsion-anxiety, and hypochondria. Each item is scored according to a four-point Likert scale (0 = seldom to 3 = severe) or (0 = seldom to 3 = always). The higher the score of a dimension, the more serious the emotional reaction. The prompt "Possible attitude or practice toward COVID-19" was set to match the actual situation of this survey. The Cronbach's α of the questionnaire for this assessment was 0.776.

SCSQ

Coping styles were assessed with the SCSQ[30]. This questionnaire reflects the attitudes and practices adopted when one experiences setbacks or difficulties. The questionnaire included 20 items in 2 dimensions: Positive coping styles (12 items, *e.g.*, try to look on the bright side, find different ways to solve a problem) and negative coping styles (8 items, *e.g.*, relieve troubles by smoking and drinking, imagine a miracle will come). A 4-point scale was used for each item (0 = never, 1 = seldom, 2 = often, and 3 = always). The total score of the positive coping subscale was from 0 to 36, and the total score of the negative coping subscale was from 0 to 24. High scores reflected high levels of the indicated coping style. The internal consistency coefficients of the positive and negative coping subscale were 0.890 and 0.680, respectively.

Data analysis

Quantitative data were analyzed with descriptive and exploratory methods. First, the skewness and kurtosis values were used to determine whether the data were normally distributed. Data were skewed, continuous variables were expressed as median (interquartile range) and were assessed by Mann-Whitney test or Kruskal-Wallis H test. Second, the correlation of variables was represented by Pearson's and Spearman's coefficients based on the type of data. Third, multiple linear regression was performed to identify predictors of online learning satisfaction. All statistical analysis was performed using SPSS 22.0 (IBM Corporation). All tests were within the 95% confidence interval. When the confidence interval did not include zero, the mediating effect was significant at $P < 0.05$. A two-tailed P value of less than 0.05 was considered statistically significant.

RESULTS

Descriptive statistics

We collected 1600 questionnaires, of which 1580 (98.6%) were effective. The average answer time was 294 ± 165 S. The average age of the participants was 19.9 years (range 17-29 years). There were 342 men (21.6%) and 1238 women (78.4%). There were 191 (12.1%) medicine and 799 (50.6%) and 590 (37.3%) arts and science students. Online learning satisfaction was poor for 3.9% (61/1580) of participants, general for 33.2% (525/1580), and good for 62.9% (994/1580).

Demographic characteristics and single factor analysis

Table 1 lists demographic characteristics and single factor analysis. In the online learning satisfaction dimension, we found statistical significance ($P < 0.05$) for age, major, academic year, family location, online status, average time attention to epidemic, whether following a regular schedule, whether bored at home, health condition, and exercise intensity.

Correlation analysis of online learning satisfaction, mental status, and personal characteristics

We assessed the correlation matrix for all study variables (Table 2). Correlation analyses showed that fear, compulsion-anxiety, positive coping style, father's education, online status, exercise intensity, health condition, whether on a regular schedule, and whether bored at home were positively associated with online learning satisfaction. However, depression, neurasthenia, hypochondria, negative coping style, age, and average time of attention to the epidemic were negatively correlated with online learning satisfaction.

Multiple linear regression of online learning satisfaction

To avoid interaction and multicollinearity, we constructed three models. The dependent variable was learning satisfaction, after confounding factors were excluded. Online learning at schedule, strong exercise intensity, good health, regular schedule, paying attention to epidemic less than one hour, and not bored at home had positive effects ($P < 0.05$) on online learning satisfaction (Table 3). There was no statistical significance for other independent variables. Depression and neurasthenia had significant negative effects on online learning satisfaction, whereas fear positively affected online learning satisfaction ($P < 0.05$; Table 4). Positive coping had a significant positive effect on satisfaction with online courses, whereas negative coping had a significant negative effect ($P < 0.05$; Table 5).

DISCUSSION

The COVID-19 epidemic disrupted education systems, and college students had to turn to distance education quickly. Online learning satisfaction affected academic achievement. As such, it is critical to assess online learning satisfaction, and we need to be aware of some implications. In this study, we showed a relation between online learning satisfaction, personal characteristics, mental status, and coping style. We propose recommendations and solutions to enhance student online learning satisfaction.

We found that online learning satisfaction was reported good by 62.9% (994/1580) of study participants, but nearly half of college students were less satisfied with their studies. Similarly, Maqableh and Alia[31] found that more than a third of surveyed undergraduate students were dissatisfied with the online learning experience. Our results might suggest that emergency online learning could be an optional approach when surviving the shift during the COVID-19 pandemic. On the basis of similar studies, we suggest that a more plausible explanation is that online learning laid a good foundation for promoting interest, effective in learning because of its unlimited access, ease of use, flexibility, innovation,

Table 1 Demographic characteristics and single factor analysis among college students during coronavirus disease 2019 [median (interquartile range)], (n = 1580)

Variable	n	Online learning satisfaction	Depression	Neurasthenia	Fear	compulsion-anxiety	Hypochondria	Positive coping style	Negative coping style
Sex									
Female	1238	7.0 (2.0)	0.2 (0.5)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.5)	20.0 (11.0)	7.0 (5.0)
Male	342	7.0 (4.0)	0.3 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.2)	0.0 (0.0)	19.0 (13.0)	7.0 (6.0)
Z value		-0.56	-2.90	-0.09	-3.56	-1.86	-1.71	-1.56	-1.01
P value		0.606	0.004 ²	0.928	<0.001 ²	0.063	0.088	0.120	0.312
Age (yr)									
17-20	1219	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (5.0)
21-29	361	7.0 (3.0)	0.3 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.5)	20.0 (11.0)	7.0 (2.00)
Z value		-3.27	-2.98	-2.46	-0.44	-0.53	-1.078	-0.77	-2.59
P value		< 0.001 ²	0.003 ²	0.014 ¹	0.660	0.600	0.281	0.440	0.010 ¹
Currently role									
Volunteers	44	7.0 (3.0)	0.3 (0.8)	0.2 (0.8)	0.5 (0.8)	0.0 (0.2)	0.0 (0.5)	17.5 (12.5)	7.5 (7.5)
At home	1536	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (5.0)
Z value		-0.62	-1.66	-0.17	-0.03	-1.92	-1.57	-0.05	-0.84
P value		0.538	0.097	0.242	0.974	0.055	0.116	0.961	0.399
Major									
Medicine	191	7.0 (3.0)	0.3 (0.8)	0.4 (0.8)	0.5 (0.7)	0.0 (0.2)	0.0 (0.5)	19.0 (11.0)	7.0 (6.0)
Art	799	7.0 (2.0)	0.2 (0.5)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (6.0)
Science	590	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	20.0 (10.0)	6.0 (5.0)
χ^2		14.80	14.42	12.20	2.54	-0.96	-0.32	7.76	7.01
P value		< 0.001 ²	< 0.001 ²	0.002 ²	0.281	0.617	0.850	0.021 ¹	0.030 ¹
Academic year									
1 st	708	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	18.0 (12.0)	6.0 (7.0)
2 nd	308	7.5 (3.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.5)	20.0 (13.0)	7.0 (6.0)
3 rd	430	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.6)	22.0 (10.3)	7.0 (5.0)
4 th	134	7.0 (3.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.8)	0.0 (0.2)	0.0 (0.5)	19.5 (11.3)	7.0 (6.0)

