Information to support the review of specified diseases and employment for the purposes of the Seafarers Rehabilitation and Compensation Act 1992

Final report

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BACKGROUND OF THE AUTHOR

This report was prepared by Professor Tim Driscoll (MBBS BSc(Med) MOHS PhD FAFOEM FAFPHM). Professor Driscoll is a specialist in occupational medicine and public health medicine and an independent consultant in epidemiology, occupational health and public health.

GLOSSARY

ACTU	Australian Council of Trade Unions
CI	Confidence interval
Comcare List	List of deemed diseases under the *Safety, Rehabilitation and Compensation Act 1998*
IARC	International Agency for Research on Cancer
MIAL	Maritime Industry Association Limited
MUA	Maritime Union of Australia
Seacare List	A replacement specified diseases and employment instrument under the *Seafarers Rehabilitation and Compensation Act 1992*
SIR	Standardised Incidence Ratio
SMR	Standardised Mortality Ratio
SWA List	List of deemed diseases recommended under Safe Work Australia's *Deemed Diseases in Australia* report

EXECUTIVE SUMMARY

Background

The Attorney-General's Department is conducting work to support the development of a replacement specified diseases and employment instrument (Seacare List) under the *Seafarers Rehabilitation and Compensation Act 1992* (Seafarers Act). This work required an update of recommendations regarding deemed diseases covered under the *Safety, Rehabilitation and Compensation Act 1998* Deemed Diseases List (Comcare List), with specific consideration regarding requirements of workers employed under the Seacare scheme. This included recommendations regarding appropriate minimum employment periods for disorders currently on the Comcare List and any additional disorders proposed to be included in the proposed Seacare List. The required information is presented in this report.

Approach

For the purposes of this report, a seafarer is essentially a person working in coastal or international shipping for merchant transport or trade purposes. It explicitly excludes people working primarily for military or fishing purposes. Studies relevant to seafarers were identified through a comprehensive search of the published literature. The findings from the studies were summarised and their relevance to the Australian context considered. In addition, a search of the literature was conducted looking for evidence published since 2014 that would support the inclusion of additional disorders since the Safe Work Australia List.

Findings

There was considerable information on the health of seafarers but little comprehensive information on the extent to which occupational exposures contributed directly to the identified disorders. There was almost no information from Australian-based studies. Recommendations have been made regarding additions to the proposed Seacare List, and regarding the addition of cancer-exposure pairs to the general Safe Work Australia List because of recently published work. Recommendations are also made regarding employment periods to use for each of the exposure-outcome pairs on the proposed Seacare List.

1. INTRODUCTION

The Attorney-General's Department ('the Department') is conducting work to support the development of a replacement specified diseases and employment instrument (Seacare List) under the *Seafarers Rehabilitation and Compensation Act 1992* (Seafarers Act). Part of this work relates to a review of the proposed specified diseases and employment instrument.

This work required an update of recommendations regarding deemed diseases covered under the *Safety, Rehabilitation and Compensation Act 1998* Deemed Diseases List (Comcare List), with specific consideration regarding requirements of workers employed under the Seacare scheme. The work had two aims. The first was to recommend whether any changes to the Comcare List were required to include additional disorders specific to or characteristic of seafarers. The second was to recommend whether to include any additional disorders in the Comcare List because of information published since 2014 (which was when the work for the original Safe Work Australia (SWA) Deemed Diseases List (SWA List) was undertaken). This included recommendations regarding appropriate minimum employment periods for disorders currently on the Comcare List and additional disorders proposed to be include in the proposed Seacare List.

The required information is presented in this report.

The specific requirements were to provide advice on:

1) whether any additional occupational diseases should be included for the Seacare scheme
2) if an occupational disease should be included, what employment-related causative factors and what, if any, minimum employment period should apply in relation to that disease
3) whether any minimum employment period(s) should be amended for the Seacare scheme
4) if the minimum employment period for a particular disease should be amended from the SRC Act Instrument for the Seacare scheme, what minimum employment period should apply in relation to that disease.

This report consists of eight chapters:

- Chapter 1 provides a brief introduction
- Chapter 2 outlines the methods used
- Chapter 3 presents a review of relevant literature regarding seafarers

- Chapter 4 presents a consideration of whether additional disorder-exposure pairs should be added to the SWA List based on information published since 2014.
- Chapter 5 presents a consideration of the three formal submissions made in regard to this and related work
- Chapter 6 provides a consideration of employment period for the disorders included on the proposed Seacare List
- Chapter 7 provides the summary recommendations
- Chapter 8 contains the references cited in the document.

2. METHODS

INTRODUCTION

This section summarises the methods used in this study to identify relevant information on occupational disorders in seafarers. For the purposes of this report, a seafarer was defined as a person working in coastal or international shipping for merchant transport or trade purposes. The definition explicitly excludes people working primarily for military or fishing purposes. More completely, the definition was that defined by the Navigation Act 2012: "'Seafarer' means any person who is employed or engaged or works in any capacity (including that of master) on board a vessel on the business of the vessel, other than the following:

a) a licensed pilot of the vessel (acting as such a pilot)
b) an owner of the vessel or a person (except the master) representing the owner
c) law enforcement personnel (in their capacity as law enforcement personnel)
d) if the vessel is a special purpose vessel—special personnel in relation to the vessel
e) a person temporarily employed on the vessel in port
f) a person prescribed by the regulations.

Additional information on the search strategy and its output is provided in Appendix 1. Information on the search strategy used to identify potentially relevant information in regards to the broader SWA List (not necessarily specifically relevant to seafarers) is described in Chapter 4. In addition to the literature search, the input from the Australian Council of Trade Unions (ACTU), Maritime Union of Australia (MUA) and Maritime Industry Association Limited (MIAL) was considered when making recommendations.

INCLUDED DATABASES

Searches were undertaken of Medline (via Ovid), Web of Science, Scopus and EMBASE. No comprehensive search was undertaken of the grey literature (literature that has not been peer-reviewed), but some grey literature articles identified during the search process were included where it was considered by the author that they provided additional useful information.

SEARCH STRATEGY

Separate search strategies were developed for each database but they all used the same general approach. The approach was to identify all publications that contained information on seafarers; all publications that contained information on occupational

diseases, injuries or exposures; and all publications that contained information on epidemiological studies. These three searches were combined to identify all studies that appeared in all three searches. The search strategy was then refined to include only publications from 2000 onwards and only studies of humans. The final searches were conducted in January 2020.

In addition to the database search, the reference list of papers was reviewed to identify any possibly relevant papers not identified by the database searches.

INCLUSION AND EXCLUSION CRITERIA

The main inclusion criteria were full publications of peer-reviewed studies that provided information on health disorders in seafarers. Review articles were included but not conference abstracts.

Excluded at the stage of reviewing the studies identified by the search output were:

- studies that only provided information on injuries
- studies that included information on commercial fishers and did not provide separate results for seafarers
- studies that only considered military naval crew
- studies published before 2000
- studies that did not focus on humans.

REVIEW PROCESS

Studies identified through searching any of the included databases were combined into a single Endnote file. All studies were reviewed by title and, if necessary, abstract. The full text version of studies that appeared to meet inclusion criteria, or for which there was some uncertainty, were examined and a final decision then made on inclusion or exclusion. For studies identified through review of reference lists, the full text version was also examined and a final decision made regarding inclusion or exclusion.

One person (the author) undertook all the searching and made the decisions regarding inclusion and exclusion.

DATA EXTRACTION, CRITICAL APPRAISAL AND SYNTHESIS

Critical appraisal of the relevant literature and consideration of the weight of evidence in regards to a particular disorder was undertaken. The results from the included studies were synthesised qualitatively.

