

BMJ Open Prevalence and risk factors of depression symptoms among Chinese seafarers during the COVID-19 pandemic: a cross-sectional study

Wenzhe Qin ,¹ Lei Li,² Dongshan Zhu ,¹ Chengfei Ju,³ Pengfei Bi,³ Shixue Li¹

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¹Centre for Health Management and Policy Research, School of Public Health, Cheeloo College of Medicine, Shandong University, Jinan, China
²Department of Health Quarantine, Jinan Airport Customs, Jinan, China
³Department of Health Quarantine, Rongcheng Customs, Rongcheng, China

Correspondence to
Prof. Shixue Li;
shixueli@sdu.edu.cn

ABSTRACT

Background To curb the spread of COVID-19, most countries have adopted measures such as banning shore leave at ports and placed restrictions on crew change. Seafarers may bear an excess pressure during the COVID-19 pandemic. This study aimed to investigate the prevalence and risk factors associated with depression symptoms among Chinese seafarers during the COVID-19 pandemic.

Design Cross-sectional study.

Methods This field survey-based study was conducted at Rongcheng Port, Shandong Province, China, from 10 June 2020 to 25 July 2020. Sociodemographic and occupational characteristics and health-related behaviours were collected through a face-to-face questionnaire. The Self-Rating Depression Scale was used to evaluate depression status during the preceding week. Logistic regression models were used to explore factors related to depression.

Results 441 male Chinese seafarers were enrolled. Overall, the proportions of seafarers with low, moderate and severe depression symptoms were 23.35%, 9.30% and 9.07%, respectively. Compared with those with good self-rated health (SRH), seafarers with poor SRH had higher odds of depression (OR, 2.24, 95% CI 1.22 to 4.11). Less leisure time or physical exercise was associated with more severe self-reported depression symptoms (1–3 per week vs ≥4 per week: OR, 1.72, 95% CI 0.71 to 4.14; none vs ≥4 per week: OR, 3.93, 95% CI 1.67 to 9.26). Poor sleep quality was associated with higher likelihood of reporting severe depression (fair vs good: OR, 2.78, 95% CI 1.54 to 5.01; poor vs good: OR, 4.30, 95% CI 1.65 to 11.24). The more frequent seafarers worked overtime a week, the higher the likelihood of reporting severe depression symptoms (1–2 per week vs none: OR, 1.82, 95% CI 1.04 to 3.18; ≥3 per week vs none: OR, 2.49, 95% CI 1.05 to 5.92). Also, high perceived work stress was linked to higher odds of being depressed (intermediate vs low: OR, 2.06, 95% CI 0.78 to 5.46; high vs low: OR, 3.83, 95% CI 1.35 to 10.90).

Conclusions There is a high burden of depression associated with COVID-19 among seafarers. Special interventions that protect the mental health of seafarers are more critical than ever in the context of the pandemic.

Strengths and limitations of this study

- This is the first study to evaluate depression status and related factors among seafarers during the COVID-19 pandemic.
- This study may provide important evidence to promote mental well-being among seafarers.
- The mental health status of seafarers before the COVID-19 pandemic was not measured.
- The participants were Chinese seafarers, which may limit extrapolation of findings.

INTRODUCTION

On 11 March 2020, the WHO declared COVID-19 a pandemic.¹ As of 24 May 2021, there have been more than 166 million confirmed cases and 3.4 million confirmed deaths worldwide.² In addition to the stress posed to health systems, the pandemic also severely impacts the global economy and the global supply chain, especially international shipping.

Around 90% of global trade is transported by sea.³ During the COVID-19 pandemic, sea logistics networks are more important than ever for global supply chains. Seafarers play an essential role in maintaining the flow of vital goods such as food and medical supplies.⁴ Globally, there are two million seafarers ensuring the global needs for goods for daily life.⁵

COVID-19 has triggered many governments to prevent transfer of seafarers to their territories and to and from their home countries and vessels. This has left some seafarers stranded while others unable to join vessels to earn income. As of December 2020, there are over 400 000 seafarers stranded on ships and had to extend their contract due to crew change issues. On the other hand, a similar number of seafarers are stuck at home, unable to join ships.⁶ Also, to avoid imported cases of

COVID-19, most countries have adopted measures such as banning shore leave at ports.