χ^2		13.48		-0.49	1.84	0.37	2.339		3.104	36.63		15.21
<i>P</i> value		0.004 ²		0.181	0.607	0.946	0.505		0.376	< 0.001 ²		0.002 ²
Family location												
Country	865	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.6)		0.0 (0.0)	19.0 (11.5)		7.0 (5.0)
Town	292	7.0 (3.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)		0.0 (0.4)	20.0 (11.0)		7.0 (5.0)
City	423	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.2)		0.0 (0.0)	20.0 (12.0)		7.0 (6.0)
χ^2		10.24		4.73	1.75	0.38	4.42		0.101	16.05		10.77
<i>P</i> value		0.006 ²		0.093	0.417	0.829	0.110		0.951	< 0.001 ²		0.005 ^b
Nationalities												
Ethnic minorities	71	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.8)	0.0 (0.0)		0.0 (0.0)	17.0 (11.0)		7.0 (5.0)
Han Chinese	1509	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)		0.0 (0.0)	20.0 (12.0)		7.0 (6.0)
<i>Z</i> value		-0.95		-0.74	-0.86	-0.49	-0.32		-1.03	-0.90		-0.47
<i>P</i> value		0.342		0.460	0.389	0.625	0.749		0.304	0.367		0.639
Whether student cadres												
Yes currently	770	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)		0.0 (0.0)	19.0 (11.0)		7.0 (5.0)
Used to be	436	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.2)		0.0 (0.0)	20.0 (11.0)		7.0 (6.0)
No	374	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)		0.0 (0.0)	20.0 (12.0)		7.0 (5.0)
χ^2		1.28		5.20	1.30	4.46	6.49		3.41	6.62		3.21
<i>P</i> value		0.528		0.074	0.521	0.108	0.039 ^a		0.181	0.037 ^a		0.201
Monthly household income (Yuan)												
< 5000	950	7.0 (2.0)		0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)		0.0 (0.0)	19.0 (12.0)		7.0 (5.0)
5000-10000	523	7.0 (2.0)		0.2 (0.5)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)		0.0 (0.0)	20.0 (12.0)		7.0 (6.0)
10000	107	7.0 (2.0)		0.3 (0.8)	0.4 (0.6)	0.7 (0.7)	0.0 (0.2)		0.0 (0.5)	20.0 (13.0)		8.0 (6.0)
χ^2		0.35		4.26	4.65	2.52	4.78		0.40	5.68		3.49
<i>P</i> value		0.840		0.119	0.098	0.284	0.092		0.819	0.058		0.174
Online status												
No network or not well	46	5.5 (3.0)		0.4 (1.2)	0.4 (1.3)	0.6 (0.7)	0.0 (0.5)		0.0 (0.1)	16.0 (12.3)		7.0 (7.5)
Can not online learning at schedule	16	4.0 (3.8)		0.8 (0.7)	1.0 (0.8)	0.8 (0.8)	0.1 (0.9)		0.0 (0.5)	17.0 (12.0)		8.0 (6.5)

Can online learning at schedule	1518	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	20.0 (12.0)	7.0 (5.0)
χ^2		49.80	17.92	29.13	6.90	20.59	1.09	10.57	0.93
<i>P</i> value		< 0.001 ²	< 0.001 ²	< 0.001 ²	0.032 ¹	< 0.001 ²	0.579	0.005 ²	0.628
Average time attention to epidemic									
Almost all day	165	7.0 (3.5)	0.0 (0.5)	0.2 (0.6)	0.7 (0.8)	0.0 (0.0)	0.0 (0.5)	20.0 (11.5)	7.0 (5.0)
About 1-3 h or more	231	8.0 (3.0)	0.2 (0.5)	0.2 (0.6)	0.7 (0.7)	0.0 (0.0)	0.0 (0.5)	21.0 (11.0)	6.0 (5.0)
< 1 h	1132	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (6.0)
Not concerned	52	5.0 (3.0)	0.2 (0.8)	0.2 (0.8)	0.3 (0.5)	0.0 (0.2)	0.0 (0.0)	14.5 (17.5)	6.5 (6.8)
χ^2		43.39	2.23	1.03	14.75	3.45	1.37	22.51	0.73
<i>P</i> value		< 0.001 ²	0.526	0.794	0.002 ²	0.327	0.713	< 0.001 ²	0.866
Whether regular schedule									
No	427	6.0 (3.0)	0.5 (0.7)	0.4 (0.6)	0.7 (0.7)	0.0 (0.2)	0.0 (0.5)	21.0 (12.0)	7.0 (5.0)
Yes	1153	7.0 (2.5)	0.0 (0.5)	0.2 (0.4)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	17.0 (9.0)	7.0 (5.0)
<i>Z</i> value		-9.97	-11.51	-9.979	-4.62	-7.05	-2.22	-6.32	-3.89
<i>P</i> value		< 0.001 ²	0.027 ¹	< 0.001 ²	< 0.001 ²				
Whether bored at home for long time									
Yes	643	7.0 (3.0)	0.3 (0.8)	0.4 (0.8)	0.7 (0.7)	0.0 (0.2)	0.0 (0.5)	19.0 (9.0)	7.0 (5.0)
No	937	7.0 (2.0)	0.0 (0.5)	0.2 (0.4)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	20.0 (12.0)	7.0 (5.0)
<i>Z</i> value		-6.86	-10.73	-9.54	-4.52	-6.86	-3.05	-2.31	-4.35
<i>P</i> value		< 0.001 ²	0.002 ²	0.021 ¹	< 0.001 ²				
Mother's education									
Junior secondary and below	975	7.0 (2.0)	0.7 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (5.0)
High School	358	7.0 (3.0)	0.7 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (6.0)
University and above	247	7.0 (2.0)	0.7 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	21.0 (13.0)	7.0 (6.0)
χ^2		3.38	0.23	0.33	1.85	0.67	0.50	2.08	2.27
<i>P</i> value		0.185	0.890	0.853	0.396	0.710	0.779	0.353	0.322
Father's education									
Junior secondary and below	963	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	19.0 (12.0)	7.0 (5.0)