3. REVIEW OF DISEASES ASSOCIATED WITH MARITIME WORK

INTRODUCTION

This chapter presents a review of published literature on occupational diseases associated with maritime work. It excludes commercial fishing and military naval work. The initial intention was to focus on the results of review papers but there were few relevant papers. So, most of the information comes from individual studies. The review provides a summary of each area for which information was identified, with more detailed consideration of some individual studies provided in Appendix 2. An overview of the mechanistic aspects of the literature search is provided first, followed by a consideration of the relevant data from the included papers.

OUTCOME OF THE LITERATURE SEARCH

Four hundred and thirty-four titles were identified in the combined searches. One hundred and seven of these were excluded as they were duplicates, leaving 327 unique titles. Another five studies were identified through review of reference lists (four) or web searching (one), resulting in 332 titles for review. Of these, 155 did not involve merchant seafarers; 91 were not relevant as they did not contain information on health disorders; and eight were excluded for other reasons. This left 78 relevant papers.

EXPOSURES

The main disease-related hazards for seafarers include stress, isolation, fatigue, infectious organisms, hazardous substances and solar-UV[1]. Studies of specific hazardous exposures included those focussing on asbestos[2] and on fumigants[3].

GENERAL STUDIES

There have been several studies of mortality, morbidity or hospital admissions involving seafarers. Many of these did not include a clear comparison group and so only provide an indication of the relative proportion of various diseases affecting seafarers. Others do provide some comparison to a general population, either the working population or the population overall. However, none provides appropriate control of possible confounding factors such as smoking, alcohol and diet. Therefore, the extent to which any of the identified disorders have occurred as a result of occupational exposures is not clear.

Most of these studies identify cardiovascular disease in general, or ischaemic heart disease in particular, as being the most common serious health disorder in seafarers. Other diseases commonly identified included gastrointestinal disease, infection, musculoskeletal diseases, respiratory diseases and cancer. [4-21]

The focus of these studies was Denmark[4, 7-9, 14, 22], Germany[12, 13], Italy[6], Japan[5], the United Kingdom[15-21] and the United States[11].

CANCER

There have been several studies specifically of cancer in seafarers. In addition, some large population-based studies of specific cancers in the Nordic countries have identified some raised rates in seafarers.

High rates of all cancers combined were found in Denmark[14, 23, 24] and Germany[25]. A wide range of individual cancers have been found to have raised rates in seafarers, with the most consistent being cancers related to smoking and/or alcohol such as cancers of the lung, larynx, pharynx, oesophagus, tongue, mouth, colon, pancreas, kidney and bladder[23-29]; and malignant mesothelioma, almost certainly due to asbestos exposure[2, 24, 28-30].

An increased risk of squamous cell carcinoma of the skin and of non-melanoma skin cancer has been found in seafarers in the Nordic countries[31], Italy[32] and Germany[25]. Other cancers for which high rates have been found in seafarers in at least one study include cancer of the rectum and cervix in women[23]; cancer of the stomach[28];cancer of the prostate[33]; soft tissue sarcoma[34]; leukaemia[25, 29]; and non-Hodgkin's Lymphoma[25].

INFECTIOUS DISEASE

Infectious disease has been identified as a problem for seafarers[1, 35, 36]. Malaria is a major problem for seafarers who operate in regions in which malaria is endemic[37-41].

DISEASES OF THE RESPIRATORY SYSTEM

Occupational asthma is an important problem in maritime workers due to a range of exposures[42, 43].

CARDIOVASCULAR DISEASE

A recent review of studies on cardiovascular risk factors and cardiovascular disease in seafarers concluded that seafarers have a higher risk of cardiovascular disease than the general population. The authors found the most common problem was overweight and obesity, with hypertension, smoking, type 2 diabetes and lipid disorders also a problem but to a lesser extent. Other risk factors highlighted in the review as being an issue for seafarers included difficult working conditions and psychological stress[44]. Several individual studies of cardiovascular disease in seafarers have also been conducted in Germany[1, 45-47], Denmark[48], Poland[49, 50] and the United Kingdom[20].

DRUG AND ALCOHOL USE

Alcohol and smoking consumption have been found to be increased in seafarers compared to the general population[51] and to be important problems in French seafarers[52].

HEARING LOSS

Hearing loss, presumed to be due to noise exposure, has been identified in seafarers in several studies[14, 22, 53].

MENTAL HEALTH

Seafarers face many challenges in terms of mental health stressors[1, 54-59], and depression and suicide are considered important health issues for seafarers[54, 60-62]. A recent review article found some evidence of an improvement in recent years in terms of mental health stressors[61].

Fatigue has also been identified as an issue for many seafarers, with the connection to ill health highlighted, although there is some uncertainty as to the direction of the relationship between reported fatigue and reported ill health[63, 64].

ORAL HEALTH

Several papers suggested that the oral health of seafarers was poor, but the lack of a clear comparison group for the seafarers' group makes interpretation of the results difficult[65, 66].

OBESITY

Obesity has been found to be a problem in seafarers in a number of studies covering various countries. These include Denmark[67], Turkey[68] and Italy[69]. Metabolic syndrome has also been found to be present in a quarter of Danish seafarers[70].

DATA ISSUES

There are many challenges to studying the health of seafarers[71]. One problem with the data is that much of it comes from studies of individual developed nations and it is not clear the extent to which this information can be extrapolated between countries. A particular concern is the extent to which it can be extrapolated to developing countries, which can be expected to have different disease patterns and different approaches to occupational health and safety. This is particularly a problem because most of the seafarers come from developing nations.[72]

STUDIES OF THE HEALTH OF AUSTRALIAN SEAFARERS

In terms of the current study, a major issue is that there were no studies of the health of Australian seafarers identified in the literature search. The search was of publications from 2000 onwards. An unrestricted search identified a study by the Australian Maritime Safety Authority that was released in 1997. This study was a survey of stress and fatigue in Australian seafarers. Unfortunately, only the abstract was able to be accessed so the results were not available[73].

Since many of the studies focussed on seafarers from developed nations, there is probably reasonable relevance to Australian seafarers. However, issues specific or common to working around Australian waters may not have been well covered. The effect of this in terms of failing to identify important issues that would affect the recommendations of this report is difficult to determine but is likely to be small.

ADDITIONAL DISORDERS TO BE CONSIDERED FOR INCLUSION ON THE PROPOSED SEACARE LIST

The literature provides consistent evidence of an increased risk of malaria in seafarers operating in tropical regions where malaria is endemic. Although much of the work of Australian seafarers is expected to be in more southerly latitudes and so not likely to involve risk of exposure to the mosquitos carrying the malaria parasite, some work off the coast of northern Australia might involve relevant exposures. In addition, work in international trade in equatorial regions might well place Australian-based seafarers at

risk. Seafarers are unlikely to contract malaria in non-occupational circumstances. Therefore, it is recommended that malaria be included in the Seacare scheme.

There are no other disorders that are not currently explicitly included in the Comcare List for which there is strong evidence of a causal connection between work as a seafarer and the occurrence of the disorder.

RECOMMENDATIONS

It is recommended that malaria be included in the proposed Seacare List.

No additional disorders are recommended for inclusion in the proposed Seacare List as a result of evidence of a close causal connection between the disorder and an exposure connected to work as a seafarer.

4. REVIEW OF PUBLISHED OCCUPATIONAL DISEASE INFORMATION SINCE 2014

INTRODUCTION

The original recommended SWA List was based on a review of the literature up to the end of 2014. Decisions on inclusion were not based on single studies. Instead, a systematic review or a number of well-conducted single studies providing similar evidence were required before it was accepted there was sufficient evidence of a causal connection between exposure and a disorder for an exposure-disorder pair to be considered for inclusion on the SWA List.

