REVIEW ARTICLE

Prevalence of Depression Among Seafarers and Maritime Workers During the COVID-19 Pandemic: A Meta-Analysis

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Background: The COVID-19 pandemic has significantly affected the psychological and mental health of seafarers and maritime workers, and a considerable proportion have experienced depression. Cognizant of the different work-related factors and pandemic-related factors which may contribute to depression, it is imperative to determine the prevalence of depression among seafarers and maritime workers to develop appropriate intervention and management.

Objective: To determine the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic. **Methods**: This is a random-effects meta-analysis of cross-sectional studies estimating the prevalence of depression among seafarer and maritime workers during the COVID-19 pandemic period. The proportion of respondents with depression, using standardized depression assessment tools, and the sample sizes of each study were extracted and recorded in an abstraction form. Pooled estimate of depression was analyzed using the metaprop command of STATA MP.

Results: The search yielded a total of 555 articles, with only 4 eligible articles included for analyses. From the included studies, 75% had good quality of evidence while 25% had fair quality. Analysis showed that the overall pooled prevalence of depression at 28% (ES=0.28, z=4.69, p=0.001, 95% Cl=0.16-0.39) was statistically significant during the COVID-19 pandemic. However, there was a substantially high heterogeneity among the included the studies (χ^2 =125.41, p=0.001, χ^2 =97.61%, χ^2 =0.01).

Conclusion: Depression is a real-life, yet underreported and underdiagnosed problem among seafarers and maritime workers before and during the COVID-19 pandemic. This result stresses the need for policy and practice changes such as implementation of screening programs to determine and evaluate depression or depressive symptoms; modification of existing protocols in performing pre-employment medical examinations with additional focus on the psychological health and well-being; and, provision of appropriate intervention such as psychological health education, counseling, and appropriate referral.

Key words: Depression, maritime workers, COVID-19 pandemic

Introduction

The Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by a new strain of coronavirus which was initially unknown until its outbreak in Wuhan, China last December 2019. It is the third coronavirus infection in the last two decades originating from Asia which is contracted through droplet and close-contact transmissions (Morens et al., 2020). Because of the outbreak, the World Health Organization (WHO) declared COVID-19 as a Public Health Emergency of International Concern and released interim guidelines on patient management.²

Aside from the impact of the COVID-19 pandemic on the healthcare system, it has greatly affected the shipping industry, particularly the

global trade via sea travel which accounts approximately 90% of the industry.³ Global trade via the seas is imperative in the economy and healthcare of a country, particularly in maintaining the flow of vital goods such as food and medical supplies and as such, seafarers and maritime workers are crucial in ensuring the functionality of such industry. Nevertheless, the COVID-19 pandemic has forced several governments to restrict or even ban the travel to and from their country's borders which caused seafarers and maritime workers to become stranded in foreign lands while others were unable to board their vessels and lost considerable amount of income (International Maritime Organization, 2020). These issues have led to several dilemmas among seafarers and maritime workers, and one of the raising health concerns is the effect of these problems to the mental health of seafarers and maritime workers.

Recent studies have shown that the COVID-19 pandemic has substantially affect the psychological and mental health of seafarers and maritime workers, and a considerable proportion have experienced depression. Depression, also known as major depressive disorder (MDD) in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM 5), is a common mental health condition and is characterized by sadness, loss of interest or pleasure, feelings of quilt or low selfworth, disturbed sleep or appetite, feelings of tiredness and poor concentration.5 Among the general population, approximately 10% of them are affected by depression,6 while the estimated prevalence of depression among seafarers was about 20 to 25%.7 Although depression has been extensively studied and has been noted to have a multifactorial origin⁸ the prevalence of such condition among seafarers and maritime workers during the COVID-19 pandemic remains underexplored. Cognizant of the work conditions in a shipping vessel such as the enclosed environment, absence of shore leave, monotonous or routine work responsibilities, and coupled by the fear of being infected with COVID-19 infection, seafarers and maritime workers may be at high risk to develop depression.