High School	348	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.8)	0.0 (0.0)	0.0 (0.5)	19.0 (12.0)	7.0 (6.0)
University and above	269	7.0 (2.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.1)	0.0 (0.0)	20.0 (12.5)	7.0 (6.0)
χ^2		4.88	0.54	0.68	2.08	2.05	2.18	1.95	1.11
<i>P</i> value		0.087	0.763	0.711	0.354	3.359	0.337	0.378	0.575
Health condition									
Poor (grade 1-3)	28	4.5 (4.0)	0.9 (1.3)	0.9 (1.4)	0.7 (0.8)	0.2 (0.6)	0.0 (0.5)	14.0 (11.5)	8.5 (6.5)
General (grade 4-6)	239	6.0 (2.0)	0.5 (0.7)	0.6 (0.6)	0.7 (0.7)	0.0 (0.2)	0.0 (0.5)	17.0 (10.0)	8.0 (6.0)
Good (grade 7-10)	1313	7.0 (2.0)	0.2 (0.5)	0.2 (0.4)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	20.0 (12.0)	6.0 (5.0)
χ^2		168.63	113.22	91.40	20.51	97.75	21.05	24.56	21.62
<i>P</i> value		< 0.001 ²							
Exercise intensity									
Weak (grade 1-3)	272	5.0 (3.0)	0.5 (0.7)	0.4 (0.6)	0.7 (0.7)	0.0 (0.2)	0.0 (0.5)	17.5 (10.0)	8.0 (6.0)
General (grade 4-6)	702	7.0 (3.0)	0.2 (0.7)	0.2 (0.6)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	19.0 (11.3)	7.0 (6.0)
Strong (7-10)	606	8.0 (2.0)	0.0 (0.3)	0.2 (0.4)	0.5 (0.7)	0.0 (0.0)	0.0 (0.0)	21.0 (12.0)	6.0 (6.0)
χ^2		382.38	129.73	91.37	21.38	43.24	17.25	17.13	22.50
<i>P</i> value		< 0.001 ²							

¹*P* < 0.05.

²*P* < 0.01 (two-tailed).

repeatedly watching for the future and review, and online learning was effective, applicable and acceptable in education [32]. However the challenge is to find the associated factors and take measures to improve satisfaction according to those factors.

Our findings indicated that college students who participated in online learning at schedule were more satisfied than students who could not get online either because of a lack of a schedule or no network accessibility. That is to say, online learning satisfaction may be related to the degree of participation. Similarly, Hensley *et al*[33] found that students who were able to participate in online courses at schedule had greater learning satisfaction and were more likely to complete their courses successfully. Also, mobile connections and the quality of internet were main factors related to student negative emotions that associated with the quality, performance, and timeliness of study obligations[34]. We suggest forming a home-school joint mechanism, constructing more and improving existing networks, and urging students to attend classes at schedule, to enhance participation and increase online learning satisfaction.

We found that strong exercise intensity, good health, and regular schedule were positively associated with learning satisfaction. Zhang *et al*[35] reported that college students who participated in physical activity < 3 d/wk had symptoms of depression compared with students who exercised ≥ 3 d/wk. There was also an interaction between long screen use,

Table 2 Correlation analysis of online learning satisfaction, mental status and characteristics

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Online learning satisfaction	-															
Depression	-0.307 ³	-														
Neurasthenia	-0.245 ³	0.624 ³	-													
Fear	0.091 ³	0.381 ³	0.575 ³	-												
Compulsion-anxiety	0.193 ³	0.531 ³	0.490 ³	0.301 ³	-											
Hypochondria	-0.075 ²	0.271 ³	0.397 ³	0.463 ³	0.289 ³	-										
Positive coping style	0.122 ³	-0.085 ²	-0.089 ³	0.057 ¹	-0.104 ³	-0.001	-									
Negative coping style	-0.089 ³	0.274 ³	0.264 ³	0.220 ³	0.212 ³	0.162 ³	0.363 ³	-								
Age	-0.093 ³	0.069 ²	0.054	0.030	0.005	0.043	0.023	0.036	-							
Father's education	0.055 ¹	0.005	-0.018	-0.024	0.024	-0.013	0.031	0.026	-0.057 ¹	-						
Online status	0.171 ³	-0.099 ³	0.118 ³	-0.044	0.111 ³	-0.017	0.080 ²	-0.020	-0.018	-0.019	-					
Exercise intensity	0.537 ³	-0.305 ³	-0.264 ³	-0.119 ³	-0.169 ³	-0.097 ³	0.111 ³	-0.113 ³	-0.184 ³	0.044	0.073 ²	-				
Health condition	0.418 ³	-0.351 ³	-0.298 ³	-0.166 ³	-0.290 ³	-0.182 ³	0.101 ³	-0.161 ³	-0.180 ³	0.020	0.096 ³	0.462 ³	-			
Average time attention to epidemic	-0.132 ³	0.035	-0.005	-0.088 ³	0.023	-0.029	-0.094 ³	0.010	0.019	-0.016	-0.022	-0.144 ³	-0.138 ³	-		
Whether regular schedule	0.251 ³	-0.290 ³	-0.251 ³	-0.116 ³	-0.177 ³	-0.056 ¹	0.159 ³	-0.098 ³	-0.044	0.060 ¹	0.105 ³	0.284 ³	0.224 ³	-0.030	-	
Whether bored at home for long time	0.173 ³	-0.270 ³	-0.204 ³	-0.114 ³	-0.173 ³	-0.077 ²	0.058 ¹	-0.110 ³	-0.053 ¹	-0.013	0.091 ³	0.121 ³	0.104 ³	-0.016	0.183 ³	-

¹*P* < 0 .05.

²*P* < 0 .01.

³*P* < 0.001 (two-tailed).

less physical activity, and symptoms of depression. High levels of depression were associated with difficulty in paying attention to academics[36] and ultimately deficient learning satisfaction. A poor physical condition leads to lack of energy, which directly affects learning satisfaction. College students who work and sleep irregularly often use the screen too long before going to bed; this behavior can cause sleep deprivation and sleep rhythm disorder, increased sleep-related disorders[37], induced adverse emotions such as anxiety and depression[38], affected cognitive function and learning [39], and eventually poor learning satisfaction. Also, sleep disturbance predicts the development and persistence of posttraumatic stress disorder and depression[40] which impair health and academic performance. Therefore, we suggest that a network interactive platform of individual-family-school-society should be established as an effective linkage mechanism to make sports and exercise programs congenial and encourage college students to participate in sports and exercise at home, or receive exercise prescription teaching to mobilize student initiative, enthusiasm, an consciousness,

Table 3 Demographic characteristics with online learning satisfaction (Model 1)

Variable	Unstandardized coefficients		Standardized coefficients beta	t value	P value
	B	Std. Error			
Can online learning at schedule (reference)					
Can not online learning at schedule	-2.490	0.394	-0.129	-6.327	< 0.001
No network or not well	-0.981	0.236	-0.085	-4.156	< 0.001
Exercise intensity	0.334	0.020	0.401	16.860	< 0.001
Health condition	0.166	0.025	0.158	6.671	< 0.001
Whether regular schedule					
No (reference)					
Yes	0.266	0.094	0.061	2.828	0.005
Average time attention to epidemic					
< 1 h (reference)					
Not concerned	-0.889	0.223	-0.082	-3.989	< 0.001
Whether bored at home for long time					
Yes (reference)					
No	0.343	0.082	0.087	4.199	< 0.001

