Fatigue-related medical conditions affecting seafarers: an exploratory case-study of Indian seafarers

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FATIGUE-RELATED MEDICAL CONDITIONS AFFECTING SEAFARERS:
An exploratory case study of Indian seafarers

By
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India

A dissertation submitted to the World Maritime University in partial fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE
In
MARITIME AFFAIRS
(MARITIME EDUCATION AND TRAINING)
2017

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I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):

(Date): 18 – Sept – 2017

Supervised by: Associate Professor - Dr. Michael Ekow Manuel

World Maritime University
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ABSTRACT

Title of Dissertation: Fatigue-related medical conditions affecting seafarers: An exploratory case study of Indian seafarers

Degree: MSc

The role of fatigue, its degrading effects on the human performance and how it has contributed either directly or indirectly to many of the major marine accidents is well documented. Similarly, fatigue among the shift-workers caused due to sleep deprivation and poor-quality sleep is known to cause cognitive disengagement, lack of concentration and increased risk of accidents in the short run and many chronic health disorders in the long run.

Studies indicate a tendency among the Indian seafarers, especially the officers, to leave the sea-career quite early in life and take up alternate jobs ashore. Some available data shows that almost two-third of all Indian merchant marine officers are leaving the sea-career before the age of 40. This dissertation study explores whether fatigue-related medical conditions are playing a part in those seafarers’ decision for leaving the sea-career early and taking up shore-based jobs.

Conclusions are drawn based on the results of the analyses of two surveys conducted; first, among the Indian seafarers and ex-seafarers, and the second, among the medical practitioners who are involved in seafarers’ medical examinations. In addition to the above, details about seafarers’ medical examinations conducted during the past two years were collected from one clinic and analyzed in detail. In the end, after a positive correlation emerged, recommendations were made to seafarers, shipping companies, and maritime policy makers, underlining the need for more effective fatigue mitigating measures and further investigation into the domain of fatigue-related illnesses.

Keywords: Fatigue, Indian Seafarers, Chronic illnesses, Health condition, Medical examination, Shift-based jobs.
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<td>B/P</td>
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<td>CVD</td>
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<td>EEG Recorder</td>
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<td>Flight Duty Periods</td>
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<td>Fatigue Risk Management System</td>
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<td>HDL</td>
<td>High Density Lipoprotein cholesterol</td>
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<td>HTW</td>
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<td>ILO</td>
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<td>MAIB</td>
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<td>STCW Code</td>
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CHAPTER – 1
INTRODUCTION

1.1 Fatigue and its impact in the Maritime sector

There is an increasing recognition of the role of fatigue, its degrading effects on the human performance and how it has contributed either directly or indirectly to many of the major marine accidents. A study conducted by the Marine Accident Investigation Branch (MAIB, 2004) of United Kingdom, examined all the collisions, groundings, contacts, and near collisions that had occurred in the United Kingdom waters from 1995 to 2003 and found that almost one-third of all groundings involved a fatigued officer who was alone on the bridge at night at the time of incident.

The United States Coast Guard funded some research studies in the past (McCallum, Raby & Rothblum, 1996; Sanquist, Raby, Forsythe & Carvalhais, 1997) to analyze the threat posed by fatigue to maritime safety. As part of these studies, over two hundred maritime casualties which occurred between 1989 and 1995 were analyzed in detail and it was found that fatigue was indeed a contributing factor in almost 16% of critical vessel casualties and 33% of personnel injuries which occurred during that period. The studies also revealed that mariners, on average, received considerably less sleep than what is required daily and accrued substantial sleep debt over a time.

From the time these studies were published, till date, there have been many other major maritime accidents, where the navigational watchkeeper’s or the maritime pilot’s fatigue was identified as being among the contributing factors. The grounding of the Bahamas-flagged M.V. Crete Cement along the south-eastern tip of Aspond Island, Norway in 2008 (Accident Investigation Board Norway, 2010), grounding of the Chinese registered bulk carrier Shen Neng I on Douglas Shoal, Australia in 2010 (Australian Transport Safety Bureau, 2011), the grounding of the M.V. Danio off Farne Islands, UK in 2013 (Marine Accident Investigation Board, 2014), are all examples of maritime casualties where accident investigators have identified fatigue as a major contributing factor.
The shipping industry with its 24x7 work culture has traditionally always considered longer working hours for the crew as a part and parcel of daily life. In one of the earliest systematic reviews of work hours, stress and safety at sea, Ivan Brown (Brown, 1989) found little objective evidence of any stress management efforts among seafarers. In his study, seafarers reported that they are expected to work continuously, under any conditions of stress, whether task-induced or environment-induced (Smith, 2007). Eleven years later, another study done in the British offshore oil support industry by Collins, Mathews and McNamara (2011) found situations which were similar to those described by Brown, concluding that stressors within the maritime domain remain noticeably under-investigated.

All the maritime accident statistics mentioned above indicates that fatigue among seafarers remains a threat to maritime safety even today, underlining the importance of learning more about it, the need for identifying its causes and the mitigating measures to be taken.

1.2 Description, classification and effects of ‘fatigue’

‘Fatigue’ is a term very loosely used to describe weariness which sets in after applying oneself to any task over a period of time. Here, we may be referring to such diverse activities as, any physical work done over lengthy periods such as gardening, office-work, driving etc. or some mental tasks such as reading a book, playing a computer game, solving mathematical puzzles etc. It may involve an activity which is not very pleasant for us but which we are compelled to do, or it can even be an activity which is very much enjoyable such as any sports activity. It may be something which may develop over few minutes, depending on the quantum of efforts required or it may take hours, days, weeks, or even months to develop, depending on the tasks involved.

Craig and Cooper (1992) described ‘fatigue’ as a term broadly covering many adverse, unwanted effects, which deters one from continuing to exercise an activity with full efficiency. It may involve any of the three modes of effects below.
• Subjective – where the person involved is so tired that he/she will be disinclined to apply any more efforts to continue; or
• Performance-based – which indicates a deteriorating performance where more than usual errors creep in; or
• Organic – which affects the body’s physiological functioning or its chemistry.

The effects of fatigue are multifaceted and complex, overlapping the areas of performance, physiology, cognition, and emotion (Gawron, French & Funke, 2001, p. 583). Fatigue affecting humans can be sub-divided as physical and/or mental. Physical fatigue is said to occur whenever a person who is exerting himself or herself can no longer put forth the required effort to complete a task (Caldwell and Lyddan, 1971, pp.18-19). Mental fatigue is defined as decrements in performance of tasks which require mental alertness or manipulation of data or retrieval of information stored in memory (Stern, Boyer, Schroeder, 1994).

Fatigue has variously been described as:

• a state of physical weakness which affects the human body after prolonged periods of strenuous physical activities. (Gawron et al., 2001); or
• a state of mental weakness or drowsiness which is the consequence of stress, emotional exhaustion and high-demand work load over prolonged periods (Yoshitake, 1978); or
• a medical symptom which is associated with some diseases like diabetes, multiple sclerosis, rheumatoid arthritis, AIDS and experienced by those who have undergone cancer-related treatment like radiation or chemotherapy (Aaronson et al., 1999).

Thus, in broader terms, fatigue can be described as a temporary inability or a decrease in the ability of humans to adequately respond to a situation, mostly due to inadequate recuperation from some previous strenuous activity, either physical, mental or emotional. It thus encompasses a variety of symptoms ranging from the pain in the muscles, difficulty in concentrating on one’s task, a general sensation of weariness or drowsiness.
The physical weakness occurring due to any prolonged physical activity can easily be overcome by taking adequate rest. However, regular occurrence of any such weakness can also be a pointer to a weaker body, lack of endurance/strength, reduced levels of fitness or any underlying medical conditions. Mental weakness can happen due to emotional stress and exhaustion or whenever there is long-term disruption of the sleep-wake cycle and circadian rhythms.

Even though fatigue and sleepiness are terms often used interchangeably, they are different in some respects. While sleepiness can be overcome after having adequate sleep, the same is not the case with fatigue which also has other serious physical aspects associated with it (Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017). Shen, Barbera and Shapiro (2006) tried to distinguish between ‘sleepiness’ and ‘fatigue’. They described these two states as interrelated but distinct phenomena. Whereas, sleepiness mostly results from neurobiological processes regulating the circadian rhythms and the drive to sleep, fatigue is a weariness after exertion (Colwell, 1989) or a feeling of strain and exhaustion (Shen, Barbera and Shapiro, 2006).
van Dongen (2006) describes a two-process neurobiological model which regulates the sleepiness and affects the extent of fatigue. The first process is homeostatic sleep drive, which creates a ‘need for sleep’ and which keeps on increasing, the longer one remains awake. This need is dissipated by getting proper sleep. The second mechanism, found among all mammals, operates diurnally during a day (24 hourly cycles) and is referred to as a circadian pacemaker. This affects not only sleepiness and fatigue, but also other bodily functions such as body temperature, endocrine levels, metabolism rate, and other physiological functions. It leads to people becoming sleepy about the same time each day, more typically at night, becoming hungry about the same times, and so on. Since, most people sleep during the night and remain awake during the day, the two drives remain in synchronization as indicated in figure 2 below:

![Figure 2: Interaction between the homeostatic sleep drive and the circadian drive](https://www.howsleepworks.com)

The two drives can become unsynchronized by following any work-schedule or engaging in any other activity which alters the work & sleep times (e.g. shift work). Such changes will disrupt the circadian sleep rhythm because the circadian pacemaker is slow to adapt, rarely adjusting by more than 1 hour per day. Consequently, when a rotating shift-worker tries to remain awake during a night-time shift, the circadian drive causes sleepiness by the early morning hours. Conversely, when he/she tries to sleep during the day time, the circadian arousal causes reduced sleeping time and degraded quality of sleep (see figure 3). Thus, individuals who are required to work during the biological night and who are most vulnerable to circadian misalignment are also at risk for shift work disorder (Drake and Wright, 2011).
In general, rotating/night or early morning shift-work may result in circadian misalignment which can further lead to impaired night-time performance, reduced productivity, increased risk of accidents and disturbed daytime sleep (Wright, Lowry, & LeBourgeois, 2012). Sleep deprivation and sleep disturbance are both recognized as fatigue-causing factors (Akerstedt, Knutsson, Westerholm, Theorell, Alfredsson & Kecklund, 2004; Balkin, Rupp, Picchioni & Wesensten, 2008; Short & Banks, 2014).

Fatigue can be classified either as acute or chronic, based on its onset and recovery duration. The short-term 'acute fatigue' occurs whenever there is inadequate time for rest and recovery after some strenuous work. Whenever there is insufficient recovery from acute fatigue over longer periods, it then progresses into long-term chronic (or cumulative) fatigue.

Figure 3: A model of wakefulness-sleepiness & circadian timings of Shift-worker

According to Soames-Job and Dalziel (2008), acute fatigue can be induced by the lack of or inferior quality of sleep, longer working hours, working at times of low alertness (circadian lows), insufficient rest between work periods, excessive workload, noise, vibration, motion etc. They further state that, effects of acute fatigue caused by both sleep and work-related factors, can easily be restored by the right interventions like sufficient rest or sleep. Short and Banks (2014, p.18) stated that recovery from chronic fatigue will take much longer time as compared to acute fatigue. According to them, the onset of chronic fatigue will be evidenced by a constant, severe state of tiredness that is not relieved just by taking rest. Any long-term sleep restriction often results in cumulative deficits in sleepiness and an increase in fatigue, confusion, tension, mental exhaustion, and stress.

While acute fatigue may affect an individual’s performance in the short run, reducing their safety and affecting their well-being, chronic fatigue will create a much longer impact, possibly affecting the mental/physical health and increasing the risk of contracting many chronic diseases including an increased risk of obesity, diabetes, hypertension, irritability and an overall decrease in motivation (Boivin & Boudreau, 2014; Knutson, 2010; Zaharna & Guilleminault, 2010).