Long-term work in an enclosed environment, a total absence of shore leave, boredom due to monotonous work, fear of being infected and lack of emotional support from families may cause mental health crisis, such as emotional instability, anxiety and depression.⁷ Thus, organisations (eg, the International Chamber of Shipping) have called for attention to the mental health of seafarers ‘trapped on board’, as there have been several cases of suicides among them.^{8 9}

Previous studies before the COVID-19 pandemic have suggested poor mental health status among seafarers. A meta-analysis of Chinese seafarers found that, compared with the general population, seafarers had poor mental health status and higher prevalence of depression.^{10 11} Evidence has also shown COVID-19 has negative impact on mental health.^{12–15} Considering the special working conditions of seafarers, we predict that seafarers’ mental health status may deteriorate even more during the COVID-19 pandemic, and especially the prevalence of depression among them might even be higher than usual.

Previous studies have found that risk factors for depression in seafarers include baseline medical conditions (history of high cholesterol, hypertension, sleep disturbances, diabetes, liver disease, cancer, etc), demographic factors (age, gender, region of origin, etc), occupational factors (rank, work experience, etc), work-related determinants (exposures to overtime work and work stress) and additional factors.^{11 16} In this study, baseline medical conditions including chronic disease and sleep duration/quality were first tested. We predicted that there would be a positive correlation between chronic disease and sleep disturbances and depression symptoms. Second, demographic factors including age, marital status, educational level and monthly income were tested. We predicted that age, other marital status, low educational level and low monthly income might be positively associated with depression symptoms. Third, occupational factors including position rank and sailing age were tested. We predicted that high position rank and short sailing age might have positive relationships with depression symptoms. Fourth, work-related determinants including sailing duration, overtime work per week, COVID-19-related stress and perceived work stress were tested. We predicted that there would be positive correlations between long sailing duration, overtime work per week and high perceived work stress and depression symptoms. Additionally, self-rated health (SRH), health behaviours and frequency of exercise were also tested. We predicted that poor SRH, poor health behaviours and lack of exercise might have positive associations with depression symptoms.

In this study, we aimed to evaluate the prevalence of depression symptoms among Chinese seafarers during the COVID-19 pandemic and to explore potential risk factors (including medical history, demographic factors, work-related determinants and SRH) associated with

depression symptoms. This study may provide important evidence to promote mental well-being among seafarers.

METHODS

Study design and participants

A cross-sectional study was conducted at Rongcheng Port, Shandong Province, China, from 10 June 2020 to 25 July 2020. To ensure the authenticity and reliability of data, anonymous face-to-face interviews with seafarers were conducted by trained investigators from Rongcheng Customs using a self-administered questionnaire (SAQ). The SAQ was structured and included five parts, namely sociodemographic information, occupational characteristics, health-related behaviours, health condition and the Self-Rating Depression Scale.

Eligible participants were Chinese seafarers who remained on board when the investigation was conducted. Two-stage sampling strategy was applied. First, a cluster random sampling method was employed to select entry of international ocean ships. All ships were required to declare entry information 24 hours before their arrival. Thus, we randomly selected one ship from ships that will arrive the next day based on their declared information. A total of 30 ships were selected during the study period. Second, all Chinese seafarers on the selected ships were interviewed. The target sample size of participants was determined using the formula $N = Z_{\alpha}^2 P(1-P) / d^2$ ($\alpha=0.05$, $Z_{\alpha}=1.96$ and $d=0.05$). The prevalence of depression symptoms among seafarers was 50.76% based on a study conducted before the COVID-19 pandemic.¹⁷ To improve the response rate, we amplified the sample size by 15%, with a goal of at least 442 participants. A total of 450 seafarers were included during the actual investigation and 9 participants refused to participate in the survey. Finally, 441 individuals completed the survey.

