U.S. INLAND MARINER WELLNESS ASSESSMENT

Perceived Effectiveness of Recommended and Implemented Interventions to Improve U.S. Inland Mariner Wellness

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Martin D. Slade, Ph.D., MPH

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EXECUTIVE SUMMARY

This *Perceived Effectiveness of Recommended and Implemented Interventions to Improve U.S. Inland Mariner Wellness* research project incorporates a review of the published literature on inland mariner health and well-being, including recommendations to improve health and well-being among this population, practices implemented by the industry, and barriers to full implementation. In this study, "inland" refers to the sector of the inland maritime industry that includes tugboats, towboats, and barges, including offshore ATBs, or "Articulated Tug Barges."

Additionally, information is reported that was garnered from a series of one-on-one semi-structured interviews with executives from United States inland maritime transportation companies aimed at understanding the sector's view of the well-being of its mariners, interventions designed to improve the well-being of their mariner workforce, and the effectiveness of these interventions.

The literature search resulted in 1,340 papers for which abstracts were used to determine relevancy. This led to 73 articles being utilized for this study. Semi-structured interviews designed to obtain viewpoints from the perspective of inland maritime transportation companies were conducted virtually between January 10, 2024 and June 20, 2024. Each of the interviews incorporated a semi-structured approach utilizing open-ended questions, to delve into what was deemed possible and beneficial to address the long-term risk factors affecting inland mariners' psychological well-being. For these interviews, the following questions were asked by the interviewer to start discussions:

1. What is your perception regarding the wellness of your crews (both physically and mentally)?
2. Has your company considered any interventions to improve crew well-being? If so, what interventions were considered?
3. Were these interventions implemented? If not, why not? If yes, what was the scope of the intervention (number of vessels/crew)?
4. How long did the intervention last? Why was it ended?
5. Do you have any idea as to the cost of the intervention?
6. Do you have any measures/thoughts on its effectiveness?
7. Would your company be willing to consider trying another intervention?

The results of the literature search and the interview sessions were analyzed with a mixed-methods approach (using both qualitative and quantitative research when one methodology does not provide all the information required) so that a fuller picture could be developed regarding the well-being of U.S. inland maritime workers, the incorporation of recommendations from the academic community, the results of those interventions on the health and well-being of these mariners, and the barriers encountered implementing the recommendations.

Various stressors were identified from the literature review to be acting within the overall mariner population. It was found that these stressors could be grouped into five categories, namely: (1) Work environment; (2) Organizational; (3) Cultural; (4) Physical; and (5) Psychosocial. These stressors can be seen to act independently, or jointly, to negatively impact the health and well-being of mariners which, unfortunately, was found to be worrisome, especially with regard to their mental health. Issues regarding mariner well-being could be grouped into the following three categories: (1) Physical; (2) Psychological; and (3) Personal/Lifestyle. Myriad recommendations to improve mariner well-being were found to be included within the literature. These were grouped into six categories: (1) Physical; (2) Psychological; (3) Personal / Lifestyle; (4) Organizational; (5) Individual; and (6) Other.

Although many recommendations for improving the health and well-being of mariners have been published, the literature contains few interventions that have been put into practice by inland maritime companies. However,

interviews with representatives of the inland maritime industry identified some additional interventions that have been employed. The various interventions tended to target different factors that affect mariner well-being, notably, work demand, mental health, lifestyle, health, nutrition, and culture. Overall, the description of methodology and reported results are often less detailed than hoped to be able to ascertain the effect of the intervention as well as its generalizability to the larger inland maritime workforce.

There are numerous barriers to the implementation of interventions to improve the health and well-being of inland mariners. The culture of the industry, which can be at odds with the well-being of its workforce, appears relatively unchanged over the past few decades. Given this, effecting change is difficult and requires strong organizational commitment. There are upfront costs associated with implementing, and in some cases, on-going costs to maintain, interventions. In the longer term, the return on investment should significantly improve a company's profitability. It appears that certain recommended interventions, such as increasing the size of crews, will only occur through regulation; however, it seems that this sort of regulation will not be forthcoming in the current environment.

In conclusion, there is great potential to increase the health and well-being of inland mariners and, in particular, the mental health of this population. Some changes could be made quite quickly and with little expense or disruption to current practices, and yet be expected to substantially increase the quality of life for the mariner. These include nutritional interventions such as educating and training cooks and crew members with catering responsibilities on healthy cooking while also educating crew members regarding healthy food choices. Ensuring mariners are properly hydrated will almost immediately result in health benefits. Leadership training, including sections on well-being and communication strategies, will help prevent, or at least mitigate, the stress associated with working in an environment with high work demands.

It is recommended that the "culture of care" that is currently present in the inland maritime industry be further enhanced. This culture of care is not only about caring for the company's employees, but extends to caring for mariners' families, caring about the organization, caring for society, and caring for the environment. A culture of care can be the core element ensuring decent work wherein employment "respects the fundamental rights of the human person as well as the rights of workers in terms of conditions of work safety…respect for the physical and mental integrity of the worker in the exercise of his/her employment". As the culture of care is enhanced, mariner well-being and job satisfaction will improve and retention rates should increase. This will allow for corporate knowledge to be retained while reducing the high cost of training new employees and reducing learning curves during which there are higher risks of accidents and injuries. Although it needs to be looked at as a long-term investment, a more robust culture of care will ultimately improve the lives of inland mariners and their families while reducing operating costs: a win-win opportunity.

It is also recommended that the work required to improve this culture of care, which is the ultimate goal, be undertaken by all sectors of the inland maritime industry working in partnership. We hope that all stakeholders, including maritime companies, government agencies, and maritime charities, will join this endeavor. In so doing, they will gain more than just a window into research, but will rather join in the truly noble goal of partnering in the research and implementation of interventions to improve the health and well-being of inland mariners.


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INTRODUCTION

BACKGROUND

The published literature on interventions to improve the health of United States inland maritime workers as compared to other occupations is limited. Although a substantial number of studies have been published in recent years regarding interventions to improve the health and well-being of international ("blue-water") seafarers, this has not been observed for the inland workforce.

Separate literature queries were conducted using Google Scholar and PubMed for three different sets of search terms, namely:

1. "brown water" health maritime wellness interventions occupational

2. +maritime workers stress demand control injury illness +("brown water" or "inland water" or "river")

3. "merchant marine" "united states" wellness health illness injury stressors risk

These queries resulted in a total of 2,496 results. In reviewing the abstracts of these results, only nine addressed wellness interventions among U.S. inland maritime workers. A better understanding of the stressors affecting inland mariners, the recommended approaches for improving the well-being of these workers, the degree to which these recommendations have been put into practice, the barriers encountered in implementation, and the resultant effect upon inland mariner well-being would be of great benefit to the industry.

In February 2023, the Seamen's Church Institute partnered with Yale University to determine the practices that have been put into place within the U.S. inland maritime industry to maintain mariner health and to determine their perceived effectiveness. In particular, three specific aims were defined:

Aim 1. To ascertain practices put in place by the inland maritime industry regarding mariner health and safety,

Aim 2. To determine the coverage of these practices across the inland maritime industry, and

Aim 3. To assess the perceived effectiveness of these practices.

Through achievement of the specific aims above, the study describes the state of health policies as they currently exist regarding the inland maritime workforce. Additionally, the perceived effectiveness of these programs is also discussed.

During the conduct of the study, it became clear that the published stressors affecting the well-being of inland mariners should also be ascertained as these are the upstream, and possibly modifiable, causes of ill health among mariners.

METHODS, DATA, & ANALYSIS

The relevant literature for this review was sourced using PubMed and Google Scholar databases. The search criteria used the keywords: "brown water", "health", "maritime", "wellness", "interventions", "occupational", "workers", "stress", "demand", "control", "injury", "illness", "inland water", "river", "merchant marine", "united states", "stressors" and "risk". Additionally, a timeframe covering the last twenty-five years (2000-2024, inclusive) was specified. All relevant papers were available without need to contact the authors. Primary peer-reviewed articles that were published in English as well as systematic reviews were included in the search. The search resulted in 1,340 papers for which abstracts were used to determine relevancy. This led to 73 articles being utilized for this study. Each of these articles were read to determine the stressors, well-being issues, recommendations, practices either studied or put into practice, results of these practices regarding inland mariner well-being, and the barriers to implementation of recommendations.

