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Factors influencing the incidence rates of injuries and accidents among seafarers and rig workers providing support to the WA offshore oil and gas industry

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**Factors influencing the incidence rates of injuries
and accidents among seafarers and rig workers
providing support to the WA offshore oil and gas
industry.**

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USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

Ethical Approval

Ethical approval for this research was granted by the Edith Cowan University Human Research Ethics Committee. All data used in this research were treated as confidential. Identifying information or records pertaining to this research were disposed of in accordance with Offshore Marine Services document control process.

Declaration

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Abstract

The aim of this study was to identify, discuss and make recommendations regarding causal factors associated with injuries and accidents among seafarers and rig workers providing support to the WA offshore oil and gas industry. These incidents cause significant personal and economic burdens for employees, employers and the community in general.

A sample of 484 participants were recruited from a workforce of 9800 employees (approximately 5%). Participants were stratified into 2 cohorts; those who had suffered injury (286 – study group) and those who had not (198 - controls).

Data from the study group were stratified into oilrig workers and vessel seafarers. A one-way analysis of variance revealed that the injury incidence rate for the seafarers in the study group was significantly higher (mean 14.4 injuries) in the first quarter of each multi week work period (“swing”) ($P=0.001$), compared to means of 4.125 and 2.44 and 4 for the subsequent quarters. For the oil rig workers, the mean injury incidence rates across the four quarters remained similar.

It was recommended that a safety officer be assigned to each vessel to support workers for the 1st quarter of each swing. Implementation of this practice has been trialled in another study leading to a reduction in the number of incidents over a 12 month period (Brown, 2009). Other factors that influenced injury incidence rates were age and level of experience, with younger and less experienced workers being more injury prone. Encouraging older, experienced workers to mentor younger employees and to manage their workload according to their physical capabilities will be a useful intervention. The implementation of these recommendations will reduce the injury incidence rate of this unique cohort of employees thus reducing the economic burden of injuries and accidents to the employee, the employer and the community in general.

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This work represents the pinnacle of my journey in the world of occupational health and safety and also the end of my travels, the writing of this thesis was the last mountain in my personal journey left to climb. Not one of my achievements in the safety world has been gained without the support of my loving family. I thank them, one and all.

To my Co-Supervisor: Dr Joseph Mate, when I needed it the most your direction and assistance was most helpful was very much appreciated.

Associate Professor Jacques Oosthuizen my Supervisor, you are the reason I have made it today, I owe this all to you, because without your belief in me, I would have never made it.

Thank you Jacques.

Glossary of Terms

Approved Vocational Rehabilitation Provider [AVRP]

A person or company accredited by Work Cover WA to provide vocational rehabilitation services to injured workers (Work Cover Western Australia, 2003b p. 28.; Work safe Victoria, 2006).

Australian Maritime Safety Authority (AMSA)

The national regulator for maritime safety in Australia and a statutory authority.

Blue Water

The common terminology used for international shipping where vessels are required to traverse the high seas.

Chief Engineer

The chief engineer on a supply or support vessel is the official title of someone qualified to oversee the engine department. The qualification for this position is colloquially referred to as a "Chief's Ticket". The Chief Engineer, commonly referred to as "The Chief", "Cheng", or "Chief" is responsible for all operations and maintenance that have to do with all engineering equipment throughout the vessel. Chief engineer is the head of the Engine department and reports to Master (Captain) of the ship. The Chief Engineer cannot assume command and the command always rests with the deck officers until and unless it is clearly mentioned within the safety management system.

Chief Mate

A Chief Mate is head of the deck department of a ship. The chief mate is customarily the watch keeper and is in charge of the ship's cargo and deck crew. The chief mate is responsible to the Master for the safety and security of the ship. Responsibilities include the crew's welfare and training in areas such as safety, firefighting, search and rescue.

Deck Hand

Responsible for the basic and manual labour on deck, such as cleaning and the maintenance of facilities and/or assisting others in the manual labour needed.

Derrick Man / Hand

Person responsible for the fine operation and general maintenance of the

mud, and mud pumps and other machines used in the pump room; also assists the Roughnecks on the drill floor. When required climb up the drilling tower and help with racking the drill pipe, when removed from the drill hole.

Directional Driller

Person who is responsible for the implementation of directional wells at the rig site; also, is involved with well engineering, design and operations, and the development of safety and operational plans.

Drill rig

A drilling unit that is not permanently fixed to the seabed, e.g. a drillship, a semi-submersible or a jack-up unit. Also means the derrick and its associated machinery.

Exploration drilling

Drilling carried out to determine whether hydrocarbons are present in a particular area or structure.

Injury Management

A workplace managed process incorporating employer and medical management from time of injury to facilitate where practicable, efficient and cost effective return to suitable employment (Work Cover Western Australia, 2003a).

Injury Management System

A comprehensive workplace based system to manage work related injuries and assist injured workers return to gainful employment (Work Cover Western Australia, 2003a).

Integrated rating

Integrated ratings carry out maintenance and lookout duties on decks and in the engine rooms of support vessels and towing vessels.

Integrated ratings may perform the following tasks:

1. Maintain deck equipment, cargo gear, rigging and lifesaving and firefighting appliances
2. Stand lookout at sea and alert deck officers when other vessels, navigation marks or hazards are sighted
3. Steer the ship under supervision
4. Secure cargoes and splice wires and ropes

5. Handle rope and wire mooring lines, gangways and ladders when the ship is berthing and un berthing
6. Maintain cleanliness of decks and structures
7. Remove rust from, treat and paint the ship's sides and structures
8. Assist in maintaining and repairing the ship's engines and mechanical equipment
9. Clean the ship's cargo compartment and the fresh water, ballast and oil tanks.
10. Deploy and run anchors and chains and recover anchors and chains.
11. Deploy and recover anchor marker buoys

Integrated ratings may spend long periods at sea. When steering the ship, on lookout duty or on watch, integrated ratings work under the direction of the officer of the watch. When in the engine room, they work under the direction of engineering officers.

Long Duration Workers' Compensation Claim (LDC)

Workers' compensation claim that requires the employee to have a total of greater than or equal to 60 days lost time or days off work because of a work related injury, illness, disability or incident.

Maritime Union of Australia (MUA)

The Maritime Union of Australia covers waterside workers, seafarers, port workers, professional divers, and office workers associated with Australian ports.

Master or Master Mariner

Person who is responsible for the rig/vessel moving, inspections and audits, risk, safety and environment issues, transportation, installation and load plans; also, has some involvement in the review and approval of offshore projects.

Motorman

The motorman is the person responsible for the smooth operation of power output from the engine room; other duties include maintenance and control of water makers and air compressors, completion of equipment reports, changing oil and filters.

Mudman

The Mudman works in the shaker room monitoring the supply of mud to the hole during drilling operations.

Occupational Rehabilitation

The restoration of injured workers to their fullest physical, psychological, social, vocational and economic usefulness (New South Wales Department of Industrial Relations and Employment 1987), as cited in Kenny.

Offshore

A term that refers to vessel operations off the coast of a country; usually related to exploration for resources (gas, minerals, oil etc).

Offshore Marine Services (OMS)

Offshore Marine Services is one of the world's leading providers of offshore drilling and marine personnel to the oil and gas industry. OMS is part of an international group of companies with offices strategically positioned in Australia, New Zealand, the United Kingdom, Malta, the United Arab Emirates and Singapore, allowing the company to offer a global solution to the industry's manning and marine requirements.

Pumpman

Person working as the assistant to the Derrickman and can work in the mud pump room or assist as a Roughneck on the drill floor when required; also known as Assistant Derrickman.

Rehabilitation

Part of the injury management process and where necessary can include, but not limited to, the use of physical and vocational services (Work Cover Western Australia, 2003a p.30).

Roughneck

Person working on the rig floor responsible for the machines and equipment used for the drilling operation; usually works in a group of three Roughnecks. The supervisor of the Roughneck is generally the Chief Driller.

Roustabout

Person who typically works on oil rigs, duties include; unloading of equipment, servicing well units, supplying equipment to rig floor when required, keeping main deck and pipe deck tidy and clean and helping with the guidance of the crane as supply loads are moved to the rig deck.

Second Engineer

The second engineer or first assistant engineer is the officer responsible for supervising the daily maintenance and operation of the engine department and reports directly to the chief engineer.

On a supply or support vessel, the second engineer is in command of the engine department after the ship's chief engineer. The person holding this position is typically the busiest engineer aboard the ship, due to the supervisory role and operational duties performed (responsibility for the refrigeration systems, main engines, and any other equipment not assigned to other engineers).

Second Mate

The second mate is an authorized person and is generally responsible for the maintenance of distress signalling equipment, bridge watch duties, plotting the ship's course, tracking the ships movement, using radar, radios, maps, safety and fire-fighting equipment, and maintaining small boats. The second mate is the navigator of the ship and as such needs to update and correct charts and lighthouse information and is responsible for the radios and the GMDSS (Global Maritime Distress and Safety System).

Seismic Crew

Person(s) who are either Geophysicists or Geologists tasked with activities related to the discovery and/or study of oil fields and wells.

Short Duration Workers' Compensation Claim (SDC)

Workers' compensation claim that requires the employee to have a total of less than 60 days lost time or days off work due to a work related injury, illness, disability or incident.

Steward

A Steward's role is to assist the Cook in preparing the daily meals, particularly in the preparation of desserts and breakfasts. Upon delivery of supply, the Steward helps load the merchandise on board the ship.

STCW

International Convention on Standards of Training Certification and Watch keeping.

Swing

A colloquial term referring to a work period away from home. The industry standard is generally 12-hour shifts for either 7, 14, or 21 continuous days (a swing).

Third Engineer

The third engineer or second assistant engineer is junior to the Second Engineer/First Assistant Engineer in the engine department and is usually in

charge of boilers, fuel, auxiliary engines, condensate, and feed systems. This engineer is also typically in charge of all bunkering operations.

Tool pusher

Second-in-command of a drilling crew, reports to the drilling superintendent. Responsible for the day-to-day running of the rig and for ensuring that all the necessary equipment is available.

Workers' Compensation Claim

A compensable work-related injury, disease or disability covered by State or Commonwealth legislation to provide worker benefits or entitlements which include weekly payments, medical expenses, settlements, vocational rehabilitation and reasonable travel until such time the worker has recovered or elected to finalise their claim for compensation.

Vocational Rehabilitation

This term applies to workers who have suffered a disability under the Workers' Compensation and Rehabilitation Act of 1981. Vocational rehabilitation includes counselling, occupational and vocational training and retraining, work assessment and the use of aids, equipment, services, or other means to facilitate the restoration of workers to their fullest capacity for gainful employment (Work Cover Western Australia, 2003a p.29).

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CHAPTER ONE

INTRODUCTION

I have worked in and around Occupational Health and Safety in the maritime and the offshore oil and gas industry in Western Australia (WA) for 35 years. My experiences and the experiences of those I have been in contact with were the driving forces that motivated me to conduct this study.

My initial remit by the CEO was to address work related injuries and ill health in the maritime industry for my employer Offshore Marine Services (OMS). I quickly became aware of the impact injury and ill health issues were having on workers and their families, as well as the significant financial burden on the maritime organisations employing seafarers. In the case of the employers, in addition to the workers' compensation expenses, organisations are required to cover expenses for non-work related issues that arise when workers are away from home. Furthermore permanent employees of Offshore Marine Services, in terms of their stated Enterprise Bargaining Agreement, are entitled to between 10 and 12 week's sick leave in the event that they have an injury or illness (which prevents them from returning to work) whilst on leave (Quirk, 2009).

Employers also have indirect costs associated with accidents and these include:

- Loss of skills and experience of the employee;
- Costs associated with obtaining a new employee to replace the injured/unwell employee, including HR costs, training, medical reviews etc;

Repatriation costs associated with returning the worker to his/her home port (Mills, 2009).

There has been very little research exploring the effects of working in the Australian maritime industry on employees and their health and safety, particularly in the WA off shore oil and gas support environment. By investigating the underlying causes of injuries and developing preventive strategies to overcome these, companies will be able to enhance efficiency and reduce costs as well as the human suffering and the inconvenience

associated with work related injuries and ill health.

1.1 Background of the Offshore Oil and Gas Industry in Western Australia

Approximately 9800 seafarers and rig workers (the workers) are employed on more than 690 various assorted vessels and oil rigs, platforms and drill ships operations in and around the Western Australian (WA) north-west shelf and the Timor Sea oil and gas projects (Sterrett, 2009)

These vessels included:

- 80-metre long 12000 horsepower anchor handling craft that pull and shift anchors for the numerous oilrigs, platforms and drill ship operations that are located along the WA coastline and Timor Sea.
- 65 meter offshore support vessels that carry cargoes of equipment, fuel and food to oilrigs, platforms and drill ships.
- 195-metre long seismic survey vessels that traverse the coast line towing floating survey streamers in search of new oil and gas reserves.
- Submersible, semi-submersible and jack up oil rigs that drill and tap into the oil and gas reserves.
- The floating production and storage facilities that process and store the oil and gas prior to shipping(Sterrett, 2009)).

Working in the maritime industry is difficult for a multitude of reasons some of which include:

- Working away from spouse and family for extended periods of time;
- Withdrawal from society for extended periods of time;
- Isolation (working at sea away from Port);
- Working in a confined vessel;
- Working with a small group of colleagues for an extended period of time;
- Lack of social outlet or interaction;
- Physical nature of the work;
- Extended hours of work;
- The need for a good onshore support network;
- The need for good and sound mental attitude and coping strategies. (Pryor, 2009)

1.1.1 Workgroups

There are two distinct groups of workers that perform tasks in the offshore oil and gas industry namely, marine crews (seafarers), who work the vessels, and platform workers, who work the rigs. Rig workers normally work a swing of 3 weeks on and 3 weeks off and marine crews normally are employed 5 weeks on and 5 weeks off (Meadowcroft, 2008).

