

Occupational Stressors Among US Maritime Workers During the COVID-19 Pandemic

A Content Analysis by Age and Gender

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Objective: The study investigated how COVID-19 impacted US mariners' well-being and the differences in stressors and needs by demographic group. **Methods:** Using a qualitative content analysis, we analyzed 478 open-ended responses from US mariners who worked during the pandemic to systematically identify stressors and solutions. **Results:** Inadequate organizational support, inability to disembark the vessel, and ineffective COVID-19 controls were identified as primary stressors. Female mariners reported more economic uncertainty concerns, while younger mariners (18 to 34) more frequently mentioned extended voyages and inability to disembark. **Conclusions:** These findings offer useful insights for the maritime industry to inform actionable strategies in future public health emergencies. Findings suggest a need for equitable application of emergency protocols, processes to preserve shore leave, consistent communication between shoreside employers and vessels, and mechanisms to address workforce well-being through compensation and recognition.

Keywords: mariners, maritime workers, COVID-19, occupational stress, mental health, gender differences, age differences, qualitative content analysis, women in maritime, shore leave, organizational support

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Consent Process: Patient consent was waived because of no identifying information being collected and the information collected posing no more than minimal risk.

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The data underlying these analyses are available at <https://github.com/bakermarissa/marinermentalhealth>.

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LEARNING OUTCOMES

- Identify stressors affecting US mariners during the COVID-19 pandemic
- Assess strategies to improve industry response in future public health emergency scenarios

The maritime industry serves as a critical component of global commerce and the US economy, facilitating international trade and supporting over 30 million jobs while contributing more than \$5.4 trillion to the national economy.¹ As of November 2024, the US Bureau of Labor Statistics estimated approximately 73,600 workers in the water transportation subsector (NAICS 483); this number includes captains, mates, and pilots of water vessels, sailors and marine oilers, ship engineers, ship operations personnel, and freight, stock, and material movers.² Mariners working on vessels face multiple occupational hazards, ranging from physical hazards (ie, heavy lifting, slippery surfaces) and chemical exposures (ie, cargo, cleaning agents, solvents, fuels) to unique psychosocial stressors that vary by vessel type and operation.³ For instance, mariners on oceangoing vessels commonly follow a 12-hours-on, 12-hours-off schedule, while those in the tug and towboat industry often operate on 6-hour rotating shifts.^{4,5} These irregular schedules, combined with extended work hours often exceeding 70 hours per week, can disrupt circadian rhythms and impact sleep quality.⁶ In addition, vessel connectivity varies substantially, with many ships having limited or inconsistent access to Internet and telephone services, restricting communication with family and support networks ashore.⁷

The impact of these and other occupational conditions on mental health deserves further study, though some research has previously looked at the mental well-being of maritime workers both in the United States and internationally. A cross-sectional study of 1572 international seafarers in 2019 found elevated rates of depression (25%) compared to the US general population (8%).⁸ These findings were supported by Hayes-Mejia and Stafström's⁹ 2023 study of 17,861 international seafarers, which identified associations between workplace conditions and mental health outcomes; specifically, safety consciousness and clear communication from employers were associated with better mental health outcomes. A 2023 systematic review further documented that seafarers face unique psychosocial stressors due to their working environment, though the review noted a lack of standardized mental health assessment methods in maritime settings.¹⁰ Despite the recognized impact of these occupational stressors on mariner mental health, research specifically focusing on US mariners remains limited, particularly regarding how these impacts and outcomes may vary across different demographic groups.

The COVID-19 pandemic introduced additional challenges to the maritime industry's existing operational environment. During this period, global travel restrictions led to what became known as the crew-change crisis, which affected the approximately 400,000 seafarers globally who remained on vessels beyond their original contracts.¹¹

Research conducted during the pandemic documented specific workplace changes that impacted US mariners, including modified crew change protocols, restricted shore leave, and altered vessel operations. A survey of 1384 US mariners who worked during the pandemic found associations between COVID-19-related workplace changes, such as longer contract lengths and lack of shore leave and mental health outcomes (depression, anxiety) and stress.¹² In addition, Hayes-Mejia and Stafström's⁹ analysis of international seafarers revealed that delays in crew changes, stemming from national quarantine guidelines and travel restrictions, negatively impacted crew well-being. These data also highlighted a difference in mental health outcomes between onboard and shoreside workers, with those working onboard ships having worse outcomes. These findings suggest that while the pandemic created new challenges for maritime operations, various workplace factors may have influenced how these challenges affected the workforce.

