Navigating Health at Sea: Work, Stress, and lifestyle as Drivers of Seafarers' Wellbeing and Self-Rated Health

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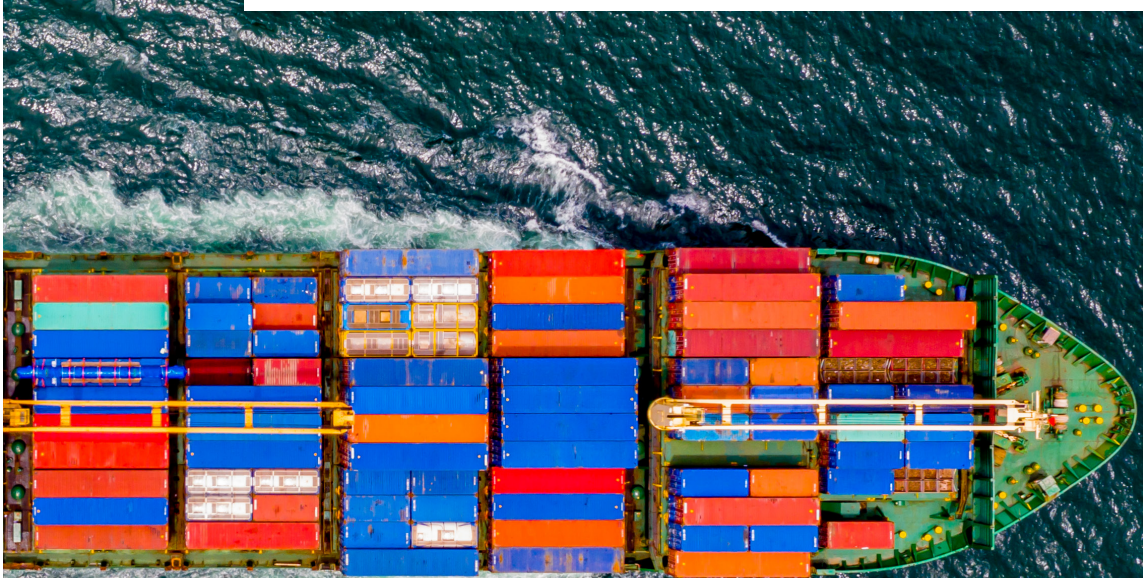

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Rebecca Hayes Mejia

LUND
UNIVERSITY

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Title and subtitle: Navigating Health at Sea: Work, Stress and Lifestyle as Drivers of Seafarers' Wellbeing and Self-Rated Health

Abstract:

Background: Seafarers constitute a global workforce exposed to unique psychosocial, organisational, and environmental stressors. Despite growing attention to maritime wellbeing, empirical evidence on how these multi-level determinants interact to shape mental and physical health remains limited. This thesis aims to identify key determinants of mental health, wellbeing, happiness, and self-rated health (SRH) among international seafarers, and to assess how psychosocial work conditions, subjective work experiences, lifestyle behaviours, physical health conditions, and stress jointly influence health outcomes.

Methods: This thesis comprises three quantitative cross-sectional studies using surveys conducted in 2022 and 2024, involving 17,861; 13,008; and 22,432 international seafarers respectively. Validated instruments (PSS-10, GAD-7, PHQ-9, WHO-5, SHS) measured mental, psychological, and general health outcomes. Multivariate regression, stratified analyses, and interaction modelling (RERI) were used to assess associations and moderating effects.

Results: Paper I showed that COVID-19 disruptions, delayed crew changes, high workload, and poor communication significantly increased stress, anxiety, and depression, while strong safety culture and clear employer communication buffered these effects. Paper II demonstrated that wellbeing and happiness were strongly associated with positive work experiences (satisfaction, fairness, expectations, skills utilisation, and social climate), while high workload weakened these benefits. Paper III found that poor SRH was linked to chronic conditions, poor sleep, inactivity, smoking, loneliness, and high screen time, with stress acting as both an independent predictor and amplifier of other risk factors.

Conclusions: Seafarers' health is shaped by interconnected regulatory, organisational, and individual determinants. Structural gaps in maritime governance, workload pressures, communication quality, leadership, and social cohesion onboard strongly influence mental and physical outcomes, while stress emerges as a central mechanism linking determinants across in particular Papers I and III. Effective health promotion requires coordinated multi-level interventions spanning regulatory enforcement, organisational reforms, and support for individual health behaviours.

Implications: Strengthen the enforceability of regulatory frameworks, improve workload and communication practices, expand access to mental-health support, and address loneliness and lifestyle risks essential to safeguarding seafarers' wellbeing to build a resilient maritime workforce.

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Work, Stress, and Lifestyle as Drivers of Seafarers' Wellbeing and Self-Rated Health

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When I sail the lonely deep
When the midnight watch I keep
I stand amazed as stars on the billow gleam
And though I know the storm is rising
High above the dark horizon
I know, oh, Lord, I know you are here with me
So let there be light, Lord, let it shine
Out of your heart
And here and into mine
When it rains from the Heaven above
Let it rain, sweet heavenly love
Let there be light
*Oh, Lord, let there be light…*Steph Macleod

To Jemima, Maxine, and Isaac

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Preface

My professional journey began in the medical field, where I trained and worked as a nurse. Although I valued the clinical environment, I was early on drawn to the preventive side of health. Yet, within health care, there was rarely time or space to work proactively. This recognition led me to broaden my academic path, taking courses in human rights, migration studies, and development studies, which ultimately sparked my interest in public health. Discovering the Master's program in Public Health provided the conceptual foundation I had long been seeking, an understanding of the social, political and structural conditions that shape health, and the principles of health promotion that extend far beyond clinical care.

A few years later, life took and unexpected but formative turn when I moved to the Philippines and began working for Marine Benefits. What began as a professional opportunity soon evolved into a deeply meaningful engagement with the maritime sector. I was introduced to the Re:fresh programme, a large-scale initiative designed to gather systematic, credible data on seafarers' health and wellbeing. I was given the rare chance to contribute to its development almost from the beginning, helping to structure and strengthen the project as it grew. Over the years, I also worked on various health promotion initiatives across the maritime industry, which broadened my understanding of seafarers' challenges and the industry's capacity to support healthier working lives.

As the Re:fresh dataset grew, it became clear that it offered a unique multinational, evidence base capturing the lived experiences, health conditions, and wellbeing of tens of thousands of seafarers. Its richness inspired me to examine it more deeply. A doctoral project allowed me to analyse this data with academic rigor, strengthen the system behind it , and most importantly, use these insights to support seafarers and inform evidence-based decisions in the maritime industry.

This thesis is therefore the culmination of a personal and professional trajectory shaped by clinical practice, public health training, and years of collaboration within the maritime sector. It reflects both the privilege of working closely with seafarers and the responsibility to ensure that their realities are seen, understood, and acted upon. I hope that the work presented here will support ongoing efforts to promote better health and wellbeing for those who keep global trade moving, often under conditions that remain largely invisible to the rest of the world.

Abstract

Background: Seafarers constitute a global workforce exposed to unique psychosocial, organisational, and environmental stressors. Despite growing attention to maritime wellbeing, empirical evidence on how these multi-level determinants interact to shape mental and physical health remains limited. This thesis aims to identify key determinants of mental health, wellbeing, happiness, and self-rated health (SRH) among international seafarers, and to assess how psychosocial work conditions, subjective work experiences, lifestyle behaviours, physical health conditions, and stress jointly influence health outcomes.

Methods: This thesis comprises three quantitative cross-sectional studies using surveys conducted in 2022 and 2024, involving 17,861; 13,008; and 22,432 international seafarers respectively. Validated instruments (PSS-10, GAD-7, PHQ-9, WHO-5, SHS) measured mental, psychological, and general health outcomes. Multivariate regression, stratified analyses, and interaction modelling (RERI) were used to assess associations and moderating effects.

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Implications: Strengthen the enforceability of regulatory frameworks, improve workload and communication practices, expand access to mental-health support, and address loneliness and lifestyle risks essential to safeguarding seafarers' wellbeing to build a resilient maritime workforce.

Populärvetenskaplig sammanfattning

Sjöfart är en av världens mest internationella branscher och bygger på ett globalt arbetslag av sjömän som arbetar under krävande förhållanden långt hemifrån. Deras arbetsmiljö präglas av långa arbetsperioder, begränsad kontakt med familj och vänner, hårt arbete och stort ansvar, samt ofta brist på vila och återhämtning. Denna avhandling undersöker hur sådana förhållanden påverkar sjömäns psykiska, sociala och fysiska hälsa, och i förlängnignen, vad som kan göras för att förbättra deras välbefinnande.

Avhandlingen bygger på tre studier utifrån två omfattande enkätstudier genomförda 2022 och 2024, där över 50 000 sjömän från hela världen deltog. I dessa studier mäts stress, ångest, depression, välbefinnande, lycka och självskattad hälsa. Sjömännen fick också svara på frågor om sin arbetsmiljö, sina arbetsupplevelser, livsstilsvanor och eventuella hälsoproblem. Resultaten visar att internationella sjömäns hälsa och välbefinnande påverkas av flera samtidiga faktorer, allt från arbetsmiljö och ledarskap ombord till livsstil, stress och globala villkor inom sjöfarten.

Studie I visar hur pandemin slog hårt mot sjömännen. Försenad besättningsrotation, resebegränsningar och svag kommunikation från arbetsgivare ökade den psykiska belastningen. Företag med stark säkerhetskultur och tydlig information lyckades däremot mildra effekterna.

Studie II visar att välbefinnande hänger nära ihop med hur sjömän upplever sitt arbete, tex. om det känns rättvist, meningsfullt och motsvarar förväntningarna. En god arbetsmiljö stärker trivseln, men en för hög arbetsbelastning tar snabbt bort dessa positiva effekter.

Studie III fokuserar på hälsa i bred bemärkelse. Resultaten visar att självskattad hälsa ofta är kopplad till kroniska besvär, livsstilsfaktorer och framför allt stress, som förstärker många risker, exempelvis dålig sömn, fysisk inaktivitet och hög skärmtid.

Sammantaget visar avhandlingen att sjömäns hälsa inte kan förstås som en fråga om enbart individuella livsstilsval. Utan det handlar om ett komplext samspel mellan regelverk, arbetsorganisation och personliga förutsättningar. För att förbättra hälsan för sjömän inom den internationella sjöfarten krävs åtgärder på alla nivåer: starkare internationell reglering, bättre arbetsvillkor, rimliga arbetsbelastningar, förbättrad kommunikation, stöd för social gemenskap samt insatser ombord som gör det lättare att leva hälsosamt till havs.

Genom att belysa dessa samband bidrar avhandlingen med viktig kunskap som kan användas av både beslutsfattare, rederier och andra aktörer inom sjöfarten. Målet är att stärka sjömäns hälsa och välbefinnande samt att skapa en mer hållbar och human arbetsmiljö för dem som bär upp den globala sjöfarten.

List of papers

This thesis is based on the following three papers referred to in the text by Roman numerals. The papers have been reprinted with permission from the publishers.

Paper I

Hayes-Mejia, R., & Stafström, M. (2023). Psychosocial work environment and mental health among the global workforce of seafarers in the wake of the COVID-19 pandemic. BMC Public Health, 23(1), 2151. https://doi.org/10.1186/s12889-023-17035-2

Paper II

Hayes-Mejia, R., & Stafström, M. (2024). Wellbeing and Happiness and Their Association with Working Conditions at Sea: A Cross-sectional Study Among the Global Workforce of Seafarers. Inquiry, 61, 469580241256349. https://doi.org/10.1177/00469580241256349

Paper III

Hayes-Mejia R., Palmieri, J., & Stafström, M. (2026) The influence of health conditions, lifestyle factors and stress on seafarers' self-rated health: A cross-sectional study (Manuscript).

Abbreviations

COVID-19	Corona Virus Disease 2019
EU	European Union
FOC	Flag of Convenience
GAD-7	Generalized Anxiety Disorder Scale
IMO	International Maritime Organization
ILO	International Labour Organization
MLC 2006	Maritime Labour Convention 2006
PEME	Pre-employment Medical Examination
PHQ-9	Patient Health Questionnaire
PSS-10	Perceived Stress Scale
RERI	Relative Excess Risk due to Interaction
SHS	Subjective Happiness Scale
SRH	Self-Rated Health
UNCTAD	United Nations Conference on Trade and Development
WHO-5	The World Health Organization -Five Wellbeing Index

Prologue

Dear Reader,

My name is Leo. I am 42 years old; I am married and have two children waiting for me back home. I have spent the last sixteen years at sea, long enough to know that a seafarer's life is complicated and challenging in ways that are hard to explain to anyone who hasn't lived it. People often try to compare it to land-based work, but out here, it's a world of its own. When the shift ends, we don't go home. We stay onboard, living and working with the same people for weeks or months. Conflicts, tensions, friendships, everything happens in the same confined space, and whatever arises must be resolved right here, because we still share tomorrow.

My wellbeing rises and falls with the rhythm of work. When tasks match my skills and the workload feels fair, I feel steady, sometimes even proud. But when demands stack up or communication breaks down, the strain sets in quickly. I've seen it in others too, the spark they carry on good days, and the heaviness on the hard ones. Like anyone ashore, we all want fair conditions, stability, and a good employer. The difference is simply that we can't step out of the environment when things get tough. We stay in it, together, no matter what.

Life onboard has changed over the years. The old days of gathering socially are mostly gone. Alcohol is often banned, port stays are short, and many colleagues retreat to their cabins to rest. Still, small things help, like a bingo night, a basketball game, a shared joke, or a quiet conversation in the corridor. Working with multinational crews has taught me more about people than any book ever could. These moments of connection give the ship a heartbeat.

I've only sailed with a few female seafarers, and they've been great colleagues, but there are still far too few of them onboard. It's a difficult life to combine with building a family. Unless the industry changes and offers better support, I don't think we'll see many more women choosing this path.

As I am getting older, I think more about my health. I have smoked for over fifteen years but want to quit, it's difficult. I've gained some weight these last years, and small health issues are starting to show. I try to exercise, but tiredness often wins, and even though the food is decent, it's nothing like home cooking. Many of us hide these things, headaches, aches, rising blood pressure, but our bodies always reveal the truth in the end, even when we don't.

I now work on a bunker vessel with a 6/6 rotation, something my wife and I agreed on before we married. I wouldn't go back to the old four- or six-month contracts. Strangely enough, being apart has made our family stronger. When I'm home, I'm truly home. Time together means something.

And looking back, all of this, the good days, the exhaustion, the loneliness, the pride, the connections, the quiet stress, it all formed long before and long after the pandemic. Those pandemic years were harder than most. Even now, the memory of extended contracts and the uncertainty we lived with sits inside me like a bruise. Loneliness became heavier during that time. Extended stays onboard, isolation from families, quarantines, and constant uncertainty took an emotional toll. Younger colleagues seemed to struggle most, carrying anxiety that showed in withdrawn conversations, restless nights, and an unease that never fully settled. Depression surfaced too, though rarely named. Seafarers tend to keep such things to themselves, but the signs were hard to miss. Dwindling motivation, a heaviness beyond physical fatigue, and a mood onboard that felt markedly different from the years before. Loneliness, anxiety, and depression were never strangers at sea, but the pandemic made them harder to ignore.

So, Dear Reader, as you begin this thesis, I hope you will hear our stories between the lines. Behind every percentage, every model, every association, there is someone like me, someone trying to stay healthy, motivated, and human in a world that demands more from us than most people ever see.