For every day a worker works offshore he or she is entitled to one day paid leave on shore; therefore, employees in this sector usually work for six months of the year. Some workers however, have two employers and could therefore work most weeks of a year (Del Rosso, 2011).

1.1.2 Workers Compensation Overview

People who are working two jobs are at greater risk of injury (Mills, 2009) due to their increased exposure time as well as other contributory factors such as fatigue and these workers could therefore have two worker compensation claims running under two different insurance companies at the same time. Offshore Marine Services had three such incidents in a twelve-month period (Mills, 2009). There have also been cases where a worker was injured on the second part time job and did not report the injury until he returned to his regular job, thus recording an “incident” with the main employer who is then forced to carry the cost of this “incident”.

The issue is complicated by the fact that confidentiality clauses in insurance contracts and worker compensation matters dealt with by the courts are often subject to confidentiality clauses. The clauses prevent details of the worker’s injuries or claims history being released and as such, employers are not able to determine if a worker has an ongoing claim from a previous job.

These two groups of workers (seafarers and rig workers) are also covered by separate Workers Compensation and Rehabilitation Acts. Western Australian rig workers are covered by the Workers Compensation and Injury Management Act (1981) in WA and as such are covered for the following:

- Capped wages of \$2351.00 per week,
- Wages limited to a prescribed amount of \$198,365.00,

- Medical treatment costs capped at \$58,510.00
- Retraining costs capped at \$13,886.00.
- Common law claims determined by impairment percentage
 - a) Over 15% and under 25% impairment is capped at \$416,569.00
 - b) Over 25% impairment is unlimited

("Workers Compensation and Injury Management Act," 1981).

Seafarers (Marine Crews) work on vessels at sea are covered by The Navigation Act 1912 and the Seafarers Compensation and Rehabilitation Act 1984, regardless of whether the vessel operates in International, Australian Commonwealth or State waters and as such are entitled to the following:

- Wages paid at the same rate as previous average weekly earnings for the first 45 weeks,
- After 45 weeks wages are reduced to 75% of average weekly wage until the worker turns 65,
- Common law claims are capped at \$140,000.00

The state workers' compensation system is administered and managed by an Insurance Company under the direction of the controlling body Work Cover WA whereas in the case of Seafarers the controlling body is Comcare who are responsible for overseeing the legislation under the Seafarers Rehabilitation and Compensation Act 1992, which is administered by the employer in partnership with Comcare (Sterrett, 2009)

The total costs of claims paid to all Australian Seafarers has almost doubled from \$5.7 million in 2007-2008 to \$ 9.2 million in the 2008-2009 period. Seafarers employed in the offshore oil and gas industry in WA had a claims total of \$5.5 million dollars for the 2008-2009 recorded year (Sterrett, 2009)

The average claim cost for seafarer's was \$23,783 in 2008-2009, which is almost \$10,000 higher than the national average of \$13,336. Furthermore, the mean number of days compensated for seafarers was 99, which is almost double the national average of 55 days. Seafarers claims are therefore significantly more expensive than the national average for workers

compensation claims (Sterrett, 2009)

The actual average cost to employers, workers and the community of accidents and work related illness in the maritime sector including fishing during 2005 in WA was estimated at \$112,550. This does not take into account lost production, flow on impacts for the family unit and other hidden costs (Phillips, 2004).

1.1.3 Shift Work Overview

Shift workers are more likely to be injured or involved in an incident at work because of the type of work they generally perform and the conditions under which they work (Folkard, Lombardi, & Tucker, 2005).

In a study conducted by the Liberty Mutual Research Institute for Safety in Maine, USA it was found that there are consistent trends in incident risk associated with features of work schedules. In some cases, these trends differ from what would be predicted based upon current knowledge of circadian rhythms. Modelling the trends in risk may prove useful in designing safer work schedules (Folkard et al., 2005).

While shift work is essential to the economy, evidence suggests that it is associated with a physical and/or emotional toll on workers (Yueng-Hsiang, Jiu-Chiuan, DeArmond, Cigularov, & Chenc, 2007).

In Australia, in 2006, 16% of all employed people were shift workers. The work-related injury rate of shift workers was 113 per 1,000 employed people, almost twice the rate of those who worked regular day time hours (60 per 1,000 employed people) (Australian Bureau of Statistics, 2008). As shift workers are more likely to be involved in dangerous work, these statistics raises concern for the well-being of that workforce involved in high risk work..

1.2 Statement of the problem

Understanding and limiting the occurrence of organizational accidents is one of the major challenges that needs to be addressed globally. Work related accidents are unacceptable in terms of their human, environmental and commercial costs. In order to eliminate work related injury and illness it is necessary to develop a set of concepts that are equally applicable to all events, and lead to improved accident/illness prevention strategies (Reason,

1997).

During the 2008 and 2009 financial years, OMS had annual salary expenditure in excess of \$16 million dollars for all staff working both onshore and offshore. Worker compensation insurance premiums are calculated as a percentage of that total salary expenditure and forecast for the year and are payable in advance. Due to the high number of claims submitted during the

years 2007 through 2009, the percentage figure set by the Offshore Marine Services insurance provider rose from 1.8% to 2.7% for the next three years from 2010 to 2013. This represented a significant increase in expenditure for Offshore Marines Services the next 3 year operating period.

1.3 Research Hypotheses

The aim of this research was to explore the factors and issues that contribute to injuries in the WA maritime industry related to off shore oil and gas work (the industry). It was hypothesised that;

1. organisational factors influence the incidence rate of injuries.
2. demographic factors influence the incidence rate of injuries.
3. the dynamics of the work period (swing) at sea influences the incidence rate of accidents and injury.
4. strategies to reduce the incidence of injuries and the impact thereof on employees can be developed specifically for seafarers working in the WA offshore oil and gas environment.

1.4 Methodology Overview

Chapter 3 provides a detailed review of the study methods. However, in brief, data were collected using a questionnaire applied to the cohort of seafarers injured in the last 36 months and controls who were not injured. All workers who were involved in an event and suffered a physical injury and the workers' compensation claims data reported by these workers between 2008 and 2011 were analysed

Approximately 9 800 workers are employed in the WA maritime oil and gas industry. Offshore Marine Services is a key stakeholder in the industry,

employing almost 25% of this workforce with over 2500 active employees at sea. In this study, 484 OMS employees (19% of the OMS population) volunteered to participate in this study (286 injured and 198 controls),

1. Sample size

To determine an appropriate sample size, prevalence data from a previous study of health, stress and fatigue among Australian seafarers (Parker, Hubinger, Green, Sargent, & Boyd, 1996) was utilized. With a population of 2500 employees and an estimated error of 5%, a sample of 321 was required (80% power).

2. Recruitment

Cases (workers injured during 2008 - 2011) were invited to participate in the study. The participation rate was low with only 286 of the 1 500 affected workers volunteering to be included in the study cohort.

All participants signed an informed consent declaration and the ECU Human Research Ethics Committee provided ethical approval prior to the commencement of data collection.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The International Labour Organization (ILO) estimated that every year, approximately 2.2 million people die from work related injuries and diseases globally. Furthermore, non-fatal work related injuries and disease impact significantly on global morbidity with an estimated 30% of all medically treated injuries among adults aged 18 to 64 years being identified as work related. Occupational injuries therefore present a major public health challenge with serious social and economic consequences, which are largely preventable through implementation of appropriate interventions. Much of the global economic impact of occupational injuries are related to time off work and it is estimated that approximately 270 million injuries occur annually where the victims miss at least 3 days of work. The ILO estimates that 4% of the US Gross Domestic Product (GDP) is lost due to workplace accidents and illnesses (Somavia, 2005).

A significant portion of the global workforce is employed either directly or indirectly by the oil and gas industry. Due to the nature and location of oil and gas operations risks of injuries in this particular industry are higher as compared to most other sectors. According to the US national safety council, non-fatal work related injuries are 49% higher in the oil and gas field services industry than for all US industries combined, and these injuries are more severe. This is a troubling statistic, particularly since most companies working in this domain consider occupational safety a high priority. Serious injuries still present a challenge for the development of the industry. The UK offshore oil and gas industry for example, has been warned against their poor safety records, as 2010 statistics showed an increase in the incidence of major injuries (Hackitt, 2010).

The majority of personal injuries in the offshore environment are caused by relatively minor accidents or incidents involving slips, trips, falls or manual handling. Poor ergonomics in the design of equipment, the working environment or job design can also contribute to these injuries through fatigue, human error and high workloads (Hackitt, 2010).

2.1 Seafarer and rig worker job requirements

The roles and activities of all workers are critical in the management of a vessel or rig (often referred to as an “asset”). These activities include a commitment by workers to their own safety and to that of their fellow workers, as well as the preservation of the asset.

A seafarer’s job is difficult, demanding and highly stressful.(Del Rosso, 2011) Masters, deck officers and offshore installation managers are responsible for the safety of all workers and the oilrig and support vessels commonly known as the assets, whilst they supervise the workforce, which is generally comprised of integrated ratings, rig floor workers such as roustabouts, derrickmen and pumpmen along with engineers and drillers.

Some of the tasks on these assets are conducted under very harsh environmental conditions ranging from monsoonal rain, rough seas and swells sometimes exceeding 15 metres or ambient temperatures of up to 45 degrees Celsius at sea level. In order to perform these duties, the integrated ratings and rig floor workers are required to have a physical fitness level that allows them to be able to complete the required tasks over a 12 hour shift, every day without a rest day over a five week period.

Seafarers employed in the waters off the coast of Western Australia (WA) are required by Australian Federal Government law as set out in the Navigation Act 1912 subsection 425 (1AA) to undertake and pass a medical test before they are allowed to work at sea. This requirement is enforced under Marine Orders Part 9 issue 6, which details(Sterrett, 2011) the various levels of fitness, required for workers performing tasks onboard these vessels. Integrated ratings are required to be able to lift 25 kilograms above their head 25 times in 5 minutes; to be able to stand on one leg; climb ladders and stairways whilst carrying loads up to 70 kilograms and to be able to climb into and navigate emergency escape hatches and bulkheads (Sterrett, 2009).

Similarly under Australian Federal Government law as set out in the Offshore Petroleum and Greenhouse Gas Storage Act 2006("Offshore Petroleum and Greenhouse Gas Storage Act 2006," 2006) and the Australian Petroleum Production and Exploration Association guidelines; all oil rig workers are required to undertake and pass a medical test to work at sea in

Australian waters. The medical standard adopted for rig workers is the Oil and Gas UK Medical Examination (formerly known as UK Offshore Operators Association (UKOOA) Medical Examination). The medical must be conducted by approved doctors or clinics and includes:

- Detailed Medical History, including vaccine review
- Physical Examination - including a range of tests
- Audiometry (hearing test)
- Spirometry (lung function test)(Knox, 2009)

Workers deemed medically fit for work are issued with a certificate of fitness. This OGUK (formerly UKOOA) certificate is valid for 2 years; however some persons may be given certificates of shorter duration if they have medical problems that need earlier review (Ballard, 2012).

2.2 Physical injuries and family impact

There is a limited research investigating the types of physical injuries sustained by workers in the offshore environment, including the extended impacts of accidents on the remaining workers in the vessel or rig setting and at home.

Watson (2008) found that the offshore oil and gas industry, fly in fly out (FIFO) workers life style was having a detrimental effect on marriages and family lives of the workers. The research showed that in the past two decades the growth of the offshore oil and gas industry of Western Australia has resulted in an increased number of families experiencing the intermittent absence of a partner/parent. The gendered nature of the offshore oil and gas industry means workers tend to be male and the partner left at home tends to be female. This was the case for the participants in this study. For three to five weeks, the family experience the absence of the male 'breadwinner', creating a gap within the family as the women and children experience the temporary loss of the partner/parent.

When the worker is absent the partner at home takes on the worker's gendered roles, tasks and responsibilities; upon his return she surrenders (sometimes willingly and sometimes not) these roles, tasks and responsibilities back to the male partner (Watson, 2010).

2.3 Attitude to work and safety

Mearns, Flin, Gordon, & Fleming (2001) examined the role of human and organizational factors in predicting accidents and incidents utilizing a self-reported questionnaire that was distributed to 11 installations on the UK Continental Shelf. The study investigated the underlying structure and content of offshore employees' attitudes to safety, feelings of safety and satisfaction with safety measures. The results concluded that 'unsafe' behaviour is the 'best' predictor of accidents and near misses as measured by self-reported data and that unsafe behaviour is, in turn, driven by perceptions of pressure for production.

In 1995 the Australian Seafarers Safety, Rehabilitation and Compensation Authority commissioned a comprehensive study of 5500 workers. The study included measures of demographics, health and lifestyle, occupational health and stress and life at sea and at home. The goal of the study was to determine reforms that aimed to improve efficiency and competitiveness in the Australian Maritime Industry. One of the key findings of this study was that workers and their families are most vulnerable to injury immediately prior to the worker leaving home and upon his return home from sea.(Parker, Hubinger, Green, Sargent, & Boyd, 1996).

The high incidence of work-related injuries affecting young workers and people new to the industry could be attributed to a number of factors including: lack of information, lack of training, lack of supervision, lack of experience on the job and lack of knowledge and skills. It is important to note that, many workers in this industry begin work at an early age and often without adequate safety training.(Knox, 2009).

The International Labour Organisation (ILO) estimated that globally workforce demographics will shift to include an increased number of young people (age range: 15-24) as well as older people (60 and above). Unfortunately, these two age groups have a higher tendency to be involved in accidents (Somavia, 2005).