Certain demographic groups within the maritime industry face distinct occupational experiences that warrant focused research attention. Comprehensive data on women's representation in the US maritime workforce are limited; in 2021, a survey of maritime companies estimated that the proportion of female seafarers by country of company headquarters was 6% for the United States.¹³ A 2024 survey of international seafarers identified key challenges for women in the industry, which included gender discrimination in employment, which 29% of women reported as a major obstacle compared to 0.4% of men.¹⁴ Age-related differences also emerge in occupational experiences: a 2019 cross-sectional study of 575 mariners from a global shipping company found higher reported levels of stress and anxiety among younger workers, particularly related to adaptation to maritime environments and separation from support networks.¹⁵ Similarly, the 2022 study by Yassin et al¹² noted elevated rates of depression, anxiety, and post-traumatic stress disorder among US mariners ages 25 to 34 as compared to older mariners, potentially attributed to age-specific stressors such as family-rearing responsibilities. These demographic variations in occupational experiences suggest the need for targeted research to understand and address group-specific challenges within the maritime industry.

While existing research has documented mental health challenges in the global maritime sector largely using surveys, significant gaps remain in understanding how these issues manifest within the US maritime context, particularly regarding demographic variations in occupational experiences and what solutions may be most impactful to mariners. The present study uses a content analysis to explore how COVID-19 pandemic stressors impacted US mariners, and the challenges and solutions mariners identified related to these stressors utilizing open-ended response data from a nationwide survey (Yassin et al). Through thematic content analysis of this open-ended survey data, we identify and compare challenges and solutions offered by mariners sailing during COVID-19, and how they differ by gender and age. Findings from this study contribute to the growing body of literature on occupational health in the maritime sector while providing evidence-based insights for developing targeted interventions to improve mariner health and well-being.

MATERIALS AND METHODS

The population of interest in this study was both credentialed and non-credentialed US mariners who sailed during the COVID-19 pandemic (from March 1, 2020). Survey respondents were required to be US citizen or permanent resident merchant mariners working on US-flagged vessels. This study was a collaboration between University of Washington and researchers from the National Institute for Occupational Safety and Health and was guided by a working group consisting of representatives from the US Committee on the Marine Transportation System COVID-19 Working Group, the US Department of Transportation Maritime Administration, and the Ship Operations Cooperative Program. The University of Washington Human

Subjects Division determined this project to be exempt from review, as researchers were collecting no identifying information. This study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cross-sectional studies, and the checklist is available as supplemental material to this manuscript (Supplemental Digital Content, <http://links.lww.com/JOM/B994>).

Survey Design and Implementation

The results presented here are analysis of the single open-ended question included on the parent survey assessing mariner mental health during COVID-19. The open-ended question included in this content analysis asked respondents: "Is there anything else you would like to let us know about your experience with COVID-19 aboard your vessel?" The full parent survey has been previously described (Yassin et al¹²) but included validated questionnaires to assess depression, anxiety, and perceived stress, in addition to asking about job satisfaction, concerns related to COVID-19, and other experiences sailing during COVID-19. Details and findings from the parent survey have been previously published. The parent survey was developed and distributed through the web-based data management and survey tool REDCap hosted at the University of Washington.¹⁶ The objective of the parent survey was to collect information on the experiences and concerns of US mariners sailing during the COVID-19 pandemic, specifically in regard to workplace factors related to COVID-19 that may impact mental health. The survey was open online to all US mariners who met the inclusion criteria from January 25, 2021, through July 31, 2021, and was completed by $n = 1384$ US mariners. For the open-ended response question analyzed qualitatively in this paper, there were $n = 478$ respondents; no respondents were excluded from the analysis. Responses were linked to self-reported demographic information, including gender, age, maritime position, and type of vessel they sail on.