One-on-one semi-structured qualitative interviews designed to obtain viewpoints from the perspective of inland transportation companies were held virtually between January 10, 2024 and June 20, 2024. A convenience sample was utilized whereby the Seamen's

Church Institute initially supplied a list of potential companies from within the U.S. inland maritime transportation sector for the study. Dr. Slade served as the interviewer for all sessions and at the end of each session asked the interviewee if they had any contacts within U.S. inland maritime transportation companies whom they believed it would be helpful to interview. Each interview session was recorded with the permission of the interviewee so that a transcript of the session could be created for use in the qualitative analysis. Each of the interviews followed the same pattern, namely, a semi-structured approach utilizing open-ended questions to delve into the perception of their company regarding the well-being of its mariners, finding out about programs that were considered to improve the well-being of their mariner workforce, and whether each program was implemented. For those programs that were not implemented, there was an attempt to ascertain the reason why. Similarly, for programs that were implemented, the mariner buy-in and usage as well as the program's effectiveness were probed. The questions for the semi-structured interviews were as follows:

1. What is your perception regarding the wellness of your crews (both physically and mentally)?

2. Has your company considered any interventions to improve crew well-being? If so, what interventions were considered?

3. Were these interventions implemented? If not, why not? If yes, what was the scope of the intervention (number of vessels/crew)?

4. How long did the intervention last? Why was it ended?

5. Do you have any idea as to the cost of the intervention?

6. Do you have any measures/thoughts on its effectiveness?

7. Would your company be willing to consider trying another intervention?

Ultimately, the results of the literature search and the semi-structured interviews were analyzed with a mixed-methods approach so that a fuller picture could be developed regarding the well-being of inland maritime workers, the incorporation of recommendations from the academic community, the results of those interventions on the health and well-being of inland mariners, as well as the barriers encountered implementing these recommendations.

This report describes the noted stressors for the health and well-being of U.S. inland mariners. It notes the current well-being issues among that population as well as the published recommendations to improve these mariners' health and well-being. The practices incorporated by industry, along with the observed result and barriers to implementation are then discussed. Lastly, the overall results based on both the quantitative and qualitative portions of the study are presented.

RESULTS AND DISCUSSION

STRESSORS IDENTIFIED FROM EITHER LITERATURE OR REVIEW OR SEMI-STRUCTURED INTERVIEWS

The following is a discussion of findings regarding stressors identified within the overall U.S. inland mariner population. The stressors are grouped into five categories, however it should be noted that these groupings are somewhat arbitrary in that certain stressors contain elements that would allow them to be classified into a different category. Nonetheless, the categorization scheme utilized appears useful to understanding the strains that mariners encounter. The five stressor categories are: (1) Work environment; (2) Organizational; (3) Cultural; (4) Physical; and, (5) Psychosocial.

Work environment

Stressors identified from either the literature or from the semi-structured interviews within the work environment include being away from home for extended periods. These periods vary from boat to boat, but can be up to twenty-eight days.

While on board, mariners perform grueling work for long hours, typically seven days per week.[1] The job is physically and mentally demanding and occurs in one of the more dangerous work environments.[2] The industry has a higher risk of accidents and fatalities compared to other safety-critical and risky occupations.

As the maritime industry is a 24-hour business, mariners must also work at night, which can lead to increased levels of stress. Shift work schedules vary, but often mariners work a watch schedule of six hours on, six hours off.[3] There can be irregular work hours and times when mariners are working more than thirteen hours per day.[4]

There is no separation between the workplace and "home."

There has been an increase in the use of technology that is meant to increase efficiency and reduce the risks of accidents. However, this greater use of technology has increased the cognitive load on mariners.[5] This apparent contradiction is likely the result of a change in the work performed by some mariners wherein they now need to integrate the demands of technology.

The crew must manage unplanned events and respond to emergencies.[6]

Other work environment stressors discussed in the literature include the lack of leisure time, lack of opportunities for physical activity,[7] and high risk of overeating.[8]

Organizational

Various stressors documented in literature or identified from the semi-structured interviews are the result of organizational philosophy or conduct.

Mariners experience poor sleep quality as well as sleep deprivation, and it has been reported that they have poor sleeping conditions.[9] Crew schedules, including the timing of crew rotation and shift definitions can add to the lack of quality sleep as there is little to no time to wind down before going to sleep.[10]

Maritime companies are responsible for providing food for the crews while they are on board, however concerns over the availability of healthy food options, appropriate portions, and the inability to access healthy food have surfaced.

Poor access to healthcare, especially for mental health issues, and concerns about confidentiality surrounding any healthcare provided are other stressors that originate at the organizational level. It has been reported that mariners may avoid medical care as some believe that they will be monitored, and that seeing a physician may lead to losing one's ability to work.

Other organizational stressors documented within the literature include the hierarchical structure of the organization,[11] changing job demands,[12] and time pressures,[13] mariners having limited decision latitude, and the lack of autonomy.

Cultural

Though not as pronounced as in the blue-water shipping industry, the U.S. inland maritime industry employs mariners with a variety of cultural backgrounds.[14] Without minimizing the positives of having multicultural crews, cross-cultural differences bring with them their own set of stressors. Living and working with people who have different cultural norms and beliefs, tied to the hierarchical structure of most boats, can lead to a sense of isolation among mariners. It takes time to acclimate to a cultural environment that is different to what one is used to, and during this time mariners may experience acculturative stress. Mealtimes, which may include different foods and preparations than those of one's background, can also increase the feeling of isolation.[15]

The industry also has a culture of overworking crew while onboard, and not admitting that one is tired. At times, crew members work extra days because of the financial incentive, with some becoming dependent on the additional money earned. Overall, the prevailing culture is one of 'always going on' for the sake of keeping the vessel operating.

Digital Media

Several studies have linked social media use to increased risks for anxiety and depression. Maritime workers are prone to mental health issues due to workload, social isolation, and challenging working conditions. It has been reported that among mariners, social media exposure for more than two hours per day is associated with increased susceptibility to depression and anxiety disorders. It should be noted, however, that social connections are important for well-being, hence, the limited use of social media may play a beneficial role.

Social media access and smart phones allow for increased communication between maritime workers and their family and friends on shore. This has been seen as a double-edged sword. On the one hand, the ability to be in touch allows for reduced isolation. On the other hand, the mariner may be made aware of situations which they have no ability to directly address, thereby increasing their stress and possibly adding to their cognitive load.

Physical

Various physical stressors have been identified from either the literature or the semi-structured interviews.

Mariners face harsh working conditions on board which can be exacerbated by bad weather and rough waters.[16] They must contend with the stresses caused by vessel noise, vibration, odors, and motion.

Additionally, they work in areas of temperature extremes where conditions can be either too hot or too cold.[17] All these physical stressors are not only present while they work, but while they are awake off-duty as well as during their sleep periods.

It has been reported that there is a lack of physical activity among wheelhouse mariners that is detrimental to their health and well-being, and often leads to increased weight gain.

Mariners are often exposed to whole-body vibration and hand-arm vibration produced by the engine and lifting equipment. Prolonged exposures to hand-arm (and whole-body) vibrations increase the risk of musculoskeletal disorders, peripheral vascular and sensorineural issues, decreased touch sensitivity, loss of manual dexterity, and vasospasm (sudden restriction of blood vessels). The physical nature of the work of deckhands further increases the risk of them experiencing musculoskeletal injuries as well as repetitive strain and ergonomic-type injuries.[18]

Psychosocial

Between the literature and the semi-structured interviews many psychosocial stressors were identified within the mariner population.

Mariners live and work on board a boat with a limited number of other people. They have noted that they worry about the safety of the vessel as well as the families that they leave at home.[19]

It has been reported that they experience high rates of mental health issues such as post-traumatic stress disorder (PTSD), anxiety, depression, and suicide ideation.[20] These issues can undoubtedly be attributed, at least in part, to feelings of loneliness and boredom as they live in relative social isolation. And while there can be extreme boredom for long periods of time, these are often followed by times of extreme stress.[21]

The transient nature of crew makeup on many boats can create issues regarding social belonging, conflicts between crew members, and a lack of social interaction and communication on board the vessel. Crew members may experience offensive actions and harassment as well as bullying from coworkers.[22] A lack of privacy has also been noted by mariners.[23]

Likely exacerbated by long absences from home followed by long periods at home, work-family conflict is another source of psychosocial stress, as are financial pressures.[24]

Table 1 (on page 12) depicts these various stressors in tabular form.

WELL-BEING ISSUES IDENTIFIED FROM EITHER LITERATURE REVIEW OR SEMI-STRUCTURED INTERVIEWS

The following is a discussion of findings regarding well-being identified within the overall inland mariner population. The issues are grouped into three categories, however it should be noted that these groupings are somewhat arbitrary in that certain issues contain elements that would allow them to be classified into a different category. Nonetheless, the categorization scheme used appears useful to understanding the described well-being issues of mariners. The three well-being issue categories are: (1) Physical; (2) Psychological; and (3) Personal/Lifestyle.