Key definitions

Self-Rating Depression Scale

The 20-item Zung Self-Rating Depression Scale was used to evaluate depression symptoms among seafarers.¹⁸ Ten items are scored positively (eg, ‘I feel downhearted and blue’) and the other ten scored negatively (eg, ‘I still enjoy the things I used to do’). Seafarers were asked to rate how frequently they experienced each symptom during the past week. Responses were distributed on a 4-point Likert scale (1=a little of time, 2=some of the time, 3=good part of the time, 4=most of the time). The sum of the scores obtained from the 20 items was the raw score, and the raw score was converted to a standard score (100-point scale) by multiplying by 1.25. A higher score indicates more severe depression symptoms. The severity of depression symptoms can be converted as follows: normal (≤ 49), mild (50–59), moderate (60–69) and severe (≥ 70). Moderate and/or severe depression were related to impaired daily functioning, reduced quality of life, and even self-harm or suicide in some cases.¹⁹ The presence of major depressive disorder during the COVID-19 pandemic might need

more attention.²⁰ In this study, we focused on seafarers with moderate and severe depression symptoms and classified depression symptoms into two categories: none/mild (score <60) and moderate/severe (score ≥60).²⁰ The Self-Rating Depression Scale has been widely used in previous studies and has good reliability and validity. The Cronbach's α was 0.76 in this study.

Sociodemographic factors

Sociodemographic factors included age, sailing age, gender, marital status, educational level and individual income. Age and sailing age were measured in chronological years, while gender was dichotomised. Marital status was categorised into married and others. Educational level was divided into three levels: high school or below, junior college, and bachelor's degree or above. Data on self-reported monthly income in the recent 1 year were collected. Most of the seafarers had been on board before the COVID-19 pandemic and their contracted income was hardly affected by the COVID-19 pandemic.

Occupational characteristics

Occupation-related factors included sailing duration, type of ship, working position, night shift frequency per week, overtime work frequency per week and self-perceived work stress. Overtime work was defined as 'work continuously for more than 10 hours a day'. Frequency of overtime work per week was categorised into none, 1–2 times and 3 times or more. Respondents were asked to rate work-related stress using the question 'In general, how would you rate your recent work stress', and seafarers' stress level was categorised into low, intermediate and high.²¹

Health status and health-related behaviours

Health status included SRH and history of chronic disease. SRH is an effective and reliable measure of health²² and has been grouped into good SRH and poor SRH in current studies. The presence of certain chronic diseases was categorised into yes or no.

Health-related behaviours including cigarette exposure, alcohol consumption, sleep duration, self-rated sleep quality and leisure time or physical exercise (LPE) in the past month were measured. Sleep duration was measured as the number of hours of sleep at night. Seafarers' work follows a shift system and thus sleep duration included sleep time during day and night and categorised into <6 hours, 6–8 hours and >8 hours. Sleep quality was divided into three categories: excellent, fair and poor. LPE was calculated as the frequency of engaging in leisure activities or physical exercise (such as walking, playing table tennis or working out in a gym) per week on board and divided into three categories: none, occasionally (1–3) and regularly (≥4).

COVID-19 stress

To evaluate seafarers' stress due to COVID-19, they were asked 'In the current global outbreak of COVID-19, how would you rate the COVID-19-related stress on you and

your relatives (such as fears of being infected, worries about losing job, have financial problems and so on)?'. A 3-point Likert scale was used: 3=high, 2=fair and 1=low.

Written informed consent was received before the respondents began to fill out the questionnaire.