Data Coding and Analysis

The study team used inductive coding approaches with a content analysis methodology in the analysis of responses, with particular attention to identifying patterns in how different demographic groups experienced and responded to pandemic-related workplace changes.¹⁷ Given that each response was relatively short, researchers began by reading through each response and taking notes on the major categories that emerged from respondent answers. After two coders reviewed these notes together, a preliminary codebook was developed that integrated these categories. A final codebook was created based around two main code groups: stressors and solutions. The stressors code group included codes to systematically capture responses that referred to things the respondent did not like when sailing during COVID-19 or things that caused them stress, frustration, or discomfort. This included subcodes to capture unjust, ineffective, or needed policies and practices; controls put in place that caused worker stress; extended time on the vessel; political climate surrounding COVID-19; inadequate shoreside support; mentions of adverse mental health; and stressors related to the home front or family life. The solutions code group was loosely based on the National Institute for Occupational Safety and Health hierarchy of controls framework¹⁸ and included subcodes to capture responses that referred to positive (or negative) attributes of existing controls, recommendations for additional controls, and other solutions to ameliorate the stressors experienced by mariners such as increased compensation or increased recognition from shore-side or the general public.

The codebook was inductively edited during the analysis to include and refine specific subcodes that captured frequently occurring sentiments among respondents. The coding process was conducted concurrently by two study team members, from here on referred to as coders. Using the co-developed codebook, coders independently coded the same randomly selected 30 responses and then met to

discuss application of the codebook and inductively edit it. Coders repeated this process two more times, independently coding the same 30 responses, comparing code applications and adjudicating coding discrepancies until consensus was achieved and inter-coder reliability reached 95%. This iterative process ensured the codebook was consistently being applied in the same manner between the two coders. After co-coding 20% of total responses, the remaining responses were split between the two coders for coding, with a final meeting at the completion of coding to adjudicate any responses that did not feel straightforward or benefited from additional discussion to code accurately. Coders could assign more than one applicable code to each response, and coded responses ranged in length from a short sentence to multiple paragraphs, with most survey responses being a few sentences in length. The full codebook is presented in Table 2.

The resulting data from the coding process, in conjunction with occupational and demographic data collected in the initial survey, were analyzed using a content analysis protocol for overall and relative frequencies of codes, specifically between substrata in the study population defined by age, sex, vessel type, and maritime credential status. Data analysis was conducted in RStudio (Version 2024.09.0, PBC, Boston, MA). Key excerpts from responses were then used to summarize key themes and support observed codes with illustrative context.

RESULTS

There was a total of $n = 478$ open-ended responses coded. Table 1 summarizes the demographic characteristics of respondents. The sample was predominantly male (81.8%) and licensed mariners (69.6%), with approximately one third of respondents over age 55 (33.5%). Government/public vessels were the most common vessel type represented (31.6%).

A total of 840 codes were applied across the responses, with stressors ($n = 692$, 82.4%) reported more frequently than solutions ($n = 101$, 12.0%). A portion of the responses were classified as non-codable ($n = 47$, 5.6%), indicating that the response did not align with any code in the codebook. Among stressors, inadequate support from shoreside was the most frequent code ($n = 103$, 12.3%), followed by inability to disembark ($n = 86$, 10.2%) and ineffective or unnecessary

controls ($n = 83$, 9.9%). The most common solution codes applied were effective existing controls ($n = 31$, 3.7%), vaccines ($n = 29$, 3.5%), and increased compensation ($n = 15$, 1.8%). Table 2 details the frequencies of assigned codes overall, by gender (male, female) and age (18 to 34, 35 to 54, 55+), along with illustrative quotes for each code.

As shown in Table 2, code frequencies were observed to vary between gender and age groups. Inability to disembark (stressor) was applied more frequently to responses from female mariners than male mariners (14.2% vs 9.4%). Economic uncertainty (stressor), which includes fears of being laid off and insufficient pay or work, was also applied more frequently to responses from female mariners than male mariners (7.5% vs 4.8%). Long/extended voyages (stressor) was applied most frequently to responses from younger mariners (18 to 34), especially when compared to mariners over the age of 55 (8.8% vs 2.8%). Unjust application of COVID policies and practices appeared less frequently among females and 18- to 34-year-olds, with 3.8% and 4.8%, respectively, compared to 6.3% overall.