2. 4 New Starters in the Offshore Oil and Gas Industry

The Chief Executive Officers Division of the Australian Petroleum Producers and Exploration Association introduced a CEO's initiative aimed primarily at the reduction of injuries involving workers entering the offshore oil and gas industry. The Common Safety Training Program (CSTP) was initiated in 2010 with a number of training organizations becoming accredited to deliver the training in Western Australian, the Northern Territory and Victoria. The CSTP aims to ensure that all new and existing employees have the same core foundation of safety skills. As of 1 January 2012 it is expected that employers will have processes in place such that:

1. All new employees attain a CSTP card; and
2. All experienced workers have CSTP cards or are working towards attaining a CSTP card. (An experienced person is anyone who has been actively engaged in the oil or gas drilling or production industry for at least one year within the last two years.) The following people are required to hold a CSTP card:
 - a. All personnel new to the industry who begin work at an offshore production or drilling facility are required to undertake an off-the-job behaviour development and demonstration training program followed by safety behaviour observation in the workplace to attain a CSTP card.
 - b. All existing personnel who meet the experienced worker definition will have to go through a combined Recognition of Prior Learning (RPL) and safety behaviour observation process to attain a CSTP card.

Personnel who are frequent visitors to a production or drilling facility; (that is, they spend more than five consecutive nights on an offshore facility or undertake six or more visits offshore within a 12-month period) must also attain a CSTP card (Knox, 2009).

In 2004 the Australian Commonwealth Government National Occupational Health and Safety Commission, commissioned a report (*Fatal Occupational Injuries – How does Australia compare internationally?*) into Australia's world standing for fatal occupational injuries (Phillips, 2004) with the main aim of this report being to obtain a measure of the gap in performance

between Australia and the best performing countries worldwide.

Countries were therefore included in this analysis if they had a lower and comparable incidence of fatality as reported to the ILO. This resulted in most of the countries included in this comparison being European. The European Union (EU) has made major efforts to harmonise the data across their member states resulting in data for the latter part of the 1990s having a higher level of comparability than seen previously. For this report, data covering the period 1998–1999 to 2000–2001 were used. This period was chosen due to the availability of consistent data.

After an initial review of the available data, ten countries were selected for the analysis on the basis that their fatality incidence rate was lower than or comparable to that of Australia. These countries included; Australia, Belgium, Denmark, Finland, Germany, New Zealand, Norway, Sweden, Switzerland and the United Kingdom. It was initially believed that differing employment profiles in the selected countries could account for some of the apparent differences in performance. However, the results of this analysis show that when the data are standardised by industry, the standardised rates differ only marginally from the non- standardised rates, leaving Australia with the seventh lowest fatality rate. Further research would be required to identify underlying reasons for the gap in performance.

The non-standardised, harmonised data, for the above countries, averaged over the three-year period shows that Sweden and the United Kingdom have the lowest rate of work related fatalities. Australian rates are 71% higher than those of Sweden and 62% higher than the UK. Sweden has a lower fatality rate than Australia for all industries except Agriculture, hunting and forestry. The United Kingdom has a lower fatality rate than Australia for all industries except Construction. Mining and quarrying recorded the highest fatality rate in most countries, including Australia (Phillips, 2004).

Over the past five years, Australia's rate of improvement has averaged 11%, whereas the UK has shown no consistent improvement in this time. If Australia continues to improve at its current rate and the UK continues to plateau, then Australia could equal the performance of the UK in around five years, which is within the life span of the National OHS Strategy 2002–2012 (Phillips, 2004).

2.5 Shift work, fatigue and accidents

Offshore oil and gas work involves the use of shift work rosters to meet production targets and shipping schedules and to increase profits. However, in reality the costs associated with increased injury rates and the associated increases in workers' compensation costs, staff turnover, absenteeism and the additional burden placed on remaining staff can often outweigh the financial benefits gained by improved production (Mills, 2009).

The magnitude of the adjustments made by families appeared to be underestimated by the employer, which treated work and family as loosely coupled systems. This assumption is particularly problematic for the families of long-term shift workers and means that families shoulder the primary responsibility for resolving the tensions between work and family.

Handy (2008) studied the effects of long-term shift work on workers in an onshore petrochemical plant. The findings suggested that long-term shiftwork imposes greater demands on families than many other types of labour and has a profound effect on the temporal, social and emotional patterns of family life. Men and women gave divergent accounts of the problems created by shiftwork, reflecting their differing responsibilities within the family and illustrating the varied adjustments made by family members. Wives sacrificed much for their partner's employment, often sacrificing their own careers in order to take primary responsibility for organising family life around the shift workers schedule.

Shift work, long work hours and international travel are all factors that promote fatigue. Other causes of fatigue include sleep disorders, some forms of medication, drugs and alcohol. Excessive fatigue can have significant adverse outcomes for performance, health and well-being and in safety-critical industries can contribute to serious incidents. Excessive fatigue affects millions of people around the world, and costs billions of dollars per year in medical expenses, accidents, injuries and lost productivity (Sullivan, 2007).

Accidents investigations into some of the worst industrial and environmental accidents of the past 30 years have frequently identified fatigue as a major contributory factor to the incident. In some of these cases, fatigue was not the sole cause. Rather, there was an initial difficulty such as a technical fault,

and because the operators were fatigued, they did not manage the situation adequately and the situation escalated to an event. Fatigue contributes to accidents by impairing performance and at the extreme end of the scale by causing people to fall asleep (Sullivan, 2007).

Although definitions vary slightly across sources, shift work can be defined as employment in any work schedule that is not a regular daytime schedule (that is, approximately 0900 to 1700). The full spectrum of shift work comprises regular evening or night schedules, rotating shifts, split shifts, on-call or casual shifts, 24 hour shifts, irregular schedules, and other non-day schedules. Shift work has long been known to disrupt circadian rhythm, sleep, and work-life balance; however, flexible work patterns remain a necessary component for a dynamic diversified industrial economy (Laugsand, 2012).

Research conducted at the Australian Sleep centre on shift workers in 2010 reported that workers have problems maintaining a balance between the competing needs of work, family, leisure and social life. (Roach & Dorrian, 2010)

Shift work was also identified as a risk factor for obesity, diabetes and heart disease and shift workers have an increased risk of injury and death at work. As a result of the research by Roach and Dorrian in 2010 it was recommended work schedules be re-designed to minimise sleep loss and circadian disruption. Effective shift work rotations result in healthier employees, safer workplaces and reduced costs to the community (Roach, 2010). A review of research findings related to shift work shows that the risk for injury increases when workers work consecutive nights. The risk level increases for each consecutive night and is increased by 6% on the second night, 17% on the third night and 36% on the fourth night (Brogmus & Maynard, 2006).

2.5.1 Diversity in offshore shiftwork schedules.

The offshore oil and gas industry schedules include a number of shift variations, however, the industry standard is generally 12-hour shifts for either 7, 14, or 21 continuous days. Shifts are variable and include permanent nights or combined nights and days. The duration of a schedule or shift pattern is sometimes referred to as a 'tour' or a 'swing'. The range of

shift schedules worked offshore is extensive. Tour lengths vary from one week to five weeks, and shift combinations include straight days, straight nights or swing shifts, which combine day and night work in a number of ways. Additionally shifts commence and end at different times, running from 0600h to 1800h, 0700h to 1900h, 0800h to 2000h, or 1200 to 2400h.

Commonly operated schedules include 14-21 nights either continuous or rotating with days. In some cases workers are placed on a week of night shifts followed by a week of day shifts. At the change over point the worker has two short rest periods and one short work shift in order to facilitate the transition from night to day shifts.

The complexity of designing shift schedules requires consideration of factors other than simply the most appropriate for circadian adaptation. Operational constraints, such as helicopter schedules and crew change arrangements further complicate decisions about shift rotation schedules. The schedules include managed meal times, segregated shifts and daytime darkness for night workers. While it has been shown that offshore shift workers on certain schedules can physiologically adapt to a specific night shift the process takes days, so they may be working a significant percentage of their tour in an unadapted state on both the day and night shifts. Historically the schedules operated offshore have evolved primarily because of the nature of the work and environment, without specific regard for the health consideration of workers, fortunately this situation is changing with a number of researchers recently investigating this issue (Gibbs, Hampton, Morgan, & Arendt, 2005).

2.5.2 Shiftwork and life outside work – Impact on Health and Wellbeing

When Loudoun studied the balance between shift work and life outside work it was found there was considerable evidence that shift workers in general suffer acutely and chronically impaired health (Costa, 2003; Harrington, 2011). There is also growing evidence that they have an increased risk of divorce and children with anxiety and behaviour problems (Pisarski et al., 2006). It is widely accepted that the negative effects of shiftwork arise from the mismatch between altered sleep-wake schedules internal timing mechanisms, and community rhythms of business, social, recreational, and domestic activity (Costa, 2003).

In essence, shift workers are required to work and sleep at times that conflict with normal societal and biological patterns. Compounding problems caused by this conflict, external time cues such as the light/dark cycle, clock time and the knowledge of others' behaviours encourage shift workers to return to normal sleep/wake cycles (Costa, 2003).

A strong argument in favour of 12-hour shifts is that these work arrangements have the potential to eliminate or reduce some of the problems of shiftwork because total work is compressed into fewer days each week. Thus, workers are generally required to work fewer shifts (therefore fewer night shifts) than when they are on 8-hour shifts. This means there are fewer circadian changes imposed on the body and workers can have more available "free" time with their family and friends (Earle, 2001). Therefore, 12-hour shifts can redress some of the conflict shift workers tend to report between their work schedule and family, biological and community rhythms. Although there are persuasive arguments suggesting 12-hour shifts are likely to help shift workers achieve less work/non-work conflict, relatively few studies have tested this argument empirically. Many studies have linked work/non-work conflict to fatigue, psychological ill-health, depressed mood and increased physical symptoms amongst 8-hour shift workers (Bohle, 1997). However, no research could be identified that specifically examined.

whether work/non-work conflict changes with the introduction of 12-hour shifts. The study by Costa investigated the relationship between work/non-work conflict and shift length using a longitudinal research design and also examined relationships between work/non-work conflict and physical and psychological health (Costa, 2003).

In summary Loudoun found that 12-hour shifts did not deliver the benefits anticipated and in fact, the findings indicate that 12-hour shifts were no worse for work/non-work conflict. The study also supports findings of previous research that highlights the importance of work/non-work conflict for shift workers' mental health (Loudoun, 2010).

2.5.3 Shift work and safety concerns.

As shift work is becoming more entrenched as a necessary part of working life, it introduces some concerns for the health & safety of the worker. The

offshore working environment presents more unique dangers than most typical work places because of the range of hazards involved, some of these include; helicopter travel, rough weather, close proximity to hydrocarbons, risk of collision from passing vessels etc., and so there are very strict safety measures in this industry that include well implemented guidelines, work instructions and job planning..

The outcome of sleep deprivation and fatigue during the night shifts is that it can become chronic over a long tour, or if insufficient rest is obtained during days off (Gibbs et al., 2005).

2.5.4 Sleep impact on health

Sleep Disorders Australia found (Sleep Disorders Australia, 2012) that throughout Australia shift workers sleep more poorly than non-shift workers. Night shift workers have difficulty staying asleep in the daytime and workers who start work in the early hours of the morning have difficulty falling asleep in the evening. The effective reduction in sleep may be as much as four hours per day but is more likely to be approximately 1 hour per day (Sleep Disorders Australia, 2012). The quality of shift workers sleep is also poor with a lot more awakenings during their sleep. Although this may improve as the worker adapts to a shift, it seldom returns to normal and shift workers accumulate a large "sleep deficit" over time, meaning shift workers are more tired than others.

Research has shown that shift workers are more tired both during and after shifts than daytime workers, leading to poor work performance. The resulting daytime tiredness and need to catch up on sleep impacts significantly on social aspects of the shift worker's life, leading to increased irritability and moodiness, forgetfulness, decreased concentration, lack of energy for family activities and ultimately to marital problems (Sleep Disorders Australia, 2012).

The requirement for sleep is a biological need and maintaining wakefulness through the nadir of the alertness rhythm can be difficult. Sometimes unavoidable lapses into unscheduled or involuntary sleep can occur. Such lapses in concentration, if they occur in the workplace or while driving, present a risk to safety that is additional to and acutely more dangerous than the risk that sleep deprivation presents to health..

There is evidence to show that sleep deficit impacts on the immune system and endocrine function, with effects on carbohydrate metabolism and glucose tolerance and an increased risk of cardiovascular disease (Gibbs et al., 2005).

Australian sleep research scientist Dr Carmel Harrington wrote about shift work in *The Sleep Diet* “it's a work regime that throws up all sorts of health issues, and they need addressing” and she details the health effects associated with disrupted sleep patterns as; increased incidences of obesity, cardiovascular disease, breast and prostate cancers, diabetes and depression. Furthermore sleep deprivation causes irrationality, and can alter personalities. (Harrington, 2011).

The association of shift work with vascular disease is controversial as reported by Laugsand (2012) when they synthesised the association of shift work with major vascular events by systematically searching major bibliographic databases, interviewing experts, and reviewing reference lists of primary articles, review papers, and guidelines. The review included observational studies that reported risk ratios for vascular morbidity, vascular mortality, or all-cause mortality in relation to shift work. The three significant outcomes of shift work on vascular events were found to be myocardial infarction (RR 1.23, 95% CI 1.15-1.31), ischaemic stroke (RR 1.05, 95% CI 1.01-1.09), and any coronary event (RR 1.24, 95% CI 1.10-1.39) (Laugsand, 2012).

All shift work schedules with the exception of evening shifts were associated with a statistically higher risk of coronary events. Shift work was not associated with increased rates of mortality (whether vascular cause specific or overall). It was finally concluded that shift work is associated with vascular events, which may have implications for public policy and occupational medicine (Laugsand, 2012).

2.6 Psychological Factors

The Health and Safety Executive (UK) conducted research addressing the relationship between health and safety at work policies and a range of other related social and economic policies, such as public health, social equality, employability, etc. This includes risks relating to gender, ethnic origin and/or region. Their research investigated the prevalence of reported

occupational stress among Afro-Caribbean, Asian and Caucasian workers

Oldenberg et al (2012) studied burnout among German seafarers as compared to on-shore workers. The authors found the burnout risk among seafarers to be moderate. They suggested that emotional exhaustion among seafarers could be reduced by extending sleeping time, avoiding long working hours, and improving the superiors' communication and leadership skills. It was also recommended that seafarers should have access to telecommunication facilities so they can frequently link with their families at home (Oldenberg, Jensen, & Wegner, 2012). These issues clearly also apply in the WA offshore oil and gas support industry where people work long shifts far away from home.