Statistical analysis

The characteristics of the seafarers were described by depression group. Data were presented as mean (SD) for continuous variables and as n (%) for categorical variables. Statistical differences in depression among the subgroups were tested using independent sample t-tests (continuous variables) or χ^2 tests (categorical variables). Multivariable logistic regression models were employed to estimate the OR and 95% CI for the associations between risk factors and depression symptoms. All statistical tests were two-tailed and the level of significance was set at 0.05. All analyses were performed using SPSS V.25.0 statistical software.

RESULTS

Demographic characteristics

The demographic characteristics of seafarers are shown in [table 1](#). The mean age was 37.54±9.74 years and the median sailing age was 8.0 (3.0–13.0) years. Of the seafarers, 53.5% were high school or below and 7.5% had bachelor's degree or above, 74.6% were married, and 52.2% were ordinary crew. The ship types that seafarers work on were mainly cargo ships and bulk carriers. By the end of the survey, the median sailing duration was 7.0 (5.0–9.0) months without disembark and travelling home. According to the contractual sailing duration stated by 'The collective bargaining agreement for Chinese crew', 30.4% of seafarers have been on board for more than 8 months, 15% for more than 10 months and 9.5% for more than 12 months.

Prevalence of depression symptoms in seafarers

In 441 seafarers, the highest standard score of depression was 73 and the total mean standard score was 38.33±10.8. According to the standard score, a considerable proportion of seafarers reported symptoms of depression (41.7%, 184), of whom 23.35% (103), 9.30% (41) and 9.07% (40) were categorised as having low, moderate and severe depression symptoms, respectively. The demographic characteristics of seafarers are presented in [table 1](#).

The distribution of depression symptoms was different in the epidemic-related categories of SRH, LPE per week, sleep duration, sleep quality, overtime work frequency per week and self-perceived work-related stress ([table 1](#)). Participants with severe depression reported experiencing poorer SRH and engaging in less LPE per week ($\chi^2=28.78$, $p<0.001$ and $\chi^2=16.45$, $p<0.001$, respectively). Seafarers with sleep duration <6 hours and with poor sleep quality had higher percentage of reporting severe depression ($\chi^2=9.63$, $p=0.008$ and $\chi^2=21.82$, $p<0.001$, respectively). Moreover, the distribution of depression symptoms

Table 1 Characteristics of all participants by level of depression symptoms

Characteristics	Total, n (%) (N=441)	Severity of depression, n (%)		P value
		Normal/mild (n=360)	Moderate/severe (n=81)	
Sailing age*, year	8.0 (3.0–13.0)	8.0 (3.0–13.0)	8.0 (2.0–12.0)	0.402†
Sailing duration*, month	7.0 (5.0–9.0)	7.0 (5.0–9.0)	7.0 (6.0–9.0)	0.432†
Age (years)				
18–44	323 (73.2)	265 (82.0)	58 (18.0)	0.712‡
≥45	118 (26.8)	95 (80.5)	23 (19.5)	
Marital status				
Married	329 (74.6)	273 (83.0)	56 (17.0)	0.207‡
Others	112 (25.4)	87 (77.7)	25 (22.3)	
Educational level				
High school and below	236 (53.5)	192 (81.4)	44 (18.6)	0.343‡
Junior college	172 (39.0)	139 (80.8)	33 (19.2)	
Bachelor's degree or above	33 (7.5)	29 (87.9)	4 (12.1)	
Income (¥)				
≤10 000	214 (48.5)	168 (78.5)	46 (21.5)	0.308‡
10 001–20 000	148 (33.6)	123 (83.1)	25 (16.9)	
20 001–30 000	25 (5.7)	21 (84.0)	4 (16.0)	
>30 000	54 (12.2)	48 (88.9)	6 (11.1)	
Position class				
Ordinary crew	230 (52.2)	183 (79.6)	47 (20.4)	0.269§
Senior officer	211 (47.8)	177 (83.9)	34 (16.1)	
Self-rated health				
Good	292 (66.2)	259 (88.7)	33 (11.3)	<0.001‡
Poor	149 (33.8)	101 (67.8)	48 (32.2)	
Chronic disease				
Yes	18 (4.1)	14 (77.8)	4 (22.2)	0.755§
No	423 (95.9)	346 (81.8)	77 (18.2)	
Smoking status				
Yes	201 (45.6)	160 (79.6)	41 (20.4)	0.326§
No	240 (54.4)	200 (83.3)	40 (16.7)	
Drinking status				
Yes	319 (72.3)	267 (83.7)	52 (16.3)	0.075§
No	122 (27.7)	93 (76.2)	29 (23.8)	
LPE per week				
None	171 (38.8)	124 (72.5)	47 (27.5)	<0.001‡
1–3	192 (43.5)	165 (85.9)	27 (14.1)	
≥4	78 (17.7)	71 (91.0)	7 (9.0)	
Sleep duration				
<6	15 (3.4)	8 (53.3)	7 (46.7)	0.008‡
6–8	181 (41.0)	145 (80.1)	36 (19.9)	
>8	245 (55.6)	207 (84.5)	38 (15.5)	
Sleep quality				
Poor	29 (6.6)	18 (62.1)	11 (37.9)	<0.001‡
Fair	214 (48.5)	163 (76.2)	51 (23.8)	
Good	198 (44.9)	179 (90.4)	19 (9.6)	

