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Sleeping habits of marine engineers

- Part of the greater study: The medical questionnaire

Master of Science Thesis

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Summary

There are done several studies and researches of marine personnel fatigue especially of deck officers. There is a demand and great interest to survey the sleeping habits of Swedish marine engineers.
The aim of this Master Thesis is to find out if marine engineers get enough sleep. The purpose is also to find differences in sleeping patterns between technical chiefs and engineers.

This Master Thesis is a part of a greater study, where the marine engineers answered a medical questionnaire and filled a diary. Test persons wore also a special watch that recorded their sleep and wake results. This Master Thesis and its results are based on the answers given in the medical questionnaire. Questionnaire was filled in on Swedish vessels operating in different maritime sectors.

The results indicated that there were differences between engine personnel's sleeping habits and especially in how they felt the fatigue. The results received from the medical questionnaire point out that there is a demand at some level for planning, execution and surveillance of marine engineers' work task. To prevent fatigue in the engine room is current and desirable.

The individual circadian rhythm could be taken in consideration when planning work shifts. Work and especially sleeping environment should be suitable. Respecting the collective agreements of working hours is also an essential part when preventing fatigue at sea.

Contents

1 Introduction

All of us have sometimes felt sleepy while working. We know how difficult it is to concentrate and perform the given task when feeling tired.
Sleeping is an important part of human function and proper sleep is needed to work in an efficient and safe manner, not to mention the health aspect of sleep. The present maritime work tasks and especially working hours out on the vessels present a challenge for the crews when talking about enough sleep. We have legislation that steers the working hours. One question is if the agreements are followed or are they just defunct and insufficient in all ways?

Several researches have been done on fatigue in working life. Transportation is in great interest and concern when dealing with drivers' and navigators' fatigue.

1.1 Background

This report is a part of a greater field study done by researchers of Chalmers University in Gothenburg. The research team visited marine engineers on Swedish vessels and collected data about engineers sleeping habits and fatigue. The data collection is explained in more detail later on in the report.

1.2 Purpose of the research

This master thesis is concentrating on fatigue of marine engineers. The goal is to analyze the collected data in a proper way so that we can find the sleeping habits of the technical chiefs and engineers.
The main question for this report is:

- Do marine engineers get enough sleep when off duty?

The possible difference in answers between engineers and technical chiefs is also of great interest and especially if there are any clear reasons for these differences.

I also try to explain what the definition for enough sleep is from a physical, mental and legal perspective.

1.3 Defining the research area

In this Master Thesis, Swedish marine engineers working on Swedish vessels have been researched. The majority of the engineers were working in daytime and watch keeping duties were divided. Only two of the engineers had watch keeping duties full time.
This study is one part of a bigger study which seeks to investigate the sleeping habits of engineers and if they possibly get enough sleep in watch keeping duties under Swedish flag.
The analysis is based on a standard health questionnaire. The questionnaire is explained more specifically later in the text.

1.4 Structure of the research

The main purpose of the first and second chapter is to discuss the goals, reasons and the ways in which the study is chosen and done.
In chapter 3, I try to tell about the different requirements that sleep demands. There are physical, mental and legal requirements that steer the person's capability to work as a unit.
Chapter 4 shows some basic statistics and definitions about circadian rhythm, "morning and evening people".

In chapter 5 I try to find some similarities and differences or positive and negative sides between maritime watch keeping duties or systems.

Chapter 6 is the most important chapter of this study because it presents the results of the questionnaire. By means of diagrams and tables I show the answers the technical chiefs and machine engineers have given. I try to analyze the tables and diagrams taking into consideration the other chapters, especially chapter 3 and 4. Chapter 6 is also an important chapter because in it there are also some of the conclusions about the actual study. This is not a typical way to do in a results chapter, but I found it a clear way anyhow.

Chapter 7 is rather a method discussion chapter than a classical comparative discussion chapter. In the chapter I go through the positive and negative aspects of the used method.

Chapter 8 is the last chapter and it is the conclusion chapter. In the chapter the results and some further questions and research possibilities are explained.

2 Background of the sleeping requirements

According to Teacher's Guide (Information about sleep, 2003) sleep is a behavioral state that is a natural part of every individual's life. We spend approximately one-third of our lives asleep. People generally know little about the vitality of this important activity. Sleep is not just some time filling activity when a person is inactive. Sleep is a required activity, not an option. We do not know the precise functions of sleep, but sleep is important for normal motor and cognitive function. We all recognize and feel the need to sleep. After sleep we recognize changes in body that have occurred, as we feel rested and more alert. Animal test has shown that sleep actually appears to be required for survival. Teachers Guide (Information about sleep, 2003); Hyyppä and Kronholm (1998) mention the animal tests. Rats without of sleep will die within two- three weeks; this is same time as to death due to starvation.

Teacher's Guide (Information about sleep, 2003) states also that it is not normal for a person to be sleepy when he or she expects to be awake. Problem sleepiness may be associated with difficulties in concentrating, memory lapses, and loss of energy, fatigue, lethargy, and emotional instability. The problem with sleepiness is common and high and has serious consequences, such as workplace accidents and errors.

Teacher's Guide (Information about sleep, 2003) states further that lifestyle and some undiagnosed or other untreated sleep disorders can cause problem sleepiness. Lifestyle factors are: not getting enough sleep, having an irregular sleep schedule, the use of alcohol or certain medications. Of the more than 70 known sleep disorders, the most common are obstructive sleep apnea, insomnia, narcolepsy, and restless legs syndrome. Large numbers of individuals suffering from these sleep disorders are unaware of, and have not been diagnosed or treated, for their disorder. In the questionnaire, the respondents are asked about possible conditions that might cause problems with sleeping.

2.1 What is fatigue?

According to Smith et al., (2007) the technical term for fatigue is not that clear. However, the main symptoms of acute fatigue are: a person that feels him/herself tired, the performance has declined and the body's physiological functioning may be affected. They continue by reminding that when estimating of the commonness of fatigue, it may vary depending on which indicator or aspect is used when defining fatigue;

"If one assumes that doing shift work is a risk factor for fatigue one might simply use the number of workers doing shift work as an indicator of prevalence. However, this is based on the assumption that shift work automatically leads to fatigue which one finds is not always the case". (Smith et al., 2007 p.1.)

IMO defines fatigue as follow:

"Fatigue can be defined in many ways. However, it is generally described as a state of feeling tired, weary, or sleepy that results from prolonged mental or physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep. The results of fatigue are impaired performance and diminished alertness". (Guidance on fatigue mitigation and management. IMO MSC/Circ. 1014 p.3)

This means that all possible aspects must be taken into consideration when evaluating the fatigue. It is essential to estimate and assess the risks, prevalence and consequences of fatigue.

2.2 About poor and good sleeping

Poor sleep influences human performance and psychic functional capacity (Kronholm, 1993; Urrila, 2007). Working hours are strongly influence the ability to act right in different situations. The risk and probability of accidents raises when working hours are

far too long or when working period is at night time or in the early hours of dawn. Humans make mistakes when tired and this thought should be emphasized in safety critical areas like traffic. (Hakola et al, 2007)

In a survey done by Hyyppä et al., (1989) a person who falls asleep in 10 minutes was defined as a good sleeper. (Hyyppä et al., (1989) also mentions a survey done by the US Navy which established that good sleepers fall asleep in 20 minutes) and sleeps 7.5 hours. He/she does not have illnesses or other internal functions that disturbs sleep. The person feels alert in the morning and possible tiredness during the day does not disturb the performance. He/she is empathetic and energetic person with good self-esteem.
The bad sleeper has problems with sleeping. He or she has sleep malfunctions and suffers from mental distress, but the person's social relations do not differ from those of better sleepers. The target group of this survey consisted of Finnish sleepers. (Hyyppä et al., 1989)
Because of the wide understanding of sleep and its interpretation, these definitions are off course only directional and cannot be the only truth.

2.3 Minimum physical and mental requirements

The recommended amount of sleep per day is 7.5 hours, preferably not disturbed and nocturnal (Lutzhöft et al., 2007), 7-8 hour (Nordic Sleep Research 1990). However some people may need as little as 5 hours or as much as 10 hours of sleep every day (Rodriguez-Martos Dauer and Monge, 2004)
A Research done by Helsinki University and Institute of Occupational Health (Wessel M. A. van Leeuwen et al., 2009) suggests that sleep debt can be dangerous for human health. According to the research, 4 hours of sleep in 5 days in a row affected the immune system negatively. This malfunction in the immune system means that the risk of cardiovascular diseases is higher for those people that sleep poorly. The situation did not improve afterwards although trying to fix it with proper sleep.
Working extra hours, stress, shift work and irregular working hours cause sleep debt.

According to a report called Fatigue at Sea Fatigue at Sea (Lutzhöft et al., 2007) the nautical officers in so called two-watch-system (6 hours on/ 6 hours off) seldom got more than 4.5 hours of sleep. The duration of sleep was even shorter in the daytime. This is due to the biological fact that the body is used to be awake in the daytime. The amount of sleep the nautical officers got was also defined as low quality sleep. Weather, noise, vibrations and other different activities negatively influence sleep onboard.
It is deemed that in experimental researches mood, age and use of medication, would explain about 16% of the change of the quality of sleep (Kronholm, 1993)

After 9 hours of work the risk of accidents rises significantly. After 12 hours of work the relative accident risk is doubled. After 16 hours the risk is tripled (Smith et al., (2007) and Hakola et al., 2007)

Sanquist et al., (1997) mention in their research that a 4-on, 8-off schedule system for watchkeepers per a 24-h period show notable disruption in sleep. The average sleep duration for all mariners was 6.6h. The sleeping periods were fragmented and frequently less than 5 hours in duration 04.00-08.00 period watch keepers slept less than 4 hour per 24-hour period. They also found that practically all mariners showed great interest for longer sleeping periods, rather than dividing their sleep into several parts.

2.4 Effects of the lack of sleep

The effects of lack of sleep can be divided in two different categories: 1) The information about the brains and other mental functions 2) The information about body's vital functions and other physical functions. The information collected from both categories is based on experiments done on people and animals (Kronholm, 1993). Here are some of the known facts.

2.4.1 Mental impacts

Every individual experiences the lack of sleep in a different way. The experiences of insomnia are strongly connected to mental and somatic health, gender, age and social status. The sleep disturbances occur in situations where there is mental stress. There is a strong connection between a minor mental disorder and feelings of insomnia (Kronholm, 1993). In Hyyppä and Kronholm´s (1998) study it is said, that when feeling tired the mood decreases and it gets depressive forms. In most persons the staying awake situation causes hostility and irritation. These symptoms in an awake stayed person points to solutions that the quality of life decreases clearly.

The most obvious consequence in mental working order when lack of sleep, is decreasing motivation and weakening focusing. They mention that lack of sleep appears sooner in willingness than in ability to perform a work task. According to Hyyppä and Kronholm (1998) in some studies they have noticed that 5 hour sleep or less in night increases the need for sleep and weakens the mental function. The performances deteriorate because the mechanism that maintains focusing is declining, the speed of information handling in brains slows down and there are also malfunctions in memory. Sometimes when the test persons stays awake very long they start to hallucinate. They get phases that reminds of psychotic symptoms. Hyyppä and Kronholm (1998) points out also that the surprisingly few researches done indicates that consequences in real life are clearly bigger than in laboratory tests.

2.4.2 Physical impacts

As earlier mentioned (Hyyppä and Kronholm 1998) test animals like a rats die when keeping them awake 10-30 days. The body temperature of the rat dramatically decreases; this same function has been noticed with monitored human experiments.

Problems with metabolism start to occur. Contour of seeds of diabetes starts to show up and cholesterol metabolism symptoms show similarities with cardiovascular diseases. (This is also found in study done by Helsinki University and Institute of occupational

Health 2009). The speed of muscle movement decreases and when lack of motivation increases the problems with burdensome physical efforts occur.

Folkard, (2000) found in his research that the probability for the shift worker of falling sleep is high when temperature is falling or low, but low when temperature is rising or high. He mentions also that when transport operator ends a night duty and tries to go to sleep the body temperature will typically be rising quickly and problems to fall asleep occur. He continues that if driver fall a sleep when the body temperature is high or rising they will sleep only for a short period. If the shift worker has problems with very short sleep duration a cumulative sleep dept increases in successive nights and this further on increases risk for accidents. The relationship with body temperature and performance efficiency is also mentioned by Fletcher et al., (Utterback and Ludwick, 1949) 1988.
Many persons show also tendency for hormonal secretion changes, but Hyyppä and Kronholm (1998) mentions that we cannot make any bigger conclusion about it yet.
Hyyppä and Kronholm (1998) states that the problems with organs compared with subjective feelings are surprisingly small.

Shiftworkers have more problems with stomach than dayworkers. Heartburn, stomachache and flatulence occur. Duedenal ulcer is five times more common among shiftworkers than dayworkers. The older the persons get the more difficult it is to adapt to shiftwork. (Hyvä Terveys. Helasti, Pirjo)

2.5 Legal requirements

The legal requirements and definitions for sleep intermission vary in different traffic modes. Maritime, aviation and road traffic have different legal activities. The circumstances are of course different in these traffic modes, which defines their own specific rules. I am comparing the given rules by IMO (International Maritime Organization) and the Swedish legislation only superficially.

2.5.1 International legislation and conventions

There are several international conventions and national legalislation that the shipping companies and vessels are bound to comply with when dealing with hours of work, rest and proper manning. All these conventions are supervised by IMO and ILO (International Labor Organization) or national law authorities.

ILO has a Maritime Labour Convention 2006 ("Super Convention"). This convention tries to integrate the international regulations for seafarers´ working and living conditions under the same regulation. Liberia, the Republic of Marshall Islands, the Bahamas, Panama and Norway (in total, 40 per cent of the world's gross tonnage) are the only countries to ratify the Convention. The European Union and other European seagoing countries have made significant steps to ratify the Convention in near future. The entry into force of the Convention requires minimum ratification of 30 ILO member states or 33 per cent of world gross tonnage ships. Because the tonnage requirement is already fulfilled by countries mentioned earlier, other countries might be tempted to ratify the Convention. The requirements for Convention entry is expected into force 2011.

