Fatigue during the COVID-19 pandemic: The experiences of Chinese seafarers

Abstract

Though the COVID-19 pandemic is drawing to a close, very little is known about the impact of China's zero-COVID policy on Chinese seafarers. This paper examines Chinese seafarers' experiences of fatigue during the pandemic. It adopted a mix-method research design involving two quantitative surveys conducted with seafarers before and during the pandemic and 35 in-depth interviews with both seafarers and managers. All the participants were from two Chinese shipping companies. The comparisons between the two surveys show that Chinese seafarers experienced significantly higher levels of fatigue during the pandemic. The interview data suggest a range of factors underpinning the higher levels of fatigue including fear of being infected, increased workload, wearing of four-piece personal protection equipment (PPE), the deprivation of shore leaves, and the prolonged service time. More importantly, the data indicate that the draconian zero-COVID policy in China and the related policy guidelines for Chinese shipping companies and seafarers reinforce these factors. This research extends previous research by providing an exclusive and comprehensive examination of seafarer fatigue during the pandemic and revealing that the policies adopted by seafarers' home countries can have profound implications for seafarers' experiences of fatigue. Suggestions are provided at the end of the paper.

Keywords: fatigue, crew change crisis, mental health, PPE, shore leaves

1. Introduction

Fatigue has been a long-standing issue in the maritime industry. It not only harms seafarers' long-term health but also induces poor concentration and poor judgment and may lead to maritime accidents. Fatigue is caused by a number of factors, such as long working hours, long periods of service on board, poor working environment, poor sleep, high work demand and the associated stress (Dohrmann & Leppin, 2017; Jepsen et al., 2015; Tang & Zhang, 2021).

The COVID-19 pandemic of the past three years had a profound impact on a wide range of industries, including the shipping industry. It exacerbated some fatigue risk factors, particularly service lengths, by causing a crew change crisis. At its peak, the crisis resulted in 400,000 seafarers being trapped on their vessels beyond their employment contracts (IMO, 2020). Uncertainties associated with crew changes, the lack of shore leaves, and the risk of being infected with the virus all add to existing occupational stressors and worsen the fatigue problem among seafarers at sea (Brooks & Greenberg, 2022).

A significant amount of research attention has been paid to the impact of the COVID-19 pandemic on seafarers' mental health (Abila et al., 2021; Baygi et al., 2021; Brooks & Greenberg, 2022; Kaptan & Olgun Kaptan, 2021; Tang et al., 2022), and a few studies highlighted fatigue induced by the crew change crisis as one occupational health issue among many (Hebbar & Mukesh, 2020; Pauksztat, Grech, et al., 2022; Shan, 2021; Slišković, 2020). However, as fatigue is caused by a range of factors, how the pandemic affected these factors and thus exacerbated fatigue at sea warrants a separate examination. In this context, this paper exclusively examines Chinese seafarers' experiences of fatigue. In the process, it also reveals the impact of the policies adopted by seafarers' home country – in this case, China – on seafarers, while the existing literature focused on COVID-related restrictions imposed by port states.

This paper is organised as follows. The next section reviews and discusses the literature. After an explanation of the research methods, this paper presents and discusses the research findings before drawing the conclusion.

2. Fatigue and the pandemic

According to the International Maritime Organisation (IMO, 2019), fatigue can be defined as

> A state of physical and/or mental impairment resulting from factors such as inadequate sleep, extended wakefulness, work/rest requirements out of sync with circadian rhythms and physical, mental or emotional exertion that can impair alertness and the ability to safely operate a ship or perform safety-related duties.

This definition enumerates a number of contributory factors to fatigue among seafarers. Two review studies similarly identified these factors (Dohrmann & Leppin, 2017; Jepsen et al., 2015), and furthermore, they elaborated on these factors. Fatigue is foremost related to a lack of recuperative rest (Williamson et al., 2011). As such, the two most common factors are poor sleep quality and poor sleep quantity. The third factor is shift work patterns – night shift work is likely to cause fatigue because it disrupts circadian rhythm and negatively affects sleep. The fourth factor is the physical work environment, which is also sleep related. Noise, vibration, ship motion, and light in the cabin inevitably have an impact on sleep, which in turn may cause fatigue. Physical as well as mental stress caused by high work demand (high workloads and long working hours), time pressure, and psycho-emotional problems are another prominent factor. Finally, the prolonged service time is also a factor because it leads to longer exposure to fatigue-related factors (Pauksztat, Andrei, et al., 2022). It should be noted that these factors are sometimes interrelated. For example, mental stress,

shift work, and work environment can cause poor sleep, and poor sleep may amplify mental stress.