Continued

Table 1 Continued

Characteristics	Total, n (%) (N=441)	Severity of depression, n (%)		P value
		Normal/mild (n=360)	Moderate/severe (n=81)	
Overtime work per week				
None	256 (58.0)	224 (87.5)	32 (12.5)	0.001‡
1–2	154 (34.9)	115 (74.7)	39 (25.3)	
≥3	31 (7.1)	21 (67.7)	10 (32.3)	
Self-perceived work stress				
Low	65 (14.7)	60 (92.3)	5 (7.7)	<0.001‡
Intermediate	277 (62.8)	232 (83.8)	45 (16.2)	
High	99 (22.5)	68 (68.7)	31 (31.3)	
COVID-19 stress				
Low	54 (12.2)	44 (81.5)	10 (18.5)	0.896‡
Intermediate	154 (34.9)	124 (80.5)	30 (19.5)	
High	233 (52.8)	192 (82.4)	41 (17.6)	

*Data are presented as median (IQR).

†Mann-Whitney rank-sum test conducted for significance testing.

‡Two-tailed χ^2 analysis conducted for significance testing.

§Fisher's exact test conducted for significance testing.

LPE, leisure time or physical exercise.

within categories of overtime work frequency and self-rated work-related stress showed different patterns. The more frequent the overtime work, the higher the level of depression ($\chi^2=14.84$, $p=0.001$). Seafarers in the high self-perceived work stress group had more severe depression symptoms ($\chi^2=16.84$, $p<0.001$). Other characteristics of seafarers showed no difference in the distribution of depression symptoms ($p>0.05$).

Factors associated with depression symptoms

Poor SRH (OR, 2.24, 95% CI 1.22 to 4.11), LPE per week (none vs ≥ 4 : OR, 3.93, 95% CI 1.67 to 9.26), sleep quality (poor vs good: OR, 4.30, 95% CI 1.65 to 11.24), frequency of overtime work per week (≥ 3 vs none: OR, 2.49, 95% CI 1.05 to 5.92) and self-perceived work stress (high vs low: OR, 3.83, 95% CI 1.35 to 10.90) were associated with reporting severe depression symptoms (table 2).

Less frequent LPE was associated with more severe self-reported depression symptoms (1–3 vs ≥ 4 per week: OR, 1.72, 95% CI 0.711 to 4.14; none vs ≥ 4 per week OR, 3.93, 95% CI 1.67 to 9.26). Having poor sleep quality was associated with higher likelihood of reporting severe depression (fair vs good: OR, 2.78, 95% CI 1.54 to 5.01; poor vs good: OR, 4.30, 95% CI 1.65 to 11.24). The more frequent seafarers worked overtime a week, the more likely they were to report severe depression symptoms (1–2 per week vs none: OR, 1.82, 95% CI 1.04 to 3.18; ≥ 3 per week vs none: OR, 2.49, 95% CI 1.05 to 5.92). Increased odds of severe depression were identified among seafarers with high perceived work stress (intermediate vs low: OR, 2.06, 95% CI 0.78 to 5.46; high vs low: OR, 3.83, 95% CI 1.35 to 10.90).