Cognizant of the psychological and mental impact of the prevailing COVID-19 pandemic and the different work-related factors among seafarers and maritime workers, mental health conditions such as depression may substantially increase. As a result of such condition, the lives of seafarers and maritime workers and their family are at risk for negative implications and necessitates appropriate intervention and management. As such, this meta-analysis aimed to determine the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic, and it was guided by the clinical question: "Among seafarers and maritime workers, what is the prevalence of depression during the COVID-19 pandemic?

The general objective of this study was to determine the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic. Consequently, the specific objective was to determine the pooled prevalence of depression during the COVID-19 pandemic among seafarers and maritime workers.

METHODS

Research Design and Eligibility Criteria

This study employed a meta-analysis research design and included cross-sectional studies which estimated the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic. The PEO framework (population, exposure, and outcome) was utilized to develop the clinical question, guide the literature search, and evaluate the eligibility of research articles. The population of interest was seafarers and maritime workers, while the exposure was the coronavirus 2019 (COVID-19) pandemic. The outcome of interest was the prevalence of depression which can be measured by different standardized or accepted methods such as the DSM V criteria and different depression rating or assessment scales. Noting these parameters, the following inclusion criteria were utilized: cross-sectional designs estimating the prevalence of depression; population of interest involved seafarers and/or maritime workers during the COVID-19 pandemic; measured

depression using standardized or accepted methods such as the DSM V criteria and different depression rating or assessment scales (e.g., Depression-Anxiety-Stress Scale, etc.);primary research articles published regardless of year and country; published in English language or has an English translation available; and, can be assessed as a full article. Nonetheless, research papers which have the following characteristics or criterion were excluded from the analysis to limit the potential sources of heterogeneity: did not report the prevalence of depression; reported depression mean scores, for studies which used depression rating scales; and, did not categorize depression scores, for studies which used depression rating scales; Case studies or series; editorials, letters, or correspondence to the journal editor; secondary research (e.g., review articles, systematic reviews, meta-analysis); qualitative studies on depression such as narrative interviews, phenomenological studies, and the like; incomplete reported data; and, conference abstracts only.

Search Strategy

Published articles were searched on PubMed, EBSCO Host, ScienceDirect, Google Scholar, and Wiley Online. Several search techniques were employed including keyword search and Boolean operators. The search was limited to research on human data and on cross-sectional designs conducted from the time of the COVID-19 pandemic (March 2020 to present). Likewise, reference lists were searched to identify additional studies.

Using keyword search and Boolean operators, the following phrases were searched:

("Prevalence") AND ("Depression" OR "Mental Health") AND ("COVID-19" OR "Pandemic") AND ("Seafarer" OR "Maritime")

Data Collection and Processing

Gathered study information were electronically encoded and managed in a standardized Microsoft Excel spreadsheet or database. This spreadsheet was also uploaded in a secured online platform (e.g., Google Document) with a secured password to facilitate real-time encoding and online verification and update between the researchers during the data collection. The study selection process was divided into three phases: screening, eligibility, and inclusion. For the screening phase, the researchers initially screened the research title, keywords, and research abstracts for possible eligibility into the study. Studies deemed eligible were then assessed by the same assessor against the previously-mentioned inclusion criteria. Afterwards, the researchers appraised the full-text articles of potentially eligible articles for final inclusion. Excluded articles and the reasons for exclusion were recorded and tabulated at each phase or stage of the study selection process. The researchers extracted data from the included studies and recorded pertinent study information in a standardized abstraction form. The abstraction form was initially piloted to determine the flaws and areas of improvement. A guideline for the process of data collection was also be developed to standardize the data extraction. Should the data be incomplete but can be estimated through other methods, these were noted, and the assistance of a statistician was sought to estimate the

missing values. The standardized abstraction form was utilized to record the following study information: authors; year of publication; population description; demographics of the participants or subjects; study design; study location or country; prevalence of depression; and, instrument used to measure depression. Should data be incomplete but can be estimated through other methods (e.g., conversion method, estimation method, etc.), these were noted, and the assistance of a statistician was sought to estimate the missing values. The outcome of the study was the prevalence of depression during the COVID-19 pandemic. The data on the total sample size and the number of participants or subjects who were positive for depression were extracted and recorded in the abstraction form. Depression can be measured by different standardized or accepted methods such as the DSM V criteria or different depression rating or assessment scales. The quality of selected articles was assessed and rated as poor, fair, or good using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional study. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional study is the most commonly used 8-item checklist for assessing the quality of cross-sectional designs in terms of sample inclusion, subject and setting, measurement of exposure, confounding and measures to control confounding bias, outcome measurement, and statistical analysis (Ma et al., 2020). These forms were independently accomplished by the researchers and were compared and discussed afterwards.