The World Health Organization defines ‘health’1 as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. With reference to this definition, shift-work and associated long-term fatigue should be considered as a risky condition as it is not only associated with many of the health disorders (such as diseases affecting gastrointestinal, psychoneurotic, cardiovascular, reproductive functions, and probably cancer), but which also perturbs the psycho-physical homeostasis (e.g. sleep/wake cycle and circadian rhythms) and overall hampers the family and social life of personnel. (Costa, 2010)

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1 As given in the Preamble to the Constitution of WHO as adopted by the International Health Conference, New York, 19 June - 22 July 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of WHO, no. 2, p. 100) and entered into force on 7 April 1948.
1.3 Supply of seafarers from India – the emerging trends

The global shipping industry is experiencing a shortage of officers to man the world’s ships. This shortage is set to escalate further in the future as the world economy moves out of recession and if a higher rate of attrition among officers is seen (Caesar, Cahoon and Fei, 2014). The high cross-sectoral movement of personnel, i.e. early movement of merchant marine officers to shore-based jobs, can be termed as ‘wastage’ as this movement is in a one-way direction and thus a loss for the industry in general and for the specific shipping company in particular (Fei, Chen & Chen, 2009; Caesar et al., 2014).

The financial costs associated with the turnover of personnel in the shipping industry can be high, as every departing seafarer costs the shipping company time and money. Crew replacement costs can be high, especially with senior ranks. High rates of turnover can also have a detrimental effect on workplace safety (Bhattacharya, 2015). Any early turnover also causes the greatest loss in the form of loss of ‘Company Knowledge’. Shipping companies, ideally, follow a strict safety management system for control of shipboard operations as dictated by the International Safety Management Code. These systems and procedures take time to learn and all that knowledge is lost once a seafarer leaves the company (Oltedal, 2011).

India is the third largest supplier of manpower to the maritime industry, with more than 44,500 officers serving the world fleet as per 2015 figures (Drewry, 2015). Presently, China is the biggest supplier of marine officers, followed by the Philippines, India, Indonesia and the Russian Federation in that order. While China is continuously increasing the supply of seafarers, with the expected simultaneous growth of the Chinese national fleet, not too many Chinese officers may be available for serving the global shipping. Hence, in the near future, unless any new technology emerges, which greatly impacts the safe manning requirements of ships, India and Philippines will continue as the most important locations for sourcing of marine officers for manning the global fleet.
Figure 4: Supply of seafarers from India to global fleet

Source: Drewry Manning Report, 2015

From the graph shown in figure 4 above, it can be seen that supply of seafarers from India has steadily increased over the years. The table 1 below indicates the average age of seafarers from a number of countries and the percentage of seafarers who continue with sea-career beyond 40 years of age in each country (Glen, 2008). The data indicates that only 31.8% of Indian seafarers are continuing with their sea careers beyond the age of 40, whereas it is 50% or more in most other countries. Thus, almost two-third of Indian seafarers are leaving their sea-career and taking up a job ashore before the age of 40, indicating a high attrition rate.

Table 1: Average age of seafarers & percentage of seafarers who are above 40 years

<table>
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<th>Country</th>
<th>Average Age</th>
<th>% of Seafarers &gt; 40 Yrs.</th>
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<tr>
<td>Philippines</td>
<td>41.2</td>
<td>57.4%</td>
</tr>
<tr>
<td>Poland</td>
<td>41.2</td>
<td>52.4%</td>
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<tr>
<td>UK</td>
<td>45.7</td>
<td>70.2%</td>
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<tr>
<td>Russia</td>
<td>39.7</td>
<td>49.8%</td>
</tr>
<tr>
<td>India</td>
<td>36.4</td>
<td>31.8%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>39.3</td>
<td>48.4%</td>
</tr>
</tbody>
</table>

1.4 Research objectives

From the previous sections in this chapter, it can be summarized that,

- Fatigue among the seafarers is very common and is among the major contributing factors to maritime accidents;
- Fatigue and stress associated with long-term shift-based jobs are considered to be causing many chronic diseases and health conditions among the personnel engaged in such jobs;
- There is a high attrition rate among Indian seafarers as compared to other nationalities.

The above three statements led to the research question – to what extent are fatigue-related health issues contributing towards the high attrition rates observed among the Indian seafarers?

In this research study, an attempt was made to address the above query by the following four steps:

1. Identifying the chronic medical conditions which are commonly found among personnel engaged in shift-based jobs in other safety-critical industries by referring to numerous literature on the subject.
2. Finding through a survey conducted among Indian seafarers, the common medical conditions which are affecting them and comparing such diseases with the diseases identified in step 1.
3. Finding through another survey conducted among medical practitioners, whether the diseases and medical conditions identified in step 1, are among the prime causes for Indian seafarers to be declared medically unfit;
4. Cross-verifying the above survey results by checking in detail, the medical examination data of seafarers conducted in one clinic over the past two years.

After the survey results gave a positive indication that medical conditions commonly affecting the shift-workers in other industries are also very common among Indian seafarers, suitable mitigation strategies were suggested to seafarers, shipping companies, maritime administration and maritime policy makers.
Figure 5: An outline of dissertation including research question & methodology
CHAPTER – 2
COMMON DISEASES AND HEALTH CONDITIONS ASSOCIATED WITH SHIFT-WORK, STRESS AND FATIGUE

2.1 Introduction

In this chapter, an attempt is made to identify the common diseases and health disorders which are associated with shift-work and related fatigue, by referring to various research-based studies among the personnel engaged in round-the-clock, safety-critical jobs.

2.2 Fatigue due to sleep deprivation

Fatigue due to sleep deprivation associated with shift-work is particularly an issue in many safety-critical occupations such as shipping/maritime operations, health care, aviation, mining, road and rail transport, nuclear safety etc. Reports on surveys conducted among night shift workers in many of these industries indicate that a sizeable percentage of the respondents are regularly deprived of adequate sleep with many of them even admitting that they had fallen asleep at least once during their work hours. (Dorrian, Hussey & Dawson, 2007; Philip, 2005; Robb, Sultana, Ameratunga & Jackson, 2008; Williamson, Lombardi, Folkard, Stutts, Courtney & Connor, 2011).

Particularly, within the transport industry, fatigue due to sleep deprivation and poor-quality sleep which are associated with shift-work and longer working hours is a recognized problem with its evident linkage to the cognitive disengagement and lack of concentration, resulting in an increased risk of accidents. (Dorrian et al. 2007; Philip, 2005; Robb et al. 2008; Williamson et al. 2011).

2.3 Chronic health conditions associated with fatigue

Sleep Disorders:
Shift-work and associated fatigue are often known to develop several types of sleep disorders among personnel. Insomnia or inability to sleep is the most commonly
reported sleep disorder by personnel engaged in irregular work hours. Fatigue resulting from sleep deprivation often translates into a craving for high-calorie food that ultimately leads to being overweight and further to many other metabolic changes among shift-workers. Sleep apnoea - hypopnoea is another sleep disorder found commonly among overweight personnel who snore in their sleep. The person affected may not be aware of the condition, but will experience sleepiness and fatigue even when awake (Jepsen, Zhao and van Leeuwen, 2015). Delayed or advanced sleep-phase syndrome occurs when the circadian rhythm is out of phase with the environment. The delayed sleep-phase syndrome causes difficulties in sleeping at night and for waking up early in the morning, whereas advanced sleep-phase syndrome causes problems staying awake during the evening (Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017; Zhu and Zee, 2012). Fatigue associated with shift-work is often known to develop sleeping disorders such as insomnia, delayed or advanced sleep-phase disorders and in general interferes with the behavior and social life of personnel (Harma and Ilmarinen, 1999; Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017).

**Gastrointestinal and Cardiovascular diseases:**
Fatigue arising from the long-duration night and shift work is often found to affect the gastrointestinal and cardiovascular functions of the body (Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017). Any changes to the hormonal and sleepiness cycles are also known to affect the lipid levels and glucose metabolism. These metabolism changes, in turn, will interfere with the general behavior and social life of the person involved and create an increased risk of job-related accidents (Garbarino, Beelke, Costa, Violani, Lucidi, Ferrillo & Sannita, 2002; Knutsson & Bøggild, 2010). Peptic ulcers and symptoms related to irritable bowel syndrome are often found increased among shift workers and there is no doubt that shift-work adds to the risk factor for coronary heart disease (Harma and Ilmarinen 1999; Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017). Obese personnel is found to be more prone to chronic diseases such as coronary heart diseases, metabolic syndrome including type II diabetes and gastrointestinal disorders including irritable bowel syndrome (Hemio, Puttonen, Viitasalo, Harma, Peltonen & Lindstrom, 2015; Jepsen, Zhao and van Leeuwen, 2015).
**Obesity and High Blood-pressure:**

Wirth et al. (2014) conducted studies among volunteer police officers in Buffalo, New York, with half of them involved in regular night-shift work. They observed that night-shift work is a potential occupational stressor, with personnel involved often exhibiting a tendency for increased consumption of calories, fat, protein, carbohydrates, sweets and a lower intake of fruits and vegetables when compared to day-shift workers. This also led to a higher ‘Body Mass Index’ (BMI) among the night-shift workers as compared to personnel doing the day-shift. Higher BMI is often related to changes in physiological processes such as blood pressure, lipid dysregulation, elevated inflammation and an overall increased risk of contracting diseases such as cardiovascular diseases, altered lipid and glucose metabolism leading to type II diabetes.

Hemio, Puttonen, Viitasalo, Harma, Peltonen & Lindstrom (2015) conducted a survey among 1478 airline employees in Europe (55% Men & 45% Women) to study the dietary habits among them. Here too, they identified that personnel who are engaged in shift work are more likely to be engaged in unfavorable dietary habits and consequently be overweight (Body Mass Index (BMI) value 30 or more).

Choi, Schnall and Dobson (2016, p.1123) conducted studies among 330 firefighters in southern California to examine their working conditions vis-a-vis their health status. It was found that, among the firefighters, those who followed a 24-hourly shift often had to cope up with increased job demands. There was a greater number of personnel with elevated blood pressure among night-shift workers.

Many studies have linked sleep deprivation among shift-workers to obesity which is caused by increased intake of high-calorie food and a sedentary lifestyle during the daytime (Jepsen, Zhao and van Leeuwen, 2015). Fatigue, adverse sleep patterns and shift-work are known risk factors for obesity, which in turn can lead to elevated levels of triglycerides and lower HDL cholesterol in the blood stream. These metabolic changes thus indicate an increased risk of metabolic syndrome (Jepsen,
Zhao, Pekcan, Barnett, and van Leeuwen, 2017; Kaltsas, Vgontzas & Chrousos, 2010).

Sleep duration may be an important factor influencing the regulation of body weight and metabolism. Indeed, body weight is physiologically regulated, and this regulation involves complex physiological systems encoded by an array of specific genes. Short sleep duration predicts an increased risk of being overweight/obese in adults and is related to a reduced circulating leptin level relative to what is predicted by fat mass. Because sleep duration is a potentially modifiable risk factor, these findings might have important clinical implications for the prevention and treatment of obesity (Chaput, Després, Bouchard and Tremblay, 2007).

Short sleep duration is correlated with an increased risk of adult overweight/obesity and some studies claim this to be related to a reduced circulating leptin level relative to what is predicted by fat mass, whereas few others have found increased circulating leptin levels after a period of short sleep (Jepsen, Zhao and van Leeuwen, 2015; van Leeuwen, Hublin, Sallinen, Härmä, Hirvonen & Porkka-Heiskanen, 2010).

**Hypertension:**
Kubo et al. (2013) investigated whether there is any association between shift work and hypertension and if yes, whether that is independent of weight gain. Subjects were 10,173 male employees (9209 daytime workers, 964 three-shift workers; mean follow-up period: 12.7 years). Hypertension was defined as systolic blood pressure 140 mm Hg or more or diastolic blood pressure 90 mm Hg or more. The risk of developing hypertension among shift workers was estimated using a Cox proportional hazards model with adjustment for several factors. It was found during the study that shift work created a significantly higher risk factor for hypertension that was found independent of both starting weight and weight gained over years of work.

**Diabetes:**
Gan et al. (2015, pp.74-75) did a meta-analysis of a number of observational studies and found a strong association between Diabetes Mellitus (DM) and shift-work. The meta-analysis covered 12 studies, which involved 226,652 participants and out of which 14,595 who were DM patients. The analysis concluded with the observation
that when compared with individuals who never did shift work, the risk of contracting DM increased by almost 9% among personnel who are associated with shift-work.

**Breathing disorders:**
van Mark et al. (2010) did a study among industrial workers in Germany (225 of them shift-workers and 137 day-workers), to learn about shift-work induced chronic circadian disruption. The study included a collection of blood samples, bio-metric data and medical examination of respondents. The study concluded that shift-work often induced chronic sleep debt as well as sleep-related breathing disorders. They observed that personnel who are engaged in shift-work often do not find time to engage in restorative physical exercises, smokes more often and generally have an elevated risk of cardiovascular diseases.