2.5.1.1 STCW

International Convention on Standards of Training, Certification and Watch keeping for Seafarers is a convention which defines the minimum requirements for safe watch keeping onboard. In the **Chapter VIII Guidance regarding watch keeping** is defined as follows:

"Measures were introduced for watch keeping personnel to prevent fatigue. Administrations are required to establish and enforce rest periods for watch keeping personnel and to ensure that watch systems are so arranged that the efficiency of watch keeping personnel is not impaired by fatigue."

The guidance and provisions clearly state that persons, vessels, environment and cargo must be taken into consideration when deciding on working and resting hours. A part of the code is mandatory and some B parts are only recommendations. There is still too much room for interpretation.

2.5.1.2 SOLAS

International Convention for the Safety on Life at Sea has a mention about the ship's manning (**Chapter V: Safety of navigation, regulation 14**.)

2.5.1.3 ILO Convention 180 (Incorporated with MLC Maritime Labor Convention 2006)

This convention has clear rules for working and resting hours that each member of this convention must follow.
In regulation **2.3 paragraph 5** the limits for maximum working hours and minimum resting hours are defined.

5. The limits on hours of work or rest shall be as follows:
(a) maximum hours of work shall not exceed:
(i) 14 hours in any 24-hour period; and
(ii) 72 hours in any seven-day period;
or
(b) minimum hours of rest shall not be less than:
(i) ten hours in any 24-hour period; and
(ii) 77 hours in any seven-day period.

In **paragraph 6** continues that the hours of rest may be divided into no more than two periods, one of which shall be at least six hours in length, and the interval between consecutive periods of rest shall not exceed 14 hours.

Concerning the manning levels the convention leaves more room for interpretation than the STCW:

"Contracting Governments undertake, each for its national ships, to maintain, or, if it is necessary, to adopt, measures for the purpose of ensuring that, from the point of view of safety of life at sea, all ships shall be sufficient and efficiently manned."

2.5.1.4 Principles of Safe Manning (IMO Resolution A 890(12))

This resolution is mainly, as the name implies, for the safe manning of the vessel, but it has an article for hours of work and rest. Safe manning, working and rest periods are strongly bound together. In this resolution, it is stated that all possible situation should be taken in consideration when manning a vessel. This is not a mandatory act but only a recommendation.
Below are examples of situations what should be taken into consideration when safe manning is required:

3.2.6 frequency of port calls, length and nature of voyages to be undertaken.
3.2.7 trading area(s), waters and operation in which the ship is involved
And
3.2.9 applicable work hour limits and/or rest requirements.

This is the general conference of the International Labor Organization concerning seafarers' hours of working and the manning of the ship. In this resolution some responsibilities of companies are mentioned.

2.5.2 Swedish Legislation

Swedish legislation is full of different acts concerning all Swedish seamen sailing under Swedish flag. There is also different kind of collective agreements between employers and machine officers. Below the most important ones:

- Act of working hours for seamen (Sjöarbetstidlagen) and
- Act of resting hours for seamen (Lag(1998:958) om vilotid för sjöman)
    - The Law of resting hours for seamen is similar to ILO convention 180
- Commandment of resting hours for seamen (Förordning (1998:962) om vilotid för sjömän)
- Collective agreements (Olika kollektiva avtal till maskinbefäl (Storsjö, färjeavtal, Europaavtal, Bogseravtal.))

National legislation is the most important way to regulate the seafarers´ working conditions and life onboard.

3 Statistics about the awakening cycles

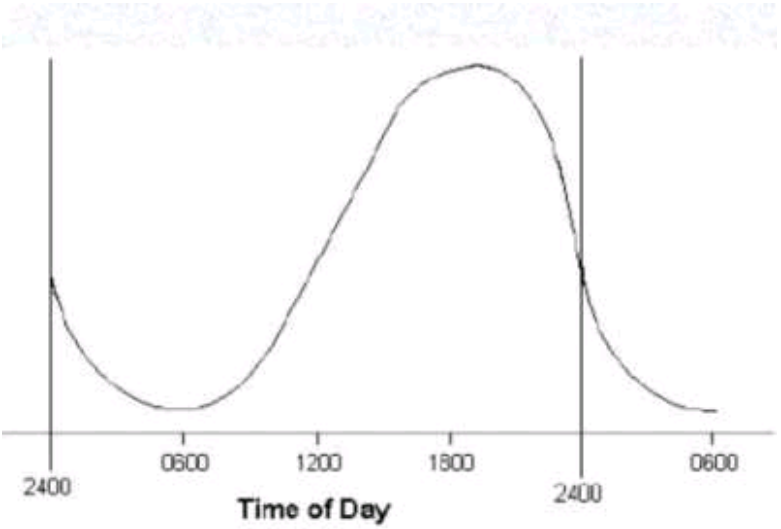
Our diurnal rhythm is based on so the circadian rhythm. These rhythms are physiological and behavioral functions. The cycle is approximately a nycthemeron long (actually near 25 hours). Circadian rhythms are controlled by the brain. The external factors (zeitgebers) such as light influence the rhythm. Crossing time zones is an example of disruption of the circadian rhythm. Normal synchronization will be interfered because of the internal day and night clock. This leads to jet lag. It takes time for the circadian rhythm to readjust to the new environment cycle. (Aviation Crew Resource Management)
These rhythms explain why people experience periods of higher alertness at certain times of the day. These cycles also dictate when humans feel sleepy or hungry. (Aviation Crew Resource Management)

Chandrashekaran et al., (1991) p.97 defines as follows;

"It is well established that almost all the body functions in the human organism show a 24 h (daily) variation and that these rhythms are in synchrony with sleep and wakefulness as well as with the alternation of a day and night (Aschoff and Wever 1981). In subjects living in isolation without any time cues these rhythms persist, as they do in plants and in animals (Bunning 1973), with circadian period of ca 25 h (Wever 1979). In the absence of entraining stimuli such as light/darkness and social cues, the rhythms freerun".

Figure 1 shows the circadian rhythm for body temperature. The curve is very tenacious. This means that even if the normal pattern of being awake and sleeping is disrupted (by shift work for example), the temperature cycle remains unchanged. 4-6 o'clock in the morning, the body temperature is lowest and it is at this time that it is hardest to stay awake. Research has shown that this drop in body temperature appears to be linked to a drop in alertness and performance. (http://www.crewresourcemanagement.net/)

Figure.1



The Circadian rhythm of Internal Body Temperature (http://www.crewresourcemanagement.net/)

3.1 Normal circadian rhythm

According to Su-Laine Yeo (1998), there are so called "larks" (morning people) and "owls" (evening people). Larks prefer to go to sleep and wake up early. Owls prefer to go to sleep and wake up at late times. People, including larks or owls, with **normal circadian systems**:

1. Can wake up in time for what they need to do in the morning, and fall asleep at night in time to get enough sleep before having to get up.
2. Can sleep and wake up at the same time every day, if they want to.
3. Will, after starting a new routine which requires they get up earlier than usual, start to fall asleep at night earlier within a few days. This adaptation to earlier sleep/wake times is known as "advancing the sleep phase." Healthy people can

advance their sleep phase by about one hour each day. This is also mentioned by Karvonen (2005)

Yeo (1998) says that researchers have used volunteers in a special environment such as caves or special apartments for several weeks without clocks or other time cues. Karvonen (2005) mentioned also similar studies in his article. Researchers noticed that the volunteers tended to go to bed an hour later and to get up about an hour later each day. These experiments appeared to show that the "free-running" circadian rhythm in humans was about 25 hours long (Also mentioned by Condon et al., (Wever 1982) 1988). However, these volunteers were allowed to control artificial lighting and the light in the evening caused a phase delay. More recent research shows that adults of all ages free-run at an average of 24 hours and 11 minutes. (Karvonen, 2005)

3.1.1 Some variations

Karvonen (2005) says that bad and dark weather extends the circadian rhythm, to Owls even 25-26 hours. The shortest measured circadian rhythm for man is 23 hours and was caused by genetic mutation Karvonen (2005). To maintain a 24 hour day/night cycle, the biological clock needs regular external environmental time cues, sunrise, sunset, and a daily routine such as working out, food and social life (Hakola et al., 2005). Time cues keep the normal human circadian clock aligned with the rest of the world.

3.2 Chronotypes

According to Police – Shift Work Guide, an individual's tolerance towards shift work has been found to be related to his particular circadian rhythm pattern. The scientific name given to this is the chronotype of the individual. According to Helasti, (Hyvä Terveys – an article based on interview by Helasti Pirjo with research Professor Mikko Härmä) Central Nervous System tries to find some kind of rhythm. CNS starts to evolve since

birth, and we start to become larks (early birds) or owls (late birds). There might be some changes as you grow up, but you never totally change from one to the another.

Humans can be categorized as falling into three different chronotypes, using measures such as the Horne-Ostberg Morningness-Eveningness Scale. The three types are "morning" (Larks), "evening" (Owls) and "indifferent".
"Morning" and "evening" types each represent approximately 15% - 20% of the human population, whilst the remaining 60% - 70% of the population fall into the indifferent category.
According to Karvonen (2005), “morningness” is two to three times more common than “eveningness”. Two people of three do not clearly belong to either group Owls or Larks. He still states that results greatly change according to the research methods and the age of the people. In some studies, there have been found opposite results: There is 15 to 20% of Owls and 10 to 15% Larks.
Iwona Chelminski et al. (1996) studied over 1600 undergraduates. 62.4% of students were evening types and 29.3% were neither type. Only 8.3% of the students were morning types, and most of these individuals were significantly older than the students who were classified in the other two types. Interesting was that females showed clearly stronger tendency toward the Larks dimension.
As we can see there is deviation between studies.

3.2.1 Definitions for Larks and Owls

According to Police – Shift Guide morning-type individuals can be described as those who naturally waken about 2 hours *earlier* than the majority of the population and are ready for sleep between 8pm and 10pm. To Larks, midnight is the middle of the night. Early shifts are easier for Larks.
Evening-type individuals (Owls) can be described as those persons who naturally waken about 2 hours *later* than the majority of the population and do not feel sleepy until between 12 midnight and 2am. Late shifts are easier for Owls.

You are most likely "indifferent" if you don't indentify your category between the "early birds" or "late birds"

Studies show that in the short term Larks have greater difficulty coping with nightshift than Owls, as their natural tendency to wake early reduces their day time sleep after a nightshift.

3.3 Some factors that regulates the circadian rhythm

According to Helasti (Hyvä Terveys – an article where she interviews a research Professor Mikko Härmä from Institution of Occupational Health), it would be wise to adapt your own rhythm, but because the rhythm is not totally determined by genetics you can influence your rhythm.

Karvonen (2005) mentions that in addition to genotype, the environment affects to circadian rhythm. It affects especially to Owls. The most important factor that regulates the circadian rhythm is light - dark rhythm. A 24 hour rhythm can be changed often only by one hour. It is easier to delay going to sleep or to waking up than to try make the same functions earlier.

Condon et al., (1988) mentions the effects of time zone crossing (east-west). In slow time-zone crossing (by boat) the effects are not that significant compared to aviation.

Condon et al., (1988) found in their research that a basic phase-adjustment (not alertness) of the circadian rhythm took place both on westbound and eastbound journeys. The normal waveform was distorted and the wave peaks in the daily curve occured earlier on westbound journeys and later on eastbound journeys. The physiological circadian system can be adapted to westbound time changes easier than in eastbound (Condon et al., (Sasaki 1964) 1988). In sleep pattern it means that sleep is longer on westward journey than in eastward journeys. The watchkeepers were affected more than day workers.

You can change the circadian rhythm from morning to night by staying under light at nights and avoiding light in the mornings. You can also delay the rhythm by delaying going to bed and sleeping longer in the mornings, which is easier for younger people.

(Hyvä Terveys – an article based on interview by Helasti Pirjo with a research Professor Mikko Härmä)

Gross (2003) states in his article (Guardian December 4 2003: Are you a lark or an owl?), that because it is always going to be relevant night work and a big part of it could be covered by clever use of natural alteration between persons' biorhythms. The larks and owls could work on working hours that suits for them. The science could help the workers to adapt the most unpopular hours in the middle of the night. Härmä & Allinen (2004) and Condon et al., (1988) also mention the need for dimensioning the work for the person.

Table 1. How larks and Owls differ.

Characteristic	Larks	Owls
Most alert (self-report)	Around noon	Around 6 P.M.
Most productive (self-report)	Late morning	Late morning, and late evening
Most active	Around 2:30 P.M.	Around 5:30 P.M.
Best mood	Between 9 A.M. and 4 P.M.	Steady rise from about 8 A.M. to 10 P.M.
Temperature highest	Around 3:30 P.M.	Around 8 P.M.
Age	Most persons over age 60	Most college students and 20-somethings
Bedtime	Go to bed 2 hours earlier than owls; fall asleep faster	More variable bedtimes; stay up later on weekends and holidays
Waketime	Awaken at desired time	Awaken about same time as larks on workdays, 1-2 hours later on days off
Use of alarm clock	Don't need it	Need multiple alarms
Temperature lowest	Around 3:30 A.M.	Around 6 A.M.
Quality of sleep	Lifelong: sleep more soundly; wake up more refreshed, usually 3.4 hours after temperature minimum, daily	Lifelong: get less sleep; wake up sleepier, usually 2.5 hours after temperature minimum

	low point on body clock	
Nap	Rarely	Take more and longer naps; fall asleep more easily in daytime
Mid-sleep time	Around 3:30 A.M.	Around 6 A.M.
Favorite exercise time	Morning	Evening
Peak heart rate	Around 11 A.M.	Around 6 P.M.
Lowest heart rate	Around 3 A.M.	Around 7 A.M.
Mood	Mood declines slightly over day	Mood rises substantially over day
Morning behavior	Chatty	Bearish
Evening behavior	Out of steam	Full of energy
Meal times	Eat breakfast 1-2 hours earlier than owls	Often skip breakfast; eat other meals at same times as larks on work days, 90 minutes later on days off
Favorite meal	Breakfast	Dinner
Daily caffeine use	Cups	Pots
Shift work adaptability	Work best on day shifts	Work best on evening shifts; tolerate night and rotating shift work better
Travel	More jet lag	Adapt faster to time zone changes, particularly going west
Peak melatonin secretion	About 3:30 A.M.	About 5:30 A.M.

http://www.nasw.org/users/llamberg/larkowl.htm

4 Watch keeping duty systems for engineers in vessels

Certain ship types, difficult weather conditions, minimal manning, short port turnarounds with quick intervals and increasing amount of traffic is a concern to all seafarers' mental and physical condition. All these aspects together are increasing the seafarers work load and fatigue is rising. Ship owners, maritime regulators, trade unions and P & I companies need to be alert and take action to improve the situation. (Smith et al., 2007)

According to Smith et al., (2007), the fatigue issue is less systematic ly approached in the shipping business than in other transport sectors;

" There are probably many reasons for this, the first being historical, the second being the extent to which occupational issues become public health issues (e.g. road transport is a public health issue as well as an occupational issue), and the final reason reflecting the extent to which the sectors reflect international or national (local) concern". (Smith et al., 2007 p.7.)