Figure 1 visualizes how the top 5 most frequently assigned codes by gender and age groups are shared between demographic groups. Inability to disembark, inadequate support, and ineffective controls occurred in the most frequently assigned codes across all gender and age groups. Extended voyages occurred as a top code among males, 18- to 34-year-olds, and 35- to 54-year-olds. Stress from general COVID-related work changes was a top code among females, 18- to 34-year-olds, and 35- to 54-year-olds. Unjust application of COVID policies and practices was a top code among males, 35- to 54-year-olds, and those aged 55+. Economic uncertainty was a top code among females and those aged 55+. Finally, effective existing controls and needed COVID controls are lacking were top codes only for those aged 55+.

DISCUSSION

The findings reveal that maritime workers experienced multiple workplace stressors during the COVID-19 pandemic, with inadequate organizational support emerging as the predominant concern. Here, we discuss significant code categories that emerged from the content analysis and offer actionable suggestions for industry leaders that could improve maritime worker health and safety. The high occurrence of inadequate support as a theme in responses across demographic groups indicates a disconnect between vessel and shoreside operations during crisis responses. Responses pointed to practical challenges in obtaining basic supplies (ie, soap, toiletries, and sanitizer) and maintaining communication with shoreside operations. The frustration with inadequate support from shoreside operations is exemplified by this response: "Mariners feel like numbers on a spreadsheet pushed around to get the mission done, not people with lives of their own. We understand that it is a difficult time, but a little outreach from the shoreside office would go a long way." These reported experiences align with Hayes-Mejia and Stafström's⁹ 2023 study, which found that employers' ability to communicate effectively and transparently with seafarers was associated with better mental health outcomes during the COVID-19 pandemic. In order to address this commonly identified stressor, maritime companies and organizations may seek to implement consistent communication protocols, give acknowledgment to the stress mariners face in their roles, provide recognition (either monetary or other) to mariners, and ensure mariners have access to necessary supplies.

The inability to disembark and extended voyages were also frequently coded as stressors among the mariner responses. Respondents noted being unable to go ashore to buy items to offer some personal enjoyment or even take a walk to clear the mind, as well as feeling contained to the vessel for 6+ months. These responses echo results from other studies, including a similar qualitative study of international seafarers wherein responses likened the experience of being

TABLE 1. Characteristics of Respondents

	<i>n</i>	%
Age (years)		
18–34	124	25.9
35–44	89	18.6
45–54	82	17.2
55+	160	33.5
Did not respond	23	4.8
Gender		
Male	391	81.8
Female	55	11.5
Other	26	5.4
Did not respond	6	1.3
Credential		
Cadet/pilot	18	3.7
Licensed	332	69.6
Unlicensed	86	18.0
Other	41	8.6
Did not respond	1	<1
Maritime vessel		
Oceangoing cargo vessels	112	23.4
Inland and coastal cargo vessels/workboats	147	30.8
Passenger vessels	28	5.9
Government/public vessels	151	31.6
Other vessels	39	8.2
Did not respond	1	<1

TABLE 2. Overall Frequency and Substrata Frequency of Assigned Codes for the Five Most Frequently Assigned Codes Among Gender and Age Groups