Physical

There is a reported high prevalence of mariners being overweight or obese.[25] Of particular concern are the reported rates of above average body mass index (BMI) among those working on tugboats. Only 5% of these mariners had a normal BMI, with 33% being overweight and 61% being obese.[26] Being overweight is associated with other well-being issues including high blood pressure, high cholesterol levels, diabetes, and metabolic syndrome (a cluster of conditions that increases the risk of heart disease, stroke and diabetes. Metabolic syndrome includes high blood pressure, high blood sugar, too much body fat around the waist and irregular cholesterol levels.) The literature has shown that inland mariners do not fare well in these measures, with 42% having hypertension, 42% having high levels of triglycerides, 47% having low levels of high-density lipids (HDL), a 9% prevalence of diabetes, and 39% having at least three features of metabolic syndrome.[27] Additionally, compared to other industries, these mariners have high prevalence of cancer.[28] Dermatological issues are also prevalent in this workforce.[29]

The physical well-being issue that is the most prevalent and widely-discussed in the literature is fatigue. Although companies put forth measures to prevent fatigue, in practice they are often ineffective. Mariners report having poor quality of sleep and often feeling tired while awake.[30] Typically, mariner watches do not allow for seven consecutive hours of sleep. It has been reported that it is difficult to fall asleep and to stay asleep given the constant noise and vibration associated with the vessel. Mariners also report using sleep-promoting medications and supplements. Additionally, the use of stimulants to stay awake, including caffeinated substances such as coffee and energy drinks, has been noted.

Psychosocial

Mariners suffer from many common psychosocial well-being issues. They have a reported high prevalence of common mental health problems including anxiety and depression.[31]

They have an elevated risk and incidence of suicide. The risk of suicide is quite high during transitions: the days immediately after leaving the vessel, and the days immediately before returning to the boat.[32]

There is reported abuse of alcohol.[33]

Mariners are also concerned about hazing, bullying, harassment, sexual harassment, and sexual assault.[34]

Personal/Lifestyle

The literature review and the semi-structured interviews identified personal or lifestyle well-being issues among the inland mariner population. Adverse health behaviors based upon prevalence ratios (adjusted for age, sex, race/ethnicity, and education) are high compared to other U.S. industries. Published articles have described a high prevalence of smoking,[35] alcohol abuse,[36] and drug abuse among this population. It has been reported that approximately 41% of these mariners smoke tobacco.

continued on page 13...

Table 1. Stressors identified from the literature

WORK ENVIRONMENT

- Long working hours
- Grueling work
- Greater use of technology resulting in increased cognitive load
- Supervisor demands
- Insufficient separation between workplace and leisure area
- Management of unplanned events and responding to emergencies
- Ambient indoor and outdoor light
- Lack of access to exercise facilities
- Length of deployment
- Separation from home and community
- Physically and mentally demanding profession in one of the more dangerous work environments
- Working at night
- Shift (6-6 worse than 4-8), working more than 13 hours per day
- High risk of overeating
- Ergonomic strain
- Task-related upper extremity (hand/arm) vibration as a result of onboard mechanical (engine/machinery) vibration
- Low physical activity
- No distinction between work and home life

ORGANIZATIONAL

- Sleep deprivation / poor sleep quality
- Poor sleeping conditions
- Shift work
- Work schedules (tugs: 12-12; inland maritime typically square watch of 6-6-6-6)
- Crew scheduling
- Crew rotation schedules
- Amount, availability, and nutritional value of food available onboard
- Task and skill variety
- High workload
- Hierarchical structure of the organization
- Time pressures
- Constantly changing job demands
- No time to wind down before sleep
- Connected (internet-enabled) vessel
- Low level of autonomy

CULTURAL

- Cross-cultural differences
- Culture of overworking onboard vessel

PHYSICAL

- Repetitive strain injury
- Environmental noise
- Bad weather
- Physical nature of work increases risk of musculoskeletal injuries
- Temperature extremes (too hot, too cold)
- Odors
- Vessel motion
- Vibration
- Heat

PSYCHOSOCIAL

- Extreme boredom for long periods of time followed by extreme stress
- Stressful environment
- Mariner's sense of belonging
- Company support
- Social integration
- Isolation from friends and family (social isolation)
- Bullying from coworkers
- Conflicts among crew members
- Worries about money
- Insufficient family care/support (both directions)
- Mental health issues (e.g., PTSD, anxiety, and stress-related disorders)
- Hazardous working conditions
- Lack of privacy
- Loneliness
- Lack of social interaction and communication onboard
- Transient nature of crews
- Prolonged absences from family
- Offensive actions and harassment
- Work—family conflict

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Binge drinking has also been noted as an issue. All these issues can be detrimental to health, but can also negatively affect the ability of mariners to perform their work safely.

Unhealthy eating habits including poor dietary intake and malnutrition have also been noted in the published literature.[37] In fact, it has been reported that the majority of crewmembers only 'sometimes' engage in healthy eating practices. There is a reported low rate of regular exercise.[38]

Lastly, there is a reported reluctance among mariners to obtain professional help for mental health issues. This may be tied to organizational structures that may lead to alienation of the mariner for seeking and/or receiving such services.[39]

Table 2, below, depicts these various stressors in tabular form.

Table 2. Well-being issues identified from the literature

PHYSICAL

Sleep problems

Metabolic disorders (conditions that affect chemical reactions occurring inside the human cell)

Medication and supplements (e.g., stimulants and sleep-promoting substances)

Exposure to pathogens

Overweight/obesity

High levels of triglycerides

Low levels of HDL cholesterol

Hypertension (high blood pressure)

High level of fasting glucose

Metabolic syndrome (a cluster of risk factors specific to cardiovascular disease including large waist circumference, high blood pressure, high fasting blood glucose, high triglyceride levels, and low high-density lipid cholesterol levels)

Diabetes

Cancer

COPD (chronic obstructive pulmonary disease)

PSYCHOSOCIAL

Burnout

High prevalence of common mental health problems (anxiety, depression)

Elevated risk and incidence of suicide

Alcohol use

Drug-induced problems

Concern about hazing, bullying, harassment, sexual harassment, and sexual assault

PERSONAL/LIFESTYLE

Poor dietary habits

Adverse health behaviors (prevalence ratio adjusted for age, sex, race/ethnicity, education) compared to other industries

Binge drinking

Smoking

Majority of crew only "sometimes" engage in healthy eating practices


WORK VEST ONLY

RECOMMENDATIONS IDENTIFIED FROM LITERATURE REVIEW

The following is a discussion of the recommendations to improve mariner health and well-being either identified within the published literature or during the structured interviews. The recommendations are grouped into six categories; however it should be noted that these groupings are arbitrary in that certain recommendations contain elements that would allow them to be classified into a different category. Nonetheless, the categorization scheme utilized appears useful to understanding the recommendations from literature regarding mariner well-being. The six recommendation categories are:
(1) Physical; (2) Psychological; (3) Personal / Lifestyle; (4) Organizational; (5) Individual; and (6) Research.

Physical

There were several categories of recommendations regarding the physical well-being of inland mariners.

Concerning screening of workers, it was recommended that there should be physical guidelines for all new-hire crewmembers, similar to those utilized by the United States military. These would include BMI requirements as well as physical ability and endurance testing. Additionally, crewmembers should be required to maintain a certain degree of health and physical activity to continue to work.[40] It was also recommended that companies utilize the Functional Movement Screen (FMS) and the Y Balance Test (YBT) to identify people at high risk of injury, thereby allowing for targeted education.[41] Another suggestion was for maritime companies to institute mandatory mid-period physicals (every 2.5 years) for credentialed mariners.[42] Lastly, there was a recommendation that companies institute a glucose monitoring program as an elevated HbA1c level could result in a mariner's license being put on hold.[43]

The second category was nutrition-based. It was recommended that healthy foods be substituted for unhealthy ones, and to reduce access to unhealthy snack foods that tend to be readily available on board the boat.[44] It was suggested that health promotion and wellness programs be instituted if they are not already available.[45]

Exercise equipment should be installed on board vessels to allow mariners to work out while on the water.[46] Lastly, it was recommended that the physical comfort of work and rest spaces be improved.[47]

Psychological Health

There were several recommendations with regard to maintaining the psychological well-being of inland mariners. Some of these were relatively non-specific, which would make them more difficult to institute. These included the recommendation to ensure a positive mood aboard the boat.[48] One specific recommendation was to introduce mental health education and the creation, or strengthening, of prevention programs for psychological well-being.[49] The institution of a resiliency program, possibly based upon the Shell resiliency model, was suggested.[50]

A 'safe environment' should be created that supports employees, ensures that their voices are heard, and creates fair conditions. Along these lines, crewmembers need a 'shared mission,'[51] and, as a part of this, the level of team cohesion needs to be improved.[52] It was suggested that companies have a shore-based mental health champion always available, and that mental health resources be posted on each vessel. For example, crews should have easy access to crisis line numbers such as the national 988 Suicide and Crisis Lifeline, and the Seamen's Church Institute chaplaincy contact details: **24-hour emergency line 800.708.1998, and email chaplain@seamenschurch.org for non-emergencies.**

Stressors noted earlier in this report included the relative isolation that mariners undergo. One recommendation was that the emotional health of mariners be assessed prior to boarding the vessel as well as at various intervals during their time onboard.[53] Although non-specific, it was noted that companies should endeavor to reduce the social isolation of mariners on board their vessels.[54] Utilizing mealtimes as opportunities for social interaction should be encouraged.[55] It was also suggested that there be peer support and mentoring of mariners.[56]

Greater incorporation and use of Employee Assistance Programs (EAPs) was suggested as the current usage has been estimated at two percent.[57] Educating these providers regarding the life of the inland mariner along with the unique stressors of the occupation was recommended. The promotion of well-being, including the provision of mental health counseling for mariners, should be an aim of all maritime stakeholders. No mariner should struggle to get necessary support for personal and work-related issues. Counseling helplines should be available to all mariners. In a competitive arena such as the maritime industry, excessive cost has been cited as a reason that these types of programs are infeasible, despite the fact

that some years ago in 1990, the U.S. Department of Labor noted that for every dollar invested in an EAP, employers saved between $5 and $16,[58] though more recently this figure has been estimated at just over $5.[59] This large return on investment makes these programs extremely cost-effective and raises quality of life for employees.