2.7 International perspective (seafarers)

Roberts and Hansen (2001) conducted a study to establish the manner and causes of all fatalities among seafarers who were serving in British merchant shipping between 1 January

1986 and 31 December 1995. The main aim of the study was to compare mortality rates with workers in other industries and with seafarers in other merchant fleets, and to make recommendations for the prevention of occupational mortality among seafarers.

This study was based upon official mortality files with a population of 253 919 seafarer-years at risk. There were 252 fatalities in British merchant shipping during the study period. The relative risk of mortality due to accidents at work (96 fatalities) was 23.9 times higher than for all workers in Great Britain during the same time (95% CI 14.0–40.7). The risk of a fatal accident in merchant shipping was also much higher than in other British industrial sectors, such as agriculture, forestry and fishing (RR 4.5), construction (RR 5.5), and manufacturing (RR 2.2).

In Australia, for 2011, it was reported by Safe Work Australia and the Seacare Authority, that for the offshore oil and gas industry in WA, which has a workforce of 9800 workers, there were no fatal workplace incidents or accidents. During this same period the construction and mining industries, which employ approximately 95 000 people reported 10 deaths (1.05%) and there were 13 (2.76%) in the agriculture, forestry and fishing

sector which employs almost 47 000 people (Phillips, 2011; (Sterrett, 2011)

The Seacare Authority in response to various reform agendas embarked on a project in 2009–10 to develop a new strategic plan for the next five years. The Seacare 2015 Plan (the Plan) has been developed around the strategic objectives of preventing injury and deaths, through implementation of best practice injury management and rehabilitation practices. The scheme reported an injury incidence rate of 45.7 (lost time claims per 1000 FTE) for 2010–11 compared to 48.3 in 2009–10. The scheme is thus outside the rate required to meet the National Occupational Health and Safety Strategy 2002–2012 (National OHS Strategy 2002–2012) which has a target of a 40% reduction in injury incidence over the 10 years of the strategy. The increase in injury incidence represents an ongoing challenge for the industry and the Authority ((Sterrett, 2011)

Many accidents at work are caused by hazardous working practices and are often preventable, as are many off-duty accidents and drowning caused by seafarers falling into docks when encountering hazardous access to their ships from the shore. Seafarers are also at special risk from acute illnesses since they lack direct access to specialist medical care while at sea (Hansen & Roberts, 2002).

Data extracted from the Danish Maritime Authority for the period 1993–1997 was analysed to investigate the frequency, circumstances, and causes of occupational accidents aboard merchant ships in international trade, and to identify risk factors for the occurrence of occupational accidents as well as dangerous working situations. During the study period, 1 993 accidents were identified during a total of 31 140 person years at sea. Among these, 209 accidents resulted in permanent disability of 5% or more, and 27 were fatal. The mean risk of having an occupational accident was 6.4/100 years at sea and the risk of an accident causing a permanent disability was 0.67/100 years aboard. Relative risks for notified accidents and accidents causing permanent disability were calculated in a multivariate analysis including ship type, occupation, age, time on board, change of ship since last employment period, and nationality. Foreigners had a considerably lower recorded rate of accidents than Danish workers. Age was a major risk factor for accidents causing permanent disability. Change of ship and the first

period aboard a particular ship were identified as risk factors. Walking from one place to another aboard the ship caused serious accidents. The most serious accidents happened on deck (Hansen, Nielsen, & Frydenberg, 2002). It was possible to identify specific work situations and task associated risk factors for accidents aboard merchant ships and many of these factors were explored in this study

Most accidents happened while performing daily routine duties. Preventive measures should focus on workplace instructions for all traditional functions aboard and on the prevention of accidents caused by walking around on the ship. Differences between the groups in relation to back injury prevalence may be attributed to differences in physical attributes among the two groups. Danish seafarers are more likely to be obese as opposed to foreigners, which could be a contributory factor in back related injury (Hansen et al., 2002).

It is interesting to note that the authors found a statistically significant difference in accident rates among workers while walking on board a rolling ship .. The West European workers tend to report accidents that have

not caused either medical treatment ashore or caused the seafarer to be off duty. Furthermore the presence of lay medical facilities aboard merchant ships may influence the reported number of serious accidents, as the initial treatment on board may reduce the number of referrals to shore-based medical facilities and there may be ethnic differences regarding shipboard treatment (Hansen, Laursen, Frydenberg, & Kristensen, 2008). The Danish Maritime Authority for the period 1993-1997, reported that the first period aboard a ship was a significant risk factor (Hansen et al., 2002).

Seafarers from South East Asia, mainly the Philippines, have a lower risk of occupational accidents as compared to their compatriots from Western and Eastern Europe. Different approaches to safety and risk taking behaviours between South East Asian and European seafarers has been identified as a reason for this, along with their positive attitudes towards accident preventing programmes. A potential source of bias in these studies is the fact that all comparisons were based on reported accidents or self reported accidents which made it difficult to determine the magnitude of

underreporting or reporting bias and thus the true differences in accident frequencies among different nationalities working under similar conditions is difficult to correctly quantify. (Hansen et al., 2008).

The human element is increasingly being acknowledged as an important factor contributing to accidents at sea. What is infrequently considered is the extent to which social isolation, and its effects on seafarers, contributes to both marine incidents and to the problems of seafarer retention currently experienced throughout the industry as a whole. Findings of several related studies undertaken at the Seafarers International Research Centre (1999-2002) along with a number of published studies on seafarer health considers both the causes and potential effects of social isolation on seafarers. These areas have not traditionally been subject to systematic scrutiny and analysis. As such, they are substantially under-researched and are often under-emphasised by policy makers and practitioners in the maritime sector. Using participant observation and detailed qualitative studies, these issues were explored in an effort to bring them on to the accident prevention agenda and to highlight the need for further detailed research in this area. Preventive strategies that could be employed by shipping companies to militate against social isolation and to encourage better mental health amongst modern day seafarers are identified by the authors (Sampson & Thomas, 2003).

2.8 Safety, Training & Skill Levels

Studies have shown that the levels of safety knowledge, training and skills, as well as cultural attitudes and approaches to work on oil rigs and off shore oil and gas vessels of large well established industry operators has changed over the last few decades. The traditional “she’ll be right mate”, learning on the job model has evolved to a model, where safety is a key feature of work in the industry. Oil and gas workers have to acquire a range of safety certifications before they step on-board a rig or vessel, this trend has also changed the way workers engage with their employers (Meadowcroft, 2008).

Consequently all crews for both rigs and vessels are better trained and more qualified to perform their roles. A negative consequence of the current model has been the fact that industries have needed to invest significantly in

training workers and many workers then use their training and skills to seek employment elsewhere for higher pay, leading to a situation where the industry is experiencing high staff turnover. Conversely, the smaller start-up companies wishing to get a foothold in the offshore oil and gas market in Western Australia often employ workers with little or no experience and train them on the job. It is often during this training time that injuries can and do occur (Walton, 2009).

2.9 Health and Physical Fitness

It has been demonstrated repeatedly that increased fitness improves the state of health of individuals (Plante, Coscarelli, & Ford, 2001) and physical inactivity has significant negative health consequences accounting for 7% of the total burden of injury and disease amongst all Australians (Begg, Vos, Barker, Stanley, & Lopez, 2008). Physical fitness has contributed to positive organisational outcomes that have reduced costs associated with absenteeism, physical injuries and psychological ill effects (Kornitzer & Kittel, 1986; Lubonovich, 2002). However, research has demonstrated that a relatively small proportion of adults maintain their fitness levels, which is necessary for both the physiological and psychological well-being of an individual and is also a factor associated with reduced workplace injuries (Proper, Staal, Hildebrandt, Van Der Beek, & Van Mechelen, 2002).

Some employers such as BHP Billiton have implemented strategies to improve workplace health and fitness levels at work by adopting workplace health programs which include physical activities such as “safe spine” and stretching exercises conducted by trained personnel in the workplace (Fallaver, 2011).

Physical activity is referred to as planned exercise that creates energy expenditure through musculoskeletal movement to increase the heat rate for an extended period of time (Fletcher et al., 1996). Physical activity is associated with fitness and would help offshore oil and gas workers meet their physical job demands without becoming fatigued (Fletcher et al., 1996).

2.10 Supply and Possession of Controlled Drugs Offshore

2.10.1 Background

Some controlled drugs, as defined by the Misuse of Drugs Act 1981 and its Regulations are included in standard first-aid and medical equipment on offshore installations. Specific examples include; diamorphine, morphine sulphate, pethidine and Diazepam. Under the auspices of the Misuse of Drugs Act these drugs can be possessed, prescribed and utilised only by a suitably qualified health professional. The Act does not make any exceptions or exclusions for use on an Offshore Installation or Vessel. It is therefore unlawful for any person on a rig or vessel, other than a qualified health professional, to be in possession of any of the plants or substances listed in Schedule 1 of the Act.

The Misuse of Drugs Act also details strict requirements in relation to record keeping and documentation for the possession, use, destruction and disposal of Schedule 1 drugs and it is the sole responsibility of the Medical Officer on a rig or vessel to attend to this record keeping and documentation.

There had been some confusion in relation to responsibility, and issues around who should be in possession of keys to a Drugs Cabinet amongst the vessel crew, however, recent amendments to the Act in 2011 have made the matter of responsibility clear.

Penalties for breaches of the Act by a Medical Officer are severe and can include cancellation of a licence to practise medicine. The penalties applying to persons other than a Medical Officer for breaches of the Act by possession or unlawful use of Schedule 1 drugs are the same whether on-shore or offshore.

2.10.2 Ramifications of Offshore Drug Misuse.

The effects of drug misuse in an offshore environment can be catastrophic. A worker under the influence of a Schedule 1 drug is not likely to work safely and effectively. (World Oilfield Network, 2012) This, in turn, can also have a flow – on effect to co – workers whose safety could also be compromised.

210.3 Culture

There had been a culture in the mining industry, particularly in the iron ore mines of the WA Pilbara region, of excessive alcohol consumption and so – called “recreational” drug use. This alcohol consumption and drug use went hand – in – hand with a myriad of schemes to “cheat” the alcohol and drug tests performed by employers. Most common of these was by having a friend perform the test for a worker who knew that he or she would probably fail the test. So entrenched was this culture that the jokes were legion about the male employee who failed a urinalysis because “he wasn’t drunk but he WAS pregnant!”

This culture has largely died out and research conducted amongst workers at the Argyle Diamond Mining site at Ord River showed that workers had recognised the danger to themselves from their hung-over and drug – affected friends in a hazardous work environment.

The incidence of taking a test for a friend was almost non – existent (Dasborough 1996).

Fortunately, this culture never seemed to gain a foothold in the Offshore Oil and Gas Industry, probably because the environment is more isolated and access to alcohol and other drugs is better controlled. However the abuse of both recreational drugs and alcohol during the offswing causes many workers problems when they first return to work from their off swing.(Del Rosso, 2011; Meadowcroft, 2008; Mills, 2009; Morgan, 2010; Pryor, 2009; Quirk, 2009; Tunncliffe, 2012) There are also smaller numbers of workers in each group and this means there is a greater reliance on other members of the team to ensure overall group safety and efficiency(Walton, 2009).

Union dynamics at times make recruitment of the best worker for a specific role very difficult. Employers are often pressurised to employ workers who may have a history of bad behaviour, both on and/or off the vessel, a high number of insurance claims, physical health problems, unsuitable work performance history and alcohol or other drug abuse problems (Del Rosso, 2011). The influence and militancy of unions connected with shipping and the waterfront in Australia is well established and has been an issue affecting the industry for many decades (Trinca & Davies, 2000).

2. 11 Experience and Age

Studies relating to years of experience on the job and age have shown different results in relation the incidence rate of work related injuries. Experience gained “on the job” helps employees to cope with hazardous situations, however, personal characteristics, such as age and tenure, have significant associations with turnover intent in high risk jobs due to the elevated threat of physical injuries and job stress (Ngwenya, 2012).

Work Safe Australia reported that in 2011, 70 people died in work-related incidents. Figure 2.8 below shows the age distribution of the fatalities. The median age of the 70 decedents was 47 years, with the youngest aged less than fifteen years and the oldest was 74 years (Phillips, 2011); see Figure 2.10 below.

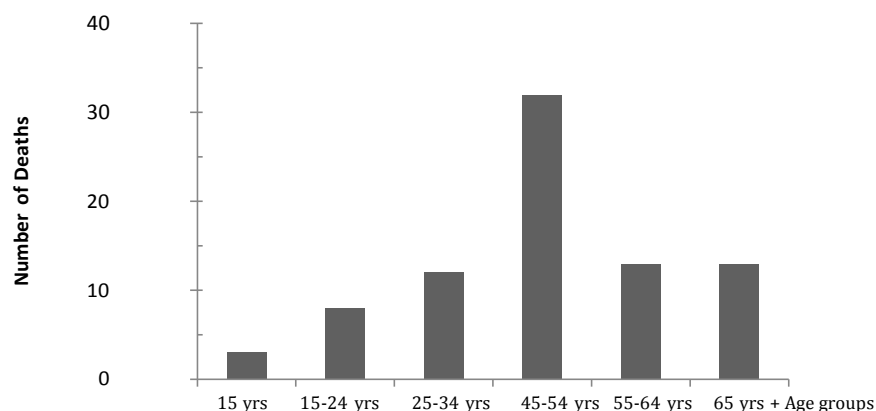


Figure 2.10. Proportion of all work related fatalities

2.12 Physical Injuries during high risk tasks in the maritime industry

Increased lost time injury rates are commonly experienced in high risk jobs such as crane operations, towing operations, salvage work, running and pulling anchors and deploying buoys which are all tasks undertaken by a large number of workers engaged in the offshore oil and gas area of work (Meadowcroft, 2008). The impacts of physical injuries can disrupt the normal work routines on vessels and rigs, thus putting other workers at risk by increasing their workload (Del Rosso, 2011). Furthermore, workers in high risk jobs in Australia often sustain injuries which are of a very serious

nature and often are long term injuries requiring many months of medical treatment and long periods of rehabilitation before they are fully fit to return to their pre-injury duties (Mills, 2009).