Code	Illustrative quote	Overall	Gender		Age		
		(n = 840*)	Male (n = 682)	Female (n = 106)	18–34 (n = 228)	35–54 (n = 321)	55+ (n = 253)
STRESSORS		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
General inadequate support from shoreside	“Decision making efforts are placed directly on the Mariner, with no support from shore.”	103 (12.3)	85 (12.5)	13 (12.3)	34 (14.9)	42 (13.1)	22 (8.7)
Inability to deboard relates to stress	“COVID rule enforcement rely on individuals’ willingness to observe and report themselves.”	86 (10.2)	64 (9.4)	15 (14.2)	35 (15.4)	30 (9.3)	15 (5.9)
Ineffective or unnecessary controls	“Being trapped on a vessel is more stressful than the fear of getting COVID-19.”	82 (9.8)	67 (9.8)	8 (7.5)	19 (8.3)	33 (10.3)	25 (9.9)
Unjust application of COVID policies and practices	“Being restricted to the ship while contractors come and go is wrong.”	53 (6.3)	45 (6.6)	4 (3.8)	11 (4.8)	21 (6.5)	19 (7.5)
Increased stress due to work changes with COVID-19	“I was on a ship from early March until mid-August...most miserable experience of my life!”	53 (6.3)	41 (6.0)	8 (7.5)	13 (5.7)	28 (8.7)	11 (4.3)
Long/extended voyages relate to stress	“The administrative burden and safety protocols increased the workload.”	51 (6.1)	43 (6.3)	7 (6.6)	20 (8.8)	21 (6.5)	7 (2.8)
Economic uncertainty due to inadequate support	“We received 30% pay cuts with no additional government benefits.”	45 (5.4)	33 (4.8)	8 (7.5)	12 (5.3)	16 (5.0)	15 (5.9)
Needed COVID controls are lacking	“I couldn’t even get sanitizer or wipes.”	42 (5.0)	36 (5.3)	4 (3.8)	11 (4.8)	14 (4.4)	16 (6.3)
Stress due to worries about family	“Most of the added stress is worrying about my family at home.”	38 (4.5)	33 (4.8)	3 (2.8)	11 (4.8)	17 (5.3)	9 (3.6)
Political climate influences experience sailing/stress	“This was never about public health, it’s about control.”	37 (4.4)	29 (4.3)	3 (2.8)	8 (3.5)	10 (3.1)	14 (5.5)
SOLUTIONS							
Effective existing controls	“Masks are required, hand sanitizer is available, vessels kept clean, and physical distancing.”	30 (3.6)	26 (3.8)	4 (3.8)	5 (2.2)	10 (3.1)	15 (5.9)
Quarantine rules	“Shipboard restriction for months, 2-week quarantine in poor hotel.”	30 (3.6)	22 (3.2)	4 (3.8)	11 (4.8)	11 (3.4)	6 (2.4)
Vaccines	“Can’t wait until I can get the vaccine and hopeful for everyone else.”	29 (3.5)	25 (3.7)	4 (3.8)	7 (3.1)	10 (3.1)	12 (4.7)
Inadequate support influences intent to leave	“I will never work for MSC contract again due to COVID being used to deny me of human rights.”	17 (2.0)	14 (2.1)	3 (2.8)	4 (1.8)	8 (2.5)	5 (2.0)
Increased compensation	“Crew should be compensated fairly during this pandemic.”	15 (1.8)	12 (1.8)	3 (2.8)	4 (1.8)	6 (1.9)	5 (2.0)
Administrative controls	“Would like to see company provide for care if COVID is contracted on board.”	14 (1.7)	12 (1.8)	NA (NA)	4 (1.8)	3 (0.9)	6 (2.4)
Increased worker flexibility	“Admin should be more understanding on our needs, like choice of which ship we go on.”	14 (1.7)	13 (1.9)	1 (0.9)	3 (1.3)	5 (1.6)	6 (2.4)
PPE rules cause increased stress	“Wearing masks creates issues with understanding helm commands.”	13 (1.5)	10 (1.5)	3 (2.8)	3 (1.3)	5 (1.6)	5 (2.0)
Testing	“Rapid testing prior to boarding could have been the solution to this pandemic.”	12 (1.4)	7 (1.0)	4 (3.8)	2 (0.9)	2 (0.6)	8 (3.2)
Public recognition/education	“Mariners should be considered critical workers and placed high on the list for vaccines.”	10 (1.2)	9 (1.3)	1 (0.9)	3 (1.3)	3 (0.9)	4 (1.6)
Things off vessel causing stress	“While ashore, I have been affected by seeing how people are out in public. It is sad.”	9 (1.1)	9 (1.3)	NA (NA)	3 (1.3)	5 (1.6)	1 (0.4)
PPE	“There should be a ready supply of PPE at the embarkation point for anyone needing it.”	4 (0.5)	3 (0.4)	1 (0.9)	NA (NA)	NA (NA)	3 (1.2)
Engineering controls	“There are vessels with temporary air-handling equipment that exchanges air every 3 minutes.”	3 (0.4)	2 (0.3)	1 (0.9)	NA (NA)	NA (NA)	3 (1.2)

*Numbers are higher than the total number of responses coded (n = 478) because many responses had more than one code applied.
NA, not applicable; PPE, personal protective equipment.

stuck onboard ships to feeling like prisoners.¹⁹ Extended voyages and inability to deboard, as measured by length of time onboard, were shown to increase mental health outcomes and fatigue in another study of international seafarers.²⁰ Responses from mariners in this study indicate that extended voyages may also impact retention in the industry; as one mariner stated: “I am 130 days overdue for relief. Add 2 months to that since I need to give the Maritime Safety Committee 2 months’ advance notice of my requested relief date. Unacceptable! I have no plans of returning back to work after I get relieved.”