Warm regards,
*Leo**

**Leo is a crafted voice; a composite figure shaped from the lived realities reflected in this thesis. Through him, the broader community of seafarers whose experiences underpin these findings is given presence and a human face.*

Background

The global maritime sector contains one of the most distinctive and structurally complex labour environments in the contemporary world economy. Seafarers, who are responsible for safeguarding vessels, cargo, and the uninterrupted flow of global goods, do not operate within a conventional workforce framework. Rather, they inhabit transnational occupational space shaped by intersecting regulatory regimes, multicultural crew compositions, and organisational arrangements that transcend national boundaries. A single oceangoing vessel, whether container, tanker, or bulk carrier, typically hosts approximately twenty crew members who live and work together for extended periods, often months at a time. These individuals may originate from numerous countries, be employed under divergent contractual agreements, and be governed simultaneously by international conventions, flag-state regulations, company policies, and the socio-legal norms of their home nations. As a result, seafarers' working conditions, welfare entitlements, and access to heath support are profoundly heterogeneous, influenced by factors rarely encountered in land-based occupations.

The inherent complexity is further shaped by the maritime industry's regulatory architecture, in which international conventions, flag-states requirements, and company policies intersect. These overlapping systems create differing expectations for employment conditions, welfare provisions, and health-related responsibilities across crews and contract types. As a result, research of seafarers health and wellbeing must account for the structural plurality that characterises maritime labour and the diverse realities experienced by those working at sea.

In response to the industry's need for systematic and credible data, Marine Benefits[1] established Re:fresh, a loss-prevention initiative designed to generate insights to seafarers' health, wellbeing and lived experiences. Since its launch in 2016, the programme has conducted recurring large-scale surveys approximately every two years, with increasing methodological refinement and broader industry participation. Over time, Re:fresh has developed beyond this initial focus on risk management and is increasingly viewed as a valuable source of public health related

[1] Marine Benefits AS is a global provider of health and employment-benefits insurance solutions for the shipping industry, offering medical coverage, claims handling, and crew-support for seafarers worldwide. For more information: https://marinebenefits.no/

insights for the maritime sector, helping to shed light on wellbeing trends among the global seafaring workforces.

Although this thesis draws data from the broader Re:fresh programme, is constitutes an independent scholarly investigation with aims that extend beyond the programme's operational scope. While Re:fresh provides a unique empirical foundation through its large-scale, longitudinal dataset, the thesis applies as deeper analytical lens to examine underlying mechanisms shaping seafarers' health and wellbeing. By engaging the material with theoretical framing, methodological rigor, and focus on emergent research questions, the thesis moves beyond descriptive benchmarking and contributes to academic understanding of maritime labour, occupational health, and the structural conditions of transnational work. In doing so, it identifies conceptual gaps and areas requiring further inquiry, demonstrating how industry-generated data can inform and advance research in this field.

Introduction

Global significance and the unique characteristics of seafaring

Seafarers underpin the functioning of the global economy, enabling the transport of 80-90% of all goods worldwide (UNCTAD, 2021a). The maritime sector employs approximately 1.9 million seafarers onboard more than 74,000 merchant vessels, comprising roughly 850,000 officers and 1,050,000 ratings. It is estimated that women represent only about 1% of the work force (IMO & WISTA, 2024). Seafaring is one of the most globalised workforces with crews drawing from many counties. For instance, the Philippines, Russia, Indonesia, China, and India account for roughly 44% of all seafarers (BIMCO, 2021).

The scale, diversity, and global reach of this workforce underscore the critical importance of seafaring to the world economy, as well as the urgent need to safeguard seafarers' health and welfare. Their health and wellbeing are foundational to safe and efficient shipping operations. Evidence shows that seafarers' wellbeing is integral to safe and efficient vessel operations, influencing both maritime safety and the resilience of supply chains. Conversely, poor health, stress, or reduced morale at sea increase the risk of human error and operational incidents, with implications for lives, assets, and global trade (Andrei et al., 2020; B. et al., 2013; Çakır, 2019; Kjersti Bergheim, 2015; Yuen et al., 2020). A such, the health and wellbeing of seafarers constitute an issue of international significance.

Occupational demands and health challenges at sea

Occupational challenges

Seafaring is widely recognized as one of the most demanding and hazardous occupations globally (Oldenburg et al., 2010; Roberts 2002; Sagaro et al., 2021). Even with substantial progress in safety and living conditions compared to earlier eras, seafarers today still face a constellation of job hazards and stressors that are particular to life at sea. Seafarers work in physically strenuous and high-risk environments that expose them to various chemical, physical, and ergonomic

hazards contributing to elevated rates of occupational injury and illness (Slišković & Penezić, 2017). Long working hours, and rotating shift schedules commonly disrupt circadian rhythms, resulting in chronic fatigue and sleep disturbances. Daily tasks often involve heavy manual labour, sustained vigilance under unstable conditions, such as rough seas, extreme weather, and constant exposure to noise, vibration and hazardous machinery (Brooks & Greenberg, 2022; Carotenuto et al., 2012; Jepsen et al., 2015; Oldenburg et al., 2020). In addition to these physical demands, seafarers face significant psychosocial stressors. Extended periods away from home, typically structured in month-long cycles at sea, followed by months on leave, combined with social isolation, confined living spaces, and limited recreational opportunities, often leading to eroded psychological wellbeing (Carotenuto et al., 2012). Restrictions on communication and the decline in traditional shore-leave, driven by faster ports operations and heightened security protocols, further intensifying feelings of loneliness and isolation. Moreover, as crew members usually spend several months onboard, with little opportunity to take breaks in normal social settings, blurring the boundaries between work and rest. Research shows that conflicts between work time and rest or sleep are common and linked to poorer quality of life among seafarers (Buscema et al., 2023). In effect, seafarers live at work, a situation that magnifies works stressors and reduces access to normal coping outlets.

Psychological health challenges

Due to the challenging nature of their work environment, seafarers are exposed to considerable occupational stress and heightened health risks. Physical demands such as fatigue, persistent noise, and irregular shift patterns often intersect with psychological pressures such as isolation and intense job responsibilities (Brooks & Greenberg, 2022). A small but growing body of research indicates seafarers experience high levels of stress, anxiety, depression and other psychological health concerns while onboard (Carotenuto et al., 2012; Hayes-Mejia & Stafström, 2023; Mellbye & Carter, 2017; Nittari et al., 2022; Oldenburg et al., 2010; Sampson & Ellis, 2019; Yassin et al., 2022).

Stress experienced by seafarers arises from a variety of factors. Occupational sources include demanding workloads, limited decision-making authority, and the ongoing responsibility for ensuring safety, all of which can be compounded by low job satisfaction and inadequate managerial support (Jensen & Oldenburg, 2019; Jepsen et al., 2015; McVeigh et al., 2019). Additionally, the social environment aboard ships plays a significant role. While positive interpersonal relationships can help alleviate stress, negative dynamics such as interpersonal conflict, bullying or ineffective leadership tend to intensify it (Aikaterini et al., 2019; McVeigh et al., 2019).

Physical health challenges

Alongside psychological stress, seafarers are also exposed to significant physical health risks. Research consistently highlights elevated rates of overweight and obesity, diabetes, hypertension, and other cardiovascular risk factors among this population (Aikaterini et al., 2019; Sagaro et al., 2021). Additionally, musculoskeletal disorders and gastrointestinal conditions are commonly reported (Belliveau & Journeay, 2025; Lukas Belz et al., 2024).

Lifestyle challenges

Lifestyle factors also play a significant role in seafarers' health. Sleep deprivation, unhealthy diet, insufficient physical exercise, and smoking are consistently associated with poorer health outcomes onboard (Oldenburg et al., 2013; Slišković & Penezić, 2017). Due to the nature of their work, access to healthy options and limited time and opportunities for recreational activities (Neumann et al., 2021) (Oldenburg & Jensen, 2019), maintaining a healthy lifestyle can be challenging for this occupational group. In a study among Filipino seafarers, high rates of smoking, inadequate physical activity and poor dietary habits were identified as key contributors to increased cardiovascular risk. Knowledge gaps regarding preventive measures and early recognition of symptoms further compounded this vulnerability (Gregorio et al., 2016). Physical activity and sleep patterns are also frequently constrained during prolonged ocean voyages, with low levels of physical activity and reduced sleep commonly observed (Youn & Lee, 2020). Additional evidence shows that seafarers experience greater sleep deprivation, higher smoking rates, and poorer dietary patterns at sea compared with when at home, while alcohol consumption and physical activity appear more favourable in the shipping environment (Slišković & Penezić, 2017).

Overall, seafarers are faced with complex and interrelated health challenges, shaped by strenuous occupational demands, prolonged social isolation, and restricted lifestyle conditions. The following section explores the regulatory mechanisms designed to safeguard the health and wellbeing of seafarers.

Regulatory framework and the challenge of enforcement

Seafarers' health and safety extend beyond individual or organizational responsibility and are governed by an international regulatory framework, such as the International Labour Organization (ILO) and the International Maritime Organization (IMO). Central to this framework is the Maritime labour Convention (MLC 2006), also known as the *Seafarers' Bill of Rights*. It sets out seafarers' rights to decent working and living conditions. Through its five Titles it covers: 1) the minimum requirements for seafarers to work on a ship, 2) conditions of

employment, 3) accommodation, recreational facilities, food and catering, 4) health protection and medical care, welfare and security protection, and 5) compliance and enforcement (ILO, 2023). In principle, the MLC 2006 and related instruments form a baseline intended to protect seafarers' welfare and prevent extensive fatigue or exploitation at sea (Exarchopoulos et al., 2018; Fotteler et al., 2020; McConnell et al., 2011).

The MLC 2006 is commonly referred to as the fourth pillar of the international maritime regulatory framework, alongside 1) SOLAS (the International Convention for the Safety and Life at Sea), 2) MARPOL (International Convention for the Prevention of Pollution from Ships), and 3) STCW (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (Fitzmaurice, 2023; Joseph & Dalaklis, 2021; Türkistanli, 2024). Together these conventions shape the international maritime regulatory regime, each contributing in different ways to the safety and health of seafarers.

Yet the effectiveness of this framework is challenged by the structure of the shipping industry itself. The governance of commercial shipping is complicated by its inherently transnational organizations. Vessels are often owned in one state, flagged in another, operated across multiple jurisdictions, and crewed by seafarers recruited through agencies located elsewhere. For an individual seafarer, this may involve being a national of State A, hired in State B, employed by an owner in State C, serving on a ship flagged to State D, currently berthed in State E, and regularly transiting the waters of States E, F and G, illustrated by the figure (1) below.

Figure 1: Illustration of a seafarer's multi-state employment and mobility network

Source: Created by Author, illustrated by Ken Tungol.

Although the flag state bears primary responsibility for enforcing maritime standards, the widespread use of flags of convenience (FOC) e.g., registrations in states with limited regulatory oversight, can obscure accountability and has been linked to heightened risk of exploitation, substandard working conditions, wage violations and even crew abandonment (Galli & Rossell, 2024). Seafarers from lower income nations may feel compelled to accept substandard working conditions due to fears of job loss, blacklisting, underscoring the gap between the regulatory standards and their effective implementation.

The COVID-19 pandemic and seafarer's wellbeing

The challenges outlined above are further intensified during international crisis. Seafarers are particularly vulnerable during such events, as crisis often leads to extended contracts, restrictions on shore leave, and heightened uncertainty, all of which carry significant health and wellbeing implications, especially for mental health. These patterns have been observed not only during geopolitical conflicts, such as those in Ukraine and now in Iran, but became especially visible during the COVID-19 pandemic, which is also the context in which the data for this thesis (Papers I and II) was collected. Against this broader backdrop of crisis-vulnerability, the COVID-19 pandemic provides the clearest recent example of how global disruptions can exacerbate existing weaknesses within the maritime labour system and significantly affect seafarers' health and wellbeing.

The above-mentioned shortcomings became evident during the COVID-19 pandemic, which triggered a global crew change crisis. Travel bans and quarantine rules made it nearly impossible to carry out crew rotations, resulting in tens of thousands of seafarers being forced to remain onboard well beyond their contractual duty (Schubert, 2021). The United Nations Conference on Trade and Development (UNCTAD) refers to the pandemic as "an un precedented humanitarian crisis for seafarers" (UNCTAD, 2021b). An estimated 400,000 seafarers remained stranded at sea, while a comparable number were unable to join vessels and were left waiting at home. As Doumbia-Henry notes, COVID-19 exposed profound vulnerabilities in global shipping, revealing how fragile the enforcement of maritime labour standards becomes during global crisis and how quickly seafarers' welfare can be sidelined under commercial and logistical pressures. The pandemic underscored the essential, yet frequently overlooked, role of seafarers and reinforced the need for stronger protections (Doumbia-Henry, 2020).

The COVID-19 pandemic had a profound and far-reaching impact on seafarers' mental health, amplifying pre-existing risks related to isolation, long working hours and limited access to support. Studies conducted during the pandemic consistently demonstrate elevated levels of mental health problems among seafarers. Baygi et al.

(2021) reported increased levels of depression, anxiety, and general psychiatric disorder significantly increasing with longer time onboard. Similarly, Zamora er al. (2021) that among cargo seafarers, 30% experienced anxiety, and 37% depression. Daily social media exposure exceeding two hours, together with less occupational experience, and being non-Catholic emerged as a notable risk factors. Another study among U.S mariners, identified strong links between COVID-19-related concerns, poor sleep, adverse onboard experiences, and weak safety climate and higher odds of depression, anxiety and stress (Yassin et al., 2022). Beyond documenting increased psychological distress, research also highlighted important protective factors. Pauksztat et al. (2022) showed that while the pandemic heightened chronic fatigue and mental health problems, peer support onboard, external social support, and reliable internet access significantly buffered the negative effects of prolonged isolation and disrupted routines. These findings echo qualitative evidence from Carrera-Arce et al. (2022), who noted that seafarers viewed mental health as central to their overall health and identified rest, improved communication and social interaction as critical determinants during the pandemic.

These studies show that the pandemic intensified existing vulnerabilities in the maritime labour system, revealing the fragility of wellbeing protections at sea and underscoring the urgent need for stronger organizational support, better communication, and more resilient regulatory safeguards to protect seafarers' health and wellbeing during future global disruptions.

Theoretical underpinnings and conceptual framework

Understanding seafarers' health requires a framework that can capture the complex interplay between the individual, organisational, and structural determinants within the globalised maritime industry. To support this analysis, two complementary models form the theoretical foundation for this research: Dahlgren and Whitehead's ecological model of health determinants (Bambra et al., 2010; Dahlgren & Whitehead, 1991; Dahlgren & Whitehead, 2021), and Labonté's holistic health promotion framework (Labonte, 1993). Together, these models provide a multi-layered perspective that highlights both the proximal and distal forces shaping seafarer wellbeing, offering a robust conceptual basis for analysing health within the unique world of international shipping.

Dahlgren and Whitehead's ecological model of health determinants

Dahlgren and Whitehead's model (Bambra et al., 2010; Dahlgren & Whitehead, 1991), conceptualizes health as the product of multiple layers of influence that extend beyond individual behaviour. The model commonly illustrates a series of circular layers that begin with the immutable individual characteristics (age, sex, genetic factors), and expand outwards to include lifestyle choices, social and community networks, living and working conditions, and the wider socio-economic, cultural and environmental context. The model demonstrates how upstream structural and societal forces shapes opportunities, constrains, and exposures that influence individual health outcomes.

Within the maritime context, the ecological model offers a useful foundation for situating seafarers' health within the broader systems they inhibit. Individual behaviours and interpersonal dynamics onboard are not isolated determinants, but are shaped by organizational practices, regulatory environments, global labour supply chains, and economic pressures that define life at sea. The model thereby foregrounds the importance of considering multiple levels of influence, including those far beyond the individual worker, when analysing health patterns and

disparities among seafarers. The model below has been adapted to reflect the specific conditions of the maritime environment, including the regulatory frameworks, mentioned in the background chapter.

Figure 2: Ecological model of health, adapted from Dahlgren and Whitehead (1991)

Source: Created by Author based on Dahlgren and Whitehead (1991), illustrated by Ken Tungol.

Labonté's holistic model of health

Labonté's holistic model of health provides a useful lens for examining seafarers' health within the structural and globalised context of contemporary shipping. Labonté conceptualizes health as an interconnected set of experiences arising from the dynamic interaction between the physical, mental, and social dimensions of human life (Labonte, 1993). He also argues that health is shaped not solely by individual behaviours or lifestyle factors, but by broader social and economic structures that enable or constrain health-related choices (Labonté, 1993). This perspective is particularly relevant to seafarers whose working and living conditions are largely dictated by global labour markets, regulatory environments and commercial pressures beyond their control.