Table 4 Mental status with online learning satisfaction (Model 2)

Variable	Unstandardized coefficients		Standardized coefficients beta	t value	P value
	B	Std. Error			
Depression	-0.776	0.134	-0.199	-5.807	< 0.001
Neurasthenia	-0.654	0.151	-0.163	-4.334	< 0.001
Fear	0.337	0.111	0.087	3.031	0.002

Table 5 Mental status with online learning satisfaction (Model 3)

Variable	Unstandardized coefficients		Unstandardized coefficients	t value	P value
	B	Std. Error			
Positive coping style	0.040	0.006	0.172	6.383	< 0.001
negative coping style	-0.061	0.012	-0.140	-5.183	< 0.001

and to expand personalities[41]. As well, students need to keep regular bedtimes and wake-up times to promote physical and mental health and ensure online learning satisfaction.

Our data suggest that low levels of online learning satisfaction were more likely to be reported by students who spent more than one hour per day looking for information about COVID-19. Previous studies have been focused on the relation between depression, anxiety, and online learning satisfaction. Wong *et al*[42] reported that students who had poor online learning satisfaction were more likely to experience stress. Kecejevic *et al*[36] found that students who spent more than an hour a day searching for information about COVID-19 were more likely to report higher levels of anxiety, depression, and somatization. These findings demonstrate that excessive attention to the epidemic was associated with high levels of anxiety, depression, and difficulty paying attention to academics, which led to low academic satisfaction. Additionally, there should be organized learning about COVID-19 to improve protection skills and avoid gossip and information overload.

Our findings indicate that college students who were bored staying at home for a long time were more likely to experience poor online learning satisfaction. Giusti *et al*[43] reported that students who studied at home either alone or with classmates were nearly three times more likely to have poor academic performance. Li *et al*[44] found that college students who lived at home for a long time tended to lack social interaction and support, and they felt lonely; family dysfunction, low social support, and low physical exercise have negative impacts on mental status. Similarly, Wissing *et*

al[45] mentioned that perceived peer support can promote collaborative learning and improve medical student learning satisfaction and participation. Therefore, in a special period of limit, we suggest that relevant organizations guide college students to increase contact and interaction with teachers and classmates and provide social and family support to promote positive feelings of long-term home confinement.

We found that high levels of depression and neurasthenia and negative coping styles had negative effects on online learning satisfaction, whereas positive coping styles had positive effects. On the basis of the control-value theory, investigators consider academic emotion to be an important factor that affects student learning satisfaction and academic performance in online learning context; negative adaptive coping strategies are associated with depression and anxiety [46]. Loneliness causes depression and anxiety, whereas procrastination completely mediates the effect of depression on academic performance[47]. Neurasthenia did not disappear; it continues to enjoy a marginal life in international classification schemes and is a common diagnosis in China[48]. Also, International Classification of Diseases (ICD)-11 Bodily Distress Disorder encompasses Neurasthenia which in the ICD-10 was classified in the grouping of "Other neurotic disorders" [49]. Huang *et al*[50] reported that 23.5% of adolescents were prone to anxiety, of which 1.7% had severe anxiety, and 26.3% of adolescents were prone to depression, of which 1.4% had severe depression. Therefore, on the basis of a study by Liu *et al*[51], we suggest that college students who experienced depressive disorders not only need support and personalized interventions from educators and school administrators, but also they need professional interventions such as cognitive behavioral therapy and online medication therapy from psychologists and psychiatrist. College student personality and psychology are still in a period of maturation. The coping styles of college students are closely related to their psychological health and learning satisfaction. Positive, mature coping is a protective factor of mental health, and it promotes developing individual adaptation. Negative, immature coping has a negative effect on mental health. To alleviate symptoms of depression, young adults who experience stressful life events may need to reinforce problem-focused coping and minimize emotion-focused coping strategies[52]. Therefore, we suggest that educators train student positive coping styles when conducting psychological intervention and educate and help students to adopt positive coping styles such as self-adjustment, help-seeking, and problem-solving. Doing so will improve college student mental health and online study satisfaction.

Our study may have some limitations. Considering differences in individual physical quality and endurance, we choose the ten grades of exercise intensity and did not use the sports scale. A standardized exercise intensity scale can be used to further refine our study. Interestingly, we found that fear was positively related to online learning satisfaction. As is well known, moderate anxiety or fear of failure in learning can motivate, and high fear of COVID-19 may have kept college students alert, promoted study of relevant topics, and mobilized their subjective initiative to respond positively, which may have increased online learning satisfaction. However, Al-Nasa'h *et al*[53] reported that fear of COVID-19 diminished the satisfaction of online learning. This difference may be related to differences in scales, sample sizes, and regions used in each study. We enrolled a large number of participants located in one metropolis of China. Hence, samples from other contexts are needed to assess the generality of our findings.

CONCLUSION

Our findings enrich our understanding about the impact of the COVID-19 pandemic on satisfaction of the college population toward emergency online learning. Although there was high online learning satisfaction, online education is still an imperfect substitute for in-person learning. College student online learning satisfaction was affected by whether it was scheduled and by depression, neurasthenia, fear, exercise intensity, attention to the epidemic, emotion at home, and coping style during the early stage of COVID-19. We suggest that college students with different characteristics should receive attention at different levels. Psychological intervention should be conducted, publicity and knowledge about COVID-19 should be strengthened, interaction between teachers and students and classmates should be strengthened when teaching online, and support from family and school should be enhanced to alleviate bad emotions that affect online learning satisfaction. Additionally, online group or individual psychological assistance, even psychotropic drugs for high-risk groups, should be made available. Students should adjust coping style and strengthen psychological defense skills. Students, families, schools, and the community can establish a joint mechanism. Related institutions can form mental health guidelines to promote safe and effective learning and a healthy life.

ARTICLE HIGHLIGHTS

Research background

The coronavirus disease 2019 (COVID-19) pandemic disrupted all facets of everyday life. Students turned to online education to minimize the pandemic's spread and negative impacts on health. Students from various backgrounds and places were required to adapt to new learning conditions. Student learning satisfaction is a crucial indicator of the effectiveness of online learning that is related to academic achievement.

Surveys of online learning satisfaction during the COVID-19 pandemic show inconsistent results. Some studies showed that the higher the psychopathology scores, the less online learning satisfaction. University period is a critical time for shaping a student's personality and developing talents, they have unique psychological characteristics. However, it is not clear which personal characteristics (demographic variables) and which emotions, e.g., depression, fear, neurasthenia, compulsive anxiety or hypochondria, had important effects in online learning satisfaction early in the pandemic.