Smith et al., (2007) suggests that there is no "one size fits all" possibility when regulating systems. At sea the situation is often such that sleeping quality is not good. This leads to the fact that there should be a different approach when regulating the maritime sector. Smith et al., (2007) mentions further that prevention and management of fatigue in the maritime sector is insufficient.

4.1 Maritime sectors and work sorting

Watch keeping duty systems may vary from boat to boat due to contracts, vessel, status, traffic area etc. The maritime sector can be divided into three different categories when

deciding where and how they operate: 1) the offshore support sector, 2) the short sea and coastal sector and 3) the deep sea sector.

1) Supply vessels, anchor handling vessels, tug boats, stand by vessels, seismic vessels, dive support vessels, pipe layers etc are serving the oil industry and are called offshore vessels.

2) Coasters, tug boats, fishing vessels, ferries, high speed ferries and some smaller product tankers etc, are called short sea vessels.

3) The deep sea sector has the biggest vessel such as containers, gas- and oil tankers, cruise ships etc.

We also need to separate the technical chiefs from engineers and day work from duty. Technical officers in this study are Swedish and sailing under Swedish flag, so I am comparing and reflecting on some Swedish law aspects.

Smith et al., (2007) mentioned a study that showed that those who reported high levels of fatigue were at a greater risk of making frequent cognitive failures. These same cognitive failures were reported by: seafarers doing shorter tours off duty; the ones with 6 or 12 hours shift; persons with poor sleep quality; the ones exposed to physical or environmental dangers; those with great job demand; those with high levels of stress at work; officers and older seafarers.

Smith et al., (2007) mentioned a survey done with offshore, onshore personnel and installation workers. 67.2 % of seafarers and 46.9 % of the onshore personnel find that their present working habits seriously threat their personal safety and the same pattern was showed in operational safety. These are reflections of sleeping disturbances. They also found that those on shorter tours off duty were more likely to report of fatigue.

What was interesting about the study was that they found rotating shift patterns; long work hours and poor sleep had all a negative effect on health. However, offshore workers surprisingly felt these issues less problematic than installation workers. They found out that seafarers had somewhat better conditions than installation workers or onshore

personnel because of their poor capability to adapt shift work. They also mentioned that if you come from a rougher environment you do not find the conditions that bad (compare, for example, the feeling of Ethiopians` hunger to that of Swedes). The example was that some of the offshore personnel were old fisherman and they found their present working environment far easier than the previous one. The conclusion was that when you feel fatigue you compare it to previous working conditions and that affects on your level of feeling fatigue. Then we can also divide fatigue into three different types: PFRS (Profile of Fatigue Related Symptoms) fatigue, fatigue in work and fatigue after work.

4.1.1 Technical chiefs

Technical chiefs are not required to do some duty work or harbor duty watch on an automated vessel that has main engine power over 3000kW (paragraph 4:6). The technical chiefs are working mainly at daytime inside the normal working hours. Exception is, for example, bunkering if it is not work delegated to the engineers.

4.1.2 Technical engineers

There are several Swedish agreements for engineer officers. The working hours for technical engineers can be divided into, according to agreement of salary and general recruitment terms for the engineers (avtal om lön och almänna anställningsvillkor för befälet), day work, duty shared engine officers (some of the engineers are day workers and others perform watch duties), tugboats and other duty work. All these duties have own specific rules, but the main thing common is that the definition for normal working hours is 8 hours per day (45 hours per week, but it may vary depending on contracts) excluding duty work. This is not absolute because some situations can extend the normal working hours to 12 hours or even to 16 hours (paragraph 3:2, 3:3).
The time between the normal working hours end, and the beginning of the next normal working hours on next day, is called duty work (paragraph 4:1).

The engineer on duty is responsible for checking the alarms and other needed work in the machine room. The duty work can affect to sleep quality very dramatically. If the vessel gets lots of alarms, whatever the reason, the engineer on duty must wake up and check the alarm. These alarms, and the fact that the technical solutions on vessels require engineers in the machine room when leaving the harbor or when arriving in the harbor, means that the duty work can be very exhausting to engineers. Sleep is disturbed and irregular. The duty work responsibility is shared between the engineers because of its heaviness. It is also mentioned in the agreement that the maximum duty work can be in a normal situation 15 duty periods and in the case of possible illness or similar cases 19 duty periods.

Stop duty is a similar system, but it is used only in ports and if the technical chief demands it (paragraph 4:2).

4.2 Challenges

The working hours the technical officers are dealing with reflect the hectic timetables when goods need to be transported as soon as possible as cheap as possible. This has lead to the sad situation where the good quality sleep is in danger what comes to the work load. Perhaps the present transportation regulations are not adequate or at least there might be problems with their control and monitoring? The rates for sleep deprivation must be analyzed more closely. In transportation, the operational professionals have own specific watch keeping or duty systems. Sea, air and land transportation have created own regulations and systems how to operate safely; but if it is working is another question?

Smith et al., (2007) mentions previous studies where it has been concluded that the transition to less standardized working requires a new way of thinking of adaptive processes. These conditions are present at sea where 24 hours working and flexibility is a relevant part of the business. They mentioned that three main links had been found for shift schedules and safety:

1) Risk of an accident is higher when working at night compared to working in the morning, (According to Lutzhöft et al, (2007) a single vehicle accident is 13 times higher at night)

2) Risk of an accident rises over a series of shifts, again especially at night.

3) Risk of an accident increases as total shift length increases over 8 hours. (in any 24 hour period).

When combining several factors that cause the fatigue and reduce well-being the risk factor for accidents rises. There are several such conditions in the seafarer's environment.

4.2.1 Two-watch-systems: 6-6 and 12-12 system

Systems simply mean that you work 6 hours or 12 hours and are off duty 6 hours or 12 hours. Both systems are used on vessels especially among the deck officers. The problem with the 6-6 system is the fact that you do not get enough sleep. The good thing is that the 6 hours work duty does not extend for long. It is easier to stay vigilance.
The 12-12 system has the opposite advantages and disadvantages. Especially, the last hours might increase the lack of vigilance. 12 hours of sleep (if no internal or external disturbances) on the other hand, gives the possibility of the recommended sleep, which is 7.5 hours.

The problem with both systems is that the possibility of nocturnal sleep is limited. Hakola et al. (2007) mentions that after nightshift the day sleep is approximately 2-4 hour shorter than the normal nocturnal sleep, especially the part of REM sleep decreases. The 12 hour system reduces the possibility of naps. The probability of a strong feeling of sleepiness during a 12 hour work shift is 50 % bigger than during an 8 hour work shift. They still point out that a bad 8 hour system is worse than good 12 hour system.

Hyyppä and Kronholm (1998) mentions that constant nightshift is better than constantly changing one.

Hakola et al. (2007) mentions a working time experiment in their research where people who had the 12 hour system onshore did like the system because they did not to have work extra hours any more. In a period of three months, they were working 40 hour per week, although, sometimes the persons felt the 12 hour shift burdensome. They used a 10 hour system and some people found it better than the12 hour system.
Hakola et al. (2007) states, that the results of the experiment showed the fact that when people have the possibility of choosing their own working time they are more satisfied. Although these systems cannot be directly adapted to working onboard.

5 Research Methods

5.1 Philosophical and theoretical basis

The theoretical context and question formulation are dictating the choice of material and the research methods. (Alkula T et al., 1994). They continue: despite the fact that the studied issue can be researched in several ways, the main point is that research arrangement must be such that the questions asked can be answered.

The basis for starting a research, and the shaping aspect of research, can be chosen between qualitative and quantitative research. Alkula et al., (1994) point out that because of changes between approaches and aspects, none of the research methods can be the only absolute way of solving research problems.

Eskola and Suoranta (1998) give a rough list of signs that might indicate which of research method is in question. The following signs of objectiveness point out that my research is based on quantitative research methods:

- I have not been in contact with test persons
- positivism (observation vs. abstraction)
- questionnaire (the questions are structured in such a way – as opposed to free-form answers – that numeral data on the answers can be collected)
- science (opposite to art)
- and causality (causal relation)

This research can be divided into two parts. Chalmers University research group collected quantitative (numerical and statistical) data when visiting onboard the vessel. The design of the study was a non-experimental study because there where neither random assignment nor multiple groups and multiple waves of measurement used (Trochim, 2006).

The research design or measurements for my part is survey with some aspects of scaling. It is a quantitative research when taking the analyzing of the questionnaires in account. Some of the measurements (Likerts scale) that are used to analyze the responses in the questionnaire are so called scaling. According to Trochim (2006), scaling is the instrument which enables qualitative construction with quantitative units. The questionnaire that produces quantitative data is very often used in surveys. (Robson, 2007).

5.2 Data collection

5.2.1 Participant

18 health questionnaires were answered and analyzed. The questionnaires were answered by the chief engineers and engineers working in Swedish vessels. There have been ships of variation and different companies involved.

The main data is collected by research group in Chalmers University, Gothenburg, Sweden. The data was collected by using the three following methods. First, the engineers were asked to complete a background information questionnaire. Second, they had to keep a sleeping diary. Third, they were asked to use an ActGraf-watch to get data on their activities on and off duty. I will only concentrate on the first part, background information in the questionnaire.

5.2.2 Questionnaire

The questionnaire used in this study is, according to Dawson (2002), a close-ended questionnaire. The questionnaire consists of questions and answer alternatives. Then you choose the best option/answer with a cross. These kinds of questionnaires are used to generate statistics in quantitative research.

The very beginning of the questionnaire and the comment part in the end of the questionnaire give the only possibilities of writing own answers and comments. Their part in this type of questionnaire is still very minimal and that is why, it cannot be called combination of the close-ended questionnaire and open-ended questionnaire. (Dawson 2002).

The questionnaire consists some rating the items questions. The rating system is called Likert scale. Questions rating such as:

- = strongly unfavorable to the concept
- = somewhat unfavorable to the concept
- = undecided
- = somewhat favorable to the concept
- = strongly favorable to the concept,

are used in the health questionnaire. This system produces quantitative data. (Trochim, 2006).

The success of sampling is a fundamental factor in quantitative research. Especially if trying to draw general conclusions from results (Aaltola and Valli 2001). They continue that there is no specified right amount that would be correct in every situation. However, they mention that a general rule could be the more samples the better. Then it is easier to do generalizations. Furthermore, they still point out that an unimaginative generalization of results is one problem that appears in quantitative research, especially if some interesting visible exceptions could have been found in the research material. They mention that this danger might also occur when using statistical programs when output data grows too big.

Background questionnaire is the most important information resource of this study. The engineer's filled a background information sheet of their health and habits. The questionnaire is done by Karolinska University of Uppsala and it is a part of the Karolinska Sleepiness Scale (KSS). The sleepiness scale is not used in this study. The KSS scale is used in filling the sleep diary. The questionnaire part is located in the appendix part.

5.3 Used instruments

Computers are usually a great utility when analyzing the results. (Alkula et al., 1994). I did not use any specific analysis program, only excel- program to demonstrate figures about the answers.

I have used internet to find relevant and accurate information to do this work. Key words in searching have been: sleep, sleep studies, healthy sleeping, morning and evening vitality, working hours etc. I have used IMO's, ILO's and other organizations' and Institutes´ sites that control seafarers' rights.

I have been in contact with some institutes that have done research on sleep, for example, Työterveyslaitos (Finnish Institute of Occupational health) and KELA (Social Insurance Institution of Finland).

I have used several library search engines to find proper studies. I have used some literature researches and studies about the basic sleeping requirements, normal circadian rhythms, written law etc.

5.3.1 The diagrams/figures

I used diagrams and tables in the analyzing part to simplify the results given in the answers. When putting the answers in graphical format, the demonstrating is clearer and more convenient than only plain text. The numbers that are showed up in diagrams are whole numbers, not decimals, and that is why they are also clear.
With bar charts you get a clear picture of the question and answer. According to Valli, Raine (2001) six bars per chart are too much. He mentions that information is blurry with too many bars. However, despite the fact that in my diagrams there are more than six bars per chart I found them very clear and understandable. The questions inside the diagrams take of course space from bars, put I found it clearer than putting the question outside the

picture. I have many diagrams in the study and when putting the question inside the picture minimizes the possibility for confusion between diagrams.
The great number of diagrams in this study can be motivated by the quite comprehensive and wide questionnaire that required from my point of view a simple and effective form.

5.3.2 Tables

Valli (2001) mentions that when trying to show information as clear as possible the best choice is table. Some of the questions were formulated in a way that the tables were the best choice. Especially when asking about the health, diseases and medical conditions. Some of the questions were too eclectic to make figure of and the best solution was to make a table of them. The tables requires more time for reading/understanding than the diagrams, but when reading the instructions given the tables will "open".
To make a diagram and table from nearly all of the questions and answers was of course very time consuming, but using these both possibilities to show some statistical material I got a clearer picture of the answers for myself and they helped me in my study and the reader to adapt the analyzed data.

6 Results

6.1 Background

The health questionnaire was divided into three parts:

1) Background
2) Sleep and tiredness
3) Sleep and the circadian rhythm.