In Labonté's model of health, the three dimensions are not treated as separate spheres, but are understood as overlapping domains in which wellbeing is created

through the interplay of bodily energy, emotional meaning, and social connection in everyday life. The *physical dimension* concerns bodily vitality, energy, and the ability to participate in daily meaningful activities. In the model, physical wellbeing is not merely the absence of disease, but the experienced capacity to do the activity that one enjoys, participate in life, and maintain functional energy, contributing to feelings of vitality and liveliness. This dimension contributes to the core experiences like feeling vital and energetic. The *mental dimension* includes psychological wellbeing, emotional regulation, and a sense of purpose and control. Labonté emphasizes that people experience wellbeing when they feel they have agency over their life and living conditions, and when their activities are connected to something meaningful. Psychological wellbeing, in this sense, is rooted in empowerment, people´s sense of having influence over their circumstances. The *social dimension* encompasses relationship, belonging and connectedness. Labonté highlights the importance of supportive relationships, supportive environments, and a felt sense of community. Social wellbeing emerges through positive social interactions, trust, and the experience of being part of a wider collective.

Figure 3: Holistic model of health and wellbeing (Labonté, 1993)

Source: Created by Author, based on (Labonté, 1993), illustrated by Ken Tungol.

Together, these three domains converge to produce the experiential qualities of wellbeing, such as vitality, agency, meaningful engagement, and social connectedness, positioning health as a multidimensional and contextually shaped experience.

In his model, Labonté also identifies six commonly expressed experiences that people describe as “health” or “wellbeing”, located in the areas where the three

dimensions overlap. Beyond the core elements of vitality, connectedness and meaning, he shows that the overlap between the social and physical domains is reflected in the enjoyment of positive social relationships, whereas the overlap between the physical and mental domains is expressed through the ability to carry out activities one enjoys, and the intersection of the mental and social domains, is associated with experiencing a sense of control over one's life and living conditions.

When viewed through the lens of seafaring, Labonté's holistic model aligns closely with the closely with the lived conditions that shape seafarers' wellbeing at sea. The physical, mental and social dimensions he identifies, are each distinctively influenced by the structural realities of maritime work.

Furthermore, Labonté argues that this conceptualization of positive health offers a basis for rethinking how health systems, health promotion , and community-based services are designed. Instead of organizing services primarily around prevention or treatment of disease, the model encourages planning that reflects the experiences that constitute wellbeing. The six speres thereby function as guideposts for the kind of lived experience we would seek to understand and measure if our focus were genially on health, as opposed to the absence of illness, as an outcome.

Although developed independently, Dahlgern and Whitehead's ecological model and Labonté's health promotion framework offer mutually reinforcing perspectives. The ecological model provides a broad, layered understanding of *where* health determinants are located, spanning individual characteristics, living and working conditions, community networks, and wider socioeconomic and policy environments. Labonte's model complements this by illustrating *how* these determinants shape the lived experience of health.

Together, the two frameworks support a comprehensive analysis of seafarer health. Dahlgren and Whitehead map the structural environmental layers in which determinants operate, while Labonté clarifies how these layers interact to shape wellbeing across physical, psychological and social domains. Their combined use enables a nuanced understanding of seafarer wellbeing that captures both ecological complexity and the structural constraints embedded in the globalised maritime sector.

Integrating the thesis within the Labonté-Dahlgren and Whitehead framework

The three papers included in this thesis can be situated within Labonté's holistic model of health (Labonté, 1993). Each paper aligns most closely with one of these domains, yet all exhibit overlapping elements, reflecting the integrated nature of health that Labonté describes.

Paper I primarily addresses the mental dimension, examining seafarers' psychological wellbeing and the elements that contribute to purpose and perceived agency. Paper II focuses on workplace experiences, aligning with the social dimension, including interpersonal relations, social support, group dynamics, and the broader shipboard environment that shape belonging and connectedness. Paper III brings in physical health and lifestyle behaviours, corresponding to the physical dimension of the model.

Although each paper aligns with a particular domain, their findings overlap. Psychological wellbeing (Paper I), working conditions (Paper II), and physical health and lifestyle factors (Paper III) intersect in ways that mirror Labonté's view of health. Workplace dynamics affect psychological health, lifestyle behaviours influence physical energy and emotional balance, and feelings of control or purpose are shaped by social and organizational conditions. Together, the papers illustrate the interconnectedness central to Labonté's model.

The ecological perspective by Dahlgren and Whitehead (1991) further situates these determinants within broader environmental and societal layers, and in combination with Labonté's holistic model, provides a comprehensive understanding of seafarer health and wellbeing.

Rationale

The maritime work environment presents a unique blend of physical, psychosocial, and regulatory challenges. Long before COVID-19, research pointed to issues like occupational stress, limited social support, and fatigue at sea (Carotenuto et al., 2012), yet systematic evidence on seafarers' health and well-being remained scarce.

The pandemic amplified these challenges while drawing unprecedented attention to the plight of seafarers from international organizations and the broader public . At the same time, on-going efforts by regulators and industry stakeholders, such as the MLC 2006 and STCW conventions, underscore a growing recognition that seafarers' health, safety, and welfare are integral to sustainable maritime operations (Doumbia-Henry, 2020).

There is a clear need for more research and attention to seafarers' health and wellbeing. In contrast to many other high-risk occupations, the maritime workforce has not been studied in depth, and significant knowledge gaps remain (Li et al., 2022).

Against this backdrop, the present thesis investigates the key determinants of mental, psychological, and physical health among seafarers, using data from large-scale surveys in 2022 and 2024. By examining factors ranging from shipboard working conditions and organizational support to personal health behaviours and stress levels, this research aims to enrich the understanding of seafarers' well-being and to inform policies and interventions that can better protect the health of this vital global workforce.

Aim and objectives

The overarching aim of this thesis was to advance understanding of health and wellbeing among international seafarers by examining determinants of mental, psychological, and physical health, and assessing the extent to which these conditions may impair them. The knowledge generated is intended to inform the development of preventive strategies at both policy and organizational levels.

Specific aims

Paper I

To investigate how different factors were associated with outcomes of stress, anxiety and depression among international seafarers during the COVID-19 pandemic. The main hypothesis being that the mental health among seafarers was affected by onboard COVID-19 mitigations strategies, independent from the general psychosocial environment.

Paper II

To investigate if seafarers' experiences of their onboard work environment are associated with wellbeing and happiness. And to examine which indicators of the work environment have an effect and in which direction.

Paper III

To investigate the associations between poor SRH and various health conditions, to investigate the impact of lifestyle factors on SRH, and to explore how these associations are modified by stress, among active-duty international seafarers.

Key terminology and definitions

Seafarer: Any person "who is employed or works in any capacity onboard a ship" to which the Maritime Labour Convention applies (ILO, 2023).

Health: "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" as defined by the World Health Organization (WHO) (Schramme, 2023).

Wellbeing: A holistic indicator of psychological functioning that includes emotional balance, vitality, and daily functioning, measured by the WHO-5 wellbeing index.

Mental health: Indicators of psychological strain such as stress, anxiety and depression.

Psychosocial work environment: The organisational and social conditions that shape seafarers' daily onboard experiences.

Self-rated health (SRH): A global measure of perceived general health that captures integrated physical, mental and psychosocial influences.

Lifestyle behaviours: Health-related behaviours including sleep, physical activity, alcohol use, screen time, and loneliness.

Stress: A psychological and physiological response to demands, and functions as a central mechanism linking work environment to mental and physical health.

Workload: The amount, pace and intensity of tasks assigned with a specific time frame, treated as a job demand and effect modifier in this thesis.

Happiness: A subjective emotional state reflecting joy, contentedness, and satisfaction with life.

Social connectedness: The quality of interpersonal relations onboard, loneliness, group cohesion, support, bullying, discrimination, and access to someone to talk to.

Safety consciousness: Perceptions of safety norms, leadership, and practices onboard.

MLC 2006: The Maritime Labour Convention 2006, an international regulatory baseline defining minimum standards for seafarers working and living conditions, including employment rights, rest, medical care, and welfare.

Materials and Methods

This thesis examines key determinants of seafarers' mental, social, and physical health. Paper I investigate stress, anxiety, and depression during the COVID-19 pandemic. Paper II explores how subjective work experiences shape wellbeing and happiness onboard. Paper III analyses how health conditions and lifestyle factors relate to self-rated health, including the moderating role of stress.

Table 1: Summary of materials and methods used in this thesis

PAPER	I	II	III
Study design	Quantitative Cross-sectional	Quantitative Cross-sectional	Quantitative Cross-sectional
Data source	Self-administered questionnaire, 2022	Self-administered questionnaire, 2022	Self-administered questionnaire, 2024
Population	17,861 international seafarers onboard and at home	13,008 international seafarers onboard	22,432 international seafarers onboard
Exposures	Work-related factors: Delay in crew change Safety consciousness Workload Social atmosphere Social interactions Employer Covid-19 scale	Work experiences: Satisfaction Expectations Ideal job Skills and training Challenges Workload	Health conditions Lifestyle factors: Sleep Physical activity Loneliness Smoking Alcohol Screen time Stress (PSS-10)
Outcomes	Stress (PSS-10) Anxiety (GAD-7) Depression (PHQ-9)	Wellbeing (WHO-5) Happiness (SHS)	Self-rated health (SRH)
Data analysis	Multivariate linear regression Stratified linear regression Cronbach's Alpha	Bivariate logistic regression Multivariate regression Stratified multivariate regression Cronbach's Alpha	Bivariate regression Multivariate regression RERI interaction analysis
Publications	BMC Public Health 2023, 23(1):2151	INQUIRY: The Journal of Health Care Organization, Provision, and Financing. 2024;61	Manuscript

Study design and collaboration

This chapter presents the unified methodological approach underlying the three papers included in this thesis. While all studies share a common survey platform, sampling strategy, and data-collection procedures, each paper focuses on distinct outcomes and exposure variables. Therefore, this chapter first outlines the overarching study design and data-collection processes, followed by paper-specific subsections describing the primary outcomes and main exposure variables relevant to each study.

All three studies (Papers I-III) were conducted as quantitative cross-sectional data analyses, collected through large-scale online surveys. Data collection was carried out in collaboration with Marine Benefits AS[2], a Norwegian insurance provider serving international shipping crews, who facilitated access to the study population and distributed survey links. The collaboration enabled access to a diverse multinational population of seafarers across a wide range of vessel types, companies, and ranks. Ethical approval and data protection procedures are described in the Ethical considerations section.

Population and sampling

Survey administration procedures

Across all studies, standardized data-collection procedures were used. Survey links were distributed via the participating companies' HR or manning departments. The seafarers could access the survey link either through emails or a QR-code posted in the mess hall or other common areas onboard. The surveys were administrated in English, the mandated working language in international shipping (James et al., 2018). Four reminders (2022) and two (2024) were issued to maximize participation.

2022 Survey round (Paper I and II)

In 2022, the survey link was distributed to approximately 160,000 seafarers both onboard and at home at the time of the survey. Of these, 28,105 provided consent and 17,861 completed the full questionnaire and were included in Paper I. Paper II

[2] Marine Benefits AS is a global provider of health and employment-benefits insurance solutions for the shipping industry, offering medical coverage, claims handling, and crew-support for seafarers worldwide. See more: https://marinebenefits.no/

used the subset of 13,008 onboard respondents to ensure direct relevance to real-time experiences at sea.

2024 Survey round (Paper III)

The 2024 data collection involved 52 shipping and manning companies and reached an estimated 200,000 seafarers globally. A total of 36,446 responses were received, and Paper III included 22,432 onboard seafarers to ensure consistency of occupational exposure.

Measurement approach shared across studies

All surveys included a common set of core measures to capture demographic characteristics, psychosocial and occupational factors, and key health-related indicators relevant to seafarers' wellbeing. Demographic variables (e.g., age, gender, nationality, rank, vessel type, and time at sea), provided contextual information for describing the study population and adjusting statistical models. The survey also assessed features of the psychosocial work environment, including workload, social atmosphere, and safety perceptions, as well as health-related behaviours such as sleep, physical activity, smoking, alcohol use, loneliness, and screen time, with the latter set emphasised in the 2024 survey. Details of the scales, coding procedures, and data quality checks are provided in the paper-specific sections and in the additional measurement details sections below.

Paper-specific outcomes and exposure variables

This section describes each paper's analytic focus, beginning with its primary outcomes followed by the main exposure variables used to explain or predict those outcomes.

Paper I: Psychosocial work environment and mental health during COVID-19

Paper I, investigated how seafarers' mental health was shaped by both the extraordinary circumstances of the COVID-19 pandemic and the everyday features of their psychosocial work environment (Hayes-Mejia & Stafström, 2023). The study focused on three primary mental health outcomes; stress, anxiety, and depression, assessed using validated psychometric instruments. Stress was measured using the Perceived Stress Scale (PSS-10) (Cohen & Janicki-Deverts, 2012; Cohen et al., 1997; Lee, 2012), and anxiety was measured using the Generalized Anxiety Disorder Scale (GAD-7) (Plummer et al., 2016; Spitzer et al.,

2006). Depression was measured using the Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001).

These measures provide a robust indication of psychological strain within the international maritime workforce during a period marked with global uncertainty and operational disruption.

To understand the factors associated with these outcomes, Paper I examined a set of exposure variables that reflected pandemic-specific challenges, rapidly altered routines, erosion of policies, and travel restrictions that prolonged time at sea for many seafarers. Additional items captured perceptions of employer communication during the pandemic, including the clarity, frequency, and transparency of updates, an important determinant of psychosocial security during crises. The study also incorporated indicators of safety consciousness and key psychological dimensions such as workload, and quality of social atmosphere onboard, acknowledging the role of interpersonal relations and support in buffering stress. Socioeconomic characteristics, including rank, vessel type, and nationality (grouped by region) were included to account for structural differences that may influence mental health risks.

By combining validated mental health outcomes with a comprehensive set of exposure variables, Paper I provided a detailed and contextual grounded assessment of how both routine working conditions and pandemic-related disruptions contributed to seafarers' psychological wellbeing during this unprecedented period.

Paper II: Subjective work experience, wellbeing and happiness

Paper II explored how seafarers' personal experiences of their work shaped two key indicators of psychological wellbeing. General wellbeing was measured with the WHO-5 Wellbeing Index (Bech et al., 2003; Topp et al., 2015), and happiness was measured using the Subjective Happiness Scale (SHS) (Lyubomirsky & Lepper, 1999) (Hayes-Mejia & Stafström, 2024). Together, these outcomes capture both emotional functioning and overarching life satisfaction, providing a holistic view of positive mental health in the maritime context.

To understand what drives variation in wellbeing , and happiness among seafarers, Paper II centred on the concept of subjective work experience, a multidimensional construct reflecting how individuals perceive and interpret their daily working lives onboard. This included several interrelated conditions. *Satisfaction* captured overall contentment with one's job, encompassing the nature of the work, working conditions, compensation, and social relationships with colleagues and supervisors. *Expectations* refer to the degree to which the job meets the employee's initial expectations regarding the role, responsibilities, and work environment. The dimension of the *ideal job* assessed how closely their current position aligned with their personal vision of an optimal or desired job.

Paper II also examined perceptions related to *skills and training* addressing whether seafarers felt their skills were effectively utilised and whether opportunities for further training and development were accessible. The *challenges* dimension captured the perceived difficulty and complexity of seafarers' tasks, reflecting day-to-day obstacles and operational demands. Finally, *workload* assessed both the amount of work and its pace, serving as in indicator of task intensity and work pressure.

By integrating these dimensions, Paper II offered a nuanced and comprehensive understanding of how seafarers evaluate their work and how these subjective interpretations influence their overall wellbeing and happiness onboard.