Furthermore, coping style is a cognitive and behavioral feature that individuals adopt when they face stressful situations and events. Coping style has a positive and a negative dimension. Positive coping helps individuals to actively manage adversity. Negative coping includes social withdrawal and avoidance. Negative coping can increase anxiety and depression and increase the degree of procrastination, which have negative effects on academic performance. Positive coping is a protective factor for mental health. Nevertheless, factors associated with emergency online learning satisfaction such as coping style have not been adequately defined for the specific pandemic period.

Research motivation

Our study will clarify satisfaction with online learning and identify personal characteristics and the emotions that had important effects on online learning satisfaction early in the pandemic. Furthermore, this study will clarify which coping style was associated with emergency online learning satisfaction in the specific period. Our findings will provide references for colleges to conduct accurate mental health education and ensure student satisfaction with online courses for a good quality academic experience and mental health.

Research objectives

Our objective is to provide references for colleges to conduct accurate mental health education for students and ensure their satisfaction with online courses. In addition, we will explain challenges to fostering a productive learning environment threatened by epidemic outbreak and economic uncertainty.

Research methods

We measured the influence of college student psychological states and coping styles on their learning satisfaction. Measurements were based on questionnaires designed to investigate mainly demographic and sociological data, *i.e.*, gender, age, current role, grade, nationality, family location, academic year, monthly household income, parents' education, online status, average daily time paying attention to the epidemic, and whether bored at home for long time. Mental status was assessed with the Psychological Questionnaire for Emergent Events of Public Health (PQEEPH). The PQEEPH scale is specially designed for public health emergencies; it is composed of 25 items of five subscales, *i.e.*, depression, neurasthenia, fear, compulsion-anxiety, and hypochondria that describe emotional status precisely and in detail. Coping styles were assessed with the Simplified Coping Style Questionnaire. Quantitative data were analyzed with descriptive and exploratory methods. First, the skewness and kurtosis values were used to determine whether the data were normally distributed. Data were skewed, continuous variables were expressed as median (interquartile range) and were assessed by Mann-Whitney test or Kruskal-Wallis H test. Second, the correlation of variables was represented by Pearson's and Spearman's coefficients based on the type of data. Third, multiple linear regression was performed to identify predictors of online learning satisfaction. All statistical analysis was performed using SPSS 22.0 (IBM Corporation). All tests were within the 95% confidence interval.

Research results

We collected 1600 questionnaires, of which 1580 (98.6%) were effective. Online learning satisfaction was poor for 3.9% (61/1580) of participants, general for 33.2% (525/1580) participants, and good 62.9% (994/1580). Demographic characteristics and single factor analysis showed statistical significance ($P < 0.05$) for age, major, academic year, family location, online status, average time attention to epidemic, whether following a regular schedule, whether bored at home, health condition, and exercise intensity. Correlation analysis of online learning satisfaction, mental status, and personal characteristics showed that fear, compulsion-anxiety, positive coping style, father's education, online status, exercise intensity, health condition, whether on a regular schedule and whether bored at home were positively associated with online learning satisfaction. Depression, neurasthenia, hypochondria, negative coping style, age, average time of attention to the epidemic were negatively correlated with online learning satisfaction. Multiple linear regression of online learning satisfaction showed online learning at schedule, strong exercise intensity, good health, regular schedule, paying attention to epidemic less than one hour, and not bored at home had positive effects ($P < 0.05$) on online learning satisfaction. Depression and neurasthenia had significant negative effects on online learning satisfaction, whereas fear had positive effects ($P < 0.05$). Positive coping had a significant positive effect on satisfaction with online courses, whereas negative coping had a significant negative effect ($P < 0.05$).

Research conclusions

The new theory is that this study assessed factors especially on personal characteristics, mental status, and coping style related to satisfaction with emergency online learning among college students during the COVID-19 pandemic. Little study has been focused on online acceptance of education in early time of COVID-19 pandemic. Our findings provide reference for educators, psychologists, and school administrators to conduct health education intervention.

The new method we used is the PQEEPH. This scale is specially designed for public health emergencies, it is composed of 25 items of five sub scales, depression, neurasthenia, fear, compulsion-anxiety, and hypochondria which describe the emotional status detailed and precisely.

Research perspectives

On the basis of our methods and findings concerning factors that affect online learning satisfaction, we suggest that it will be possible to assess the effects of psychological intervention for college students during the next emergency online learning period and then formulate corresponding and mature programs.

FOOTNOTES

Author contributions: Wang XY and Ni AH contributed to conception and design of the study; Jing P organized the database; Zhao Y, Zhang K, Lei DC, and Han JT collected data; Zhai XY performed the statistical analysis and write the article; All authors contributed to manuscript revision, read, and approved the submitted version.

Institutional review board statement: The study protocol was approved by the Ethics Committee of Hebei General University and complied strictly with ethical requirements. Ethics Review No. 2020 scientific ethics No. 30.

Informed consent statement: All study participants or their legal guardian provided informed written consent about personal and medical data collection prior to study enrollment.

Conflict-of-interest statement: Dr. Wang has nothing to disclose.

Data sharing statement: Technical appendix, statistical code, and dataset available from the first author at 13832346369@163.com. Consent was not obtained but the presented data are anonymized and risk of identification is low.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Xiao-Yan Zhai [0009-0005-3344-5246](https://orcid.org/0009-0005-3344-5246); Xue-Yi Wang [0000-0002-0798-2049](https://orcid.org/0000-0002-0798-2049).