It was suggested that an inland maritime equivalent of the Seafarers Happiness Index be created to assess crews on a regular basis, and that trends in this index be evaluated to determine if interventions need to be implemented. It was also suggested that newsletters be sent to maritime workers with messaging on the emotional health subjects of coping, dealing with stressful or anxiety-producing situations, forgiving, and grace.[60]

Personal/Lifestyle

There were a few personal/lifestyle recommendations to increase the well-being of mariners. One suggestion was to change the mariner mindset to incorporate a healthier lifestyle.[61] Positive health messages should be advocated by the company through training, policies, and marketing material.[62] As part of this training, the importance of good nutrition and physical exercise should be addressed.[63] Annual health fairs that incorporate education regarding chronic diseases should be held. It was also recommended that inland maritime companies hold friendly competitions among boat crews aimed at improving their lifestyles.

It has been reported that crew members are not averse to healthier food options; that they enjoy the taste of healthier foods and would snack on fruits and vegetables. Thus, it is imperative that maritime companies have healthier foods on board and that cooks and captains receive training on preparing and providing nutritional foods.[64]

Communication

It was recommended that inland maritime companies take steps to improve communication between employees, both among those on the boat as well as between the boat and the company's onshore employees.[65] It was suggested that watch-ready conferences be incorporated into the standard operating procedure of the vessel.[66]
As part of a holistic approach to the mariner, it was recommended that companies communicate with the families of mariners to ensure that they are faring well while the mariner is working on board.[67]

Healthcare

The literature recommended improving the medical services available to inland mariners. The use of telemedicine to access healthcare professionals, including physicians, is recommended.[68] Telepsychiatry should be included within the telemedicine realm wherein mental health professionals are able to respond in a timely manner.

It has been reported that it is difficult to obtain professional help for mental health issues.[69] It is possible that there are not enough mental health professionals available to support mariners and there are surely even fewer who understand the unique stressors of the occupation.

The establishment of health surveillance programs for mariners was recommended.[70] One benefit of a surveillance program would be the identification of mariners at increased risk of a significant health event. As an example, mariners diagnosed with high blood pressure could obtain treatment on the vessel, thereby reducing the risk of a negative outcome for the mariner and the resulting impact on crew psychology, workload, and product delivery schedule.

It is important to note that there is a general distrust of the medical care system among inland mariners. Many mariners are suspicious of the system, particularly that if medical issues are identified, the mariner will lose their job and not be able to find employment within the industry.[71] This perception needs to be changed as many mariners will only seek medical help as a last resort, at times leaving untreated conditions to worsen rather than proactively seeking help.

Culture

The overarching recommendation is that the culture of care needs to be improved within the inland maritime industry. As part of this, the work environment and quality of life on board need to be improved. It was recommended that a health and wellness strategy be developed such that mariner well-being is considered in any organizational decision, thereby developing an approach that embraces prevention of problems.

It was also recommended that maritime companies view mariners' work more holistically. They should promote work arrangements that incorporate social support for the crew and their families.[72] Awareness of employee well-being needs to be improved.

Inland maritime companies need to reduce/eliminate the cultural stigma regarding the reporting of mental health and well-being issues.[73] The culture needs to be changed so that it is not only okay to discuss mental health, but it is encouraged.[74]

Currently, there is a culture that may encourage excessive alcohol use, including binging, during time off the vessel. This needs to be addressed.

The companies need to endeavor to create an environment wherein mariners feel safe to discuss concerns.

It was also recommended that companies provide resources to mariners' families—spouses, parents, children, extended family—concerning the importance of supporting mariners' health and safety while on board by minimizing potential distractions over which the mariner has little or no control while at work.[75]

It was suggested that maritime companies ensure that mariners are aware of their company EAP program, and that they know that there are no adverse effects to the mariner for using this program.[76]

Lastly, it was recommended that the captain be a role model for healthy behavior.[77]

Work Demand

There were various recommendations in the literature and from the semi-structured interviews regarding reducing work demands on the mariner. Two of the more simplistic suggestions were to check staffing levels and, more specifically, to increase the number of crew.[78] This would achieve the goals of another recommendation, namely, to mitigate the mental and physical burden of work on board the boat.

It was also suggested to promote work arrangements that incorporate a high degree of decision-making and latitude as a way of engaging the mariner. It was recommended that there be more autonomy among the crew, allowing them to utilize their variety of skills.[79]

Nutrition

It was recommended that a healthy diet policy be encouraged at the management level and include specifically-designed programs to promote a healthy diet onboard the vessel.[80] This would include educating and training cooks about healthy cooking as well as educating crewmembers regarding healthy food choices.

The use of unhealthy food should be reduced while healthy food options need to be readily available. Cooks should be hired with the understanding that healthy cooking is a requirement of the position. [81]

It was recommended that worksite wellness programs focusing on the captains and cooks be implemented, as they are the decision-makers when it comes to food. Additionally, cooks and captains should be utilized as the onboard "nutritional gatekeepers" to facilitate a cultural change.[82] A change in culture that results in healthier and more nutritious eating habits will help reduce cardiovascular disease risk factors such as high BMI, high cholesterol, and high blood pressure. The creation of a healthier crew will not only benefit the employees, but will also reduce health care costs, increase productivity, and retain trained crewmembers.

Fatigue

There were two overarching topics concerning recommendations for reducing fatigue among mariners. The first was to develop and implement a fatigue management plan and incorporate it into the existing safety management system. The American Waterways Operators published a guide specifically addressing this recommendation.[83] They stated that the plan should incorporate the four core elements of education, environment, work readiness and fatigue reporting, and performance measurement.

The educational component should discuss why fatigue awareness and risk management is important, how to mitigate fatigue, and how the company is helping its crewmembers manage fatigue.

The environmental component needs to address engineering controls to consider in the sleep environment such as black-out shades, incorporation of light dimmers, and good-quality bedding; engineering controls to consider in the vessel environment including installation of "soft floors," and ensuring that smoking areas are located to minimize noise and smells for crewmembers trying to sleep. Behavioral controls to consider include avoiding holding crewmember meetings and drills in the middle of rest periods, avoiding sharp increases or decreases in vessel thrust while crewmembers are sleeping, and as much as possible, using doors away from sleeping quarters.


CAPT FRANK GIBSON
CAPT FRANK GIBSON

The work readiness and fatigue reporting component of the fatigue management plan should make clear that crewmembers should report to work rested and that the company should provide adequate opportunity for crewmembers to rest. It should establish a procedure for crewmembers to report fatigue without penalization (unless this is a recurring theme for the crewmember). Lastly, within this component, it should encourage crewmembers to regularly assess themselves and each other for signs of fatigue, such as feeling exhausted, difficulty concentrating or completing tasks, forgetfulness, irritability and mood swings, yawning, dropping one's head, and eye-rubbing.

The performance measurement element should establish a baseline prior to implementation of new fatigue mitigation strategies to determine the impact of the intervention. It should also monitor fatigue reporting for trends and address recurring risk factors. Crewmember feedback should be solicited through surveys, or other means, to determine what works, what doesn't work, and to gather suggestions to reduce fatigue onboard.

The second overarching topic for recommendations to reduce fatigue among mariners involved the measurement of fatigue while on board.[84] Mariner fatigue, sleepiness, and sleep behavior should all be captured. It was suggested that a process to detect fatigue in real-time needs to be developed.[85]

Training

The literature review and the semi-structured interviews resulted in the following recommendations regarding the training of crew members.

A resilience training program should be implemented for all mariners.[86]

Leadership training is of paramount importance.[87] This should include leadership skills training as well as effective leadership communication. The human element of leadership should also be addressed with a focus on training regarding the well-being of the crew.

It was suggested that simulator technology be utilized to address issues related to teamwork, communication, and job roles.[88] Physical and technical adjustments to the operation of the boat could then be evaluated.