**Cancer/ Tumor:**
Cancers of breast and prostate are the two most common cancers found among women and men engaged in shift-related jobs. There is mounting evidence from human and animal-based studies that shift-work involving work under artificial lighting and circadian disruption may be an important risk factor. The International Agency for Research on Cancer has classified shift work as a probable human carcinogen but research on this issue is quite complex (Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017; Stevens et al., 2011). Compared with daytime workers, shift workers showed a non-significant increase in the risk of prostate cancer. However, the result was not statistically significant due to the very small number of cases identified. To firmly establish the prostate cancer risk among shift workers, longer-term follow-up, including the period after retirement, will be required (Kubo et al., 2011).

2.3.1 Maritime scenario
Work on board ships is not much different from the other previously mentioned industries, with ships' crew-members having to work round the clock in regular shifts. Additionally, the ship is not only a workplace but also the temporary home for the seafarers sailing on board, thus removing the luxury of recuperating after reaching home which personnel engaged in the shore-based job has the opportunity to. While the ship is at sea, the unpredictable nature of sea and weather conditions, odd watch-
keeping hours etc. all affect the sleep and rest hour patterns of seafarers. Even when the ship is in port, life on board can be quite hectic with the requirements for attending to cargo work, maintenance routines, attending to visits by various officials, service providers and any other miscellaneous visitors etc. All these activities really take a toll on the rest period of seafarers, depriving them of essential undisturbed and uninterrupted sleep. Studies indicate that even though all seafarers on board are affected, individual susceptibility to fatigue varies and this also needs to be considered while implementing corrective measures (Project HORIZON, 2012). Later studies also have identified excessive work-load and stress on the Master of the ship as compared to others (Project MARTHA, 2017).

Pedersen and Jepsen (2013), conducted some studies among Danish seafarers to learn more about their health conditions and how that compared with the general population. Necessary data for the studies were collected from four clinics in Denmark where seafarers' medical fitness examinations were conducted. Additional details were collected from 527 volunteer seafarers. The study showed that Metabolic Syndrome is significantly higher among the seafarers (24.2%) than the general Danish population. Metabolic Syndrome has an etiological relation to nutritional factors, sleep patterns, work-related stress, fatigue, and physical activity — all of which are critical issues at sea. Metabolic Syndrome is known to be a strong risk factor for a number of chronic diseases, including diabetes and cardiovascular conditions. (Pedersen and Jepsen, 2013). The adverse effects of factors such as smoking, sedentary lifestyle, obesity, all of which are widely prevalent among seafarers, are adding to the already present ill-effects of their shift-work related job (Harma and Ilmarinen, 1999; Jepsen, Zhao and van Leeuwen, 2015).

2.4 Summary

To summarize, the research studies referred to in this chapter, identified the following common diseases and health conditions as the ones which are affecting the personnel who are engaged in rotating/night shift-work in various fields:

- Sleeping disorders (insomnia, sleep apnea, hypopnea, delayed or advanced sleep-phase syndrome),
- Gastro-intestinal disorders (peptic ulcer, irritable bowel syndrome etc.),
– Abnormal blood pressure,
– Diabetes,
– Cardio-vascular diseases,
– Mental disorders (including depression),
– Cancer and tumor, and
– Obesity related diseases.
CHAPTER – 3
RESEARCH METHODOLOGY

3.1 Research approach

One of the main objectives of this research study was to identify the common diseases which are affecting the Indian seafarers and which are rendering them unfit for sea-service. This was done with the aim of cross-verifying such diseases and health conditions with the diseases which are commonly associated with fatigue/stress affected personnel engaged in shift-based jobs in other industries and to seek commonality, if any.

For the above, one online survey was conducted and relevant health-related data collected directly from the seafarers. Another online survey was conducted to collect the data pertaining to the medical examinations of seafarers from medical practitioners who regularly conduct such examinations. Afterwards, details about the pre-joining medical examination of seafarers, covering a period of two years was collected from one clinic with the intention of cross-verifying that data with the data collected earlier from the seafarers and medical practitioners.

3.2 Research procedures

For conducting the above surveys, two sets of questionnaires were prepared; the first one for collecting health-related details directly from the seafarers and the second one for collecting seafarers’ medical-examination-related details from the medical practitioners.

The first questionnaire was sub-divided into two parts, with the first part aimed at active seafarers and the second part aimed at ex-seafarers. For the purpose of this survey, seafarers were considered to be ‘active’ if they had sailed within the past two years; otherwise, they are considered as ex-seafarers. The first questionnaire aimed
at seafarers was prepared using ‘Google forms’ and the second questionnaire aimed at medical practitioners was prepared using ‘JotForms’.

After receiving the survey responses from different medical practitioners, it was decided to create further supportive evidence to the survey findings by collecting more detailed information about seafarers’ medical examination from one of the major clinics involved. This data, pertaining to pre-joining medical examinations of seafarers conducted in that clinic for the past two years was collected as an excel spread-sheet, showing details like date of examination, rank, whether declared ‘fit’ or ‘unfit’, if ‘unfit’ then the reason for it etc.

### 3.3 Selection of participants

The first questionnaire was prepared and the link sent electronically to seafarers, some of them who are currently sailing and few others who are on leave, in between their onboard contracts. Similarly, a link to the questionnaire was also sent to many ex-seafarers who have quit sailing and subsequently taken up shore-based jobs. To get a balanced response, a good mix of respondents were chosen from

- among active and ex-seafarers;
- among officers presently serving (or earlier served) at management level and operational level;
- among seafarers serving on different types of vessels; and
- among seafarers who are from different age groups.

The request to participate in the survey was sent out to seven well-known clinics engaged in the medical examination of seafarers in different cities and towns, in North, East, South and Western parts of India. This was done with the aim of creating a demographic diversity in the data being collected, with people from various parts of the country, usually following different staple diets and food habits. However, only four clinics out of seven responded within the time-frame indicated and these clinics were from Calcutta in the eastern part of India, Vizag in the South-eastern part of India and Chennai city and Chennai suburban area from the Southern part of India.
Of these, two clinics, one from Calcutta and other from Chennai metropolitan area were major clinics where on an average, over 8000 seafarers' medical examinations are conducted annually. The remaining two clinics were of medium size, where on an average 400 and 700 medical examinations are conducted annually.

3.4 Study design

The questionnaire for collecting health-related data from seafarers was prepared using Google forms and consisted of 78 questions. Of these, 2 questions were common for all seafarers; 38 questions included in section – A, were aimed at active seafarers and the rest of the questions included in section – B, were aimed at ex-seafarers. The questions were a mix of short-answer type questions, multiple choice type questions and Likert-Scale response format type questions (see Annex I – Questionnaire sent to Seafarers).

The questionnaire prepared for collecting seafarers’ medical-examination-related data from medical practitioners was prepared using JotForms and consisted of 8 questions. The questions included were again a mix of short-answer type questions, open-ended type questions, multiple-choice type questions and Likert-Scale response format type questions (see Annex II – Questionnaire sent to Medical Practitioners).

3.5 Compilation of data

All survey related data collected from seafarers using Google Forms were automatically compiled in the form of pie-charts, bar charts and graphical format for quantitative analysis. In addition to this, the compiled data was also separately downloaded in a spread-sheet format for doing detailed qualitative analysis, section by section.

The survey data from medical practitioners compiled using JotForms were downloaded in PDF format. This data too was converted into a spread-sheet format for easier analysis.
During the final phase, pre-joining medical examination data of seafarers covering a period of two years (from Jan 2015 to Dec 2016), were collected from one clinic. This included details of 1916 medical examinations of seafarers of different ranks. This data was downloaded in excel sheet format and qualitative analysis done using various excel statistical formulae.

3.6 Ethics statement

In compliance with the WMU Ethics Committee guidelines, on every survey forms as well as during every correspondence with the survey respondents, the following statements were included:

- All data collected will strictly be used for academic purposes only.
- Any personal and private information about participants and/or organizations will be treated with utmost confidentiality.
- All data will be analysed in aggregate and no individual elements will be isolated without respondent’s direct permission.
- Respondent has every right not to participate in the survey and may decide to withdraw at any stage during the survey and
- All data collected will temporarily be stored in a hard-drive and deleted after the dissertation submission.
CHAPTER – 4
SUMMARY OF RESEARCH FINDINGS

4.1 Survey questionnaire sent to seafarers

A desirable mix of responses was received from the seafarers who participated in the survey. Of the 98 valid responses received, 55 respondents (56.1%) were active seafarers and 43 were ex-seafarers (43.9%).

Figure 6: Ratio between active seafarers and ex-seafarers

4.1.1. Age-wise distribution

The survey respondents were sub-divided into five different age groups as indicated in the table below. The maximum number of participants (47.7%) were in the age-group 20 to 30 years; followed by 27.34% in the 40 to 50 years age-group.
Table 2: Age-wise distribution of survey respondents

<table>
<thead>
<tr>
<th>Age group</th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 30 yrs.</td>
<td>61.80%</td>
<td>29.60%</td>
<td>47.67%</td>
</tr>
<tr>
<td>30 to 40 yrs.</td>
<td>12.70%</td>
<td>8.50%</td>
<td>10.86%</td>
</tr>
<tr>
<td>40 to 50 yrs.</td>
<td>20.10%</td>
<td>36.60%</td>
<td>27.34%</td>
</tr>
<tr>
<td>50 to 60 yrs.</td>
<td>1.80%</td>
<td>21.10%</td>
<td>10.27%</td>
</tr>
<tr>
<td>&gt; 60 yrs.</td>
<td>3.60%</td>
<td>4.20%</td>
<td>3.86%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>100.00%</strong></td>
<td></td>
</tr>
</tbody>
</table>

4.1.2 Rank-wise distribution

As indicated in table 3 below, 54% of the respondents were serving at Management level during their last contract on board and 46% at Operational level.

Table 3: Rank-wise distribution of survey respondents

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Master</strong></td>
<td>23.60%</td>
<td>60.00%</td>
<td>39.57%</td>
</tr>
<tr>
<td><strong>Chief Mate</strong></td>
<td>5.50%</td>
<td>1.70%</td>
<td>3.83%</td>
</tr>
<tr>
<td><strong>Chief Engineer</strong></td>
<td>5.50%</td>
<td>13.20%</td>
<td>8.88%</td>
</tr>
<tr>
<td><strong>2nd Engineer</strong></td>
<td>1.80%</td>
<td>1.70%</td>
<td>1.76%</td>
</tr>
<tr>
<td><strong>Total - Management level</strong></td>
<td><strong>36.40%</strong></td>
<td><strong>76.60%</strong></td>
<td><strong>54.04%</strong></td>
</tr>
<tr>
<td><strong>2nd Mate</strong></td>
<td>9.10%</td>
<td>3.30%</td>
<td>6.56%</td>
</tr>
<tr>
<td><strong>3rd Mate</strong></td>
<td>5.50%</td>
<td>1.70%</td>
<td>3.83%</td>
</tr>
<tr>
<td><strong>Deck Cadet</strong></td>
<td>45.00%</td>
<td>16.70%</td>
<td>32.58%</td>
</tr>
<tr>
<td><strong>3rd Engineer</strong></td>
<td>4.00%</td>
<td>1.70%</td>
<td>2.99%</td>
</tr>
<tr>
<td><strong>Total - Operational level</strong></td>
<td><strong>63.60%</strong></td>
<td><strong>23.40%</strong></td>
<td><strong>45.96%</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>100.00%</strong></td>
<td></td>
</tr>
</tbody>
</table>
4.1.3 Distribution of respondents based on types of ships

Survey respondents have served on diverse types of ships as indicated in table 4 below, thus creating a good mix for the survey sample. The maximum number of respondents have predominantly served on oil tankers (27.7 %), closely followed by people with more experience on bulk carriers (24.3%).