Paper III: Health conditions, lifestyle behaviours, stress and self-rated health

Paper III explored how seafarers' overall health status, captured through the widely used measure of Self-Rated Health (SRH) (Balaj, 2022; Cullati et al., 2018; Darviri et al., 2011; Jylhä, 2009; Jylhä et al., 2006), was associated with a combination of physical health conditions, lifestyle behaviours, and psychological stress. SRH was addressed using a single, global question commonly employed in epidemiological research (How do you rate your health in general?), subsequently dichotomized into categories of good and poor health to facilitate interpretation and comparison with established population-health literature (Alvarez-Galvez & Salvador-Carulla, 2013; Baćak & Ólafsdóttir, 2017; Idler & Benyamini, 1997).

To identify factors associated with variations in SRH, Paper III examined three domains of exposure variables. The first, *health conditions*, encompassed self-reported chronic illnesses, experiences of pain, and other health issues. The second domain, *lifestyle behaviours*, included indicators of sleep quality, physical activity, smoking habits, alcohol consumption, loneliness, and screen time. These behaviours are particularly relevant in the maritime context , where extended periods at sea, isolation from family, and demanding work schedules can shape opportunities for healthy routines.

The final domain centred around stress, measured using the PSS-10 instrument. In addition to being examined as an independent predictor of health status, stress was also evaluated as a potential effect modifier to determine whether it altered the strength or direction of association between lifestyle behaviours, health conditions, and SRH. This analytical approach allowed the study to assess not only the direct contribution of stress but also its potential amplifying or buffering role in seafarers perceived health.

Data analysis

The analytical strategies applied across Papers I-III were designed to address each study's specific research aims while ensuring methodological coherence, statistical rigor and transparency. Descriptive statistics were first used to summarize sample characteristics and assess variable distributions.

Regression modelling

Different regression models were selected based on the type of outcome.

Paper I, applied multivariable linear regression for continuous mental health outcomes (PSS-10, GAD-7, PHQ-9), followed by a stratified analysis (Hayes-Mejia & Stafström, 2023).

Paper II used multivariable logistic regression for dichotomized wellbeing (WHO-5) and Happiness (SHS) outcomes, with stratified analyses to explore potential effect modification by workload (Hayes-Mejia & Stafström, 2024).

Paper III, applied multivariable regression for self-rated health (SRH), supplemented with a RERI interaction analysis to test whether stress modified associations between lifestyle behaviours and SRH.

Model adjustment and diagnostics

All models were adjusted for core demographic and occupational covariates including age, rank, vessel type, and time spent onboard, to account for structural differences within the seafaring population.

Psychometric instruments used across studies were assessed for internal consistency using Cronbach's alpha to verify scale reliability. This approach ensured methodological consistency and robust estimations across papers I-III.

Use of artificial intelligence

Artificial intelligence (AI) was employed in this thesis, for the purpose of enhancing textual precision through grammar checking, linguistic refinement, and translation. The AI tool used for these functions was Copilot. I take full responsibility for the content.

Ethical considerations

The research was conducted in accordance with applicable ethical guidelines and data-protection guidelines, with approval granted by the Swedish Ethical Review Authority for the 2022 (Dnr 2022-00444-01) and 2024 (Dnr 2024-01217-01) survey rounds (Etikprövningsmyndigheten, 2023).

Participants received detailed information about the purpose of the study, the voluntary nature of participation, anonymity of responses, and how data would be used for research. Informed consent was required before accessing the survey. No identifying information was collected, and companies did not have access to individual-level data.

Collaboration with Marine Benefits AS supported survey distribution but did not influence study design, data analysis, interpretation, on manuscript preparation, and was not involved in the research beyond data collection. This independence was clearly stated to participants to minimize concerns related to power dynamics, especially given the nature of seafaring employment. Steps were taken to reduce any perceived coercion: participation was voluntary, anonymous, and companies could not determine who responded, and partaking had had no implications for employment or benefits.

Data were securely stored and accessible only to the research team. All procedures were designed to protect participants' confidentiality, reduce risks, and ensure that findings would contribute to improved understanding of seafarers' health and wellbeing without compromising individual privacy or professional security.

Main results

Across the three studies in this thesis, a coherent picture emerges of how psychosocial work environment, subjective work experience, lifestyle factors, and stress shape the health and wellbeing of international seafarers. Although each paper addressed distinct outcomes, mental health, wellbeing, happiness and self-rated health, their results collectively highlight the central role of working and living conditions at sea, as well as the strong modifying influence of stress.

Paper I: Psychosocial work environment and seafarers' mental health (COVID-19)

Paper I, examined the mental health of 17,861 international seafarers during the COVID-19 pandemic, focusing on stress, anxiety and depression. Using responses from both onboard and home-based seafarers in early 2022, the study examined how pandemic-related disruptions and everyday working conditions shaped psychological wellbeing. Key exposures included delays in crew changes, safety climate, workload, social atmosphere, and the clarity and frequency of employer communication (Table 2). The finding showed that mental health outcomes were influenced not only by the exceptional circumstances of the pandemic, but also by underlying psychosocial work environment factors. The results also revealed that seafarers at sea rated their health differently compared to those at home (Table 3).

Protective work environment factors

Despite the unprecedented strain of the pandemic, supportive work environments helped mitigate psychological harm. Seafarers who reported strong safety consciousness onboard, and clear consistent communication form their employers experienced lower levels of stress, anxiety, and depression. In contrast, those affected by delayed crew changes, eroded routines, and policy breakdowns reported significantly worse mental health outcomes. The data revealed a stark divide. Seafarers who remained onboard during the pandemic were considerably more distressed than those who had returned home (Table 4). While stress was present across both groups, prolonged time at sea under restrictive conditions emerged as a

major risk factor for poor mental health. These findings underscore the protective role of effective crisis management, particularly transparent communication and strong safety culture, in safeguarding seafarers' mental wellbeing during global disruptions.

Table 2: Descriptives of the main exposure variables: Due to COVID-19

Variable	Category	Total		At sea		Onshore		χ2*
		n	%	n	%	n	%	
Experienced crew change delays past 6 months	No	7285	39.6	4000	41.0	3285	38.0	<0.001
	Yes, while at home	4537	24.7	2491	25.6	2046	23.7	
	Yes, while onboard	6576	35.7	3256	33.4	3320	38.4	
There has been a positive change in routines?	Strongly disagree	1275	7.1	730	7.7	545	6.4	<0.001
	Disagree[1]	1940	10.8	985	10.3	955	11.2	
	No[2]	3978	22.0	2138	22.4	1840	21.6	
	Agree	8749	48.5	4666	49.0	4083	48.0	
	Strongly agree	2100	11.6	1011	10.6	1089	12.8	
I have become more safety conscious	Strongly disagree	282	1.6	163	1.7	119	1.4	<0.001
	Disagree[1]	297	1.7	156	1.6	141	1.7	
	No[2]	2334	12.9	1263	13.3	1071	12.6	
	Agree	897	49.7	4918	51.6	4052	47.6	
	Strongly agree	6159	34.	303	31.8	3129	36.8	
My workload has increased significantly	Strongly disagree	431	2.4	236	2.5	195	2.3	0.019
	Disagree[1]	678	3.8	351	3.7	327	3.8	
	No[2]	6861	38.0	3728	39.1	3133	36.8	
	Agree	7921	43.9	4109	43.1	3812	44.8	
	Strongly agree	2151	11.9	1106	11.6	1045	12.3	
Now I have more social interaction onboard	Strongly disagree	888	4.9	518	5.4	370	4.4	0.003
	Disagree[1]	1546	8.6	804	8.4	742	8.7	
	No[2]	6777	37.6	3567	37.4	3210	37.7	
	Agree	7562	41.9	4008	42.1	3554	41.8	
	Strongly agree	1269	7.0	633	6.6	636	7.5	
The social atmosphere has improved	Strongly disagree	1059	5.9	611	6.4	448	5.3	<0.001
	Disagree[1]	2304	12.8	1183	12.4	1121	13.2	
	No[2]	5098	28.3	2746	28.8	2352	27.6	
	Agree	8172	45.3	4301	45.1	3871	45.5	
	Strongly agree	1409	7.8	689	7.2	720	9.0	

[1] A bit worse

[2] The same as pre-covid

Table 3: Description of continuous variables applied in the analysis.

	Total				At sea				Onshore				t-test*	Wilcoxon*
	n	Mean	SD	%[1]	n	Mean	SD	%[1]	n	Mean	SD	%[1]	p-value	p-value
Stress	20830	15.87	4.66		11004	16.06	4.65		9826	15.65	4.65		p<0.001	
Anxiety	20087	3.09	3.94	5.6	10630	3.21	4.06	6.2	9457	2.95	3.79	4.9	p<0.001	0.0001
Depression	19430	3.44	4.40	8.3	10298	3.69	4.51	9.1	9132	3.16	4.25	7.5	p<0.001	p<0.001
Time onboard/on shore (months)	23951	3.03	1.96		12634	2.79	1.63		11317	3.29	2.27		p<0.001	
Employer COVID-19 measures scale	17861	31.39	5.69		9426	31.02	5.81		8435	31.81	5.52		p<0.001	

[1]Indicated

*Tests of statistical difference between those at sea and those onshore, for Anxiety (GAD-7) and Depression (PHQ-9) we also tested the proportion of those being indicated as being anxious and depressed between those at sea and those onshore applying the Wilcoxon rank test.

Table 4: Stratified multivariate linear regression analyses of the association between stress, anxiety, and depression and the main exposure variables.

	Stress				Anxiety				Depression			
	At sea		On shore		At sea		On shore		At sea		On shore	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Experienced crew change delays past 6 months	.148	0.004	.104	0.050	.045	<0.001	.0144	0.246	.044	<0.001	.009	0.455
There has been a positive change in routines	-.116	0.021	.022	0.679	-.015	0.167	.004	0.743	-.011	0.286	.001	0.503
I have become more safety conscious	-.222	<0.001	-.193	0.006	-.025	0.071	-.031	0.052	-.038	0.004	-.033	0.032
My workload has increased significantly	.478	0.201	.246	<0.001	.053	<0.001	.023	0.096	.051	<0.001	.011	0.407
Now I have more social interaction onboard	.078	<0.001	.174	0.006	-.046	0.001	-.004	0.796	-.005	0.709	.009	0.512
The social atmosphere has improved	.222	<0.001	.149	0.019	.0160	0.213	.015	0.307	-.014	0.237	.002	0.874
Employer COVID-19 measures scale	-.025	0.009	-.041	<0.001	-.005	0.027	-.001	0.650	-.012	<0.001	-.003	0.211
Model R-squared	*0.264*		*0.244*		*0.253*		*0.204*		*0.309*		*0.261*	

Note: This includes the comparison of those at sea and those onshore, adjusting for both socioeconomic background variables and psychosocial work environment conditions, applying 95% confidence intervals.

Paper II: Work experiences onboard and seafarers' wellbeing and happiness

Paper II shifted focus to positive mental health, examining general wellbeing and happiness among the 13,008 seafarers who were onboard during the 2022 survey. The central question was how subjective work experiences relate to these outcomes. Six dimensions were assessed. Job satisfaction, whether the job meets expectations, alignment with an ideal job, perceived adequacy of skills and training, daily challenges and workload. Analyses controlled for demographic and psychosocial factors such as loneliness and social support onboard.

Table 5: Prevalence of wellbeing and happiness, work experience and psychosocial work environment among seafarers at sea (N=13008).

Outcome variable	Category	Total	
		n	%
Wellbeing	All well	10047	77.2
Happiness	Happy	9941	81.9
Main exposure variables			
Satisfaction	Low	1574	16.1
	Medium	5316	54.3
	High	2898	29.6
Expectations	Low	1216	12.4
	Medium	6372	65.1
	High	2200	22.5
Ideal	Low	1617	16.5
	Medium	6435	65.7
	High	1736	17.7
Training/Skills	Low	931	9.5
	Medium	6371	65.1
	High	2486	25.4
Challenges	Low	1172	12.0
	Medium	6816	69.6
	High	1800	18.4
Workload	Low	1854	18.9
	Medium	6934	70.8
	High	1000	10.2

Psychosocial work environment	Category	n	%
I feel lonely	At no time	3601	36.2
	Some of the time	4515	45.4
	Less than half of the time	475	4.8
	More than half of the time	471	4.7
	Most of the time	491	4.9
	All of the time	387	3.9
I have at least one co-worker to talk to	At no time	1520	15.3
	Some of the time	2644	26.6
	Less than half of the time	371	3.7
	More than half of the time	1509	15.2
	Most of the time	537	5.4
	All of the time	3359	33.8
I feel bullied	At no time	7576	76.2
	Some of the time	1598	16.1
	Less than half of the time	249	2.5
	More than half of the time	168	1.7
	Most of the time	173	1.7
	All of the time	176	1.8
I feel discriminated	At no time	7392	74.4
	Some of the time	1792	18.0
	Less than half of the time	244	2.5
	More than half of the time	162	1.6
	Most of the time	186	1.9
	All of the time	164	1.6
We have group activities onboard	At no time	1450	14.6
	Some of the time	3577	36.0
	Less than half of the time	691	6.9
	More than half of the time	1986	20.0
	Most of the time	1089	11.0
	All of the time	1147	11.5
I get enough sleep	At no time	567	5.7
	Some of the time	2,31	23.2
	Less than half of the time	596	6.0
	More than half of the time	2807	28.2
	Most of the time	930	9.4
	All of the time	2730	27.4

Work experience as key drivers of wellbeing and happiness onboard

Despite two tough pandemic years, most seafarers reported high wellbeing and happiness levels. Crucially, these outcomes were strongly linked with seafarers' work experiences on board. Nearly all the work-experience factors showed a significant association with wellbeing and happiness. Higher job satisfaction, having one's job meet expectations, feeling the job is ideal or a good fit, feeling well utilized in terms of skills and training, and even finding the job appropriately challenging, all associated with substantially higher odds of high wellbeing and greater happiness. For example, the bivariate regression analysis showed that seafarers' who reported high satisfaction, alignment with expectations, or an ideal job fit had roughly 3-4 times higher odds of high wellbeing/happiness compared to those with low satisfaction or poor job fit, see Table 6. This suggests that positive subjective work conditions, such as enjoying one's job and finding it meaningful are key determinants of mental wellbeing at work.

Table 6: Bivariate logistic regression analysis – Subjective work experience variables and the odds for wellbeing and happiness.

	WHO-5			Happiness		
Variable	**OR**	**95% CI**		**OR**	**95% CI**	
Satisfaction	3.7	2.92	3.42	3.9	3.56	4.27
Expectations	3.9	3.56	4.28	4.5	4.09	5.04
Ideal	4.0	3.62	4.35	4.3	3.85	4.71
Training/Skills	2.3	2.07	2.46	2.8	2.51	3.06
Challenges	2.1	1.87	2.23	2.5	2.25	2.76
Workload	.93	.85	1.01	1.1	.99	1.2

Note: presented as bivariate odds ratios (OR) and 95% confidence intervals (CI) among international seafarers while onboard. Source: Hayes-Mejia & Stafström, 2024. Licensed under CC BY 4.0.

One factor, however, stood out as an exception. In the overall analysis, perceived workload (high vs. low) was not directly associated with wellbeing or happiness. In other words, just having a heavy workload didn't automatically predict lower wellbeing if other aspects of the job were positive. However, workload played an important modifying role. When the analysis was stratified, a high workload was found to blunt the benefits of other positive work factors (Table 7). For instance, even a usually satisfying job might not translate into happiness if the crew is overworked to the point of chronic fatigue. This indicates that a manageable workload is necessary to fully realize the gains from improvements in satisfaction expectations, or other factors.

Table 7: Stratified multivariate regression analysis – subjective work experience, wellbeing and happiness stratified by workload.