The background part was mainly based on the working history and the present working feelings, and also some questions about the medical conditions were introduced (appendix).

The sleep and tiredness part focused on the sleep quality of the engineers and technical chiefs.

Third and last part, sleep habits and the circadian rhythm, tried to open some own views of the persons sleep habits and needs. Third part contained also an own comments possibility for more information.
The comment part was used very seldom; only three times. This indicates either that the questionnaire is very inclusive or that the persons did not find the comment part important.

The questionnaire was filled in out 2007. The respondents' average age was 41.6 years. For the engineers it was 40.5 years (max -1 year). For the technical chiefs the average was 48.2 years (max -1 year). The youngest one was born in 1980 and the oldest one in 1946. One of the engineers did not tell his/her age.

Table 2. Age distribution

Age	Engineers	Chiefs
20-29	2	0
30-39	6	2
40-49	1	1
50+	3	3

Eight respondents worked in position of 2nd engineer, four people worked as 1st engineer, and six as a technical chief.
Eight persons were unmarried and ten married (half of the engineers and four of the technical chiefs were married).

Five persons had one or more children living at home and were under seven years old (all engineers). Four persons had one or more children living at home and were over seven years old (two of the engineers and two of the technical chiefs). Only two, both engineers, had both categories filled. Eight persons did not have any children living at home at all. One person did not answer.

The average number of years work experience out at sea was 18.4 years. For the engineers it was approximately 15 years and for the technical chiefs it was 25 years. The smallest reported number of years of work experience was 4 years (engineer) and the largest was 35 years (technical chief).
The average work experience in the current position was 6 years (engineers 5.3 and technical chiefs 7.3 years) while shortest was 0.5 years (engineer) and longest 18 years (technical chief).

The average of watch keeping system years per engineer was 7.1 years (two of the engineers did not answer) for the technical chiefs the average was 8.7 years. Remarkable was that that two of the technical chiefs had 20 years or more of experience and last four had less than 5 years.

The average for working years that included duty was 13.7 years. One engineer answered; never. The figures for technical chiefs were 11 years. One did not answer at all.

Only seven engineers answered that they have working hours that require 24 hour availability.

Only three persons had some additional work besides work at sea. Two of them were engineers and only one technical chief.

6.1.1 Contentment in work

In the questionnaire, the engineers were asked how satisfied they were with their work. How did they like their present working hours, overall situation and how did they feel about their present assignment? Only one person (engineer) did not answer.

A clear majority from the both sides liked their present working hours. We can see that the chief engineers are more satisfied with the working hours, overall situation and with the assignment than engineers. We can still point out that engineers are also more or less happy with the same issues. Only one engineer did not like his/her present working hours although he thought that his assignments were very good. This engineer was the only one whose answering category changed from good to bad in these mentioned questions. The other answerers were more or less in the same category despite the question.
The figures 2-4 show the trends in self-rated answers.

Figure 2.

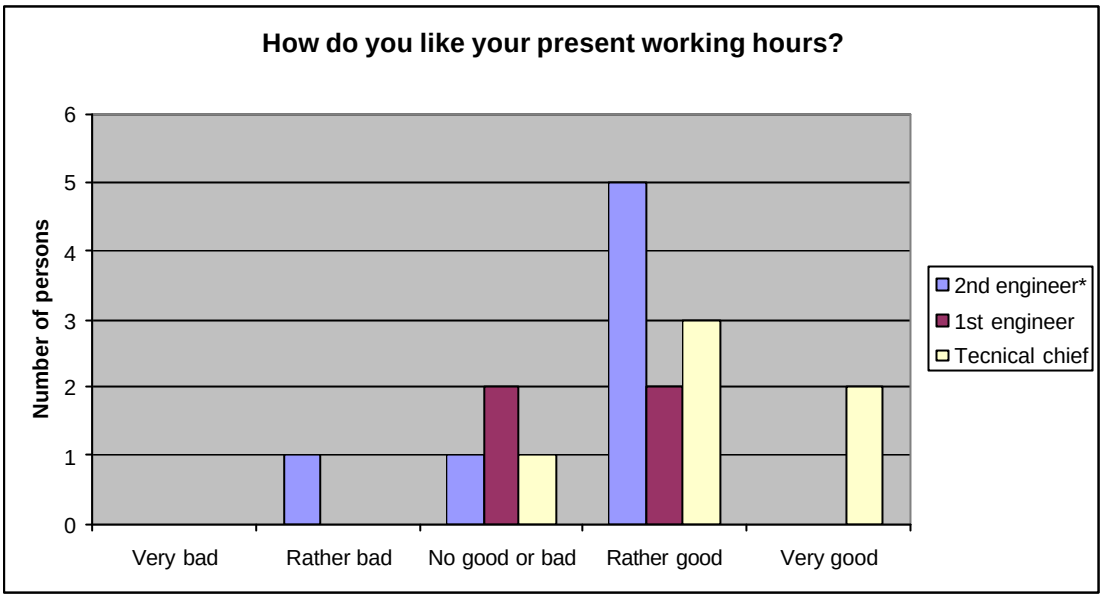
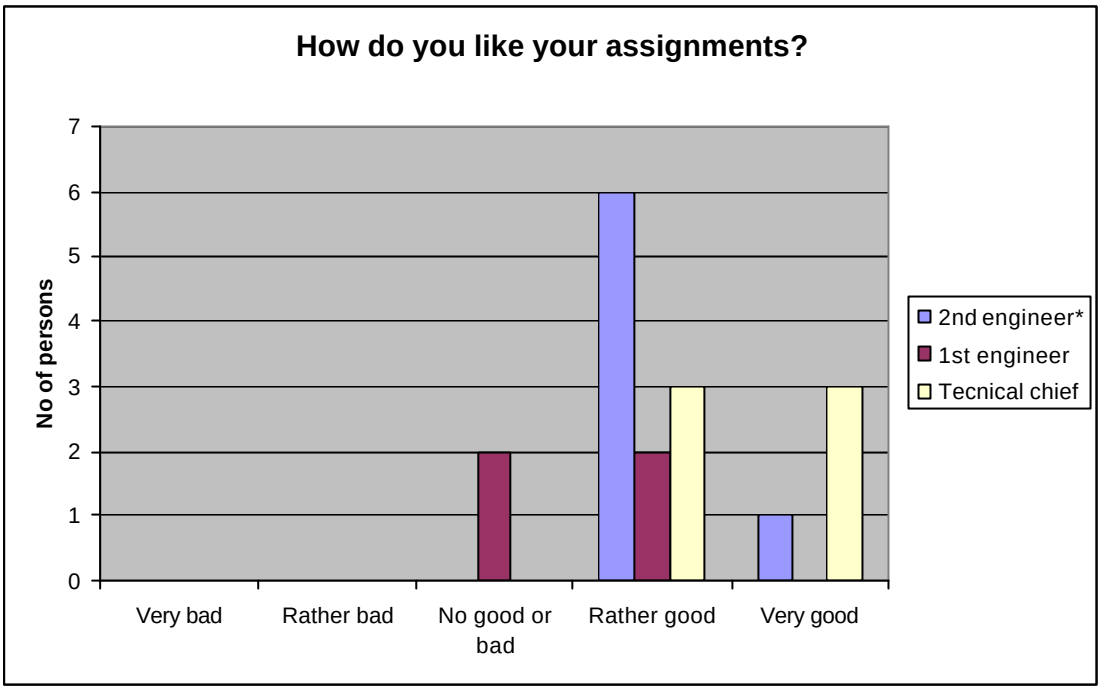


Figure 3.

Figure 4.



6.1.2 Diseases and medical conditions

The health questionnaire included questions about possible diseases and medical conditions in the last 6 months. The following questions were asked:

- Been bothered by your neck and shoulders
- Been bothered by your chest or the lumbar part of the back
- Other troubles with the locomotion
- Nervous or psychological problems
- Neoropathy (paralysis, epilepsy etc.)
- Trouble with sleeping
- Trouble with the eyes
- Trouble with the ears
- Allergy /hay fever etc.
- Asthma, chronic problems with the respiratory passages

- Other respiratory diseases
- Heart attack
- High blood pressure
- Angina pectoralis
- Gastric- or enteral diseases
- Biliary or liver diseases
- Infection of the urinary tract
- Other kidney- or urinary infection
- Other diseases

Four of the engineers and one the technical chief did not have any of these conditions asked or other diseases for that matter. Some persons had many of these conditions (4-6) although light ones, but significant majority had only one or two of mentioned conditions. One of the engineers did not answer at all to the concerned questions.

Neoropathy, other respiratory diseases, Angina pectoralis, Biliary or liver diseases, infection of the urinary tract, other kidney- or urinary infection were diseases which did not appear at all among the test persons. One of the engineers had severe prostate inflammation, one had severe high blood pressure and one had severe troubles with sleeping. These were only severe conditions.

Having troubles of sleeping was clearly the most common condition although it was a light trouble. Four of the engineers and two of the technical chiefs suffered from light sleeping troubles and as mentioned earlier, one of the engineer had severe sleeping troubles.
Another condition worth mentioning that caused light troubles was neck/shoulders and eyes.

6.1.3 Medication

The test persons were asked if they had used some of the following medicine (with or without prescription) in last 6 months:

- Sleeping pills, tranquilizers, medicine against depressions, medicine against stomach problems (Novalucol, Samarin etc.), painkiller or antipyretic medicine (Magnecyl, Doleron), antihypertensive drug or heart medicine.

Drugs not used were sleeping pills, tranquilizer, medicine against depressions and heart medicine.
The most used medicine was painkiller or antipyretic medicine. Seven of the engineers had not used the medicines in question during the last six months. What was remarkable was that all of the technical chiefs had used the painkillers seldom or sometimes. Four of the engineers used painkillers seldom or sometimes, one of them even most of the time. One of the engineer used antihypertensive drug most of the time and one of the technical chief always.
Two of the engineers did not answer to the concerned question.

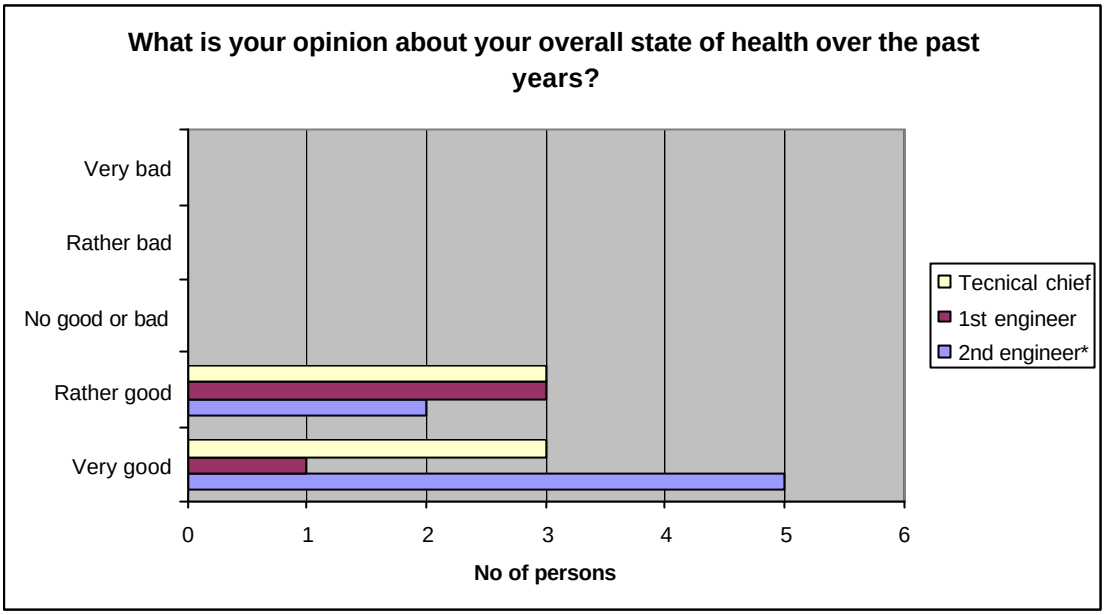
We can state that medication is quite minimal except with painkillers. This can be a reflection of neck and shoulder problems mentioned in earlier questions.

6.1.4 Overall health

This part of the questionnaire was a simple question about the engine officers own feelings about their overall health.

None of the engineers or technical chiefs found problems with the overall state of health. The situation was rather good or very good and was divided pretty evenly in both categories and both professions. (Figure 5)

Figure 5.



Condition question 1 from the questionnaire:

- **Have you experienced any of the following conditions during the past 6 months? Please answer all the alternatives.**

In the Table 3, you can only read how common the conditions are between the different engine officers.

The two first numbers in the column are the 2nd engineer and the 1st engineer in this order. The third and last number indicates the number of technical chiefs that chose the response alternative in question.

For example;

- The first row, mentally tired: Three (3) of the 2nd engineers and two (2) of the 1st engineers and one (1) of the technical chief have never had this condition during the past 6 months.

The table 3 does not show the answers for each individually. This means that you cannot tell, for example, one specific person's all answers and see how many of these conditions he/she is suffering from

Table 3. Condition A

	Never	Seldom	Sometimes	Most of the time	Always
Mentally tired	3,2,1	3,2,0	0,0,5	2,0,1	0
Headache	2,3,0	5,0,4	0,1,2	1,0,0	0
Restlesness	4,3,3	1,0,1	3,1,1	0,0,1	0
Nervous/Worried	4,4,2	1,0,4	3,0,0	0	0
A feeling that everything is meaningless	2,3,5	3,1,1	3,0,0	0	0
Unconcerned	4,3,3	2,1,3	2,0,0	0	0
Passive	4,4,3	2,0,2	2,0,1	0	0
Lack of initiative	3,3,3	3,1,3	2,0,0	0	0
Pain in the pit of the stomach	7,4,5	1,0,1	0	0	0
Feeling of sickness	4,4,4	3,0,1	1,0,1	0	0
Heart beat	5,4,4	3,0,2	0	0	0
Troubles with breathing	7,4,5	1,0,1	0	0	0
Pain/ a tight feeling over the chest	6,4,5	2,0,1	0	0	0
Pain or stiffness in any joint or leg/arm	5,3,3	2,0,2	1,1,1	0	0

Backache	5,4,4	2,0,2	0	1,0,0	0
Muscle tension	5,3,3	2,1,3	1,0,0	0	0
Tense jaws	6,2,5	1,2,1	0	1,0,0	0
Bad appetite	3,2,5	2,2,1	3,0,0	0	0
Feeling hungry	2,2,2	2,2,2	2,0,2	1,0,0	1,0,0
Heartburn	4,4,2	2,0,2	1,0,2	0	1,0,0
Diarrhoea	5,2,5	3,2,1	0	0	0
Flatulence	7,2,5	1,2,0	0,0,1	0	0
Constipation	8,4,6	0	0	0	0
Other	3,2,2*	0	0	0	0

* All did not answer.