2.13 Workers Compensation Claims and Lost Time Injuries (LTI's)

Workers' compensation, social security or employer's liability cover for workers is pertinent to many countries worldwide. In most countries, including Australia, insurance cover for injuries to employees and workers is compulsory. Whilst the nature and extent of the cover and entitlements may vary significantly throughout the systems, the fundamental principles of providing compensation in the form of income support, medical expenses indemnity and rehabilitation (benefit costs) for workers who suffer a work related disability is common to all schemes (Mills, 2009).

Work related physical injuries and other health related issues result in organisations having to pay higher workers compensation premiums and employ a number of staff to manage those injured workers. Alternatively this work can be outsourced at a significant cost, which expends resources that might have been applied elsewhere (Del Rosso, 2011).

Seacare reports there have been increases in compensation claims from 154 claims in 2006/07, 199 claims in 2007/08, 242 claims in 2008/09, 254 claims in 2009/10 and 256 claims in 2010/11 (Sterrett, 2008). These compensation data are influenced by concurrent growth in the total workforce; however, the per capita injury rate still shows an increasing trend. In 2003/04 there were 3934 employees in the offshore oil gas industry in Australia and 1.83% of those workers were injured. In 2004/05 the employee cohort had grown to 4274 with 1.10% of those workers injured at work. The total number of claims lodged in 2010–11, 279, represents a 10.3 per cent increase compared with the previous year (253). The number of accepted claims (256) also increased from the previous year; refer to Table 2.12

Table 2.12: Employee numbers and hours worked

Claim Year	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011
Claims accepted	154	199	242	254	256
Employees Numbers	5690	6105	6255	6446	7126
% of claims to workers	2.70%	3.25%	3.86%	3.96%	3.59%
f/Time equivalent	3544	4185	4682	4513	4818
% of claims to full time	4.34%	4.75%	5.16%	5.62%	5.31%
Hours worked	16,577,060	18,696,570	20,973,333	20,240,480	20,649,348

The total number of employees covered by the Seafarers Act in 2010–2011 increased 10.5 % from the previous year. The employee number includes FTE workers as well as those who may have worked on limited term contracts and for multiple employers at different times throughout the year.

Physical injuries resulting in long duration claims have shown affected workers also suffer many other health issues such as post-traumatic stress disorder and emotional distress, including depression, this can cause additional harm by affecting an individual's social life and his/her ability to function properly, resulting in further workplace risks.(Mills, 2009) When a worker is ostracised or marginalised by management or his supervisors or there is lack of management support for the worker many claims are escalated into long duration claim (Mills, 2009).

2.14 Workers right to work in Australia

When international companies, based out of countries such as France, Netherlands and Belgium who specialise in maritime fields such as seismic survey work or dredging are awarded contracts to work in Australia, their vessels have to be crewed by Australian seafarers, this being a requirement of the Australian Council of Trade Unions and Commonwealth workplace laws, (Kearney, 2011) and ("Fair Work Act," 2009,). This practice creates problems where the Australian crew replacing the foreign crew are often

not competent to operate these expensive, complicated and highly specialised vessels, which in turn result in injuries and accidents (Quirk, 2009).

Offshore Marine Services were contracted to supply a crew of seafarers to work the rock cutter suction dredger, the Leonardo Da Vinci in 2007 in Port Hedland. That operation resulted in 250 injuries over a 9 month period (Mills, 2009). The same vessel had previously operated without the Australia crew completing similar work in the Middle East and incurred less than 15 injuries to trained workers doing similar tasks over the same time period (Meadowcroft, 2008).

2.15 Ageing workforce

The dynamics of the global financial environment has created significant financial pressures for businesses and employees. For many workers approaching retirement age, the global economic crisis has impacted significantly on superannuation portfolios or asset creation and the decision to retire has had to be delayed causing individuals to stay in the workforce longer (Communication Workers of America Occupational Safety and Health Department, 2001).

Older members of the workforce unable to perform heavier labour intensive aspects of work often place others at risk of injury or fatigue. Younger or fitter colleagues become disgruntled because they must perform the majority of the physical work and this can cause tension and problems in a team setting. For this reason, the performance management system implemented by the organisation should be both robust and flexible. Organisations need to understand that as the workforce continues to age, diversify and change, they need to adapt and tailor ways in which they manage the needs of the workforce.

2.16 Conclusion

It can be concluded from the literature that the issue of accidents and injuries in the Maritime sector have been investigated, mostly overseas, and that much of the research has centred on causal factors. Some of the issues discussed included psychological factors associated with feelings of separation from family and friends for extended periods of time in remote

and isolated environment. Drug and alcohol use is also an issue, particularly when sailors are on shore leave. These may be contributory factors that may explain why many accidents occur in the early part of a stint at sea. Age and general health as well as experience level have all been identified as additional causal factors. Not much research on the topic has been done in the Australian maritime sector and there is none that is specific to the support role offered by the industry to the oil and gas sector in Western Australia.

CHAPTER THREE

METHODOLOGY

This study followed a case control design and investigated a number of factors among a cohort of 286 injured and 198 non – injured workers employed by Offshore Marine Services (OMS).

Research Questions

The following questions were investigated amongst Offshore Marine Services (OMS) staff;

1. What organisational factors contribute to the injury incidence rate of OMS employees?
2. Does the demographic profile of the work force influence the injury incident rate among OMS staff?
3. To what extent do the dynamics of the “swing” (i.e. number of days, length of time worked, and working on the first day or last day) contribute to injury incidence rate among OMS staff?
4. Can strategies be developed and implemented that will ultimately lead to a reduction in the incidence of injuries and the impact thereof on OMS employees?

3.1 Study Design

A questionnaire adapted for this study by inclusion of information extracted from the measurement of occupational health and safety performance as detailed in Standards Australia (Standards Australia., 1990). Permission to use the questionnaire was granted by OMS, the Australian Maritime Safety Authority and the 4 major unions involved with these work places. These unions were the Maritime Union of Australia, Australian Workers Union, The Australian Engineers Union and the Deck Officers Union of Australia.

The questionnaire was administered to a cohort of 286 workers who had been injured at work in the previous three years, and to a group of 198 workers who had not been injured at work in the previous three years (controls).

The variables investigated included demographic data, marital status, age

group, chronic/acute illnesses, smoking and alcohol use habits, length of work experience, length of time on current vessel or oil rig and the day of the swing the event occurred on.

3.1.1. Subject selection for the study reference population

Approximately 9 800 workers are employed in the WA maritime oil and gas industry. Offshore Marine Services is a key stakeholder in the industry, employing approximately 25% of this workforce (2 500) and 484 employees (19% of the OMS population) were recruited to participate in the study (286 injured and 198 controls).

3.1.2 Sample size

To determine an appropriate sample size, prevalence data from a previous study of health, stress and fatigue among Australian seafarers (Parker et al., 1996) was utilized. With a population of 2500 employees and an estimated error of 5%, a sample of 321 was required (80% power).

3.1.3 Recruitment

A total of 484 people were recruited to participate in the study. Cases consisted of workers injured during 2008 – 2011 (n=286). Controls were recruited opportunistically during visits to offshore vessels and oilrigs, or when OMS staff were attending the Perth office of the company on other unrelated matters (n=198).

3.2 Data Collection

All injured workers at OMS are assigned to an injury management case officer and these officers were guided by the researcher to assist in the collection of the survey data. Injured workers and opportunistically recruited controls were requested to participate in the study and after providing informed consent, questionnaires were filled in by the worker or with the assistance of the case officer. Furthermore, OMS workers' compensation claims processed between 2008 and 2011 were analysed to provide additional information.

3.3 Data Analysis

All statistical analyses were performed using STATA version 9.1. (Stata Corp, 4905 Lakeway Dr, Texas 77845 USA). Data analysis enabled a comparison of health and lifestyle behaviours of participants when at sea and at home

(shore).

Descriptive statistics were used to identify variables of interest. Day of incident, occurrence rates, length of swing, shift data and unskilled versus skilled accident rates, were calculated from data of injuries already recorded on the OMS database.

Logistic regression analysis techniques were used to adjust for the age profiles of comparison groups. Repeated measure ANOVA, and repeated measures logistic regression analysis techniques were used to determine if comparisons between behaviours at sea and behaviours ashore were different. Descriptive data are reported as percentages and mean values with standard deviations. A Survival analysis was used to analyse the probability of injury through analysis time. A log rank test was used to compare survival curves between groups. Univariate and multivariate logistic regression analysis were used to predict risk of injury based on demographic and organisational variables. Statistical significance was accepted at $p \leq 0.05$.

3.4 Ethics approval

Permission to collect data from the injured workers and the non injured workers employed by OMS was given by the Chief Executive Officer of the company. The research design was discussed with the principal supervisor and with representatives of the four key Unions that have members engaged in the offshore oil and gas industry in Western Australia. The research proposal was approved by ECU Ethics Committee before commencement of the study. Introductory letters and consent forms were provided to all participants before administration of the questionnaires.

CHAPTER 4

RESULTS

The data presented in this chapter was obtained through administration of a questionnaire to OMS personnel employed in the offshore oil and gas industry in Western Australia (n = 484), which equates to approximately 20% of the total OMS workforce in Australia. Of the 484 personnel in the cohort, 286 were injured (cases) in a workplace event in the previous 3 years and the other 198 participants (controls) had not been injured in a workplace event in the previous 3 years.

4.1. Organisational factors that contribute to injury rates

4.1.1 Risk factors

Both vessel and oil rig workers are employed on night and day shifts, with oil rig workers having a 21 day on and 21 day off work cycle while vessel workers have a 35 day on and 35 day off cycle. Table 4.1.1 below highlights the injury rates experienced by sub-groups of this cohort of workers.

Table 4.1.1 Injury risk factors

Risk factors	Odd ratio	95% CI	P- Value
All workers	0.462	0.167-1.278	P=0.137
Rig-vs- vessel workers	3.452	0.787-	P=0.100
Skilled-vs- unskilled	1.889	0.539-6.618	P=0.032
All day shift-vs- night shift	0.442	0.159-1.227	P=0.117
Rig day shift-vs-night shift	3.452	0.787-	P=0.100
Vessel day shift-vs-night shift	1.889	0.539-6.618	P=0.320

From the data presented in table, 4.1.1 it would appear as if rig workers have the greatest injury risk (OR 3.45) and they are also more likely to sustain an injury during a day shift (OR 3.45). However, in both cases the confidence intervals are wide and include the number 1 and P values >0.05. This trend is therefore not statistically significant.

4.2 Contributing demographic factors to workplace injury incidence rate

4.2.1 Population age characteristics

Results from the survey indicated that the age range for all injured OMS employees surveyed was between 20 to 71 years, with rig workers ranging from 22 - 60 years as compared to a range of (20 - 71 years) for vessel workers. Figure 4.2.1 shows the age distribution for both Rig and Vessel workers combined. Approximately 52% of the cohort was over 44 years of age.

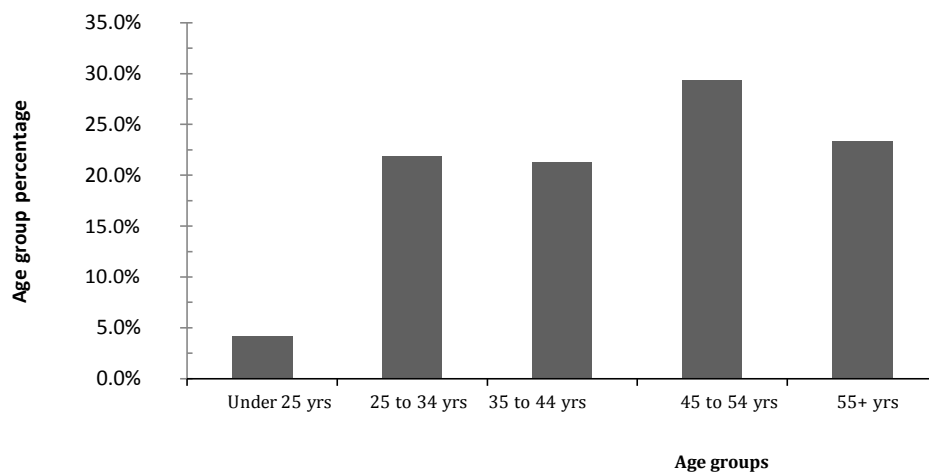


Figure 4.2.1 Age distribution of all seafarers

4.2.2 Injury by age groups

An analysis of injury rate over the 3-year study period revealed that 30.4% of workers aged 45-54 years had been injured at work. Of the workers aged 55 years and older, 23.4% had been injured. Workers under 25 years of age had the lowest injury rate of 2.9% during the same period. The distribution of injury burden is proportional to the age distribution of the sample population and therefore no particular age group appears to be more injury prone, this correlation is demonstrated in Figure 4.2.2.