APPROACH

A search of the literature from 2015 onwards was conducted in an attempt to identify any additional exposure-disorder pairs which appear to meet the requirements for being added to the SWA List. Where such exposure-disorder pairs were identified, consideration was made as to whether the pair should be recommended to be included in the proposed Seacare List. This search focussed on PubMed, using relevant key words for each of the disorders and exposures being considered and, for cancers, the International Agency for Research on Cancer (IARC) Monographs.

FINDINGS

INFECTIOUS DISEASE

No new information on infectious disease was identified which would suggest there should be additions to the SWA List.

CANCER

The decisions on inclusion in the original SWA List were based on the classifications by IARC. Only exposures classified as IARC Group 1 (carcinogenic to humans) were deemed eligible for inclusion on the SWA List. The same approach has been adopted for the current consideration of the evidence.

Since the beginning of 2015, IARC has classified six additional exposures with potential occupational relevance in Australia as Group 1 (carcinogenic to human). These are:

- 1,2-Dichloropropane (resulting in chloangiocarcinoma)[74]
- Acheson process (resulting in lung cancer)[75]
- lindane (resulting in non-Hodgkin's lymphoma)[76]

- pentachlorophenol (resulting in non-Hodgkin's lymphoma)[77]
- ultraviolet light from welding (resulting in ocular melanoma)[78]
- welding fumes (resulting in lung cancer), having previously been classified as Group 2B (possibly carcinogenic to humans)[78].

All these cancer-exposure pairs meet the requirements to be added to the SWA List. It is recommended that four of these cancer-exposure pairs be added to the proposed Seacare List. It is not recommended that lung cancer associated with the Acheson process or with welding fumes be included in the proposed Seacare List. This is because, lung cancer is not included in the existing Comcare List (except where the lung cancer was associated with exposure to asbestos) on which the proposed Seacare List is to be based. Also, the Acheson process is not recommended as a relevant exposure because it is not an exposure that a seafarer could reasonably be expected to experience in the course of their work.

There was one other finding of relevance. The causal connection between benzene exposure and the occurrence of acute myeloid leukaemia was reinforced by a recent IARC Working Group[79]. Acute myeloid leukaemia is not explicitly mentioned in the SWA List, nor the equivalent Comcare List. Instead, leukaemia, excluding chronic lymphatic leukaemia, is mentioned. It is not intended to make the proposed Seacare List more restrictive than the Comcare List. Therefore, the current use of the term "leukaemia" is considered reasonable and no change is proposed for the leukaemia-benzene entry in the proposed Seacare List.

The recent classification of fluoroedenite as a Group 1 carcinogen causing mesothelioma[75] is not considered relevant as exposure to fluoroedenite does not appear to occur in Australia, either in an occupational or non-occupational context.

MENTAL OR NEUROPSYCHIATRIC DISEASES

No new information on mental or neuropsychiatric disease was identified which would suggest there should be additions to the SWA List.

NEUROLOGICAL DISEASES

No new information on neurological disease was identified which would suggest there should be additions to the SWA List.

NOISE-INDUCED HEARING LOSS

No new information on noise induced hearing loss was identified which would suggest there should be additions to the SWA List.

CARDIOVASCULAR DISEASE

Many studies, both single studies and review articles, have been published since 2014 considering the relationship between occupational exposures and the risk of developing cardiovascular disease (for example[80, 81]). However, the situation remains similar to when the SWA List was developed. The evidence regarding cardiovascular disease, and risk factors such as hypertension, is not strong enough to warrant inclusion on the SWA List, especially given how common cardiovascular disease is in the general community. Therefore, no additions to the SWA List regarding cardiovascular disease are suggested.

RESPIRATORY DISEASES

As is the case for cardiovascular disease, many studies, both single studies and review articles, have been published since 2014 considering the relationship between occupational exposures and the risk of developing chronic obstructive pulmonary disease (for example[82-92]). However, this new information does not change the decision made when developing the SWA List that chronic obstructive pulmonary disease does not meet the criteria necessary to be included in the SWA List.

HEPATIC DISEASES

No new information on hepatic diseases was identified which would suggest there should be additions to the SWA List.

SKIN DISEASES

No new information on skin diseases was identified which would suggest there should be additions to the SWA List.

MUSCULOSKELETAL DISEASES

No new information on musculoskeletal diseases was identified which would suggest there should be additions to the SWA List.

VIBRATION DISEASES

No new information on vibration diseases was identified which would suggest there should be additions to the SWA List.

GENITOURINARY SYSTEM DISEASES

No new information on genitourinary system diseases was identified which would suggest there should be additions to the SWA List.

REPRODUCTIVE RISKS

No new information on reproductive risks was identified which would suggest there should be additions to the SWA List.

ACUTE CHEMICAL POISONING / TOXICITY

No new information on acute chemical poisoning or toxicity was identified which would suggest there should be additions to the SWA List.

MULTIPLE CHEMICAL SENSITIVITY

No new information on multiple chemical sensitivity was identified which would suggest there should be additions to the SWA List.

RECOMMENDATIONS

It is recommended that additions be made to the proposed Seacare List to include the cancer-exposure pairs identified earlier in this chapter. These are non-Hodgkin's lymphoma and pentachlorophenol, non-Hodgkin's lymphoma and lindane, chloangiocarcinoma and 1,2-Dichloropropane, and ocular melanoma and welding ultraviolet light.

5. COMMENTS ON SUBMISSIONS BY INTERESTED PARTIES

INTRODUCTION

This chapter considers the comments made in formal submissions by the Australian Council of Trade Unions (ACTU), the Maritime Union of Australia (MUA), the Australian Institute of Marine and Power Engineers (AIMPE) and The Australian Maritime Officers Union (AMOU) (joint submission), Maritime Industry Australia Ltd (MIAL) and Comcare.

ACTU

The ACTU submission argues that the level of evidence required to qualify a disorder for inclusion on the proposed Seacare List should be lower than is required to include a disorder on the Comcare List. This is because the relevant legislation covering workers' compensation is different – the Comcare legislation requires employment to have contributed "*to a significant degree*" to the disease (or its aggravation), whereas the Seacare legislation requires "*contribution in a material degree*". The ACTU submission argues that the Seacare legislation requires less certainty in the evidence (just "*more likely than not*") than does the corresponding Comcare legislation, and that therefore disorders that might not meet the requirements of the Comcare legislation for compensation purposes might meet the requirements of the Seacare legislation. This argument seems valid in terms of decisions about general compensation. However, it does not seem relevant to the work of the current report, which explicitly only considers deemed diseases. The legislation referenced by the ACTU submission refers to all disorders eligible for compensation. In contrast, this report explicitly considers only disorders that should be considered deemed diseases, which will be a subset of disorders that are considered compensable. Not all compensable disorders are appropriate to be considered deemed diseases. The ACTU argument would only be relevant to the current work if there was a disorder for which the level of evidence was insufficient to qualify it for inclusion on the Comcare List but was sufficient to qualify it for inclusion on the proposed Seacare List. This is very unlikely because one of the requirements for inclusion of a disorder on any deemed disease list is that the level of evidence that exposure causes the disorder must be high (e.g. for the SWA List, Criterion One was "*strong causal link between the disease and occupational exposure*"[93]).