While fatigue has long been recognised as a problem in the shipping industry (Bhattacharya & Tang, 2013; Dohrmann & Leppin, 2017; Jepsen et al., 2015; Wadsworth et al., 2008; Zhao et al., 2020), the COVID-19 pandemic makes the situation worse and heightens the concerns for seafarers' mental health and fatigue. Industry reports suggested that due to the crew change crisis, seafarers endured anxiety, panic attacks, depression, loneliness, frustration, burnout, and fatigue (Clayton, 2021b, 2021a; ITF, 2020), which significantly increased the instances of seafarers calling mental health support hotlines about suicidal thoughts and other concerns (Bush, 2021; Clayton, 2021b). This trend has been corroborated by the academic research literature. Qualitative studies (Kaptan & Olgun Kaptan, 2021; Shan, 2021; Slišković, 2020) showed that during the COVID-19 pandemic seafarers at sea suffered fatigue and crew change related uncertainties, which caused stress, anxiety, depression, and even suicidal thoughts. Similarly, quantitative surveys indicated that a large number of seafarers suffered stress, depression, anxiety and fatigue (Hebbar & Mukesh, 2020; Pauksztat, Grech, et al., 2022). For example, Hebbar and Mukesh (2020) surveyed 288 seafarers, among whom 40 percent felt unhappy, 30 percent endured stress and over 15 percent felt completely fatigued. Thus, fatigue is a common problem for seafarers among many that are either caused or exacerbated by the pandemic.

Furthermore, while some studies on the impact of the pandemic on seafarers did not highlight fatigue, they nevertheless touched on the issue of poor sleep. In Pesel et al.'s (2020) survey of 72 seafarers during their ship calls at the Port of Trieste, 30 percent of the participant reported suffering from insomnia to the extent of becoming concerned. Radic et al. (2020) conducted a synchronous online focus group with nine cruise ship seafarers at sea during the pandemic, and all the participants reported poor sleep due to worries, fears and anxieties. Similar findings were also presented by other researchers (Kaptan & Olgun Kaptan, 2021; Slišković, 2020). As such, mental health problems, such as anxiety and depression, worsened by the pandemic (Baygi et al., 2021; Pauksztat, Andrei, et al., 2022), have a negative impact on seafarers' sleep quality, which is likely to cause fatigue.

The above discussion indicates that the body of literature on the impact of the COVID-19 pandemic on seafarers largely treats fatigue as one of the mental health issues. According to the IMO definition, however, fatigue has both physical and mental/emotional dimensions and is caused by a range of factors. In this context, this

paper examines Chinese seafarers' experiences of fatigue during the pandemic in all dimensions, which complements the previous research and generates a comprehensive understanding of this issue.

There are a number of reasons to focus on Chinese seafarers. First, China is one of the major seafarer supply countries (Tang, 2022b), boasting to have 592,998 registered seafarers in 2020 (MSA, 2021). Second, Chinese seafarers are largely underrepresented in previous research (Pauksztat, Grech, et al., 2022; Wadsworth et al., 2008). Third, China implemented a zero-COVID policy until early January 2023. While COVID control policies in other countries aimed to flatten the infection curve and avoid overwhelming the healthcare system, China's policy was to keep COVID-19 infection cases as close to zero as possible. To achieve this goal, China implemented strict measures, including mass testing, mandatory quarantine of the infected in government facilities, and strict lockdowns that could cover entire cities and confine people to their homes for weeks or even months. These measures were often seen as draconian in comparison to those taken by other countries, which allowed people to go out for essential shopping and exercise during the lockdown. In line with the zero-COVID policy, the Chinese maritime authorities issued a number of regulations on ship and port operations, such as *The Operational guidelines on the prevention and control of COVID-19 for seafarers (11th edition, issued on 17 November 2022), The operational requirements on the change of Chinese crew onboard international sailing ships during the prevention and control of COVID-19 pandemic (issued on 10 December 2021),* and *The Guide for Ports and Frontline Workers on the Prevention and Control of COVID-19 (11th edition, issued on 15 November 2022).* These regulations made specific and meticulous requirements on crew changes, shore leaves, use of COVID-19 control and prevention items on ships, and ship management. They created many problems for Chinese seafarers as well as shipping companies. For example, when Chinese seafarers signed off a ship in a foreign country, they had to endure two to three weeks of hotel quarantine in the foreign country before being allowed to board a plane back to China, and when they arrived in China, they had to endure another two to four weeks of hotel quarantine in the city of landing before being allowed to go home. Furthermore, in many cases, crew changes between Chinese seafarers were not allowed in Chinese ports by the local authorities (Tang, 2022a), and as a result, many seafarers were forced to extend their sailing contracts. Compared with seafarers of other nationalities, Chinese seafarers were likely to face longer quarantine periods and more uncertainty about crew changes. The impact of such a draconian policy on seafarers' fatigue, however, has not been studied. Previous research mainly focused on the impact of the restrictions imposed by port states on seafarers, leaving the policy of seafarers' home country unexamined. By examining the experiences of Chinese seafarers, this paper also fills this gap.