It was recommended that cooks and captains be trained regarding nutrition and healthy diets.[89]

Finally, it was recommended that crewmembers be trained to recognize the signs of a mental health crisis and offer basic support to colleagues in need.

Individual

The published literature also included recommendations specific to the individual mariner as opposed to organizational level interventions.

It was recommended that the mariner always follow standard processes and procedures.[90]

There was a recommendation that crewmembers use personal protective equipment (PPE) as appropriate and that others onboard encourage this practice.[91]

It was suggested that mariners avoid caffeine and alcohol prior to sleep as it interferes with getting good rest.

Lastly, mariners were encouraged to seek mental health support if they are struggling, and crewmembers were reminded to check in with colleagues, asking directly if they are considering self-harm or suicide, or if there are concerns about their mental well-being.

Government

It was recommended that there be better communication between the United States Coast Guard and maritime companies regarding forthcoming regulatory changes, as this would give companies time to prepare. For instance, it was noted that a physical wellness policy was established in 2008 that reduced the maximum recommended body mass index (BMI) level from 40 to 35 without coordination with the companies.[92]

It was also recommended that regulations on state and federal levels concerning the care of mariners be reviewed. Of particular concern is that the use of telemedicine may be problematic as a boat crosses state lines due to state-specific licensure of physicians. Thus, a mariner may be undergoing a mental health crisis and receiving healthcare through telemedicine as the boat crosses from one state to another. In many cases, the physician may not be licensed in the next state and would legally have to end care.

Other

A few of the recommendations from the literature or from the semi-structured interviews did not fall neatly into one of the categories listed above.

It was recommended that maritime company leadership and management meet and interact with their crews,[94] and that they should listen to crew concerns and opinions. This would be one step in showing the crew that their roles are valued, which is important for both morale as well as mental health of the mariners.

One criterion for promotion should be how leaders relate to their coworkers and colleagues. It was suggested that human factor data already being collected by maritime companies be tracked and analyzed to determine areas that need improvement. [95]

It was recommended that companies share safety knowledge and experience across the industry. [96] This could be implemented through an anonymous database accessible by stakeholders.

Lastly, it was recommended to ensure that the vessel's equipment is safe and up to date. [97]

Research

It should be mentioned that the literature noted a lack of knowledge about maintaining the well-being of mariners. As such, many of the published papers recommended that research be conducted to fill in these gaps. It was suggested that research be utilized to determine how crewmembers rate their stress, the demands put on them, control, relationships, role, and support. It was also recommended that crew health-related data be collected, analyzed, and tracked to better understand the risk factors for poor well-being as well as their relationship with injuries and incidents.[98]

It was recommended that research be conducted on the use of positive psychology interventions. [99] In particular, whether positive psychology interventions and training are viable options in the inland maritime workplace and, if so, whether they enhance well-being, performance, and safety. Research should also be conducted to determine the advantages and disadvantages of incorporating these types of interventions, as opposed to other forms of psychological treatments in the maritime context.

Research should be used to determine how a systems-based approach to analysis and implementation can be designed to facilitate integrated health care interventions in the maritime environment. [100] The holistic approach should be incorporated such that health-related behaviors both on and off the boat, as well as how behavior transfers from the boat to the home environment and back again are included. Motivational strategies that initiate and sustain health-related behavior changes beyond the extrinsic factors of job loss and company incentives need to be explored.

It was recommended that the behavior risk data, anthropometric measurements (assessing the size, proportions, and composition of the human body that include height, weight, limb lengths, and various circumferences), diagnoses of chronic diseases, and biochemical indices of crewmembers be compared between mariners from companies that embrace and promote healthier lifestyles on the boat to those that are not being proactive.

It was also recommended that the health and nutritional educational levels of inland marine cooks and captains, as well as their perceptions of benefits and barriers to healthy eating, be evaluated. [101] If found to be lacking, it is recommended that they be trained in this regard as it is often the cooks and captains who are key decision makers when it comes to setting a culture of healthy eating on the vessel.

Lastly, it is recommended that suicide data, both operational and non-operational, be collected as the industry has a relatively high prevalence of mental health issues and, particularly, suicide. [102] This data should be tracked to determine modifiable risk factors.

Regarding nutrition, the eating patterns of mariners need to be studied and potential interventions evaluated.[103] Motivations need to be identified to initiate and sustain health-related behavior. Health-related behaviors need to be examined both on and off the vessel to determine how behavior transfers between the vessel and home. The percentage pass rate for Merchant Mariner credentials should be investigated to determine the effectiveness of health promotion activities.

Research should be undertaken to determine the root causes of health risks for inland mariners. [104]

The incidence, as well as the characterization, of fatigue within this occupational cohort need to be determined.[105] The feasibility of adopting and implementing fatigue mitigation systems needs to be determined. The efficiency of these systems also needs to be evaluated. [106]

The importance of monitoring working hours as they relate to the health and safety of the mariner, especially on board the vessel, needs to be determined. [107]

It was also recommended that gender differences in occupational health and safety among inland mariners be researched. [108]

The effects on mariner well-being with regard to their family support and obligations on individual levels need to be better understood.

It is recommended that this research incorporate randomized controlled trials and longitudinal research methods (collecting at least three observations, at different times, on a variable of interest in order to detect any temporal changes) as they are more able to determine causality than the cross-sectional studies that have generally been used to study mariner health and well-being to date. Additionally, more qualitative research is recommended to better understand the concepts, opinions, and experiences of the inland maritime industry. [109]

Tables 3a (on page 21), 3b, 3c, 3d, 3e, and 3f (on pages 22 and 23) depict these recommendations in tabular form.

Table 3a. Physical, psychological, and personal/lifestyle recommendations to improve the well-being of mariners identified from the literature

PHYSICAL

Increase the physical comfort of work and rest spaces

Incorporate health promotion programs

Utilize the Functional Movement Screen and Y Balance Tests (YBT) as screening tools to identify people at higher risk of injury. This would allow for targeted education

Institute a wellness program

Institute mandatory mid-period physicals (every 2.5 years)

Institute a glucose monitoring program as an elevated HbA1c would put mariner's license on hold

Install exercise equipment onboard the vessels so that mariners could work out while on the water

Substitute healthy foods for unhealthy ones

New hire health and physical guidelines (for all crew members) similar to that of the military (i.e., BMI requirements, physical ability and endurance testing). Employees should be required to maintain a certain degree of health and physical activity to continue work on the river

Regular yearly or bi-yearly BMI and physical ability testing to maintain Merchant Mariner credential as opposed to every five years

Reduce access to unhealthy snack foods that tend to be always available

MENTAL HEALTH

Greater incorporation and use of employee assistance programs (EAPs). Educate providers of EAPs regarding the life of the mariner and the unique stressors of the occupation

Counseling helplines

Reduce social isolation onboard

Peer support and mentoring

Improve level of team cohesion

Create a "safe environment" that supports employees, ensures that their voice is heard, and creates fair conditions and rewards

Improve interaction among crew members as well as between shoreside employees and mariners

Institute the equivalent of the Seafarers' Happiness Index for inland mariners, and monitor regularly

Ensure positive mood on board

Create a "shared mission"

Utilize mealtimes as opportunities for social interaction

Institute a resiliency program, possibly based upon the Shell resiliency program model

Emotional health should be checked before mariners get on a vessel and at certain periods during the trip

Send newsletters to workers with messages regarding emotional health (coping, dealing with stressful or anxiety-producing situations, forgiving, grace)

PERSONAL/LIFESTYLE

Train crew regarding the importance of good nutrition and physical exercise

Change mariner mindset to incorporate a healthier lifestyle

Hold yearly health fairs that incorporate education about chronic diseases

Create friendly competitions among boat crews to improve their lifestyles

Positive health messages must be advocated by the company through training, policies, and marketing materials

Table 3b. Communication, healthcare, and culture recommendations to improve the well-being of mariners identified from the literature

COMMUNICATION

Incorporate watch-ready conferences

Improve communication between employees, both among those on the vessel as well as between the vessel and shore-side personnel

HEALTHCARE

Incorporate telemedicine for onboard health concerns

Ensure telemedicine systems are staffed with mental health professionals able to respond in a timely manner

Increase trust in the medical care system

CULTURE

Reduce/eliminate the cultural stigma regarding the reporting of mental health and well-being

View mariners more holistically

Have the Captain be a role model for healthy behavior

Change culture that encourages (excessive) alcohol use during time off the vessel

Reduce stigma around discussing mental health

Create an environment where mariners feel comfortable reporting concerns

Have meetings with spouses to educate them about the importance of health and safety

Enhance the "Culture of Care"

Improve awareness of employee well-being

Develop a health and well-being strategy so that well-being is considered in any organizational decision and could thus develop a more comprehensive approach

Table 3c. Work demand, nutrition, and fatigue recommendations to improve the well-being of mariners identified from the literature

WORK DEMAND

Allow crew to utilize their variety of skills

Allow more autonomy among crew

Increase human resources (crew)