Table 4: Distribution of respondents based on types of ship

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. Cargo Ships</td>
<td>1.80%</td>
<td>5.20%</td>
<td>3.29%</td>
</tr>
<tr>
<td>Bulk Carriers</td>
<td>21.80%</td>
<td>27.60%</td>
<td>24.34%</td>
</tr>
<tr>
<td>Container Vessels</td>
<td>14.50%</td>
<td>20.70%</td>
<td>17.22%</td>
</tr>
<tr>
<td>Oil Tankers</td>
<td>29.10%</td>
<td>25.90%</td>
<td>27.70%</td>
</tr>
<tr>
<td>Chemical Carriers</td>
<td>7.30%</td>
<td>1.70%</td>
<td>4.84%</td>
</tr>
<tr>
<td>Gas Carriers</td>
<td>25.50%</td>
<td>12.10%</td>
<td>19.62%</td>
</tr>
<tr>
<td>Any Other types</td>
<td>0.00%</td>
<td>6.80%</td>
<td>2.98%</td>
</tr>
<tr>
<td></td>
<td>100.00%</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

4.1.4 Report about ‘extra tiredness’ after some contracts

One of the survey questions sought feedback from respondents about extra tiredness they felt (if any) at the end of certain contracts. Almost 46.3% of respondents admitted that there were instances when they felt more than usual tiredness at the end of certain contracts. A greater number of active seafarers (50.9%) reported such instances as compared to ex-seafarers (40.4%). About 14.5% of respondents were not sure of such instances.

Table 5: Percentage of respondents who felt 'extra-tired' after some contracts

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50.90%</td>
<td>40.40%</td>
<td>46.29%</td>
</tr>
<tr>
<td>Not Sure</td>
<td>10.90%</td>
<td>19.20%</td>
<td>14.54%</td>
</tr>
<tr>
<td>No</td>
<td>38.20%</td>
<td>40.40%</td>
<td>39.17%</td>
</tr>
<tr>
<td></td>
<td>100.00%</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>
To those respondents who answered the previous question in the affirmative, it was further asked ‘what in their opinion caused such extra-tiredness during certain contracts’. Almost 83% of respondents marked ‘vessel schedule’ related matters as the cause for extra tiredness. About 32% marked ‘vessel crew related’ matters, followed by 24% of respondents who felt ‘faulty vessel equipment/ frequent breakdowns’ was the root cause for their tiredness. Only 5% of respondents marked ‘health and hygiene’ (this will include sickness) as the main reason for their tiredness. There were some respondents who felt more than one reason as valid and marked so.

Table 6: Reasons indicated for ‘extra-tiredness’ after some contracts

<table>
<thead>
<tr>
<th>Reason</th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel Schedule related</td>
<td>85.70%</td>
<td>80.60%</td>
<td>83.02%</td>
</tr>
<tr>
<td>Vessel Equipment related</td>
<td>10.70%</td>
<td>35.50%</td>
<td>23.73%</td>
</tr>
<tr>
<td>Vessel Crew related</td>
<td>25.00%</td>
<td>38.70%</td>
<td>32.20%</td>
</tr>
<tr>
<td>Health &amp; Hygiene related</td>
<td>0.00%</td>
<td>9.70%</td>
<td>5.10%</td>
</tr>
<tr>
<td>Any other reasons</td>
<td>14.30%</td>
<td>6.50%</td>
<td>10.20%</td>
</tr>
<tr>
<td></td>
<td><strong>135.70%</strong></td>
<td><strong>171.00%</strong></td>
<td></td>
</tr>
</tbody>
</table>

(** Higher percentage indicate more than one reason being ticked by some respondents)

To those respondents who answered the initial question in the affirmative, it was further asked whether such feeling of tiredness extended beyond their sign-off from those vessels. About 15.3% of the respondents confirmed that the feeling of extra tiredness extended beyond their sign-off and continued during their leave period. Almost 14% marked that they were not very sure about this.

Table 7: Respondents who indicated that ‘extra tiredness’ even beyond leaving the vessel

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>10.70%</td>
<td>19.40%</td>
<td>15.27%</td>
</tr>
<tr>
<td>Not Sure</td>
<td>14.30%</td>
<td>12.90%</td>
<td>13.56%</td>
</tr>
<tr>
<td>No</td>
<td>75%</td>
<td>67.70%</td>
<td>71.16%</td>
</tr>
<tr>
<td></td>
<td><strong>100.00%</strong></td>
<td><strong>100.00%</strong></td>
<td></td>
</tr>
</tbody>
</table>
To those respondents who answered the previous question in the affirmative, it was further asked ‘how long did such feeling of tiredness stay with them after they left the vessel and proceeded on leave’.

Table 8: Response about how long the feeling of extra-tiredness remained after leaving the vessel

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 2 days</td>
<td>0.00%</td>
<td>16.70%</td>
<td>13.36%</td>
</tr>
<tr>
<td>Beyond 2 days; up to 1 week</td>
<td>33.30%</td>
<td>49.90%</td>
<td>46.58%</td>
</tr>
<tr>
<td>Beyond 1 week; up to 1 month</td>
<td>33.35%</td>
<td>16.70%</td>
<td>20.03%</td>
</tr>
<tr>
<td>Beyond 1 month</td>
<td>33.35%</td>
<td>16.70%</td>
<td>20.03%</td>
</tr>
<tr>
<td></td>
<td>100.00%</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

About 13.4% of respondents stated that the feeling of constant tiredness stayed with them for about 1 or 2 days. About 46.6% felt that such a feeling stayed with them beyond 2 days and up to 1 week. About 20.3% felt that the feeling stayed with them beyond 1 week and up to 1 month. Another 20.3% of respondents felt that the feeling stayed with them even beyond 1 month.

4.1.5 Report about common diseases affecting seafarers

In the survey, respondents were asked to report any common diseases which they are suffering from and the duration/period when they suffer or have suffered from such diseases. The common diseases about which feed-back was sought were,

- Abnormal Blood Pressure (High and Low B/P),
- Cardio-vascular diseases (Hypertension, Stroke, Myocardial Infarction),
- Mental disorders (including depression),
- Gastro-intestinal disorders (Peptic Ulcer, Irritable bowel syndrome),
- Sleeping disorders (Insomnia, Sleep apnea, Hypopnea, Delayed/ advanced sleep phase syndrome),
- Multiple sclerosis, and
- Cancer/ Tumor related diseases.
Table 9: A summary of common illnesses reported by seafarers

<table>
<thead>
<tr>
<th>Illness Description</th>
<th>Active Seafarers (%)</th>
<th>Ex-Seafarers (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Blood Pressure (High B/P; Low B/P)</td>
<td>12.70</td>
<td>31.30</td>
<td>20.86</td>
</tr>
<tr>
<td>Cardio-vascular diseases (Hypertension, Stroke, Myocardial infarction)</td>
<td>0.00</td>
<td>9.40</td>
<td>4.12</td>
</tr>
<tr>
<td>Metabolic disorders (Diabetes, Hyper lipemia, Metabolic syndrome)</td>
<td>3.60</td>
<td>9.50</td>
<td>6.19</td>
</tr>
<tr>
<td>Mental disorders (Depression)</td>
<td>1.80</td>
<td>3.20</td>
<td>2.41</td>
</tr>
<tr>
<td>Gastro-intestinal disorders (Peptic ulcer, Irritable bowel syndrome)</td>
<td>9.10</td>
<td>14.30</td>
<td>11.38</td>
</tr>
<tr>
<td>Sleeping Disorders (Insomnia, Sleep apnea, Hypopnea, delayed/advanced sleep phase syndrome)</td>
<td>7.30</td>
<td>14.50</td>
<td>10.46</td>
</tr>
<tr>
<td>Multiple Sclerosis</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cancer/ Tumor related</td>
<td>0.00</td>
<td>1.60</td>
<td>0.70</td>
</tr>
</tbody>
</table>

As can be seen from the summary report as shown in Table - 9, the most frequently occurring illness which is affecting Indian seafarers is High Blood Pressure with almost a third of ex-seafarers being affected by this disease. Other common diseases with a significant presence among ex-seafarers include Sleeping disorders (14.5%), Gastro-intestinal disorders (14.3%), Diabetes (9.5%) and Hypertension (9.4%).

The same diseases were found present among the active seafarers too but a lesser percentage of respondents were affected; Abnormal B/P (12.7%), Gastro-intestinal disorders (9.1%), Sleeping disorders (7.3%) and Diabetes (3.6%).

4.1.6 Report about obesity affecting seafarers

There is a very high incidence of obesity reported among active seafarers as well as ex-seafarers. The survey feed-back indicated almost 17.7% of respondents (9.1% of active seafarers and 28.6% of ex-seafarers) have Body Mass Index values greater than 30 which is considered as over-weight.
Table 10: Percentage of respondents with above-normal BMI value

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity (BMI Value &gt; 30)</td>
<td>9.10%</td>
<td>28.60%</td>
<td>17.66%</td>
</tr>
</tbody>
</table>

4.1.7 Report about constant feeling of fatigue/tiredness

The survey sought feedback about any constant feeling of tiredness or fatigue among the respondents. 6.32% of respondents reported in the affirmative about a constant feeling of tiredness affecting them. About 32% of respondents reported that such a feeling exists but only occasionally.

Table 11: Report about constant feeling of fatigue or tiredness

<table>
<thead>
<tr>
<th></th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>3.60%</td>
<td>9.80%</td>
<td>6.32%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>30.90%</td>
<td>32.80%</td>
<td>31.73%</td>
</tr>
<tr>
<td>No</td>
<td>65.50%</td>
<td>57.40%</td>
<td>61.95%</td>
</tr>
</tbody>
</table>

4.1.8 Priority reasons for leaving sea-career or contemplating doing so

The survey respondents were asked to list the main reasons (up to 5 reasons, in order of priority) for leaving the sea-career (among ex-seafarers) or for contemplating doing so (among active seafarers). The top priority reason which was marked by both groups were ‘family related reasons’ (44.3%). This was followed by availability of ‘alternative career prospects ashore’ (22.9%), tough conditions on board (8.4%), boredom with sea-life (4.7%) and medical reasons (4.1%) in that order.

The top priority reason as listed by the respondents for leaving the sea-career or for contemplating doing so were as indicated in Table 12 and Figures 7 & 8 shown below:
Table 12: Priority - 1 reason for leaving sea-life or contemplating doing so

<table>
<thead>
<tr>
<th>Reason</th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family related reasons</td>
<td>41.82%</td>
<td>47.46%</td>
<td>44.29%</td>
</tr>
<tr>
<td>Alternate career prospects ashore</td>
<td>18.18%</td>
<td>28.81%</td>
<td>22.85%</td>
</tr>
<tr>
<td>Tough conditions on board (crew/ high work load etc.)</td>
<td>10.91%</td>
<td>5.08%</td>
<td>8.35%</td>
</tr>
<tr>
<td>Medical reasons</td>
<td>7.27%</td>
<td>0.00%</td>
<td>4.08%</td>
</tr>
<tr>
<td>Financial security/ planning achieved</td>
<td>5.45%</td>
<td>1.69%</td>
<td>3.80%</td>
</tr>
<tr>
<td>Criminalization of Seafarers</td>
<td>5.45%</td>
<td>1.69%</td>
<td>3.80%</td>
</tr>
<tr>
<td>Maritime Security related reasons (Piracy etc.)</td>
<td>1.82%</td>
<td>1.69%</td>
<td>1.76%</td>
</tr>
<tr>
<td>Boredom with sea-life</td>
<td>1.82%</td>
<td>8.47%</td>
<td>4.74%</td>
</tr>
<tr>
<td>Any other reasons</td>
<td>3.64%</td>
<td>1.69%</td>
<td>2.78%</td>
</tr>
<tr>
<td>Left blank/ Do not want to leave Sea career</td>
<td>3.64%</td>
<td>3.39%</td>
<td>3.53%</td>
</tr>
</tbody>
</table>

Figure 7: Priority 1 reason for active seafarers contemplating to leave sea-career

Figure 8: Priority 1 reason for leaving sea-career as stated by ex-seafarers
Table 13 and Figures 9 & 10 below indicates the next priority reasons as recorded by the respondents.