The only condition none of the persons suffered from was constipation. In vernacular it means hard stomach.

Mentally tired, headache, restlessness, feeling hungry, heartburn and in some scale backache and tensed jaws are the most common conditions or at least the most frequent when reflecting on sometimes and most of the time answers.

What is worth of noticing is that these conditions do occur in the categories seldom or never quite often and with many of the engineer officers.

Two of the engineers did not have any of these conditions (cannot be seen in the condition table).

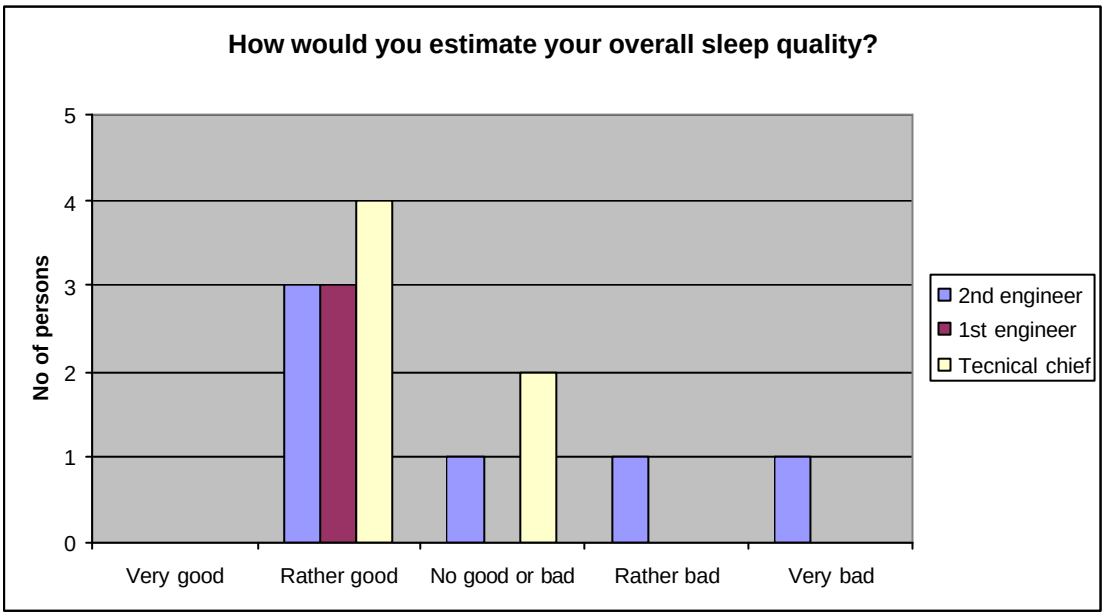
When comparing the results with the diseases and medical chapter (6.1.2), here, the number of conditions related to feelings is far more common. A clear majority in both professions suffered from many of these mentioned conditions. Some had more than half of these conditions.

6.2 Sleep and tiredness

Sleep and tiredness is the second part of the medical questionnaire and the idea with it was to find out if there is a relation between sleeping quality and working patterns.

The respondents were asked to estimate their overall sleeping quality. The results showed that none of the engineers or technical chiefs found the overall sleep very good. But, as we can see from figure 6 a clear majority of the engineers and all the technical chiefs found their overall sleep quality more or less good.

Figure 6.



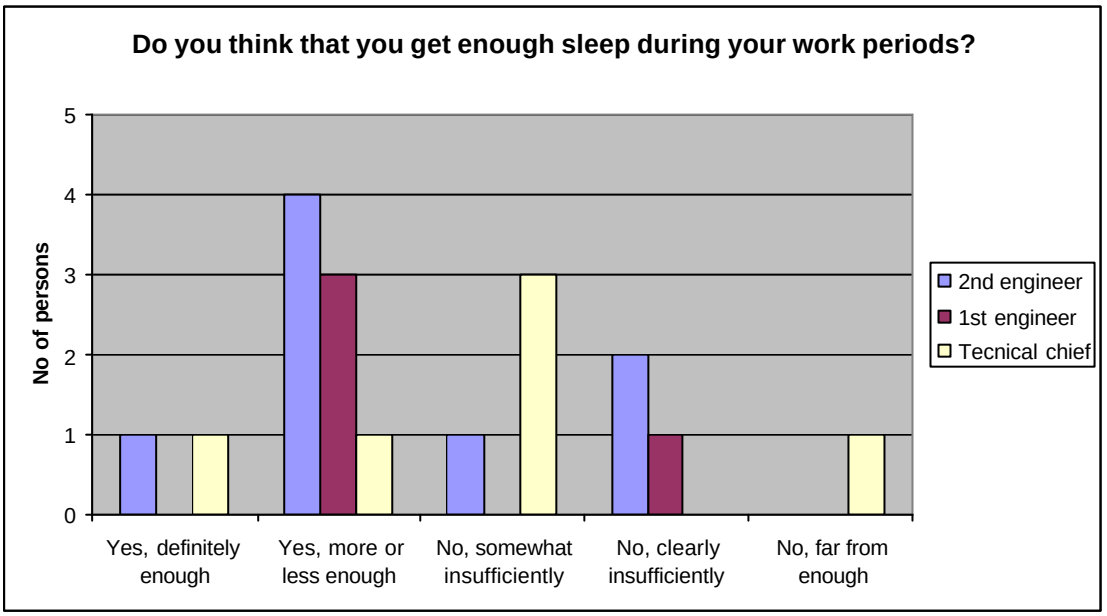
The greater amount of unhappy engineers to their sleep quality might be explained by the fact that technical chiefs do not have watch keeping duties. The engineers are dealing and fixing the alarms in engine during the night.

In figure 7 we can see a distinctive variation from previous tables and marked difference between the engineers and technical chiefs.

Only two of the technical chiefs estimated that they get enough sleep during the work period. Eight of the engineers found that they get enough sleep during the working period. This is approximately 55 percent of the persons. Four of the technical chiefs and four of the engineers found that they do not get enough sleep.

This indicates that technical chiefs got less sleep in this research than engineers (in percent).

Figure 7.



Eleven of the persons required 8 hours or more sleep per day. (Average was 7.86 hours; for the engineers 8.29 hours and for the technical chiefs 7 hours.) Ten of them were engineers and only one was technical chief.
Five of the technical chiefs and only two of the engineers required less than eight hours of sleep per day.

This is an interesting aspect when according to the table the technical chiefs find that sleep during work period is more or less insufficient. This deviation might be explained

by the fact that the test persons are working for different companies, on different vessels and in different traffic areas.

Condition question 2 from the questionnaire.

- **Have you experienced any of the following conditions during the last 6 months period? Please mark all alternatives.**

This table is read in exactly the same way as the condition A table in the background chapter earlier.

Table 4 produced clearly most variation from all answers in questionnaire. All the answering alternatives from "never" to "most of the time" were practically used in every question, although never answer was also very normal.

All the answers from "seldom to always" indicated that there were many conditions that occurred.

Table 4. Condition B

	Never	Seldom	Sometimes	Most of the time	Always
Difficulties in falling asleep	1,1,1	0,3,2	4,0,3	3,0,0	
Difficulties in waking up	3,3,1	0,0,2	4,1,2	1,0,1	
Repeated awakenings with difficulties in going back to sleep	1,3,1	3,1,3	3,0,1	1,0,1	
Heavy snoring (according to those around you	4,3,2	2,1,2	2,0,1	0,0,1	
Bad dreams	3,1,2	3,2,1	2,0,3	0,1,0	
Not feeling thoroughly rested when waking up	1,0,0	3,2,1	1,2,4	3,0,1	

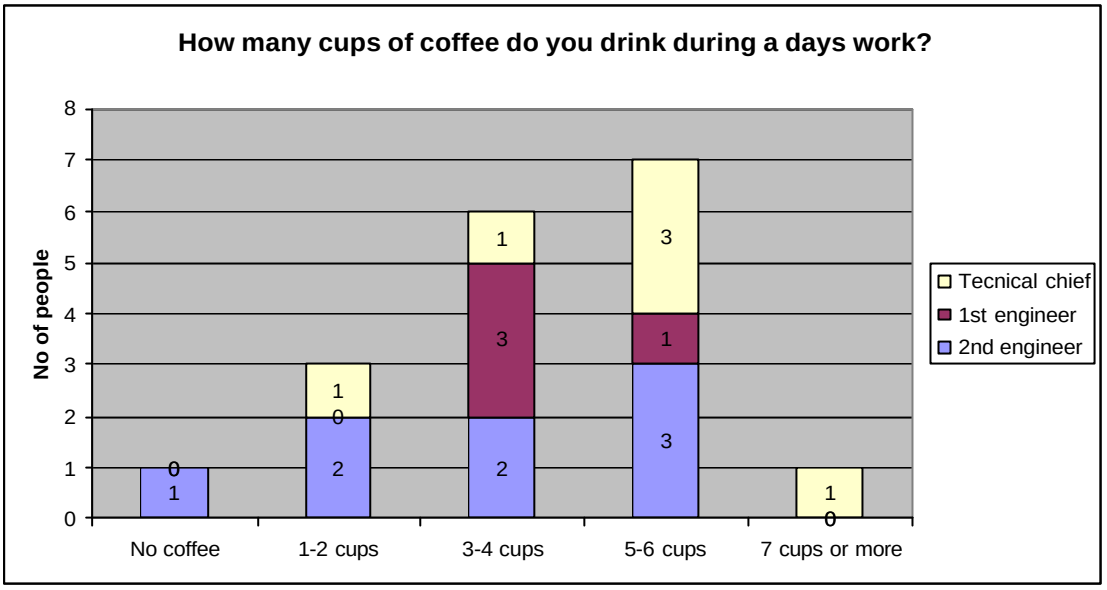
Too early (definite) an awakening	1,1,1	2,1,0	2,2,5	2,0,0	1,0,0
Disturbed sleep	1,1,0	2,0,2	1,2,4	3,1,0	1,0,0
Too little sleep (less than 6 hours)	1,1,0	2,1,1	1,2,5	3,0,0	1,0,0
A feeling of being exhausted when waking up	2,1,3	0,2,1	4,1,2	1,0,0	1,0,0
Feeling sleepy during work hours / spare time	1,0,0	2,3,1	1,1,5	3,0,0	1,0,0
Feeling irritated or tired in the eyes	2,2,0	0,1,1	3,1,3	2,0,1	1,0,0
Unintentional sleep periods during the work	4,2,3	1,2,2	2,0,1	0	0,0,1
Drop of to sleep during your spare time	6,2,3	0,1,2	1,1,1	1,0,0	
Having to fight the sleep in order to stay awake	2,2,1	3,1,2	2,1,3	1,0,0	

A coffee drinking question was the last part of the sleep and tiredness part. In figure 8 we can see the coffee drinking habits of the engine officers.

According to diagrams coffee drinking is common among the engine officers especially among the technical chiefs, there was even one heavy user with 7 cups or more per day.

It was not that clear with connection between coffee drinking and sleep. The heavy drinker with seven cups per day did not find any problems to fall asleep during the day or night. The other ones answer indicated similar pattern. Especially some of the persons' with significantly less amount of coffee did have difficulties to fall asleep during the day and night. To make any further conclusions the sampling might be to scarce.

Figure 8.



6.3 Sleep habits and circadian system

Sleep habits and the circadian system was the last part of the health questionnaire. In this part, I try to point out some sleep habits and figure out if there were early and late birds among the test persons and if so, how were they divided and if there were some reasons and exceptions for sleeping habits. In this part of the questionnaire, the persons needed to state their ability to fall asleep and wake up in different situations.

A majority of the engineers and technical chiefs fall asleep easily either during the night or during the day. Half of the technical chiefs fall asleep easily both during the night and day. Seven engineers of twelve fall sleep easily during the night and day. 25% of the engineers find it difficult to fall asleep both in the night and daytime.