3. Research methods

The research was conducted with two Chinese state-owned shipping companies. Company A was a container shipping company, operating 289 container ships sailing on 354 international and national routes in 2014. By the end of 2021, the number of its ships increased to 313. Company B was a dry bulk shipping company, operating 329 bulk ships trading worldwide in 2014, and 354 in 2021.

Both companies directly employed around 10,000 officers and ratings on fixed-term contracts (5–8 years), all of whom are Chinese. They also recruited some ratings through crewing agencies on single-voyage contracts. As state-owned companies enjoying government financial support, the two companies provided directly employed seafarers with better social insurance coverage, more non-wage benefits, and better working conditions than companies under other types of ownership (Chen & Tang, 2022). Furthermore, the crew sizes in the two companies were bigger than the market average. For example, they deployed a political commissar on each ship. As such, they are at the better end of Chinese shipping companies in terms of safety management, and they have relatively more resources to manage fatigue.

This research adopted a mix-method research design involving two quantitative surveys and 35 in-depth interviews. The two surveys (Surveys 1 and 2) were conducted with seafarers from the two companies before and during the pandemic. The questionnaire used in the surveys was an edited version of that used in the Cardiff Seafarers' Fatigue Research Programme (Smith et al., 2006). The questions were designed to explore the perceived fatigue levels of seafarers as well as the organisational and individual factors associated with fatigue. Survey 1 was conducted between March and July 2014. The questionnaire was distributed via email to all the 466 seafarers working on 20 of the two companies' vessels, and 393 of them (84.3%) participated and returned the survey questionnaire. Survey 2 was conducted during the COVID-19 pandemic between May and August 2021. The questionnaire was distributed via email to all the 421 seafarers working on 18 of the companies' vessels and 359 of them (85.2%) returned. Overall a total number of 752 seafarers completed the questionnaire, including 392 officers, 330 ratings and 30 petty officers[1]. In terms of department, 395 (52.5%) participants were from the deck department and 302(40.2%) were from the engine department. Their ages ranged from 21 to 59, and the average age was 33.8. As the two companies did not employ female seafarers, all the participants were male.

In this paper, we focus on comparing the perceived fatigue levels of Chinese seafarers before and during the pandemic, by calculating the means of reported fatigue scores at the different periods. Statistical analyses were conducted with SPSS Version 27. To capture both the intensity and frequency of perceived physical and mental fatigue, we used a weighted mean of five aspects of fatigue to measure the fatigue level:

1. Which of the following responses best describes your typical state during work? Scored 0 (very alert) to 4 (sleepy), weight 5/4

2. About how often do you feel tired at work? Scored 0 (never) to 5 (about everyday), weight 1

3. About how often do you feel sleepy at work? Scored 0 (never) to 5 (about everyday), weight 1

4. In a normal workday, how physically tired do you usually feel at the end of the working day? Scored 0 (Not at all) to 3 (Extremely), weight 5/3

5. On a normal working day, how mentally tired do you usually feel at the end of the working day? Scored 0 (Not at all) to 3 (Extremely), weight 5/3

On top of the surveys, semi-structured in-depth interviews were conducted with 11 managers (5 from Company A and 6 from Company B) and 24 seafarers (12 from each company) in 2021. The interviews explored whether and how the pandemic affected seafarers' work and life on board and their experiences of fatigue. Interviews allowed the respondents the scope to express what they considered to be important in their own words, and gave the interviewers the opportunity to capture the attitudes and feelings of interviewees and the freedom to ask additional questions as they saw fit (Fontana & Frey, 2005). As such, the interviews facilitated a deep and comprehensive understanding of seafarers' perceptions and experiences. They provided a contextualised explanation of the survey findings.