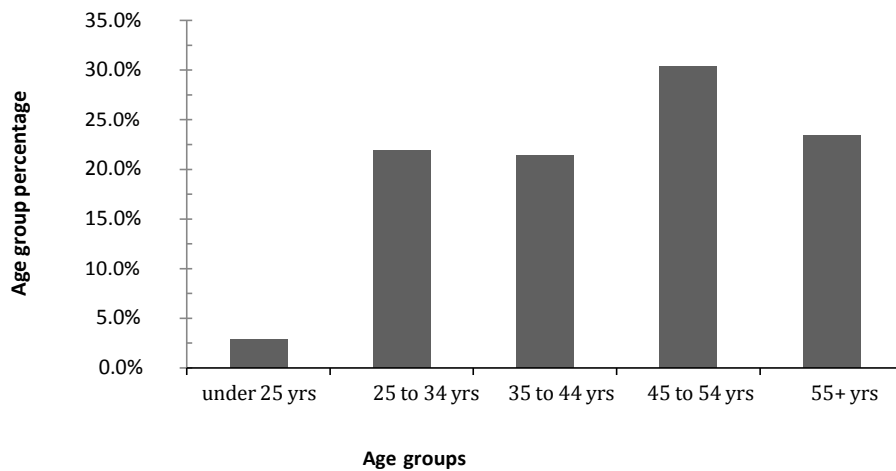


Figure 4.2.2 Injuries by age group

4.2.3 Years of experience

Upon comparison of the years of experience in the industry, it was observed that 40% of the participants had less than 9 years' experience, 25% had between 10 and 19 years' experience, 18% had 20 to 29 years' experience, 8% had 30 to 39 years' experience and 7% had more than 40 years' experience. These data are presented in Figure 4.2.3.



Figure 4.2.3 Years of experience

4.2.4 Years of experience and injury

When the length of service was compared to injury incidence during the 2008 to 2011 study period, it was found that 32.9% of injuries occurred within the first 10 years of employment and decreased to 29.1% after 10 years, and to 21.3% with 20 to 30 years of experience. Those workers who

served 30 to 40 years were found to have the lowest injury rate out of all age groups (16.8%). Figure 4.2.4 below shows length of service versus injury.

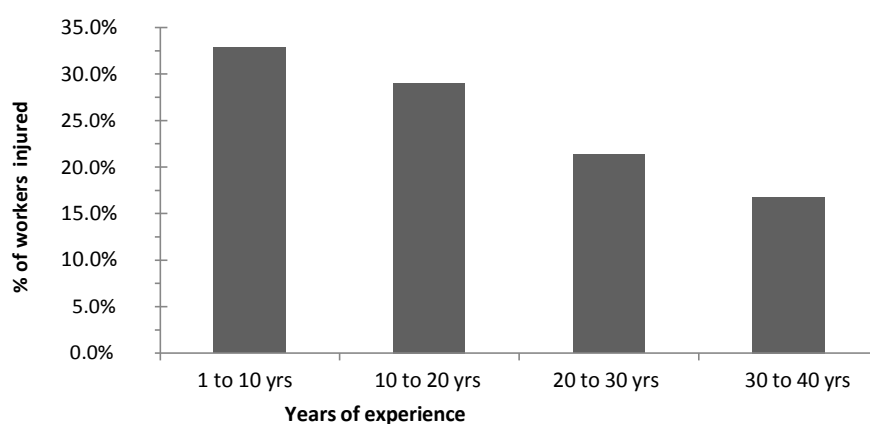


Figure 4.2.4 Length of service versus injury

4.2.5 Lifestyle factors

Lifestyle factors such as consuming alcohol, smoking, skill level, length of service, working on a rig or vessel and health issues were analysed to ascertain if any of these factors were contributing to the incident rate for injuries (Table 4.2.5).

Lifestyle Factors

Lifestyle factors	Odd ratio	95%	P- Value
Consume alcohol	0.505	0.191-1.336	P=0.169
Smoking	1.173	0.760-1.811	P=0.47
Skilled	0.267	0.165-0.434	P=0.00
Length of overall service	1.051	1.031-1.072	P=0.00
Rig or vessel worker	4.301	2.391-7.737	P=0.00
Health issues	0.870	0.545-1.388	P=0.560

Table 4.2.5 Lifestyle Factors

This data shows that consuming alcohol, smoking, length of overall service and health issues are not associated with the injury burden of this cohort.

Working on a rig was found to be a significant injury risk factor (OR 4.3, P=0.001) and being skilled was found to be protective of injury risk (OR 0.27, P 0.001).

4.3 Swing dynamics that contribute to injury incidence rate

The first quarter of the swing resulted in the greatest number of total injuries for all maritime workers. This injury incident rate was significantly greater ($P=0.001$) than the remaining three quarters. Comparing the injury rates between the second, third and fourth quarters of the swing, no differences were observed ($P=0.706$).

When comparing the quarterly injury rates for each cohort, rig workers were found to have a uniform rate of injuries across the entire swing duration. In other words, no observable differences were found in rig workers between swing quartiles ($P=0.862$). Vessel workers had a significant injury rate within the first quarter of the swing ($P=0.001$) when compared to the remaining three quartiles. In the remaining quarters of the vessel swing, no injury rate differences ($P= 0.999$) were measured.

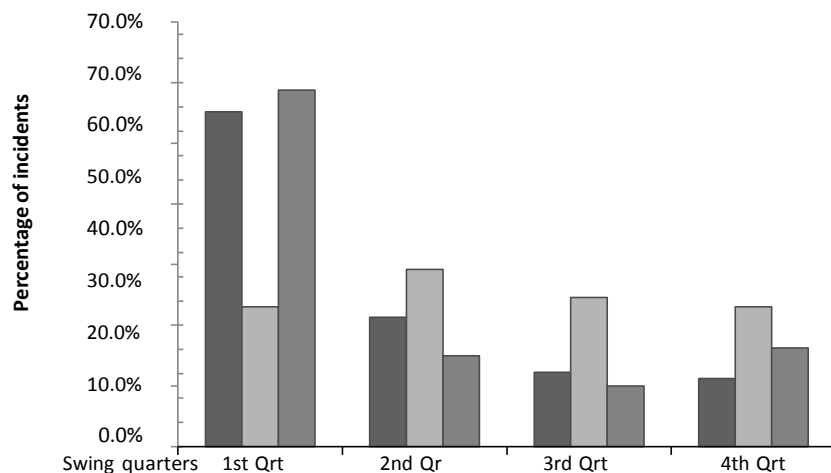


Figure 4.3.1 Swing quartiles comparisons

4.4 Personal factors that contribute to injury incidence rate

When personal factors such as age, marital status, alcohol consumption, smoking and health issues were examined (Table 4.4), it was observed that being separated/alone/no relationship (OR 2.47, $P= 0.05$) and being divorced (OR 2.04, $P=0.02$) was significantly associated with being injured. Furthermore the data suggest the consumption of alcohol (while off duty on shore leave) is a protective factor to becoming injured (OR 0.3, $P = 0.009$), whilst smoking and health related matters appear unrelated to injury incidence among this cohort.

Table 4.4 Contributing demographic factors for injury rate

Demographic factor	Odd's ratio	95%	P- Value
Age	0.787	0.507-1.221	P=0.286
Marital status			
Widowed	3.241	0.324-32.364	P=0.316
Separated/alone/no	2.473	1.316-4.647	P=0.005
Divorced	2.041	1.119-3.271	P=0.020
Married/de-facto	0.749	0.382-1.468	P=0.400
Smoking	1.171	0.771-1.779	P=0.458
Alcohol	0.301	0.121-0.744	P=0.009
Any health issues	1.099	0.696-1.733	P=0.684

An additional contributory factor to injuries is the lack of physical fitness amongst this cohort where 147 of the 286 injured workers (51%) reported that they performed no physical exercise whilst at sea and only 7 of the injured did.

CHAPTER 5

DISCUSSION

This chapter will discuss the findings of the study based on the data obtained from the cohort. The chapter concludes by addressing the research questions;

1. What organisational factors contribute to the injury incidence rate of employees in the WA offshore oil and gas industry?
2. Does the demographic profile of the work force influence the injury incident rate in the WA offshore oil and gas industry?
3. To what extent do the dynamics of the “swing” (i.e. number of days, length of time worked, and working on the first day or last day) contribute to injury incidence rate in the WA offshore oil and gas industry?
4. Can strategies be developed that will lead to a reduction in the incidence of injuries and the impact thereof on employees.

5.1 Organisational factors

In this industry, union dynamics make recruitment of the best worker for a specific role very difficult. Employers are often expected to employ workers offered to them by the union. It is not uncommon therefore to be pressurised to employ workers who may have a history of bad behaviour, both on and/or off the vessel, a high number of insurance claims, physical health problems, unsuitable work performance history and alcohol or other drug abuse problems (Del Rosso, 2011). The influence and militancy of unions connected with shipping and the waterfront in Australia is well established and has been an issue affecting the industry for many decades (Trinca & Davies, 2000).

5.1.1 Length of Service

As shown in Table 4.2.3, 28.7% of study participants had less than 5 years' experience in the offshore marine sector, 44% had between 5 and 25 years' experience and 26% had more than 25 years' experience. These data also demonstrate that there are a large number of workers with between 1 and 2 years' experience and also a large number of workers with extensive experience, however after acquiring 2 years of experience there appears to

be a significant reduction in workers. This phenomenon could possibly be associated with the perception by many that they can set themselves financial goals and once those are achieved move on to more stable employment.

The benefits to those workers who do depart after a short period are obvious – they do not become embroiled in the long – term family, social and other problems associated with the life style that arise over time. The disadvantage being a loss of employees who are trained skilled and experienced, this assertion is supported by the data as the highest number of injuries occurs during those early years of service while workers are still gaining their job related skills (Clifford, 2009; Meadowcroft, 2008).

As demonstrated in table 4.2.3, there are almost as many workers who have elected the industry as a life-long career choice (40 years of experience) than those who are in the industry for a short duration (2 years). It is interesting to note that the incidence of injury appears to be lowest in the “Life Career” group. The data demonstrated that 23.42% of workplace injuries were sustained within the first five years on the job. In this study, 59% of workers sustain injuries annually, thus demonstrating the high risk associated with seafaring activities. A reasons why less experienced workers are more likely to be injured may be that workers are still in the learning stages of the profession and are finding ways to cope with the job requirements and demands. Newly recruited workers can suffer physical injuries and this then leaves them feeling uneasy about carrying out their day to day duties, making them even more vulnerable (Mills, 2009).

5.1.2 Unskilled workers versus skilled workers

The education level of the cohort was investigated to determine if there was an association between level of education and a worker being injured. The study cohort contained 28.71% workers who had completed higher level certificated training that required three to five years or more of training, which are required for positions of command on a vessel as a Master and Chief Engineer or as an Offshore Installation Manager.

The cohort responses to role type were examined and stratified into skilled and unskilled workers groups, employed on either an oilrig or a vessel. Of the injured cohort (n=221), 189 (85%) were unskilled back deck workers.

This correlation was significant $P = 0.01$. When the same data for injured oil rig workers was examined ($n=64$), 36 (56.25%) of those injured were unskilled drill-floor workers such as roustabouts and mudmen as opposed to skilled drillers and toolpushers.

The findings of this research show that there is an association between education level and injuries in a WA offshore oil and gas environment, as workers being injured were predominantly unskilled. This area needs further investigation as it is likely that the unskilled workers are engaged in more physically demanding and high-risk tasks.

5.2 Demographic and other personal factors

Exploring the population characteristics of workers is one way of understanding high- risk occupational issues that affect people in their various working environments. This section discusses the findings on the characteristics of seafarers, exploring their age, health status, attitude towards fitness, diet and nutrition, marital status, current employment status, years of experience in the job and skills level. The discussion will then outline how each characteristic includes factors influencing the incidence rates of injuries and accidents among seafarers and rig workers providing support to the WA offshore oil and gas industry.

Demographic data of the study population showed that ages ranged from 20 years to over 70 years for the total workforce. A review of the OMS staff database, which was inclusive of all employees, confirmed these findings as being reflective of the age distribution of the total workforce. The age group over 45 years represents approximately 53% of the total study cohort. The mean age of all workers in the total study was 44 years with 42% of workers in management positions over 50 years of age.

When stratified into rigs and vessels the mean age for all workers employed on oil rigs was 39.9 years (mode 50) and the mean age was 44.9 (mode 45) years for the vessel workers. This reflects the ageing workforce trend that is typical of Australia (Chan, 2010). These groups were further subdivided into the 2 most physically challenging roles, namely that of integrated ratings, who work on the back deck of a vessel and that of the roustabout who work on the drill floor of offshore oil rigs or drill ship operations. These data show that the aging trend is also prevalent amongst

the integrated ratings (mean age 44.5 years) which presents some challenges for vessel operators such as managing physical workloads for older workers. Rig roustabouts have a mean age of 35.3 years.

The large number of aging integrated ratings may increase the overall safety risk for these workers as 161 integrated ratings submitted workers compensation claims over the last three years as compared to 12 roustabouts, which reflects the impact of workplace injuries among the aging workforce. When these data were compared to the mean ages of workers who had been injured, and those who had not, on oilrigs and vessels, it was observed that vessel workers were older; however, this was not the case for rig workers.

It has been demonstrated that age has an effect on the physical strength and power of an individual and this exposes workers to work related strains and musculoskeletal disorders when conducting physically demanding work (Westerholm & Kilbom, 1997).

When vessel and rig workers were cross tabulated, with the groups of injured and not injured and the mean ages analysed, the trends regarding age were reversed. The mean age of a non-injured oil rig worker was 42.74 years and the mean age for an injured oil rig worker was 38.83 years. For the vessel workers the mean age of a non-injured vessel worker was 43.21 years and the mean age for an injured vessel worker was 46.35 years. In summary, the younger workers on oil rigs are the workers being injured. In the case of the vessel crew, it is the older workers on the vessels that are more injury prone. There is thus a trade-off between experience level which is protective and older age which is a risk factor.

Other studies have shown that high risk jobs, such as seafaring, have negative impacts on an aging work force and this results in staff planning early retirement; which in turn contributes to the experienced workers leaving their jobs early, thereby creating a skilled personnel shortage (Gershon, Lin, & Li, 2002; Mahoney, 2005; Western Australia, 2005). The phenomenon observed in this study supports findings of previous studies that have shown that age is significantly associated with staff turnover intent in high-risk jobs. This is due to the elevated threat of physical injuries and job stress (Kasl, 1981; Lambert, 2006).