Figure 9. To fall asleep

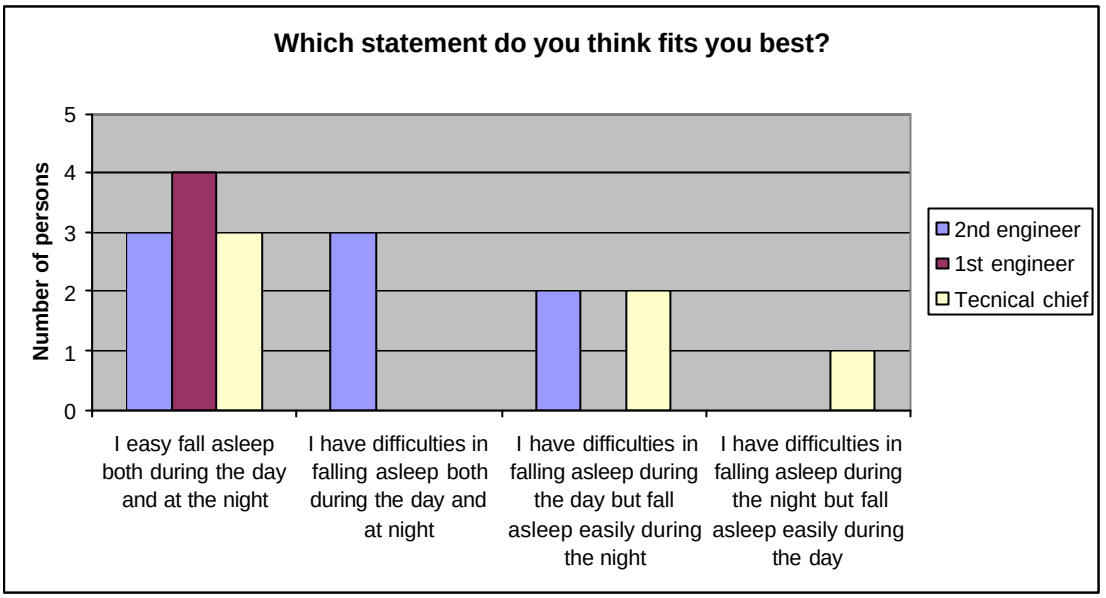


Figure 10. To wake up

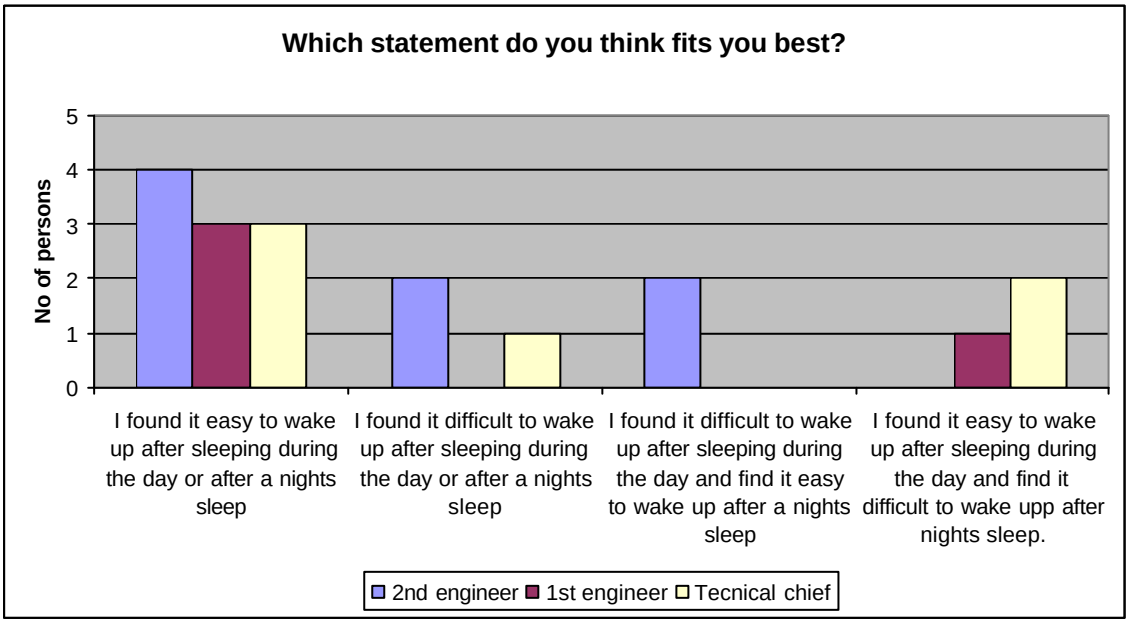
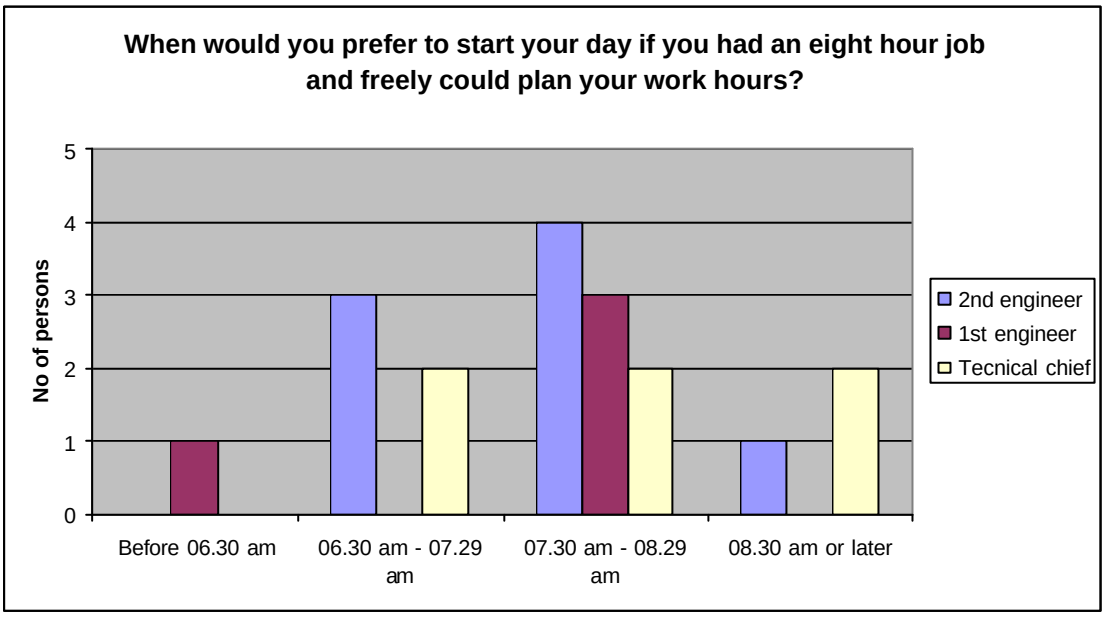


Figure 10. shows a similar trend to the Figure 9. A majority of the answerers found it easy to wake up after sleeping during the day or after night. The ones who found it easy to fall asleep during the night and day found it also easy to wake up after the sleep during the day or after a night's sleep.

In Figure 11 and 12 is presented the answers when asked about the freely plans if having an eight hours days; When they start working and when they go to the bed.

In figure 11, we can see that a clear majority of the both sides would choose to start working 07.30 am or later. Only one third of the technical chiefs and engineers wanted to wake up before 07.30 am. This is still quite a big part.

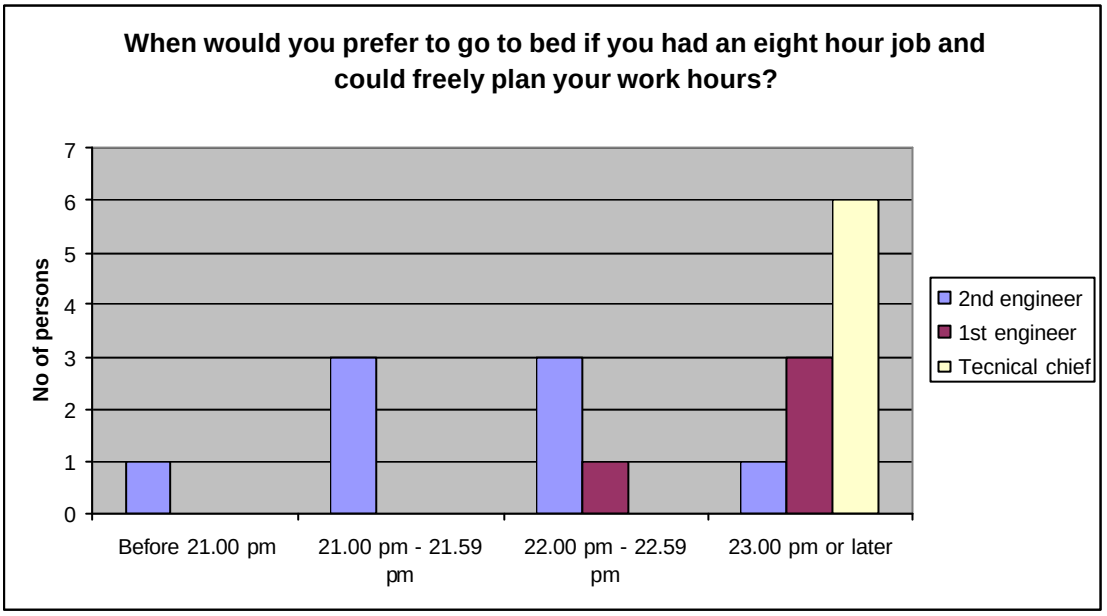
Figure 11.



The fact that all technical chiefs wants to go to sleep at 23.00 pm or later (see Figure 12) indicates that they are more satisfied with their working hours and that their circadian rhythm is more or less an optimal (see also Figure 13).

In Figure 12 we can also see clear deviation in free planning. Interesting is that all the technical chiefs would go to sleep 23.00 pm or later. One third of the engineers want to go to sleep before 22.00 pm and one even before 21.00 pm clearly states that there is deviation with the circadian rhythm and that there is both larks and owls.

Figure 12.



Six of the engineers chose both the preferred bed time and feeling tired time (not shown in the figure, only in the questionnaire). They were in an optimal situation.

The fact that there is a variation in freely plan indicates that the personal circadian rhythm should be taken into consideration when planning working hours.

Question 1 about bedtimes:

- **If you always had to go to bed at 09.00 pm, how difficult do you think it would be to fall asleep?**

Problems to get sleep before 09.00 pm is 50-50 %. However the technical chiefs found the early bedtime more difficult.

Table 4.

	2nd engineer	1st engineer	Tecnical chief
Very hard - I would lay awake for a long time	1	0	2
Rather hard - I would lie awake for quite a bit	3	1	2
Rather easy - I would lie awake for a short while	3	3	2
Easy - I would practically fall asleep at once	1	0	0

Question 2 about bedtimes:

- **If you always had to get out of the bed at 06.00 am, how do you think it would feel?**

We can state, according to the Table 5 that a clear majority has no bigger problems to wake up at 06.00am. The percentage for the variationbetween the both groups is equal.

Table 5.

	2nd engineer	1st engineer	Tecnical chief
Very hard and uneasy	1	0	0
Rather hard and uneasy	4	0	2
Slightly uneasy, but not a bigger problem	2	2	1
Easy - no problem at all	1	2	3

In Figure 13, we can find out that answers are divided quite widely.

The only clear sign is that technical chiefs start feeling tired later than engineers.

Is this possible because of the age distribution, watch keeping duty system of the engineers or physical exertion or all together?

Figure 13.

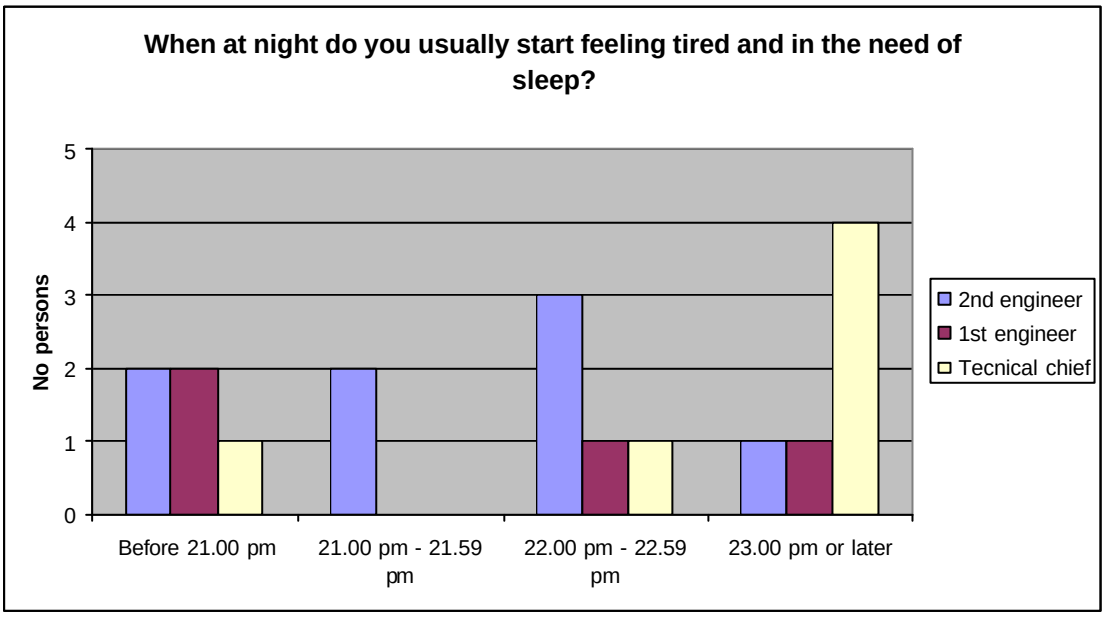
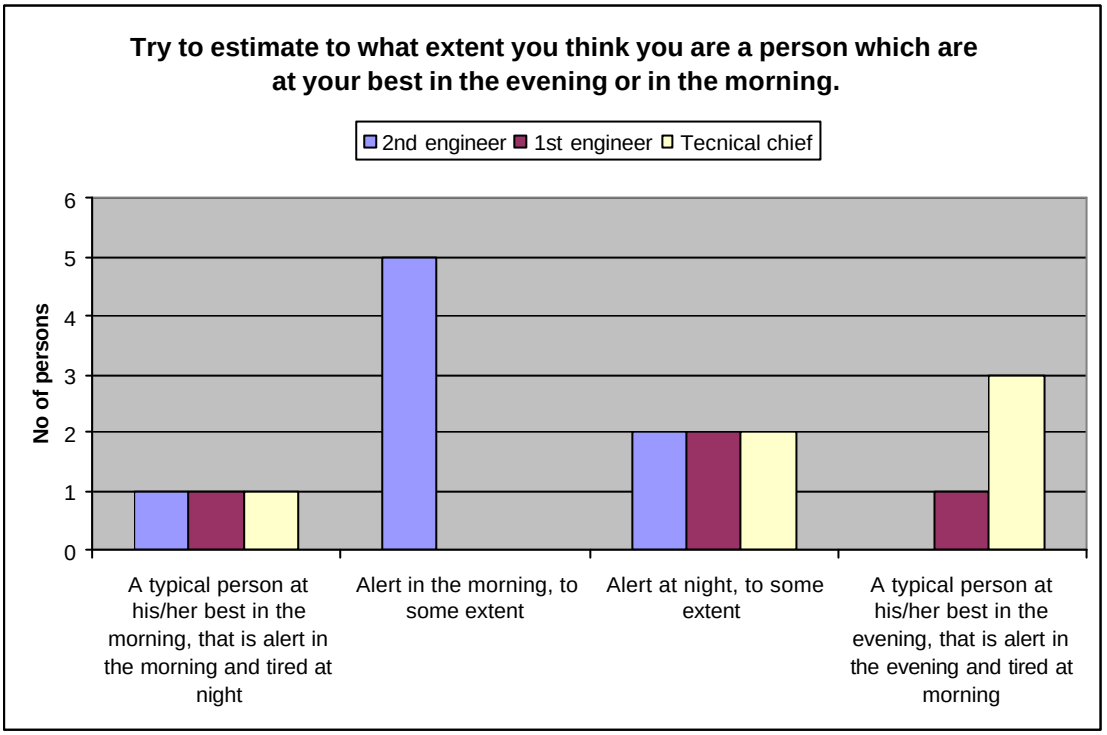


Figure 14 is a diagram where is presented the answers when asked the estimations about the “morningness” and “eveningness”.
The technical chiefs seem to be more Owls than Larks. This table is very similar with Figure 13.