Secondly, the submission notes that seafarers work and live in the same environment, with the implication that in a given period of working a seafarer would have a greater total (cumulative) exposure than an equivalent worker who went home each day. This

implies that a shorter employment period might be appropriate than would be appropriate for someone working in a more typical work setting. This argument appears logical, but is potentially countered by the fact identified in the MUA and MIAL submissions that seafarers also spend considerable periods away from the workplace when employed, as compensation for the continuous period spent on board vessels. This would mean that in a given calendar period of employment the total exposure to a particular hazard might be similar to the exposure of a person who worked in a more typical work setting that did not involve living in the workplace for any period. Notwithstanding that, the ACTU submission implicitly argues that this different workplace setting and work arrangement mean the exposure periods or employment periods developed for the Comcare scheme should not be "unquestionably adopted". That appears to be a valid argument and indeed was considered in reaching the recommendations regarding employment periods presented in this report. The proposed minimum employment periods do take such considerations into account to the extent they can, but in practice there is not enough detail in the available information to allow much differentiation from the exposure periods recommended to be used for the Comcare scheme.

Thirdly, the ACTU submission argues that the approach taken in regard to asbestos and mesothelioma is "*indefensible*" because of the inclusion of a one-year minimum exposure period for the Comcare List, when it is accepted that much shorter exposures could result in mesothelioma. The submission rightly notes that these conditions could occur with shorter exposure periods, as is explicitly noted in the 2017 report. However, the recommended periods are explicitly and deliberately not minimum exposure periods in terms of the shortest period that could be conceivably consistent with causation. They are periods after which it is reasonable to assume that if the condition occurs it is very likely to have been due to that exposure, which seems more consistent with the overall deemed diseases approach. These issues are further considered in Chapter 6 of the current report. The 2017 report argued that different recommendations would be made if the exposure periods nominated were supposed to be the minimum conceivably consistent with causation. That remains the case. Nevertheless, several submissions reinforce the fact that asbestos is a common exposure on many vessels on which seafarers work and that seafarers may spend prolonged periods working and living on vessels. This increases the likelihood that if a seafarer is diagnosed with mesothelioma that the relevant asbestos exposure occurred in the course of work as a seafarer. Given this, the original recommendation regarding employment period has been changed from one year to three months.

The ACTU submission highlights the arguments in the 2015 report for and against the use of minimum exposure periods and argues that minimum employment periods should

not be used in the Seacare scheme. Those arguments remain valid. In that project, the decision was made not to use minimum periods. For the Comcare scheme, a different decision was made. The decision to introduce minimum exposure/employment periods for the Comcare and proposed Seacare schemes, and the merits of this decision, are beyond the scope of the current report. Instead, this report provides recommendations on minimum periods if they are to be used, noting the challenges in developing such recommendations.

MUA

The MUA submission does not support the introduction of minimum employment/exposure periods into the Seacare scheme. The MUA submission makes similar arguments to the ACTU submission, quoting from the 2015 SWA Deemed Diseases in Australia report[93] and the 2017 report to Comcare[94]. The submission argues that the preferred epidemiological approach is to use cumulative exposure, which is not adequately reflected by employment period.

The comments made above in relation to the ACTU submission apply also to the MUA submission. Using employment period as a proxy measure for cumulative exposure definitely has limitations and the ACTU and MUA submissions make cogent arguments against using any measure of cumulative exposure before a claim can be made. The question remains as to whether it is better to require such a period before a claim can be made under the deemed diseases legislation or whether to consider after a claim has been made if there has been enough exposure. The MUA submission correctly argues that most deemed diseases systems in Australia do not have exposure period or employment period requirements prior to a claim being able to be made. However, in terms of the approach of other legislation, it is worth noting that for firefighters in Australia the specific deemed disease approach in regard to cancer does in effect include minimum exposure or employment periods, requiring, for example, a "*qualifying period of active firefighting service for that disease*" (Queensland legislation[*]).

The submission also questions the proposed periods for mesothelioma and pneumoconiosis. "*One particularly problematic minimum exposure period is that of one year for mesothelioma. The fact is that brief periods of days or weeks of exposure can materially contribute to the development of the condition. In these circumstances, we cannot understand why a minimum period of one year has been recommended…"; "Similarly, for pneumoconiosis which the Professor notes can arise from a very brief*

[*] https://www.worksafe.qld.gov.au/laws-and-compliance/workers-compensation-laws/laws-and-legislation/workers-compensation-and-rehabilitation-and-other-legislation-amendment-act-2015/firefighter-provisions-2015

period of heavy exposure, the recommendation is made of a minimum exposure period of 5 years. We cannot understand how this is a valid scientific recommendation particularly with cases rising recently in Australia.". The submission rightly notes that these conditions could occur with shorter exposure periods, as is explicitly noted in the 2017 report. However, as mentioned earlier, the recommended periods are explicitly and deliberately not minimum exposure periods in terms of the shortest period that could be conceivably consistent with causation. They are periods after which it is reasonable to assume that if the condition occurs it is very likely to have been due to that exposure, which seems more consistent with the overall deemed diseases approach. These issues are further considered in Chapter 6 of the current report. The 2017 report argued that different recommendations would be made if the exposure periods nominated were supposed to be the minimum conceivably consistent with causation. That remains the case. As stated in response to the ACTU submission, the decision to introduce minimum exposure/employment periods for the Comcare and proposed Seacare Lists, and the merits of this decision, are beyond the scope of the current report. However, as noted in the response to the ACTU submission, and giving due weight to the argument that asbestos is a common exposure on many vessels on which seafarers work and that seafarers may spend prolonged periods working and living on vessels, the original recommendation regarding employment period for asbestos and mesothelioma has been changed from one year to three months. The argument does not carry the same weight in relation to seafarers and pneumoconiosis and therefore the minimum employment period recommendation has not been changed for these disorders.

The MUA submission notes similar concerns to the ACTU submission in terms of non-standard working arrangements, particularly that seafarers work and live in the same environment. The submission also notes that 1:1 work:leave arrangements exist for most vessels with union agreements but not necessarily for workers on vessels without union agreements. For such workers, the greater exposure during a calendar period of work might not be offset by a prolonged period of shore leave.

The submission mentions some particular exposures or disorders not currently on the Comcare List or proposed for inclusion on the Seacare List and about which concerns have been raised by their seafarer members. Some of these are already included in the Comcare List (radioactive materials and crystalline silica); some currently have insufficient evidence of an exposure-disorder link in one or more specific relevant work groups to be included in a deemed diseases system (mental health and the SARS-CoV-2 pandemic; firefighting foams; bushfire smoke and PM2.5 particulates; Guillain-Barre syndrome); and one was explicitly considered in the original 2015 SWA publication on Deemed Diseases and the arguments presented there still apply (Legionnaire's disease). It should be noted that an exposure-disorder pair not currently included in a deemed

diseases system relevant to a worker can still be the subject a workers' compensation claim. However, the claim would need to be made through the general compensation system.

Finally, the submission states that it appears most ("*the overwhelming majority*") claims to date have been related to asbestos exposure. Some relevant information is included in the Comcare submission, which provided information on claims under the Seafarers Act from 2005 to late 2020. This identified 94 claims "*…which may relate to deemed disease conditions under the Seacare deemed disease instrument...*", of which 78 had been accepted. Of the 76 for which details are provided in the submission, 15 (20%) were identified as being due to asbestos and the remainder appear not to have been or probably not to have been.

Consistent with the above arguments, and others mentioned in the submission, the submission argues for a change in the Terms of Reference. Changes to the Terms of Reference are beyond the scope of the current report and are not further considered here.