S-Editor: Lin C

L-Editor: A

P-Editor: Chen YX

REFERENCES

- Bollyky TJ**, Castro E, Aravkin AY, Bhangdia K, Dalos J, Hulland EN, Kiernan S, Lastuka A, McHugh TA, Ostroff SM, Zheng P, Chaudhry HT, Ruggiero E, Turilli I, Adolph C, Amlag JO, Bang-Jensen B, Barber RM, Carter A, Chang C, Cogen RM, Collins JK, Dai X, Dangel WJ, Dapper C, Deen A, Eastus A, Erickson M, Fedosseeva T, Flaxman AD, Fullman N, Giles JR, Guo G, Hay SI, He J, Helak M, Huntley BM, Iannucci VC, Kinzel KE, LeGrand KE, Magistro B, Mokdad AH, Nassereldine H, Ozten Y, Pasovic M, Pigott DM, Reiner RC Jr, Reinke G, Schumacher AE, Serieux E, Spurlock EE, Troeger CE, Vo AT, Vos T, Walcott R, Yazdani S, Murray CJL, Dieleman JL. Assessing COVID-19 pandemic policies and behaviours and their economic and educational trade-offs across US states from Jan 1, 2020, to July 31, 2022: an observational analysis. *Lancet* 2023; **401**: 1341-1360 [PMID: [36966780](https://pubmed.ncbi.nlm.nih.gov/36966780/) DOI: [10.1016/S0140-6736\(23\)00461-0](https://doi.org/10.1016/S0140-6736(23)00461-0)]
- Copeland WE**, McGinnis E, Bai Y, Adams Z, Nardone H, Devadanam V, Rettew J, Hudziak JJ. Impact of COVID-19 Pandemic on College Student Mental Health and Wellness. *J Am Acad Child Adolesc Psychiatry* 2021; **60**: 134-141.e2 [PMID: [33091568](https://pubmed.ncbi.nlm.nih.gov/33091568/) DOI: [10.1016/j.jaac.2020.08.466](https://doi.org/10.1016/j.jaac.2020.08.466)]
- Wang ZH**, Yang HL, Yang YQ, Liu D, Li ZH, Zhang XR, Zhang YJ, Shen D, Chen PL, Song WQ, Wang XM, Wu XB, Yang XF, Mao C. Prevalence of anxiety and depression symptom, and the demands for psychological knowledge and interventions in college students during COVID-19 epidemic: A large cross-sectional study. *J Affect Disord* 2020; **275**: 188-193 [PMID: [32734907](https://pubmed.ncbi.nlm.nih.gov/32734907/) DOI: [10.1016/j.jad.2020.06.034](https://doi.org/10.1016/j.jad.2020.06.034)]
- Karadag E**, Su A, Ergin-Kocaturk H. Multi-level analyses of distance education capacity, faculty members' adaptation, and indicators of student satisfaction in higher education during COVID-19 pandemic. *Int J Educ Technol High Educ* 2021; **18**: 57 [PMID: [34778542](https://pubmed.ncbi.nlm.nih.gov/34778542/) DOI: [10.1186/s41239-021-00291-w](https://doi.org/10.1186/s41239-021-00291-w)]
- Turan Z**, Kucuk S, Cilligol Karabey S. The university students' self-regulated effort, flexibility and satisfaction in distance education. *Int J Educ Technol High Educ* 2022; **19**: 35 [PMID: [35891707](https://pubmed.ncbi.nlm.nih.gov/35891707/) DOI: [10.1186/s41239-022-00342-w](https://doi.org/10.1186/s41239-022-00342-w)]
- Tasso AF**, Hıslı Sahin N, San Roman GJ. COVID-19 disruption on college students: Academic and socioemotional implications. *Psychol Trauma* 2021; **13**: 9-15 [PMID: [33382329](https://pubmed.ncbi.nlm.nih.gov/33382329/) DOI: [10.1037/tra0000996](https://doi.org/10.1037/tra0000996)]
- Sum M**, Oancea A. The use of technology in higher education teaching by academics during the COVID-19 emergency remote teaching period: a systematic review. *Int J Educ Technol High Educ* 2022; **19**: 59 [PMID: [36531306](https://pubmed.ncbi.nlm.nih.gov/36531306/) DOI: [10.1186/s41239-022-00364-4](https://doi.org/10.1186/s41239-022-00364-4)]
- Jones HE**, Manze M, Ngo V, Lamberson P, Freudenberg N. The Impact of the COVID-19 Pandemic on College Students' Health and Financial Stability in New York City: Findings from a Population-Based Sample of City University of New York (CUNY) Students. *J Urban Health* 2021; **98**: 187-196 [PMID: [33570739](https://pubmed.ncbi.nlm.nih.gov/33570739/) DOI: [10.1007/s11524-020-00506-x](https://doi.org/10.1007/s11524-020-00506-x)]
- Visuddho V**, Nugraha D, Melbiarta RR, Rimbun R, Purba AKR, Syaafa'ah I, Bakhtiar A, Rejeki PS, Romdhoni AC. Predominant aspects of knowledge and practical skills among medical students with online learning during the COVID-19 pandemic era. *Med Educ Online* 2023; **28**: 2182665 [PMID: [36855247](https://pubmed.ncbi.nlm.nih.gov/36855247/) DOI: [10.1080/10872981.2023.2182665](https://doi.org/10.1080/10872981.2023.2182665)]
- Yekefallah L**, Namdar P, Panahi R, Dehghankar L. Factors related to students' satisfaction with holding e-learning during the Covid-19 pandemic based on the dimensions of e-learning. *Heliyon* 2021; **7**: e07628 [PMID: [34381894](https://pubmed.ncbi.nlm.nih.gov/34381894/) DOI: [10.1016/j.heliyon.2021.e07628](https://doi.org/10.1016/j.heliyon.2021.e07628)]
- Keržič D**, Alex JK, Pamela Balbontín Alvarado R, Bezerra DDS, Cheraghi M, Dobrowolska B, Fagbamigbe AF, Faris ME, França T, González-Fernández B, Gonzalez-Robledo LM, Inasius F, Kar SK, Lazányi K, Lazăr F, Machin-Mastromatteo JD, Maróco J, Marques BP, Mejía-Rodríguez O, Méndez Prado SM, Mishra A, Mollica C, Navarro Jiménez SG, Obadić A, Raccanello D, Rashid MMU, Ravšelj D, Tomažević N, Uleanya C, Umek L, Vicentini G, Yorulmaz Ö, Zamfir AM, Aristovnik A. Academic student satisfaction and perceived