		Low workload			Medium workload			High workload		
WHO-5		**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
Satisfaction	Low									
	Medium	2.0	1.29	3.03	1.9	1.56	2.40	1.2	0.61	2.23
	High	2.8	1.58	4.94	1.7	1.28	2.28	1.3	0.58	2.71
Expectations	Low									
	Medium	0.9	0.58	1.46	1.7	1.29	2.19	1.3	0.62	2.53
	High	1.4	0.66	2.81	1.9	1.28	2.73	1.4	0.57	3.44
Ideal	Low									
	Medium	2.0	1.34	2.91	1.9	1.57	2.40	2.4	1.32	4.24
	High	2.1	1.04	4.13	2.9	2.05	4.20	3.2	1.50	6.89
Training/Skills	Low									
	Medium	1.1	0.73	1.52	1.0	0.80	1.31	1.7	0.82	3.5
	High	1.0	0.62	1.60	1.0	0.72	1.32	2.0	0.95	4.36
Challenges	Low									
	Medium	1.3	0.98	1.78	1.5	1.13	1.87	1.7	0.81	3.46
	High	1.0	0.57	1.64	1.3	0.93	1.77	1.9	0.89	3.88
Happiness		**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
Satisfaction	Low									
	Medium	1.6	1.04	2.49	2.0	1.56	2.46	3.2	1.55	6.46
	High	3.7	1.94	7.09	2.8	1.98	3.89	2.9	1.27	6.62
Expectations	Low									
	Medium	1.2	0.75	1.88	1.5	1.12	1.92	0.4	0.20	0.96
	High	1.2	0.53	2.54	1.9	1.20	2.93	0.9	0.32	2.75
Ideal	Low									
	Medium	2.0	1.35	3.00	1.4	1.14	1.81	2.5	1.33	4.85
	High	1.9	0.90	4.10	1.9	1.20	2.89	3.2	1.25	7.93
Training/Skills	Low									
	Medium	1.1	0.79	1.66	1.4	1.06	1.72	1.4	0.70	2.70
	High	1.1	0.68	1.84	1.4	1.05	1.99	1.5	0.72	3.08
Challenges	Low									
	Medium	1.5	1.08	1.99	1.4	1.10	1.84	1.6	0.80	3.20
	High	1.6	0.88	2.77	1.3	0.94	1.89	1.7	0.86	3.52

Note: Presented as odds ratios (ORs) and 95% confidence intervals (CIs) among international seafarers onboard. Source: Hayes-Mejia & Stafström, 2024. Licensed under CC BY 4.0.

Paper III: Health conditions, lifestyle factors, stress and self-rated health

Paper III extended the scope and encompasses physical health and overall wellbeing, investigating determinants of seafarers' self-rated heath (SRH). Using a new survey round in 2024, this study analysed 22,432 international seafarers (onboard) who rated their general health. The study examined how SRH was associated with three domains of factors. These were health conditions, lifestyle behaviours and psychosocial factors, and stress.

Overall, SRH among seafarers was remarkably high, describing their health as good or excellent. However, the remaining seafarers, reporting "poor" health provided critical insights, see Table 8.

Table 8: Prevalence of self-rated health, demographic variables, and health conditions with good or poor SRH

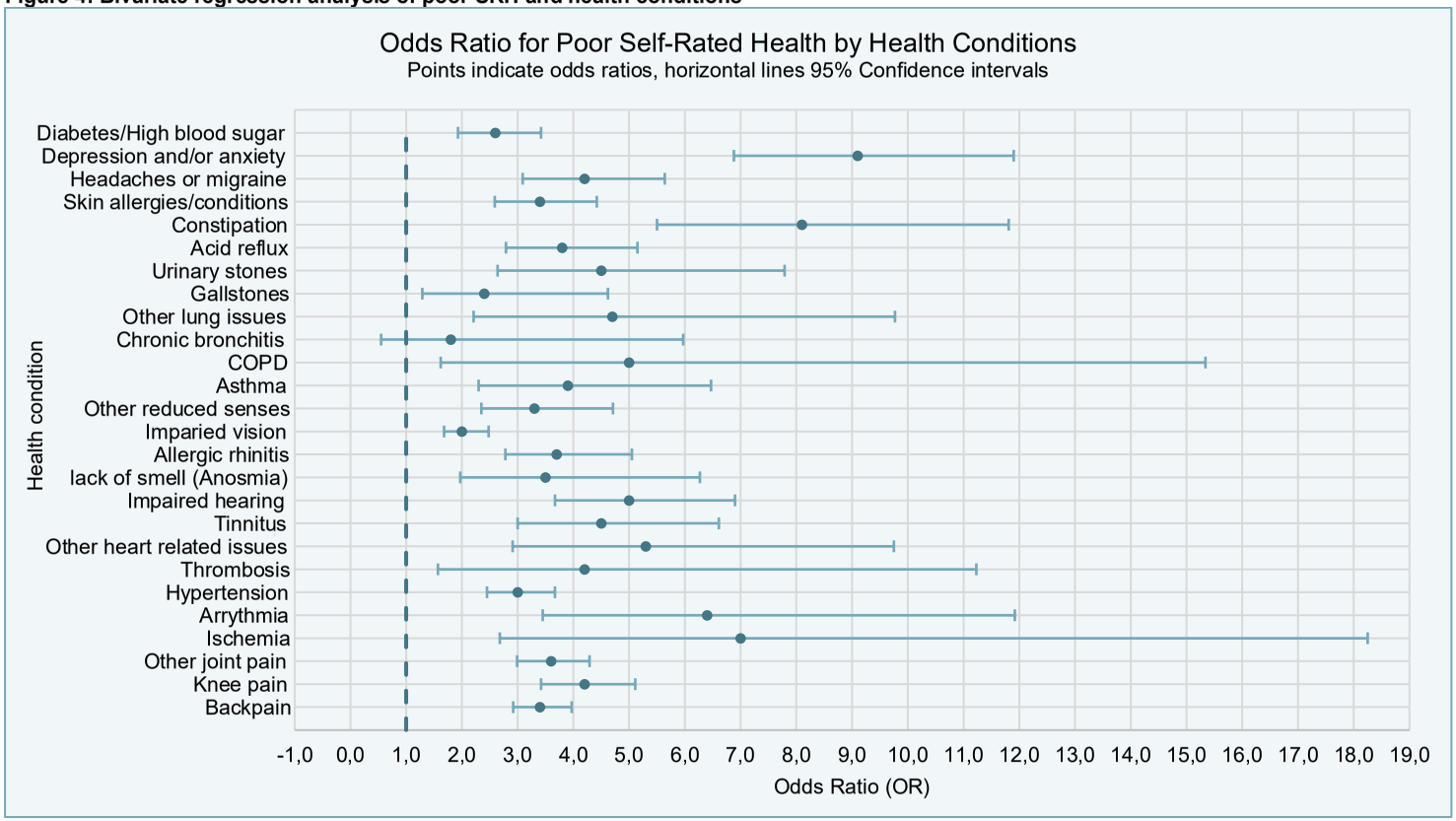
Variable	Category	Total		Good SRH		Poor SRH		
		n	%	n	%	n	%	P-value
Self-rated health	SRH	22,432	100	21,124	94	1,308	6	
Health conditions	Backpain	1,445	6	1,219	84	226	16	0.000
	Knee pain	679	3	550	81	129	19	0.000
	Other joint pain	955	4	796	83	159	17	0.000
	Ischemia	20	0	14	70	6	30	0.000
	Arrythmia	50	0	36	72	14	28	0.000
	Hypertension	971	4	840	87	131	13	0.000
	Thrombosis	25	0	20	80	5	20	0.002
	Other heart issues	58	0	44	76	14	24	0.000
	Tinnitus	155	1	123	79	32	21	0.000
	Impaired hearing	231	1	179	77	52	23	0.000
	lack of smell	79	0	65	82	14	18	0.000
	Allergic rhinitis	300	1	245	82	55	18	0.000
	Impaired vision	1,217	5	1,090	90	127	10	0.000
	Reduced senses	234	1	195	83	39	17	0.000
	Asthma	94	0	76	81	18	19	0.000
	COPD	17	0	13	76	4	24	0.002
	Chronic bronchitis	30	0	27	90	3	10	0.329

	Other lung issues	41	0	32	78	9	22	0.000
	Gallstones	85	0	74	87	11	13	0.005
	Urinary stones	79	0	62	78	17	22	0.000
	Acid reflux	280	1	228	81	52	19	0.000
	Constipation	122	1	82	67	40	33	0.000
	Skin allergies	404	2	336	83	68	17	0.000
	Headaches/migraine	273	1	218	80	55	20	0.000
	Depression/anxiety	238	1	155	65	83	35	0.000
	High blood sugar	472	2	413	88	59	13	0.000
Number of health conditions	0	17,409	78	16,676	96	733	4	0.000
	1	3,063	14	2,834	93	229	7	
	2	1,156	5	1,028	89	128	11	
	3	447	2	350	78	97	22	
	4	357	2	236	66	121	34	
Sex	Male	21,937	98	20,689	94	1,248	6	0.000
	Female	449	2	398	89	51	11	
	Non-binary	46	0,2	37	80	9	20	
Rank	Officers	10,706	49	9,935	93	771	7	0.000
	Non-Officers	10,946	51	10,471	96	475	4	
Cont. variables		*Mean(SD)*		*Mean (SD)*		*Mean (SD)*		
Age		38(10.1)		38 (10.1)		38 (10.1		
Time at sea		3.4 (2.5)		3.4 (2.5)		3.3 (2.5)		

Note: Among (N=22,432) international seafarers onboard.
Source: Paper III, Hayes-Mejia, Palmieri and Stafström (Manuscript).

The bivariate analysis (Figure 4) found that numerous health conditions were significantly associated with poorer SRH, confirming that SRH is a meaningful reflection of objective health problems. In particular, having mental health issues (especially depression or anxiety) was one of the strongest predictors of poor SRH among seafarers. Besides mental health, several physical conditions sharply elevated the risk of poor SRH, for example, musculoskeletal pain (like back pain, knee, or joint pain) was common and strongly linked to poor health ratings. Certain chronic health conditions, such as hypertension, diabetes, some cardiovascular or respiratory issues, and sensory impairments (loss of hearing, vision) also showed significant associations with reporting poor health, Notably, even a seemingly minor issue like constipation emerged as a strong predictor of poor SRH, perhaps relating to the challenges of diet and nutrition at sea.

Figure 4: Bivariate regression analysis of poor SRH and health conditions



Note: Presented as odds ratios (OR) and 95% confidence intervals (CI), adjusted by age.
Source: Created by Author, based on data from Paper III, Hayes-Mejia, Palmieri and Stafström (Manuscript).

Moreover, SRH declined steeply as the number of co-occurring health issues increased. Ther was a clear does-response relationship where each additional health condition dramatically raised the odds of a seafarer reporting poor SRH. For instance, having two conditions was associated with nearly three times the odds of poor SRH compared to none, and having four or more conditions raised the odds more than tenfold (Table 9). This cumulative burden effect means that minor issues together can significantly erode a person's perceived health. Encouragingly, addressing even one health problem can measurably improve overall health, effectively "halving" the risk of poor SRH in some cases.

Table 9: Logistic regression analysis of number of health conditions and SRH

Number of health conditions	Crude OR*			Model 1**		
	OR	***95% CI***		***OR***	***95% CI***	
0						
1	1.8	1.58	2.14	1.9	1.60	2.19
2	2.8	2.32	3.45	2.9	2.34	3.51
3	6.3	4.98	7.99	6.4	5.03	8.15
4	11.7	9.26	14.70	11.5	9.08	14.56
Age				1.0	0.98	0.99
Female				1.7	1.21	2.38
Non-binary				2.1	0.86	4.99
Rank				1.5	1.36	1.74

* Crude odds ratios, presented as odds ratios (OR) and 95% confidence intervals (CI).

** Model 1: Logistic regression between SRH and number of health conditions, adjusted for age, sex, and rank, presented as odds ratios (OR) and 95% confidence intervals (CI).

Note: presented as odds ratios (OR) and 95% confidence intervals (CI), adjusted for age, sex and rank.

Source: Paper III, Hayes-Mejia, Palmieri and Stafström (Manuscript).

Beyond health conditions, lifestyle and psychological factors were strongly associated to SRH. Seafarers with healthier habits and social wellbeing tended to report better health, whereas risky behaviours or poor social conditions predicted worse health ratings. In fully adjusted models, controlling for age, sex, rank, insufficient rest or poor sleep, physical inactivity, smoking, loneliness, and excessive screen time stood out as significantly associated with reporting poor health (see Table 10).

Interestingly, high alcohol use was not significantly linked to poor SRH after controlling for other factors. Heavy drinking did show a slight increase in risk, but the effect was not statistically significant in the full model.

Table 10: Multivariate regression analysis of self-rated health (SRH) and lifestyle factors

Variable	Category	Model 1			Model 2			Model 3		
Lifestyle factors		**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
Physical activity	Active									
	Sedentary	1.6	1.22	2.22	1.7	1.26	2.29	1.7	1.24	2.26
Feeling rested and get enough sleep	Yes									
	No	2.3	1.92	2.65	2.3	1.91	2.65	2.1	1.77	2.46
Smoking	No									
	Yes	1.2	1.02	1.42	1.2	1.03	1.44	1.2	1.04	1.45
Audit-C (Alcohol)	No/low risk									
	Moderate /high risk	1.1	0.94	1.31	1.1	0.93	1.30	1.1	0.90	1.27
Feel lonely	No									
	Yes	2.2	1.84	2.57	2.2	1.85	2.59	2.0	1.65	2.33
Screen time	Limited screentime									
	Excess screen time	1.6	1.27	1.92	1.6	1.33	2.02	1.6	1.33	2.02
Age					1.0	1.00	1.02	1.0	1.01	1.02
Sex	Male									
	Female				1.9	1.15	3.07	1.9	1.15	3.07
	Non-binary				3.0	0.96	9.36	3.1	1.00	9.74
Rank	Non-officer									
	Officer				1.3	1.12	1.57	1.4	1.16	1.63
Time at sea					1.0	0.96	1.02	1.0	0.95	1.02
PSS	Low stress									
	High stress							1.7	1.42	2.02

Model 1 Unadjusted
Model 2 Adjusted for socioeconomic factors (SE)(age, sex, rank and time onboard)
Model 3 Adjusted for socioeconomic factors (SE) and stress
Note: presented as odds ratios (OR) and 95% confidence intervals (CI).
Source: Paper III, Hayes-Mejia, Palmieri and Stafström (Manuscript).

Table 11: RERI interaction analysis between stress, lifestyle factors and self-rated health (SRH) among international seafarers onboard

Lifestyle factors	Physical activity			Rest and sleep			Smoking			Alcohol			Loneliness			Screen time		
Stress and SRH	**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
Low stress /High risk	0.9	0.37	1.54	1.3	0.93	1.72	0.4	0.19	0.69	0.2	0.05	0.44	1.3	0.90	1.76	0.5	0.23	0.95
High stress /Low risk	1.6	0.59	3.29	0.9	0.52	1.27	1.3	0.99	1.76	1.1	0.75	1.61	0.9	0.61	1.33	1.2	0.89	1.55
High stress /High risk	3.1	2.02	4.69	3.6	2.85	4.49	2.0	1.44	2.77	1.8	1.19	2.52	3.1	2.42	3.90	2.9	1.96	4.01
RERI values	0.67			1.45			0.27			0.48			0.87			1.11		
Synergy Index (SI)	1.27			1.67			1.15			1.37			1.39			1.64		
P-values	0.321			0.000			0.436			0.187			0.030			0.021		

Note: Presented as odds ratios (OR) and 95% confidence intervals (CI), RERI, and Synergy Index (SI)
Source: Paper III, Hayes-Mejia, Palmieri and Stafström (Manuscript).

A pivotal finding was the role of stress. Consistent with expectations, seafarers with high perceived stress (PSS-10) scores were much more likely to report poor SRH, compared to those with low stress. In fact, stress emerged as key moderator. The RERI interaction analysis showed that high stress levels exacerbate the impact of other risk factors on SRH (Table 11).