AIMPE AND AMOU

The joint AIMPE and AMOU submission makes similar arguments about minimum employment periods to those included in the ACTU and MUA submissions described earlier. The submission does not support the use of minimum employment periods. It notes that seafarers work and live in the same environment, with the implication that in a given calendar period of working a seafarer would have a greater total (cumulative) exposure than an equivalent worker who went home each day. This implies that a shorter employment period might be more appropriate than would be appropriate for someone working a more typical work setting. This argument appears logical, but is potentially countered by the fact identified in the MIAL and MUA submissions that seafarers also spend considerable periods away from the workplace when employed, as compensation for the continuous period spent on board vessels. This would mean that in a given calendar period of employment the total exposure to a particular hazard might be similar to the exposure of a person who worked in a more typical work setting that did not involve living in the workplace for any period.

The submission separately notes there may be hazards encountered on board the ship which are not encountered on shore. This is of course true and was part of the basis for the work presented in Chapter 3.

Consistent with the above arguments, the submission argues for a change in the Terms of Reference. Changes to the Terms of Reference are beyond the scope of the current report and are not further considered here.

MIAL

There are two key differences between the MIAL submission and the submissions considered earlier in this chapter.

The first is that MIAL explicitly supports the use of minimum employment periods. The long continuous periods of work and downtime on board a vessel are noted, but stated to be balanced by equal periods of time away from work. Minimum employment periods, it is argued, should take these periods into account and might therefore result in different minimum periods to those used in the Comcare instrument. The MIAL submission argues that these proposed periods should be "*…based on empirical evidence, as far as possible taking into account the likely exposure of those workers covered by the Scheme being seafarers.*". These are valid points. The MIAL submission also suggests clarifying the types of workplaces to which the Seacare scheme applies, so that these can be taken into account when proposing minimum exposure periods. The proposed minimum employment periods do take such considerations into account to the extent they can, but in practice there is not enough detail in the available information to allow much differentiation from the exposure periods recommended to be used for the Comcare List.

The second key difference is that the MIAL submission argues that seafarers have different exposures to many in the workforce, which means that some disorders included on the Comcare List are not relevant to the work of seafarers and so should not be included on the proposed Seacare List. The MIAL submission does argue for a specific consideration of conditions and disorders relevant to seafarers which, it argues, logically could mean some disorders appropriate for inclusion on the Comcare List might not be appropriate for inclusion on the Seacare List. Therefore, it argues that the Terms of Reference for the current report should include consideration of "*…whether any disease as included in the Comcare Instrument should not appear in the specified diseases instrument that will apply to the SRC Act.*". The decision for the Terms of Reference not to consider whether any disorders should be removed for the Seacare scheme is beyond the scope of the current report and is not further considered here. Both MIAL submissions also include comments on other matters that are beyond the scope of this report and are not considered here.

COMCARE

Comcare made a submission on the basis that the proposed Seacare List is to be based on the Comcare List, an approach that Comcare's submission supported. Comcare also supported the review of the SWA List to take into account information published since the original SWA List was developed.

6. EMPLOYMENT PERIOD

INTRODUCTION

This chapter presents information on the recommended employment period for the exposures recommended to be included in the proposed Seacare List. No changes to the employment period in the Comcare List are recommended for the same conditions included on the proposed Seacare List. However, employment periods are required to be recommended for the additional disorders recommended to be included on the proposed Seacare List.

In developing the recommendations regarding the employment period, there are several challenges. These were considered in the report prepared for Comcare when the Comcare List was developed and remain relevant to the current work[94]. The text below is heavily based on the text prepared by the author of that report.

For most conditions included on the SWA List there is likely to be a minimum exposure ('sufficient exposure') or employment period below which the disorder would not occur or is very unlikely to occur. The relevant measure of this exposure is usually the total exposure (cumulative exposure) rather than just a length of exposure or a level (concentration or intensity) of exposure. That is, a higher exposure (in terms of the concentration in air or liquid, or the force required for movement) for a shorter time is assumed to have a similar risk to a lower exposure for a longer time.

Unfortunately, for most exposure-disorder pairs, the minimum exposure is not well characterised. In addition, the level (concentration) of exposure is unlikely to be known with any accuracy for an individual worker. Therefore, any judgments on this can really only be based on a qualitative assessment. Although there is some information for some limited exposure-disorder pairs, assessing this comprehensively for all conditions on the Comcare or SWA Lists is unlikely to provide definitive recommendations on sufficient exposure that are precise enough to make a meaningful difference to the current assessment required for the proposed Seacare List.

In the absence of definitive information on required cumulative exposure and the likely absence of useful workplace exposure data to establish the cumulative exposure of an individual worker, the appropriate approach taken was to recommend a minimum employment period (which is assumed to be correlated with a minimum exposure time) rather than to try to stipulate a minimum cumulative exposure. This assumes that typical workers with exposure to a particular hazardous substance have similar levels of exposure, which means that if they are exposed for a similar length of time they will

have a similar cumulative exposure and thus a similar risk of developing the disease related to the exposure. This is the rationale for proposing a minimum exposure period or employment period rather than proposing a minimum cumulative exposure. Therefore, with the above provisos, recommendations on sufficient exposure (based on employment period) are made for relevant conditions, based on a qualitative and semi-quantitative assessment of the available information. This does not mean that a shorter, intense, exposure could not result in the development of the condition, but there would be enough uncertainty about this to mean such a claim might be better pursued through the usual compensation pathway rather than the deemed diseases pathway.

CANCER

ALL CANCERS

Four new cancer-exposure pairs were recommended for inclusion in the proposed Seacare List that were not included in the Comcare List. These inclusions are a result of information that has become available since the original SWA List was developed.

The same approach used to develop the minimum employment period for the other cancers on the Comcare List is recommended to be used for the new cancers. This is because there is no information specific to these exposures that would provide adequate guidance to modify the standard approach used for the vast majority of the cancer-exposure pairs on the Comcare List.

As was the case with the Comcare List, the minimum employment periods to adopt for the proposed Seacare List depend on the degree of sensitivity (i.e. including all claims that do arise from occupational exposures and therefore that should be compensated) and specificity (excluding all claims that do not arise from occupational exposures and therefore that should not be compensated). Inevitably, the approach adopted must be a balance between the two, keeping in mind that individual cases which are deemed not to fall under the deemed diseases approach can still be the subject of a claim using the usual compensation methods.

The approach used for the Comcare scheme and recommended below have been developed with an assumption that the deemed diseases approach to be adopted for the Seacare scheme should not be based on minimum required exposure considered plausible, but on exposure periods or employment periods developed so there should be little question that the disease of interest could have developed as a result of the occupational exposures in question. Different recommendations would be made if absolute minimum employment periods were to be adopted. However, the adoption of such minimum employment periods is less consistent with the deemed diseases approach

of including disorders very likely to be due to work-related exposures while excluding disorders where the relationship to work is less clear.

For the Comcare List, specific recommendations were made for mesothelioma and lung cancer associated with asbestos exposure. For all other cancers, a single recommendation was made for solid cancers and a single recommendation for haematological malignancies, as there is insufficient published information available to provide reliable separate estimates.

It is recommended that the new cancer-exposure pairs have a minimum employment period consistent with minimum exposure periods recommended for the Comcare List. That means for two of the pairs (chloangiocarcinoma and 1,2-Dichloropropane and ocular melanoma and welding ultraviolet light), a five-year employment period is recommended. For the remaining two pairs (non-Hodgkin's lymphoma and pentachlorophenol and non-Hodgkin's lymphoma and lindane) a two-year employment period is recommended.

It is recommended that for all other cancer-exposure pairs, the minimum employment period for the proposed Seacare scheme should be the same as the minimum exposure period for the corresponding pair in the Comcare scheme. The one exception to this is mesothelioma and asbestos. Asbestos is a common exposure on many vessels on which seafarers work and seafarers may spend prolonged periods working and living on vessels. This increases the likelihood that if a seafarer is diagnosed with mesothelioma that the relevant asbestos exposure occurred in the course of work as a seafarer. Given this, it is recommended that the relevant employment period be three months rather than the one year used for the Comcare scheme.