Table 13: Priority - 2 reason for leaving sea-life or contemplating to do so

<table>
<thead>
<tr>
<th>Reason</th>
<th>Active Seafarers</th>
<th>Ex-Seafarers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family related reasons</td>
<td>23.64%</td>
<td>18.64%</td>
<td>21.45%</td>
</tr>
<tr>
<td>Alternate career prospects ashore</td>
<td>18.18%</td>
<td>27.12%</td>
<td>22.10%</td>
</tr>
<tr>
<td>Tough conditions on board (crew/ high work load etc.)</td>
<td>5.45%</td>
<td>1.69%</td>
<td>3.80%</td>
</tr>
<tr>
<td>Medical reasons</td>
<td>14.55%</td>
<td>6.78%</td>
<td>11.14%</td>
</tr>
<tr>
<td>Financial security/ planning achieved</td>
<td>14.55%</td>
<td>11.86%</td>
<td>13.37%</td>
</tr>
<tr>
<td>Criminalization of Seafarers</td>
<td>1.82%</td>
<td>1.69%</td>
<td>1.76%</td>
</tr>
<tr>
<td>Maritime Security related reasons (Piracy etc.)</td>
<td>5.45%</td>
<td>5.08%</td>
<td>5.29%</td>
</tr>
<tr>
<td>Boredom with sea-life</td>
<td>0.00%</td>
<td>3.39%</td>
<td>1.49%</td>
</tr>
<tr>
<td>Any other reasons</td>
<td>3.64%</td>
<td>3.39%</td>
<td>3.53%</td>
</tr>
<tr>
<td>Left blank/ Do not want to leave Sea career</td>
<td>12.73%</td>
<td>20.34%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 9: Priority 2 reasons for active seafarers contemplating leaving sea-career

Figure 10: Priority 2 reasons as given by ex-seafarers for leaving the sea-career
4.2 Survey questionnaire sent to medical practitioners

The second survey questionnaire was sent to 7 clinics in different cities in India where seafarers’ medical examinations are conducted. Out of these, 4 clinics sent responses within time. Two of them were major clinics who have been operating for many years and where +8000 medical examinations are conducted annually. The other two clinics were of moderate size, conducting 400 and 700 medical examinations annually.

Table 14: Details of medical clinics who participated in the survey

<table>
<thead>
<tr>
<th>Question</th>
<th>Clinic 1</th>
<th>Clinic 2</th>
<th>Clinic 3</th>
<th>Clinic 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>For how many years has your clinic been involved in the Medical Examination of Seafarers?</td>
<td>14</td>
<td>2</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>On an average, how many seafarers undergo medical examination in your clinic annually? (You may give last year’s figure)</td>
<td>8200</td>
<td>400</td>
<td>700</td>
<td>25000**</td>
</tr>
</tbody>
</table>

** This clinic is part of a chain of clinics where seafarers’ medical examinations are done

Each clinic was asked to report the frequency at which seafarers fail their medical examination, their age-bracket and the most likely reasons for them to be declared unfit. The responses received are tabulated in table 15 below:

Table 15: Responses from different clinics about seafarers who are declared unfit

<table>
<thead>
<tr>
<th>Question</th>
<th>Clinic 1</th>
<th>Clinic 2</th>
<th>Clinic 3</th>
<th>Clinic 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your experience, approx. how many seafarers fail in their medical examination during the first time? (You may give last year’s figure)</td>
<td>Approx. 4 in 100</td>
<td>1 in 100</td>
<td>35 in 700</td>
<td>10 in 1000</td>
</tr>
<tr>
<td>In which age-bracket are most number of seafarers failing in their medical examinations? (Give order of priority)</td>
<td>40 to 50 yrs.; 30 to 40 yrs.</td>
<td>40 to 50 yrs.</td>
<td>30 &amp; 40 yrs.</td>
<td>&gt;50 years</td>
</tr>
<tr>
<td>What reasons do you have, if any, for your observations in the previous questions?</td>
<td>Life style change; Poor dietary habits; Alcohol consumption</td>
<td>Poor Dietary habits &amp; Lifestyle</td>
<td>Long hours of work especially night time triggers high sugar response and High B/P</td>
<td>Heart Diseases; Diabetes, Obesity, Renal Calculus</td>
</tr>
</tbody>
</table>
Doctors listed poor lifestyle, dietary habits, alcohol consumption, long working hours at night etc. as the reasons leading to diseases like high B/P, Diabetes, Obesity, Coronary diseases, Renal Calculus etc.

In the next section of the questionnaire, doctors were given a list of common diseases and they were asked to classify these diseases as per their probability for being a reason for seafarers to be declared unfit for service. The list of diseases was prepared based on the experience of survey feedback obtained from seafarers. The table 17 below depicts the list of diseases and how each doctor classified them as highly likely, moderately likely and least likely.

Table 16: List of common diseases and their codes

<table>
<thead>
<tr>
<th>Code</th>
<th>List of Common Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Blood Pressure - High B/P</td>
</tr>
<tr>
<td>B</td>
<td>Cardio-Vascular diseases - Stroke; Hypertension</td>
</tr>
<tr>
<td>C</td>
<td>Metabolic Disorders - Diabetes</td>
</tr>
<tr>
<td>D</td>
<td>Mental Disorders - Depression</td>
</tr>
<tr>
<td>E</td>
<td>Sleep Disorders - Insomnia, Sleep apnea</td>
</tr>
<tr>
<td>F</td>
<td>Gastro-intestinal disorders - Peptic Ulcer</td>
</tr>
<tr>
<td>G</td>
<td>Multiple Sclerosis</td>
</tr>
<tr>
<td>H</td>
<td>Cancer/ Tumor</td>
</tr>
<tr>
<td>I</td>
<td>Obesity (BMI &gt; 30)</td>
</tr>
<tr>
<td>J</td>
<td>Fatigue - Chronic Fatigue</td>
</tr>
<tr>
<td>K</td>
<td>Other ailments not mentioned above</td>
</tr>
</tbody>
</table>

Table 17: Response from clinics showing priority of illness as reasons for declaring seafarers 'unfit'

<table>
<thead>
<tr>
<th></th>
<th>Clinic 1</th>
<th>Clinic 2</th>
<th>Clinic 3</th>
<th>Clinic 4</th>
</tr>
</thead>
</table>

(Refer to Table – 16 for deciphering the codes used)
Doctors gave higher priority for diseases like high blood pressure, diabetes, obesity, heart diseases and peptic ulcer, which agrees with the findings of the survey conducted earlier among the seafarers. In the next section of the survey, doctors were asked whether seafarers ever complained to them about job-related fatigue or stress and if yes, how often did they get such complaints. All doctors responded in the affirmative but indicated the frequency of receiving such complaints as low.

4.3 Analysis of seafarers’ medical examination data

From clinic no. 4 above, all the data pertaining to seafarers’ pre-joining medical examination during the period 1st Jan 2015 to 31st Dec 2016 were collected separately for analysis. This data collected included details of 1916 medical examinations of seafarers (both officers and crew) of which, 74 people were found declared as ‘unfit’ during the initial examination. This means, about 3.86% of examinees were declared unfit which agrees with the submission given earlier by the doctors.

Table 18: Details of seafarers’ medical examination data collected from Clinic No. 4 (during the period 2015-16)

<table>
<thead>
<tr>
<th>Personnel level</th>
<th>No. of medical examinations conducted</th>
<th>No. of people declared as ‘unfit for service’</th>
<th>Personnel declared ‘unfit’ as a percentage of the total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management level (Master, Chief Mate, Chief Engineer, 2nd Engineer)</td>
<td>473</td>
<td>16</td>
<td><strong>3.38%</strong></td>
</tr>
<tr>
<td>Operational level (other officers)</td>
<td>585</td>
<td>20</td>
<td><strong>3.42%</strong></td>
</tr>
<tr>
<td>Support level (Ratings, Trainees, Cadets)</td>
<td>858</td>
<td>38</td>
<td><strong>4.43%</strong></td>
</tr>
<tr>
<td>Total</td>
<td>1916</td>
<td>74</td>
<td></td>
</tr>
</tbody>
</table>

The main reasons for the personnel being declared unfit were, Obesity (47 Cases), Hyperglycemia (7 cases), Renal/Gall bladder Calculus (6 cases) and Abnormal lab parameters (6 cases) etc.
CHAPTER – 5
ANALYSIS OF RESEARCH FINDINGS

5.1 Significant findings of the survey and the implications

Some significant findings of the survey conducted among the seafarers and medical practitioners and the implications thereof, are indicated below.

5.1.1 Analysis of feeling of ‘extra-tiredness’ after certain contracts

About 46% of the survey respondents reported ‘more than usual tiredness’ after some contracts in the past. Of these, a significant portion of respondents (15.3%) felt positive that such ‘feeling of tiredness’ stayed with them even beyond the sign-off and after leaving the vessel. However, about 13.6% respondents were not very sure about it. There were some respondents who recorded that the feeling of tiredness stayed with them even beyond one month after they signed off from the vessel.

In the absence of any other reasons, including any adverse pathological conditions, such a feeling of tiredness which stayed on even after getting adequate rest can only be a positive indication of chronic fatigue.

5.1.2 Analysis of constant feeling of fatigue or tiredness

As a corollary to the previous question, respondents were also asked whether any of them are experiencing a constant feeling of tiredness and/or fatigue. About 6.3% of respondents reported in the affirmative about such a feeling of tiredness and 32% of respondents reported that they have experienced such a feeling but only occasionally.

Wadsworth, Allen, McNamara, Wellens, and Smith, (2006, p.838) examined the associations between perceived fatigue, risk factors for fatigue and cognitive failures. Their studies indicated that those who self-reported higher levels of fatigue were also at a greater risk of making frequent cognitive failures. The fact that 6.3% of
respondents here self-reported a feeling of constant fatigue also indicate a higher risk of cognitive failure among them.

Even a single mistake by a fatigue affected person during critical situations could prove very costly when operating ships, where accidents could often lead to loss of life and multi-billion-dollar losses to property and environment. For example, one missed course alternation by a very tired chief mate who was on bridge duty resulted in the grounding of M.V. Sheng Neng off Great Barrier Reefs, Australia, in April 2010 causing huge pollution in a particularly sensitive environmental protected region (ATSB, 2011).

5.1.3 Analysis of prevalence of lifestyle diseases and obesity

The results of both surveys indicated that a significant percentage of Indian seafarers are very prone to lifestyle diseases like hypertension, gastrointestinal disorders, diabetes, sleeping disorders etc., thus indicating a commonality with the chronic diseases which are identified with shift-work related fatigue and stress (refer chapter -2).

There is a very high incidence of obesity (17.7%) as reported by the survey respondents. About 9.1% of active seafarers and 28.6% of ex-seafarers reported having a Body Mass Index (BMI) value greater than 30 which marks them as overweight. Obesity was among the major factors which rendered seafarers ‘unfit’ for sea-service as indicated by the analysis of pre-joining medical examination data collected from a clinic as part of this study. In that report, during a period of two years, about 47 seafarers out of 1916 who were medically examined were declared unfit only due to obesity related reasons.

There is a very close link between obesity and lifestyle diseases which are mentioned earlier. A study conducted by Wilsgaard, Jacobsen and Arnesen (2005, p.1180) at Tromso, Norway, involving 11,115 men and women, aged between 20 and 60 years, between 1979 and 2001, found a close link between higher BMI and lifestyle of the population. This included their physical activities at work and during leisure time, shift
or night work, consumption of coffee, alcohol etc., smoking habits and the level of education. It was found during the study that higher the BMI value, greater is the risk factor for various chronic diseases.

Antunes et al. (2010, pp. 155-6) stated that high BMI value is a pointer to higher risk factor for a series of pathological conditions such as coronary diseases which are responsible for almost 17 million deaths globally per year and diabetes which has almost become a global epidemic and is expected to increase by another 50% in the next 10 years.

5.2 Limitations of the study

Even though the survey results imply a commonality between the chronic ailments affecting Indian seafarers and the diseases which are associated with long-term shift work in other safety-critical industries, there are some limitations to the research conducted and the subsequent observations.

- It will be hard to prove the link between lifestyle diseases which are prevalent among seafarers (as identified during this study) and the chronic fatigue associated with long-term shift-work without any doubt, since it can be argued that similar lifestyle diseases are also present among the general populace, with many of them not associated with any shift-based jobs.

However, if we refer to the data published by the National Family Health Survey – No. 4 (NFHS, 2015), conducted among the Indian adult population, on average, 10.4% of Indian men and 6.7% of Indian women are reportedly suffering from higher than normal blood pressure. Similarly, higher than normal blood sugar levels are found among 8% of men and 5.8% of women.

In the surveys conducted among the seafarers as part of this study, the percentage of respondents who are suffering from high blood pressure and diabetes were found to be 20.9% and 9.5% respectively. Thus, when comparing the figures pertaining to incidence of above diseases among the Indian seafarers as indicated from the
sample used in this study and the incidence rate of diseases among the average Indian adult population as reported in the NFHS survey, it can be seen that, as a separate demographic group, the Indian seafarers are found much more prone to such lifestyle diseases as compared to the general population. The fact that the NFHS-4 fieldwork in India was conducted from 20\textsuperscript{th} Jan 2015 to 4\textsuperscript{th} Dec 2016, the same time-frame when the seafarers’ medical examination data were collected for this study, gives more credence to such an observation.