For example, a seafarer who both feels highly stressed *and* is not getting enough sleep has an especially high risk of poor SRH, higher than the sum of each factor's individual effect. Similarly, combinations like high stress + physical inactivity, or high stress + loneliness, or stress + excessive screen time all produced a synergistic increase of the likelihood of poor SRH. In short, stress multiplies the harm of other unhealthy behaviours or conditions, underpinning the importance of stress management as part of any health promotion effort.

Summary of key findings across all papers

In summary, the three papers collectively deepen our understanding of what drives seafarers' mental and physical health. They highlight that the wellbeing of seafarers is shaped by both the conditions in which they work and live, and their personal health and habits. Good communication, reasonable workloads, and supportive social environments on ships can protect and enhance mental health (even in challenging times like a pandemic). At the same time, attention must be paid to the medical and lifestyle challenges seafarers face, managing chronic diseases, improving sleep and fitness, and reducing stress and isolation, to maintain high overall health.

These findings are not just academically interesting. They carry practical implications for maritime policies and company practices. Ultimately, investing in better working conditions *and* health promotion for seafarers will pay dividends in the form of a more resilient, healthy, and productive global maritime workforce. The overarching lesson is that seafarers' health and happiness are driven by a web of interrelated factors, from the quality of their workplace and support networks to their personal habits and stress levels, and all these must be addressed to truly improve their wellbeing.

Discussion

Summary of key findings

Paper I demonstrated that during the COVID-19 pandemic, seafarers' mental health, particularly stress, anxiety and depression, was strongly shaped by work environment conditions. Pandemic-related disruptions, such as delays in crew changes, coupled with poor communication and decreased employer support, significantly heightened psychological distress. Conversely, stronger safety culture and supportive employer practices provided a buffering effect.

Paper II highlighted the positive side of mental health by showing that seafarers' experiences of their working conditions, job satisfaction, fairness, role clarity, skill utilization, and manageable workload, were strongly associated with higher levels of happiness and wellbeing. Thes findings underscored that positive psychological experiences onboard are meaningful determinants of flourishing at sea.

Paper III broadened the analysis to overall health status and found that poor self-rated health (SRH) was associated with multiple interacting determinants, mental health conditions, especially depression and anxiety, poor sleep, physical inactivity, loneliness, smoking, and high screen time. Stress functioned as both an independent predictor and a modifier that strengthened the effect of other risk factors.

Together, these papers reveal a multidimensional landscape in which psychosocial, organizational, lifestyle and structural determinants interlock. Mental health, subjective wellbeing, and physical health are deeply interconnected, with stress emerging as an underlying mechanism linking outcomes across studies.

General discussion

Psychosocial work environment and mental health (Paper I)

The first research question addressed how pandemic-related conditions and onboard psychosocial factors shaped stress, anxiety and depression among seafarers. The findings corroborate earlier research showing elevated psychological strain under uncertainty, prolonged isolation, and restricted mobility (Baygi et al., 2021; Yassin et al., 2022; Zamora et al., 2021). This study extends that evidence by demonstrating that COVID-19 mitigation measures, especially disrupted crew changes, functioned as structural determinants of mental health rather than as merely operational inconveniences. Qualitative work has similarly highlighted lack of rest, isolation, and communication challenges as salient stressors (Carrera-Arce et al., 2022). The protective effects of employer support and safety climate align with occupational health literature on organizational justice, leadership support, and safety culture as buffers against stress (Aikaterini et al., 2019; McVeigh et al., 2019). Overall, even amid global crisis, company-level practices at the meso-level remained powerful determinants of mental wellbeing.

Organizational conditions, work experience, and positive wellbeing (Paper II)

The findings in paper II advance the understudied domain in maritime research by focusing on positive mental health. Happiness and wellbeing were strongly associated with job satisfaction, fairness, alignment between expectations and job realities, and skill utilization. These results reinforce earlier work linking psychosocial work environmental factors to wellbeing (Brooks & Greenberg, 2022; Nielsen et al., 2013; Sampson & Ellis, 2019; Slišković & Penezić, 2015), while adding evidence that meaningful work and fair treatment operate as proactive promoters of happiness. The negative impact of high workload echoes established findings connecting excessive working hours with fatigue, and occupational incidents (Jepsen et al., 2015; M. Oldenburg et al., 2010). Critically, Paper II demonstrates that positive climate factors cannot fully compensate for inadequate staffing or insufficient rest, indicating that wellbeing promotion requires realistic workload management alongside psychosocial investments.

Health conditions, lifestyle factors and self-rated health (Paper III)

Paper III shows that SRH is shaped by an interplay of physical, psychological and behavioural factors. Consistent with earlier maritime research (Belliveau & Journeay, 2025; L. Belz et al., 2024; Sagaro et al., 2021), physical inactivity, poor

sleep, and smoking emerged as key predictors. A major contribution of Paper III is demonstrating the strong association between mental health symptoms and poor SRH, echoing broader public-health evidence that psychological distress is integral to general health perception (Idler & Benyamini, 1997). Loneliness was also a potent predictor, aligning with studies underscoring isolation, limited communication opportunities, and social disconnection as fundamental challenges at sea (Abila et al., 2023; Carotenuto et al., 2012; Pauksztat et al., 2022). The observed stress-interaction effects suggests that chronic psychological strain amplifies vulnerability to existing health conditions, supporting stress process theories within occupational health (Karasek Jr, 1979; Theorell et al., 1990).

Importantly, Paper III's reliance on SRH as the primary outcome is strongly supported by epidemiological evidence. SRH is not merely a subjective impression: decades of research demonstrate that individual's own assessment of their health is a robust predictor for future morbidity and mortality. Early studies showed that SRH predicts mortality risk independently of clinical indicators, suggesting that individuals integrate subtle symptoms, functional limitations, psychological strain, and social factors in ways biomedical measures alone may not capture (Idler & Benyamini, 1997; Perruccio et al., 2012). More recent work (Cullati et al., 2018; Jylhä, 2009) further emphasizes that SRH reflects holistic appraisal incorporating physical, mental, and social dimensions of health. For seafarers, whose health is influenced by complex interactions of work stress, isolation, disrupted sleep, and limited access to care, SRH serves as a particular meaningful summary indicator. When a seafarer rates their health as "poor", this typically signals a convergence of multiple burdens, physiological, emotional, and environmental, with real implications for functioning and risk, and may warrant further assessment .

A further dimension deserving emphasis is the cumulative burden of multiple health conditions and poor SRH. Although paper III examined individual health conditions separately, the pattern of elevated associations across musculoskeletal, cardiovascular, sensory, and chronic conditions suggest that many seafarers experience multimorbidity. In demanding occupational settings such as maritime labour, even relatively modest conditions e.g., joint pain, mild hearing loss, or episodic gastrointestinal problems can, in combination, exert disproportional impact on daily functioning, sleep and perceived wellbeing. Recognising SRH as a holistic measure allows these cumulative effects to be captured when individual conditions seem moderate in isolation, highlighting the importance of addressing not only acute clinical issues but the aggregate load of co-occurring conditions many seafarers carry.

The role of stress across the papers

Across Papers I and III, stress emerged as a notable pattern, with Paper I, showing a clear association with psychological strain. In Paper II, although stress was not

measured directly, workload, one of the strongest predictors to stress, played a central role by shaping how social context and work experiences influenced wellbeing. High workload is a well-established determinant of stress (Bakker & de Vries, 2021), meaning that the workload effects observed in Paper II likely reflect an underlying stress pathway. In Paper III, stress compounded the risk for poor SRH when combined with lifestyle factors.

This tri-paper convergence provides strong evidence that stress is not simply another variable, but a central pathway linking working conditions to mental, emotional, and physical health. The maritime environment, marked by isolation, long contracts, fatigue and operational pressure, creates conditions ripe for chronic stress, which in turn may aggravate both psychological and physical health conditions. Recognizing stress as a cross-cutting pathway underscores the importance of systemic approaches to maritime health promotion. Interventions focusing solely on individual behaviours (e.g., exercise, diet) are insufficient if the structural determinants of stress remain unchanged.

Social connectedness as a protective and risk modifying factor

Social connectedness, or its absence, repeatedly appeared as a determinant of health across Papers II and III, and was consistently associated with poorer wellbeing and mediated through increased stress. In isolation prone environments, social support networks serve as fundamental protective resources (Gable & Bedrov, 2021). This thesis demonstrates that social connectedness not only improves psychological outcomes but may indirectly influence physical health by reducing stress and encouraging healthier lifestyle behaviours.

Unexpected or contradictory findings

Some findings related to wellbeing diverged from initial expectations. Despite the challenging circumstances during the pandemic, several seafarers reported high levels of wellbeing, suggesting possible contributions from resilience, professional identity or strong social cohesion onboard. At the same time, structural stressors such as mobility restrictions and contract uncertainty appeared to outweigh more typical exposures like workload or interpersonal conflict. Finally, the pronounced impact of loneliness on poor self-rated health underscores the central importance of social connectedness in maritime settings, and highlights limitations of interventions that focus solely on individual lifestyle change.

Interpretation through Dahlgren & Whitehead's and Labonté's frameworks

A holistic interpretation of these findings is achieved by situating them within the combined analytical lens of Dahlgern and Whitehead's ecological model and Labonté's structural health promotion framework. Together, these models illuminate the multi-layered organisation of health determinants and the structural mechanisms through which seafarers' agency is enabled or constrained.

Dahlgren & Whitehead: The layered determinants of health

The ecological model (described in the theoretical chapter) depicts health as a product if interacting layers. Individual lifestyle factors (sleep, physical activity, smoking) were central in Paper III but clearly conditioned by the realities of shipboard living conditions. Social and community networks, camaraderie versus isolation, substantially shaped wellbeing (Paper II) and SRH (Paper III). Living and working conditions such as workload, communication quality, job fairness, and safety climate affected stress and wellbeing across Papers I and II. Finally, broader socioeconomic, political and environmental factors became prominent during COVD-19, when global mobility restrictions and fragmented maritime governance intensified stress.

Across all layers, the model helps explain why seafarers' health cannot be understood through individual factors alone. Health emerges from the interplay between personal habits, social relations, organizational practices, and structural conditions.

Labonté's holistic model: Agency, cohesion and structural constraints

While the ecological model indicates *where* determinants reside, Labonté's holistic model clarifies *how* seafarers sustain physical vitality, psychological meaning and agency, and social connectedness. In other words, determinants become health experiences through their effects on the physical, mental, and social domains.

At the individual level, Labonté emphasises empowerment as the felt capacity to act. In shipboard practice, this maps onto opportunities to use skills, experience role clarity, and obtain work satisfaction, all of which support the mental domain (purpose and perceived control) and, by extension, physical activity (energy and reduced strain). When seafarers can apply competence meaningfully and understand expectations, their psychological wellbeing is stronger and stress is lower, consistent with Labonté's focus on agency.

At the interpersonal level, Labonté highlights cohesion and group support. Onboard, cohesive crews, supportive leadership, and respective group climates bolster the social domain (belonging and trust), buffering stress and enhancing mental wellbeing, patterns emphasized in Papers I-II. This group-level social fabric is a

protective condition through which the model's social domain actively supports the mental and physical domains.

At the political and structural level, the results correspond with the structural vulnerabilities in the shipping industry identified by Doumbia-Henry (2020). The pandemic illustrated how quickly structural disempowerment can erode protections, such as repatriation, medical access, contract limits. These upstream determinants, including reliance on labour-sending states, the use of flags of convenience, and uneven enforcements, are not minor contextual footnotes. They shape seafarers' exposure to stress, fatigue, and ill-health across the physical, mental and social domains that constitute wellbeing in Labonté's model.

Interplay of structure and agency in seafarer health

Taken together, the ecological map and Labonté's model explain why behaviour change alone has limited leverage. Seafarers may intend to sleep more, exercise, or maintain connections, but constraints on working hours, shore leave, crewing levels, and communications, are structural and organisational, not merely personal. In Labonté's terms, agency over the mental domain and opportunities that sustain social and physical domains require enabling conditions, not just individual effort.

In combination, the two frameworks convey a clear message: Seafarers' health is produced by the interplay of individual, social, organizational, and structural forces, many of which lie beyond workers' immediate control. Effective interventions therefore require across levels, strengthening empowering conditions (work design, protections and access) while supporting individual capacities, so that the experience that constitutes health in Labonté's (vitality, meaning, agency, and connectedness) can emerge in the realities of global shipping.

A multilevel approach to seafarers' health and wellbeing

Although the COVID-19 pandemic was not the primary focus of this research, it served as a critical stress test for the maritime labour system, revealing vulnerabilities that are highly relevant for understanding seafarers' health and wellbeing. The combined findings indicate that meaningful improvements require coordinated action across the maritime system. Health is not solely a function of individual choice; it is co-produced by organisational practices and structural governance.

Structural and policy-level recommendations

At the structural level, the results underscore the need to strengthen both the robustness and enforcement of maritime regulation. The Maritime Labour

Convention, 2006 (MLC 2006) (ILO, 2023), articulates minimum standards for working and living conditions, yet the pandemic demonstrated that these standards could erode quickly when global systems are under strain (Doumbia-Henry, 2020). For example, despite MLC provisions requiring timely repatriation or crew change and limits on the maximum length of service, many seafarers remained onboard for 12 to 17 months during COVID-19 due to travel bans and commercial pressures, conditions directly associated with increased stress and deteriorating mental health in Paper I.

Preventing future breakdowns requires consistent accountable enforcement, particularly among flags of convenience, where oversight is uneven. Shared international protocols should guarantee crew mobility during emergencies, through for example pre-agreed "green lanes" for crew travel, so that rights are upheld even am id global disruptions. Improved coordination among flag states, and labour-sending countries is essential to protect medical access, repatriation rights, and rest hour provisions when routine operations are interrupted. In short, seafarers' health ultimately depends on the integrity and enforceability of global maritime governance, not only on company-level policy.

Organizational-level recommendations

Shipping companies exert decisive influence over the lived experience onboard. The evidence shows that workload, communication, leadership and social climate shape both mental health (Paper I) and happiness (Paper II). Practical implications include ensuring adequate manning to reduce chronic fatigue, aligning shift rotations with operational demands, and institutionalising transparent, regular briefings during crisis to reduce uncertainties. Low-cost measures that strengthen social cohesion, regular social or cultural events, group exercises and improved connectivity can mitigate loneliness, a major predictor of poor SRH in Paper III. Expanding confidential tele-counselling and access to maritime-informed psychological support could provide critical avenues for care at sea. Consistent with Labonté's model of health, such measures operate not only at the individual level but also at the collective level, where group cohesion, shared identity, and mutual support act as foundational social resources that generate wellbeing. Strengthening these meso-level conditions enhance the social domain of health and provides an empowering environment in which individual health practices become more feasible and sustainable. Conceptually, these steps enhance capacities that either constrain or enable individual health practices.

Individual-level recommendations

While individual behaviour change is not sufficient on its own, it remains important when supported by enabling environments. In line with Labonté's model, interventions at this level should aim to strengthen seafarers' sense of personal agency without implying that health is solely their responsibility, a tendency that Labonté cautions against (Labonte, 1993). Individual health strategies are most effective when workers have the capacity, time and support needed to act on them.

Practical examples might include offering workshop-style sessions on sleep hygiene, tailored to shift workers, or providing exercise routine that require minimal space or equipment. Similarly, brief, culturally sensitive stress-reduction exercises can provide seafarers with portable strategies for managing psychological strain in demanding environments. From Labonté's perspective, such efforts strengthen the mental and physical dimensions of wellbeing by supporting purpose, emotional balance, and vitality.

However, the effectiveness of these interventions depends on the wider organisational and structural conditions in which they occur. Teaching seafarers about the importance for adequate sleep, for instance, is only meaningful if rest hours are protected and respected, a point reinforced by the association between sleep quality and SRH in Paper III. Likewise, opportunities for physical activity are only feasible when workload, scheduling, and space constraints allow them. Labonté's model underscores that empowerment requires not only knowledge, but also realistic conditions in which individuals can act.