INFECTION

There is no minimum exposure period in terms of infectious agents and a resulting disorder. Any confirmed or likely contact with the relevant infectious agent would be deemed sufficient exposure. This is the case for malaria, the only new infection recommended for inclusion in the proposed Seacare List. Therefore, no minimum employment period is recommended.

OTHER DISORDERS

There is no information available to suggest a different employment period to the exposure period used in the Comcare List should be used for any of the other disorders proposed for the proposed Seacare List. Therefore, it is recommended the minimum employment period for the proposed Seacare scheme should be the same as the minimum exposure period recommended for the Comcare List for all other disorders included in the proposed Seacare List.

7. RECOMMENDATIONS

Chapter 3

1) It is recommended that malaria be included in the proposed Seacare List.

Chapter 4

2) It is recommended that the proposed Seacare List include four additional cancer-exposure pairs identified as a result of information in the literature published since 2014. These are non-Hodgkin's lymphoma and pentachlorophenol, non-Hodgkin's lymphoma and lindane, chloangiocarcinoma and 1,2-Dichloropropane, and ocular melanoma and welding ultraviolet light.

Chapter 6

3) It is recommended that the new cancer-exposure pairs have a minimum employment period consistent with the exposure periods recommended for the Comcare List. That means for two of the pairs (chloangiocarcinoma and 1,2-Dichloropropane and ocular melanoma and welding ultraviolet light), a five-year employment period is recommended. For the remaining two pairs (non-Hodgkin's lymphoma and pentachlorophenol and non-Hodgkin's lymphoma and lindane) a two-year employment period is recommended.

4) It is recommended that for all other cancer-exposure pairs, the minimum employment period for the Seacare scheme should be the same as the minimum exposure period for the corresponding pair in the Comcare scheme. The one exception to this is mesothelioma and asbestos, for which it is recommended that the relevant employment period be three months rather than the one year used for the Comcare scheme.

5) It is recommended there is no minimum employment period in terms of malaria.

6) It is recommended the same employment (exposure) period as recommended for the Comcare List is used for all other disorders included in the proposed Seacare List.

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APPENDIX 1 – DETAILS OF SEARCH METHODOLOGY

Medline

Database: Ovid MEDLINE(R) ALL <1946 to January 24, 2020>

Search Strategy:

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1 epidemiology.mp. or exp Epidemiology/ (1714739)
2 exp Naval Medicine/ or maritime.mp. (12291)
3 seafarer.mp. or exp Naval Medicine/ (9583)
4 occupational disease.mp. or exp Occupational Diseases/ (130580)
5 occupational injury.mp. or exp Occupational Injuries/ (3623)
6 occupational exposure.mp. or exp Occupational Exposure/ (69526)
7 work-related.mp. (15634)
8 2 or 3 (12333)
9 4 or 5 or 6 or 7 (192472)
10 1 and 8 and 9 (288)
11 limit 10 to yr="2000 -Current" (157)
12 limit 11 to humans (155)
13 limit 12 to english language (144)

Scopus

(TITLE-ABS-KEY (epidemiology) AND TITLE-ABS-KEY ((seafar* OR sailor OR maritime OR naval OR navy OR navies)) AND TITLE-ABS-KEY (disease* OR injur* OR expos*) AND TITLE-ABS-KEY ((occupation OR work))) AND PUBYEAR > 1999 AND (LIMIT-TO (LANGUAGE , "English")) 46

Web of Science

(TS=((epidemiology) AND (seafar* OR sailor OR maritime OR naval OR navy OR navies) AND (disease* OR injur* OR expos*) AND (occupation OR work))) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article); Timespan: 2000-2020 31

EMBASE

Database: Embase Classic <1947 to 1973>, Embase <1974 to 2020 January 24>

Search Strategy:

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1 exp epidemiological data/ or exp epidemiology/ or epidemiolog*.mp. (4684156)

2 maritime.mp. or exp ship/ (9140)

3 seafarer.mp. (130)

4 naval.mp. (3816)

5 2 or 3 or 4 (12757)

6 occupational disease.mp. or exp occupational disease/ (138875)

7 occupational injury.mp. or exp occupational accident/ (24053)

8 occupational exposure.mp. or exp occupational exposure/ (86054)

9 6 or 7 or 8 (206790)

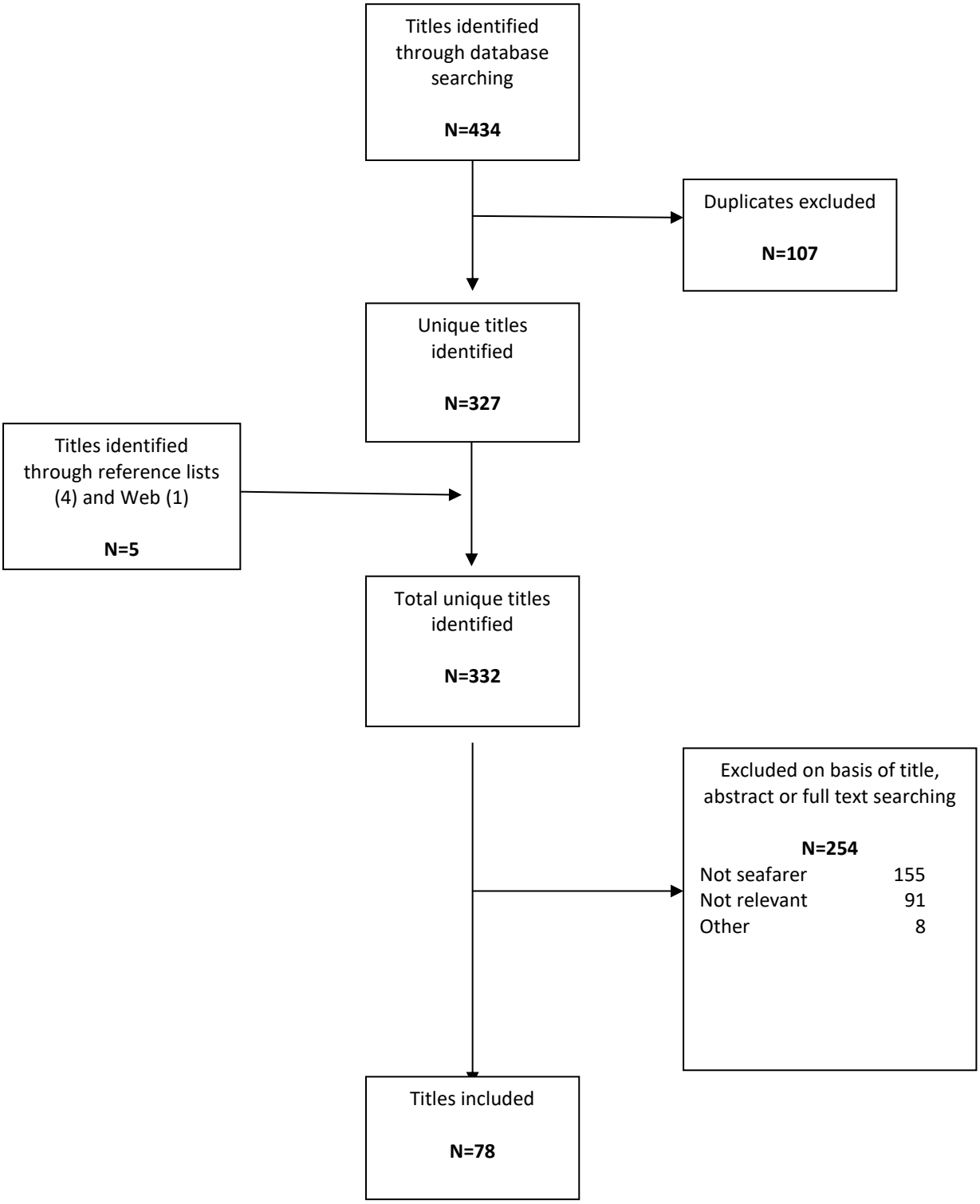
10 1 and 5 and 9 (384)

11 limit 10 to yr="2000 -Current" (238)

12 limit 11 to human (234)

13 limit 12 to english language (213)

Figure 1: Flow chart of study identification and selection



APPENDIX 2 – REVIEW OF DISEASES ASSOCIATED WITH MARITIME WORK – ADDITIONAL INFORMATION

INTRODUCTION

This appendix provides some more detail on information summarised in Chapter 3, providing a review of published literature on occupational diseases associated with maritime work.