- performance in the e-learning environment during the COVID-19 pandemic: Evidence across ten countries. *PLoS One* 2021; **16**: e0258807 [PMID: 34669757 DOI: 10.1371/journal.pone.0258807]
- 12 **Arain SA**, Ali M, Arbili L, Ikram MF, Kashir J, Omair A, Meo SA. Medical Students and Faculty Perceptions About Online Learning During COVID-19 Pandemic: Alfaisal University Experience. *Front Public Health* 2022; **10**: 880835 [PMID: 35812490 DOI: 10.3389/fpubh.2022.880835]
 - 13 **Wilhelm J**, Mattingly S, Gonzalez VH. Perceptions, satisfactions, and performance of undergraduate students during Covid-19 emergency remote teaching. *Anat Sci Educ* 2022; **15**: 42-56 [PMID: 34859608 DOI: 10.1002/ase.2161]
 - 14 **Eansor P**, Norris ME, D'Souza LA, Bauman GS, Kassam Z, Leung E, Nichols AC, Sharma M, Tay KY, Velker V, Warner A, Willmore KE, Campbell N, Palma DA. Is Remote Learning as Effective as In-Person Learning for Contouring Education? A Prospective Comparison of Face-to-Face versus Online Delivery of the Anatomy and Radiology Contouring Bootcamp. *Int J Radiat Oncol Biol Phys* 2022; **112**: 590-599 [PMID: 34710522 DOI: 10.1016/j.ijrobp.2021.10.011]
 - 15 **The Lancet**. COVID-19: the intersection of education and health. *Lancet* 2021; **397**: 253 [PMID: 33485430 DOI: 10.1016/S0140-6736(21)00142-2]
 - 16 **Mohammed LA**, Aljaberi MA, Amidi A, Abdulsalam R, Lin CY, Hamat RA, Abdallah AM. Exploring Factors Affecting Graduate Students' Satisfaction toward E-Learning in the Era of the COVID-19 Crisis. *Eur J Investig Health Psychol Educ* 2022; **12**: 1121-1142 [PMID: 36005228 DOI: 10.3390/ejihpe12080079]
 - 17 **Sidi Y**, Shamir-Inbal T, Eshet-Alkalai Y. From face-to-face to online: Teachers' perceived experiences in online distance teaching during the Covid-19 pandemic. *Comput Educ* 2023; **201**: 104831 [PMID: 37193045 DOI: 10.1016/j.compedu.2023.104831]
 - 18 **Adesuyi EO**, Akingbade O, Tola YO, Otun O, Faleti DM, Fawole IO, Faleti DD, Dairo EA, Sado O, Adefehinti P, Adewa TO. Satisfaction and perceived impact of virtual learning during COVID-19 lockdown: A case study of an online nursing research conference. *Nurs Open* 2023; **10**: 6215-6227 [PMID: 37259231 DOI: 10.1002/nop2.1857]
 - 19 **Zou W**, Ding X, Xie L, Wang H. Relationship between higher education teachers' affect and their psychological adjustment to online teaching during the COVID-19 pandemic: an application of latent profile analysis. *PeerJ* 2021; **9**: e12432 [PMID: 34760399 DOI: 10.7717/peerj.12432]
 - 20 **Eberle J**, Hobrecht J. The lonely struggle with autonomy: A case study of first-year university students' experiences during emergency online teaching. *Comput Human Behav* 2021; **121**: 106804 [PMID: 36568042 DOI: 10.1016/j.chb.2021.106804]
 - 21 **Tleuken A**, Turkyilmaz A, Unger K, Tokazhanov G, El-Thalji I, Mostafa MY, Guney M, Karaca F. Which qualities should built environment possess to ensure satisfaction of higher-education students with remote education during pandemics? *Build Environ* 2022; **207**: 108567 [PMID: 36568651 DOI: 10.1016/j.buildenv.2021.108567]
 - 22 **Dragioti E**, Li H, Tsitsas G, Lee KH, Choi J, Kim J, Choi YJ, Tsamakidis K, Estradé A, Agorastos A, Vancampfort D, Tsiptsios D, Thompson T, Mosina A, Vakadaris G, Fusar-Poli P, Carvalho AF, Correll CU, Han YJ, Park S, Il Shin J, Solmi M. A large-scale meta-analytic atlas of mental health problems prevalence during the COVID-19 early pandemic. *J Med Virol* 2022; **94**: 1935-1949 [PMID: 34958144 DOI: 10.1002/jmv.27549]
 - 23 **Ionescu CG**, Chendea A, Licu M. Is Satisfaction with Online Learning Related to Depression, Anxiety, and Insomnia Symptoms? A Cross-Sectional Study on Medical Undergraduates in Romania. *Eur J Investig Health Psychol Educ* 2023; **13**: 580-594 [PMID: 36975397 DOI: 10.3390/ejihpe13030045]
 - 24 **Chang WW**, Zhang L, Wen LY, Su H, Jin YL. Association Between Online Self-Directed Learning Ability and Negative Emotions Among College Students During the COVID-19 Pandemic: A Cross-Sectional Study in Anhui Province, East China. *Front Psychol* 2021; **12**: 720911 [PMID: 34916987 DOI: 10.3389/fpsyg.2021.720911]
 - 25 **Lawrance EL**, Jennings N, Kioupi V, Thompson R, Diffey J, Vercammen A. Psychological responses, mental health, and sense of agency for the dual challenges of climate change and the COVID-19 pandemic in young people in the UK: an online survey study. *Lancet Planet Health* 2022; **6**: e726-e738 [PMID: 36087603 DOI: 10.1016/S2542-5196(22)00172-3]
 - 26 **Song L**, Wang Y, Zhang Q, Yin J, Gan W, Shang S, Qi L, Chen S, Liu T. The mediating effect of resilience on mental health literacy and positive coping style among Chinese empty nesters: A cross-sectional study. *Front Psychol* 2023; **14**: 1093446 [PMID: 36760438 DOI: 10.3389/fpsyg.2023.1093446]
 - 27 **Freyhofer S**, Ziegler N, de Jong EM, Schippers MC. Depression and Anxiety in Times of COVID-19: How Coping Strategies and Loneliness Relate to Mental Health Outcomes and Academic Performance. *Front Psychol* 2021; **12**: 682684 [PMID: 34759855 DOI: 10.3389/fpsyg.2021.682684]
 - 28 **Han Z**, Tang X, Li X, Shen Y, Li L, Wang J, Chen X, Hu Z. COVID-19-Related Stressors and Mental Health Among Chinese College Students: A Moderated Mediation Model. *Front Public Health* 2021; **9**: 586062 [PMID: 34222162 DOI: 10.3389/fpubh.2021.586062]
 - 29 **Huang Z**, Zhang L, Wang J, Xu L, Li Y, Guo M, Ma J, Xu X, Wang B, Lu H. The structural characteristics and influential factors of psychological stress of urban residents in Jiangxi province during the COVID-19 pandemic: cross sectional study. *Heliyon* 2021; **7**: e07829 [PMID: 34485727 DOI: 10.1016/j.heliyon.2021.e07829]
 - 30 **Yan L**, Gan Y, Ding X, Wu J, Duan H. The relationship between perceived stress and emotional distress during the COVID-19 outbreak: Effects of boredom proneness and coping style. *J Anxiety Disord* 2021; **77**: 102328 [PMID: 33160275 DOI: 10.1016/j.janxdis.2020.102328]
 - 31 **Maqableh M**, Alia M. Evaluation online learning of undergraduate students under lockdown amidst COVID-19 Pandemic: The online learning experience and students' satisfaction. *Child Youth Serv Rev* 2021; **128**: 106160 [PMID: 36540702 DOI: 10.1016/j.childyouth.2021.106160]
 - 32 **Mirsepasi Z**, Karimi E, Mohammadjafari A. Psychiatric training program during the COVID-19 pandemic: An experience in Iran. *Asian J Psychiatr* 2022; **73**: 103130 [PMID: 35447537 DOI: 10.1016/j.ajp.2022.103130]
 - 33 **Hensley A**, Hampton D, Wilson JL, Culp-Roche A, Wiggins AT. A Multicenter Study of Student Engagement and Satisfaction in Online Programs. *J Nurs Educ* 2021; **60**: 259-264 [PMID: 34039134 DOI: 10.3928/01484834-20210420-04]
 - 34 **Šorgo A**, Crnković N, Gabrovec B, Cesar K, Selak Š. Influence of Forced Online Distance Education During the COVID-19 Pandemic on the Perceived Stress of Postsecondary Students: Cross-sectional Study. *J Med Internet Res* 2022; **24**: e30778 [PMID: 35171098 DOI: 10.2196/30778]
 - 35 **Zhang Y**, Wu X, Tao S, Li S, Ma L, Yu Y, Sun G, Li T, Tao F. Associations between screen time, physical activity, and depressive symptoms during the 2019 coronavirus disease (COVID-19) outbreak among Chinese college students. *Environ Health Prev Med* 2021; **26**: 107 [PMID: 34727892 DOI: 10.1186/s12199-021-01025-0]
 - 36 **Kecojevic A**, Basch CH, Sullivan M, Davi NK. The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PLoS One* 2020; **15**: e0239696 [PMID: 32997683 DOI: 10.1371/journal.pone.0239696]
 - 37 **Zhang X**, Dimitriou D, Halstead EJ. Sleep, Anxiety, and Academic Performance: A Study of Adolescents From Public High Schools in China.