Taken together, this implies that individual-level initiatives must be paired with supportive group environments and organisational practices that promote cohesion, fair treatment, and predictable routines. When such meso-level conditions are in place, individual strategies become more accessible and sustainable, and the three domains of wellbeing physical, mental, and social, can reinforce each other.

A multilevel pathway to improving seafarers' health and wellbeing

Ultimately, the recommendations arising from this thesis form a coherent multilevel strategy. Addressing fatigue for instance, requires (1) structural enforcement of rest-hour regulations through MLC 2006, (2) organizational measures such as increased manning and better scheduling , and (3) individual support in the form of sleep-health education. The same logic applies to loneliness, stress, and mental health outcomes. This integrated approach reflects the central insight of both the empirical findings and the theoretical frameworks. Health at sea is ecologically layered and structurally conditioned, produced by forces operating across structural, organizational, social and individual domains.

Strengths and limitations

A major strength of this thesis lies in its large, diverse and genuinely multinational sample, which is rare in maritime health research. The data set spans tens of thousands of seafarers across ranks, nationalities, fleet segments, and employment situations, offering an unprecedented degree of statistical power and validity. The breadth makes it possible to identify not only population level trends, but also subgroup patterns. The coherence of the data set(s) across the three studies, each drawing on the same overarching survey infrastructure also ensures a unified methodological approach, enhancing comparability and enabling a layered, ecological interpretation of health determinants. This is a notable strength in a field where fragmented data collection often limits theoretical expansion. In addition, this thesis benefits from its integration of multiple health outcomes (mental health, subjective wellbeing, self-rated health) examined within a consistent conceptual framing. By applying Dahlgren and Whitehead's ecological model and Labonté's structural framework, this thesis provides a theoretically grounded and multilevel interpretation that moves beyond descriptive epidemiology toward a deeper understanding of how structural, organizational, and individual factors interact to shape seafarers' health.

However, there are limitations that should be acknowledged. First, all three studies rely on cross-sectional data, which limits causal inference. While the theoretical models and empirical patterns suggest plausible pathways of influence, temporal sequencing cannot be established. Second, the analysis depends on self-reported measures, which may introduce reporting biases, including social desirability bias, underreporting of mental health symptoms, or cultural variation in self-rated health. Third, variable drop-out and item non-response across questionnaires may lead to different representation, particularly among sub-groups with lower survey engagement (e.g., ratings or certain nationalities). Although the large sample size and consistency of associations across papers reduce concern about random error, the potential for systematic bias cannot be fully excluded, e.g., not all companies participated, companies with poorer conditions may be under-represented, or the fact that the surveys were distributed via employers may have influenced the willingness to participate, even if anonymous. These factors may introduce directional error.

Finally, the data used in this thesis were generated through surveys distributed via commercial company channels, meaning participation relied on the willingness of shipping companies to engage in the process. As a result, organisations with weaker welfare structures or less favourable labour practices may be underrepresented, potentially biasing the sample towards comparatively better working conditions. This possibility of systemic underrepresentation underscored the need for methodological diversification and the development of more robust longitudinal designs for future research.

Methodological considerations

This thesis benefited from the researcher's dual role as both a public-health scholar and an industry practitioner. The insider perspective offered valuable contextual understanding of shipboard life, labour structures, and operational realities, which strengthened the interpretation of findings. At the same time, such proximity may introduce interpretive bias, particularly when evaluating organisational dynamics or structural constraints. To manage this, analytical decisions were based on established methodological standards and validated instruments rather than personal experience.

The research employed large-scale cross-sectional surveys across two global data-collection rounds. While this approach offers substantial breadth and enables examination of diverse crews, vessel types, and ranks, the design limits inference. Associations observed between work environment factors, stress, wellbeing, and self-rated health cannot establish temporal sequencing. Longitudinal or mixed-methods design would therefore be valuable for future research.

All studies relied on self-reported data, which introduces potential reporting biases. Mental health symptoms, lifestyle behaviours, and self-rated health may be under- or over-reported due to stigma, cultural norms, mood at the time of response, or interpretation of English survey items. Although validated scales enhance reliability, they may not fully capture nuances in the maritime occupational setting, such as the cyclical nature of fatigue, cultural differences in expressing distress, or the layered experience of isolation.

Sampling-related limitations also warrant consideration. Survey distribution occurred through participating companies, which may have influenced who received the survey. Seafarers facing heavy workloads, limited digital connectivity, or poorer working conditions may be underrepresented. Variability in response rates across ranks and nationalities suggest potential non-response bias. The reliance on onboard respondents for Papers II and III enhances validity but excludes the experience of those ashore, who may face different stressors of health trajectories.

Measurement limitations are also relevant. While the use of validated instruments strengthens comparability, these tools measure perceived, not objective conditions. For instance, the PSS-10 captures perceived stress rather than the structural stressors that underpin it. Similarly, lifestyle measures are subject to recall and interpretation differences.

Taken together, these considerations highlight both the strengths and limitations of the thesis. It offers extensive, multinational, quantitative evidence grounded in real-world industry insight, while also indicating the need for future longitudinal and qualitative approaches to deepen the understanding of the mechanisms shaping seafarers' health.

Future studies

Future research should build on the current findings by deepening our understanding of seafarers' lived experiences and the structural conditions shaping their health. First, qualitative studies are needed to explore seafarers' own perception of health, wellbeing and risk, going beyond survey measures to capture nuances of daily life at sea, variations across ranks and nationalities, and how workers themselves interpret the resources and constraints of their environment. Such research should also extend to manning agencies and HR departments, whose practices around recruitment, deployment and contract management significantly influence working conditions yet remain insufficiently studied.

Second, a longitudinal intervention study would provide critical evidence on what health promoting activities work in maritime settings. While interventions studies have shown promise in other occupational groups, the shipping industry still lacks robust, long-term evaluations of programs targeting mental health, lifestyle behaviours, or organizational culture. Given the globalised and transient nature of shipping, testing interventions over time, ideally across different flag states, fleets or vessel types, would help determine effectiveness, feasibility and scalability in real operational environments.

Third, findings from this thesis suggest that the regulatory environment, and within the four pillars of the international maritime regulatory framework, particularly the protections in the Maritime Labour Convention (MLC 2006), may have direct implications for seafarers' health and wellbeing. These indications underscore the value of further research examining how core international conventions such as MLC 2006, the STCW Convention, and related ILO and IMO regulations are interpreted and implemented in practice. Existing research highlights persistent gaps between formal regulatory provisions and lived working conditions at sea, especially under uneven enforcement regimes and flags of convenience. Comparative analyses that situate these maritime instruments alongside national public health and occupational health legislation could help identify where protections remain weak or inconsistent, and how regulatory frameworks might be strengthened to better support seafarers' wellbeing. Such work could also assist policymakers, industry leaders, and regulators in enhancing compliance mechanisms and aligning maritime labour standards with contemporary principles of health equity.

Finally, the existing datasets generated throughout this research contain substantially more information than could be analysed within the scope of this dissertation, offering rich opportunities for further exploration.

Conclusion

This thesis demonstrates that international seafarers' health and wellbeing are shaped by the combined influence of working conditions, organisational practices, lifestyle factors, and structural conditions in global shipping. Across three large-scale cross-sectional studies, the findings show clear and consistent patterns that have direct implications for maritime policy, governance, and industry practice.

Paper I highlight how pandemic-related disruptions, especially delayed crew changes, mobility restrictions, and weakened employer communication, significantly undermined mental health. Stronger safety culture, and clear communication was associated with reduced psychological harm, illustrating the company level governance can buffer risks even during global crisis.

Paper II shows that wellbeing and happiness depend heavily on seafarers' subjective work experiences, including job satisfaction, challenges, skill utilisation, and alignment between expectations and work realities. Positive working environments promote wellbeing, but high workload limits these benefits. This underscores the need for staffing models and work-rest scheduling that realistically reflect operational demands.

Paper III broadens the lens to overall health, demonstrating that poor self-rated health is associated with chronic conditions, and lifestyle factors with stress amplifying nearly all risks. This provides evidence that maritime health promotion must integrate physical, psychosocial, and behavioural components, rather than focus narrowly on single risk factors.

Taken together, the three studies show that seafarers' health is shaped by multi-level determinants, structural regulatory gaps, and limited crisis protections, along with onboard organisational conditions, which together enable or constrain individual health behaviours. Whie this thesis did not directly measure regulatory mechanisms; the findings are consistent with the broader understanding that maritime governance structures impact the health of seafarers.

By clarifying these relationships through a theoretically grounded, multinational evidence base, this thesis provides actionable insights for policymakers, regulators and industry stakeholders seeking to build a healthier, safer and more resilient maritime workforce.

Epilogue

Dear Reader,

I am not sure where to begin, except to say that life at sea makes you think, often more than you expect. With the ocean stretching in every direction, my thoughts turn to what lies ahead. The world feels tense, and with the situation unfolding in the Middle East, I can't help but imagine what might happen if things continue. I haven't sailed those waters under these new conditions , but I picture longer detours, stricter rules, and that familiar wait for updates that never come fast enough. It brings back memories of the pandemic years, not the fear, but how everything depended on clear, honest communication. I hope we have not forgotten those lessons. Out here, knowing what is going on steadies you more than anything.

Reading this research also opened my eyes to how much our lives at sea are shaped by forces far bigger than our vessels. I may not know the details of every convention or standard, but I do know that when protections are taken seriously, life onboard simply feels better. When they aren't, we feel it immediately. Maybe, with the world as uncertain as it is, people will start paying closer attention to that.

But what gives me the most hope isn't only what might change far above us, it's what could change right here, on deck, in the mess room, in the small routines that shape our days. I want to believe that future crews will have more to say in their own wellbeing, more support, and more chances to shape their working lives. That ships will be places where people actually talk to each other, where workloads make sense, where rest truly means rest, and where looking after yourself, body, and mind, isn't something you apologise for.
And maybe that is why, even with all the uncertainty, I still hope more young people will choose this profession. The sea still has something to offer, a sense of meaning you do not find anywhere else. I just want them to walk into an industry that sees them, supports them, and gives them reasons to stay.

I do not know how the geopolitical situation will unfold. None of us do. But standing here, watching the horizon shift, I hold on to the thought that change is still possible, on deck, within the industry, and within each of us.

*// Leo**

**Leo is a constructed character, designed to illustrate the lived experiences reflected in the empirical findings from this thesis and to represent the broader population of seafarers whose realities these results reveal.*

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References

Abila, S., Kitada, M., Malecosio, S., Jr., Tang, L., & Subong-Espina, R. (2023). Empowering Seafarers as Agents of Their Mental Health: The Role of Information and Communication Technology in Seafarers' Well-Being. Inquiry, 60, 469580231162752. https://doi.org/10.1177/00469580231162752

Aikaterini, D., Vasileios, P., Aris, C., Kanella, Z., Dimitris, K., & Efthymios, K. (2019). Seafarers' health problems, emergencies, diseases and risk factors. A systematic review of the literature. Int J Med Health Res, 5(2), 43-48.

Alvarez-Galvez, J., & Salvador-Carulla, L. (2013). Perceived discrimination and self-rated health in Europe: evidence from the European Social Survey (2010). PLoS One, 8(9), e74252. https://doi.org/10.1371/journal.pone.0074252

Andrei, D. M., Griffin, M. A., Grech, M., & Neal, A. (2020). How demands and resources impact chronic fatigue in the maritime industry. The mediating effect of acute fatigue, sleep quality and recovery. Safety Science, 121, 362-372. https://doi.org/https://doi.org/10.1016/j.ssci.2019.09.019

B., N. M., K., B., & J., E. (2013). Relationships between work environment factors and workers' well-being in the maritime industry. Int Marit Health, 64(2), 80-88.

Baćak, V., & Ólafsdóttir, S. (2017). Gender and validity of self-rated health in nineteen European countries. Scand J Public Health, 45(6), 647-653. https://doi.org/10.1177/1403494817717405

Bakker, A. B., & de Vries, J. D. (2021). Job Demands-Resources theory and self-regulation: new explanations and remedies for job burnout. Anxiety Stress Coping, 34(1), 1-21. https://doi.org/10.1080/10615806.2020.1797695

Balaj, M. (2022). Self-reported health and the social body. Social Theory & Health, 20(1), 71-89.

Bambra, C., Gibson, M., Sowden, A., Wright, K., Whitehead, M., & Petticrew, M. (2010). Tackling the wider social determinants of health and health inequalities: evidence from systematic reviews. Journal of epidemiology & community health, 64(4), 284-291.

Baygi, F., Mohammadian Khonsari, N., Agoushi, A., Hassani Gelsefid, S., Mahdavi Gorabi, A., & Qorbani, M. (2021). Prevalence and associated factors of psychosocial distress among seafarers during COVID-19

pandemic. BMC Psychiatry, 21(1), 222. https://doi.org/10.1186/s12888-021-03197-z
Bech, P., Olsen, L. R., Kjoller, M., & Rasmussen, N. K. (2003). Measuring well-being rather than the absence of distress symptoms: a comparison of the SF-36 Mental Health subscale and the WHO-Five Well-Being Scale. Int J Methods Psychiatr Res, 12(2), 85-91. https://doi.org/10.1002/mpr.145
Belliveau, J., & Journeay, W. S. (2025). Medical causes of repatriation in commercial seafarers and offshore workers: a scoping review. International Maritime Health, 76(2), 97-114.
Belz, L., Fritze, P., Harth, V., & Oldenburg, M. (2024). A systematic review on the impact of ship movements on lower back among maritime workers. Int Marit Health, 75(3), 155-166. https://doi.org/10.5603/imh.100136
Belz, L., Fritze, P., Harth, V., & Oldenburg, M. (2024). A systematic review on the impact of ship movements on lower back among maritime workers. International Maritime Health, 75(3), 155-166.
BIMCO. (2021). Seafarer workforce report: The global supply and demand of seafarers in 2021. Copenhagen: Baltic and International Maritime Council and International Chamber of Shipping.
Brooks, S. K., & Greenberg, N. (2022). Mental health and psychological wellbeing of maritime personnel: a systematic review. BMC Psychol, 10(1), 139. https://doi.org/10.1186/s40359-022-00850-4
Buscema, F., Grandi, A., & Colombo, L. (2023). How can the seafarers do it? Qualitative research in psychosocial risks of South Italy's seafarers. Int Marit Health, 74(1), 54-61. https://doi.org/10.5603/imh.2023.0006
Çakır, E. (2019). Fatal and serious injuries on board merchant cargo ships. International Maritime Health, 70(2), 113-118.
Carotenuto, A., Molino, I., Fasanaro, A. M., & Amenta, F. (2012). Psychological stress in seafarers: a review. Int Marit Health, 63(4), 188-194.
Carrera-Arce, M., Bartusevičienė, I., & Divari, P. (2022). Healthy workplace onboard: Insights gained from the COVID-19 impact on mental health and wellbeing of seafarers. Work, 73(1), 29-40. https://doi.org/10.3233/wor-210791
Cohen, S., & Janicki-Deverts, D. (2012). Who's stressed? Distributions of psychological stress in the United States in probability samples from 1983, 2006, and 2009 1. Journal of applied social psychology, 42(6), 1320-1334.
Cohen, S., Kessler, R. C., & Gordon, L. U. (1997). Measuring stress: A guide for health and social scientists. Oxford University Press.
Cullati, S., Mukhopadhyay, S., Sieber, S., Chakraborty, A., & Burton-Jeangros, C. (2018). Is the single self-rated health item reliable in India? A construct validity study. BMJ Glob Health, 3(6), e000856. https://doi.org/10.1136/bmjgh-2018-000856
Dahlgren, G., & Whitehead, M. (1991). Policies and strategies to promote social equity in health. Stockholm: Institute for future studies, 27(1), 4-41.