Promote work arrangements that incorporate high degree of decision-making and latitude

NUTRITION

Educate and train cooks and mariners about healthy cooking

Educate crew members regarding healthy food choices

Reduce use of unhealthy food

Utilize captain's and cook's role as the on-board "Nutritional Gatekeeper" to facilitate a culture change

Hire cooks with the understanding that healthy cooking is a requirement of the position

Mandate that healthy food options must be readily available

Implement a worksite wellness program focusing on the captains and cooks as they are the decision-makers when it comes to food

Incorporate healthier foods

FATIGUE

Develop a process to detect fatigue in real time

Implement fatigue management techniques

Measure fatigue onboard (fatigue, sleepiness, sleep behavior)

Mandate rest time akin to airline pilots

Table 3d. Training, individual, and government recommendations to improve the well-being of mariners identified from the literature

TRAINING

Resilience training program

Leadership training and development

Simulation exercises

Leadership communications and leadership skills training

Training session prior to boarding vessels

Simulator technology including issues related to teamwork, communication, job roles, and physical/technical adjustments

Teach psychological first aid to crews

Train cooks and captains regarding nutrition

Well-being training for leaders and managers (human element)

INDIVIDUAL

Use personal protective equipment (PPE)

Follow standard processes and procedures

Avoid caffeine and alcohol prior to sleep

GOVERNMENT

Review issues related to care of mariners via telemedicine as boat crosses state lines due to the state-specific licensure of physicians

Better communication between USCG and maritime companies regarding forthcoming regulatory changes

Table 3e. Other recommendations to improve the well-being of mariners identified from the literature

OTHER
Openly share safety knowledge and experience across the industry
Ensure equipment is safe and up to date
Leadership and management should meet and interact with crew
Leadership and management should listen to crew concerns and opinions
Leadership and management should show crew that their roles are valued
Promotion criteria should be based on how leaders relate to colleagues
Human factor data already being collected should be tracked and analyzed to determine areas that need improvement
Create and maintain an anonymous database to share learned knowledge across the industry

Table 3f. Research recommendations to improve the well-being of mariners identified from the literature

RESEARCH
Collect and analyze health-related data
Determine how crew rate their stress, the demands put on them, their level of control, relationships, role design, and support
Determine whether positive psychology computer-based interventions and training are effective and viable options in the maritime context
Determine whether positive psychology interventions and training enhance well-being, performance, and safety in the maritime workplace
Determine the facilitators and barriers to the effective implementation of positive psychology interventions in the maritime context
Determine the advantages and disadvantages of incorporating positive psychology interventions, relative to other forms of psychological intervention, in the maritime context
Determine whether positive psychology interventions and training can be designed and administrated so that they are accessible across ranks, sexes, ages, races, and ethnicities on board
Determine how a systems-based approach to research and implementation can be designed to facilitate integrated health care interventions in the maritime environment
Identify motivations that initiate and sustain health-related behavior changes beyond the extrinsic factors such as job loss and company incentives
Examine the "whole person," i.e., health-related behaviors both on and off the boat as well as how the behaviors transfer from the boat to the home and back
Investigate percentage pass rate for Merchant Mariner credentials, and whether the yearly physicals and health promotion activities made an impact
Compare and contrast behavior risk data, anthropometric measurements, diagnoses of chronic disease, and biochemical indices of the crew from companies embracing and promoting healthier lifestyles on the boat to those who are not being proactive
Investigate the health and nutrition status of inland cooks and captains, as well as their perceptions of benefits and barriers to eating healthily and physical activity
Collect suicide data (operational and non-operational)

PRACTICES EMPLOYED AND/OR STUDIED

Several different interventions have been put into practice by maritime companies to increase the health and well-being of mariners. The amount of discussion regarding these interventions, including the methods employed for their implementation, the willingness of mariners to embrace the interventions, and the evaluation of the effects of the interventions, is limited. The various interventions tended to target different factors relating to mariner well-being. These included: work demand, lifestyle, physical health, mental health, stress management, fatigue, and culture. There were also interventions that did not fall into one of these categories and were, therefore, included in an "Other" category.

Regarding work demand, two interventions were discussed. The first was to evaluate different hitch rotations. These schedules included:

1. 20 days on, 10 days off
2. 28 days on, 28 days off, and
3. 21 days on, 21 days off

It was determined that working twenty-eight days in a row resulted in many mariners reporting that they felt miserable by the last week. There was no discussion regarding the benefits or detriments of working other deployment schedules.

The second intervention relating to work demand was to have a watch-ready conference prior to each shift. The companies found that this was very effective in reducing stress as crewmembers were not only able to get mandated information about operational issues, but were also given an opportunity to voice concerns. The intervention was initiated three to four years ago and is in use today.

A few lifestyle interventions were reported in the literature. The first was to modify recipes and menus to make crew food options healthier. The second was to incorporate environmental changes that put regular food out in open spaces while putting snack foods and desserts in cabinets. Another intervention was to eliminate soda machines and to keep water out in open spaces. The use of smaller plate size was also implemented. Unfortunately, although there was information noting that these interventions had been implemented, there is no information regarding their effectiveness, or whether any or all of them are still in place.

Telemedicine has been incorporated by the inland maritime industry. This would be expected to improve crew well-being, both physically and mentally. However, there is no discussion about the effectiveness of telemedicine on the well-being of these crewmembers, much less its efficacy on different medical conditions.

Regarding physical health, many boats have had gym equipment, including step climbers, installed onboard. Again, there is no reporting of the effectiveness of this type of intervention. One company has initiated a glucose monitoring program for crewmembers with known high levels of HbA1c, as this condition would put a mariner's license on hold without an intense diabetic monitoring program. Initial feedback is that the program can be effective but, to date, it has included very few mariners.

Another intervention that could improve the physical health of mariners is organizational in nature. Shell Shipping & Maritime openly shares its safety knowledge and experience across the industry through its "Partners in Safety" program, which was created in 2012.[110] As part of this program, Shell Shipping & Maritime may have boats boarded in order ascertain a company's organizational culture. They will ask the crewmembers questions as to whether their chief executive officer (CEO) visits the boat, when was the last time that the crewmember saw management and what did they discuss, and whether the crewmember was informed about the five basic principles of human and organizational performance. The overall effectiveness of the program is not noted in the published literature, nor is any information on its return on investment.

One company instituted a wellness program wherein employees had the insurance costs reduced by $600 per year if they saw a physician and got a yearly physical exam. The program was somewhat effective as 40% of the employees took advantage of the offer. Unfortunately, it still means that the majority of their employees did not see a doctor for a yearly physical examination. There is no information regarding the effect of the program on the well-being of the mariners.

Various interventions were undertaken to try and improve the mental health of mariners. The largest and most discussed is the incorporation of Employee Assistance Programs. These programs are typically outsourced to a third party, in part to ensure the confidentiality of the mariners who utilize the service. The cost to the company

has been reported as between $12 and $14 per employee per month. Unfortunately, the use of these programs by crewmembers has remained low, estimated by some to be approximately 2%. The culture of the inland maritime industry is such that crewmembers who utilize the EAP feel judged due to the stigma surrounding mental health issues. Again, the effectiveness and the return on investment for EAPs in the inland maritime industry has not been documented in the literature.

A largely blue-water initiative that may have found its way to the inland marine sphere (it is unclear from the literature) is a resilience program. Shell Global's International Trading & Shipping Company professionals created the Shell Health psychosocial program the goal of which is to support the welfare of employees both on- and off-shore. The voluntary program was piloted in 2014 with an intervention group consisting of twenty-one vessels, half of its fleet. The intervention consisted of the following twelve psychosocial program modules:

1. Introduction: What is resilience?
2. Take care of yourself
3. Make connections
4. Avoid seeing crises as insurmountable problems
5. Accept that change is part of living
6. Move towards your goals
7. Take decisive actions
8. Look for opportunities for self-discovery
9. Being grateful can accomplish more
10. Nurture a positive view of yourself
11. Keep things in perspective
12. Maintain a hopeful outlook

Officers acted as facilitators of the modules, each of which are 40–60 minutes in duration. It was determined that the onboard psychosocial program may have provided a psychological buffer that countered the impact of a mariner's time on board upon perceived stress. One challenge to incorporating this type of program aboard is the frequent changeover of crew. To alleviate this issue, a peer-to-peer training scheme was utilized whereby officers trained other officers on board so that if a trained facilitator disembarked, the program would still be able to continue. Fatigue is widespread among working mariners. One risk factor for fatigue is lack of adequate or quality sleep. A simulation study was performed regarding sleep, though the details of the study are unknown. The outcome of the study was that if a mariner gets six hours of quality sleep, they will be "good to go." Exactly what "good to go" meant is unclear.