EXPOSURES

The main disease-related hazards for seafarers include stress, isolation, fatigue, infectious organisms, hazardous substances and solar-UV[1]. Studies of specific hazardous exposures included those focussing on asbestos[2] and on fumigants[3].

GENERAL STUDIES

There have been several studies of mortality, morbidity or hospital admissions involving seafarers. Many of these did not include a clear comparison group and so only provide an indication of the relative proportion of various diseases affecting seafarers. Others do provide some comparison to a general population, either the working population or the population overall. However, none provides appropriate control of possible confounding factors such as smoking, alcohol and diet. Therefore, the extent to which any of the identified disorders have occurred as a result of occupational exposures is not clear.

Most of these studies identify cardiovascular disease in general, or ischaemic heart disease in particular, as being the most common serious health disorder in seafarers. Other diseases commonly identified included gastrointestinal disease, infection, musculoskeletal diseases, respiratory diseases and cancer. [4-21]

The focus of these studies was Denmark[4, 7-9, 14, 22], Germany[12, 13], Italy[6], Japan[5], the United Kingdom[15-21] and the United States[11].

A study of marine deaths in Danish ships used data from a variety of sources. The study identified the main cause of disease death – infection, ischaemic heart disease, gastrointestinal disease and cerebrovascular disease – but there was no comparison or rate information.[4]

A study investigated reports of diseases in Japanese seafarers from 1986 to 2000. Commercial fishers were included but separate results were available for merchant seafarers. The most common diseases were digestive, musculoskeletal, cardiovascular, respiratory and malignant diseases. However, there was no comparison information.[5]

A study of causes of death in Italian seafarers between 1986 and 2010 used reports from the Italian Telemedical Maritime Assistance Service. This showed cardiovascular disease was the most common cause of death. However, there was no calculation of the incidence nor comparison to an external population.[6]

A study of a cohort of Danish merchant seafarers investigated the rate and causes of hospitalisation of the cohort members, with results compared to those for the total workforce. Cohort members were followed for five years. High rates were found for a range of disorders, in particular endocrine and nutritional diseases (probably primarily diabetes), cervical disc disorders, gastritis and duodenitis, and neoplasms. The low rate of acute myocardial infarction was said to be probably due to affected people tending to be hospitalised overseas rather than when back in port in Denmark[7].

A study of a cohort of Danish merchant seafarers investigated the rate and causes of hospitalisation of the cohort members, with results compared to those for the total workforce. Cohort members were followed for ten years. High rates were found for a range of disorders, in particular bronchitis, emphysema, cancer of the lung, alcohol-related liver diseases and diabetes in male non-officers and for skin melanomas for female officers[8]. A later similar study by the same authors found similar results and identified a raised rate for HIV-related admissions[9]. The rate of hospitalisation for noise-induced hearing loss was also found to be raised in engine room personnel compared to the general population and to other seafarers[22].

A study of a telemedicine database that covered seafarers worldwide identified dental, skin, gastrointestinal and respiratory conditions as the most common but there was no comparison to a reference group[10]. A later study by the same group used the same database but focussed on American seafarers. This study found very similar results, except that respiratory diseases were the second-most common disorder[11].

A study of German seafarers examined the discharge diagnosis over an eleven-year period. The main non-cancer disorders identified were diseases of the circulatory system, diseases of the digestive system and diseases of the musculoskeletal system. However, the rates of these diseases were lower compared to the general population, apart from for asbestosis. An exception to this was that the hospitalisation rates for many of these diseases were higher in galley staff than the general population[12].

A study of German seafarers examined deaths at sea over 11 years (1998-2008). The most common types of disease deaths were acute ischaemic heart disease and chronic ischaemic heart disease. Crude mortality rates were calculated but no informative comparisons were made to an external reference group[13].

A review of Danish register-based studies of seafarers found increased mortality rates for cirrhosis of the liver, cancer and suicide; and increased hospitalization rates for male seafarers for endocrine/nutritional conditions, cervical disc pathology, gastrointestinal disease, cardiovascular disease, cancer and hearing impairment. For female seafarers, hospitalisation rates were increased for cancer, circulatory disease and genitourinary disease[14].

Several studies of UK seafarers have been published. These have examined mortality and morbidity. Cardiovascular disease; gastrointestinal disease, particularly liver cirrhosis and stomach ulcers; and acute pancreatitis were the most common disorders. Most of the studies just described deaths without a comparison group[15-21].

CANCER

There have been several studies specifically of cancer in seafarers. In addition, some large population-based studies of specific cancers in the Nordic countries have identified some raised rates in seafarers.

STUDIES OF MULTIPLE TYPES OF CANCER

High rates of all cancers combined were found in Denmark[14, 23, 24] and Germany[25]. A wide range of individual cancers have been found to have raised rates in seafarers, with the most consistent being cancers related to smoking and/or alcohol such as cancers of the lung, larynx, pharynx, oesophagus, tongue, mouth, colon, pancreas, kidney and bladder[23-29]; and malignant mesothelioma, almost certainly due to asbestos exposure[2, 24, 28-30].

A retrospective cohort study of seafarers in Denmark was followed from 1986 to 2002 and the rates of cancer compared to rates in the national population. High Standardised Incidence Ratios (SIRs) were found for all cancers combined (SIR=1.26, 95% CI 1.19 to 1.32) for men and (SIR=1.07, 95% CI 0.95 to 1.20) for women. Specific cancer types found to have increased rates were cancers of the lung, larynx, tongue, mouth, pharynx, oesophagus, colon, pancreas, kidney, bladder and bone in men and cancer of the lung, rectum and cervix in women. The use of tobacco was identified by the authors as a probable important contributor to the high rates of cancer in men[23].

An update of this study extended the follow-up to 2015. The findings were similar, with an increase in all cancers in males (SIR=1.19, 95% CI 1.15 to 1.23) and females (SIR=1.14, 95% CI 1.07 to 1.22) compared with the general Danish population. Increased rates were found for several different cancer types, but particularly gastrointestinal, respiratory and genitourinary cancers, and again many cancers for which smoking and/or alcohol were risk factors. There were also increased risks of mesothelioma in males[24].

A retrospective cohort study linking census data to cancer registry data in Denmark, Finland, Iceland, Norway, and Sweden from the 1961 to 2005 identified a high risk of several different cancer types in seafarers. Raised rates were seen for cancer of the mouth, tongue and pharynx; oesophagus; stomach; colon; rectum; larynx; lung; pancreas; kidney and bladder. As noted by the authors, these are sites of cancer where the risks are increased by alcohol and tobacco use and probably protected by consumption of fruit and vegetables[27].