Dahlgren, G., & Whitehead, M. (2021). The Dahlgren-Whitehead model of health determinants: 30 years on and still chasing rainbows. Public Health, 199, 20-24. https://doi.org/10.1016/j.puhe.2021.08.009

Darviri, C., Artemiadis, A. K., Tigani, X., & Alexopoulos, E. C. (2011). Lifestyle and self-rated health: a cross-sectional study of 3,601 citizens of Athens, Greece. BMC Public Health, 11, 619. https://doi.org/10.1186/1471-2458-11-619

Doumbia-Henry, C. (2020). Shipping and COVID-19: protecting seafarers as frontline workers. WMU Journal of Maritime Affairs, 19(3), 279-293.

Etikprövningsmyndigheten. (2023). Protecting the individual in research. Retrieved 2026-03-09 from https://etikprovningsmyndigheten.se/en/

Exarchopoulos, G., Zhang, P., Pryce-Roberts, N., & Zhao, M. (2018). Seafarers' welfare: A critical review of the related legal issues under the Maritime Labour Convention 2006. Marine Policy, 93, 62-70.

Fitzmaurice, M. (2023). The international convention for the prevention of pollution from ships (MARPOL). In Research Handbook on Ocean Governance Law (pp. 91-108). Edward Elgar Publishing.

Fotteler, M. L., Andrioti Bygvraa, D., & Jensen, O. C. (2020). The impact of the Maritime Labor Convention on seafarers' working and living conditions: an analysis of port state control statistics. BMC Public Health, 20(1), 1586.

Gable, S., & Bedrov, A. (2021). Social isolation and social support in good times and bad times.. Current opinion in psychology, 44, 89-93 . https://doi.org/10.1016/j.copsyc.2021.08.027.

Galli, N. V., & Rossell, A. (2024). Wage demands and fair working conditions of seafarers on cargo ships under a flag of convenience: establishment of a place of jurisdiction in Switzerland. International Journal, 7(2), 76-92.

Gregorio, E. R., Jr., Kobayashi, J., Medina, J. R., & Simbulan, N. P. (2016). Knowledge, attitudes, and related practices of Filipino seafarers regarding cardiovascular diseases. Int Marit Health, 67(4), 214-222. https://doi.org/10.5603/imh.2016.0039

Hayes-Mejia, R., & Stafström, M. (2023). Psychosocial work environment and mental health among the global workforce of seafarers in the wake of the COVID-19 pandemic. BMC Public Health, 23(1), 2151. https://doi.org/10.1186/s12889-023-17035-2

Hayes-Mejia, R., & Stafström, M. (2024). Wellbeing and Happiness and Their Association with Working Conditions at Sea: A Cross-sectional Study Among the Global Workforce of Seafarers. Inquiry, 61, 469580241256349. https://doi.org/10.1177/00469580241256349

Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: a review of twenty-seven community studies. J Health Soc Behav, 38(1), 21-37.

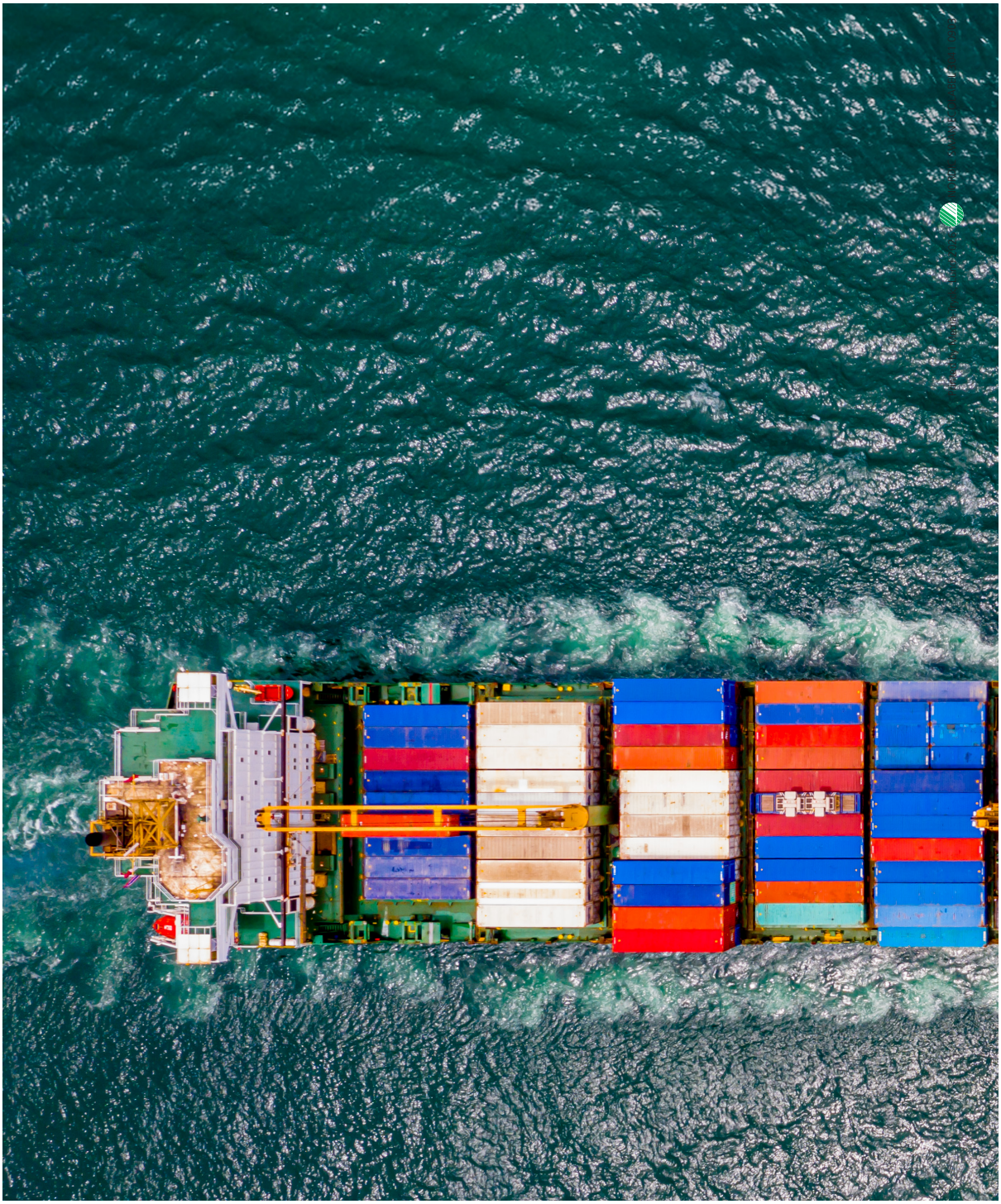
ILO. (2023). Maritime Labour Convention, 2006, as amended. ILO. Retrieved August 20 from

https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:91:0::NO::P91_SECTION:MLC14_A2
IMO & WISTA (2024) Women in Maritime Survey: A report on the participation of women in the public and private maritime sector workforces.
James, A. J., Schriever, U. G., Jahangiri, S., & Girgin, S. C. (2018). Improving maritime English competence as the cornerstone of safety at sea: a focus on teaching practices to improve maritime communication. WMU Journal of Maritime Affairs, 17(2). https://doi.org/https://doi.org/10.1007/s13437-018-0145-4
Jensen, H. J., & Oldenburg, M. (2019). Potentially traumatic experiences of seafarers. J Occup Med Toxicol, 14, 17. https://doi.org/10.1186/s12995-019-0238-9
Jepsen, J. R., Zhao, Z., & van Leeuwen, W. M. (2015). Seafarer fatigue: a review of risk factors, consequences for seafarers' health and safety and options for mitigation. Int Marit Health, 66(2), 106-117. https://doi.org/10.5603/imh.2015.0024
Joseph, A., & Dalaklis, D. (2021). The international convention for the safety of life at sea: highlighting interrelations of measures towards effective risk mitigation. Journal of International Maritime Safety, Environmental Affairs, and Shipping, 5(1), 1-11.
Jylhä, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. Soc Sci Med, 69(3), 307-316. https://doi.org/10.1016/j.socscimed.2009.05.013
Jylhä, M., Volpato, S., & Guralnik, J. M. (2006). Self-rated health showed a graded association with frequently used biomarkers in a large population sample. J Clin Epidemiol, 59(5), 465-471. https://doi.org/10.1016/j.jclinepi.2005.12.004
Karasek Jr, R. A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. Administrative science quarterly, 285-308.
Kjersti Bergheim, M. B. N., Kathryn Mearns, Jarle Eid,. (2015). The relationship between psychological capital, job satisfaction, and safety perceptions in the maritime industry. Safety Science, 74, 27-36. https://doi.org/https://doi.org/10.1016/j.ssci.2014.11.024.
Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med, 16(9), 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x
Labonte, R. (1993). Health Promotion and Empowerment: Practice Frameworks (Centre for Health Promotion and ParticipACTION, Toronto).
Labonté, R. (1993). A holosphere of healthy and sustainable communities. Australian journal of public health, 17(1), 4-12.
Lee, E. H. (2012). Review of the psychometric evidence of the perceived stress scale. Asian Nurs Res (Korean Soc Nurs Sci), 6(4), 121-127. https://doi.org/10.1016/j.anr.2012.08.004

Li, X., Seah, R., Wang, X., & Yuen, K. F. (2022). Investigating the role of sociotechnical factors on seafarers' psychological capital and mental well-being. Technology in Society, 71, 102138.
Lyubomirsky, S., & Lepper, H. S. (1999). A measure of subjective happiness: Preliminary reliability and construct validation. Social Indicators Research, 46. https://doi.org/10.1023/A:1006824100041
McConnell, M. L., Devlin, D., & Doumbia-Henry, C. (2011). *The Maritime Labour Convention, 2006* (pp. 294-291). Leiden and Boston: Martinus Nijhoff Publishers.
McVeigh, J., MacLachlan, M., Vallieres, F., Hyland, P., Stilz, R., Cox, H., & Fraser, A. (2019). Identifying Predictors of Stress and Job Satisfaction in a Sample of Merchant Seafarers Using Structural Equation Modeling. Front Psychol, 10, 70. https://doi.org/10.3389/fpsyg.2019.00070
Mellbye, A., & Carter, T. (2017). Seafarers' depression and suicide. Int Marit Health, 68(2), 108-114. https://doi.org/10.5603/imh.2017.0020
Neumann, F. A., Belz, L., Dengler, D., Harth, V., von Münster, T., Westenhöfer, J., Oldenburg, M., & Zyriax, B. C. (2021). Eating behaviour and weight development of European and Asian seafarers during stay on board and at home. J Occup Med Toxicol, 16(1), 41. https://doi.org/10.1186/s12995-021-00329-9
Nielsen, M. B., Bergheim, K., & Eid, J. (2013). Relationships between work environment factors and workers' well-being in the maritime industry. International Maritime Health, 64(2), 80-88.
Nittari, G., Gibelli, F., Bailo, P., Sirignano, A., & Ricci, G. (2022). Factors affecting mental health of seafarers on board merchant ships: a systematic review. Rev Environ Health. https://doi.org/10.1515/reveh-2021-0070
Oldenburg, M., Baur, X., & Schlaich, C. (2010). Occupational risks and challenges of seafaring. J Occup Health, 52(5), 249-256. https://doi.org/10.1539/joh.k10004
Oldenburg, M., Baur, X., & Schlaich, C. (2010). Occupational risks and challenges of seafaring. Journal of occupational health, 52(5), 249-256.
Oldenburg, M., Felten, C., Hedtmann, J., & Jensen, H.-J. (2020). Physical influences on seafarers are different during their voyage episodes of port stay, river passage and sea passage: A maritime field study. PLoS One, 15(4), e0231309.
Oldenburg, M., Harth, V., & Jensen, H. J. (2013). Overview and prospect: food and nutrition of seafarers on merchant ships. Int Marit Health, 64(4), 191-194. https://doi.org/10.5603/imh.2013.0003
Oldenburg, M., & Jensen, H. J. (2019). Recreational possibilities for seafarers during shipboard leisure time. Int Arch Occup Environ Health, 92(7), 1033-1039. https://doi.org/10.1007/s00420-019-01442-3
Pauksztat, B., Grech, M. R., & Kitada, M. (2022). The impact of the COVID-19 pandemic on seafarers' mental health and chronic fatigue: Beneficial

effects of onboard peer support, external support and Internet access. Mar Policy, 137, 104942. https://doi.org/10.1016/j.marpol.2021.104942
Perruccio, A. V., Katz, J. N., & Losina, E. (2012). Health burden in chronic disease: multimorbidity is associated with self-rated health more than medical comorbidity alone. Journal of clinical epidemiology, 65(1), 100-106.
Plummer, F., Manea, L., Trepel, D., & McMillan, D. (2016). Screening for anxiety disorders with the GAD-7 and GAD-2: a systematic review and diagnostic metaanalysis. Gen Hosp Psychiatry, 39, 24-31. https://doi.org/10.1016/j.genhosppsych.2015.11.005
Roberts, S. E. (2002). Hazardous occupations in Great Britain. The Lancet, 360(9332), 543-544.
Sagaro, G. G., Dicanio, M., Battineni, G., Samad, M. A., & Amenta, F. (2021). Incidence of occupational injuries and diseases among seafarers: a descriptive epidemiological study based on contacts from onboard ships to the Italian Telemedical Maritime Assistance Service in Rome, Italy. BMJ Open, 11(3), e044633.
Sampson, H., Ellis, N. (2019), Seafarer's mental health and wellbeing. IOSH, 2019
Schramme, T. (2023). Health as complete well-being: The WHO definition and beyond. Public health ethics, 16(3), 210-218.
Schubert, R. (2021). Trapped at Sea in a Pandemic: International Law's Impact on Seafarers' Rights. Md. J. Int'l L., 36, 112.
Slišković, A., & Penezić, Z. (2015). Descriptive study of job satisfaction and job dissatisfaction in a sample of Croatian seafarers. International Maritime Health, 66(2), 97-105.
Slišković, A., & Penezić, Z. (2017). Lifestyle factors in Croatian seafarers as relating to health and stress on board. Work, 56(3), 371-380. https://doi.org/10.3233/wor-172501
Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med, 166(10), 1092-1097. https://doi.org/10.1001/archinte.166.10.1092
Theorell, T., Karasek, R. A., & Eneroth, P. (1990). Job strain variations in relation to plasma testosterone fluctuations in working men-a longitudinal study. Journal of internal medicine, 227(1), 31-36.
Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: a systematic review of the literature. Psychother Psychosom, 84(3), 167-176. https://doi.org/10.1159/000376585
Türkistanli, T. T. (2024). Advanced learning methods in maritime education and training: A bibliometric analysis on the digitalization of education and modern trends. Computer Applications in Engineering Education, 32(1), e22690.

UNCTAD. (2021a, 2021). Review of maritime transport 2021: overview United Nations Conference on Trade and Development Geneva. https://unctad.org/system/files/official-document/rmt2021_en_0.pdf
UNCTAD. (2021b). Review of maritime transport 2021: overview. Geneva: United Nations Conference on Trade and Development
Yassin, A. H., Spector, J. T., Mease, L., Shumate, A., Hill, R., Lincoln, J. E., & Baker, M. G. (2022). Workplace Determinants of Depression, Anxiety, and Stress in U.S. Mariners during the COVID-19 Pandemic. Int J Environ Res Public Health, 19(24). https://doi.org/10.3390/ijerph192416628
Youn, I. H., & Lee, J. M. (2020). Seafarers' Physical Activity and Sleep Patterns: Results from Asia-Pacific Sea Routes. Int J Environ Res Public Health, 17(19). https://doi.org/10.3390/ijerph17197266
Yuen, K. F., Bai, X., & Wang, X. (2020). Safety behaviour at sea: Policy implications for managing seafarers through positive psychology. Marine Policy, 121, 104163. https://doi.org/https://doi.org/10.1016/j.marpol.2020.104163
Zamora, A. A., Regencia, Z. J. G., Crisostomo, M. E., Van Hal, G., & Baja, E. S. (2021). Effect of daily social media exposure on anxiety and depression disorders among cargo seafarers: a cross-sectional study. Int Marit Health, 72(1), 55-63. https://doi.org/10.5603/imh.2021.0008



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