Additionally, the fact that seafarers undergo regular medical examinations as part of the regulatory requirements may also work in favor of the argument that any such illnesses, if it were pre-existing, must have got screened out during the mandatory pre-joining medical examinations of seafarers.

• As per the submissions made by the doctors and as indicated by the scrutiny of medical examination records collected from a clinic, most cases where the seafarers were declared as ‘unfit’ for sea-service were due to diseases like high obesity, high blood pressure, gastrointestinal diseases, cardiovascular diseases, diabetes etc. Doctors who responded to the survey accorded high priority to lifestyle issues and poor dietary control when asked about the most likely causes which are rendering seafarers unfit for duty. However, both seafarers, as well as doctors, accorded a ‘low priority’ for fatigue as a likely reason for it.

Such a viewpoint is limited as most of the diseases and health conditions which were accorded a high priority could, in fact, be linked to long-term shift-work related stress and fatigue, as identified by the research studies conducted in other critical industries (as detailed in chapter 2). Thus, ‘fatigue’ should have been accorded a much ‘higher priority’ as an adverse health condition which could affect seafarers and render them unfit for duty.

Arguably, this limited view on the part of respondents may be due to the fact that ‘fatigue’ and its potential link to many diseases and cognitive lapses are not fully appreciated by both seafarers and the medical practitioners who examine them. From the literature included in chapter 2, it becomes apparent that the issue of fatigue has
been approached in a more systematic way in other transport sectors than it has been in the maritime sector. There can be many reasons for this, the first being historical, the second being the extent of public/media attention in those sectors and finally, the extent to which any incidents affecting such sectors readily cause national or international concern (Smith, 2007). It is imperative that the extensive research on fatigue in other transport sectors (and in other occupations) should also be applied to seafarers’ fatigue issues.

- One doctor who participated in this survey, attributed the higher incidence of lifestyle diseases among seafarers to shift work and the long night-working hours, especially among the watch-keepers. Such an observation is also supported by many other studies conducted globally. For example, a study conducted by Antunes, Levandovski, Dantas, Caumo and Hidalgo (2010, p.159) found that shift work is accompanied by a greater incidence of many medical disorders such as cardiovascular, metabolic, gastrointestinal and sleep disorders. They stated that risks for diseases such as hypertension, diabetes, coronary artery disease and weight gain increased proportionally to the duration of exposure to shift-work. Another study by Wang, Armstrong, Cairns, Key and Travis (2011, p. 85) on metabolic syndrome found that shift workers were at an increased risk of three metabolic syndrome components namely, obesity, hypertension, and high triglycerides when compared to day workers.

5.3 Other significant findings of the survey

Another important aspect which was brought out during the survey (even though it is not directly connected to the main theme of this dissertation study) is that about 23% of ex-seafarers left sea-career early, while only serving at operational level and had taken up shore-based jobs. The reasons given by many of them for leaving sea-career ranged from ‘family related reasons’, ‘availability of better career prospects ashore’ to ‘other reasons’. Included in the ‘other reasons’ given could be, graduates from maritime training institutes, who are left in the lurch, when they cannot complete their mandatory on-board training for lack of availability of sea-berths and who are then forced to take up some shore-jobs for sustenance.
5.4 Summary of findings

The analysis of the results of the surveys conducted can be summarized as below:

- Almost half of the respondents of this survey felt extra tiredness after some contracts in the past and a significant percentage of those respondents felt that such tiredness extended even beyond their leaving those vessels which can be a positive indication of chronic fatigue.

- A minor percentage of respondents reported having a constant feeling of tiredness which never goes away even after taking rest, which is again a positive indication of chronic fatigue.

- In the survey held among medical practitioners, they accorded high priority to various life-style diseases and obesity, but accorded a low priority to fatigue, as likely reason for seafarers being unfit for sea. This viewpoint does not seem to take into consideration the fact that these lifestyle diseases can in fact be linked to fatigue/ stress connected with shift-work and the stresses of a life at sea.

- When compared with the general population in India, the incidence of lifestyle diseases and obesity are much higher among Indian seafarers which is indicative of poorer health status among seafarers and arguably, by extension, low levels of awareness and management of fatigue and health among seafarers.

- There is a significant percentage of ex-seafarers who have left their sea career early and taken up alternate jobs ashore. There are various reasons recorded for this and which will require further detailed study to unveil the underlying factors.
CHAPTER – 6
MITIGATION STRATEGIES

Given the variety of health-related causes and consequences of fatigue and stress caused by shift-work, it is highly unlikely that a “one size fits all” approach will ever be successful while addressing the issue. An overall holistic view will be needed while identifying the various effects of stress and health related factors affecting the seafarers which are associated with longer periods away from home, limited scope for leisure activities and the consistently high work-loads on board.

There is always scope for further education and training of the stakeholders in maritime safety, including the seafarers, medical practitioners, maritime administration, maritime policy makers, shipping companies etc. to improve the awareness about fatigue and its long-term effects on the health of personnel.

6.1 Legislative measures in place to control fatigue

There were persistent demands from the industry players to have adequate measures in place to tackle the mounting accident rates in the maritime sector, many of which, attributed to seafarers’ fatigue. In response to the above, IMO promulgated the “Guidelines on Fatigue Mitigation and Management” in 2001 (IMO, 2001) which contained useful information on the causes and consequences of fatigue. These guidelines break the subject of fatigue down into separate chapters, each aiming at different areas of responsibility onboard the ship (e.g. fatigue and the rating, fatigue and the ship’s officer etc.)

There were some criticisms of these guidelines in that, they were perceived to have over-emphasized the personal responsibility of crew to manage fatigue without due recognition of fact that seafarers have little or no control over many of the operational factors at sea and hence, many of the remedies suggested therein are impractical (McNamara, Allen, Wellens and Smith, 2005).

In 2015, IMO took the decision to revise these guidelines. The new guidelines are presently under preparation by a working group set up under IMO Sub-Committee on
Human Element, Training and Watchkeeping (HTW) and are expected to be tabled during the next sitting of the sub-committee in 2018 (HTW - 5).

The association of physical fatigue with the duration of the task was always well known and was among the key considerations while formulating various occupational safety related regulations which restricted the maximum hours of work. ILO ‘Hours of Work (Commerce and Offices) Convention, 1930 stipulated a maximum of eight hours per day and 48 hours per week for all industrial workers. This was later amended in 1962 through ILO Instrument 116 which reduced the maximum hours per week to 40 hours.

The ILO Convention - 180 on Seafarers’ Hours of Work and Manning of Ships, which came into force in 2002 (which was later superseded by Maritime Labour Convention (MLC), adopted in 2006), stipulated that the maximum period of work for seafarers should not exceed 14 hours in any 24-hour period and should not be greater than 72 hours in any 7-day period.

The IMO instruments concerning hours of rest of seafarers are specified under the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention). Regulation VIII/1 of this convention requires maritime administrations to establish and enforce rest periods for watchkeeping personnel on board ships for the purpose of preventing fatigue. The related section of Part A of the Seafarers’ Training, Certification and Watchkeeping Code (STCW Code) sets minimum periods and frequency of rest. Earlier, the minimum rest period requirements under STCW Code was at variance with the ILO -180/ MLC requirements but with the revision of STCW Code in 2010, it was made in line with the requirements under MLC 2006.

The International Safety Management (ISM) Code is another regulatory instrument which stipulates that if fatigue, due to excessive hours of work, or lack of adequate rest is readily apparent, the master and/or the company management should intervene to immediately remedy the problem. The Code while reiterating the over-riding authority of the master of a ship with regard to measures to be taken to ensure safety on board, also stipulates that the company cannot absolve itself from the responsibility of ensuring that the master, officers and the crew are properly qualified,
experienced, trained, familiarized and be sufficient in number for ensuring a safe operation. Under these rules, it is implied that if a situation arises on board, where a seafarer is not able to achieve the mandated minimum hours of rest or exceeds the allowable maximum period of work and is possibly suffering from fatigue, it must be recorded and reported (Jepsen, Zhao and van Leeuwen, 2015).

6.1.1 Some gaps observed in the present regulatory regimes

It is observed that all above regulatory regimes in the maritime sector, in their present form, have certain drawbacks:

- **Non-working hours v/s Rest hours**

To comply with the present rules on ‘rest hours’, any time which is not official ‘working time’ is considered as ‘rest time’ for the crew and recorded accordingly. Thus, even if the crew members are engaged in some activity which does not provide any rest to them, (e.g. going ashore on shore-leave) for the sake of regulatory compliance, they will be recorded as being rested. It is essential that present rules be amended suitably to differentiate between non-working hours and rest hours for more effective compliance on board.

The overly punitive approach of enforcing strict compliance (e.g. through Port State Control intervention) while maintaining the commercial pressures on seafarers for quicker turnarounds of ships have led to the tendency of under-reporting/falsifying the rest records by many seafarers. Under-recording of working hours just for complying with the regulatory requirements is counter-productive as far as fatigue mitigation measures are concerned (Jepsen, Zhao and van Leeuwen, 2015). Allen, Wadsworth & Smith (2006; 2008) noted that seafarers who are under-reporting (even occasionally) their working hours are significantly more likely to be fatigued and less healthy, than non-under-recording counterparts.
• **Circadian variations in sleep requirements**

The present rules/requirements treat all 24 hours equally and do not consider any circadian variations in the sleep requirements of personnel. If anyone keeps awake during the circadian low, he/she requires more sleep to recover. This aspect has already been considered and the rules of rest requirements amended in other industries. One such example is the 2006 amendments to European Union Regulations² covering the aviation Flight Time Limitations (FTL) rules and rest requirements. Under these revised rules, the Flight Duty Periods (FDP) limitations should also take into account whether the rest period provided fall within ‘favourable’ or ‘un-favourable’ periods based on the circadian cycles of the crew members. Any flight duty period covering the un-favorable period, also called ‘window of circadian low’ (0200 hrs. till 0600 hrs.) will have further limitations imposed by the law as compared to other periods. Thus, it is essential that such restrictions be incorporated in the maritime legislations too.

6.2 **Mitigation measures at organization/individual level**

There are limitations to what legislative or administrative measures can achieve when it comes to fatigue mitigation on board. Also, some aspects are totally beyond the control of anyone including the vagaries of nature, the weather and the sea conditions. Even the best ship’s design cannot fully eliminate the noise and vibrations on board. However, there are some measures which can be taken at the shipping company’s level and the individual seafarer’s level, which can help reduce fatigue and improve the health of seafarers on board ships.

• **Special circumstances which warrant an increase in level of manning**

Every vessel will be issued with a ‘minimum safe manning document’ by the Flag State which determines the manning levels to be maintained on board that vessel. As the name indicates, it is the bare minimum level of manning which is considered adequate under normal circumstances of operation.

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However, a shipping company should consider any exceptional circumstances which may exist including any maintenance related issues, frequent port turnarounds, lighterage operations, enhanced security requirements etc. which may warrant an increase in the number of crew employed on board a ship to ensure safety. The International Safety Management (ISM) Code has mandated that a shipping company cannot absolve itself from the responsibility of ensuring that the crew is properly qualified, experienced, trained, familiarized and are sufficient in number for ensuring a safe operation (Jepsen, Zhao and van Leeuwen, 2015).

- **Training the seafarers about fatigue management**
Implementing an effective fatigue management system on board will involve training the crew members to understand the necessity and importance of organizing their work in an efficient manner and getting proper/adequate rest. They should be made aware of the implications of being fatigued, how it can compromise their own safety, the safety of those working with them and the safety of the ship in general. The training on fatigue detection, mitigation and management should
  - especially be targeted at the senior staff on board at management level,
  - should be an ongoing process and
  - be assessed periodically through an audit.

- **Improvements in shipboard conditions**
Some improvements, if implemented in the shipboard environment can to an extent, alleviate many negative effects of fatigue and stress. The cabin conditions of night watch-keepers should always be optimized by reducing any work-related noise levels in the surrounding areas, whenever they are taking rest. Maintaining a comfortable temperature inside their cabins using air conditioners and using thicker curtains to shield out daylight can greatly improve their sleep quality.