A cohort study of Icelandic marine engineers followed subjects from 1955 to 1998, with comparison to the general population. Increased SIRs were found for stomach cancer and lung cancer, and also for all cancers, pleural mesothelioma and bladder cancer when a 40-year lag period was applied[28]. An analysis from a related study of deck officers found a decreased risk of bladder cancer but an increased risk of soft tissue sarcoma[34].

A study of German seafarers examined the discharge diagnosis over an eleven-year period for cancers and compared these to cancer discharge diagnoses for the general population. Higher rates of discharge were found for cancer overall and for leukaemia, non-Hodgkin's Lymphoma, respiratory cancers and non-melanoma skin cancer[25].

A nested case-control study was conducted of cancer in Finnish seafarers, with follow-up from 1967-1992. The main findings were increased risks of leukaemia and renal cancer, and possibly lymphoma, in deck crews on tankers; and increased risk of mesothelioma in engine room workers[29].

STUDIES OF NON-MELANOMA SKIN CANCER

An increased risk of squamous cell carcinoma of the skin and of non-melanoma skin cancer has been found in seafarers in the Nordic countries[31], Italy[32] and Germany[25].

A retrospective cohort study linking census data to cancer registry data in Finland, Iceland, Norway, and Sweden covering the years 1961 to 2005 identified an increased

risk of squamous cell carcinoma in seafarers over the age of 50 years (SIR=1.23, 95% CI 1.14-1.32)[31]

A case control study in northern Italy found an increased risk of non-melanoma skin cancer in fishermen, sailors and lifeguards (combined) (Odds Ratio=4.3; 95% CI=1.14-16.4)[32].

BLADDER CANCER

A retrospective cohort study linking census data to cancer registry data in Denmark, Finland, Iceland, Norway, and Sweden from 1961 to 2005 identified an increased risk of bladder cancer in seafarers over the age of 50 years (SIR= 1.22; 95% CI 1.16 to 1.30)[26].

MALIGNANT MESOTHELIOMA

A study reviewed 50 cases of malignant mesothelioma in seafarers in Italy in the period 1973-2003. Twenty-six of the affected people had been in the merchant navy. The latency periods ranged from 33 to 72 years, with a mean 56.1 years[30].

Seafarers are occupationally exposed to asbestos and this has been known since the 1970s. However, one author argued that it is not clear whether seafarers actually do have an increased risk of mesothelioma or lung cancer resulting from asbestos exposure, because of the difficulty of accounting for asbestos exposure during other occupational work[2].

Other cancers for which high rates have been found in seafarers in at least one study include cancer of the rectum and cervix in women[23]; cancer of the stomach[28]; cancer of the prostate[33]; soft tissue sarcoma[34]; leukaemia[25, 29] and non-Hodgkin's Lymphoma[25].

PROSTATE CANCER

A retrospective cohort study linking census data to cancer registry data in Denmark, Finland, Iceland, Norway, and Sweden from the 1961 to 2005 identified a small increased risk of prostate cancer in seafarers over the age of 50 years (SIR= 1.05; 95% CI 1.02 to 1.09)[33].

INFECTIOUS DISEASE

Infectious disease has been identified as a problem for seafarers[1, 35, 36]. Malaria is a major problem for seafarers who operate in regions in which malaria is endemic[37-41].

A study focussing on infectious disease considered all medical events documented aboard cargo ships of a French international shipping company over four years. Skin infections,

urinary tract infections and dental infections were the most common infections identified[35].

DISEASES OF THE RESPIRATORY SYSTEM

Occupational asthma is an important problem in maritime workers due to a range of exposures[42, 43]. A study of Russian maritime workers found better respiratory health in merchant seafarers than in commercial fishers but there was no comparison to the general population[95].

CARDIOVASCULAR DISEASE

A recent review of studies on cardiovascular risk factors and cardiovascular disease in seafarers concluded that seafarers have a higher risk of cardiovascular disease than the general population. The authors found the most common problem was overweight and obesity, with hypertension, smoking, type 2 diabetes and lipid disorders also a problem but to a lesser extent. Other risk factors highlighted in the review as being an issue for seafarers included difficult working conditions and psychological stress[44]. Several individual studies of cardiovascular disease in seafarers have also been conducted in Germany[1, 45-47], Denmark[48], Poland[49, 50] and the United Kingdom[20].

Increased rates of cardiovascular disease compared to the general population have been identified in seafarers in several studies and reviews[1, 45]. However, a study of German seafarers found that although coronary heart disease risk factors were common amongst seafarers, the age-standardised 10-year coronary heart disease risk for seafarers was similar to that of a comparison group of shore workers[46, 47].

A register-based cohort study of Danish seafarers calculated the Standardised Mortality Ratio (SMR) for coronary heart disease, cerebrovascular disease and total mortality. The comparison was to the general adult population in Denmark. Male seafarers under the age of 46 were found to have a raised risk of coronary heart disease (SMR=1.48, 95% CI 1.06–2.01) and cerebrovascular disease (SMR=1.93, 95% CI 1.16–3.02). The analysis accounted for age but not other known risk factors for cardiovascular disease[48].

A study of male Polish seafarers found the incidence of acute myocardial infarction was not higher than that of the general male Polish population. This was stated to be probably due to a healthy worker effect. However, the rate of death from acute myocardial infarction prior to reaching hospital or within one month was higher in the seafarers. This was stated to be probably due to work-related factors on-board ships and

the difficulty in receiving early treatment if the incident occurred while the person was at sea[49].

A study of cardiovascular disease in British seafarers found a decreased risk (compared to the general population) during work on board ship but an increased risk in seafarers on land within 30 days of leaving their ship. The lower rates on board ship were argued to probably be due to a healthy worker effect[20].

Finally, a study of sudden cardiac events of seafarers on board Polish ships identified several occupational risk factors of importance, particularly related to physical effort and heat[50].

DRUG AND ALCOHOL USE

Alcohol and smoking consumption have been found to be increased in seafarers compared to the general population[51] and to be important problems in French seafarers[52]. A questionnaire-based study of alcohol and drug use in French seafarers found 44% of participants were current smokers (27% overall were nicotine dependent) and 11% drank alcohol every day (2% overall were alcohol dependent)[52].

HEARING LOSS

Hearing loss, presumed to be due to noise exposure, has been identified in seafarers in several studies[14, 22, 53]. For example, a population-based study in Norway identified loss of hearing was more common in several population groups, including seafarers (Prevalence ratio=1.6(95% CI 0.9-3.0)[53].

MENTAL HEALTH

Seafarers face many challenges in terms of mental health stressors[1, 54-59] and depression and suicide are considered important health issues for seafarers[54, 60-62]. A recent review article found some evidence of an improvement in recent years in terms of mental health stressors[61]. A study of coastal seafarers in the United Kingdom found a lower level of severe stress, but a higher proportion of workers with depression, compared to comparison general population work groups[60]. In contrast, a study of Turkish mariners found a low level of bullying by groups of workers[57].

Fatigue has also been identified as an issue for many seafarers, with the connection to ill health highlighted, although there is some uncertainty as to the direction of the relationship between reported fatigue and reported ill health[63, 64].

ORAL HEALTH

Several papers suggested that the oral health of seafarers was poor, but the lack of a clear comparison group for the seafarers group makes interpretation of the results difficult[65, 66].

OBESITY

Obesity has been found to be a problem in seafarers in a number of studies covering various countries. These include Denmark[67], Turkey[68] and Italy[69]. Metabolic syndrome has also been found to be present in a quarter of Danish seafarers[70]. This prevalence was a little under the national rates for this condition. However, the included seafarers were younger and probably from a higher social status group than the population as a whole, and the authors suggested the observed rates were probably higher than a group of the general population comparable in terms of age and social status[70].