The impacts of extended time spent onboard and the inability to go ashore was a top stressor mentioned by younger mariners (18 to 34) compared to those over 55, suggesting potential age-specific vulnerabilities to prolonged deployment. This could be due to younger mariners lacking some of the resiliency that older mariners have developed over their longer careers, younger mariners having different stressors both on and off the vessel (eg, they are more likely to have younger families at home who could be navigating school/day care closures, or they may be more accustomed to having access to Internet or social

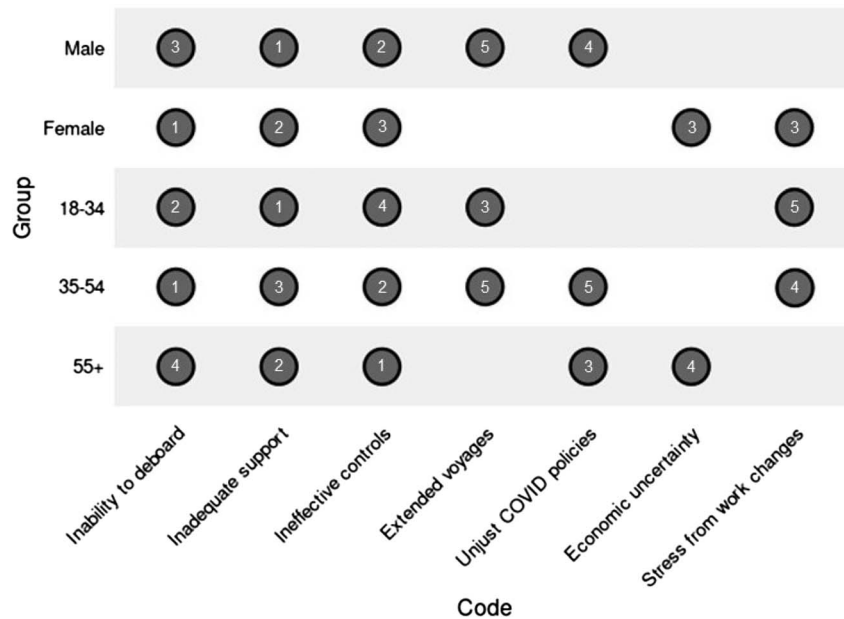


FIGURE 1. The above figure depicts the top 5 codes for gender and age groups, with a circle indicating the code on the x axis was in the top 5 codes for the group on the y axis and the number within the circle corresponding to the code's rank within the group. Groups with more than five circles indicate that codes were ties for the fifth place for a group.

media for communication than older mariners would be) or younger and thereby newer mariners not having access to preferential schedules and vessels like the older mariners who may have scheduling seniority. Future research focusing on the needs and experiences of younger or newer mariners will be valuable not only for ensuring their well-being at work but also for improved recruitment and retention of younger mariners by maritime companies, which remains a priority.²¹ Older mariners (55+) were more likely to comment that the existing controls were effective or comment that COVID-19 controls were lacking compared to younger mariners. This is supported by broader pandemic research showing that older populations demonstrated higher risk perception and compliance with preventive measures.²² The co-occurrence of these codes within respondents can be seen in this response from a 55+ year old mariner: “The ship is feeling safer with mask wearing at all times. Not enforcing mask wearing was highly dangerous.”

The analysis also revealed demographic variations in common stressors by gender, with female-identifying mariners being more likely to comment on the stressors of economic uncertainty and inability to disembark the vessel than their male counterparts but less likely to comment on the stressors of the ineffectiveness or unjust application of COVID-19 controls. This may reflect broader pandemic-driven gender disparities in employment security and experiences, as women were disproportionately economically impacted by the pandemic. Female unemployment increased by 4.2% compared to 3.0% for men, and women faced a 24% higher likelihood than men of permanently losing their jobs during the pandemic.^{23,24} Some of this disparity was due to the increase in at-home caregiving responsibilities during COVID-19, largely undertaken by women, attributable to school and day care closures, and increased care needs for older and vulnerable individuals.^{22,25,26} One female mariner commented on the interplay between caregiving and economic uncertainty: “For me, as for many others, the effects suffered by the pandemic have been financial rather than health. I am VERY grateful to have this job, and to be onboard for as long as my company needs me. My family and friends that have lost their jobs due to the overreaction by the government to this disease all rely on my paycheck. The government has not stepped up...to help the residents, so it's up to myself and others like me who will take a job like this to keep money coming to those that have had their ability to support

themselves stripped from them.” However, the relatively small number of female-identifying mariners who responded to this survey ($n = 55$) makes it challenging to draw broad conclusions for female mariners. Importantly, these responses would not reflect the experiences of women who were not able to continue sailing during COVID-19 due to changes in their employment status due to increased caregiving responsibility or other pandemic-related factors.

The findings point to several mariner-identified solutions that could improve experiences during public health emergencies. While testing and vaccination emerged as important controls, mariners also emphasized the need for increased compensation to reflect heightened risks and challenges, particularly given extended deployments and restricted shore leave. Respondents frequently highlighted that COVID-19 protocols should apply equally across the organization. The frustration with inconsistent application of protocols is exemplified by one mariner's observation: “I think it's crazy that we were locked down, not allowed to go ashore, yet contractors were allowed to come and go with just a temperature check and a questionnaire. We were exposed to the contractors every day, yet we could not go ashore.” This inconsistency in COVID-19 protocol application causes confusion and stress, mirroring challenges documented in other essential worker populations during the pandemic.²⁷ The preference for systematic, organizational-level solutions aligns with healthcare industry research showing that comprehensive organizational interventions to reduce occupational stress are more effective than individual-level interventions.²⁸ Beyond specific control measures, mariners called for greater recognition of their essential worker status through both tangible support (increased pay, hazard compensation) and intangible acknowledgment of their sacrifices during the crisis. These findings suggest future emergency protocols should integrate both practical safety measures and mechanisms to address workforce morale and well-being through appropriate compensation and recognition.

This study's qualitative methodology provided several strengths for understanding mariners' experiences during the pandemic. The open-ended response format enabled insights into lived experiences and uncovered nuanced perspectives that more structured surveys are not designed to capture. The large sample size for a qualitative study ($n = 478$) and diverse representation across vessel types and maritime

positions enhanced the richness of the collected data. The inductive coding approach permitted the discovery of previously unidentified stressors and coping mechanisms informed directly by data specific to the maritime environment, while the methodology was particularly valuable for exploring this relatively understudied population within occupational health research. In addition, the qualitative approach captured rich descriptions of workplace transactions and personal narratives that added crucial depth to understanding how pandemic policies affected different demographic groups, particularly regarding gender and age variations in stress responses. The open-ended format also empowered mariners to express their concerns in their own words, providing an authentic platform for feedback about their experiences, which is especially valuable for understanding perspectives of under-represented groups within the maritime workforce.

This study has limitations that warrant consideration. The responses were gathered in response to a single open-ended question in the context of a larger survey of stress and mental health among US mariners; this context likely influenced the responses received to the question used in this analysis. The qualitative methodology, while providing detailed insights into mariners' experiences, limits generalizability to the broader maritime population. The data collection timing during an active pandemic may have influenced response patterns, potentially emphasizing acute rather than chronic industry challenges. The self-selected nature of survey participation could have introduced response bias, particularly among those most impacted by pandemic-related changes. Finally, the coding was done using human coders; interrater reliability was high at 90% on average, but there is a risk of subjectivity in applying codes, thus imparting bias on the results.

This study revealed the occupational challenges faced by US mariners during the COVID-19 pandemic, with inadequate organizational support emerging as the most common code overall. The analysis identified key stressors including inability to deboard, extended voyages, and ineffective controls, with notable variations across gender and age groups. Female mariners reported higher concerns about economic uncertainty, reflecting broader pandemic-driven gender disparities in employment security, while older mariners (55+) showed greater attention to both effective and lacking COVID-19 controls.

The findings have several implications for maritime industry practices and policy development. They demonstrate the need for enhanced communication infrastructure between shoreside management and vessel crews, especially during crisis situations. In addition, they highlight the importance of implementing standardized, evidence-based protocols for vessel access and crew changes that effectively balance operational requirements with crew welfare. The variation in reported stressors across gender and age groups also suggests the need for targeted approaches in future emergency response protocols. The unique experiences reported by women and younger mariners demonstrate the vital need to create a supportive work environment in order to recruit and retain these populations in the maritime workforce.

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