Figure 14.



According to all presented tables and figures above, and the information written in the questionnaires, we can state that a majority of the technical chiefs are late birds. They require a late bed time and when they were asked to estimate their ”morningness” or ”eveningness”; five of six answered to be a typical person at his/her best in the evening. That is, alert in the evening and tired in the morning or alert at night, to some extent.

There was more variation among the engineers’ answers. Seven of twelve engineers answered as follows: a typical person at his/her best in the morning. That is, alert in the morning and tired at night or alert in the morning, to some extent. Weight on the latter.

So we can state that there is an equal number of early birds and late birds between the involved engineers.

6.3.1 Sleeping disturbance conditions

When the respondents were asked about the disturbing sleeping conditions in the period of last three months, such as heavy snoring, gasp for breath, interruptions in breathing, "formications" and other discomforts in legs and involuntary twitching in legs while sleeping, both the engineers and technical chiefs mostly answered never.
Five of the engineers and one of the technical chiefs did not have any of these conditions. All the others had one or more of these sleeping disturbances. Only few had mentioned sleep disturbances "seldom" (a few times per year) or "sometimes" (a few times per month).

What is worth noticing is that one engineer had all of these conditions at some level (the youngest person who answered) and that three of the engineers had one of these conditions often (1-2 times per week) or most of the time (3-4 times per week), whereas none of the technical chiefs had any of these conditions.
Six of the engineers (one of the engineers did not answer at all) and five of the technical chiefs had one or more of these sleeping disturbances.

So, we can state that a majority of the persons are suffering or have suffered in the last 3 months from some of the above mentioned conditions, although not often. And that is why we can conclude that these conditions are not a significant reason for possible sleeping disturbances.

Figure 15.

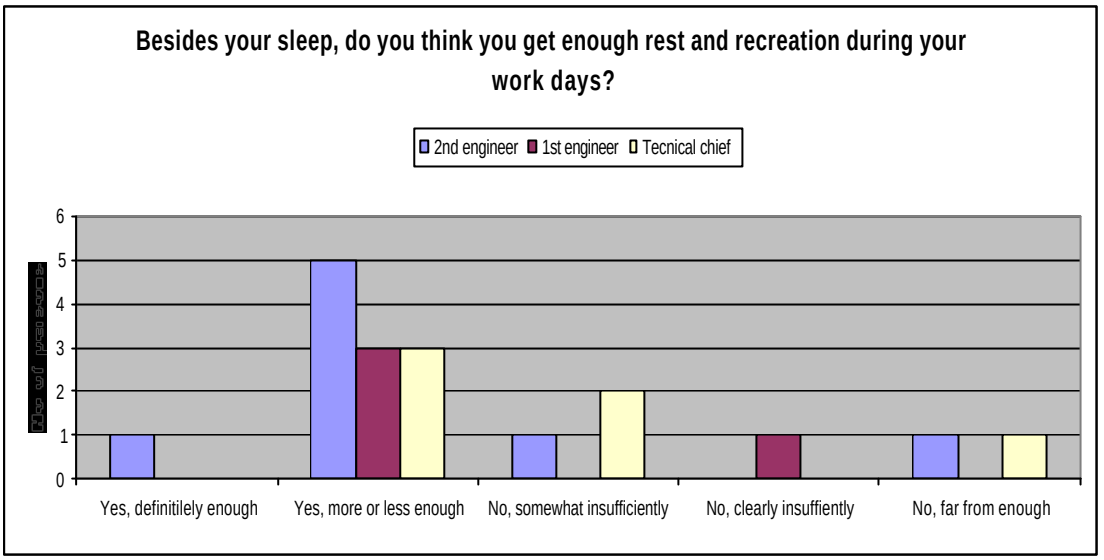


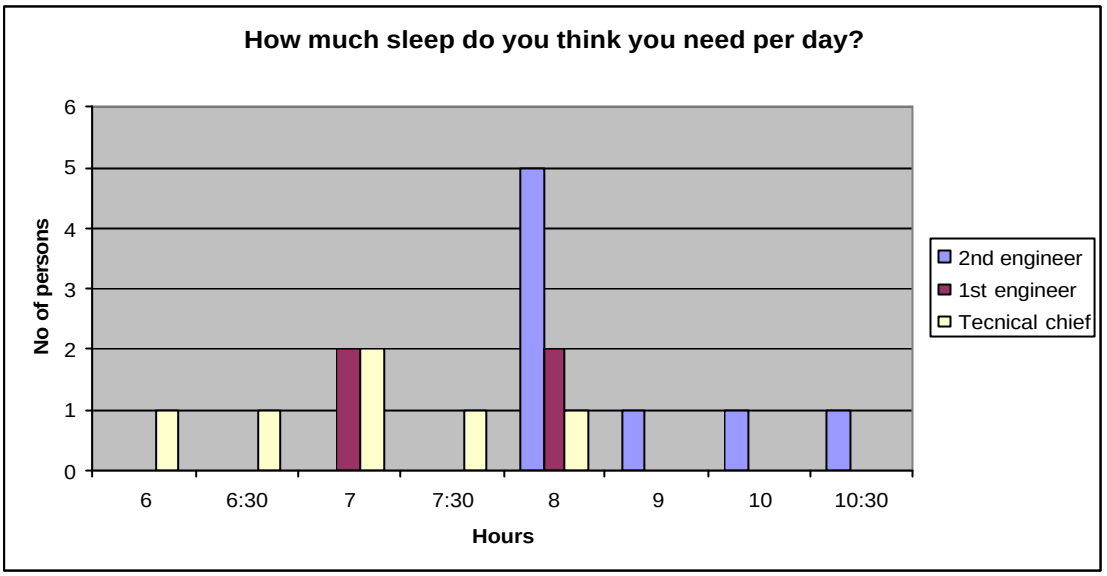
Figure 15 indicates that a majority of the engineers (75%) and half (50%) of the technical chiefs get at least enough rest and recreation while awake.

The fact that some respondents feel that they do not get enough rest and recreation during work days can be in some extent explained by the traffic area or by the other internal variations.

Clearly, technical chiefs need less sleep than engineers. The average preferred sleep hour for technical chiefs is seven hours. The average for the engineers is 8.3 hours (See Figure 16). The age difference still does not tell the whole picture. One of the engineers who were born in the 1950's preferred ten hours of sleep - whereas another engineer who was also born in the 1950´s - required only seven hours of sleep. The other engineer with seven hours sleep was born in the early 70's.

If we delete these statistical exceptions from both ends, we can draw the conclusion that the age affects sleeping requirements. Of course the different working efforts for both sides have some kind of influence.

Figure 16.


How much sleep do you think you need per day?
No of persons
0
1
2
3
4
5
6
6
6:30
7
7:30
8
9
10
10:30
Hours
2nd engineer
1st engineer
Tecnical chief

7 Discussion

7.1 Research problems

7.1.1 Health/background questionnaire

Some of the questionnaires were not totally filled out. Somehow, some persons had not answered some question and this caused some problems with the accuracy of the test results and especially with their analysis.
The number of the technical chiefs in this research could have been greater. This might have given more accurate results, or it would have given at least more support for possible interpretations.
This also leads to the questions: that is eighteen persons enough and should each maritime sector studied separately?

When the respondents were asked about the estimated time of being "yourself" after a night sleep, I noticed that the possibility of choosing the alternative 10-20 minutes was only included in two questionnaires (out of 18). The other ones were 0-10 min, 20-40 min and more than 40 minutes. The only answers that could be used were the answers more than 40 minutes (two of the technical chiefs and one of the engineers chose this possibility. I did not use the information received from this question.

The coffee question woke up a question on formulating issue in questionnaire. The studies recommend no coffee before sleep. To ask only consumption is a correct way when comparing the differences between the marine engineers. Should there also be a question of the moment of time the coffee enjoined? This would at least give perspective if finding reasons for disturbances to fall asleep.

7.1.2 Data collection

There occurred problems with the collecting of theory, especially with specific information. There are numerous studies about the sleep and even some sleep studies done of the seafarers, but not of the technical marine officers. Furthermore, even the fact that general background information for the seafarers working and sleep habits is more or less similar to all seafarers, the specific work circumstances and arrangements in the engine room makes such a difference, that the adaptation of the background information to the technical engineers was little bit relative and might not be that accurate.

The work, sleep situation and conditions vary notably between ships and this should have been taken into consideration in collecting the data. These variations can affect the test results. Maritime sectors and traffic areas vary in such manner, that it should be taken into consideration.

7.1.2.1 Internet

. I found mainly two fundamental problems with the internet sourcing:

1. Validity of the information
2. Access to the information

The validity of the information was challenging. The problem was the number of unofficial material. There were lots of good written text about the keyword issues, but they did not fulfill the formalities of the scientific researches. The good thing with the texts was that they were summary of the scientific facts. In some cases I had problems to find original sources if none, although the texts contained right information (when comparing into some scientific studies). The advance with the unofficial text was that they were more understandable, and that the information was found more quickly than in the scientific researches.

A problem occurred when finding general publications without the names of the authors, for example, Teachers Guide. The guide was clearly done by a considerable institute, but there where not any authors' names published.

The access to the valid information was the most challenging and frustrating part, because many of the interesting written sources were chargeable.

I tried to use only reliable internet sources.

7.1.3 Data analysis

A problem that occurred when I was analyzing the material was all the different possibilities to analyze the answers. The generalization of the answers was quite an obvious choice in the beginning. Later, I noticed that each answer in one person's questionnaire could be analyzed individually to find out, for example, one person's sleeping habits, which could be then compared with the answers. The problem was that this kind of analyzing would take too much time, especially without any proper data analyzing program.
The generalization was still possible when you found the exception and took it into consideration in the analyzing process.

7.2 Research Direction

To make a quantitative research was a completely new thing to me and it was quite difficult to perceive. I used several books to find differences between these two main research approaches. On the other hand I made a scheme how to plan and execute the Master Thesis and while executing the research I noticed that direction was more on quantitative side.

7.3 Conclusion

The reason why I make conclusions on the results chapter (6) is that it was a lucid way for me. To make a conclusion after every question, figure and table was from my point of view rational. This way I ensured a logical and systematic way to collect every conclusion part to one entire conclusion.

8 Conclusions

According to the self-rated answers given in the background part (see figures 2-4) we can clearly state that both the chief engineers and engineers are satisfied with their present working hours, overall situation and work assignments. This was all the more clearer with the chief engineers. These answers reflect to the fact, that the marine engineers have working conditions in such a state that they should have good possibilities to get enough sleep.

When the answerers were asked about medical conditions that we know are connected with sleep, and how they experience it, we found out that a majority of the answerers had one or two of the mentioned diseases or problems and some had more than two, but only light symptoms. The most common symptom was light problems with sleeping, so we can see a trend with diseases and with trouble sleeping, although all of the persons found their overall health rather- or very good. This is also the situation when examining the condition table. The few "most of the time" – answers given were all given by engineers. This might be because of their bigger number compared to the chief engineers. The deviant part was so minimal that we can generalize the result, notably when comparing it with the answers given in overall health question.

All these conditions also indicate that marine engineers have moderately good or good possibilities to get enough sleep.

Sleep quality answers created some variation. A clear majority of all groups defined their sleep quality as rather good. Only two of the engineers found it bad at some level. When the most important question concerning this Master Thesis was asked, namely, if the answerers found that they can get enough sleep while on working period, the anomaly between answers were most distinctive. In percent, chief engineers were clearly less satisfied with their amount of sleep. They found their sleep insufficient.

Engineers were significantly more satisfied with their sleep rate. However, one third of the engineers found their sleep insufficient at some level. A slight majority of all persons found that they get enough sleep while on working period.

What was interesting about the answers of the chief engineers is that a significant part of them required less than eight hours of sleep per day. The average for the required amount of sleep for them was 7 hours. The engineers´ average was 8.3 hours and a clear majority of them required more than eight hours of sleep. This is interesting because the required amount of sleep for technical chiefs is less and their sleep quality is good, and they did not find any greater problems to fall asleep either and still they were more unsatisfied with the amount of sleep.
Engineers on the other hand stated more problems with sleeping conditions but they still found their sleeping more satisfied than technical chiefs.
These variations might be explained by the fact that the test persons are serving in different companies, on different vessels and in different traffic areas.

I found also that the technical chiefs preferred later awakening and later bedtime than engineers. This raises questions, such as: might this be possible because of the age distribution, watch keeping duty system of the engineers or of the physical exertion or all reasons together?
According to the answers given about the circadian system the technical chiefs are more "owls" than engineers. Is this coincidence or is this more work related?

We find out that both groups in general get enough sleep. Anyhow, there are variations between the groups and inside the groups. The circumstances onboard are variable because of several reasons and we can see a pattern that there is a demand and desire for improving the sleeping conditions.

To get a comprehensive understanding of the results, the sleep diary responses and the ActGrafwatch findings must be analyzed.

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Appendix 1

Morningness-Eveningness Scale

(Adapted from an article: A Self Assessment Questionaire to Determine Morningness-Eveningness in Human Circadian Rhythms. by J.A. Horne and O. Ostberg, International Journal of Chronobiology, 1976, Vol. 4, 97- 110).

Read each question carefully. Select the most appropriate answer and note the corresponding value next to it.