Due to the circumstances, the interviews were conducted online, and informed consent was obtained orally from all the interviewees. The participants were anonymised. The ethical approval for this research was granted by the Psychology Ethics Committee of Dalian Maritime University. All the seafarer interviewees had also taken part in the questionnaire surveys, and their interviews were conducted when they were on leave. The interviews were audio recorded and transcribed. Analyses were carried out using the NVivo software package and organised around key emerging themes.

4. **Fatigue levels before and during the pandemic**

Table 1 Comparison of fatigue levels between Survey 1 and Survey 2 respondents

		N	Mean	SD	Sig
All seafarers	Survey 1	393	1.7223	0.801	0.000
	Survey 2	359	2.1452	0.888	
Officers	Survey 1	193	1.8331	0.778	0.000
	Survey 2	199	2.2977	0.825	
Ratings	Survey 1	179	1.6046	0.815	0.000
	Survey 2	151	1.9772	0.930	
Deck	Survey 1	232	1.8364	0.749	0.032
	Survey 2	163	2.0166	0.908	
Engine	Survey 1	123	1.6299	0.787	0.000
	Survey 2	179	2.2611	0.872	

Table 2 Levels of aspects of fatigue reported by Survey 1 and Survey 2 respondents

	Survey 2	Survey 1	Sig
Feel sleepy during work			
Officer	12.3%	6.7%	0.966
Rating	10.1%	6.2%	0.530
Deck	9.9%	6.0%	0.125
Engine	12.1%	5.6%	0.414
Feel tired at work more than once a week			
Officer	48.4%	38.4%	0.026
Rating	45.5%	25.2%	0.030
Deck	49.1%	31.0%	0.025
Engine	43.5%	37.0%	0.014
Feel sleepy at work more than once a week			
Officer	36.0%	30.9%	0.000
Rating	24.1%	23.8%	0.000
Deck	32.9%	25.4%	0.010
Engine	38.2%	20.1%	0.000
Physically tired feel at the end of the working day			
Officer	48.8%	13.9%	0.000
Rating	46.8%	25.3%	0.000
Deck	42.6%	19.3%	0.000
Engine	52.8%	19.3%	0.000
Mentally tired feel at the end of the working day			
Officer	48.8%	29.4%	0.000
Rating	40.3%	21.4%	0.000
Deck	42.5%	28.6%	0.002
Engine	48.5%	21.8%	0.000

As shown in Table 1, the mean of the self-reported fatigue level was significantly higher among Survey 2 respondents (M =2.1452, SD =0.888) than that among Survey 1 respondents (M =1.7223, SD =0.801; $p < .001$). This difference was also significant when comparisons were made within ranks and departments (deck at the 95% confidence level).

In comparison with Survey 1 respondents, a significantly larger proportion of Survey 2 respondents reported experiencing four out of the five aspects of fatigue (regarding 'Feel sleep during work', the difference was not significant), regardless of rank and department (see Table 2).

When asked about tiredness/fatigue when on watch, Survey 2 respondents again reported higher fatigue levels (Table3). Overall, therefore, Survey 2 respondents reported higher levels of fatigue than Survey 1 respondents. Next, we use the interview data to explore the impact of the pandemic on Chinese seafarers' experiences of fatigue.

Table 3 Tiredness/fatigue when on watch among Survey 1 and Survey 2 respondents

	N	Mean Rank	Asymp.sig(2-tailed)
Survey 1	239	224.59	.000
Survey 2	303	308.50	
Total	542		

5. Interview findings

5.1. Fear and extra workload

Fear of catching COVID-19 is common among frontline workers, like health workers (Labrague & de Los Santos, 2021; Malik et al., 2021), restaurant customer-facing employees (H. Chen & Eyoun, 2021), and flight attendants (Cheng et al., 2022), which leads to problems such as stress, anxiety and burnout. Seafarers are also frontline workers. Furthermore, if the infection spreads among seafarers while sailing at sea, it would be impossible to seek treatment ashore. Therefore fear among seafarers has been well documented (Hebbar & Mukesh, 2020; Radic et al., 2020; Slišković, 2020). Nevertheless, fear seems to be more pronounced in China. To legitimate the zero-COVID policy, Chinese broadcasting and social media have been highlighting the message that COVID-19 is highly dangerous, resulting in long-COVID, and sometimes lethal, which has induced pervasive public fear of it (Yang, 2022). It is not surprising that the interviewed seafarers expressed fear of infection. They worried that if they caught the virus, they might suffer from long-COVID and their health, job, economic security, and future would be ruined. One rating, for example, said:

> No one wants to get infected. If you are infected, you will lose your job; you will spend all your money to cure the disease and the many serious sequelae, and the rest of your life will be in pain.