One key step towards improving health on board is the dietary control of seafarers. Minimizing the intake of high-calorie foods, fat, protein, carbohydrates, sweets and increasing the intake of fruits and vegetables (whenever they are available) can
greatly help to improve the metabolism of the body and prevent obesity. Seafarers should be taught about the importance of reducing the intake of caffeine, nicotine and alcohol, especially two hours prior going to sleep, to improve the quality of sleep. Regular physical exercise is essential to maintain good health but heavy exercise just prior going to bed may affect the sleep quality.

Taillard, Capelli, Sagaspe, Anund, Akerstedt and Philip (2012) did a study among night-time car drivers to find whether a continuous exposure to a monochromatic blue light placed on the dashboard, could improve their driving performance. They found this method to be effective and one way of fighting nocturnal sleepiness at the wheel, among blue light-tolerant drivers, irrespective of their age. This method could be adopted on board ships too, on a trial basis, to check its effectiveness on reducing the sleepiness and fatigue among seafarers.

Consumption of coffee (caffeine) is known to counteract sleepiness. Mets, Baas, van Boven, Olivier & Verster (2012) did an experiment where they compared the driving performance of two set of drivers, under controlled conditions in a driving simulator. Of this, one group performed after consuming coffee and the second group without. Their findings demonstrated a positive effect of one cup of caffeinated coffee on the overall driving performance and subjective sleepiness during monotonous simulated highway driving. Drinking coffee or taking a strategic nap at night significantly reduced driving impairment without altering subsequent sleep. However, such naps should be kept short (15–40 min) to avoid waking up from a deep sleep. (Guilleminault & Ramar, 2006; Jepsen, Zhao and van Leeuwen, 2015; Philip, Taillard, Moore, Delord, Valtat, Sagaspe & Bioulac, 2006). Seafarers could adopt any one or more of the above methods to reduce sleepiness during their night-watches.

There can be several such counter-measures which can alleviate the negative impact of shift-work and further prevent sleepiness while working during the night and insomnia during the day when night watchkeepers are required to sleep. However, it

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3 Some shipping companies, especially tanker operators, have already prohibited the use of alcohol on board which is a positive step towards improving the health of seafarers on board.
remains a fact that even when all these measures are applied, even with the best combination, there seems at present to be no way of totally eliminating all the negative effects of shift work on human physiology and cognition (Åkerstedt & Wright, 2009; Jepsen, Zhao and van Leeuwen, 2015; Jepsen, Zhao, Pekcan, Barnett, and van Leeuwen, 2017).

6.3 Seafarers’ fatigue risk management: Conclusions and the way forward

Cheng and Drake (2016) describes ‘Occupational Sleep Medicine’ as an emerging field of medical science which aims at achieving best productivity while maintaining safety within industrial settings. This branch of science involves a study of the circadian biologic clock, effects of transient and cumulative sleep loss, and the recovery process to mitigate workplace fatigue. It employs ‘fatigue risk management system’ (FRMS) principles for ascertaining the sleepiness scale and then uses that knowledge to manage worker fatigue. This field is developing rapidly and is now employed in many high-safety demand jobs including road transport, airlines, hospitals, power plants etc.

In the maritime sector, some research studies were initiated as part of efforts towards identifying the causes of fatigue among seafarers and for recommending suitable mitigation measures. The ‘Project Horizon’, a European Commission sponsored, 30 months long study, developed and led by Warsash Maritime Academy, along with 11 other academic institutions and shipping organizations, was conducted between June 2009 and Jan 2012. The project investigated the effect of different watch-keeping patterns on seafarers’ cognitive performances and found that almost 50% of participants in the 6 On- 6 Off \(^4\) watch pattern tends to fall asleep during their watch due to fatigue.

\(^4\) In 6-On, 6-Off watch system, two watchkeepers will keep alternating the watch between them. i.e., One person keeps watch from 0000 hrs. to 0600 hrs. and from 1200 hrs. to 1800 hrs. The other person keeps the watch from 0600 hrs. to 1200 hrs. and from 1800 hrs. to 2400 hrs.
The more recent ‘Project MARTHA’, launched in 2013, further built up on the findings of ‘Project Horizon’ and evaluated the effectiveness of fatigue risk management systems (FRMS) using a computer-based prediction model. The findings of the studies were presented to IMO at the 4th session of HTW sub-committee in February 2017. Among the key findings of the report was the role of motivation and cultural background of seafarers which influenced fatigue.

Measuring fatigue can be rather complicated because of the need to measure individual’s perceptions, performances and physiological functioning. The lack of a suitable tool by which fatigue can accurately be measured makes it all the more difficult to co-relate any observable health or safety related outcome and attribute it directly to fatigue. Research studies like ‘Project Martha’ have tried to measure the level of sleepiness using the “Karolinska Sleepiness Scale” or KSS. In this method, a comparison is made between electroencephalographic (EEG) recordings and various behavioral variables to arrive at the individual’s level of sleepiness.

During these experiments, ‘sleep diaries’, ‘Actigraph’ monitoring while at sea and EEG recordings of the individuals etc., were all used in combination to gather information about the level of activity of a person and to deduce whether he/she was suffering from fatigue. All the above studies on seafarers’ fatigue focused on measuring the level of human activity using devices like EEG recorders, Actiwatches etc. and then used that data to ascertain the ‘level of sleepiness’ and hence the onset of acute fatigue. As stated earlier, acute fatigue over a time can develop into cumulative or chronic fatigue.

While it is relatively easy to identify and measure acute fatigue which may be readily apparent due to its symptoms, same is not the case with chronic fatigue especially since many of the symptoms are similar to the symptoms of other common diseases as discussed earlier.

In conclusion, it can be stated that the way forward will be to create better awareness about seafarers’ fatigue and associated illnesses among all stakeholders and treat that as a serious health and safety issue. All efforts are needed to tackle the issue through better education and training of the human element both onboard and ashore and optimised organizational systems rather than just punitive measures for non-
compliance with regulatory requirements. Best practices from other transport industries could be adopted and optimized before implementation in the maritime sector. There is little doubt that seafarers remain among the highest risk groups for diseases which are associated with their working and living conditions as well as for occupational accidents, diseases whose presence is often mediated by fatigue, both acute and chronic. Much more needs to be done to quantify fatigue and to quantify patterns of illness that could be associated with the profession for the betterment of the industry.
References


Survey questionnaire sent to active seafarers and ex-seafarers

Dear Respondent,

Thank you for taking the time to respond to this survey. Both your work as a seafarer and your contribution to this research work, is deeply appreciated.

I am a student at the World Maritime University, Malmo, Sweden, studying to complete a post-graduate degree in Maritime Affairs. As part of my studies, I am seeking to collect data about the main illnesses which are affecting the seafarers worldwide, and the severity of fatigue at sea, for the purpose of identifying suitable mitigating measures.

I will be grateful if you would kindly take a few minutes to answer the attached questionnaire and help me to collect necessary data for my studies. Responding to the questionnaire should not take more than 10 to 15 minutes.

The data collected will be used strictly for academic purposes only. Any personal and private information about participants and organizations will be treated with utmost confidentiality. All data will be analyzed in aggregate and no individual elements will be isolated without your direct permission. All research related data will be temporarily stored on a hard drive during the survey and then deleted after completion of analysis. As a recipient of this questionnaire, you have every right not to participate in the survey and withdraw at any stage. It is my hope, however, that you will participate and help in the completion of this work, with a view to contributing to the enhancement of the career of seafarers and for the general benefit of the seafaring community.

Thanks, once again,
Capt. Sarat Kumar

* Required field

1. Email address *  _______________________

Questionnaire to all seafarers:

2. Are you at present an active seafarer? * (For this purpose, you are considered to be an active seafarer if you have sailed within the last two years)

☐ Yes (Go to Q. No. 3)
☐ No (Go to Q. No. )
Section – A: Active seafarers

3. What is your name? (optional)
 ________________________________

4. What is your age? *

☐ Less than 20
☐ Between 20 and 30
☐ Between 30 and 40
☐ Between 40 and 50
☐ Between 50 and 60
☐ More than 60

5. What is your nationality?
 ________________________________

6. For how long have you been a seafarer?
 ________________________________

7. What was your rank during the last contract?

☐ Master
☐ Chief mate
☐ 2nd Mate
☐ 3rd Mate
☐ Deck Cadet
☐ Chief Engineer
☐ 2nd Engineer
☐ 3rd Engineer
☐ Junior Engineer/ Eng. Cadet
☐ Electrical officer or ETO
☐ Deck crew
☐ Engine crew
☐ Saloon crew
☐ Any other rank
8. Which type of vessels have you predominantly served on?

☐ General Cargo Ships
☐ Bulk carriers
☐ Container vessels
☐ Oil tankers
☐ Chemical carriers
☐ Gas carriers
☐ RoRo/ Passenger vessels
☐ Any other type vessels

9. Have you ever felt especially tired and exhausted (more than usual) after certain contracts in the past?

☐ Yes (Go to Q. No. 10)
☐ No (Go to Q. No. 13)
☐ Not sure (Go to Q. No. 13)

People who experienced unusual tiredness at the end of few contracts

10. What in your opinion was the cause of this unusual tiredness experienced after certain contracts at sea?

☐ Vessel Schedule related (e.g. frequent port calls, coastal voyages etc.)
☐ Vessel equipment related (e.g. frequent m/c breakdown etc.)
☐ Vessel crew related (e.g. inexperienced/difficult/multi-national crew)
☐ Health & Hygiene (poor food, poor sleep, high noise/ vibration etc.)
☐ Any other reason

11. Did this feeling of tiredness continue even beyond your sign-off from that vessel?

☐ Yes (Go to Q. No. 12)
☐ No (Go to Q. No. 13)
☐ Not sure (Go to Q. No. 13)
12. After sign-off from such vessels, how long did it take for you after reaching home to completely recover and feel energetic again?

☐ 1 to 2 days
☐ Beyond 2 days; up to 1 week
☐ Beyond 1 week; up to 1 month
☐ Beyond 1 month

Common illnesses reported by seafarers

Appended below are few illnesses commonly reported by shift-workers worldwide. Please report if you are at present, suffering from any of these illnesses.

13. Are you suffering from abnormal blood pressure? (High B/P or Low B/P)

☐ Yes (Go to Q. No.14)
☐ No (Go to Q. No.16)

14. Are you suffering from High B/P or Low B/P?

☐ High B/P
☐ Low B/P

15. How long you have been suffering from abnormal B/P?

____________________

16. Are you suffering from any Cardiovascular diseases? (e.g. Myocardial infarction, Stroke, Hypertension etc.)

☐ Yes (Go to Q. No.17)
☐ No (Go to Q. No.19)

17. Please specify the type of cardiovascular disease that you are suffering from.

☐ Myocardial infarction
☐ Stroke
☐ Hypertension
☐ Any other type (Please specify) ________
18. How long you have been suffering from above disease?  
______________________

19. Are you suffering from any Metabolic Disorders? (e.g. Metabolic syndrome, Hyperlipemia, Diabetes etc.)

☐ Yes  (Go to Q. No.20)
☐ No   (Go to Q. No.22)

20. Please specify the type of Metabolic Disorders that you are suffering from.

☐ Metabolic syndrome
☐ Diabetes
☐ Hyperlipemia
☐ Any other type (Please specify) ________

21. How long you have been suffering from above disease?  
______________________

22. Are you suffering from any Mental Disorders? (e.g. Depression)

☐ Yes  (Go to Q. No.23)
☐ No   (Go to Q. No.24)

23. How long have you been suffering from above disease?  
______________________

24. Are you suffering from any gastrointestinal disorders? (e.g. Peptic ulcer, Irritable bowel syndrome, etc.)

☐ Yes  (Go to Q. No.25)
☐ No   (Go to Q. No.27)

25. Please specify the type of Metabolic Disorders that you are suffering from.

☐ Peptic ulcer
☐ Irritable bowel syndrome (includes cramps, abdominal pain, gas, acidity, diarrhea, constipation etc.)
☐ Any other type (Please specify) ________
26. How long you have been suffering from above disease?

______________________

27. Are you suffering from any sleep disorders? (e.g. Insomnia, Sleep apnoea, hypopnea, delayed/ advanced sleep syndrome, etc.)