Further research is required to determine if there is a correlation between the physical and mental conditions of offshore oil and gas workers and long-term workers compensation claims. With improved safety conditions in the offshore industry over the past decades, the incidence of serious injury has decreased substantially. However, the costs of workers compensation claims have increased. This phenomenon can be partly attributed to the aging population of offshore workers and a subsequent increase in the occurrence of non-work related medical conditions (Tunnicliff, 2012).

When exploring marital status for risk of receiving an injury. Those individuals who are separated, alone or in no relationship (OR 2.47, $P = 0.05$) or divorced (OR 2.04, $P = 0.02$) tend to be at increased risk of sustaining an injury when compared to those individuals who are married or live in a de-facto relationship. Reid, Roberts and Dawson (Reid, Roberts, & Dawson, 2012) found that non-standard work schedules may induce stress by preventing the worker from fulfilling important family roles. Social companionship may adversely be affected by work schedules.

In some cases, these effects can be major and can severely affect mood, motivation, and sleep; therefore, having indirect effects on performance and safety. Marital problems, increased domestic workload and community alienation are all well documented results of the strain placed on workers by work schedules (Reid et al., 2012). It is unknown how the mental state of a worker is affected upon their return to work when they have spent their off swing not in a relationship. The emotions associated with being alone could possibly make a worker more susceptible to an injury. Conversely, workers who are happily married or in a de-facto relationship may be able to focus on work and in doing so avoid being injured at work.

Interestingly, in table 4.2.5 the consumption of alcohol was measured to have a protective factor to being injured ($P = 0.009$) whilst smoking ($P = 0.458$) and health related matters ($P = 0.684$) increased the odds of becoming injured.

Furthermore the data suggest the consumption of alcohol (while off duty on shore leave) is a protective factor to becoming injured (OR 0.3, $P = 0.009$), whilst smoking and health related matters appear unrelated to injury incidence among this cohort. It must be noted that alcohol is not permitted

in the off shore work environment and the questions related to alcohol consumption refer to the time when workers are on their off swing. These findings, although of apparent benefit in injury prevention are of concern from a general public health perspective. Only 32 of the 484 study participants did not drink alcohol when at home on their off swing. Of the 261 injured workers who drank, 172 (66%) drank on 5 or more days of the week with 96 of those workers (56%) drinking more than 5 to 8 standard drinks every day. This alcohol intake level is well above the guideline set by The Australian National Health and Medical Research Council Guidelines "Alcohol and your health"(National Health and Medical Research Council, 2001). Some of these workers may be experiencing alcohol withdrawal symptoms at the start of their swing, this hypothesis is supported by findings of an Australian federal Government report (Elizabeth Proude, Olga Lopatko, Nicholas Lintzeris, & Haber., 2009) and the issue warrants further investigation.

5.3 Dynamics of the swing

As demonstrated in figure 4.3.1, data for oilrig workers was evenly distributed across 4 quarters and there was no significant difference in terms of injury rate and time period of the swing ($P = 0.86$). Vessels were observed to have a significantly skewed injury rate across the four quarters; 14.4 for the first quarter, 4.1 for the second quarter, 2.4 for the third quarter and 4 for the fourth quarter ($P = 0.0001$). This finding supports that of the Danish Maritime Authority for the period 1993-1997, where it was reported that the first period aboard a ship was a significant risk factor (Hansen et al., 2002).

The results of this study suggest that workers employed for OMS in the offshore oil and gas industry in Western Australia, when working on a vessel as opposed to working on an offshore oil rig, are more likely to be injured during the first nine days of their swing. This cohort also presented a higher number of workers compensation claims, lost time injuries (LTIs), loss of experienced workers, high absenteeism rates and lower morale when compared to oil rig workers (Tunnickliff, 2012). Future studies should include a larger proportion of maritime workforce in Australia, incorporating other maritime labour hire companies and their respective employees and these studies should explore factors such as the influence of

marital status, relationship issues and relaxation strategies for off duty personnel.

5.4 Strategies to reduce accidents and injuries

5.4.1 Other risk factors

Fatigue has been shown to contribute to accidents in the workplace (Sullivan, 2007) and it has also been found to be a factor in the number of workers being injured at sea. Of the 286 cases in this study 202 (70%) of the workers, who had reported being injured at work in the past three years also reported inadequate rest breaks between shifts and having been awakened at night to report for duty to solve urgent problems at sea.

An additional contributory factor in the development of fatigue among seafarers is the lack of physical fitness amongst this cohort, with (51%) of injured workers reporting that they performed no physical exercise whilst at sea and only 7 of the injured workers reported performing some kind of physical exercise program whilst at home (n=286). It has been reported that physical inactivity has negative health consequences accounting for 7% of the injury burden of Australians (Begg et al., 2008). It has also been found that few adults participate in fitness programs to maintain their fitness levels, as they age and this is most likely the case with workers engaged by OMS in Western Australia (Proper KI, 2002).

Although OMS provides gym facilities for their workers on seagoing vessels and oil rigs, there are no programmed physical training sessions or company supplied trainers to lead physical exercise programs and there is also no specific allocated time set aside for physical exercise. Workers are expected to exercise in their own time; therefore, utilization of the company provided facilities is generally very poor.

If OMS were to provide health and fitness workplace programs which integrated increasing flexibility and strength for their employees, this intervention could enhance the workers ability to do their job and reduce fatigue. Thus, reducing the number of workplace injuries as a result of workplace fatigue(Chan, 2010). The primary objective of any company with a sound occupational health and safety policy is to ensure that the policy protects the health of employees from adverse effects of work activities

(Hackitt, 2012). There are five main groups of health hazards in the offshore oil and gas industry:

1. musculoskeletal disorders (manual handling, ergonomics)
2. hazardous substances
3. physical hazards (noise, vibration, asbestos and radiation)
4. biological hazards (food/water hygiene)
5. psychosocial hazards (stress)(Hackitt, 2012).

A systematic approach to managing health risks associated with work activities in the offshore oil and gas industry requires a four-stage risk assessment for each of the occupational health risks. This risk assessment is a small but key part of the overall occupational health and safety management system. The four stages of the risk assessment process are:

1. Identify the health hazards

Managers can do much of the hazard identification based on their knowledge of the work activity, although they may need access to specialist advice (e.g. from occupational hygienists, nurses or physicians). Developing an inventory of health hazards may be a useful and systematic way of gathering this information.

It is important to include hazards created by work activities, such as welding fumes, exhaust gases or hydrogen sulphide, noise/vibration from use of power tools, proliferation of legionella in water systems and psychosocial stressors, such as the way that work is organised. For most health hazards there are specific regulations with supporting guidance which will help to identify significant hazards (Hackitt, 2012)

2. Assess the health risks

A risk is defined as the likelihood that someone will be harmed by the hazard in the circumstances in which it is met and it is necessary to:

- a. determine the nature of the hazard
- b. identify who may be affected and when
- c. measure the extent and duration of exposure to the hazard

The assessment should show whether the control measures in use are

successful in reducing the risk to an acceptably low level. If this is not the case, it is necessary to select and implement further control measures (Hackitt, 2012).

3. Control the risks to health

If the risk assessment shows that further control measures are required, it will be necessary to select the most appropriate type. This 'hierarchy' of control measures can assist in the selection of the most effective measures for any situation:

- a. elimination
- b. substitution
- c. engineered controls
- d. procedural controls
- e. personnel protective equipment.

The removal of any health hazards, if possible, would be the option of choice. Failing that, the approach should be to use the highest control in the hierarchy where reasonably practicable. Personal protective equipment only protects the wearer and only when worn properly. It should only be used as a final solution or as a stopgap measure until something better can be put in place. All control measures need to be properly maintained and workers need to be trained and supervised in their use (Hackitt, 2012).

4. Mitigate the risks to health

The main aim of health risk assessments is to prevent workers' health being affected by their job and therefore if identified these hazards need to be controlled as soon as possible. Health surveillance should be implemented in order to recognise early signs of ill health caused by work. Medics and first-aiders should be provided with training and be equipped to deal with the full range of health problems that may arise. There should also be arrangements to transport sick or injured workers to shore promptly to seek medical attention.

Workers who have recovered from illness or injury may have difficulty in adjusting again to work, especially after a long period. They will need assistance and advice to rehabilitate them into the work environment (Hackitt, 2012).

In this chapter, the data were used to; identify organisational, demographic and personal factors that contribute to the injury incidence rate of employees in the WA offshore oil and gas industry. Strategies to reduce the incidence of injuries and the impact thereof on employees were also identified.

Chapter 6

Conclusions and recommendations

As far as could be ascertained, this was the first investigation into injury causal factors among seafarers working in the Western Australian offshore oil and gas industry. Opportunities to make comparisons to previous research were therefore limited. Furthermore, much of the data related to physical, and mental injuries are held in confidence by insurance companies and could therefore not be analysed in detail. Examination of the survey results supports the notion that the majority of accidents and injuries occur in the first quarter of each shift or “swing”. The causes underpinning this trend are largely attributable to, demographic profile and other factors in both the domestic and work environments of these workers. The impact of these factors influence the workers cognitive ‘application to task’ (or lack thereof) when placed in what is inherently a highly dangerous and hazardous workplace environment.

The following specific recommendations to address the identified issues have been formulated and it is expected that implementation of these will have a positive influence on the accident and injury rate of this unique cohort of seafarers.

1. Design and implement a re-orientation program for workers returning from shore leave on their first day back from leave and provide additional occupational safety and health support, reinforcement and supervision for the first quarter of a swing.
2. In partnership with the unions, develop a recruitment strategy specifically aimed at attracting young people into the industry, particularly to work on vessels in physically demanding roles.
3. Assess the length of the swing among vessel workers and align this better with that of rig workers, the longer period away from home may be an underlying cause for the higher injury incidence rate in the first quarter.
4. The design of shift, shift rotations and length of the swing, in conjunction with operational factors, such as sleep disruption and accommodation on vessels appears to be linked to fatigue. An attempt should

be made to align these better with the work cycles employed on rigs.

5. Single workers appear to be at higher risk of receiving an injury when compared to those with a partner. Additional support should be provided for single personnel.

6. Exercise programs should be developed and implemented while workers are at sea in order to maintain levels of personal fitness.

7. Issues that require further research and investigation include;

- Reasons why vessel workers have a higher accident rate need to be further investigated; these could potentially be related to the older age of vessel workers, risks associated with on board tasks, fatigue and interrupted sleep on vessels, shift rosters, longer length of the swing or personal relationship stresses.
- Reasons why the vessel workers are more likely to have an accident during the first quarter of their swing; these could be related to alcohol or other drug use while on shore (withdrawal), or other psychological factors associated with being away from home for an extended period.

This study has defined “Factors influencing the incidence rates of injuries and accidents among seafarers and rig workers providing support to the WA offshore oil and gas industry” and provides empirical knowledge to the maritime industry in general and in particular to labour hire companies specialising in the hiring of maritime labour.

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Appendix A

ECU Ethics Approval

14 April 2011

Mr Tony Martinovich

67 Jenkin Street

South Fremantle WA 6162

Dear Mr Martinovich

I am pleased to write on behalf of the Higher Degrees Committee, Faculty of Computing, Health and Science, to advise that your Professional Doctorate research proposal has been approved – **Factors influencing the incidence rates of injuries and accidents among seafarers and rig workers providing support to the WA offshore oil and gas industry.**

I also wish to confirm that your proposal complies with the provisions contained in the University's policy for the conduct of ethical research, and your application for ethics has been approved. Your ethics approval number is 4309 and the period of approval is: **13 April 2011 to 31 July 2012**

Approval is given for your supervisory team to consist of: Principal Supervisor: A/Prof Jacques Oosthuizen - ECU Co Supervisor: TBA

The examination requirements on completion are laid down in *Part VI of The University (Admissions, Enrolment and Academic progress) Rules for Courses Requiring the Submission of Theses* available at: http://www.ecu.edu.au/GPPS/legal_legis/uni_rules.html

Additional information and documentation relating to the examination process can be found at the Graduate Research School website: <http://research.ecu.edu.au/grs/>

Please note: the Research Students and Scholarship Committee has resolved to restrict a Professional Doctorate theses to a maximum of 60,000 words. Under special circumstances a candidate may seek approval from the Faculty Research and Higher Degrees Committee for an extension to the word length (RSSC 33/04).

I would like to take this opportunity to offer you our best wishes for your

research and the development of your thesis.

Yours sincerely

Patricia Brown

Research Assessment Coordinator

Research Assessments- SSC Phone 08 6304 3864

Email: researchassessments@ecu.edu.au

Principal Supervisor: A/Prof Jacques Oosthuizen – ECU

Appendix B

Dear Potential Participant,

Factors influencing the incidence rates of injuries and accidents among seafarers and rig workers providing support to the WA offshore oil and gas industry.

You are invited to participate in this research project, which is being conducted as part of the requirements of a Professional Doctorate Degree at Edith Cowan University.

The purpose of this project is to define and quantify the factors that influence the incidence rates of injuries and incidents in the offshore oil and gas industry of WA.

If you choose to participate in this project, you will be asked to answer a number of questions relating to the type of work you perform, the conditions you work under, your health and family life. The question will take about 30 minutes to answer. The captured data will be included in a database and electronically stored and will be destroyed five years after the completion of the project. There are no physical risks involved.

Any information will only be used for this research project and only the student and supervisor will have access to the information.

Any information or details given for this study will be kept confidential. You will not be identified in any report or presentation of the results of this research project. You can ascertain the results of this project verbally from the student at the end of the project which is expected to be December 2011.

Participation in this project is voluntary. If you choose to participate, you are free to withdraw from further participation at any time without giving a reason and with no negative consequences. You are also free to ask for any information which identifies you to be withdrawn from the research project.

If you have any questions or require any further information about the research project, please contact Tony Martinovich on +61419942729 or email tonymartinovich@amnet.net.au or Dr. Jacques Oosthuizen (Supervisor) on +61 8 6304 5876 or email j.oosthuizen@ecu.edu.au.