- Front Psychol* 2021; **12**: 678839 [PMID: 34276498 DOI: 10.3389/fpsyg.2021.678839]
- 38 **Meaklim H**, Junge MF, Varma P, Finck WA, Jackson ML. Pre-existing and post-pandemic insomnia symptoms are associated with high levels of stress, anxiety, and depression globally during the COVID-19 pandemic. *J Clin Sleep Med* 2021; **17**: 2085-2097 [PMID: 33985647 DOI: 10.5664/jcsm.9354]
- 39 **Kreutzmann JC**, Havekes R, Abel T, Meerlo P. Sleep deprivation and hippocampal vulnerability: changes in neuronal plasticity, neurogenesis and cognitive function. *Neuroscience* 2015; **309**: 173-190 [PMID: 25937398 DOI: 10.1016/j.neuroscience.2015.04.053]
- 40 **Wang D**, Zhao J, Zhai S, Ye H, Bu L, Fan F. Does sleep disturbance predicts posttraumatic stress disorder and depression among college students during COVID-19 Lockdown? A longitudinal survey. *Front Public Health* 2022; **10**: 986934 [PMID: 36176529 DOI: 10.3389/fpubh.2022.986934]
- 41 **Zhong XL**, Sheng DL, Cheng TZ, Zhang ZW. Effect of exercise prescription teaching on exercise quality and mental health status of college students. *World J Psychiatry* 2023; **13**: 191-202 [PMID: 37303933 DOI: 10.5498/wjp.v13.i5.191]
- 42 **Wong SS**, Wong CC, Ng KW, Bostanudin MF, Tan SF. Depression, anxiety, and stress among university students in Selangor, Malaysia during COVID-19 pandemics and their associated factors. *PLoS One* 2023; **18**: e0280680 [PMID: 36696454 DOI: 10.1371/journal.pone.0280680]
- 43 **Giusti L**, Mammarella S, Salza A, Del Vecchio S, Ussorio D, Casacchia M, Roncone R. Predictors of academic performance during the covid-19 outbreak: impact of distance education on mental health, social cognition and memory abilities in an Italian university student sample. *BMC Psychol* 2021; **9**: 142 [PMID: 34526153 DOI: 10.1186/s40359-021-00649-9]
- 44 **Li Y**, Zhao J, Ma Z, McReynolds LS, Lin D, Chen Z, Wang T, Wang D, Zhang Y, Zhang J, Fan F, Liu X. Mental Health Among College Students During the COVID-19 Pandemic in China: A 2-Wave Longitudinal Survey. *J Affect Disord* 2021; **281**: 597-604 [PMID: 33257043 DOI: 10.1016/j.jad.2020.11.109]
- 45 **Wissing RO**, Hilverda F, Scheepers RA, Nieboer AP, Vollmann M. Peer relationships buffer the negative association of online education with education satisfaction and subsequently with study engagement among undergraduate medical students. *BMC Med Educ* 2022; **22**: 276 [PMID: 35418086 DOI: 10.1186/s12909-022-03337-3]
- 46 **Zhao L**, Sznajder K, Cheng D, Wang S, Cui C, Yang X. Coping Styles for Mediating the Effect of Resilience on Depression Among Medical Students in Web-Based Classes During the COVID-19 Pandemic: Cross-sectional Questionnaire Study. *J Med Internet Res* 2021; **23**: e25259 [PMID: 34033579 DOI: 10.2196/25259]
- 47 **Wu C**, Jing B, Gong X, Mou Y, Li J. Student's Learning Strategies and Academic Emotions: Their Influence on Learning Satisfaction During the COVID-19 Pandemic. *Front Psychol* 2021; **12**: 717683 [PMID: 34630228 DOI: 10.3389/fpsyg.2021.717683]
- 48 **Bynum B**. Neurasthenia. *Lancet* 2003; **361**: 1753 [PMID: 12767784 DOI: 10.1016/S0140-6736(03)13332-6]
- 49 **Keeley J**, Reed GM, Rebello T, Brechbiel J, Garcia-Pacheco JA, Adebayo K, Esan O, Majekodunmi O, Ojagbemi A, Onofa L, Robles R, Matsumoto C, Medina-Mora ME, Kogan CS, Kulygina M, Gaebel W, Zhao M, Roberts MC, Sharan P, Ayuso-Mateos JL, Khoury B, Stein DJ, Lovell AM, Pike K, Creed F, Gureje O. Case-controlled field study of the ICD-11 clinical descriptions and diagnostic requirements for Bodily Distress Disorders. *J Affect Disord* 2023; **333**: 271-277 [PMID: 37100177 DOI: 10.1016/j.jad.2023.04.086]
- 50 **Huang BW**, Guo PH, Liu JZ, Leng SX, Wang L. Investigating adolescent mental health of Chinese students during the COVID-19 pandemic: Multicenter cross-sectional comparative investigation. *World J Psychiatry* 2022; **12**: 1323-1334 [PMID: 36438680 DOI: 10.5498/wjp.v12.i11.1323]
- 51 **Liu XQ**, Guo YX, Zhang WJ, Gao WJ. Influencing factors, prediction and prevention of depression in college students: A literature review. *World J Psychiatry* 2022; **12**: 860-873 [PMID: 36051603 DOI: 10.5498/wjp.v12.i7.860]
- 52 **Pelekanakis A**, Doré I, Sylvestre MP, Sabiston CM, O'Loughlin J. Mediation by coping style in the association between stressful life events and depressive symptoms in young adults. *Soc Psychiatry Psychiatr Epidemiol* 2022; **57**: 2401-2409 [PMID: 35895096 DOI: 10.1007/s00127-022-02341-8]
- 53 **Al-Nasa'h M**, Al-Tarawneh L, Abu Awwad FM, Ahmad I. Estimating students' online learning satisfaction during COVID-19: A discriminant analysis. *Heliyon* 2021; **7**: e08544 [PMID: 34909480 DOI: 10.1016/j.heliyon.2021.e08544]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
Telephone: +1-925-3991568
E-mail: bpgoffice@wjgnet.com
Help Desk: <https://www.f6publishing.com/helpdesk>
<https://www.wjgnet.com>