It is important for a company to foster a positive culture, as it will reduce stress while increasing well-being of the employees as well as profits for the business. A culture of care sees its employees as real people with friends and family whom they care for and who care for them. It is one in which employees are valued and regarded as the most valuable asset of the company. It is also one in which the employee feels motivated and engaged in the business. Knowing whether the employees are engaged in the business is important in understanding the state of the company. Some inland marine companies employ annual employee engagement surveys to understand the current level of engagement and its current trend.

As part of a culture of care, to help alleviate stress among those employed in the inland maritime industry the Kirby Corporation created a 501c charity: Kirby Disaster Relief. This allowed employees to donate money so that the charity could assist maritime families that are adversely affected by severe weather. Thus, if a damaging storm occurred while the mariner was working and away from home, they know that their loved ones will be supported. Through this, the company promoted a feeling of familial support, thereby reducing stress on the mariner.

Another company meets with the spouses of its crewmembers to educate them about the importance of supporting mariners' health and safety by minimizing distractions while they are at work. The company invites all spouses to attend a "No Harm" Banquet, and as part of this gathering, a session is held with spouses where company officials discuss why mariner safety is as important to the company as a whole as it is to the mariner's loved ones. This intervention treats the mariner holistically and encourages everyone in the company to think of themselves as one large family.

A priority of the U.S. Committee on the Maritime Transportation System (MTS) is to advance the health, welfare, diversity, and growth of the MTS workforce. One objective is to provide an interagency forum for discussions and initiatives related to the health and welfare of the MTS workforce including mariner mental health, sexual assault,

sexual harassment, and living conditions aboard vessels. This collaboration will, hopefully, lead to governmental policies that increase the well-being of inland mariners.

Human factors rather than mechanical factors are the cause of most fatal accidents. Major antecedents include unsafe working practices, negligence, flawed perception of risk, and inadequate training. Important preventive measures include training and partnering new crew members with more experienced mariners. Of paramount importance is the maintenance of sensors and controls including oxygen and hazardous atmosphere detectors for entry into enclosed spaces and, for navigation, electronic chart display information systems in combination with global positioning systems, and bridge navigational watch alarms.

BARRIERS TO IMPLEMENTATION

There are various barriers to the implementation of interventions to improve mariner well-being. Inland maritime companies state that the cost of implementing an intervention is not of great concern as they believe an effective intervention will not only keep mariners healthier but will have a high return on investment. At the same time, the idea of increasing crew size is not considered viable due to the pressure to remain competitive in the marketplace. “Limited wake shift-work” schedules redistribute time-at-work into smaller aliquots which are evenly spaced across a 24-hour period. Inland maritime companies commonly use a limited wake shift-work schedule which is defined as six hours-on/six hours-off. Limited wake shift-work schedules minimize consecutive hours at work, promote opportunities for rest between shifts, and allow all workers at least some opportunity to sleep during nighttime. Published research regarding limited wake shift-work schedules has suggested that four hours-on/eight hours-off schedules offer the greatest promise to maximize sleep and reduce sleepiness, with likely benefits to performance. But a shift from a six hours-on/six hours-off schedule to a four hours-on/eight hours-off schedule would necessitate increasing the number of crewmembers on board a boat, thereby increasing cost for salaries as well as all the other costs associated with feeding and caring for a mariner. As the industry is very competitive, unless all U.S. inland maritime companies were to increase crew sizes, those that did would be at a competitive disadvantage. The only likely method to have all companies increase crew sizes would be to mandate it through regulation, something that is very unlikely.

Without increasing the crew size, combatting fatigue will remain a challenge. There is an expectation that mariners are responsible for managing and tolerating fatigue as part of their working life on the water. It leaves, as such, an individualistic approach to managing fatigue. This approach will continue to present difficulties as some mariners, due to work schedules, will not be able to consistently get at least seven hours of continuous sleep. This is problematic as, according to the Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society, sleeping less than seven hours per night on a regular basis is associated with adverse health outcomes, including hypertension, heart disease, stroke, depression, weight gain and obesity, diabetes, and increased risk of death. Sleeping less than seven hours per night is also associated with deficient immune function, increased pain, impaired performance, escalated errors, and greater risk of accidents. Additionally, circadian rhythms are often not adequately internalized due to the 24/7 operations of the boat.

The ability to reduce noise and vibration in sleep areas on the boat would require design changes in the boat building process. This would require additional architecture and construction costs. Although this is not a reason to pass on redesigning boats, it would be years until these improvements would reach the maritime workers. It is also likely that to redesign or retrofit current boats to reduce the noise and vibration would be cost-prohibitive.

Proper nutrition has its own barriers. Like most average Americans, a mariner's diet is high in fat, salt, and sugar. Many crewmembers on towboats look forward to eating traditional “southern-style” food. Additionally, large portions of food are considered by some to be one of the benefits of working on a boat. Although it has been reported that inland marine crewmembers are open to healthier food options, that they enjoy the taste of healthier foods, and would snack on fruits and vegetables, shifting culture in this manner is often difficult and takes conviction on the part of maritime companies and individual mariners to see it through over time.

Another barrier to the implementation of interventions to increase the well-being of mariners is that the vessel environment is not conducive to promoting physical activity. The boats have limited space with obstructions, wires, deck fittings, and hatches, all of which create a challenge for physical activity. Walkways are often narrow, making it difficult to run on them. As was the case with reducing noise and vibration, changing the built environment would require additional design and construction costs and it would be years until these improvements would reach the maritime workers.

GAPS IN THE LITERATURE

There are significant gaps in the literature with regard to the health and well-being of inland mariners. These gaps are effectively delineated in the recommendations for research section of this document. Most notably, longitudinal studies that follow mariners over the course of their careers are needed to understand the causal relationships between demographic, psychosocial, environmental, and occupational factors relating to the well-being of mariners. These types of studies will allow risk factors of acute and chronic conditions to be identified. They also are essential to understanding the effectiveness of interventions.

CONCLUSIONS AND RECOMMENDATIONS

The literature has identified a substantial number of stressors that may affect the health and well-being of the inland mariner population. The stressors can be placed into the following five categories: (1) Work environment; (2) Organizational; (3) Cultural; (4) Physical; and, (5) Psychosocial. Exposure to a stressor within any of these categories can have an adverse effect upon mariner well-being. Unfortunately, the literature supports the belief that mariners are often, if not chronically, exposed to many of these stressors.

There is relatively sparse literature describing the health and well-being of inland mariners. There appear to be three overarching constructs under which issues relating to inland mariner welfare can be broadly grouped: (1) Physical; (2) Psychological; and (3) Personal/Lifestyle. The literature is rich in describing issues experienced by mariners in each of these categories. As with the stressors mentioned above, mariners have high prevalence of health and well-being issues related to these domains and many have more than one issue concurrently. Of note, overall, the mariner population has relatively poor mental health compared to land-based workers, with high levels of depression, anxiety, and suicide ideation.[111] Additionally, they work in harsh, isolated environments that often require physical effort. There are also lifestyle choices made among the mariner population that are problematic, including unhealthy eating habits, lack of exercise, tobacco smoking, and high alcohol consumption.

There are recommendations for improving the well-being of inland mariners, and almost all of them can be grouped into thirteen categories: (1) Physical; (2) Mental Health; (3) Personal/Lifestyle; (4) Communication; (5) Healthcare; (6) Culture; (7) Work Demand; (8) Nutrition; (9) Fatigue; (10) Training; (11) Individual; (12) Government; and (13) Research. For many of these categories, there are specific suggestions that would almost immediately improve the well-being of mariners. For instance, interventions such as training cooks and crew members with food preparation responsibilities about health and nutrition while also educating crewmembers regarding healthy food choices or ensuring mariners are properly hydrated will almost immediately result in health benefits. Leadership training, including sections on effective communication strategies, will help prevent or at least mitigate the stress associated with working in an environment with high work demands. On the other hand, improving the physical comfort of work and rest spaces, or developing strategies so that mariner wellness is a key factor to be considered in any organizational decision, could take a much longer time to accomplish, thereby delaying their benefit to the health and well-being of the crew. One overriding factor that cannot be ignored regarding many of the recommendations is that they will require investment from the organization in terms of effort and expenditure, but it seems that those are costs that many inland maritime companies are willing to expend.

Although many recommendations for improving the health and well-being of mariners have been published, the literature contains few interventions that have been put into practice by maritime companies. Interviews with representatives of the inland maritime industry have identified some additional measures that have been employed, though the numbers remain low. The various actions tended to target different factors relating to mariner well-being: work demand, mental health, lifestyle, health, nutrition, and culture. Overall, the description of methodology and reported results are often less than hoped in order to be able to ascertain the effect of the intervention as well as its generalizability to the larger inland maritime workforce. It is recommended that those who commission as well as those who conduct research include impact analysis protocols within the methodology of their pilot studies.