If you would like to participate in this project, please complete and return the consent form.

Tony Martinovich

Tony Martinovich
Professional Doctorate student

This research project has been approved by the Faculty of Computing, Health and Science Ethics Subcommittee. If you have any concerns or complaints and wish to talk to an independent person, you may contact the Research Ethics Officer on +61 8 6304 2170 or email research.ethics@ecu.edu.au

Appendix C

Western Australian Maritime Offshore Oil & Gas Workers Health & Incident Survey

**Adapted from the 1996 'Fatigue, Stress and Occupational
Health in the Maritime Industry' study questionnaire by Dr
Lyle Hubinger of Queensland University of Technology**

Participants Information Package

Project Objectives:

The objectives of the study are twofold. Firstly, the study will describe the physical and mental health of the workers employed in the WA maritime offshore oil and gas industry. Secondly, the study will identify the work, social and related at sea demands for this group.

The attached questionnaire will allow the researcher to collect and analyse information on physical health, mental health and workplace demands.

Rationale:

There are a number of unique problems faced by WA maritime offshore oil and gas industry workers due to the nature of the industry.

Test Procedures:

Information will be collected by way of this questionnaire.

Informed Consent:

Participation in this study is entirely voluntary and you are free to withdraw from this study at any time. Non participation will not disadvantage you in any way.

Confidentiality:

All questions, answers and results for this study will be confidential and names of participants will not be recorded and therefore individuals will not be identifiable.

Questions concerning the procedure and or the rationale used in this investigation are welcomed at any time. Please ask for clarification of any point you may feel is not explained to your satisfaction.

Your points of contact are Tony Martinovich (Student): Phone +61419942729 or

Dr. Jacques Oosthuizen (Supervisor) Phone +61 8 6304 5876

Informed Consent Form

The researcher conducting this project support the principles governing the ethical conduct of research, and the protection at all times of the interests, comfort and safety of seafarers

This form and the accompanying Participants Information Package are given to you for your own protection. They contain a detailed outline of the procedures. Your signature below indicates six things:

1. You have received the Participants Information Package;
2. You read the contents;
3. A telephone contact have been provided for you to discuss the contents;
4. You clearly understand the purpose and procedure;
5. You voluntarily agree to participate in this project;
6. You may end your participation in this project at any time.

Any further enquires or further questions may be directed Tony Martinovich on +61419942729.

All inquiries re this research may also be directed to Edith Cowan University Research Ethics Committee on +61 406571815.

I agree to participate in procedures set out in the Subject Information Package.

Last Name_____ Given Names_____

Signature_____ Date_____

WITNESS

Last Name_____ Given Names_____

Signature_____ Date_____

This page will be removed by the research team before data analysis commences to ensure your name cannot be linked with responses to the questions.

All Answers Are Confidential.

**Section One:
Background:**

1. In which area do you work? Tick one box only.

1 ☐ Vessels

2 ☐ Rigs

2. What is your current occupational category? Tick one box only.

1 ☐ Master

2 ☐ OIM

3 ☐ Chief Mate

4 ☐ Mate

5 ☐ Driller

6 ☐ Toolpusher

7 ☐ Assist driller

8 ☐ Derrickman

9 ☐ 1st Engineer

10 ☐ Motorman

11 ☐ Roustabout

12 ☐ Utility

13 ☐ Chief Engineer

14 ☐ 2nd Engineer

15 ☐ Painter

16 ☐ Steward

17 ☐ Cook

18 ☐ TIR

19 ☐ PIR

20 ☐ IR

21 ☐ Kitchen hand

22 ☐ Pumpman

23 ☐ Crane operator

24 ☐ Floorman

25 ☐ Electrician

26 ☐ Welder

27 ☐ Radio operator

28 ☐ Camp boss

29 ☐ Other_____

3. How long have you worked in the maritime industry?

_____years_____months

4. How long have you worked in this current position?

_____years_____months

5. How long have you worked on your current vessel?

_____years_____months

6. Sex

1 ☐ Male

2 ☐ Female

7. What is your current marital status? Tick one box only.

1 ☐ Married

2 ☐ Widowed

3 ☐ Separated

4 ☐ Divorced

5 ☐ Single

6 ☐ De-facto

Section Two: Health:

8. Has a doctor ever told you that you suffer from, or have you ever experienced any of the following? Tick as many boxes as apply.

1. ☐ Heart disease, if YES what? _____
2. ☐ Blood pressure abnormalities, if YES what? _____
3. ☐ Lung/respiratory disease, if YES what? _____
4. ☐ Joint problems, if YES what? _____
5. ☐ Nervous systems problems, if Yes what? _____
6. ☐ Stomach problems, if YES what? _____
7. ☐ Gland problems, if YES what? _____
8. ☐ Psychiatric problems, if YES what? _____
9. ☐ Other problems? Please specify? _____

9. Please list any medications that you are currently taking.

Medication _____ What for? _____

Medication _____ What for? _____

Medication _____ What for? _____

Medication _____ What for? _____

10. Has a doctor ever told you in the last year that you suffer from high cholesterol? Tick one box only.

1. ☐ Yes - above 5.5 (mmol.L⁻¹)
2. ☐ Yes- below 5.5 (mmol.L⁻¹)
3. ☐ Yes- do not know the value
4. ☐ NO

11. Have you been in hospital in the last 3 years? Tick one box only.

1 ☐ Yes

2 ☐ No

If YES what for? _____

12. Do you have any medical conditions (including surgery) for which a Doctor has ever recommended some permanent restriction on your work activity? Tick one box only.

1 ☐ Yes

2 ☐ No

If YES what was the restriction for? _____

13. Do you smoke? Tick one box only.

1 ☐ Yes, Go to question 13a

2 ☐ No, Go to question 14

13a. How many do you smoke a day? Tick one box only.

1 ☐ cigarettes per day

2 ☐ pipes per day

3 ☐ cigars per day

14. Do you drink alcohol? Tick one box only.

1 ☐ Yes, Go to questions 14a and 14b

1 ☐ No, Go to question 15

14a. How many days per week do you drink? Tick one box only.

1 ☐ one day a week

2 ☐ two days a week

3 ☐ three days a week

4 ☐ four days a week

4 ☐ five days a week

5 ☐ six days a week

5 ☐ everyday of the week

14b. On the days of the week that you do drink how many drinks do you have per day? Tick one box only.

- 1 ☐ one to two drinks per day
- 2 ☐ three to four drinks per day
- 3 ☐ five to eight drinks per day
- 4 ☐ nine to twelve drinks per day
- 5 ☐ thirteen to twenty drinks per day
- 6 ☐ more than twenty drinks per day

Note one standard drink = ten grams of alcohol which is equivalent to:

- 1. Middy of beer 285 mls
- 2. One can of reduced alcohol beer 375 mls
- 3. One small glass of wine 120 mls
- 4. One glass of port 60 mls
- 5. One nip of spirits 30 mls

15. How often do you exercise each week while at sea? Tick one box only.

- 1. ☐ Never
- 2. ☐ Yes once a week
- 3. ☐ Yes twice per week
- 4. ☐ Yes three times per week
- 5. ☐ Yes four times a week
- 6. ☐ Yes five or more times a week

16. How often do you exercise each week while at home? Tick one box only.

- 1. ☐ Never
- 2. ☐ Yes once a week
- 3. ☐ Yes twice per week
- 4. ☐ Yes three times per week
- 5. ☐ Yes four times a week
- 6. ☐ Yes five or more times per week

Section Three: Nutrition:

17. The following questions refer to your attitudes to nutrition, for each statement indicate your response using the rating scale one to six, where 1 indicates strongly agree and 6 indicates strongly disagree.

Strongly Agree

Strongly disagree

1 2 3 4 5 6

1. Nutrition is only important for people over 40 ☐ ☐ ☐ ☐ ☐ ☐
2. Nutrition is only import when you are sick ☐ ☐ ☐ ☐ ☐ ☐
3. If you take vitamins and minerals you do not
need to eat healthy food ☐ ☐ ☐ ☐ ☐ ☐
4. Junk food is an important of my life ☐ ☐ ☐ ☐ ☐ ☐
5. The taste of food is more important than its
nutritional value ☐ ☐ ☐ ☐ ☐ ☐
6. Eating healthier food would improve my life ☐ ☐ ☐ ☐ ☐ ☐
7. Because I live such a busy life I tend to eat what
is handy, not necessarily healthy ☐ ☐ ☐ ☐ ☐ ☐
8. It seems that most of the foods I like eating
are bad for me ☐ ☐ ☐ ☐ ☐ ☐

Section Four: How you feel about your job:

18. The following questions refer to the extent to which you feel satisfied or dissatisfied with your job , Do not let other factors influence your answer. Simply indicate your response using the rating scale one to six, where 1 indicates very much satisfied and 6 indicates very much dissatisfied.

	Very much satisfied			Very much dissatisfied		
	1	2	3	4	5	6
1. Communication and the way information flows around your vessel	[]	[]	[]	[]	[]	[]
2. The relationships you have with other people at work	[]	[]	[]	[]	[]	[]
3. The feeling you have about the way you and your efforts are valued	[]	[]	[]	[]	[]	[]
4. The actual job itself	[]	[]	[]	[]	[]	[]
5. The degree to which you feel 'motivated' by your job	[]	[]	[]	[]	[]	[]
6. The style of supervision that your superiors use	[]	[]	[]	[]	[]	[]
7. The kind of work or tasks that you are required to perform	[]	[]	[]	[]	[]	[]
8. The amount of participation which you are given in important decision making	[]	[]	[]	[]	[]	[]
9. The amount of work you are given to do whether too much or too little	[]	[]	[]	[]	[]	[]
10. The degree to which you feel extended in your job	[]	[]	[]	[]	[]	[]

Section Five: Your experiences at work:

19. Below is a list of statements concerning your experiences. Please indicate the degree to which each one of these statements is characteristic of your job.

All items below are work demands. You are required to rate them in terms of the degree of demand each may place on you.

Rating Scale

Very definitely is a demand	6
Definitely is a demand	5
Generally is a demand	4
Generally is not a demand	3
Definitely is not a demand	2
Definitely is not a demand	1

Very definitely is a demand Definitely is not a demand
6 5 4 3 2 1

1. Having far too much work to do	[]	[]	[]	[]	[]	[]
2. Lack of power and influence	[]	[]	[]	[]	[]	[]
3. Managing or supervising the work of other people	[]	[]	[]	[]	[]	[]
4. Coping with work politics	[]	[]	[]	[]	[]	[]
5. Taking my work home between swings	[]	[]	[]	[]	[]	[]
6. Personal beliefs conflicting with those of the management	[]	[]	[]	[]	[]	[]
7. Inadequate guidance and backup from superiors	[]	[]	[]	[]	[]	[]
8. Lack of consultation and communication	[]	[]	[]	[]	[]	[]
9. Not being able to switch off at home	[]	[]	[]	[]	[]	[]
10. Inadequate training	[]	[]	[]	[]	[]	[]
11. Lack of social support from the crew at work	[]	[]	[]	[]	[]	[]
12. My spouse's attitude towards my work	[]	[]	[]	[]	[]	[]
13. Having to work long hours	[]	[]	[]	[]	[]	[]
14. Conflicting job tasks and demands in my role	[]	[]	[]	[]	[]	[]
15. Covert discrimination and favouritism	[]	[]	[]	[]	[]	[]
16. Feeling isolated	[]	[]	[]	[]	[]	[]
17. A lack of encouragement from superiors	[]	[]	[]	[]	[]	[]
18. A hot working environment	[]	[]	[]	[]	[]	[]
19. Staff shortages and unsettling staff turnover	[]	[]	[]	[]	[]	[]
20. Demands my work makes on my relationship with my spouse/children	[]	[]	[]	[]	[]	[]
21. Being undervalued	[]	[]	[]	[]	[]	[]
22. Having to take risks	[]	[]	[]	[]	[]	[]
23. Changing jobs to progress with career	[]	[]	[]	[]	[]	[]

- | | |
|---|--|
| 24. Too much or too little variety in work | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 25. Inadequate feedback about my own performance | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 26. Being away from home for extended periods | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 27. Demands that work makes on my private life | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 28. Factors not under my direct control | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 29. Sharing of work and responsibility evenly | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 30. Ship morale | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 31. Attaining your own personal levels of performance | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 32. 'Personality' clashes with others | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 33. Implications of mistakes you make | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 34. Pursuing a career at the expense of home life | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 35. Concern for loved ones ashore | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 36. Work travel and having to live in hotels | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 37. Inadequate rest breaks between trips | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 38. Being woken unexpectedly from your sleep to deal with a problem | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 39. Inadequate rest breaks between shifts | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| 40. Tensions between Officers and crew | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |

Thank you for your answers.

For further queries, please contact: Tony Martinovich School of Exercise and Biomedical Health Sciences Edith Cowan University tonym@student.ecu.edu.au

Appendix D



Research Ethics Committee
Edith Cowan University
Joondalup

November 6th, 2009

To Whom It May Concern

Dear Sir/Madam

This letter is a written introduction and approval to confirm that Tony Martinovich, a PhD student at Edith Cowan undertaking research in the field of Occupational and Environmental Safety and Health and also an employee of Offshore Marine Services (OMS) has been granted permission from Offshore Marine Services to undertake such research involving OMS employees and accessing OMS databases.

Permission is granted for the following:

1. To conduct a survey with any OMS employee as required,
2. Access to Offshore Marine Services incident report database,
3. Access to Offshore Marine Services human resources database,
4. Interview any OMS employee as required.

Offshore Marine Services strongly supports this research into the effects of working in the maritime industry in Western Australia on the occurrences of injuries and workplace incidents and as such hereby grant unrestricted access.

A handwritten signature in black ink, appearing to read 'Ian Del Rosso'.

Ian Del Rosso

Chief Executive Officer
Offshore Marine Services