Likewise, shipping company managers also feared that their ships might get infected, which would disrupt ship operations and cause troubles and economic losses to the whole company. As such, they saved no effort circulating the message to seafarers that it would be disastrous to catch the virus, as a 2nd engineer reported:

> The company always reminds us that if one person gets it, the whole crew will get infected and suffer - you won't be able to work properly, you won't be able to change shifts, the whole crew will have to be taken off the ship, quarantined, adjusted, and it won't be good for anyone.

Senior officers, particularly political commissars[2], are tasked to strictly enforce control and prevention measures on board and educate and discipline their subordinates. A commissar stated:

> Our company has been updating and improving our pandemic prevention policies and practices in accordance with the Ministry of Transport and the national directives, especially the Operational Guidelines for the Prevention and Control of COVID-19 for seafarers. I think our crew is relatively conservative in their thinking and do not want to be infected, and the awareness of the crew is relatively strong in terms of pandemic prevention. On our ship, we have been training and educating the crew on COVID-19 prevention, from wearing personal protection equipment (PPE) to disinfection. Such effort makes the crew follow instructions.

However, other senior officers were not as positive about such tasks as the commissar. One captain, for example, complained that these extra responsibilities and activities added a heavy workload on him, making him exhausted:

> It may not be appropriate for me to say this – it is a bit anti-management (laugh), but what we can't stand is that the company always sends us all kinds of documents related to COVID prevention - sometimes even the policy documents issued by the Ministry of Transport to companies are sent directly to the ship. Every document requires training for the crew, recording the process of training activities, writing summaries of activities, and writing reflective reports. During the safety month and fire-fighting month, we are then required to study various safety and fire-fighting documents in the context of COVID prevention, and to write various activities and reflective reports. Really, the best and safest time on our ship was when there were no training and no report to write. Now there is just too much paperwork and it is so unnecessary. I think the company should pay us overtime for all this work; it takes up too much energy and time, especially writing reports. In fact, we should just work

> according to the company's SMS system documents on board, but now there is too much extra work and it's really tiring. Sometimes the political commissar can help me write, but the political commissar cannot help with writing the reports that need professional and technical knowledge. I have to write them, and there is no other way.

Previous research perceived that additional tasks induced by the pandemic, such as enhanced cleaning, disinfecting, more paperwork in connection with port calls, and new working and living arrangements to observe physical distancing might exacerbate fatigue on board ships (Pauksztat, Grech, et al., 2022). The captain's word above indicates that the *de facto* COVID-19 control and prevention training and education on Chinese ships increased workloads and led to fatigue. This affected not only senior officers, but also junior officers and ratings because they had to spend time taking part in the training. On top of training, the interviewed seafarers also mentioned that disinfecting increased workload. One 3rd officer, for example, said,

> Disinfection increased the workload. Disinfection operations are almost continuous, twice a day during sailing, and three times a day at port.

5.2. Four-Piece PPE

Compared with the pandemic-induced training, paperwork, and disinfection discussed above, anti-virus PPE was emphasised more by the interviewees in this research as having an impact on fatigue. According to a manager, anti-virus PPE consists of four pieces: a pair of disposable medical gloves, an N95 mask, a hazmat suit, and a pair of protective goggles. In order to contain the infection and prevent the pandemic from entering China from abroad through ports and in line with the zero-COVID policy, the Ministry of Transport promulgated the *Guide for Ports and Frontline Workers on the Prevention and Control of COVID-19 (11th edition)*, according to which, port frontline workers must wear four-piece PPE if the work requires meeting people or dealing with cargo arriving from other countries or high-risk areas. Although seafarers were not port workers, the shipping companies complied with the Guide to mitigate the potential risk that seafarers catch the virus during port operations and then infect the whole ship. In compliance with the Guide, the companies made it mandatory that seafarers wear four pieces when they work on deck and the ship is berthed. One manager explained:

> The company now requires all crew members to wear four-piece PPE when they leave the living quarters. For example, if the ship is berthing, or if there is a pilot on board, or if there are inspectors, surveyors, or port officials on board, or if seafarers need to attend in person outsiders or people with risk, they must wear four-piece PPE. …When berthed, all personnel on deck must wear the four-piece PPE. Crew members from the engine department must also wear them. The electric officer, for example, must wear them when conducting the daily checks of refrigerated containers regardless of whether it is berthed at port

> or sailing at sea. The engineers must wear them during bunkering operations as well. (Manager 1)

From the perspective of seafarers, while PPE protected them from catching the virus, they nevertheless were uncomfortable to wear. One 3rd engineer elaborated:

> The four-piece PPE, you can imagine. The hazmat suit is stuffy, hot in summer, and not breathable. The gloves are also not breathable, and after some time, the hands are soaked white. The protective goggles, sometimes it makes people feel vertigo, and stuffy. Needless to say, the N95 mask is particularly stuffy. It is difficult to breathe with it, and you feel short of breath if you wear it for long.