DISCUSSION

A high prevalence of depression symptoms among Chinese seafarers was found during the COVID-19 pandemic. Of the seafarers, 40.72% reported depression symptoms and around 9% of them had severe depression symptoms. Poor SRH, poor sleep quality, less LPE, more overtime work and higher work stress were associated with experiencing severe depression symptoms. Our findings provide the latest profile of the psychological status of seafarers during the COVID-19 pandemic. Seafarers' mental health may need more attention during the COVID-19 pandemic.

Previous studies have shown a substantial burden of depression symptoms in the general population following the COVID-19 pandemic.^{20 23 24} A nationally representative study of American adults indicated that compared with the same period before COVID-19, the prevalence of depression symptom was much higher during the COVID-19 pandemic (mild: 24.6% vs 16.2%; moderate: 14.8% vs 5.7%; moderately severe: 7.9% vs 2.1%; severe: 5.1% vs 0.7%).²⁰ Compared with the general Chinese population during the COVID-19 pandemic, we found seafarers have excessive prevalence of depression symptoms (41.72% vs 27.9%²³ and 41.72% vs 36.5%,²⁴ respectively).

Compared with previous studies that investigated seafarers' depression symptoms before the COVID-19 pandemic, our study showed a higher prevalence (41.72% vs 35.26%,²⁵ 41.72% vs 20.26%,²⁶ and 41.72% vs 38.56%²⁷). Also, the overall detection rate of depression symptoms in our study is lower than in Mei *et al*'s study¹⁷ (41.72% vs 50.77%), the rate of severe depression symptoms in our study was much higher (9.07% vs 1.67%).

**Table 2** Multivariable regression analysis of factors associated with depression symptoms

Variable	Moderate/severe, n (%)	OR (95% CI)	P value*	
			Category	Overall
Self-rated health				
Good	33 (11.3)	1 (reference)	NA	0.009
Poor	48 (32.2)	2.24 (1.22 to 4.11)	0.009	
LPE per week				
≥4	7 (9.0)	1 (reference)	NA	0.001
1–3	27 (14.1)	1.72 (0.71 to 4.14)	0.229	
None	47 (27.5)	3.93 (1.67 to 9.26)	0.002	
Sleep quality				
Good	19 (9.6)	1 (reference)	NA	0.001
Fair	27 (14.1)	2.78 (1.54 to 5.01)	0.001	
Poor	11 (37.9)	4.30 (1.65 to 11.24)	0.003	
Overtime work per week				
None	32 (12.5)	1 (reference)	NA	0.041
1–2	39 (25.3)	1.82 (1.04 to 3.18)	0.035	
≥3	10 (32.3)	2.49 (1.05 to 5.92)	0.039	
Self-perceived work stress				
Low	5 (7.7)	1 (reference)	NA	0.019
Intermediate	45 (16.2)	2.06 (0.78 to 5.46)	0.147	
High	31 (31.3)	3.83 (1.35 to 10.90)	0.012	

*Category refers to the p value for each category versus the reference, while overall refers to the results of the logistic regression. LPE, leisure time or physical exercise; NA, not applicable.