☐ Yes  (Go to Q. No.28)

☐ No   (Go to Q. No.30)

28. Please specify the type of sleep disorders that you are suffering from.

☐ Insomnia

☐ Sleep apnoea - hypopnea

☐ Advanced/delayed sleep syndrome

☐ Any other type (Please specify) ________

29. How long you have been suffering from above disease?

______________________

30. Are you suffering from Multiple Sclerosis?

☐ Yes  (Go to Q. No.31)

☐ No   (Go to Q. No.31)

31. Are you suffering from any Cancer or Tumor?

☐ Yes  (Go to Q. No.32)

☐ No   (Go to Q. No.33)

32. Please specify the body part affected by cancerous growth/ Tumor

_________________________________

33. Is your Body Mass Index (BMI) value above normal?
 (BMI = Body weight in kilogram/ Square of height in metres; Any value > 30 indicates that you are over-weight)

☐ Yes  (Go to Q. No.34)

☐ No   (Go to Q. No.35)
34. Please specify your BMI value

☐ Between 30 and 35  
☐ Between 35 and 40  
☐ Above 40;

35. For how many years you have remained over-weight?

_____________ years

36. Are you always having a feeling of constant tiredness/ sleepiness?

☐ Yes  
☐ No  
☐ Occasionally

37. Is there any other illness or medical conditions that you are suffering from and which you are anxious about (which in your opinion may affect your well-being on board ships)?

☐ Yes  (Go to Q. No.38)  
☐ No  (Go to Q. No.39)

38. Please specify the type of illness or medical conditions that you are suffering from and which you are anxious about

__________________________________________________________

Career planning

39. All going well, how long more do you wish to continue with your sea-career?

☐ Less than 5 years  
☐ 5 to 10 years  
☐ More than 10 years

40. Can you list out few reasons, which in your opinion may make you consider leaving the sea-career in future?  
(Here, you may choose and tick up to 5 reasons in the table below showing various choices on top, but as per their decreasing order of their priority)


Section – B: Questionnaire to ex-seafarers

41. What is your name? (optional)

_______________________________

42. What is your age? *

☐ Less than 30
☐ Between 30 and 40
☐ Between 40 and 50
☐ Between 50 and 60
☐ More than 60

43. For how long did you serve as a seafarer?

______________________ years

44. How long ago did you stop sailing?

------------------------------------- Years

45. What was your rank during the last contract on board?

☐ Master
☐ Chief mate
☐ 2nd Mate
☐ 3rd Mate
☐ Deck Cadet

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<th>Family related reasons</th>
<th>Financial security achieved</th>
<th>Medical reasons</th>
<th>Alternate career prospects ashore</th>
<th>Tough conditions on board</th>
<th>Maritime Security related</th>
<th>Criminalization of seafarers</th>
<th>Any other reasons</th>
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Chief Engineer
2nd Engineer
3rd Engineer
Junior Engineer/ Eng. Cadet
Electrical officer or ETO
Deck crew
Engine crew
Saloon crew
Any other rank

46. Which type of vessels have you predominantly served on?
General Cargo Ships
Bulk carriers
Container vessels
Oil tankers
Chemical carriers
Gas carriers
RoRo/ Passenger vessels
Any other type vessels

47. During your sailing days, have you ever felt especially tired and exhausted (more than usual) after certain contracts?
Yes (Go to Q. No. 48)
No (Go to Q. No. 51)
Not sure (Go to Q. No. 51)

People who experienced unusual tiredness at the end of few contracts

48. What in your opinion was the cause of this unusual tiredness experienced after certain contracts at sea?
Vessel schedule related (e.g. frequent port calls, coastal voyages etc.)
Vessel equipment related (e.g. frequent m/c breakdown etc.)
Vessel crew related (e.g. inexperienced/difficult/multi-national crew)
Health & Hygiene (poor food, poor sleep, high noise/vibration etc.)
Any other reason

49. Did this feeling of tiredness continue even beyond your sign-off from that vessel?
☐ Yes (Go to Q. No. 50)
☐ No (Go to Q. No. 51)
☐ Not sure (Go to Q. No. 51)

50. After sign-off from such vessels, how long did it take for you after reaching home to completely recover and feel energetic again?
☐ 1 to 2 days
☐ Beyond 2 days; up to 1 week
☐ Beyond 1 week; up to 1 month
☐ Beyond 1 month

Common illnesses reported by seafarers
Appended below are few illnesses commonly reported by shift-workers worldwide. Please report if you are at present, suffering from any of these illnesses.

51. Are you suffering from abnormal blood pressure? (High B/P or Low B/P)
☐ Yes (Go to Q. No.52)
☐ No (Go to Q. No.54)

52. Are you suffering from High B/P or Low B/P?
☐ High B/P
☐ Low B/P

53. How long you have been suffering from abnormal B/P?
______________________
54. Are you suffering from any Cardiovascular diseases? (e.g. Myocardial infraction, Stroke, Hypertension etc.)

☐ Yes  (Go to Q. No.55)  
☐ No    (Go to Q. No.57)  

55. Please specify the type of cardiovascular disease that you are suffering from.

☐ Myocardial infraction  
☐ Stroke  
☐ Hypertension  
☐ Any other type (Please specify) ________  

56. How long you have been suffering from above disease?  
_____________________  

57. Are you suffering from any Metabolic Disorders? (e.g. Metabolic syndrome, Hyperlipemia, Diabetes etc.)

☐ Yes  (Go to Q. No.58)  
☐ No    (Go to Q. No.60)  

58. Please specify the type of Metabolic Disorders that you are suffering from.

☐ Metabolic syndrome  
☐ Diabetes  
☐ Hyperlipemia  
☐ Any other type (Please specify) ________  

59. How long you have been suffering from above disease?  
_____________________  

60. Are you suffering from any Mental Disorders? (e.g. Depression)

☐ Yes  (Go to Q. No.61)  
☐ No    (Go to Q. No.62)
61. How long have you been suffering from above disease?  
____________________

62. Are you suffering from any gastrointestinal disorders? (e.g. Peptic ulcer, Irritable bowel syndrome, etc.)  

☐ Yes  (Go to Q. No.63)  
☐ No  (Go to Q. No.65)

63. Please specify the type of Metabolic Disorders that you are suffering from.  

☐ Peptic ulcer  
☐ Irritable bowel syndrome (includes cramps, abdominal pain, gas, acidity, diarrhea, constipation etc.)  
☐ Any other type (Please specify) __________

64. How long you have been suffering from above disease?  
____________________

65. Are you suffering from any sleep disorders? (e.g. Insomnia, Sleep apnoea, hypopnea, delayed/ advanced sleep syndrome, etc.)  

☐ Yes  (Go to Q. No.66)  
☐ No  (Go to Q. No.68)

66. Please specify the type of sleep disorders that you are suffering from.  

☐ Insomnia  
☐ Sleep apnoea - hypopnea  
☐ Advanced/delayed sleep syndrome  
☐ Any other type (Please specify) __________

67. How long you have been suffering from above disease?  
____________________

68. Are you suffering from Multiple Sclerosis?  

☐ Yes  (Go to Q. No.69)
69. Are you suffering from any Cancer or Tumor?
   □ Yes  (Go to Q. No.70)
   □ No   (Go to Q. No.71)

70. Please specify the body part affected by cancerous growth/ Tumor

_________________________________

71. Is your Body Mass Index (BMI) value above normal?
   (BMI = Body weight in kilogram/ Square of height in metres; Any value > 30 indicates that you are over-weight)
   □ Yes  (Go to Q. No.72)
   □ No   (Go to Q. No.73)

72. Please specify your BMI value
   □ Between 30 and 35
   □ Between 35 and 40
   □ Above 40;

73. For how many years you have remained over-weight?
   ____________ years

74. Are you always having a feeling of constant tiredness/ sleepiness?
   □ Yes
   □ No
   □ Occasionally
75. If your answer to the above is yes, from when did you start having this feeling?

- [ ] Right from sailing days
- [ ] Immediately after leaving the sea-career
- [ ] Much later

76. Are there any other illness or medical conditions (not mentioned above) that you are suffering from and which you are anxious about?

- [ ] Yes  (Please mention the type of illness: __________)  
- [ ] No

77. If your answer was ‘yes’ to any of the illnesses mentioned above, was that among the reasons which made you consider leaving the sea-career?

- [ ] Yes
- [ ] No
- [ ] May be

78. Can you list out few reasons, which in your opinion made you leave the sea-career?

(Here, you may choose and tick up to 5 reasons in the table below showing various choices on top, but as per their decreasing order of their priority)

<table>
<thead>
<tr>
<th>Priority 1</th>
<th>Boredom with sea-life</th>
<th>Family related reasons</th>
<th>Financial security achieved</th>
<th>Medical reasons</th>
<th>Alternate career prospects ashore</th>
<th>Tough conditions on board</th>
<th>Maritime related</th>
<th>Criminalization of seafarers</th>
<th>Any other reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 2</td>
<td></td>
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<td>Priority 3</td>
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<tr>
<td>Priority 4</td>
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<td>Priority 5</td>
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</tbody>
</table>
APPENDIX – 2

Survey questionnaire sent to medical practitioners

Dear Sir/Madam,

Thank you for taking the time to respond to this survey. Your contribution to this research work, is deeply appreciated.

I am a student at the World Maritime University, Malmo, Sweden, studying to complete a post-graduate degree in Maritime Affairs. As part of my studies, I am seeking to collect data about the main illnesses which are affecting the seafarers worldwide, and the severity of fatigue at sea, for the purpose of identifying suitable mitigating measures.

I will be grateful if you would kindly take a few minutes to answer the attached questionnaire and help me in collecting necessary data for my studies. Responding to the questionnaire should not take more than 10 to 15 minutes.

The data collected will be used strictly for academic purposes only. Any personal and private information about participants and organizations will be treated with utmost confidentiality. All data will be analyzed in aggregate and no individual elements will be isolated without your direct permission. All research related data will be temporarily stored on a hard drive during the survey and then deleted after completion of analysis. As a recipient of this questionnaire, you have every right not to participate in the survey and withdraw at any stage. It is my hope, however, that you will participate and help in the completion of this work, with a view to contributing to the enhancement of the career of seafarers and for the general benefit of the seafaring community.

Thanks again,
Capt. Sarat Kumar

Questionnaire

1. How long have you been involved in the Medical Examination of Seafarers?

------------------- years

2. On an average, how many seafarers undergo a medical examination in your clinic annually?

-------------------
3. Of these seafarers, in your experience, approximately how many seafarers fail in their medical examination the first time?

4. In your experience, in which age-bracket, more number of seafarers are failing in their medical examinations?

   - < 20 yrs.
   - 20 to 30 yrs.
   - 30 to 40 yrs.
   - 40 to 50 yrs.
   - > 50 yrs.

5. What reasons you have, if any, for your observations in questions 3 and 4?

6. Which of the health conditions below will you consider as the most likely reason for a seafarer to be declared unfit for sea? Please tick in the appropriate column on a scale of 1 to 5, with 1 being highly likely and 5 being least likely.

<table>
<thead>
<tr>
<th>Illness</th>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 4</th>
<th>Scale 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure (High B/P; Low B/P)</td>
<td></td>
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<tr>
<td>Cardiovascular Diseases</td>
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<tr>
<td>(including Myocardial infraction, Stroke, Hypertension)</td>
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<tr>
<td>Metabolic Disorders (including Metabolic syndrome, Hyperlipemia, Diabetes)</td>
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<td>Mental Disorders (including Depression)</td>
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<tr>
<td>Sleeping disorders (including Insomnia, Sleep apnoea, hypopnea, Delayed/ advanced sleep phase syndrome)</td>
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<tr>
<td>Gastrointestinal disorders</td>
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<td>(including Peptic ulcer, Irritable bowel syndrome)</td>
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<tr>
<td>Multiple Sclerosis</td>
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<tr>
<td>Cancer/ Tumor</td>
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<tr>
<td>Obesity (BMI Index &gt; 30)</td>
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<tr>
<td>Fatigue - Chronic</td>
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<tr>
<td>Any other medical conditions not mentioned above (please specify: ______ )</td>
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</tbody>
</table>
7. Do seafarers ever complain to you about job-related fatigue or stress at sea?

☐ Yes
☐ No

8. If you answered “yes” to the above,
   a. From which rank/rating did you usually receive such complaints more often?

☐ Management level
☐ Operational level
☐ Support level (Ratings, Trainees, Cadets etc.)
☐ Cannot exactly specify

b. How often did you receive such complaints?
   (Very often: >10%; Often: 1 to 10%; Rarely: < 1%)

☐ Very often
☐ Often
☐ Rarely
☐ Cannot exactly specify

**Doctor’s/ Clinic’s details:**

Name of Doctor: _______________________________

Qualification: _______________________________

Name and Address of clinic:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________