Despite the discomfort, seafarers must wear them over a long period on some occasions. At the port, one cargo operation shift lasts either four hours for ratings or six hours for officers. During this period, the duty seafarers must wear PPE continuously. One captain mentioned that when passing a long passage, such as the Suez Canal, or entering a river port, such as Hamburg, as there were pilots on board, they had to wear PPE for up to eight hours. One chief officer recounted the ordeal of wearing PPE for long periods:

> The longest time I've ever worn four-piece PPE was nearly 12 hours, from 4 or 5 in the morning to 4 or 5 in the afternoon. In this case, all the clothes I was wearing underneath were soaked through. Basically, the vest and underwear I wore inside were all soaked through. In the Middle East, where the weather is hot and it's already more than 30 degrees outside, if you wear PPE, it's even more uncomfortable.

Seafarers complained that wearing PPE made them physically exhausted. Nevertheless, they had to wear them, not only for their own health and safety but also because their compliance with the zero-COVID policy was under constant surveillance. The managers explained their determination to enforce the company’s zero-COVID policy:

> The company monitors in real time via satellite whether prevention and control measures are in place on board, for example, whether PPE is worn. (Manager 3)

> We are strengthening the supervision of crews' correct use of pandemic prevention materials, and we are determined to win the battle against the pandemic. (Manager 2)

Therefore, in addition to the heavy tasks of disinfection, the regulations and the control of the companies over wearing anti-virus PPE made seafarers feel even more fatigued when working on board. It is not surprising that Survey 2 respondents were more likely to report feeling physically tired than Survey 1 respondents.

5.3. Shore leave bans

Under normal circumstances, it can be a hectic and stressful time for seafarers when the ship is berthed because they have to multi-task, receiving inspections and accommodating different demands and requests from various authorities on top of supervising cargo operations (Sampson et al., 2016). Nevertheless, the port stay also allows seafarers to take shore leaves and enables them to temporarily escape the stressful environment on the ship, refresh their minds, and relax for a while. During the pandemic, however, shore leaves were largely curtailed (Pauksztat, Andrei, et al., 2022; Shan, 2021). The interviewed seafarers had not taken any shore leaves since the pandemic started. One 3rd officer complained:

> I served nine months on my last ship but never set foot on the ground. Some countries nowadays take it to the extreme: they do not let you get off the ship, and even when the chief officer needs to check the drafts, they do not allow you to set foot on the dock. This is too much. Some ports, especially some Chinese ports are very strictly regulated now.

For engineer officers, the situation could be worse because they worked in the engine room. One 3rd engineer recalled his experience in the previous ship:

> For almost a year, we did not get off the ship. Because we worked in the engine room where there was no sunlight, I now feel it is a luxury to be showered in the sunshine. In that year, except for drills, I did not get out on the deck and did not get the sunlight.

Without the occasional shore leaves to escape the shipboard environment and refresh their minds, seafarers felt that work-related stress and depression could only be accumulating over time. They developed a lay theory explaining why it would be good for health to have shore leaves:

> The ship creates a magnetic field, and the earth has its own geomagnetic field. When we are at sea, we are under the influence of the ship's magnetic field which interferes with the earth’s natural magnetic field and affects the body. It would be definitely good for health to be able to get off the ship and take a walk ashore often. There is no scientific basis for this, but it is our habit to walk ashore wherever we can. (2nd officer).

They had not been able to do so since the pandemic started. Whether this theory is true or not, it reflects seafarers' concern that being deprived of shore leaves, the accumulated stress and depression could not be released. This made them mentally exhausted and consequently jeopardised their health, and also seemed to explain why Survey 2 respondents were more likely to report feeling mentally tired. One 2nd engineer argued that it greatly affected his sleep:

> The quality of sleep became really poor, the duration of sleep became short, and I woke up more frequently than before at night. I personally feel the main reason for this is that I could not have shore leaves. In the past, I could take shore leaves from time to time, but now I cannot. I think this greatly affected my sleep.