The present study identified several risk factors that contributed to severe depression symptoms. Seafarers with poor SRH were two or three times more likely to report severe depression symptoms. Our result is consistent with findings of previous research which indicated that SRH can predict the risk of major depression in the future.²⁸ Moreover, our study found seafarers with less LPE were susceptible to severe depression symptoms. A review on psychological stress among seafarers reported that limited recreational activity was one of the most important factors associated with mental, psychosocial and physical stressors of seafarers.²⁹ Another study also confirmed that moderate to vigorous physical activities reduce the prevalence of depression.³⁰ Our study also found that seafarers with poor sleep quality reported severe symptoms of depression. Sleep quality is an important risk factor for depression.³¹ A large proportion of seafarers reported no good sleep or having sleep disruptions, especially seafarers on international voyages who often experience 'jet lag'.³² In addition, seafarers' work follows a shift system; the overtime work resulting from crew change restrictions during the global epidemic affects the quality of sleep, increasing psychological burden and causing mental diseases.

Another prominent finding was the substantial impact of overtime work and high perceived work stress on depression, which is consistent with previous studies.³³

Overtime work is often accompanied by decline in sleep quality, which is the major source of stress and chronic fatigue.³⁴ Moreover, due to restrictions caused by the epidemic, seafarers have to stay at sea for a long time, facing overload work. Overtime work, lack of safety in the workplace and poor career prospects affect the mental health of seafarers. Previous studies have shown that seafarers are exposed to unique sources of work stress, such as special workplaces, monotonous work, climate change and long-term separation from family members.³⁵ These factors increase seafarers' anxiety and loneliness and lead to insomnia and emotional instability, and especially boredom on board due to monotonous work, which is an important source of stress and addiction, according to data from the literature.³⁶ Jegaden *et al's* study³⁷ found that there is a significant correlation between boredom and depression among office staff and seafarers, and boredom is an important factor that cannot be ignored. Also, the inability to change shifts in time due to the epidemic will gradually aggravate these bad mental states and cause severe depression symptoms.³⁸

According to previous literature and the issues noted in our study, there needs to be a unified approach which looks at protecting the mental health of seafarers at the government, organisational and individual level. To facilitate movement, seafarers should be recognised as key workers and provided with documentation to demonstrate

this status. Also, to mitigate the crew change crisis, it is necessary to release a crew change framework endorsed by the International Maritime Organization, and authorities are encouraged to implement these proposals. Third, shipping companies should improve care for seafarers, including ensuring availability of some leisure activities, encouragement of physical engagement and installation of shipboard telecommunication systems to contact families and friends. Better organisation of working hours and work shifts should also be included. This would allow longer and continuous period of sleep. Appropriate psychological health education could prepare seafarers to recognise job-specific stressors and implement suitable coping strategies. Finally, seafarers themselves should adjust their mentality, look for happiness and satisfaction in their careers, broaden social interactions, obtain social support, and have the courage to seek professional psychological counselling and help.

This study has several limitations. First, the cross-sectional design brings question about the interpretation of the relationships between some ‘risk factors’ and depression. Second, the participants are Chinese seafarers and thus extrapolation of findings might be limited. Third, the status of depression symptoms was self-reported rather than clinically diagnosed. Fourth, the mental health status of seafarers before the COVID-19 pandemic was not measured. Whether the observed high prevalence of depression was related to the COVID-19 pandemic cannot be evaluated. However, the prevalence of severe depression among seafarers was much higher than that reported before COVID-19; thus, we believed that the increased rate of severe depression symptoms is associated with the COVID-19 pandemic. Countries are currently taking measures to ease the dilemma of crew change, and follow-up studies are needed to further investigate the long-term effect of the COVID-19 pandemic.

CONCLUSIONS

The COVID-19 crisis may have led to increased mental health problems, especially depression among seafarers. Poor SRH, less LPE, poor sleep quality, more overtime work and high perceived work stress are all linked to reporting of depression symptoms.

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Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval This study was approved by the Academic Research Ethics Committee of Shandong University (ECCHMPDSU20201103) and performed in accordance with the Helsinki Declaration.

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ORCID iDs

Wenzhe Qin <http://orcid.org/0000-0002-2891-4221>

Dongshan Zhu <http://orcid.org/0000-0002-0697-7432>

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