1. If you were entirely free to plan your evening and had no commitments the next day, at what time would you choose to go to bed.?

1. 2000hrs - 2100hrs..... 5
2. 2100hrs - 2215hrs..... 4
3. 2215hrs - 0030hrs..... 3
4. 0030hrs - 0145hrs..... 2
5. 0145hrs - 0300hrs..... 1

2.You have to do 2 hours physically hard work. If you were entirely free to plan your day, in which of the following periods would you choose to do the work?

1. 0800hrs - 1000hrs..... 4
2. 1100hrs - 1300hrs..... 3
3. 1500hrs - 1700hrs..... 2
4. 1900hrs - 2100hrs..... 1

3. For some reason you have gone to bed several hours later than normal, but there is no need to get up at a particular time the next morning. Which of the following is most likely to occur?

1. Will wake up at the usual time and not fall asleep again.....4
2. Will wake up at the usual time and doze thereafter.....3
3. Will wake up at the usual time but will fall asleep again.....2
4. Will not wake up until later than usual.....1

4. You have a 2 hour test to sit which you know will be mentally exhausting. If you were entirely free to choose, in which of the following periods would you choose to sit the test?

1. 0800hrs - 1000hrs.....4
2. 1100hrs - 1300hrs.....3
3. 1500hrs - 1700hrs.....2
4. 1900hrs - 2100hrs.....1

5. If you had no commitments the next day and were entirely free to plan your ownday, what time would you get up?

1. 0500hrs - 0630hrs.....5
2. 0630hrs - 0745hrs.....4
3. 0745hrs - 0945hrs.....3
4. 0945hrs - 1100hrs.....2
5. 1100hrs - 1200hrs.....1

6. A friend has asked you to join him twice a week for a work-out in the gym. The best time for him is between 10pm - 11pm. Bearing nothing else in mind other than how you normally feel in the evening, how do you think you would perform?

1. Very well.....1
2. Reasonably well.....2
3. Poorly.....3
4. Very poorly.....4

7. One hears about 'morning' and 'evening' types of people. Which of these types do you consider yourself to be ?

1. Definitely morning type..... 6
2. More a morning than an evening type.....4
3. More an evening than a morning type.....2
4. Definitely an evening type.... 0

Now add the scores together to get your total and compare your total score with the table below to get an idea of your ***Chronotype***:

Morningness - Eveningness Scale

1. Definitely morning type .....32 - 28
2. Moderately morning type .....27 - 23
3. Neither type .....22 - 16
4. Moderately evening type.....15 - 11
5. Definitely evening type.....10 - 6

http://web.ukonline.co.uk/bjlogie/test.htm

Appendix 2

questionnaire

Name:
1. Year of birth:

2. Marital status: ☐ married/cohabitant ☐ unmarried/living alone
3. Number of children living at home, 7 years old or younger:
4. Number of children living at home, older than 7 years :

5. How long have you been at sea? Approximately years
5a. I work as a (your position?)
5b. For how long have you had your present position? Approximately years

6. How long have you worked irregular working times including watch standing or other working times with night work? Approximately years

7. Do you have extra work (e.g. farming, business of your own, other extra work, etc.) **beside your ordinary work**?
☐ yes, I work hours per month
☐ no

8. How do you like your present working times?
☐ very little
☐ rather little
☐ neither little nor much
☐ rather much
☐ very much

9. How do you like your present work situation?
☐ very little
☐ rather little
☐ neither little nor much
☐ rather much
☐ very much

10. How do you like your present work tasks?
☐ very little
☐ rather little
☐ neither little nor much
☐ rather much
☐ very much

Health
11a. How do you think your general state of health has been the past year?
☐ very good
☐ rather good
☐ tolerable
☐ rather bad

☐ bad

11b. Have you used any of the following medicines (with or without prescription) the past 6 months? Tick one alternative for each type of medicine!

		Never	Seldom, a couple of times per year	Sometimes, a couple of times per month	Often, a couple of times per week	Always, nearly every day
11.1	Sleeping pills	☐	☐	☐	☐	☐
11.2	Sedatives	☐	☐	☐	☐	☐
11.3	Medication against depression	☐	☐	☐	☐	☐
11.4	Medication against heart burn	☐	☐	☐	☐	☐
11.5	Medicines against pain or fever (e.g aspirin)	☐	☐	☐	☐	☐
11.6	Medication against high blood pressure	☐	☐	☐	☐	☐
11.7	Medication against heart disease	☐	☐	☐	☐	☐

12. Have you suffered from any of the following illnesses or troubles the past 6 months? If you answer "yes", please indicate if the troubles are slight or severe.

		No	Yes, slight	Yes, severe
12.1	Troubles from neck or shoulders	☐	☐	☐
12.2	Troubles from your back	☐	☐	☐
12.3	Other troubles from arms or legs	☐	☐	☐
12.4	Nervous problems	☐	☐	☐
12.5	Neurologic disease (paralysis, epilepsy etc)	☐	☐	☐
12.6	Sleeping troubles	☐	☐	☐
12.7	Troubles from your eyes or with your vision	☐	☐	☐
12.8	Troubles from your ears or with your hearing	☐	☐	☐
12.9	Allergy (hay fever etc.)	☐	☐	☐
12.10	Eczema, skin troubles	☐	☐	☐
12.11	Asthma, breathing troubles	☐	☐	☐
12.12	Lung disease	☐	☐	☐
12.13	Cardiac infarction	☐	☐	☐
12.14	High blood preassure	☐	☐	☐
12.15	Vascular spasm	☐	☐	☐
12.16	Gastric or intestinal disease	☐	☐	☐
12.17	Troubles from the bile or liver	☐	☐	☐
12.18	Urinary tract infection	☐	☐	☐
12.19	Other illnesses of the kidney or urinary tract	☐	☐	☐
12.20	Diabetes	☐	☐	☐
12.21	Other illnesses			

13. Have you suffered from any of the following troubles the past 6 months? If you answer "yes", please indicate if the troubles are slight or severe!

		Never	Seldom, a couple of times per year	Sometimes, a couple of times per month	Often, a couple of times per week	Always, nearly every day
13.1	Tired in your head	☐	☐	☐	☐	☐
13.2	Headache	☐	☐	☐	☐	☐
13.3	Dizziness	☐	☐	☐	☐	☐
13.4	Restlessness	☐	☐	☐	☐	☐
13.5	Nervousness/uneasiness	☐	☐	☐	☐	☐
13.6	Depressed	☐	☐	☐	☐	☐
13.7	A feeling of that everything is meaningless	☐	☐	☐	☐	☐
13.8	Indifference	☐	☐	☐	☐	☐
13.9	Passivity	☐	☐	☐	☐	☐
13.10	Lack of initiative	☐	☐	☐	☐	☐
13.11	Pain in the stomach	☐	☐	☐	☐	☐
13.12	Feeling sick	☐	☐	☐	☐	☐
13.13	Palpitations/ fast or irregular heart beats	☐	☐	☐	☐	☐
13.14	Breathing problems	☐	☐	☐	☐	☐
13.15	Pain or a feeling of pressure in your chest	☐	☐	☐	☐	☐
13.16	Pain or stiffness in a joint or arms/legs	☐	☐	☐	☐	☐
13.17	Pain in your back	☐	☐	☐	☐	☐
13.18	Tense muscles	☐	☐	☐	☐	☐
13.19	Tense jaws	☐	☐	☐	☐	☐
13.20	Lack of appetite	☐	☐	☐	☐	☐
13.21	Hunger	☐	☐	☐	☐	☐
13.22	Heart burn	☐	☐	☐	☐	☐
13.23	Diarrhoea	☐	☐	☐	☐	☐
13.24	Flatulence	☐	☐	☐	☐	☐
13.25	Constipation	☐	☐	☐	☐	☐
13.26	Other?					

Sleep and fatigue

14. How do you judge your general sleep quality?

☐ Very good
☐ Rather good
☐ Neither good nor bad
☐ Rather bad
☐ Very bad

15. Do you think you get enough sleep during work periods?

☐ Yes, definitely enough
☐ Yes, nearly enough
☐ No, somewhat insufficient
☐ No, clearly insufficient
☐ No, far from enough

16. Have you had the following problems **during the past 6 months** (**during work periods**)? Tick one alternative for every problem!

		Never	Seldom, a couple of times per year	Sometimes, a couple of times per month	Often, a couple of times per week	Always, nearly every day
16.1	difficulties falling asleep	☐	☐	☐	☐	☐
16.2	difficulties waking up	☐	☐	☐	☐	☐
16.3	repeated awakenings with difficulties returning to sleep	☐	☐	☐	☐	☐
16.4	loud snoring (according to other people	☐	☐	☐	☐	☐
16.5	nightmares	☐	☐	☐	☐	☐
16.6	not well rested at awakening	☐	☐	☐	☐	☐
16.7	premature (final) awakening	☐	☐	☐	☐	☐
16.8	disturbed/unrestful sleep	☐	☐	☐	☐	☐
16.9	too little sleep (less than 6 hours)	☐	☐	☐	☐	☐
16.10	sense of being exhausted at the awakening	☐	☐	☐	☐	☐
16.11	tired/sleepy during work	☐	☐	☐	☐	☐
16.12	irritated and tired eyes	☐	☐	☐	☐	☐
16.13	unintended periods of sleep (nodding off) during work	☐	☐	☐	☐	☐
16.14	having to fight against sleep in order to remain awake	☐	☐	☐	☐	☐

17. Have you had the following problems **during the past 6 months (during leisure)?** Tick one alternative for every problem!

		Never	Seldom, a few times per year	Sometimes, a few times per month	Most of the time, several times per week	Always, every day
17.1	difficulties falling asleep	☐	☐	☐	☐	☐
17.2	difficulties waking up	☐	☐	☐	☐	☐
17.3	repeated awakenings with difficulties returning to sleep	☐	☐	☐	☐	☐
17.4	loud snoring (according to other people	☐	☐	☐	☐	☐
17.5	nightmares	☐	☐	☐	☐	☐
17.6	not well rested at awakening	☐	☐	☐	☐	☐
17.7	premature (final) awakening	☐	☐	☐	☐	☐
17.8	disturbed/unrestful sleep	☐	☐	☐	☐	☐
17.9	too little sleep (less than 6 hours)	☐	☐	☐	☐	☐
17.10	sense of being exhausted at the awakening	☐	☐	☐	☐	☐
17.11	tired/sleepy during leisure	☐	☐	☐	☐	☐
17.12	irritated and tired eyes	☐	☐	☐	☐	☐
17.13	unintended periods of sleep (nodding off) during leisure	☐	☐	☐	☐	☐
17.14	having to fight against sleep in order to remain awake	☐	☐	☐	☐	☐

18. How many cups of coffee do you approximately consume on a work day?
☐ none ☐ 1-2 cups ☐ 3-4 cups ☐ 5-6 cups ☐ 7 cups or more

Sleep habits and diurnal rhythm

19. Which one of the following statements fits in best?
☐ I can easily fall asleep both during the day and the evening.
☐ I have difficulties falling asleep during the day, but no difficulty in the evening.
☐ I have difficulties falling asleep both during the day and in the evening
☐ I have difficulties falling asleep in the evening, but no difficulty during the day.

20. Which one of the following statements fits in best?
☐ I have no difficulty waking up after sleeping both during the day and the night.
☐ I have difficulties waking up after sleep during the day but not after night sleep
☐ I have difficulties waking up after sleep both during the day and the night
☐ I have difficulties waking up after sleep during the night, but not after night sleep.

21. When would you prefer to rise (provided you have a full day´s work – 8 h) if you were totally free to arrange your time?

☐ Before 06.30h
☐ 06.30 - 07.29h
☐ 07.30 - 08.29h
☐ 08.30h or later

22. When would you prefer to go to bed (provided you have a full day´s work – 8 h) if you were totally free to arrange your time?

☐ Before 21.00h
☐ 21.00 - 21.59h
☐ 22.00 - 22.59h
☐ 23.00h or later

23. If you always had to go to bed at 2100h, how do you think it would be to fall asleep then?

☐ Very difficult – would lie awake for a long time
☐ Rather difficult – would lie awake for some time
☐ Rather easy – would lie awake for a short time
☐ Easy – would fall asleep practically at once

24. If you always had to rise at 0600h, how do you think it would be?

☐ Very difficult and unpleasant
☐ Rather difficult and unpleasant
☐ A little unpleasant but no great problem
☐ Easy – no problem at all

25. When do you usually begin to feel the first signs of tiredness and need for sleep?

☐ Before 21.00h
☐ 21.00 - 21.59h
☐ 22.00 - 22.59h
☐ 23.00h or later

26. How long time does it usually take before you "recover your faculties" in the morning after rising from a night's sleep?

☐ 0 - 10 minutes
☐ 11 - 20 minutes
☐ 21 - 40 minutes
☐ More than 40 minutes

27. Please, indicate to what extent you are a morning or evening active individual.

☐ Pronounced morning active (i.e., morning alert and evening tired)
☐ To some extent morning active
☐ To some extent evening active (i.e., morning tired and evening alert)
☐ Pronounced evening active

28. How much sleep do you need? hours minutes

29. Except for sleep, do you think you get enough rest/relaxation during work periods?
- ☐ Yes, definitely enough
- ☐ Yes, nearly enough
- ☐ No, somewhat insufficient
- ☐ No, clearly insufficient
- ☐ No, far from enough

30. How often do you exchange watches on the bridge with a colleague?
- ☐ Never
- ☐ Seldom (a few times per year)
- ☐ Sometimes (a few times per month)
- ☐ Often (several times per month)
- ☐ Most of the time (nearly every week)

31. How are your possibilities for undisturbed recuperation, rest and sleep (depending on external factors, family or social reasons)?
- ☐ Definitely enough
- ☐ Nearly enough
- ☐ Somewhat insufficient
- ☐ Nearly insufficient
- ☐ Far from enough

32. How often do you exercise or train physically (so that you are perspiring)?
- ☐ Never
- ☐ Seldom (a few times per year)
- ☐ Sometimes (a few times per month)
- ☐ Often (a few times per week)
- ☐ Most of the time (several times per week)

THANK YOU FOR PARTICIPATING!

Other comments: