PhD Thesis

Health promotion intervention in the maritime setting

A 1-year follow-up study among seafarers in two Danish shipping companies

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Table of content

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Summary

Seafaring is a risky occupation when compared to land-based industries as incidence rates of mortality and morbidity are higher. This trend is partly due to a higher number of accidents but also a higher incidence of lifestyle-related diseases like cardiovascular disease and lung cancer. In Denmark, the proportion of smokers as well as heavy smokers is higher among seafarers compared with the general population. The same applies for the proportion of overweight and obese persons. This high burden of risk factors among seafarers indicates that this occupational group might be a ticking bomb at sea in regard to safety and health issues. However, there still is a lack of knowledge about health promotion approaches that work and about how they are best implemented and maintained within this line of occupation. Based on this knowledge gap, the overall aim of the PhD study was to investigate how health promotion interventions may improve health and health behavior of seafarers in two Danish shipping companies. To determine if and how health promotion interventions improve the health of the seafarers, three objectives were addressed: 1) An assessment of the need for health promotion based on health status (physiological parameters) and the prevalence of lifestyle risk factors/behaviors among the seafarers. 2) Identifying health and lifestyle risk behavior changes connected to different evidence-informed interventions based on a 1-year follow-up of health status and lifestyle risk behavior/factors. 3) In addition, and more specifically, an assessment of whether a training intervention for ship cooks could improve seafarers' diet on board and in particular to identify possible challenges occurring in the implementation of such improvements in practice on board.

Objective 1:

To identify lifestyle related risk factors and risk behaviors among seafarers (paper 1)

In order to assess the need for health promotion interventions in two Danish shipping companies, the first step was identifying the magnitude of lifestyle risk factors and risk behaviors among the employed seafarers. This was done based on a questionnaire survey (T1) in 2007-2008 on seafarers' health, wellbeing, diet, smoking and physical activity. In addition, a health profile was offered to the respondents, consisting of physiological measurements, such as fitness rating, body mass index (BMI), cholesterol and blood pressure measurement. The response rate for the questionnaire study was 57% (*n* = 360) of which 76% (*n* = 272) received a health profile. Results (males) showed 44% daily smokers as compared to 32% in the general Danish adult male population. 25% of the seafarers were obese with a BMI > 30 as compared to 12% of the Danish adult male population. 51% of the respondents were found to have metabolic syndrome, as compared to 20% of the Danish adult male population. These findings are thus clearly in line with the

assumption that seafaring is a risky occupation when looking at the seafarers' health. The survey confirms the need for behavioral health promotion interventions such as smoking cessation courses, healthy cooking courses and physical exercise programs, enabling healthier lifestyle and work environments.

Objective 2:

To identify changes in lifestyle related risk factors and risk behaviors due to health promotion interventions (Paper 2)

A one year follow-up survey was conducted in 2008-2009 in order to identify changes in lifestyle related risk factors and risk behaviors before and after implementing two structural health promotion interventions (healthy cooking courses for ship cooks and improvement of fitness facilities) as well as health education interventions (smoking cessation courses, individual exercise guidance and extra health check-ups with individual feedback) at the maritime workplace. In addition, qualitative interviews with participants and non-participants were conducted in order to gain in-depth information on experiences with and opinions about the intervention processes. Significant changes were identified for levels of fitness, daily sugar intake and metabolic syndrome. However, these results were not associated with participating in the health educational interventions (individual training guidance and extra health check-ups with feedback). One possible explanation for the improved fitness rate could be the upgrading of fitness equipment onboard the ships provided by the management level. The decrease in daily sugar intake and prevalence of seafarers with metabolic syndrome might be associated with the cooking course intervention which aimed at providing healthier daily meals on board. The findings thus suggest that structural changes within the setting might be more relevant than individual health education. However, due to methodological limitations regarding the study design and the measurement of food intake and leisure time physical activity, such conclusions are tentative, and studies with more rigorous research designs are needed. Also, an assessment study of the cooking course intervention, for instance, could provide more in-depth information explaining not only the improved changes such as the reduced consumption of sugared products but also the challenges of implementing such an intervention in practice.

Objective 3:

To identify challenges of implementing healthy cooking courses for ship cooks (Paper 3)

In order to enhance the options for healthier nutrition of seafarers, the effectiveness of structural interventions aimed at improving the supply of foods and meals on board as well as the challenges such interventions meet will need to be identified. In order to assess changes in the healthiness of meals and food ingredients, interviews and participant observations were conducted during the two-day courses for

ship cooks as well as interviews with the participants one year after. In addition, changes in eating behavior of the seafarers were assessed based on the follow-up data presented in paper 2. The results of this study revealed a positive change in the self-perception of eating healthily (green, coarse and lean products) a majority of days during a week. However, several challenges affecting the possibilities of offering nutritious and healthy meals were identified, such as lack of or insufficient training of cooks limiting cooking skills and confined physical capacities on board limiting space for storage and proper equipment. Further issues were a restricted frequency of supply options affecting the freshness of fruit and vegetables on a daily basis, limited variety of supplies and suppliers, which impinge on the quality and price of healthy food products as well as the opinion of the master, which may inhibit healthy cooking if he is not in favour of change. In conclusion, while positive changes were identified by the seafarers, to fully encounter the benefits of such changes as well as future health promotion interventions, many challenges related to the specific maritime work place structures need to be acknowledged and addressed by the companies and relevant maritime stakeholders.

In this PhD I have established the need for health promotion interventions in the case of the two Danish shipping companies - results which are likely to have implications for the Danish merchant fleet in general. Significant changes in lifestyle related risk factors and some of the lifestyle risk behaviors investigated were identified in the course of the study. Involvement of the management level of the companies in identifying, acknowledging and addressing challenges for health promotion interventions on a structural level such as encouraging healthier cooking and updating the fitness rooms onboard the ships appear to have had a positive influence on health and lifestyle changes. I recommend a more formalized approach to ensure health promotion initiatives in the maritime setting, preferably in line with ‘safety management’ guidelines, taking into account the special conditions of the maritime workplace setting.

Dansk resumé

Søfart er en risikabel arbejdsplads sammenlignet med landbaserede arbejdspladser grundet højere forekomst af dødelighed og sygelighed. Denne tendens skyldes dels et højere antal ulykker, men også flere tilfælde af livsstilsrelaterede sygdomme som hjertekarsygdomme og lungekræft. I Danmark er andelen af rygere såvel som storrygere højere blandt søfolk sammenlignet med den generelle befolkning. Det samme gælder for andelen af overvægtige og svært overvægtige personer. Den større byrde af risikofaktorer blandt søfolk antyder, at denne faggruppe kan være en tikkende bombe på havet med hensyn til sikkerhed og sundhed. Der mangler dog viden om, hvilke sundhedsfremmende tiltag der virker, og om, hvordan de bedst implementeres og vedligeholdes inden for denne type af beskæftigelse. På baggrund af denne manglende viden, var det overordnede mål for nærværende ph.d. studie at undersøge, hvordan sundhedsfremmende interventioner kan forbedre sundhed og sundhedsadfærd blandt søfolk i to danske rederier. For at undersøge om og hvordan sundhedsfremmende interventioner kan forbedre sundheden for søfolk blev følgende 3 delmål formuleret: 1) En vurdering af behovet for sundhedsfremme baseret på sundhedstilstanden (fysiologiske målinger) og forekomsten af livsstilsrelaterede risikofaktorer/adfærd blandt de søfarende. 2) Identificere ændringer i sundhed og livsstils risikoadfærd i relation til forskellige evidensinformerede interventioner baseret på en 1-års follow-up af sundhedstilstanden og livsstils risikoadfærd/faktorer. 3) Desuden blev en vurdering af et hovmesterkursus gennemført med henblik på at identificere de udfordringer, der forekom i forbindelse med gennemførelsen og vedligeholdelsesfasen.

Delmål 1.

At identificere livsstilsrelaterede risikofaktorer og risikoadfærd blandt søfolk (artikel 1).

For at vurdere behovet for sundhedsfremmende interventioner i to danske rederier, blev det første skridt at identificere omfanget af livsstilsrelaterede risikofaktorer og risikoadfærd blandt de ansatte søfolk. Dette blev gjort på grundlag af en spørgeskemaundersøgelse (T1) i 2007-2008 om søfarendes sundhed, velvære, kost, rygning og fysisk aktivitet. Desuden fik respondenterne tilbudt en sundhedsprofil, bestående af fysiologiske målinger, såsom kondital, body mass index (BMI), kolesterol og blodtryksmåling. Svarprocenten for spørgeskemaundersøgelsen var 57% (n = 360), hvoraf 76% (n = 272) af de adspurgte har modtaget en sundhedsprofil. Resultater (mænd) viste 44% daglige rygere sammenlignet med 32% i den generelle danske voksne mandelige befolkning. 25% af søfolkene var overvægtige med en BMI> 30 sammenlignet med 12% af den danske voksne mandlige befolkning. 51% af de adspurgte blev defineret som havende metabolisk syndrom, sammenlignet med ca. 20% i den danske voksne mandlige befolkning. Disse resultater er således

klart i tråd med den antagelse, at søfart er et risikabelt erhverv, når man ser på søfolkenes sundhed. Undersøgelsen bekræfter behovet for adfærdsmæssige sundhedsfremmende tiltag såsom rygestopkurser, kurser i sund madlavning, motionsprogrammer såvel som strukturelle tiltag, der kan fremme en sundere livsstil.

Mål 2.

At identificere forandringer i livsstilsrelaterede risikofaktorer og risikoadfærd i relation til sundhedsfremmende interventioner (artikel 2).

En opfølgende undersøgelse efter 1 år blev gennemført i 2008-2009 med henblik på at identificere forandringer i livsstilsrelaterede risikofaktorer og risikoadfærd før og efter gennemførelsen af to strukturelle sundhedsfremme interventioner (sunde madlavningskurser for skibets kokke og forbedring af fitness-faciliteter) samt 3 sundhedslære interventioner (rygestopkurser, individuel motionsvejledning og ekstra sundhedstjeks med individuel feedback) på den maritime arbejdsplads. Derudover blev kvalitative interviews med deltagere og ikke-deltagere gennemført for at få dybtgående oplysninger om erfaringer med og meninger om interventions-processerne. Signifikante ændringer blev identificeret for fitnessniveau, dagligt sukkerindtag og metabolisk syndrom. Imidlertid kunne der ikke påvises nogen relation til de sundhedsfremmende interventioner (individuel træningsvejledning og ekstra sundhedtjek med feedback). En mulig forklaring på det forbedrede fitness niveau kunne være opgraderingen af fitness-udstyr ombord på skibene fra ledelsesniveau. Reduktionen af det daglige sukkerindtag og forekomsten af søfarende med metabolisk syndrom kan være forbundet med det sunde madlavningskursus, som havde til formål at fremme sundere daglige måltider og fødevarer ombord. Resultaterne af undersøgelsen tyder på, at de strukturelle ændringer kan være mere relevante end den individuelle sundhedslære. Men på grund af metodologiske begrænsninger i undersøgelsens design og måling af fødeindtagelse, er sådanne konklusioner foreløbige og mere information er nødvendig. En nærmere undersøgelse af sund kost kurset vil ikke kun give mulighed for mere dybdegående information om de forbedringer, der er sket, men også om de udfordringer, der er forbundet med udførelsen i praksis.

Mål 3.

At identificere udfordringer ved gennemførelsen af sundkost kurset for skibskokke (artikel 3).

For at øge mulighederne for sundere ernæring af søfolk, er det nødvendigt at afdække effektiviteten af de strukturelle interventioner i forhold til forbedring af udbuddet af fødevarer og måltider ombord samt de udfordringer, sådanne interventioner møder. Deltagerobservation samt interviews med deltagere blev gennemført i forbindelse med kursets afholdelse samt efter 1 år, med henblik på at vurdere ændringer i

forberedelsen af måltider og indkøbsvaner. Desuden blev ændringer i besætningernes spiseadfærd vurderet på basis af data fra en follow-up spørgeskemaundersøgelse vedrørende deres selvvurderede sundhed og trivsel. Resultaterne af denne undersøgelse viste en positiv ændring i søfolkenes selvopfattelse af at spise sundt (grønt, groft-og magert) et flertal af ugens dage til søs. Undersøgelsen identificerede samtidig flere udfordringer, som påvirkede mulighederne for at tilbyde nærende og sunde måltider til søs; manglende eller utilstrækkelig uddannelse af assistenter med kokkeansvar, hvilket begrænser madlavningsfærdigheder; begrænset fysisk kapacitet, hvilket begrænser plads til opbevaring af varer og udstyr; begrænset hyppighed af forsyningsmuligheder, hvilket begrænser friskhed af frugt og grøntsager på daglig basis; begrænset udvalg af leverandører og varer, hvilket påvirker kvaliteten og prisen på sunde fødevarer samt kaptajnens mening, idet denne kan være en barriere for sund madlavning, hvis han ikke er tilhænger af forandringer. Det kan således konkluderes, at til trods for de positive ændringer, som blev identificeret af søfolkene, så vil det - for fuldt ud at afdække fordelene ved sådanne ændringer såvel som fremtidige sundhedsfremmende interventioner – være nødvendigt, at de mange udfordringer relateret til de maritime arbejdsplads-strukturer anerkendes og tages hånd om af rederierne og relevante maritime interessehavere.

Denne ph.d. har påvist behovet for sundhedsfremme interventioner i to danske rederier – resultater, som sandsynligvis vil have konsekvenser for den danske handelsflåde i almindelighed. Væsentlige ændringer inden for livsstilsrelaterede risikofaktorer og - i mindre omfang – inden for livsstilsrelateret risikoadfærd blev identificeret i løbet af undersøgelsen. Inddragelse af rederiernes ledelsesniveau i arbejdet med at identificere, anerkende og tage hånd om udfordringer for sundhedsfremmende interventioner på et strukturelt niveau, som fx at tilskynde sundere madlavning ombord på skibene og opdatering af skibenes fitness rum, synes at have haft en positiv indflydelse på sundheds- og livsstilsændringer. Der anbefales en mere formaliseret tilgang til at sikre sundhedsfremmende initiativer i den maritime branche på linje med de mange sikkerhedsfremmende foranstaltninger og retningslinjer - dog med hensyntagen til de særlige forhold som gør sig gældende inden for den maritime arbejdsplads.

List of papers

1. ***A risky occupation? (Un)healthy lifestyle behaviors among Danish seafarers***
   Lulu Hjarnoe; Anja Leppin
   Health Promotion International 2013; doi: 10.1093/heapro/dat024 (published April 28th.)

2. ***Health Promotion in the Danish Maritime Setting: Challenges and possibilities for changing lifestyle behavior and health among seafarers.***
   Lulu Hjarnoe; Anja Leppin
   (BMC Public Health. Submitted June 28th, 2013)*

3. ***What does it take to get a healthy diet at sea?***
   A maritime study of the challenges of transferring knowledge from a health promotion intervention to the workplace at sea
   Lulu Hjarnoe; Anja Leppin
   (Manuscript submitted June 28th, 2013)

*A slightly revised version has been accepted for publication December 2nd, 2013

Abbreviations

CVD	Cardiovascular disease
HPI	Health Promotion Intervention
HPT1/HPT2	Health Profile T1/Health Profile T2
ILO	International Labor Organization
MLC-2006	Maritime Labour Convention of 2006
QT1/QT2	Questionnaire T1/ Questionnaire T2
SAHP	Settings Approach for Health Promotion
WHP	Workplace Health Promotion

Introduction

Traditionally, the public has tended to perceive of seafaring as a risky business - a view mainly based on the occurrence of shipping accidents, and on newly emerging threats such as piracy. In fact, however, mortality rates from shipping disasters and personal accidents have fallen drastically over the last eight decades, particularly in Western industrialized countries, even though there is still a substantial disparity between accident incidence and mortality in maritime as compared to land-based work places (Roberts et al., 2002; Oldenburg et. al., 2010).

A less straightforward question is whether seafarers are also at heightened risk for chronic, life-style-related diseases such as cancer and coronary heart disease. Evidence in this area is scarce. A recent study based on registry data from several Northern European countries found seafaring among the occupations with the highest standardized incidence rates for all cancers combined (Pukkala et al., 2009), which might be due to various factors, among them exposure to chemicals as well as sunlight but also life-style behaviors such as smoking, alcohol consumption and diet (Pukkala et al., 2009; Oldenburg et al., 2010). The few existing studies on cardiovascular disease-incidence and mortality in male seafarers, however, have reported no major differences compared to males in land-based occupations beyond mortality effects due to less efficient emergency treatment for myocardial infarction and other medical emergencies (Nystrom et al., 1990; Brandt et al., 1994; Jaremin et al., 2003). A recent study based on registry data from the United Kingdom (UK), however, suggested that a closer look might be warranted. While the data revealed a lower rate of cardiovascular disease (CVD) for those on board, seafarers ashore actually had higher rates than the general population (Roberts & Jaremin, 2010), a difference which the authors attributed to a healthy worker-effect as the mandatory two-yearly health check for seafarers is likely to contribute to a de-selection of diseased employees from the active work-force. Similar CVD rates in the general population workforce and in active seafarers or lower rates in the latter do therefore not necessarily imply that seafarers are actually at lower or even at the same risk than the land-based workforce.

Recent studies from Poland, France, Norway and Germany have indeed reported that cardiovascular risk factors such as high blood pressure, high triglycerides, diabetes and obesity as well as behavioral risk factors such as smoking and physical inactivity are highly prevalent in seafarers (Fort et al., 2009; Geving et al., 2007; Oldenburg et al., 2010; Filikowski et al., 2003; Oldenburg et al., 2008). While different occupations within seafaring might share many features such as being confined in space and mobility, which in general set them apart from occupations on land, there are also many crucial differences within

the seafaring business. Thus work places on board differ depending on the general type of vessels, such as cargo and container ships, tankers, coasters, passenger ships etc. and the work demands they involve, but also the more specific physical and social environments in terms of availability of leisure time facilities including exercise space and equipment, food provisions or smoking regulations. These specific settings are likely to provide dissimilar opportunities or discouragements for healthy or unhealthy lifestyles and thus might create important variance in health risks within the seafaring occupation. Another important differentiating factor might be related to the educational and occupational status of the employees themselves.

Cardiovascular diseases and the risk factors related to them have been found to vary along a social gradient in general populations (Lantz et al., 2010) and thus might also be expected to differ among occupational groups of seafarers such as officers and crew ranks. Evidence in this area is scarce yet, however a recent study on UK seafarers found higher CVD mortality among the crew than among officers (Roberts & Jaremin, 2010).

The workplace, especially in the maritime setting, is a valuable arena for studying the need for and ways to enable health promotion initiatives, considering the time spent on duty (as well as off duty) on board. Compared to work life onshore, work life at sea is often compressed into longer periods away from home, there is an exchange of on-duty and off-duty periods, work is typically beyond 37 hours per week and rarely less than 7 days a week. Leisure time at sea is scarce and often confined to the limited space of the ship. Much of this free time is spent on meals, snacking, resting and corresponding with family/friends, whereas only a minority of employees engages in physical fitness activity (Hjarnoe & Leppin, 2013a). Bearing in mind that a majority also holds jobs which are largely sedentary, the level of physical inactivity among this occupational group is alarmingly high. The advantages with workplace health promotion (WHP) is thus the presence of social networks, the possibility of reaching large populations, and the amount of time spent at work (Hutchinson & Wilson, 2012). Many studies on effects of land based WHP and WHP intervention programs have shown that health as well as health behavior can be improved (Hutchinson & Wilson, 2012).

Studies on health promotion interventions within the maritime setting are scarce and only one study was identified which had implemented interventions: a Finnish 1-year follow-up study from 1996 aimed to activate sailors to take care of their own health and well-being by way of health education on diet, smoking and alcohol and physical fitness courses on-shore (Saarni et al., 2001). Results revealed an increase in the frequency of physical exercise (‘at least 3 times a week’) at sea as well as on shore, a perception of better

and healthier meals at the follow-up, an increase in job satisfaction and a decrease in mental stress, however, no changes were documented in the physiological parameters. There is thus a need for further studies investigating the effect of health promotion interventions at the work place at sea, however, we also lack knowledge of how to best implement such interventions in the maritime industry, how to maintain them and to what extent they will change the risk behavior of the seafarers.

Aim and objectives

The high burden of risky lifestyles and lifestyle related risk factors established among seafarers indicates that this occupational group might be a ticking bomb at sea in regard to safety and health issues. The main aim of the PhD study was thus to investigate how health promotion interventions may improve health and health behavior of seafarers in two Danish shipping companies.

To determine if and how health promotion interventions improve health and lifestyle risk behavior of seafarers, three objectives were addressed:

1) An assessment of the need for health promotion intervention based on health status (physiological measurements) and the prevalence of lifestyle risk factors/behaviors among the seafarers.

2) Identifying health and lifestyle risk behavior changes connected to different workplace health promotion interventions based on a 1-year follow-up of health status and lifestyle risk behavior/factors.

3) In addition, and more specifically, to assess whether a training intervention for ship cooks could improve seafarers' diet on board and in particular to identify possible challenges for the implementation of such improvements in everyday reality on board.

Study context

This section describes the context of the research carried out. As a starting point, a brief description of the Danish merchant fleet will be provided followed by a presentation of the legal framework on regulations related to maritime and occupational health. Lastly, the specific maritime setting and study population will be presented.

The Danish merchant fleet

Ninety percent of the world's goods are transported by ship. Danish shipping transports approximately 10 percent of total world trade in terms of value and controls about 7 percent of the total world tonnage. The Danish merchant fleet consists of 611 ships of more than 100 gross tonnage (GT); 13.8 million deadweight tons (DWT) and 11.5 million GT. Danish shipping earnings have been increasing for many years, except for a decline in 2009, and are the largest single contributor to the Danish foreign exchange earnings. The Danish merchant fleet employs approximately 17.000 people, of which 9.600 have Danish citizenship (The Danish Shipowners´Association, 2013).

Rules and regulations

Danish Maritime Authority, which is a government agency under the Ministry of Business and Growth, has the responsibility for Seafarers' employment, health and conditions of social security. The Seamen's Act is the backbone when we are dealing with the seaman's rights and duties. According to this Act, all Danish seafarers signing on for jobs covered by a ship's safe manning must have a discharge book. The Danish Maritime Authority issues discharge books only to Danish citizens who have turned 16 years of age. In addition, to be able to work on Danish ships of or above 20 tons or on fishing vessels (irrespective of size) all seafarers must regularly undergo medical examinations. This examination includes an assessment of color blindness, blood pressure, hearing, vision, etc. Seafarers must be at least 16 years old to undergo medical examinations. Seafarers below 18 years must normally be examined every year, whereas seafarers above 18 years are to be examined every second year. According to the Act on medical examination of seafarers and fishermen, it is stated: *"At the examination the doctor makes an estimate of whether the physical and mental state of the investigated person is in such a general state that the person is suitable to work on a ship"* (Erhvervs og Vækstministeriet, 2008). There is no BMI limit, as is the case in Norway where a BMI>35 means absolute rejection, and BMI between 30-35 gives relative contraindication depending on the assessment of the physician (Nærings- og handelsdepartementet, 2001). In Denmark a BMI > 40 at the medical examinations requires an evaluation of the extent to which "*the fat and muscle distribution is a severe limitation for mobility*" before issuing a medical certificate (Erhvervs og Vækstministeriet, 2008).

A special medical certificate is used for the medical examination. In Denmark, only medical practitioners appointed by the Danish Maritime Authority as maritime medical practitioners are permitted to carry out medical examinations.

Below some of the seaman's right concerning health and wellbeing are listed which in some cases will be slightly altered with the new convention that came into effect August 2013:

1. A seaman is entitled to protection and the protective equipment that is needed against accidents and exposure to effects harmful to health during work.
2. A seaman is entitled to good and sufficient food.
3. A seaman is entitled to at least 10 hours rest a day. The time of rest can be divided into a maximum of two periods, one of which must be of at least 6 hours. There must be a maximum of 14 hours between two rest periods. (From 1. July 2002 a seaman is entitled to at least 77 hours rest a week.) A seaman who is younger than 18 must have a total rest period of at least 12 hours each working day, and the rest period must ordinarily be between 8 pm and 6 am. If the seafarer is on watch, the rest period can be divided into a maximum of two periods, one of which must be of at least 8 hours between 8 pm and 6 am. Within every seven days and nights, young persons must have two days off on end. If necessary, the master can, however, postpone the weekly days off by later replacing them for the equivalent time off.
4. A seaman is entitled to go ashore in his spare-time when the ship is in port or at a safe anchoring place unless his presence is required on board, for example for safety reasons.

MLC-2006

On August 20th 2013, the new Convention, the Maritime Labour Convention 2006 (MLC 2006) will take effect and will apply to all 30 countries which ratified it. In a Danish context, the law will apply to all Danish ships over 500 BT, sailing in international waters with the aim of providing clear standardized rights and security that are valid globally. MLC 2006 contains minimum requirements for seafarers to work on a ship, in regard to factors such as medical certificates, hours of work and rest, repatriation, medical care, welfare and safety, and to be paid wages on a monthly basis – but also to recreational facilities, food and catering. In regard to food, facilities and training of cooks it is stated in the convention that the purpose is: *"To ensure that seafarers have access to good quality food and drinking water provided under regulated hygienic conditions"* (International Labour Organization, 2006). Ships must carry sufficient quantities of good quality food and drinking water and supply it free of charge during the seafarers' period of engagement. Organization and equipment of the galley should facilitate the provision of adequate, varied and nutritious meals. Religious and cultural differences also have to be considered. Ships' cooks have to be

over 18 and appropriately trained and qualified for the job. However, on ships with less than 10 crew or in exceptional cases for a period no longer than one month, the cook does not have to be fully qualified. However, all those responsible for handling food must be trained in matters relating to hygiene, food and its storage on board (International Labour Organization, 2006). Port state control (PSC) of ships investigates the compliance with the requirements of the MLC-2006, and violation is sanctioned with detentions and fines.

Smoke-Free Environment Act of August 15th. 2007

In regard to smoking, the Danish Smoke-Free Environment Act of August 15th. 2007 (Ministry of the Interior and Health, 2007) prohibits indoor smoking unless it takes place in special locations.

Occupational challenges

Work at sea has for many seafarers, especially officers, become less and less physically demanding as work tasks have become more mechanized. However, at the same time the crews onboard are getting smaller and smaller, which increases the workload of some occupational groups. A major part of the work of masters and officers today consists of administrative "desk work". Also psychosocial working conditions are special, because the work takes place in closed social environments with a great preponderance of men. Sedentary, stressful working conditions due to increased administrative tasks, obesity and lack of exercise are a potentially growing problem within certain parts of the maritime sector (Hjarnoe & Leppin, 2013a).

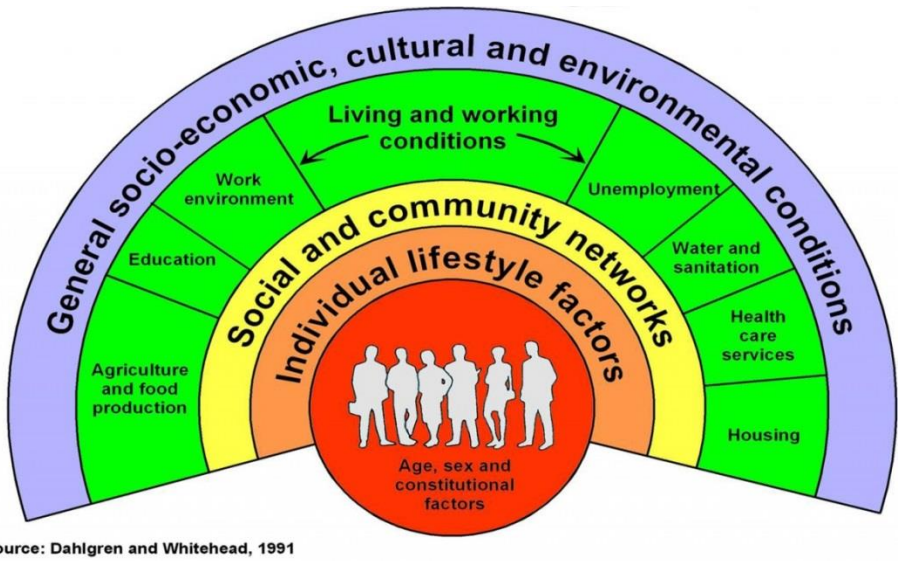
The maritime setting and the two participating companies

Two shipping companies participated in the study. One was a cargo service company which operated mainly in the North Atlantic between Aalborg in Denmark and Greenland's Disco Bay and had approximately 190 seafaring employees. The majority of these seafarers were nationals of Denmark and Greenland. The off-shore period was between 4-8 weeks, followed by 4-8 weeks at home. Seafarers from 7 different ships participated and the average crew size was between 12-15 people. The work focused mainly on cargo management during the port visits and maintenance of the ship. The second company was an offshore rescue and support vessel operator which mainly operated in and around the North Sea, where they circulated offshore installations, keeping watch for accidents, like e.g. oil spill or "man overboard" incidents. The company had approximately 440 employees, of which the vast majorities were nationals of Denmark as well as the Faroe islands. The off-shore period was between 2-4 weeks, followed by 2-4 weeks off. Seafarers from 24 different ships participated, and the crew size varied between 6-12 people. Aside from maintenance of the ship, the crew's main task was to practice and retain their rescue skills, including a short response time in case of emergency, which means they performed regular rescue and security drills.

Conceptual framework

This chapter presents the theoretical framework of the thesis and starts out by briefly introducing the concept of 'Health Promotion' and Dahlgrens model of the 'determinants of health', as the conceptual basis of the study. The overall aim of the PhD study was to investigate how health promotion interventions may improve health and health behavior of seafarers in two Danish shipping companies. This aim will be pursued by way of the settings approach for health promotion as well as the structural approach for health promotion intervention presented below.

The concept of health promotion received its global breakthrough in the Ottawa Charter for Health promotion as a key strategy for improving population health. The charter was issued at the first International conference on Health Promotion in 1986, and defined 'health promotion' as: —*the process of enabling people to increase control over, and to improve, their health* (WHO, 1986). According to this definition, health is not only seen as absence of disease but also as a resource for everyday life, including physical, mental and social well-being. With the Ottawa charter, the idea of health promotion was moved away from a biomedical and individual perspective towards a greater ecological focus on the living context of people and to the determinants that keep people healthy. Today, there is thus a greater focus on the factors influencing health, the determinants of health, rather than on individual risk factors for disease (Potvin & McQueen, 2007). The Dahlgren model below thus highlights the different layers of everyday life that influence health.



Source: Dahlgren and Whitehead, 1991

According to Dahlgren and Whitehead, health is created and sustained within our daily environments. Creating supportive environments for health is thus a core strategy for health promotion and a central part of the settings approach which advocates intervention in everyday environments like e.g. the school or the workplace (Green et al., 2000).

Settings approach for health promotion

The settings approach for health promotion (SAHP) builds on the Ottawa Charter statement, that: *"Health is created and lived by people within the settings of their everyday life; where they learn, work, play and love"*(WHO, 1986). SAHP thus understands health as determined by a complex interaction of environmental, organizational and personal factors, and focuses on interventions in our daily environments to support better health. SAHP thus define the "subject" of intervention (individually and collectively), the location of health promotion, and the frames of the setting itself as a target of intervention (Green et al., 2000). The settings approach emphasizes the importance of traditional, individual-focused methods such as health education in changing individual behavior based on theoretical approaches such as the health belief model (Rosenstock, 1988). However, the settings approach also highlights that these strategies should only be seen as complementing (not replacing) the overall aim to identify and address settings-based sources of e.g. ill health (Noblet & Murphy, 1995). SAHP includes three key elements that will influence the individual's health: creating supportive and healthy working and living environments, integrating health promotion into the ordinary and daily functioning of the settings, and developing collaboration between different settings that influence the individual's health (Dooris, 2004). As stated above the SAHP recognizes the workplace as a core setting for health promotion intervention.

Workplace health promotion

The workplace offers an important setting and infrastructure to support the promotion of health for a large target group. By improving their knowledge and skills to manage health, and by establishing a supportive environment to improve health within and outside the respective workplace, the workers, their private networks and the workplace itself should benefit. It is presumed that the health-promoting workplace can bring about positive changes which support the overall success of an organization (Renaud et al., 2008). The traditional approach to WHP was focused on individual employees, trying to change their risk-behaviors by way of education and information dissemination. The individual approach has been criticized for blaming the victim (the employee) instead of acknowledging individual risk behavior as due to or sustained by organizational barriers, more than being a result of negative personal attributes. Teaching or guidance initiatives for employees to e.g. improve health at the workplace might be seen as blaming the individual employee for what is in fact an organizational malfunction. Workplaces that remain determined

on changing e.g. the individual workers lifestyle with little consideration as to what influences the behavior, do not target the real problem, but only the symptoms of this problem (Syme & Balfour, 1997). Workplace health promotion interventions should focus on both, organizational or structural changes as well as include health education in order to facilitate individual behavior change (Green & Kreuter, 2005). This is in line with a literature review which thus concluded that health-promoting programs will enhance employee health only when both individual and environmental issues are targeted (Shain & Kramer, 2004).

Structural interventions for health promotion

This approach builds on a socio-ecological perspective, which suggests that structural factors are critical determinants of health outcomes and that better health can be achieved by changing e.g. physical environments like the provision of clean water. The approach argues that health promotion interventions should manipulate and adjust the conditions in which people live to influence individual health behavior (Cohen et al., 2000). Structural interventions are defined as: *"Interventions that change conditions beyond individual control such as the social and physical environments"* (Cohen et al., 2000). The aim of structural interventions is to influence and change the behavior of the study population at hand, by way of manipulating different components. Four components have been suggested by Cohen et al: 1) Availability of e.g. consumer products and health promotion services, 2) physical structures, 3) social structures and policies, and 4) cultural and media messages (Charania et al., 2011; Cohen et al., 2000).

Availability

Availability refers to the accessibility or inaccessibility of certain consumer products and health promotion/prevention services. The general assumption is that greater accessibility to these products is associated with greater use and, vice versa the lower the accessibility, the lower the use. Thus, higher accessibility to tobacco, alcohol and high-fat foods is associated with higher usage of these products while higher accessibility to healthy products such as fresh fruits, vegetables, fitness facilities or health care services will similarly enable higher usage. The availability of products and services can change behavior without influencing attitudes or beliefs. However, the opposite is also a possibility as unrestricted availability of a product or service may provide the message that these products are regarded as normative and safe to use.

Physical structures

Physical structures refer to the physical accessibility of the above mentioned consumer products or health promotion services that either reduce or increase opportunities for healthy behaviors and healthy outcomes. Examples of physical structures are presence of green spaces or fitness clubs in the

neighborhood environment, which enable exercise, or of high quality food stores in the vicinity, which enable purchase of fresh fruits/vegetables. Again the quality and appearance of physical structures may influence behavior, e.g. a messy environment may encourage more litter.

Social structures

Social structures refer to laws and policies that require or prohibit certain behaviors. Social structures set guidelines to limit high-risk behaviors and can provide a framework for encouraging low-risk behavior. Examples of social structures that lead individuals to comply with rules and regulations are enforcements, which can be formal (such as fines) or informal (such as supervision by family, friends or colleagues). Social structures can influence health behavior directly without changing social attitudes or beliefs like e.g. laws prohibiting indoor smoking etc., but can also work indirectly, through changing social norms and expectations about appropriate behavior.

Cultural and media messages

Cultural and media messages refer to messages that people see and hear frequently by way of conventional media channels, stories or cultural practices. Media is considered a structural intervention when it influences norms and/or the values and behaviors associated with products or health promotion services that are perceived normative.

Material and methods

As a starting point, this chapter presents an overview of the study design, provided in flowchart 1. Next, the interventions will be presented, followed by the main research methods. Thirdly, the data and methods of the three papers will be described, and finally, the ethical considerations in relation to the study will be presented.

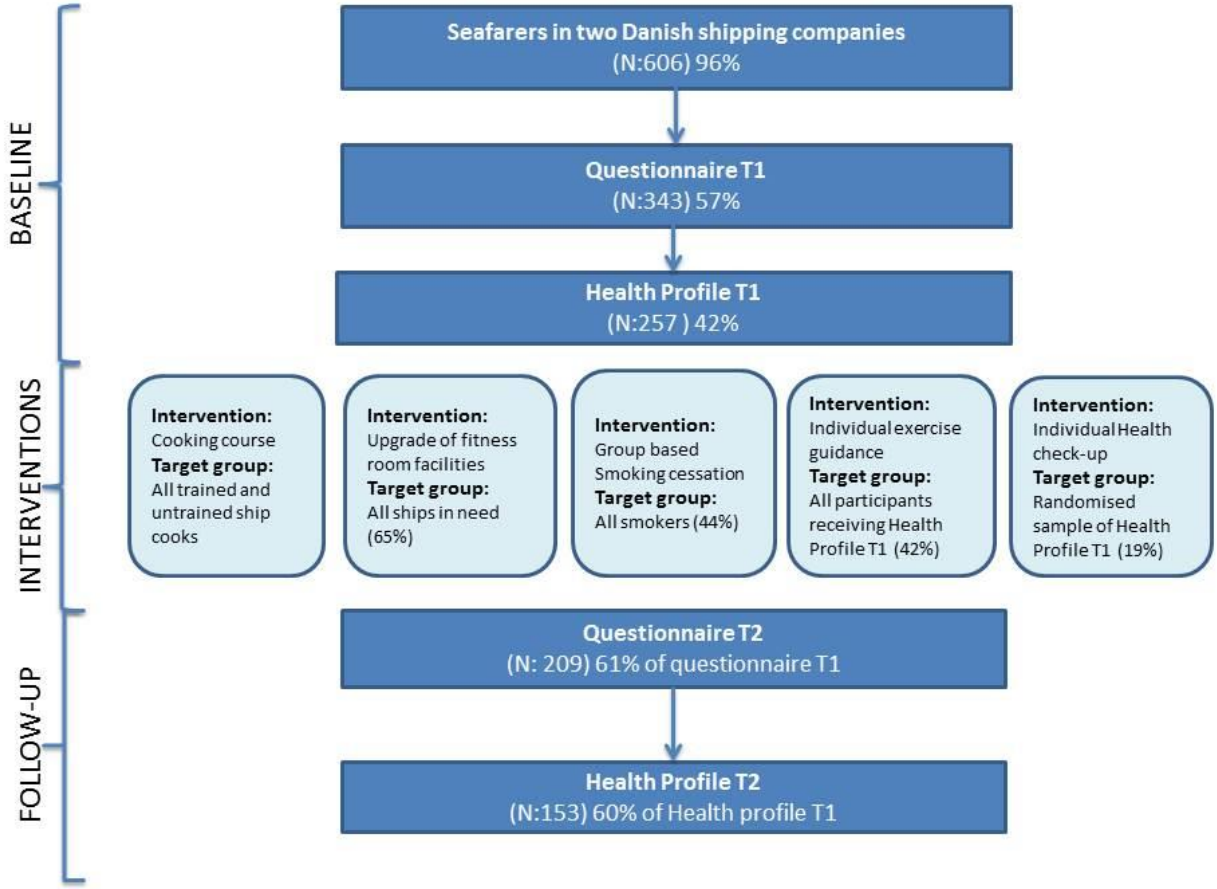
Study design

This study builds upon a one-year follow-up design measuring lifestyle related risk behavior and risk factors among seafarers in two Danish shipping companies before and after implementing several health promotion interventions. The study consisted of three phases:

1) baseline data collection,
2) implementation of interventions, and lastly
3) follow-up data collection.

Baseline and follow-up data were collected with the help of 1) a self-administered standardized questionnaire, which was sent to all employees of the two companies, and 2) an individual health profile assessing parameters of physical health and physical fitness which was offered all the respondents. The questionnaire was posted end of 2007 and again approximately one year after, in the beginning of 2009, to the home address of all seafaring employees (N=630). An electronic version of the questionnaire was made available for the follow-up as well. The health profile was carried out between October 2007 and December 2008, and follow-up data were collected between January and December 2009. In addition, qualitative interviews were conducted face-to-face or by phone to gain knowledge about the reasons of those who were eligible but did not participate in the different health education intervention modules.

The three phases in the study design and the participant flow through these phases are illustrated in the flowchart below. As the number of female seafarers in the study was very small (N = 17), it was decided to remove them from the analysis.



Interventions

Five different interventions were implemented in 2008/2009. Two of those were structural or socio-ecological interventions aimed at providing a healthier environment for all seafarers in the two companies (cooking course and upgrading of fitness room onboard the ships). In addition, three health education interventions were offered. One was a group-based intervention (smoking cessation), and two were individual-focused interventions (guidance on physical training and extra health check-ups).

Healthy cooking

The intervention consisted of a two-day cooking course on healthy diet targeting all chefs and crew members with cooking responsibilities from the two companies. The course took place on-shore at a geographical location situated between the two main offices of the participating companies, and the trainers were health consultants with knowledge of the maritime occupation. The first day was an introduction to healthy diet according to official Danish recommendations and how to improve nutrition in everyday dishes in accordance with the recommendations. The participants were divided into groups and received a practical task of preparing recipes from the maritime cookbook “Food at Sea”. Day two was

devoted to motivation and communication skills with the aim of implementing a more nutritious diet on board the ships. A total of five courses were conducted during a period of 8 months, between May 2008 and January 2009, with a total of 49 participants. The aims of the cooking course were to facilitate the promotion of a nutritious and healthy diet at sea by way of: 1) providing the opportunity to share knowledge and experiences with cooks from other companies, 2) creating awareness of the official recommendations for a healthy and nutritious diet and advice on how to do it, 3) establishing the opportunity to become familiar with the usage of the cookbook "Food at sea", which was produced by Seahealth Denmark in collaboration with chefs from the maritime setting, containing foreign and Danish dishes and aiming to motivate chefs for healthy tasty cooking, and 4) creating awareness of communication strategies to promote a healthy diet onboard the ships among the crews (Seahealth Denmark, 2004).

Upgrading of fitness rooms

The upgrading of fitness room facilities onboard the ships (N = 31) was initiated by the management level of the shipping companies as a response to requests for better equipment onboard by crew members from 20 of the ships during T1. According to the qualitative interviews, respondents from 14 different ships acknowledged improvements of the facilities in the fitness room.

Smoking cessation

Smokers were offered group-based smoking cessation courses and lung function tests as well as guidance on and reimbursement of nicotine replacement products. Group counseling took place at or close to the main office ashore consisting of 2 times 2-hour meetings and 3 telephone contacts. The first group meeting was dedicated to prepare, motivate and set a date for the smoking cessation. Approximately 3 weeks after the first meeting the group met again. This second meeting date was set to be approximately 3 days after the smoking cessation date. The aim of the second meeting was to provide coping methods during craving periods to ensure a smoke-free future. Telephone contact was conducted with each participant approximately a week after the first meeting.

The intended target group for the smoking cessation intervention was smokers employed in both companies who had acknowledged a wish to participate in a smoking cessation course in questionnaire T1 or during their health profile T1. All received an e-mail and post invitation informing about time and place of the smoking cessation course as well as content of the first course day. The invitation offered two optional course dates in May 2008. All participants who did not reply received another e-mail invitation with a deadline after which they were called up by phone to ensure they received the invitation. 18% of this

group (N=13) accepted the offer and showed up at the first course day (7 people in Esbjerg and 6 people in Aalborg), however the second meeting was cancelled in Aalborg as they were unable to agree on a second meeting date in which 2 or more persons could attend. Also the other course in Esbjerg experienced difficulties in finding a second meeting date for all due to different sailing schedules, and the final meeting was conducted with a reduced group (N=4). Two additional courses were offered, but it was not possible to gather enough participants, and they were both cancelled.

Guidance on physical training

All participants receiving the individual health profile were offered motivational counseling as well as given the option of individual guidance on physical training with a physiotherapist. The offer was accepted by 76 seafarers and consisted of a tailored physical exercise program based on the individual seafarers need taking into account the results of the individual health profile as well as any muscular-skeletal disorders or diagnoses that the seafarer may have had. The program was offered also as a printout with pictures for each exercise to enable home training. The individual would afterwards be able to go ahead with his/her exercise program to e.g. improve fitness, lose weight, reduce joint and muscle pains. The offer included the option of a follow-up counseling (by phone or mail) of the progress after 3 months, which, however, only a minority requested (N = 28).

Extra health check-ups

From the group of seafarers, who had received the baseline health profile, 19% (N = 50) were randomly selected from the participant list to be offered 2 extra health-check-ups with an interim of 3 months, consisting of the same anthropometric and physiological measurements which had been offered in the health profile (fitness rating, body mass index (BMI), waist circumference, blood pressure, cholesterol (HDL, LDL, total), triglycerides and blood sugar level). The intention of the extra check-up was to increase awareness of risk factors in the seafarers and also serve as a monitor of the individual seafarers' lifestyle behavior. Only a minority of N =14 received both check-ups.

Overview of data and methods in the three papers

Table 1 below gives a brief overview of the aims, study design, methods, data and study periods of the three papers.

Table 1: Overview of aims, design, method and data in the three papers

	Paper 1	Paper 2	Paper 3
Aim	To identify lifestyle related risk factors and risk behavior among seafarers	To identify changes in lifestyle related risk factors and risk behaviors due to health promotion interventions and identify challenges in the implementation process	To assess the effects of a training intervention for ship cooks and identify possible challenges for the implementation on board
Study design	Cross-sectional survey	Single group pre-post	Single group pre-post; Case study
Measurement	(T1) Questionnaire survey, (T1) Health profile	Mixed methods: (T2) Questionnaire survey, (T2) Health profile, Qualitative interviews and participant observation	Mixed methods: Questionnaire survey (paper 1 & 2), Qualitative interviews and participant observation
Response rate	Response rate of T1-questionnaire was N=360 and of T1-health profile was N=272	Response rate of T2-questionnaire was 60% and of T2-health profile 58%. Transcribed data from 104 telephone interviews, 4 group interviews and field notes	Response rate of questionnaire question (T2) N=193. 35 transcribed telephone interviews with ship cooks and field notes from participant observation during two cooking course interventions and 2 onboard fieldtrips.
Study period	Oct. 2007- Dec. 2008	Jan. 2009-Oct. 2010	May 2008 – Oct. 2010

The main study methods in this thesis will be described below based on the mixed methods approach, which integrates both quantitative and qualitative research methods.

Core research methods

Quantitative and qualitative research techniques have been applied in this PhD study in order to best investigate how health promotion interventions improve health and health behavior of seafarers in two Danish shipping companies. This approach is also referred to as a mixed methods approach.

Mixed methods approach

The mixed methods approach builds on the strength of both qualitative and quantitative methodology by integrating elements of both into the same research study in order to increase breadth and depth of understanding (Johnson et al., 2007).The approach is applied to provide a more comprehensive understanding of a study, which the two methods alone cannot do. The mixed methods approach is appropriate in studies focusing on e.g. research questions that call for real-life contextual understandings, multi-level perspectives, and cultural influences. The overall purpose of mixing methods in the present

thesis was to gain a more comprehensive insight and understanding of the need for-, effects of- and facilitators/barriers of maintaining- health promotion intervention in the maritime setting; a complex phenomenon which calls for both quantitative and qualitative research methods (Wisdom et al., 2012). The mixed methods applied are: questionnaire survey, health profile, qualitative interviews and fieldwork.

Standardized questionnaire survey

Postal questionnaire surveys offer the opportunity to sample larger populations/groups answering the same questions and have the advantage of being a low-cost method with the ability to reach geographically dispersed populations. Disadvantages, however, are issues like a generally low response rate, no opportunity of assisting or correcting misunderstandings and no assessments based on observations. However, this method was considered ideal to collect self-perceived information on health and health behavior from a large group spread across 3 countries.

Physiological measurements

Physiological measurements refer to quantitative measurements of body functions and body states such as blood pressure, cholesterol, fitness rating, BMI and waist circumference. Such measurements offer the opportunity to study health changes in e.g. before-after studies such as the present.

Qualitative interviews

Interviews, face-to-face, group or by telephone can provide insights that are not available to researchers working with large survey samples and are known to be the most suitable approach when looking for data on individuals' experiences and attitudes. Disadvantages are that interviews are often very time-consuming to conduct, transcribe and analyze. This data collecting method will provide an opportunity to collect in-depth information on the procedures, beliefs and knowledge related to the implementation and maintenance of the health promotion interventions.

Participant observation

Participant observation is a method which is a part of the qualitative research tradition from anthropology in which the researcher directly observes and participates (participant observation) in small-scale social settings with the purpose of gaining an understanding of the social world of the study population. As was the case with the interviews, this method provides the possibility of in—depth descriptions of processes, beliefs and knowledge or for exploring the reason for certain behaviors including the opinion of respondents about different issues. Data collection involves objective and accurate reporting of statements and activities of the participants in the given social setting usually by way of field diaries. This method is useful during voyaging, visits on the ships and participating in the interventions for gaining knowledge of

the seafarers' social life and their behavior within the different social settings. In addition, it will provide knowledge of the physical challenges of the social life onboard in regard to the interventions.

Methods: Papers 1 and 2

The aim of paper 1 was to assess the need for health promotion intervention among Danish seafarers by way of identifying lifestyle risk factors (smoking, physical activity and eating habits) and lifestyle-related risk factors (obesity, waist circumference, physical fitness, and metabolic syndrome). In addition, differences in these factors were investigated in relation to the seafarers' occupational rank (officers versus non-officers) and types of work settings (cargo-shipping company versus supply and rescue company). Based on a one-year follow-up, the aim of paper 2 was to identify changes in lifestyle related risk behavior (smoking, physical (in)activity and unhealthy eating) related to structural- and/or health education interventions. In addition, a goal was to identify changes in the prevalence of high physical fitness, high waist circumference as well as metabolic syndrome related to structural- and health education interventions. Lastly, the aim of paper 2 was to identify challenges in the implementation process of the health promotion program at the maritime work place.

In order to access the need for health promotion interventions and identify possible change in lifestyle related risk factors/behaviors, a comprehensive questionnaire survey covering questions on seafarers' self-perceived health, well-being, and health-related behaviors was conducted. In addition, a health profile was offered to the respondents, consisting of physiological measurements, such as fitness rating, body mass index (BMI), cholesterol and blood pressure. In order to understand and explain changes identified in the follow-up, qualitative interviews and fieldwork were conducted.

Standardized questionnaire survey

A standardized questionnaire containing different questions and sub-questions was sent out the first time ultimo 2007 and the follow-up was done ultimo 2008 to all seagoing employees in the two shipping companies (N = 630). The questionnaire consisted of 1 open and 68 closed questions with standard rating scales.

The following questions were only part of paper 1. To assess the level of physical activity at work and during leisure time: "What type of work do you have/How physically active are you in your work?" Possible responses were: "Mostly sedentary work", "Mostly work that I perform standing or walking", "Mostly standing or walking with some lifting or carrying", and "Mostly heavy or fast work which is tiring". The second question was: "How much do you exercise during your home period (e.g. walking and cycling during leisure time and to and from work, cleaning, physically strenuous gardening, and physically active play with

your children)?" The reply options were: "Less than 30 minutes daily", "30 to 60 minutes daily" and "More than 60 minutes daily". The next 4 questions were applied in paper 1 (T1) and paper 2 (T2). Smoking status was assessed by asking: "How many cigarettes do you smoke a day – on average?" with the following reply options: "none", "1-5 cigarettes","6-10 cigarettes", "11-15 cigarettes" or "more than 15 cigarettes". Dichotomous measure for non-smokers or smokers was 0 versus $\geq$ 1 cigarettes. Assessment of physical activity was asked for sea and home setting each based on the question: "How often do you exercise, so it increases your fitness and / or strengthens muscles?" Response options were: "3 times a week or more", "1-2 times a week", "Less than once a week" and "Never". Cut off for low or high physical exercise was $\leq$2 versus $\geq$3 times a week. In relation to eating habits at sea and at home one question was asked for frequency of overeating ("Do you eat more than you need?") and one for intake of sugared products: ("Do you eat cake, sweets/drink sugared sodas? "). Possible responses were: "5-7 days a week", "3-4 days a week", "1-2 days a week" and "less". Cut off for low or high intake of sugar was $\leq$2 versus $\geq$3 times a week.

Individual health profiles – anthropometric and physiological measurements

Anthropometric and physiological measurements were recorded by a registered nurse and/or by a physiotherapist during the course of individual sessions on board and on land.

Fitness was assessed from the sub-maximal exercise test using a cycle ergometer and pulse meter to estimate maximal oxygen uptake (VO2max) based on two consecutive workload intervals, divided by body weight in kg. Fitness scores obtained from the test were directly classified into one of three groups: low, medium and high stratified for age and gender (Keller, 2001). For analysis purposes, the low and medium groups were put together as "low" and compared to the "high" group.

A BMI-of 30 and above was used as an index of general obesity (WHO, 1998). Waist circumference was measured between the lowest rib and the top of the person's hipbone. A WHO-recommended circumference of 94 cm for males was chosen as cut-off to distinguish normal from enlarged sizes (WHO, 2011).

Blood pressure was measured in millimeters of mercury (mm Hg) with an inflatable cuff on the upper arm ("Omron M7" over-arm devices). All measurements indicating high blood pressure were repeated at the end of the session to reduce effects of nervousness (white coat hypertension). Cholesterol and blood sugar were measured using "Cholestec LDX" equipment, which is a lipid analyzer providing results after just five minutes. Presence of metabolic syndrome was defined in accordance with the guidelines of the International Diabetes Federation (IDF): Central obesity of $\geq$ 94 cm for males plus presence of at least two

of four other risk factors: Raised triglycerides (≥1.7 mmol/L for males), reduced HDL cholesterol (<1.03 mmol/L for males), raised blood pressure (systolic BP ≥ 130 mm/Hg or diastolic BP ≥85 mm Hg) and raised fastening plasma glucose (≥5.6 mmol/L) (Alberti, 2005). The data produced at T1 were used in paper 1 and T1 and T2 data were used in paper 2.

Interviews and observations (Paper 2)

Interviews with participants (face-to-face and by phone) were conducted during and after the first year of the interventions in order to gain in-depth knowledge on the seafarers' experiences and opinions of the health education- and structural interventions. Also interviews with non-participants were conducted to collect information on reasons for not participating in the interventions as well as their experience with the structural interventions carried out. In addition, participant observation was carried out for all types of interventions as outlined below. Field notes were produced during and after field observations. All interviews were taped and transcribed. The data produced were used mainly as background information in paper 2.

Qualitative data in % and N of total sample for male and female seafarers

	Observations consultations/courses	Interviews %	N
Health profile T1 & T2 Participants	18	23%	35
Individual exercise guidance	8	12%	9
Extra health check-ups	4	33%	9
Drop-outs between Health profile T1 and T2		19%	21
Cooking Course	2	57%	35
Smoking cessation	1	100%	9
Non-participants	1	15%	39
In total of all employees (N=630)		22%	139

Data analyses for paper 1 and paper 2

To describe health behaviors and health status indicators at T1 and T2, means, standard deviations as well as percentages were used. In paper 1, comparisons of behaviors at home versus at sea (physical activity and eating) were made with the help of Wilcoxon rank tests. Associations between occupational status and occupational setting with the various health criteria were tested with logistic regression analyses entering both covariates (place of occupation and rank) into the equation simultaneously and adjusting for age. Results are presented as Odds ratios (OR) with 95% confidence intervals (CI). A level of $p < .05$ was regarded as statistically significant. In paper 2, to describe and determine change in behaviors and health status indicators between baseline and follow-up, cross-tabulations and McNemar tests were used, matching pairs of subjects between the two periods of time. Results are presented as McNemar p-values. $P < .05$ was regarded as statistically significant. Associations between participation in the individual health education

intervention modules and the various health criteria were tested with hierarchical logistic regression analyses. One or where appropriate both interventions (individual physical training guidance and extra health check-up) were entered into the equation simultaneously after, in a first step, adjusting for the baseline of the respective criterion variable, age and rank (officers versus crew). Results are presented as Odds ratios (OR) with 95% confidence intervals (CI). A level of $p < .05$ was regarded as statistically significant. As the gender distribution was extremely asymmetric, i.e. there were only 17 female employees, all analyses were run for male participants only. All statistical analyses were performed using IBM SPSS version 19.

In paper 2, the transcribed interview material was managed by way of a content analysis approach based partly on a manual content analysis and partly on the N-Vivo 9 software program, which is described in more detail in paper 3.

Methods: Paper 3

Qualitative interviews

Semi structured group interviews (N=4) were conducted during two of the cooking courses, throughout the practical group tasks on day one and day two. The aim of the interviews was to gather information about participants' opinions of the course, the tasks at hand and to discuss their cooking experiences at sea. Semi-structured telephone interviews were conducted one year after completion of the course (N=35) based on an interview guide containing questions about personal background, such as position, length of occupation and daily occupational tasks, followed by questions about the course content and whether, and if so which changes to cooking had been made during the past year. Experiences of challenges during the transfer and maintenance phase were also asked for as well as the cooks' assessment of the support of the crew and management level to possible changes. All interviews were taped and afterwards transcribed.

Participant observation and field work

Participant observations were carried out during two of the cooking courses in order to gather information on the content of the program, and to observe how they were conducted and received by the participants. In addition, two field trips were conducted on ships from each company around the time of the cooking courses, with the opportunity to observe and experience the options and challenges related to the galley operation and to interview the crew. Field notes, pictures and transcribed interviews from the courses as well as field trips were part of the data production.

Standardized questionnaire

A standardized questionnaire covering questions on seafarers' self-perceived health, well-being, and health-related behaviors was sent out to all seagoing employees in the two shipping companies (N=630) at the end of 2007 (T1) and a follow-up (T2) was conducted at the end of 2008. The response rate was 60% of T1 participants. In order to assess changes in eating behavior among the crew, one question was asked for frequency of eating healthily: "Do you eat healthily (green, coarse and lean)?" Response options were: "5-7 days a week", "3-4 days a week", "1-2 days a week" and "less". For the purpose of data analysis, the response categories were merged into two groups: "3-7 days a week", "2 days a week or less".

The qualitative data used in paper 3:

Qualitative data material	**Total**
Structured telephone interviews with chefs/assistants	35
Semi-structured group interviews with chefs/assistants	4
Field work (notes, pictures, unstructured interviews)	
Cooking courses	2
Ship visits/voyaging	2

Data analyses of paper 3

A content analysis approach was used for the qualitative data material based partly on a manual content analysis and partly on the N-Vivo 9 software program. The latter program allows assembling and managing many different types of data (including pictures and field notes) and coding them according to themes relevant for the aim of the paper (E.g. "workplace", "experience during the cooking course", "experiences at the follow-up", "challenges") and subthemes (e.g. "cook/untrained cook", "shared knowledge with colleagues", "implementation of methods", "food at sea", "board wages"). However, not all information concerning these themes and subthemes were detected in the following search options due to alternative phrasing by the respondents. To ensure all relevant information was included from the material an additional manual content analysis was performed and these findings were added into N-vivo.

To describe and determine changes in self-report of eating behaviors between the baseline and follow-up, cross tabulations and McNemar tests were used, matching pairs of subjects between the two periods of time. The results are presented as McNemar p-values. A level of $p < .05$ was regarded as statistically significant.

Ethical considerations

According to The National Committee on Health Research Ethics (The Danish National Committee on Health Research Ethics, 2011), no ethical approval was required. However, the study design and procedures of data handling were reported to the Danish Data Protection Agency. Answering the questionnaire was voluntary as well as participating in the health profiling and interventions, except the cooking course, which was made mandatory after the first two courses. Interview respondents all gave prior consent to the interview and the recording of it on tape as part of the study. The two shipping companies contributed in the research process by way of two-yearly status meetings, at which experiences seen from management level as well as the employee level were discussed in order to facilitate a smooth implementation process. The companies were also provided with several unpublished status presentations and reports relevant for practice work with implementing the intervention. All respondent data have been anonymized in the study to avoid identification.

Results

This chapter presents the PhD results based on the main findings of the 3 papers. The results will be presented separately for each paper and structured according to the research questions formulated in the three papers.

Paper 1:

Prevalence of lifestyle risk factors related to rank and workplace setting

Smoking

44% of the seafarers stated that they were daily smokers. Within this group of daily smokers 6% were light smokers (1-5 cigarettes), another 8% and 15% each smoked between 6-10 and 11-15 cigarettes a day, while the large majority, i.e. 71%, smoked more than 15 cigarettes per day, and thus could be considered heavy smokers. The share of daily smokers did not differ between the two companies (45% vs. 42%), however, the share of heavy smokers was considerably higher in the supply and rescue company where 78% of the smokers reported to smoke more than 15 cigarettes daily compared to 53% in the cargo shipping company. Looking at occupational status, the results showed that non-officers were significantly more likely than officers to be daily smokers (see table 2 below).

Table 2: Demographic differences in smoking and exercise among seafarers

		Smoking Status		Frequency of exercise at home		Frequency of exercise at sea		Physical Fitness
		(yes = 44%)		(Thrice a week or more = 24%)		(Thrice a week or more = 32%)		(High = 30%)
		n = 335		*n* = 330		*n* = 332		*n* = 221
	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)
Age[1]		0.98 (0.96-1.00)		1.04 (1.01-1.06)		1.01 (0.98-1.03)		1.00 (0.98-1.03)
Shipping Company								
Cargo	42	1.00	18	1.00	19	1.00	33	1.00
Rescue and Support	45	1.03 (0.62-1.71)	27	1.55 (0.82-2.93)	37	2.64 (1.41-4.92)	29	0.87 (0.45-1.69)
Rank								
Officers	36	1.00	23	1.00	32	1.00	33	1.00
Non-officers	56	2.20 (1.39-3.48)	25	1.17 (0.68-1.99)	30	0.79 (0.48-1.31)	27	0.79 (0.43-1.44)

[1] cont. variable, ascending.

Physical activity

About one third of the respondents reported having a largely sedentary occupation, another third that they had a job mostly requiring standing and/or walking, while the last third described their job as involving standing, walking and some lifting or weight bearing. Only a very small minority of about 1% said their job required very hard physical efforts. As for leisure time exercise, 32% claimed to do fitness training three

times a week or more at sea versus only 24% at home, however this difference was not significant (Z = -1.447; p = .148). In both settings at home and at sea, nearly one half (49%) exercised less than once a week or never. In the multivariable analysis, frequency of exercise at sea differed between employees in the two shipping companies, revealing a considerably higher chance for regular activity (thrice a week or more) within the rescue and supply company. Officers were no more likely to be physically active than non-officers (see table 2).

Eating behavior

More seafarers reported a high frequency of overeating (Z = -2.56; p = .01) as well as consuming sweets, cake and sugared sodas (47% vs. 40% for overeating; 52% vs. 40% for sweets and sugared sodas) on board compared to the home setting (Z = -4.65; p = .000). There were no significant differences between professional status groups or work places.

Prevalence of lifestyle-related risk factors related to rank and work setting

Fitness score

Physical fitness testing revealed that one third had low physical fitness while 37% fell in the middle range and only 30% were classified as having high physical fitness. Officers and non-officers did not differ in that respect. Neither was there any difference between the two shipping companies.

Weight, waist circumference and metabolic syndrome

Mean body mass index was M = 27.52 (SD = 4.06). The distribution further showed that only 25% of the seafarers were of normal weight, i.e. had a BMI of under 25, while half (50%) were overweight (BMI between 24.9 and 29.9), and one fourth were obese (BMI ≥ 30.0). Waist circumference with increased risk of metabolic complications (≥94cm) was registered for 2/3 of the participants, and more than one third of them (37%) were classified as having a waist circumference ≥102 cm, which entails a substantially increased risk of metabolic complications (see table 3).

Table 3: Demographic differences in eating behaviour at home and at sea

	Frequency of overeating 3 days a week or more				Frequency of eating sugared products 3 days a week or more				Obesity		High waist circumference	
	At home (yes = 40%) *n*= 325		At sea (yes = 47%) *n* = 318		At home (yes = 40%) *n* = 327		At sea (yes = 52%) *n* = 321		(≥30 = 25%) *n*= 235		(≥94cm = 66%) *n* = 236	
	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)
Age*		1.01 (0.98-1.03)		1.00 (0.98-1.02)		0.96 (0.94-0.99)		0.97 (0.95-1.00)		1.04 (1.01-1.07)		1.07 (1.04-1.10)
Shipping Company												
Cargo	43	1.00	47	1.00	43	1.00	53	1.00	27	1.00	77	1.00
Rescue and support	40	0.90 (0.54-1.51)	47	1.01 (0.61-1.67)	39	0.86 (0.51-1.45)	52	0.96 (0.58-1.60)	24	0.89 (0.47-1.68)	62	0.38 (0.19-0.77)
Rank												
Officers	44	1.00	51	1.00	38	1.00	50	1.00	26	1.00	67	1.00
Non-officers	35	0.68 (0.43-1.10)	41	0.67 (0.42-1.07)	43	1.09 (0.67 - 1.75)	56	1.18 (0.74-1.88)	26	1.09 (0.60-1.98)	65	1.21 (0.66-2.22)

* cont. variable (ascending)

As can be seen in table 3, both indicators of obesity, i.e. a body mass index of 30 and above and a waist circumference of 94 and above, were independent of rank. However, a high waist circumference was more common among the employees of the cargo company.

Central obesity (waist circumference ≥ 94 cm) was found among a majority (66%) of the seafarers and is considered a significant factor for metabolic syndrome when at least two additional risk factors are present, which was the case for almost three thirds of this subgroup of seafarers, as presented in table 4. The findings further showed that for a majority of 62% within this subgroup raised triglycerides were measured, and almost half (48%) had high blood pressure.

Table 4: Associations of work place and occupational status with various risk factors for metabolic syndrome in the subgroup of those with waist circumference ≥94cm

	High blood pressure (SBP >130 and DPB >85 = 48%) *n* = 136		High triglycerides (>1.7mmol/L = 62%) *n* = 141		Low HDL cholesterol (<1.03mmol/L = 38%) *n* = 140		High glucose level (>5.6mmol/L = 71%) *n* = 134		≥2 Risk factors = 73% *n*= 125	
	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)	%	OR (CI)
Age*	7	1.05 (1.01-1.09)		0.99 (0.96-1.03)		0.97 (0.93-1.00)		1.03 (0.99-1.08)		1.00 (0.96-1.04)
Shipping Company										
Cargo	62	1.00	67	1.00	33	1.00	77	1.00	80	1.00
Rescue & supply	40	0.39 (0.18-0.83)	58	0.59 (0.28-1.24)	41	1.32 (0.63-2.79)	68	0.66 (0.29-1.49)	69	0.51 (0.21-1.23)
Rank										
Officers	47	1.00	57	1.00	33	1.00	69	1.00	72	1.00
Non-officers	51	1.40 (0.66-2.96)	70	1.90 (0.91-3.98)	43	1.50 (0.73-3.09)	75	1.44 (0.64-3.22)	77	1.47 (0.62-3.51)

* cont. variable (ascending)

Paper 2: Results

Changes in health behaviors and health indicators from T1 to T2

Table 1 shows the percentages for socio-demographic characteristics as well as prevalence rates for the different health/health behavior indicators at T1 and T2 including the drop-outs. Table 2 presents prevalence rates only for the subgroup of those who provided valid data at T1 and T2.

Smoking

The overall percentage of smokers in the study sample decreased from 40% to 35% between T1 and T2, which was non-significant (see table 2). When participants versus non participants in the smoking cessation course were compared, a significant effect for participation was found (see table 3). Thirty-three percent of the participants in the smoking cessation intervention had quit smoking at T2 compared to only eight percent of the seafarers who had not participated in the intervention. However, this effect was based on very small absolute numbers in the group of participants (see above).

Exercise activity and fitness score

As for the target of reaching officially recommended levels of exercise activity (3 times and more a week) only slight increases of 2% (at home) and 3% (at sea) from T1 to T2 were found for the overall group. To additionally check whether changes below that level of high activity occurred, analyses were also performed for moving from being largely inactive (<1 times a week) to being active more than once a week. In this case 4% less were inactive at home and 5% less at sea, however, this was again not significant (see table 2). Neither was there any significant association between participating in the exercise counseling or receiving an extra health check and the level of exercise activity or inactivity at follow-up (Table 4). However, the share of seafarers with a high fitness score increased significantly from 34% at T1 to 50% at T2 (see table 2), although no significant relation to participating in the exercise guidance or the extra health profile was found (see table 4).

Dietary behavior

There was no significant reduction in the self-reported tendency to overeat at sea or at home between T1 and T2 (table 2). However, for both the sea and the home setting the percentage of study participants reporting frequent intake of high-sugar products, such as sweets, cake or sodas, had decreased significantly. Logistic regression analysis indicated that this change in eating behavior was not influenced by participation in the extra health profile (table 5).

Waist circumference and metabolic syndrome

The percentage of those with high waist circumference had decreased by 5% from 71% at T1 to 66% at T2. This was, however, only a non-significant trend. For metabolic syndrome, on the other hand, there was a significant decrease from 57% to 48% of affected seafarers between T1 and T2 (see table 2). In none of these cases was there any significant association between participating in the exercise guidance or the extra health profile interventions and the respective outcomes (table 6).

Table 1: Baseline, follow-up and drop-out characteristics of male seafarers in two different shipping companies obtained through questionnaires and health examinations

Questionnaire data	**Total**			**Company 1**			**Company 2**		
	Baseline questionnaire T1	**Follow-up questionnaire T2**	**Drop-out**	**Baseline questionnaire T1**	**Follow-up questionnaire T2**	**Drop-out**	**Baseline questionnaire T1**	**Follow-up questionnaire T2**	**Drop-out**
	(N=343)	**(N=209)**	**(N=134)**	**(N=89)**	**(N=52)**	**(N=37)**	**(N=254)**	**(N=157)**	**(N=97)**
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Age (M/SD)	42 (10.46)	44 (10.30)	41 (10.40)	41 (10.71)	42 (10.52)	40 (11.10)	43 (10.33)	45 (10.41)	41 (10.16)
Men	343 (95%)	209 (96%)	134 (94%)	89 (85%)	52 (88%)	37 (80%)	254 (100%)	157 (99%)	97 (100%)
Officer rank	214 (63%)	148 (71%)	77 (59%)	65 (75%)	42 (81%)	24 (69%)	149 (59%)	106 (68%)	53 (56%)
Smokers	144 (44%)	75 (37%)	64 (49%)	36 (42%)	15 (29%)	16 (43%)	108 (45%)	60 (39%)	48 (52%)
Frequency of exercise level ≥ 3 times weekly at home	82 (24%)	57 (28%)	30 (23%)	16 (18%)	12 (23%)	6 (17%)	66 (27%)	45 (30%)	24 (25%)
Frequency of exercise level ≥ 3 times weekly at sea	108 (32%)	73 (35%)	42 (32%)	16 (19%)	13 (25%)	6 (17%)	92 (37%)	60 (39%)	36 (37%)
Frequency of exercise level < 1 time active weekly or never at home	165 (49%)	93 (46%)	64 (50%)	47 (54%)	28 (54%)	18 (50%)	118 (48%)	65 (43%)	46 (50%)
Frequency of exercise level < 1 time active weekly or never at sea	164 (49%)	83 (40%)	72 (55%)	50 (58%)	27 (52%)	22 (63%)	114 (45%)	56 (36%)	50 (52%)
Frequency of overeating ≥ 3 days weekly at home	133 (40%)	79 (38%)	49 (39%)	37 (43%)	19 (37%)	15 (42%)	96 (40%)	60 (39%)	34 (37%)
Frequency of overeating ≥ 3 days weekly at sea	152 (47%)	86 (42%)	64 (51%)	41 (47%)	25 (49%)	18 (50%)	111 (47%)	61 (40%)	46 (51%)
Frequency of eating high-sugar products ≥ 3 days weekly at home	132 (40%)	61 (30%)	49 (38%)	37 (43%)	14 (27%)	15 (42%)	95 (39%)	47 (31%)	34 (37%)
Frequency of eating high-sugar products ≥ 3 days weekly at sea	170 (52%)	86 (43%)	65 (50%)	46 (53%)	23 (44%)	19 (53%)	124 (52%)	63 (42%)	45 (49%)
Health profile data	**Total**			**Company 1**			**Company 2**		
	Baseline Health profile T1	**Follow-up Health profile T2**	**Drop-out**	**Baseline Health profile T1**	**Follow-up Health profile T2**	**Drop-out**	**Baseline Health profile T1**	**Follow-up Health profile T2**	**Drop-out**
	(N=257)	**(N=153)**	**(N=104)**	**(N=75)**	**(N=49)**	**(N=26)**	**(N=182)**	**(N=104)**	**(N=78)**
High physical fitness (age and gender standardized VO2submax test)	69 (30%)	71 (50%)	24 (26%)	19 (33%)	23 (52%)	6 (33%)	50 (29%)	48 (49%)	11 (24%)
Obesity (≥ BMI 30)	64 (25%)	42 (28%)	25 (24%)	20 (27%)	14 (29%)	10 (39%)	44 (24%)	28 (27%)	15 (20%)
High waist circumference (wc), male ≥94cm	163 (66%)	96 (65%)	58 (59%)	52 (75%)	33 (72%)	16 (70%)	111 (62%)	63 (63%)	42 (55%)
Metabolic syndrome (wc ≥94cm and 2 further risk factors)	123 (50%)	56 (37%)	44 (42%)	41 (55%)	24 (49%)	12 (46%)	81 (45%)	32 (31%)	32 (41%)

Table 2: Prevalence of life-style behaviors and risk factors at T1 and T2

	Health Behaviors and Health Indicators	T1 N (%)	T2 N (%)	p
	Smokers	79 (40%)	74 (38%)	0,300
At home	Physical exercise ≥ 3 times weekly	50 (25%)	53 (27%)	0,749
At sea	Physical exercise ≥ 3 times weekly	65 (32%)	72 (35%)	0,435
At home	Physical exercise < 1 weekly or never	100 (50%)	93 (46%)	0,390
At sea	Physical exercise < 1 weekly or never	92 (45%)	82 (40%)	0,250
At home	Overeating ≥ 3 times weekly	83 (42%)	78 (39%)	0,576
At sea	Overeating ≥ 3 times weekly	85 (45%)	83 (43%)	0,883
At home	Intake of high-sugar products ≥ 3 times weekly	81 (41%)	60 (30%)	**0,004**
At sea	Intake of high-sugar products ≥ 3 times weekly	102 (53%)	84 (44%)	**0,022**
	High fitness score	45 (34%)	67 (51%)	**0,000**
	High waist circumference ≥94 cm	102 (71%)	93 (65%)	0,064
	Metabolic syndrome	79 (57%)	66 (48%)	**0,029**

Table 3: Intervention participation and smoking

	Smoking at T2 *N = 73*	
	OR	(CI)
Age[1]	0.96	(0.90-1.03)
Rank[2]	0.33	(0.06-1.74)
Intervention		
Smoking cessation course[3]	0.13	(0.02-0.81)

[1]Cont. variable, ascending; [2]Officers = 1, Non-officers=2; [3]no=0, yes=1;

Table 4: Intervention participation and high exercise level/ high physical fitness score at T2

	High exercise level at home (T2) (Thrice a week or more) *N = 146*		High exercise level at sea (T2) (Thrice a week or more) *N = 149*		High physical fitness score(T2) *N = 126*	
	OR	(CI)	OR	(CI)	OR	(CI)
High physical exercise level T1[1]	10.50	(4.11-26.8)	3.56	(1.68-7.58)		
High physical fitness score T1[2]					7.34	(2.97-18.17)
Age[3]	1.02	(0.98-1.06)	1.05	(1.01-1.09)	1.01	(0.97-1.04)
Rank[4]	0.44	(0.16-1.18)	0.47	(0.21-1.07)	0.50	(0.21-1.16)
Interventions						
Physical exercise guidance[5]	1.10	(0.43-2.83)	1.06	(0.47-2.38)	1.26	(0.54-2.93)
Extra health check-up[6]	1.39	(0.44-4.36)	1.10	(0.40-3.06)	0.60	(0.22-1.65)

[1] ≤2 times a week=0, ≥3 time a week=1; [2] low=0, high=1; [3]Cont. variable, ascending; [4]Officers = 1, Non-officers=2; [5] no=0; yes=1; [6] no=0, yes=1

Table 5: Intervention participation and dietary behavior at T2

	Overeating at home (T2) (≥Three days a week) *N= 155*		Overeating at sea (T2) (≥Three days a week) *N = 147*		Eating high-sugar products at home (T2) (≥Three days a week) *N= 153*		Eating high-sugar products at sea (T2) (≥Three days a week) N= 147	
	OR	(CI)	OR	(CI)	OR	(CI)	OR	(CI)
Overeating T1[1]	6.63	(3.23-13.61)	8.10	(3.85-17.02)				
Eating high-sugar products T1[1]					8.77	(3.81-20.20)	6.69	(3.11-14.39)
Age[2]	1.01	(0.97-1.04)	1.01	(0.97-1.05)	0.97	(0.94-1.01)	0.97	(0.93-1.00)
Rank[3]	0.75	(0.35-1.62)	0.77	(0.35-1.68)	0.38	(0.24-1.36)	1.13	(0.52-2.44)
Interventions								
Extra health check-up[4]	0.63	(0.22-1.80)	1.06	(0.36-3.10)	1.50	(0.52-4.30)	1.11	(0.40-3.09)

[1] ≤2 days a week=0, ≥3 days a week=1; [2]Cont. variable, ascending; [3]Officers = 1, Non-officers=2; [4]No=0, yes=1; [4]No=0, yes=1

Table 6: Intervention participation and metabolic syndrome at T2

	Metabolic syndrome T2 *N = 131*	
	OR	(CI)
Metabolic syndrome T1[1]	14.79	(5.88-37.19)
Age[2]	1.00	(0.96-1.04)
Rank[3]	1.12	(0.47-2.70)
Interventions		
Physical exercise guidance[4]	0.85	(0.35-2.04)
Extra health check-up[5]	0.52	(0.18-1.53)

[1] No=0, yes=1, [2]Cont. variable, ascending; [3]Officers = 1, Non-officers=2; [4]No=0; yes=1; [5] No=1, yes=2

Implementation of the intervention components and participant reach

As for the *smoking cessation course*, about half (49%; N = 70) of all employees who smoked indicated that they were interested in a cessation course at T1. Of this group only 14, that is 18% of the motivated subgroup, actually joined one of the two offered courses. Furthermore, only one of these courses actually ran both of the initially planned group meetings, while the other course had to cancel the second meeting due to an inability to find a commonly acceptable date. According to the qualitative interviews with non-participants of the course the low attendance rate was due mainly to logistical issues. Among these were foremost conflicting sailing schedules, which meant it was impossible to find meeting dates fitting the schedules of all crew members from different ships. Another often mentioned issue was that seafarers' home bases were geographically dispersed, and that family obligations during the home period prevented long transportation times back to course localities in port.

Thirty percent (N=76) of those eligible (all who took part in HPT1) accepted the offer to receive *exercise guidance* and of these 37% (N=28) also received the 3-months follow-up guidance. Responses from interviews with non-participants indicated communication problems since some did not recall being

offered the intervention at all. Other reasons given were mainly either that participants felt healthy/and, or that they were already physically active and had sufficient knowledge of how to use the fitness facilities.

The target group for the *extra health check-ups* consisted of 50 seafarers who had been randomly selected from the subgroup of those who had received the first health profile. Only 27 of these (54%) took up the offer. Reasons given for non-participation were mainly related to logistics such as conflicting sailing schedules and – during home leave – distances too far from the locations where the physical exams were scheduled. If the location of the office was thus not in a convenient distance of the seafarers whereabouts at the given date of the check-up, they were inclined to reject participation.

The *cooking course*, which was announced as mandatory by the companies, was attended by 49 ship cooks, which equals 75% of all cooks in the two companies. Reasons for non-participation were again mainly conflicting sailing schedules.

An *upgrade of fitness room facilities* onboard the ships was requested by 64% of the participating ships (N = 20), and in the individual interviews with seafarers from the different ships 14 (70%) reported that improvements had been made.

Paper 3: Results

Improvements of seafarers' diet based on a healthy cooking course intervention

The first aim of the cooking course was to provide the opportunity to share knowledge and experience with cooks from another company and with different qualifications. This attempt was perceived as positive by all the respondents from company 2, and the general opinion is reflected in the quote below:

> *"The mixed group was obviously something you learned from, working with a professional chef. I thought it was the best that day."* (Untrained cook, company 2)

A majority of the chefs from company 1, however, were surprised about the limited training of the untrained cooks in company 2, which was observed during two courses and shown in following statements:

> "*I was very surprised. I was not aware that there were some seamen who ran around and had galley service a week at a time. It surprised me."* (Chef, company 1)

> *"We had to spend a lot of time explaining to them [the untrained cooks] what we were talking about. For me this included having to explain to a man the difference between beetroot and red cabbage."* (Chef, company 1)

For the chefs in company 1, the opportunity to meet up with colleagues from their own company was perceived as highly positive:

> *"They* [the management level] *should make sure to arrange more things like this where we are joint together somewhere and get to know each other and get inspiration from each other. We are by ourselves out there when we are working at sea, and it's rare that we get to talk to each other [the cooks], and it's also rare that the ships meet in port and are together."* (Chef, company 1)

The second aim concerned the usefulness of the information provided by the health consultants. This information included the official recommendations for healthy and nutritious diet and tips on how to implement these guidelines in their daily cooking. The information was perceived as useful but was not really new to the chefs. Untrained cooks, however, tended to perceive the tips as new and useful but also as difficult to fully understand. This tendency was observed during the courses and also reflected in the statements below from two untrained cooks:

> *"It was a bit difficult to follow the information when you are not a chef."* (Untrained cook, company 2)

> *"The course could have lasted two days more, so there was time to get more into the things with the diet. Half of us are ordinary seamen and when we cook, we peel 10 pounds of potatoes and make beef..... We need to know how new things are done. We may only have experience from seeing how our mother did things. We are self-taught to stand in a galley. It's something you have to do as*

ordinary seaman, it is not voluntary. You are frowned upon if you can't cook onboard a ship. But it would help with more training if the course was extended a couple of days". (Untrained cook, company 2)

A third aim of the cooking course was to become familiar with the usage of the maritime cookbook "Food at Sea". The interviews showed that all cooks from company 1 were familiar with this book, having used it for inspiration and tried out different recipes. Most cooks in company 2, however, had little or no experience using the cookbook. They perceived it as difficult to understand, unsuitable for small crews, producing too fancy food and requiring too many ingredients which they did not have access to:

"….we might seek inspiration in it from time to time, but usually that's not what we do. If we can't remember how to do things we use "Miss Jensen [ABC cookbook (Jensen, 2010)]". (Untrained cook, company 2)

The last aim of the cooking course was to create awareness of communication strategies in order to promote healthy diet onboard the ships. The cooks, however, found this task difficult, since they perceived factors like traditions, age and hierarchy to be barriers for a positive reception by the crew:

"They [seafarers] *are quite difficult to convince. To convince some hardworking seafarers who are out in all kinds of weather for 12 hours daily, they are quite difficult to move. You may move them a little at a time, not too much and do not remove it all* [the known dishes] *at once, then they will protest. I know the people I work with very well; if introduced* [healthy diet] *a little at a time, then suddenly it will become a habit."* (Chef, company 1).

"Those below 35 years of age are always super excited about it [healthy diet] *whereas those who are older have to be worked on a little. Some of them are okay and some are not okay with it and need more time to get the positive idea of things. But most are reasonably open to changes as long as you do not make it appear too healthy. It may very well be healthy, but it should not appear too obvious, as you will lose the older crew members".* (Chef, company 1)

"It can be difficult to change his [the captain' s] *habits. If he has been accustomed to getting his salami once a day, you do not beat him on the head and tell him to eat more vegetables ... It* [changes] *can be difficult in practice..... It's hard when you're on a ship, as there is always an alpha male onboard yelling his head off……complaining, and this of course creates limitations in promoting the healthy diet ... but if skipper is in favour, it's easier to make changes. "*(Untrained cook, company 2)

Changes at the 1-year follow-up

Follow-up interviews in both companies revealed improvements in applying the knowledge from the course one year after. In particular, the trained and untrained cooks from company 2 had served more vegetables and fruits, and applied fat and sugar reducing tips from the course:

"I changed some daily routines after the course e.g. that there are other things to life than crème. I have this printed on my forehead every time I find myself standing with the heavy crème. Sometimes it goes back in the fridge, and I use low fat milk instead. People say wauuu, Ihhh and ohhhh anyway. There are several things from the course that I use..... I think I can say that I use more vegetables now than before, also frozen. "(Untrained cook, Company 2)

"We have found out that if the fruit is cut into small delicious pieces, people take them. If they themselves have to fumble with it and peel it themselves, etc. they do not bother." (Untrained cook, company 2).

"….I have generally reduced fat in my cooking at sea and at home, and also sugar." (Untrained cook, company 2)

"We drink more low-fat milk now that we did before .... and we buy whole grain buns instead of regular bread rolls". (Untrained cook, company 2)

"We have demolished sodas. Before you could just go and take them. It's empty calories and we do not need it". (Untrained cook, company 2)

"Engaging myself with a recipe that I have no prior experience with, would not be something I would have done prior to the course, but since the course I have done this. I've gained more courage to try out new things like that". (Untrained cook, company 2)

Challenges of implementing improvements in practice on board

Despite positive changes in the reduction of fat and sugar, the untrained cooks in company 2 did not think they had sufficient time on a daily basis to practice healthier cooking and thus improve their cooking skills, as reflected in the quote below:

"Here [company 2]*, we're not all trained chefs. We are on the deck, and at the same time we have the job in the galley* [cooking]*. I will say this that if you are to practice this health trend then you can't go around doing work with the containers, sail in the* [rescue] *boats, and service other companies while at the same time having to cook. This is what you do in this company."* (Untrained cook, company 2)

Challenges for the untrained cooks concerning the supply system were also highlighted, as they lacked sufficient experience with the system and did not have an overview of the necessary stocking of goods needed during a trip. This overview is important, as the frequency of supply delivery varies, and storage space is limited. This was observed during the fieldwork in company 2 and shown in the following statements:

"It's difficult for the unskilled cooks and it is equally difficult for many of the skippers, as they do not have a clue. They just send off the order and then it suddenly turns out that it is completely wrong what they deliver." (Chef, company 2)

"…. this supply list that we order from, it's a bit messy. If you are not familiar with it, you can easily get into trouble ". (Untrained cook, company 2)

"Small ships like ours, where we have 3 small chest freezers and 2 refrigerators, the space is limited. We can't keep fruits and vegetables fresh for long.....those who do not get supplies every 14 days have a problem with getting enough fruits and vegetables". (Untrained cook, company 2)

Another challenge concerning the supplies was selection of products from the ordering catalogues. In the catalogues that were available to cooks some products were not available or could only be ordered in quantities that were not suitable for a small crew:

"Sometimes I feel limited by the sea area in which I operate, in regards to practicing healthy living. For example, if I have to have vegetables from Denmark, then it has to be shipped up as goods to Greenland. " (Cook, company 1)

"If you have special [product] *requests, this is also possible to order. The options are there, but just not outright available in the order list, which we have access to from the Company. For instance if we need such a thing as spices, the quantity you have to order, compared to what we are able to use and store, does not add up".* (Chef, company 2)

"It's hard with all the ingredients [in the cookbook 'Food at sea'] *as we do not have them, and it's not all that we can get. When you sail out* [onboard the ship]*, it's the one* [Cook] *before you, who – for the most times - ordered the food…. You are left with what is there ... it can be difficult to make changes".* (Untrained cook, company 2)

The use of board wages in company 2 affected the food budget of some of the ships. Saved board-wages thus meant an increased pay-out sum, which was prioritized by some crews. However, for the crews sailing in especially the Norwegian sector, the food prices were higher compared to Denmark, and they had difficulties staying within the food budget of the board wages.

"We pay our own food, so we also constantly have to keep an eye on our expenses. We get 83.30 kr. a day and then it depends from ship to ship how well you can manage to keep the cost down……our ship is at 65 kr. per day, which is then withdrawn from our salary". (Chef, company 2)

"It's fine that everyone wants us to live healthy, but if it costs us too much money, then we do not live as healthy. That's probably the truth." (Untrained cook, company 2)

"We discuss it [board wages] *onboard. If the food becomes too expensive, then the food budget is raised. However, they are not entirely satisfied with that. I feel it's a limitation that you must adhere to a certain amount per day as fruits and vegetables are incredibly expensive in Norway. Those who remained in the Danish Sector have access to Danish fruit and things like that, which was cheaper, and also they could get it more often compared to us who are up here in the Norwegian sector."* (Chef, company 2)

A final challenge mentioned by the cooks in both companies was the opinion of the captain. If the captain is not in favour of the changes, it will be a major challenge for the cook to implement healthier cooking on-board the ship.

> *"If the captain doesn't approve of the diet, it doesn't matter what the rest thinks; it will not be served again."* (Chef, company 1)

> *"I tried serving those celery steaks, but the captain and the crew asked if I had fallen down from the moon, and then I was sent back in the galley to make some real food".* (Untrained cook, company 2)

Changes in the seafarers` eating behavior at 1-year follow-up

Table 2 shows a significant change in the seafarers' self-reported eating behavior from T1 to T2, as a greater number claimed to eat healthily on more days of the week at T2 (diet of green, high-fibre and lean products). Fifty-eight percent of the respondents who claimed to eat healthily only 2 days a week or less (N=42) at T1 thus improved their eating habits, eating healthily 3-7 days a week at T2.

Table 2. McNemar test for changes between T1 and T2 for eating behavior at sea

	Questionnaire T2			
Questionnaire T1	Eating healthily on 2 days of the week or less	Eating healthily on 3-7 days of the week	Total	P- value
Eating healthily * on 2 days of the week or less	31 (43%)	42 (57%)	73 (100%)	
Eating healthily * on 3-7 days of the week	9 (8%)	111(92%)	120 (100%)	
Total	40 (21%)	153 (79%)	193 (100%)	0,000

* Eating green, high-fibre and lean products

Discussion

As a starting point the main findings of this PhD study will be presented followed by a discussion structured according to the following points:

- Workplace related challenges
- Challenges for health promotion intervention in the maritime workplace
    - Changes in health behavior and health indicators
    - Special challenges: Healthy cooking
- Structural intervention approach in the maritime workplace setting

Finally the strengths and limitations will be considered and reflections provided on the challenges of doing practice-based research.

Main study findings

The main results of the baseline data collection (paper 1) suggested that seafaring might indeed be a risk to health beyond the well-established threats created by accidents and limited access to acute medical care. Risk factors such as smoking, obesity, physical inactivity as well as metabolic syndrome were up to 100% more prevalent among seafarers than among the general male working-age population. When taking into consideration a "healthy worker effect" these results are even more alarming as this suggests the present findings are based on a positive selection. The results of paper 1 highlighted a definite need for health promotion initiatives to modify the risk potential of seafaring work places and enable and support more healthy lifestyles.

The follow-up study (Paper 2) identified positive changes in some of the lifestyle risk behavior and lifestyle related risk factors, which might suggest that the interventions had an effect. However, none of the changes could be linked to the health education interventions. Positive effects may have come from the structural interventions which, however, due to design limitations, remain speculative. A definite finding of the study was that implementing health promotion interventions in the maritime workplace setting is a challenging task. Structural restrictions on achieving appropriate reach of the seafarers was a clear barrier which point to the need for easily accessible and specifically tailored health promotion intervention taking into account the special conditions of the maritime workplace setting.

The main findings of the cooking intervention study suggest (Paper 3) that it is possible to promote a nutritious and healthy diet at sea by way of health education provided to the professional group acting as gatekeepers of nutrition on ships: the cooks. However, structural barriers within the maritime setting

prevent getting the full benefit from this learning process, which calls for additional attention from the management level of the maritime industry. If pervasive and sustainable change is to be achieved, these structures need also to be included as targets of health promotion.

Workplace related challenges

Seafaring is among the occupations with the highest standardized incidence rates for all cancers combined (Pukkala *et al*., 2009). This might be due to various factors such as exposure to chemicals and sunlight but also life-style risk behaviors such as smoking, alcohol consumption and diet (Pukkala et al., 2009; Oldenburg et al., 2010). There are only few existing studies on cardiovascular disease-incidence and mortality in seafarers. However, compared to land-based occupations no major differences have been reported, beyond mortality effects due to less efficient emergency treatment for myocardial infarction (Nystrom et al., 1990; Brandt et al., 1994; Jaremin & Kotulak, 2003). A recent study based on registry data from the United Kingdom, however, suggested that a closer look might be warranted. While the data revealed a lower rate of cardiovascular disease (CVD) for those on board, seafarers ashore actually had higher rates than the general population (Roberts & Jaremin, 2010). A difference which the authors attributed to a healthy worker-effect as the mandatory two-yearly health check for seafarers is likely to contribute to a de-selection of diseased employees from the active work-force. Similar CVD rates in the general population workforce and in seafarers do therefore not necessarily imply that seafarers are not at higher risk. Recent studies from Poland, France, Norway and Germany have indeed reported that cardiovascular risk factors such as high blood pressure, high triglycerides, diabetes and obesity as well as behavioral risk factors such as smoking and physical inactivity are highly prevalent in seafarers (Fort et al., 2009; Geving et al., 2007; Oldenburg et al., 2010; Filikowski et al., 2003; Oldenburg et al., 2008). However, while different occupations within seafaring might share many features which in general set them apart from occupations on land, there are also many crucial differences within the seafaring business due to, for instance, type of vessels, such as cargo and container ships, tankers, coasters, passenger ships etc. and the work demands they involve as well as more specific physical and social environments in terms of availability of leisure time facilities including exercise space and equipment, food provisions or smoking regulations. These specific settings are likely to provide dissimilar opportunities or discouragements for healthy or unhealthy lifestyles and thus might create important variance in health risks within the seafaring occupation.

SMOKING

The baseline study showed a high prevalence of daily (44%) and heavy (31%) smokers among the seafarers in this study when compared to the general male adult Danish population where only 32% smoked daily, and 19% were heavy daily smokers (Ekholm *et al*., 2006). Yet, it is also notable that in line with the general

decrease of smoking rates in many Western countries during the last 20 years the subpopulation of seafarers also seems to have reduced smoking. While the present study is cross-sectional and does not provide time trend data, comparisons with studies from the early nineties show that the reported rates for daily smokers among seafarers were 23% higher than in the current study, and 12% more were heavy smokers (Hansen *et al*., 1994).

Non-officers were significantly more likely than officers to be daily smokers. This is in line with findings from population studies in Western countries, where the proportion of daily smokers as well as heavy smokers is usually lower among the higher-educated than the less-educated population groups which can mainly be explained in terms of different social/subcultural norms and attitudes which make smoking more or less acceptable, different levels of knowledge about health consequences of smoking as well as differences in experience of stress and in choice of coping strategies (Giskes *et al*., 2005; Huisman *et al*., 2005). The differences in intensity of smoking between employees of the two companies, i.e. the higher number of cigarettes smoked daily in the rescue and support company might partly be explained by a considerably higher amount of "unstructured work time", as main parts of the work time consist of "staying alert" which provides employees with plenty of time to e.g. smoke.

PHYSICAL ACTIVITY

A majority of the respondents held jobs which were largely sedentary or required only little physical activity, whereas a job demanding moderate to hard physical efforts was reported only by about one third of the seafarers. These results are almost identical with those for the general Danish adult male population (Ekholm *et al*., 2006). Contrary to the traditional image, seafaring has become a physically undemanding job for many, which to a large degree is due to factors like better equipment, particularly automation of many work routines on-board the ships as well as during port dockings.

High frequency (more than three times a week) of physical activity during leisure time was reported by only about one third of respondents for the work setting and only one fourth for the at home situation, which was largely in line with figures reported for the general Danish male populations (27%) (Ekholm *et al*., 2006). A closer look, however, also revealed that only 13% of the general male population described their leisure time activity level as being mainly sedentary compared to 21% and 22% of the seafarers who reported never to exercise at sea or at home. This level of exercise is clearly below the Danish National Board of Health recommendation of at least twice weekly high intensity exercise of 20 to 30 minutes.

A Norwegian study on seafarers' physical activity (Geving *et al*., 2007) found a similar degree of on-board inactivity (20%), but a lower degree of inactivity for the home setting with only 5% being inactive at home. This difference, however, might be explained by a difference in measurement, as the Norwegian study included exercise as well as physical activity around the house in their assessment. In both studies, lack of motivation due to poor weather conditions at sea or lack of time were the main reasons cited for not being physically active at sea.

While there were no differences between officers and non-officers with regard to physical activity levels, the study revealed a difference between the work places as more seafarers from the rescue and supply company were found to exercise at sea. A major reason for these varying levels of exercise might be that at the time of the survey the supply and rescue company had arranged a competition between their ships, "Tour de North Sea" - doing most kilometres on fitness bikes within a certain time period - which is likely to have hiked up exercise rates. Variance in training facilities is not likely to be a reason as the training space and equipment offered in the cargo company (except for 1 ship) were equivalent to or even larger and better placed than in the supply and rescue company. Nevertheless, the physical environment might have played a role insofar the supply and rescue company was operating mainly on rebuilt fishing boats which provided only limited space to move around. Together with the already mentioned relatively unstructured work time, this sense of confinement might have made the on-board exercise room with treadmill and exercise bike seem more appealing. Another factor might have been a desire of the rescue personnel to maintain the image of being physically fit and strong – a characteristic, which initially, when they had started out on their jobs, had been a professional requirement and selection criterion.

EATING BEHAVIOR AND WEIGHT

A difference between the sea and home setting was found in the tendency to overeat which was more common at sea. Here 47% were found to overeat 3 days or more per week compared to 40% when at home. This difference can be interpreted in the light of most seafarers being served 3 main meals and additional snacks during the traditional 2-3 daily coffee breaks at sea. The servings are regarded as a social event and perceived as highlights of the day. Regular consumption of sweets, cake and sugared sodas (3-7 days a week) was reported by 52% of the respondents at sea which is almost 10% higher compared to consumption at home, and more often the consumers were found among the older staff.

The current study found higher rates of obesity compared to earlier data on seafarers' weight. According to a study from 1994 only 16% of Danish seafarers were obese with a BMI equal to or above 30 (Hansen *et al*., 1994) while the present data identified 25% as obese – a rate similar to those reported by two other

studies from 2005 (23%), and 2011 (27%) (Hoeyer & Hansen, 2005; Hansen *et al.*, 2011). This rate is more than twice as high as the one for the general Danish population, for whom only 12% obese males were reported in 2005 (Ekholm *et al*., 2006).

A majority (66%) of the seafarers was measured with central obesity which, in combination with two additional risk factors, constitutes metabolic syndrome (IDF definition) (Alberti *et al*., 2005). In this sub-group of seafarers with central obesity almost three quarters (73%) were tested positive for at least two such additional risk factors, which equals more than half (51%) of the total sample of seafarers who had their waist circumference measured (*n*=246). This rate is more than twice as high as the one reported for the general Danish male adult population, as results from 2003 revealed only 20% with metabolic syndrome (Prescott *et al*., 2007). However, it needs to be noted that the size of the difference is influenced by different cut-off-points for waist circumference ($\geq$102cm vs. $\geq$94 cm in the current study) and HDL (< 1.0 mmol/L vs. <1.03 mmol/L), which means that the difference might be smaller than estimated here.

In general, the present data suggest that seafaring might indeed be a risk to health beyond the threats created by accidents and more difficult access to acute medical care. Thus risk factors such as smoking, obesity, physical inactivity as well as metabolic syndrome were more prevalent among seafarers than the general male working-age population. These findings are in line with studies from other countries (Oldenburg et al., 2008; Pancic et. al, 2005) and are alarming particularly when taking a "healthy worker effect" into consideration. Every second year, the seafarers undergo a medical examination in order to renew their health certificate, which is mandatory for signing on to a ship. This suggests that either the present findings are based on a positive pre-selection, i.e. despite being comparatively high the figures still underrate the size of the problem, as workers with manifest disease have already been screened out, or else they should question the practice of these examinations. In any case, they highlight a definite need for health promotion initiatives to modify the risk potential of seafaring work places and enable and support more healthy lifestyles.

Situational barriers for living a healthy life at sea are numerous: From easy access to duty-free and therefore cheaper tobacco as well as sweets and other high-sugared-products, which are made available in special on-board shops, lack of education or adequate training of the ship cooks, narrow food budgets, which negatively influence the nutritional value and variety of servings, to the problem that inclement weather with high seas tends to leave the on-board gyms empty. In addition, prevalent stress and boredom induced by longer-term absences from home and confinement in small spaces with limited leisure time

facilities (Jezewska, 2006) might contribute to “compensatory behaviors”. In particular, this could explain the high smoking rates but also why there were higher rates of overeating and sweets consumption at sea compared to the home setting. Similarly, but with a contrary effect, the slightly higher rates of physical activity at sea compared to the home setting might also be an indirect product of the work organization as seafarers might be reluctant to spend their precious leave time on exercise instead of with their families and friends.

With regard to social status, the only significant difference was found for smoking, which was more prevalent in non-officers than officers, while differences between the two types of work places providing different environments and different work tasks were more prominent. This finding clearly suggests that for seafarers setting-related variance might have a larger impact on health than individual factors, which emphasizes the importance of health-promoting work-place settings.

Challenges for health promotion interventions in the maritime workplace

Health promotion in the work place has often proved to be challenging (Mhurchu et al., 2010), and the maritime setting seems even more demanding than most work environments. Worksite intervention studies have reported participation rates as low as 8% and as high as 97% with a median of 61% (Bull et al., 2003; Rongen et al., 2013). While rates for the present study were above the lower limit they were also distinctly below the reported median. Initial interest in participation in the different intervention offers varied between around 50% and 30%. Only the semi-mandatory cooking courses reached a rate of 75%. This might partly reflect a general lack of motivation or prioritization of health issues among seafarers or a reluctance to deal with these issues in the work place (see below), which suggests that considerably more efforts at motivating this target group for health promotion might be warranted. However, it also became clear that actual reach in some cases was still considerably below the initial rates, and a main factor responsible for this seems to lie in the nature of work organization in the maritime field. Seafarers and their work places literally are “moving targets”. Naturally the ships travel, but many seafarers also frequently shift between ships, and all seafarers move between their ships and their home bases, which are geographically widely dispersed. Providing interventions for such a target group is a distinct logistic challenge, which might require resources beyond the level of what is needed for a “normal” stationary work place. In the following, the findings for changes in different criterion variables will be discussed within the context of these implementation problems.

Changes in health behaviors and health indicators

As for percentage of *smokers* among employees, only a slight and non-significant decrease of 2% occurred between both measurement points. Considering that between 2008 and 2009 a 7% reduction of daily smokers was registered among men from the general Danish population aged 20-69 years, seafarers not only had higher smoking rates than the general population (Danish Health and Medicines Authority, 2008; Danish Health and Medicines Authority, 2009), but also seemed to be lagging behind the downward secular trend. A significant positive effect was found for the smoking cessation intervention, which, however, should be interpreted with caution, as only few seafarers had signed up for the course. While for many non-participants logistic issues seemed to have played a major rule for not feeling able to attend, it must also be assumed that the few who actually did attend differed substantially in motivation and determination from those who did not. However, it also needs to be noted that the finding is in line with results from a Cochrane review of onshore workplace interventions for smoking cessation (Cahill et al., 2008). Cahill et al. (2008) found strong evidence that individual workplace cessation interventions as well as group counseling and pharmacological treatment to overcome nicotine addiction significantly increased the likelihood of quitting smoking. Despite its methodological limitations the present study indicates that a smoking cessation intervention in the maritime workplace setting has the potential to make a significant contribution to seafarers' health. To achieve more broad-based success, a more specified and tailored approach is required which takes into account the specific restrictions inherent in a "moving work place". Instead of trying to schedule joint dates for crew members from different ships, which seems non-feasible, it might be tried to target smokers within their ship crews in order to ensure some continuity of group counseling and also enable daily group support by offering sessions compatible with arrival or departure times in/from port, by sending out counselors to the ships while in port or during crew change at sea and/or by offering internet-based support.

Even though slight improvements on *exercise level* were noted, these changes were not significant, whereas there was a significant increase in *physical fitness scores* showing that 1/3 of the participants had improved their fitness score at T2 towards the recommended level. One explanation for this seeming discrepancy might be a difference in samples, since the fitness scores could only be computed for the smaller – and probably more motivated – subsample, which had not only participated in the questionnaire survey but also in the health profile at baseline and follow-up. However, an additional analysis of exercise change for this subgroup yielded the same non-significant result as for the larger sample. Another reason may be that measurement of exercise behavior in terms of frequency without including a measure of duration/intensity might have prevented accurate classification and underrated possible changes.

There was no differential change from T1 to T2 based on participation in the exercise guidance or the extra health check-up. As described, the one-dimensional measurement of exercise behavior might have prevented detecting change, in particular as the exercise guidance emphasized adequate fitness training and correct use of fitness equipment which might be expected to impact duration or intensity of exercise rather than frequency alone. As for the extra health risk check-up it could be discussed whether the first health profile that was used for baseline assessment of fitness and health parameters and was provided to all might not already have motivated participants into contemplating change, so that the additional monitoring of health status three months later was not able to make a substantial additional contribution. A further aspect to be taken into account is the partial implementation failure. Due to the substantial drop-out, both the exercise guidance and the health-check were implemented as single events and not as a monitoring system providing feedback in regular intervals. Yet another factor could be program failure. A recent review by Vuillemin et al. (2011) on general worksite physical activity interventions reported moderate evidence for effects of longer-term exercise training programs on physical fitness outcomes and exercise behavior but inconclusive or lacking evidence for counseling interventions. Exercise guidance and individual feedback about health and fitness status are both counseling-type components and it might be discussed whether more intense and longer-term guided exercise programs which create socially more binding structures are likewise required in the maritime setting. This might be more difficult to achieve for seafaring than for onshore workplaces, but web-based communication devices might be considered for overcoming logistic problems.

Beyond the lack of evidence for effects of the health education modules, it needs to be noted that the change which occurred in fitness might be attributable to the structural changes made by upgrading fitness rooms on board in combination with the treadmill/rowing machine competitions between boats. In a similar vein, a Finnish study on seafarers with high risk factor load installed new fitness rooms on board or improved fitness room equipment, provided exercise guidance and subsidized fitness club visits on shore and found a 25% decrease in inactivity from baseline to the one-year-follow-up (Saarni et al., 2001).

As for *dietary behavior*, there was no significant change in reported overeating, while intake of high-sugar products, such as sweets, cake and sodas decreased significantly between T1 and T2. This change was not associated with participating in an additional individual health monitoring, but it might be assumed that the "healthy cooking courses" offered to ship cooks might at least have contributed to this development. As no control group was assigned, no definite effect attribution is possible. However, additional findings from

interviews with the participating cooks, which have been reported elsewhere (Bull, 2003; Hjarnoe & Leppin, 2013a; Hjarnoe & Leppin, submitted 2013b) suggest that on many ships supply changes were made in terms of reducing fat and sugar content in meals, offering fruit instead of cake and/or abolishing sugared soda drinks.

The Finnish study on health promotion for seafarers similarly introduced training for ship cooks in preparing lighter meals combined with group interventions such as "weight-watcher" groups and individual support from occupational nurses. Seafarers perceived the meals at the one-year-follow up as being healthier than at baseline. Similarly, two recent reviews on general worksite health promotion interventions for employees' diets found evidence for small to moderate effects of educational and/or structural interventions, particularly for fruit, vegetable and fat intake (Vuillemin et al., 2011; Mhurchu et al., 2010).

Beyond self-report changes in behavior, there was a modest decrease in the percentage of seafarers with *high waist circumference* at T2 compared to T1 as indicated by a non-significant trend. Most notable, however, was a significant decrease in the percentage of employees with *metabolic syndrome*. Again, there was no significant association of this change with participating in the extra health risk feedback or in the exercise guidance. Like for the decrease in self-reported intake of high-sugar products, the positive change in the meals served on board due to the cooking intervention for ship cooks might have contributed to this development. In fact, additional sub-analyses (not reported here) showed that the risk factor for metabolic syndrome, which had changed most, was glucose level. This is in contrast to the Finnish study on work site health promotion among seafarers (Saarni et al., 2001) which also reported improvements in self-reported eating behavior, but did not find changes in related physiological parameters. Both studies were based on pretest-posttest designs though, which clearly restricts internal validity. Also, it is important to note that metabolic syndrome still was highly prevalent in the sample. A US-American cross-sectional study of health characteristics among merchant marine captains and pilots showed similar rates of 39% with metabolic syndrome (Scovill, 2012). In comparison, a Danish study of the general population found only 20% of 20-97 year old males with metabolic syndrome (Prescott, 2007), and a Canadian study from 2011 revealed 18% prevalence among its male participants (Riediger, 2011). In particular, when assuming a healthy-worker effect due to the requirements of frequent health examinations, the rates among seafarers are alarming and indicate an urgent need for heightened intervention efforts.

Special challenges: Healthy cooking

Healthy diet

There was a significant change in daily sugar intake between T1 and T2, but as the cooking courses were part of a structural intervention, thus influencing all employees, testing the impact from this intervention was not possible. However, as seen in table 1, the change was most apparent for the cargo company. This may partly be explained due to the focus and engagement of the management level of this company, having the 'healthy diet' approach as a top priority. This focus on 'healthy diet' was also reflected in the coverage of the project in their company magazine with stories about improvements in the galley. When looking at the 'healthy cooking course' intervention the cargo company may also have had an advantage due to the professional level of the cooks, as all ships in this company had trained ship cooks onboard as compared to the rescue and support company where this was only the case for a minority of the ships. If we are to expect that trained cooks understand most information provided from professional training and guidance which was the case according to observations and interviews with cooks during and after the 2-days 'healthy cooking course' intervention, then the result of the higher level of reduced sugar intake in this company was not a surprise. The untrained assistants from the Rescue and support company experienced difficulties during the course, following the recipes as well as identifying the right ingredients. However, they benefited from doing side-by-side cooking with the trained ship cooks and requested the possibility of having additional courses like this.

A majority of the untrained cooks were perceived as lacking basic knowledge about cooking and ordering of supplies by the chefs – a view which was shared by most of the untrained cooks themselves. This limited the opportunity of sharing knowledge and experiences about cooking among the different groups. Nevertheless, the cooks without professional training did still benefit from working alongside their professional colleagues and receiving their support and guidance while cooking. The general lack of experience among the untrained cooks makes the task of implementing and maintaining a new cooking trend a huge challenge, which needs to be acknowledged and addressed by the management levels of the companies.

The practical task of preparing different dishes from the cookbook 'Food at sea' during the course was received very positively by the participants. However, at the one-year follow-up only a minority of the chefs and untrained cooks in company 2 were using it for more than inspiration purposes. This was mainly due to lack of supply options for many of the ingredients, and also the recipes were perceived as hard to follow by the untrained cooks. Bearing in mind that the cookbook was produced for chefs, this last finding is not

surprising (Seahealth Denmark, 2004). As long as the law (International Labour Organization, 2006) does not require a professional chef on board ships with crews below 10 people, untrained cooks will continue to be found in the galley and in need of basic and healthy cooking training and/or of being provided with a maritime ABC cookbook with very basic low-fat recipes of traditional Danish courses.

During the cooking course, the idea of implementing a healthy diet onboard the ships was perceived as a major challenge by a majority of the participants, due to especially conservative food habits and traditions among the older crew members. Other important challenges in promoting a healthy diet onboard the ships were insufficient space and storage facilities and the board wages in company 2. Especially the latter were perceived as a barrier for ships sailing in the Norwegian sector, as board wages were difficult to balance due to supplies being more expensive and deliveries less frequent than in the Danish sector. This means cooks order less perishable and expensive products such as fresh vegetables and fruit. However, the board wages also appear to influence the promotion of healthy diet in the Danish sector for those ships aiming to save as much as possible on the food budget in order to maximize the payout sum. This practice influences the quality of food bought and is an involuntary incentive for unhealthy behavior.

Structural intervention approach in the maritime workplace setting

In this section the four factors constituting the structural intervention approach (availability, physical- and social structure and acceptability through cultural and media messages) will be discussed to see how they influenced the interventions implemented at the workplace.

Availability:

Availability of products or services influencing negatively on the health of seafarers include tobacco and sugared products, such as candy and soda drinks, which was all considered highly available on board the ships at the baseline study (paper 1). A package of cigarettes thus cost less than 1 Euro and is sold in the ship boutique,' Sloppen' (which may just be a shelf or a drawer of products sold by the captain or the chef). On the other hand, availability of products or services which potentially have a positive influence on the health of the seafarers such as fitness equipment and nutritious diet, fresh fruit and vegetables were mostly regarded as limited on a daily basis due to factors such as cost, storage and supply (paper 2 and 3). At follow-up, availability of cigarettes was unchanged, whereas for sugared products – according to the cooks – availability had decreased, as they did no longer buy e.g. soda drinks for the crew, or had themselves reduced sugar and fat in their daily baking and cooking. From the results of the questionnaire survey this notion is in line with the seafarers' report of consuming significantly less sugared products at T2.

In addition, the availability of fresh fruit and vegetables had improved, as more frequent deliveries were made possible (for the rescue and support company). The availability of fitness equipment had also increased at T2, however, the behavioral results revealed no increase in the amount on people using the facilities.

Physical structures

The physical structures refer to the accessibility of healthy vs. unhealthy products or services at the workplace. Looking at the physical conditions of the workplace of the seafarers at sea, their daily lives on board are restricted by the physical boundaries of the ship. This confinement limit the freedom in regard to especially leisure time activities, for instance sports as well as seeking alternative places to shop and dine. The physical structures of the ship have no likely impact on the smokers, as smoking is allowed outside the ship and in designated areas inside, more or less always at close reach. At T1 respondents from more than two thirds of the ships mentioned a need for improvements of their ships' fitness rooms, which to a large extent was implemented for all. However, there was no increase in the frequency of exercise level or in the share of people using the facilities at follow-up. Physical structure onboard, such as the limited space for storage of supplies and space for equipment was found to be a barrier for getting full benefit of the cooking course intervention.

Social structure

Within the maritime setting there are rules and regulations prohibiting certain behaviors in certain places, such as smoking. The Smoke-free Environments Act (Ministry of the Interior and Health, 2007) thus prohibits indoor smoking on-board Danish ships, unless it takes place in special locations with sufficient ventilation. The company can be fined if the law is violated. According to the MLC-2006 all seafarers are entitled *to "good quality food and drinking water provided under regulated hygienic conditions"* (International Labour Organization, 2006). However, this right may be open for interpretation, as the food provided by e.g. the inexperienced assistants with cooking responsibilities might not meet this standard. The same law, however, makes this dilemma possible – giving companies the possibility of letting untrained and inexperienced cooks in charge of the galley onboard ships with crew sizes below 10 people. The same can be said for the board wages which may unintentionally be an incentive for increasing salary, and thus limiting the option of getting *good quality food* as required in the MLC-2006 (International Labour Organization, 2006). An additional barrier in fulfilling the MLC-2006 requirement for quality food is the higher prices of products, especially in certain sectors of the ocean. There are no laws so far, proclaiming a certain fitness score in order to work at sea, however, reaching a BMI $\underline{\geq}$ 40 at the medical examinations requires an evaluation of the extent to which "*the fat and muscle distribution is a severe limitation for*

mobility" before issuing a medical certificate (Erhvervs og Vækstministeriet, 2008). This group is still very small, but if we look at the trend from this study (paper 1) showing that the share of obese employees has increased over the past 20 years, more highly obese seafarers may appear in future.

Cultural and media messages

Acceptability of the interventions by way of cultural and media messages were sought through internal as well as external information about the project. All employees were thus informed about the project before entering the study, and a personal letter from the management level was enclosed with the questionnaire encouraging participation. From a local company perspective, the project was highlighted in the company magazines with articles reflecting positively on the project as a whole as well as on the interventions specifically and frequent up-dates of the project were sent out on the companies' intranet. Most contributions were stories about the cooking intervention and cooking onboard in general, and may thus have had an impact on the positive reception of the initiatives in the galley by the crew.

The structural approach to health promotion interventions in the maritime setting offered a useful tool to analyze the influencing contextual factors of the workplace on the effect of the interventions. This study showed that the maritime context is a challenging arena for conducting interventions, as so many factors influencing individual health are out of the control of the employees, and need management involvement as well as legislative attention. However, at the same time, this highlights the structural approach as probably the most feasible model to enhance long-term changes in this setting as it targets "*Interventions that change conditions beyond individual control"* (Cohen et al., 2000). The better the interventions are integrated as part of the company culture or norm as well as being available and accessible, the better the prospect for having a long-term effect (Charania et al., 2011).

Limitations

Paper 1

The response rate was only 43% for the health profile and 57% for the questionnaire survey. Two types of selection bias might be associated with this limited participation rate. For one, there might be an overrepresentation of more experienced and job-secure seafarers (officers), however, according to project managers of both companies, the distribution of gender, age and rank among the respondents reflected the actual division among the seafaring personnel. The second and more serious issue is that it is seafarers in better health and with more favourable health behaviors who are more likely to have taken part. This would imply that a more complete representation of all employees would have generated an even more alarming picture of their health status. Likewise, social desirability tendencies may have affected, that is

favourably biased, the results based on the self-report data about health behaviors. The sample consisted of mainly Danish seafarers, which limit the generalizability of the results to seafarers from especially non-western industrialized countries. As for measurement, the assessment of eating behaviors was based on very general single items, which are bound to generate less valid reports than more elaborate measures, such as food diaries.

Paper 2:

A major limitation of the study is the possibility of selection bias. 43% of employees did not participate in the first questionnaire round, even more did not take part in the first health profile (58%). Interviews with non-participants of health profile 1 revealed different reasons, some of which suggest more random effects, such as misunderstandings about locations or time frames for signing up as well as conflicting sailing schedules. Other explanations, however, indicate more systematic influences, such as employees maintaining that lifestyles were a matter of privacy, and some saying they were afraid their data would be registered and followed by their employers. This might suggest an underrepresentation of employees with health problems. On the other, hand there was also a sizeable group who reported that they were already very physically active and eating healthily and for that reason did not consider it necessary to participate, which indicates an opposite tendency. Furthermore, there were sizeable drop-out rates towards T2 of 39% for the questionnaire survey and 40% for the health profile. There did not appear to be substantial differences in the main variables of interest between these two groups at baseline, but it can be expected that a substantial part of the drop-outs were those who did not improve over time so that some of the more favourable developments found might be overestimations. This difficulty to attribute positive changes over time to one or several of the various interventions is furthermore reinforced by reliance on a before-after design without a genuine control group. For the health education interventions it was possible to compare participants with non-participants. Such comparisons, however, are naturally problematic due to non-equivalence of the groups, not at least due to differences in motivation to change.

There certainly is a need for more methodologically rigorous studies, but it also needs to be stated that there is a genuine conflict between demands for scientific rigor and stakeholder needs for and interests in workplace interventions (Mhurchu et al., 2010). Moreover, the organization of the maritime setting in particular presents practical challenges, which makes control group designs extremely hard to achieve due to constantly moving work places and many crew members regularly shifting ships. Lastly, limitations in behavior measurement need to be acknowledged. Like in all studies using self-report measures, reporting bias might have occurred due to social desirability tendencies. Another pertinent problem might be a lack

of differentiation in measurement as already discussed for exercise assessment. Similarly, food diaries or more elaborate food questionnaires might have provided more reliable and valid results than single items asking for frequency of consuming different types of food.

Paper 3

This study was based mainly on self-reported data (semi-structured and unstructured interviews) as well as one standardized question from a quantitative questionnaire. The use of self-reported data in this study may have led to bias due to social desirability tendencies. However, all respondents were guaranteed anonymity, and no-one gave any indication for fear of reprisals from their company. Also, critical opinions were common, indicating that a systematic distortion of the interview data is unlikely. The study lacks information on the opinion of the seafarers and the captains on the diet before and after the cooking course. Their perspective might have provided valuable knowledge about the actual change of diet – as perceived from the whole crew of the ship. In addition, the opinion of the management would have provided important knowledge as to the willingness and possibilities to target the structural challenges identified. For the quantitative data included in this study, it has to be noted that eating behavior was assessed with only one question. More differentiated questions on eating behaviour or the use of food diaries would certainly have provided more reliable and valid information. An important limitation, which should be highlighted with regard to the generalizability of findings, is the homogeneity of the respondents, as all cooks and seafarers were Danish. However, many of the crew and cooks in the Danish merchant fleet are typically not from Denmark, but from countries like India and the Philippines. Therefore, the study results may not apply for foreign mixed crews.

General limitations

The main limitation of the present study might be considered to be the lack of a control group, which would have provided important information on the perceived effect of the intervention. However, a traditional experimental design is limited when studying social systems and the complex interaction between health interventions, individuals and their environment. The unique features of different organizations such as the two shipping companies thus limit the utility of randomized controlled trials or other experimental methods of evaluation (Øvretveit, 1998). On the positive side, this study tried to target the comprehensiveness of the ecological settings-based approach by applying mixed methods in the data gathering process in order to obtain different perspectives and information of the e.g. identified intervention challenges.

Conclusions and perspectives

This PhD study has established the need for health promotion interventions in the case of the two Danish shipping companies studied - results which are likely to have implications for the Danish merchant fleet in general. The study thus contributes with new knowledge about health promotion in a very special work place, which, however, – not at least for economic reasons - is important for societies depending on foreign trade: seafaring. One of the major findings was that implementing health promotion interventions in the maritime workplace setting is a very challenging task, even more so than in work place health promotion in general due to the "moving nature" of the maritime work place, which makes particularly the implementation goal of a high participant reach extremely difficult to achieve. Future studies in the field need to focus on this aspect and try to make particular efforts at ensuring sufficient and sustainable reach for intervention implementation. Because of the low reach in the present study and other methodological limitations the changes found in behavior and health parameters should be interpreted with caution and need to be replicated in further studies. Nevertheless, the findings still point to pertinent issues calling for further investigation. Thus there was no evidence for effects of more traditional health education measures, but indication that involvement of the employers, that is the companies and their engagement in health promotion initiatives on a structural level, such as, for instance, training ship cooks in providing healthier meals for all or upgrading fitness rooms on board, might have influenced health and lifestyle changes of the seafarers. However, even after such changes were initiated, the prevalence of risk factors was still high among the seafarers suggesting a need for increased efforts aimed at easily accessible and specifically tailored health promotion initiatives, preferably in line with 'safety management systems', taking into account the special conditions of the maritime workplace setting.

From a research perspective, new knowledge has been provided on the importance of structural conditions as potential facilitators or barriers to effects of health promotion. However, in order to improve the access to a healthy and nutritious diet at sea, more knowledge is needed on the effects of interventions that aim to improve, among others, the availability and easy *access to good quality food and drinking water*, as declared by the MCL-2006. The MLC-2006 is the new convention on minimum requirements for seafarers' health and welfare onboard ships, ratified by 30 countries and will take effect August 20th 2013. Being a health promoting workplace may very well have a positive effect on health and wellbeing, such as preventing sick leave, chronic illness and early retirement and improving psychological well-being. It could also reflect positively on the company branding. However, further studies will be needed to evaluate nutrition-related health promotion efforts for seafarers in greater detail and in doing so also test for such

longer-term outcomes. Also, while this study looked at many different outcomes, it did not look at mental health, which not only is a highly important outcome in itself, but also is linked to health behavior. Thus, physical activity or healthy nutrition can positively influence mental wellbeing. Vice versa many health related behaviors such as eating, smoking or alcohol consumption are often used as means to cope with stress and negative mental states. In addition, this study is limited to a Danish context, study group and special shipping business, such as the cargo and support and rescue companies, and should be extended to also encompass other groups and settings. In order to fully realise the benefits of health promotion interventions, the challenges need to be acknowledged and addressed by the companies as well as relevant maritime stakeholders. The MLC-2006 may just be the lifeline needed for improving the conditions for seafarers health on board, especially from less regulated flag states. However, it's effect will rely heavily on the port state control inspections, that is, their quality and quantity.

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