There are numerous barriers to the implementation of interventions to improve the health and well-being of inland mariners. The culture of the industry, which can be at odds with the well-being of its workforce, appears relatively unchanged in recent decades and seems firmly established. Given this, effecting change is difficult and requires strong organizational commitment. There are upfront costs associated with implementing, and in some cases, ongoing costs to maintain, interventions. In the longer term, the return on investment should significantly improve a company's profitability. It appears that certain recommended interventions, such as increasing the size of crews, would only occur through regulation; however, it appears that this sort of regulation will not be forthcoming in the current environment.

The semi-structured interviews were informative, as the participants were willing to discuss the culture of their organizations as well as interventions that were implemented in an effort to improve the well-being of their mariners. Overall, the interviews mirrored the available literature regarding mariner welfare, the potential upside of effecting change, along with the associated barriers. The participants tended to agree that additional research is needed to determine the effectiveness of different interventions, as well as to share learned knowledge across the industry. Additionally, most participants believed that company investment to improve the well-being of their workforce would not be an issue.

In conclusion, there is great potential to increase the health and well-being of inland mariners and, in particular, the mental health of this population. Some changes could be made quite quickly and with little expense or disruption to current practices, and yet be expected to substantially increase the quality of life for the mariner. These include nutritional interventions such as training cooks and crew members with food preparation responsibilities on health and nutrition, while also educating crew members regarding healthy food choices. Ensuring mariners are properly hydrated will almost immediately result in health benefits. Leadership training, including sections on effective communication strategies, will help prevent or at least mitigate the stress associated with working in an environment with high work demands.

It is recommended that the existing culture of care be further enhanced by the inland maritime maritime industry. This culture of care is not only about caring for the company's employees, but extends to caring for the mariners' families, caring about the organization, caring for society, and caring for the environment. A culture of care can be the core element ensuring decent work wherein employment "respects the fundamental rights of the human person as well as the rights of workers in terms of conditions of work safety…respect for the physical and mental integrity of the worker in the exercise of his/her employment."[112] As the culture of care is enhanced, mariner well-being and job satisfaction will improve, and retention rates should increase. This will allow for institutional knowledge to be retained while decreasing the high cost of training new employees and reducing learning curves during which there are high probabilities of accidents and injuries. Although it needs to be looked at as a long-term investment, a more robust culture of care will ultimately improve the lives of inland mariners and their families while reducing operating costs; a win-win opportunity for all.

It is also recommended that the work required to improve the culture of care, which is the ultimate goal, be undertaken by all stakeholders in the inland maritime industry working in partnership. With this in mind, we ask these stakeholders, including inland maritime companies, government agencies, and maritime charities, to join this endeavor. In so doing, they will gain more than just a window into research, but will join the truly noble goal of partnering in the research and implementation of interventions to improve the health and well-being of inland mariners.


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APPENDIX

CORRESPONDENCE TO INLAND MARITIME ORGANIZATIONS

Yale University Maritime Research Center is collaborating with the Seamen's Church Institute to determine practices that have been put into place within the U.S. inland maritime industry to maintain and improve mariner health. This project has three specific aims, namely:

1. To perform a literature review to identify published recommendations for the industry.
2. To ascertain practices put in place by the industry regarding the health and safety of its maritime workforce as well as their alignment with the published recommendations.
3. To assess the perceived effectiveness of these practices.

I am hoping that you would be willing to support this endeavor with a thirty minute virtual call with one of Yale's investigators to discuss practices that your organization have contemplated and/or implemented. The information obtained will be de-identified, so that it will not be attributable to your organization, and aggregated with that obtained from other organizations.

I sincerely hope that you, or someone in your organization, would be willing to participate in the near future as this information could yield a healthier workforce. Thank you in advance.

Best regards,

Marty Slade, Ph.D.
Director, Yale University Maritime Research Center

NOTES

1. Mansyur, Sagitasari, Wangge, Sulistomo, & Kekalih, 2021; Null, 2011; Null, 2012

2. O'Connell & Brock, 2013

3. Mansyur et al., 2021

4. Bloyd Null, Hasin, Partridge, & Welshimer, 2019

5. Oraith, Blanco-Davis, Yang, & Matellini, 2021

6. Shattuck, Lawrence-Sidebottom, Matsangas, & Nicholson, 2023

7. Bloyd Null et al., 2019

8. Null, 2012

9. Duval, 2019; Hobbs et al., 2018; Salyers, 2015; Thorndike, 2004

10. Null, 2011; Shan & Neis, 2020

11. Mansson, Lützhöft, & Brooks, 2017

12. Nuutinen & Norros, 2009

13. Lefkowitz, Slade, & Redlich, 2018

14. Hinkle, 2024; Oraith et al., 2021

15. Rudin-Brown, Dubé, Gauthier, Mohan, & Rosberg, 2023

16. Shattuck et al., 2023

17. Mansyur et al., 2021

18. Saraji, Hassanzadeh, Pourmahabadian, & Shahtaheri, 2004

19. Baker, 2021

20. *Ibid.*

21. Mansyur et al., 2021; Thorndike, 2004

22. Anonymous, 2004

23. Baker, 2021

24. *Ibid.*

25. Bloyd Null et al., 2019

26. Lefkowitz, Null, Slade, & Redlich, 2020

27. Scovill, Roberts, & McCarty, 2012

28. Lefkowitz et al., 2018

29. *Ibid.*

30. Hobbs et al., 2018; Lefkowitz et al., 2020; National Academies of Sciences, Engineering & Medicine, 2016

31. Baker, 2021; Lefkowitz et al., 2020

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Notes continued...

32. Anonymous, 2004

33. Lefkowitz et al., 2020

34. Ellison, 2023; Ryals, 2023

35. Lefkowitz et al., 2020; Null, 2012

36. Lefkowitz et al., 2020

37. Null, 2012

38. *Ibid.*

39. Anonymous, 2004

40. National Academies of Sciences, Engineering & Medicine, 2016; Null, 2012

41. Cosio-Lima et al., 2016

42. Null, 2012

43. NVIC, 2008

44. National Academies of Sciences, Engineering & Medicine, 2016; Null, 2012

45. National Academies of Sciences, Engineering & Medicine, 2016

46. *Ibid.*

47. *Ibid.*

48. *Ibid.*

49. *Ibid.*

50. *Ibid.*

51. Mansson et al., 2017

52. Carter, 2005

53. MHSS, 2021

54. Sampson & Thomas, 2003

55. Pike, 2002

56. Carter, 2005

57. National Academies of Sciences, Engineering & Medicine, 2016; Yassin et al., 2022

58. Buon, 2018

59. Attridge, 2022; Hargrave, Hiatt, Alexander, & Shaffer, 2008

60. Anonymous, 2004

61. Bloyd Null et al., 2019

62. Callais & Chapman, 2010

63. Bloyd Null et al., 2019; National Academies of Sciences, Engineering & Medicine, 2016; Null, 2012

64. Null, 2012

65. Paulauskas et al., 2021

66. MMIA, 2021

67. Anonymous, 2004

68. Lefkowitz, 2013; Lefkowitz et al., 2020

69. Anonymous, 2004

70. Baker, 2021; National Academies of Sciences, Engineering & Medicine, 2016

71. Anonymous, 2004

72. *Ibid.*

73. Yassin et al., 2022

74. Ellison, 2023

75. Anonymous, 2004

76. National Academies of Sciences, Engineering & Medicine, 2016

77. Null, 2012

78. Chou, Su, Li, Tsai, & Ding, 2015; Rüpke & Athanassiou, 2024

79. Pike, Broadhurst, Austin, & Rojon, 2015

80. *Ibid.*

81. Null, 2012

82. *Ibid.*

83. AWO, 2018

84. AWO, 2022; Carter, 2024; Hobbs et al., 2018

85. Hobbs et al., 2018

86. Bashir, 2025; Griffioen, van der Drift, & van den Broek, 2021

87. Downey, 2025; Oltedal & Lützhöft, 2018

88. Aderogba, 2018; Chiing et al., 2025; Jeong, Song, Chen, Lee, & Lee, 2011; Sorensen, Jensen, Caspersen, & Nielsen, 2009

89. Null, 2012

90. Chiing et al., 2025; El Desouky, 2023

91. Lee, Kim, & Lee, 2017

92. Anonymous, 2004

93. Ivanova et al., 2025

94. May, 2023

95. Case, 2023

96. Cameron, 2001; Gad, 2023; Shan & Neis, 2020

97. Sleisinger, 2009

98. National Academies of Sciences, Engineering & Medicine, 2016

99. McVeigh et al., 2017

100. *Ibid.*

101. Null, 2012

102. Baker, 2021; Lefkowitz et al., 2020

103. Null, 2012

104. Lefkowitz et al., 2018

105. Sieber et al., 2022

106. *Ibid.*

107. Mansyur et al., 2021

108. Shan & Neis, 2020

109. Anonymous, 2004

110. Bajorek, Lucy, & Bevan, 2020

111. Baker, 2021; Lefkowitz et al., 2020

112. ECOSOC, 2005

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