Previous research has highlighted the problem of no shore leaves during the pandemic (Hebbar & Mukesh, 2020; Shan, 2021; Slišković, 2020). Chinese seafarers, however, face extra challenges. On top of the bans imposed by some port authorities, the maritime authority in China as well as shipping companies did not allow seafarers to take shore leaves for fear that seafarers catch the virus ashore or bring the virus ashore in China. *The Operational guidelines on the prevention and control of COVID-19 for seafarers (11th edition)* stipulates that during the pandemic, seafarers should minimise their contact with shore personnel, and in principle should stay in the living quarters during cargo operations. One manager explained their policy, 'To protect our seafarers and avoid infection, we try our best not to take shore leaves.' As such, one 2nd officer mentioned, 'even though some Western countries have already opened their borders and allowed shore leaves, our company does not allow that.'

5.4. Extended service time

On top of shore leave bans, extended contracts further exacerbated stress and mental exhaustion. Previous research has predominantly emphasised the problems associated with the crew change crisis and the heavy toll it took on seafarers (Baygi et al., 2021; Brooks & Greenberg, 2022; Hebbar & Mukesh, 2020; Pauksztat, Andrei, et al., 2022; Slišković, 2020). Chinese seafarers similarly suffered from extended service times. One 3rd engineer explained:

> The normal service time in a contract is 7 months plus or minus one month. The longest time I served was more than 11 months during the pandemic, just one week short of a year. The crew extended their contracted service time and overstayed for a long time. This definitely had an impact on the body, mind, and sleep.

Crew changes between Chinese seafarers were often conducted at Chinese ports. This practice not only saved costs but also minimised the problems associated with travel restrictions during the pandemic. However, China's zero-COVID policy created multiple barriers in this respect. One chief officer recounted their experience:

> After our ship has docked, the customs officers come on board to take Polymerase Chain Reaction (PCR) test samples, and then they take it ashore for the tests which take at least seven or eight hours, or ten hours in some cases. If we do crew changes, the whole crew has to be PCR tested negative before the crew changes can proceed. While you are waiting for the test results, cargo operations are not allowed. If you do not conduct crew changes, however, PCR tests are not required, and cargo operations can start immediately. Do not think this is odd? They use this tactic to delay cargo operations. So if you are not desperate, you do not do crew changes. We are at the dock for about 20 hours in total, but it takes so long to do PCR tests. It delays ship operations for more than 10 hours, so we cannot afford the delays and do not do crew changes.

Similarly, other seafarers mentioned that the company did not allow such costly waiting. Apart from the costly waiting, crew changes required approvals from various maritime authorities with complicated procedures. A captain complained:

> In the past, you did not need approval from the Maritime Safety Administration for crew changes; and you only need to go through the border control agency. Now, you need approvals to get off the ship from the Maritime Safety Administration in conjunction with various local agencies. Numerous procedures with loads of paperwork, very cumbersome. Basically, you need to inform them a week in advance and complete all the relevant documents and paperwork three days in advance. So the approvals are difficult to obtain – they need all sorts of formalities, all sorts of paperwork. So difficult.

Due to the zero-COVID policy, the local authorities faced pressure from above and were held accountable if their decision to allow crew changes opened the door to new infections (Shen, 2020). There have been many cases whereby local officials were punished for outbreaks (Yang, 2022). As such, many local authorities were reluctant to approve crew change requests (Tang, 2022a). A captain explained the situation:

> In some ports, no one dares to say yes to crew change requests, unless there is an emergency. They are all afraid that something might happen. No one dares to make a decision, and they are afraid of taking responsibility.

These barriers often forced seafarers to extend their contracts and delay their annual leaves which would allow them a decent break and recuperation from the prolonged exposure to stress and fatigue in the workplace.

6. Concluding discussion

By comparing two matched samples, previous research (Pauksztat, Andrei, et al., 2022) has shown that the COVID-19 pandemic contributed significantly to higher levels of depression and anxiety among seafarers. This paper specifically focuses on seafarers' experiences of fatigue, and the comparisons between two surveys conducted with the same two Chinese shipping companies suggest that the pandemic significantly increased the fatigue levels of Chinese seafarers. A significantly higher proportion of the survey respondents during the pandemic reported mental and physical tiredness than that before the pandemic.