Data Analysis

Meta-analysis of the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic was conducted with STATA Statistical Software, Version 13, College Station, TX: StataCorp LP using the metaprop command to pool the estimates of depression among the included studies. A p-value \leq 0.05 was considered significant. Since this study did not assume one effect size among all the studies, the overall effect was estimated using a random-effects model (REM), which takes within-study and between-study variation into account. However, if the estimated heterogeneity was non-significant and not substantial (<50%), a fixed-effect model (FEM) was utilized. Statistical heterogeneity between studies were evaluated using Q statistics test, 12 statistics, and tau squared (τ 2) statistics (Higgins, 2003). Q statistics examined the presence or absence of true heterogeneity and analyzes if the presence of true heterogeneity was statistically significant (Higgins, 2003). A statistically significant Q statistic indicates the presence of true heterogeneity among the included studies. On the other hand, 12 statistic represented the proportion of the difference in true effects among the included studies thus, quantifying the amount of heterogeneity (Higgins, 2003). 12 values may be categorized as no heterogeneity (0%), low heterogeneity (1% to 49%), moderate heterogeneity (50% to 74%), and high heterogeneity (>75%) (Singh, Singh, & Seth, 2011). Tau-squared $(\tau 2)$, for this part, is an estimate of the between-study variance hence, quantifies the amount of heterogeneity (Higgins, 2003). In the event heterogeneity is substantially high, approaches to detect the sources of heterogeneity such as subgroup analysis and meta-regression were performed, if feasible. Publication bias was graphically evaluated using contour-enhanced funnel plots. Formal statistical assessment of funnel plot asymmetry was performed using Egger's regression asymmetry test and Begg's adjusted rank correlation test (Sterne, 2009). A significant Egger's regression asymmetry test and Begg's adjusted rank correlation test may indicate publication bias among the included studies (Sterne, 2009).

RESULTS

Study Selection

The search strategy retrieved a total of 567 articles. After initial screening, 12 duplicates were removed leaving 555 papers. The abstract and title of the remaining 555 articles were screened, and 544 of these were removed because to the reasons indicated in Figure 1. The full-text articles of the remaining 11 papers were then reviewed and 7 of these were removed because of inadequate or incomplete data reported (Figure 1).

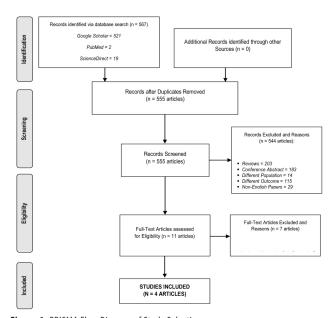


Figure 1. PRISMA Flow Diagram of Study Selection.

Study Characteristics of Individual Studies

All studies selected for this meta-analysis were cross-sectional studies with a total of 4 research papers. Table 1 presents a summary of the characteristics of the included studies and the population in these studies.

Risk of Bias (ROB) and Quality of Evidence Assessment using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Study

The risk of bias and quality of evidence assessment is depicted in Table 2. In general, the results indicated that 75% of the included

Table 1. Characteristics of included research studies (N = 4).

Study (Year) and Country		Sample Size	Measurem ent of Outcome	Demographic	: Characteristics	Outcomes		
	Population			Age	Sex Distribution	Prevalence (n) of Depression	Severity of Depression	
Qin et al. (2021) China	Chinese seafarers from select international ocean ships who arrived in the Rongcheng Port, Shandong Province, China	441	Self-Rating Depression Scale	37.54 (SD=9.74)	441 Males, 0 Female	41.72% (n = 184)	No Depression = 58.28% Mild Depression = 23.35% Moderate Depression = 9.30% Severe Depression = 9.07%	
Baygi et al. (2021) Iran	Multinational seafarers with different ranks and job categories who were working onboard ocean-going vessels of two international oil tanker shipping companies	439	Depression- Anxiety- Stress Scale-21 (DASS-21)	34.80 (SD=7.30)	439 Males, 0 Female	12.30% (n = 54)	Not Reported	
Zamora et al. (2021) Belgium	International seafarers who were 18 to 65 years old, employed on a merchant cargo ship, and have worked for at least 2 months and arrived at the Antwerp Seafarer Centre in Antwerp, Belgium	153	Patient Health Questionnair e-9 (PHQ-9)	31.00 (SD=8.30)	153 Males, O Female	37.25% (n = 57)	No Depression = 62.70% Mild Depression = 24.20% Moderate Depression = 7.20% Moderate Severe Depression = 4.60% Severe Depression = 1.30%	
Baker et al. (2021) USA	Merchant mariners who were of U.S. citizen or permanent resident who works in a US vessel.	1,559	Patient Health Questionnair e-2 (PHQ-2)	Mostly (18.60%) were 55 – 64 years old	1,001 Males, 125 Females	20.72% (n = 323)	Not Reported	

Table 2. Risk of bias and quality of evidence assessment using the Joanna Briggs Institute (JBI) Critical Appraisal checklist for analytical cross-sectional study (N = 4).

	ASSESSMENT AREAS AND INDICATORS FOR CROSS-SECTIONAL DESIGNS								Overall Quality of Evidence
Study and Year	Clear Inclusion Criteria	Detailed Study Subjects and Setting	Valid Measurement Exposure	Valid Measurement of Condition	Valid Measurement of Outcomes	Identification of Confounders	Strategies to deal with Confounders	Appropriate Statistical Analysis	
Qin et al. (2021)	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Yes	Good Quality
Baygi et al. (2021)	Yes	Yes	Yes	Not Applicable	No	Not Applicable	Not Applicable	Yes	Good Quality
Zamora et al. (2021)	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Yes	Good Quality
Baker et al. (2021)	No	No	Yes	Not Applicable	No	Not Applicable	Not Applicable	Yes	Fair Quality

^aNote: Thresholds for converting JBI Scores:

- **Good Quality**: ≥50% of the total applicable items.
- <u>Fair Quality</u>: ≥25% of the total applicable items
- **Poor Quality**: <25% of the total applicable items

articles have good quality of evidence and low probability of risk for bias, while only 25% of the included studies has fair quality of evidence and has moderate risk of bias.

Pooled Estimate of the Prevalence of Depression

Figure 2 presents the pooled estimate for the prevalence of depression among the included research articles. A total of 4 cross-sectional articles with 2,592 participants were included. Results showed that the overall pooled prevalence of depression was statistically significant (ES=0.28, z=4.69, p=0.001, 95% Cl=0.16 - 0.39) during the COVID-19 pandemic, denoting that the pooled prevalence was 28%. Nevertheless, results also showed that there was a significantly high heterogeneity among the included the studies (χ^2 =125.41, p=0.001, l^2 =97.61%, τ^2 =0.01).

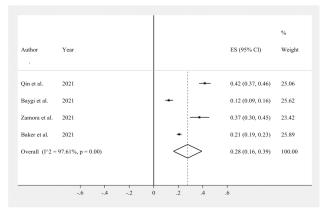


Figure 2. Meta-analysis for the pooled prevalence of depression.

Sensitivity Analysis of the Prevalence of Depression

The sensitivity analysis of the meta-analysis is illustrated in Figure 2. Cognizant that the study of Baker, et al. (2022) had a fair quality of assessment and involves respondents who were mostly at the late adult stage (55 to 60 years old) compared to the remaining three studies, which involve middle-aged adults, sensitivity analysis was conducted. The three remaining studies for the sensitivity analysis included a total of 1,033 respondents. It can be noted in the forest plot that the overall pooled prevalence of depression in the sensitivity analysis, which was 30%, was statistically significant (ES=0.30, z=2.76, p=0.001, 95%)

CI=0.09 – 0.52). However, analysis still indicated a significantly high heterogeneity among the included the studies (χ^2 =123.47, p=0.001, I²=98.38%, τ^2 =0.04).

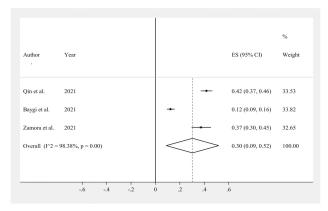


Figure 3. Sensitivity analysis of the pooled estimate of depression.

Meta-Regression Analysis of Study Heterogeneity Using Age as Covariate

Due to the high heterogeneity estimated, meta-regression was conducted with the mean age as the covariate. Results indicated that the mean age was not significantly associated with pooled estimate of depression (beta=0.01, p=0.967). Age also accounted 1.39% of the measured between-study heterogeneity for prevalence of depression (initial I2 = 98.38%). However, the residual variance for the prevalence of depression (I2Res= 96.99%, τ 2=0.05, p=0.001) remained unexplained and statistically significantly (Table 3).

Publication Bias Analyses

Graphical analysis using contour-enhanced funnel plots indicated the likelihood of funnel asymmetry with a right-side predominance, suggestive that publication bias was possible (Figure 5). However, formal statistical tests using Begg's (z=0.34, p=0.734) and Egger's tests (Bias=7.96, p=0.398) indicated that there was no evidence of publication bias among the included studies (Table 3).

Discussion

This study determined the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic. By

Table 3. Meta-regression analysis of the influence of age on the pooled estimate of depression prevalence (N = 3).

Study Outcomes	Regression Coefficient	SE	<i>p</i> -value (Two-Tailed)	R ²	τ²	<i>p</i> -value (Two-Tailed)	l ² _{Res}
Age	0.01	0.05	0.967	1.39%	0.05	0.001	96.99%

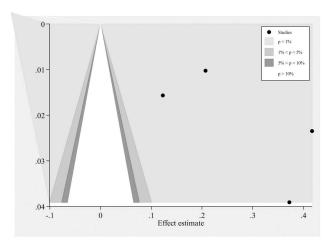


Figure 4. Contour-enhanced funnel plots for the analysis of publication bias for speech discrimination threshold at quiet (Left) and noisy (Rights) settings.

and large, results indicated that the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic was significantly high, with a pooled prevalence of 28% to 30%. Depression among seafarers and maritime workers is a real-world issue that has received increasing attention over the years. This mental health issue is a complex problem with varying risk factors. Even before the COVID-19 pandemic, studies have noted that the seafarer and maritime worker population are at high risk for the development of depression^{7,10,15}, with a prevalence of approximately 20 to 25% pre-pandemic period.

Seafaring is a high risk, high stress, and extremely dangerous occupation, leading to higher probability for the development depression due to physical challenges of the job; restrictions and hazards in the physical environment; and, emotional, psychological, and social factors. 11 Seafaring demands a lot of physical effort from the seafarers and maritime workers and causes physical exhaustion, inadequate sleep, and poor or negative health behaviors like smoking and physical inactivity. 10,12 The physical tasks of seafarers and maritime workers are also routinary and monotonous which increases the risk for musculoskeletal disorders.^{8,16} The working or physical environment of living in a ship, which encompasses limited or enclosed spaces; substantial amounts of noise, heat, and vibration; and, constant motion of the ship have also been risk factors for depression and other negative mental health conditions. 17,18 To add to this, emotional, social, and psychological risk factors such as feelings of loneliness and hopelessness; the fear of potential piracy; physical separation from one's family and loved ones; lack of shore leave; and, job instability have also been noted to aggravate the likelihood of depression and mental health disorders among seafarers and maritime workers. 11

The COVID-19 pandemic astronomically increased the risk of seafarers and maritime workers for mental health issues, including depression. Extra-ordinary restriction measures such as quarantine of ships at ports and 14-day self-isolation on international ships, which caused many seafarers and maritime workers to be trapped or stranded at sea for more than 12 months¹⁹, may have contributed to the development of depression among the population. Moreover,

the study of Pesel, Canals, Sandrin, & Jensen (2020)²⁰ reported that approximately 50% of the participating seafarers felt unsafe doing their jobs due to their fear of contracting COVID-19 infection. It is also worth noting that according to Qi, Li, Zhu, Ju, Bi, & Li (2021),²¹ seafarers were at greater risk for depression during the COVID-19 pandemic due to low self-reported health, less leisure time and physical exercise, poor sleep quality, higher overtime work, and high perceived work stress. Lucas et al. (2021) also emphasized that being stranded in ships in faraway seas, extended board time, repatriation difficulties, and financial concerns of unexpected employment due to the COVID-19 pandemic has magnified the likelihood of developing depression and other mental health disorders among seafarers and maritime workers.

With these results, it should, therefore, be realized that depression is a multifactorial mental health issue among seafarers and maritime workers which require immediate attention. Although the current study presented a substantially high pooled prevalence of depression during the COVID-19 pandemic period, such statistic may have been underestimated due to selection bias14, since most seafarers in the current generation come from developing countries such as the Philippines who are unable to differentiate depressed affect and somatic symptomatology due to their cultural tendencies thus, they underreport depressive symptoms. 11 In addition, the prevalence of depression among seafarers and mariner workers may be underreported since the population is predominantly composed of males. Studies have previous noted that the ratio of depression between males and females is 1:2, denoting that the prevalence of depression is twice lower among males than their female counterparts.^{23,24,25} Males have been noted to underreport depression and its symptoms than their female counterparts to maintain their image of masculinity and to societal scrutiny from fellow males.²³

The presented results of this random-effects model, metaanalysis emphasize the substantially high prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic. Cognizant that the prevalence of depression among seafarers and maritime workers, a workforce predominated by males²³ and employees from unestablished sources or poor inland areas9, remains underreported and underdiagnosed, shipping companies and maritime industries must institute appropriate screening programs and policies to determine and evaluate depression or depressive symptoms among this population. Noting that pre-employment medical examinations primarily focus on the physical fitness of employees prior to disembarkation¹⁴, existing practices and policies on pre-employment examination should be revisited and modified to give additional focus on the psychological health and well-being of seafarers and maritime workers. Healthcare professionals rending medical care to seafarers and maritime workers should also meticulously assess depressive symptoms, its potential sources, and provide appropriate intervention such as psychological health education, psychological counseling, and appropriate psychological referral.

Albeit the presented results, this study has certain limitations. First, only four articles with a total of 2,952 participants were included and analyzed in the study, a factor which may have affected the current results. Although an exhaustive search of eligible articles was conducted, there were only four articles which fitted the study's criteria

hence, the low number of analyzed studies. In addition, although statistical power estimation for meta-analysis, using the formula recommended by Valentine, Pigott, & Rothstein (2010)²⁶, yielded a power of 100% (minimum power must be 80%) which denotes sample sufficiency, a larger number of eligible studies may provide more precise and robust results. Second, the risk of bias for confounding was not identified and controlled in all included studies; hence, their results, which were the foundation of this study's analysis and results, may have been confounded and affected. Third, there is a substantially high heterogeneity was estimated among the included studies (>97%). Even though meta-regression, using age as a covariate, and sensitivity analysis were conducted, with the omission of the study of Baker, et al. (2021)²⁷, heterogeneity remains substantially high. Nevertheless, this study has several strengths which include the meticulous and exhaustive search strategy for eligible studies, the good quality of evidence and low risk of bias among the included articles, and the low likelihood of publication bias.

CONCLUSION AND RECOMMENDATION

This study determined and analyzed the prevalence of depression among seafarers and maritime workers during the COVID-19 pandemic. Employing a random-effects model approach, pooled estimates of the prevalence of depression was significantly high, with a pooled prevalence of 28% to 30%. Depression is a real-life, yet underreported and underdiagnosed problem among seafarers and maritime workers even before the COVID-19 period. However, coupled with other risk factors predisposing this workforce to depression, such as physical challenges of the job; restrictions and hazards in the environment; and, emotional, psychological, and social factors, the pandemic further magnified the likelihood of depression among seafarers and maritime workers due to extra-ordinary restriction measures, less leisure time and physical exercise, and perceived fear of contracting the virus.

The result of this study stresses the need for policy and practice changes such as implementation of screening programs to determine and evaluate depression or depressive symptoms; modification of existing protocols in performing pre-employment medical examinations with additional focus on the psychological health and well-being; and, provision of appropriate intervention such as psychological health education, counseling, and appropriate referral.

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