The interview data shed light on the reasons behind the higher levels of fatigue experienced by Chinese seafarers during the pandemic. In line with previous research findings (Hebbar & Mukesh, 2020; Kaptan & Olgun Kaptan, 2021; Pauksztat, Grech, et al., 2022; Radic et al., 2020; Shan, 2021; Slišković, 2020), the interviewees in this research pointed out that fear of being infected, increased workload, the deprivation of shore leaves, and the prolonged service time all contributed to physical and mental exhaustion. While not disputing that seafarers of any nationalities are likely to have experienced these issues, this research has nevertheless shown that the draconian zero-COVID policy in China and the related policy guidelines for Chinese shipping companies and seafarers implemented during the COVID-19 pandemic exacerbated the problems in a number of ways.

First, to minimise infection risk, during the pandemic Chinese shipping companies required their seafarers to undergo COVID control and prevention training and study related company policy documents regularly. Furthermore, senior officers were required to write reports on such training and studies. Second, it was mandatory for Chinese seafarers to wear four-piece PPE to work on many occasions and over long periods, which was uncomfortable and physically exhausting. Third, even though many countries had been gradually opening their borders and seafarers were allowed shore leaves in some ports, Chinese seafarers were an exception because the national guidelines and the company policy prohibited them from doing so. Finally, the zero-COVID policy made Chinese port authorities reluctant to allow crew changes between Chinese seafarers at their ports, and as a result, they created many barriers to discourage shipping companies and seafarers from making crew change requests. All these exposed seafarers to increased stress and fatigue (both physically and mentally) in the workplace and delayed (or even denied) the opportunity for recuperative rest.

This paper complements the previous studies which mainly focused on the impact of the restrictions imposed by port states on seafarers by demonstrating that the

domestic COVID control policy of China has a profound impact on Chinese seafarers sailing internationally, and significantly increased their fatigue levels.

It should also be acknowledged that this research has limitations. It focuses on two Chinese shipping companies and the samples are not representative. Nevertheless, given that the policy and policy guidelines were implemented nationally, all the Chinese port authorities and shipping companies had to comply with them. As such, Chinese seafarers working in other Chinese shipping companies were also likely to be subject to the problems and restrictions imposed by these policy guidelines and they were likely to face similar challenges when conducting crew changes at Chinese ports. Moreover, being big and state-owned, the two companies had more financial resources to manage fatigue than smaller and non-state-owned shipping companies. If it was difficult for them to manage fatigue, other companies with less resources were likely to find it more difficult. Thus, it might be argued that the zero-COVID policy was likely to have intensified and prolonged the impact of the pandemic on many Chinese seafarers' fatigue levels, which harmed their long-term health and leads to more human errors. It may put Chinese shipping companies in a disadvantageous position in terms of health and safety performance.

Furthermore, with the Chinese government strictly imposing the zero-COVID policy which served to deteriorate the working and employment conditions of Chinese seafarers, the attractiveness of a seafaring career could be negatively influenced and the sustainable development of the seafarer workforce in China may be undermined. Historically, one attractiveness of the seafaring career is derived from the opportunity to travel around the world with ships and visit different places during port calls, and reunion with families at the end of the contract (Tang & Zhang, 2021). Due to the pandemic and zero-COVID policy, however, Chinese seafarers were stranded on ships with extended contracts, working under the fear of infection and enduring mental and physical fatigue. Although the research did not explore seafarers' intention and motivation to continue to work at sea, it could be reasonably assumed that the situation would demotivate some of them. After all, it is demonstrated elsewhere that the pandemic-related restriction has made a small number of seafarers decide to leave the profession (Marine Benefits, 2022). Thus, it could be argued that between 2020 and 2022 the zero-COVID policy in China was likely to bring about prolonged impact to the occupational health and safety of Chinese seafarers. It might cause damage to the sustainable development of the workforce.

China lifted its zero-COVID policy and pandemic restrictions in early 2023. Nevertheless, there are still lessons that Chinese shipping companies can learn from the experience of Chinese seafarers during the pandemic. Shipping companies are

required to implement safety management systems and manage fatigue risks by the International Safety Management (ISM) Code. During the pandemic, while shipping companies had no choice but to implement relevant government policies, they could take some measures to manage the fatigue risks related to such implementation. For example, they could monitor seafarers' fatigue levels, reduce paperwork associated with COVID prevention, and listen to seafarers' complaints. In the light of the findings from this study, it can be suggested that when new policies and regulations are adopted, companies should assess the impact of their implementation on seafarers' fatigue and take measures to manage the fatigue risk.

Notes:

1. Because their duties in relation to navigational safety are not significant in comparison with officers and ratings, we excluded these seafarers from the analyses.
2. Political commissars sail together with the crew. They are expected to exercise political and ideological control over seafarers as eyes and ears of the party-state. They enjoy high positions on board as the deputy head of the ship and are directly responsible to the captain.

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