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Original Articles

The health and wellbeing of offshore workers: a narrative review of the published literature

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Abstract

Recent developments within the offshore industry have highlighted the role that health and wellbeing plays in ensuring the safety and longevity of the offshore workforce. Developing an understanding of the overall health and wellbeing of offshore workers could aid future developments. This narrative review aims to identify and synthesise the relevant published literature on offshore health and wellbeing. The Cochrane Library, Cumulative Index to Nursing and Allied Health Literature, Medical Literature Analysis and Retrieval System Online, PsycArticles, and Web of Science databases were searched with publication search dates limited from January 1994 to November 2014. Twenty-six studies were identified and covered aspects of occupational stress; mental wellbeing; body mass index; diet; physical activity; musculoskeletal disorder; smoking; alcohol and drug use; shift work amongst offshore workers.

This narrative review has highlighted a lack of high quality and relevant research. There is a particular need to research workers' participation in self care activities and the resultant influence of domains on health and well being.

Introduction

The oil and gas industry is a vital contributor to the global economy and a key source of employment in oil-producing countries. Financial forecasts predict its continued economic influence; however, oil production is, in part, largely dependent on a core workforce who will commit themselves to a unique and somewhat arduous working lifestyle. Sustained working periods, allied to the intrinsic demands and hazards of offshore work, may place significant physical and psychological burden on workers, and consequently, would necessitate that workers are in good health over the course of their career.

As stipulated by Oil and Gas UK, it is mandatory that all offshore workers undertake a medical examination, conducted by a certified doctor, once every two years to maintain their certificate to work. In an effort to ensure health standards are upheld and to mitigate incidences of poor health, workers are required to satisfy the minimum criteria on a range of medical assessments: body mass index, vision, pulse and blood pressure, lung capacity and urinalysis ¹. Increasingly providers are utilising Functional Capacity Evaluations to assess physical fitness. Such measures seek to evaluate: strength; stamina; aerobic fitness; role-specific functional task simulation ².

Well maintained health stands to benefit employee safety in addition to the broader personal gains achieved via improvement. Further, according to a report published by the International Association of Oil and Gas Producers ³, an unhealthy workforce will incur higher rates of absenteeism, and will increase the likelihood of emergency evacuation from an installation. The paper, A Recommended Fitness Standard for the Oil and Gas Industry ⁴, advises that improving the health and wellbeing of employees working within the offshore industry could be a critical determinant in ensuring economic opportunities are maximised and the longevity of the workforce.

Developing an understanding of the health and wellbeing of personnel working in offshore

environments is of significant interest. The aim of this narrative review is to synthesise the published literature on health and wellbeing in the offshore workforce.

Method

A narrative review is typically defined as an overview and synthesis of literature pertaining to a specific topic. Literature searches should be performed and documented, and it should be evidenced that high levels of methodological rigour have been applied⁵. Electronic searches were carried out using: The Cochrane Library, Cumulative Index to Nursing and Allied Health Literature, Medical Literature Analysis and Retrieval System Online, PsycArticles, and Web of Science databases. Key terms were separated by the Boolean Operator AND, and truncated, where appropriate, using the asterisk symbol (*). Key word searches included: offshore AND health*; offshore AND well* (to cover wellbeing and wellness).

All study designs (qualitative; quantitative; mixed methods; systematic reviews) were included in the review. In addition, the inclusion criteria specified that studies on offshore health and wellbeing were published: in the English language; between January 1994 and November 2014. Hand searching, to identify eligible articles which may not have been indexed using the key terms, was performed on the reference list of each article identified within the electronic search.

A total of 26 papers satisfied the inclusion criteria and included: two systematic reviews; 23 quantitative; one qualitative study. Articles were collated into a broader categories, based on their findings, and nine domains of health and wellbeing were identified: (i) occupational stress; (ii) mental wellbeing; (iii) body mass index; (iv) diet; (v) physical activity; (vi) musculoskeletal disorder; (vi) smoking; (viii) alcohol and drug use; (ix) shift work.

Results

Results are presented according to each of the health and wellbeing domains outlined in Table 1.

Table 1. Domains and definitions

Domain	Definition
Occupational stress	<i>“the adverse reaction people have to excessive pressures or other types of demand placed on them at work”⁶</i>
Mental health	<i>“a state of wellbeing in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community”⁷</i>
Body mass index (BMI)	<i>“Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person’s weight in kilograms divided by the square of his height in meters (kg/m²)”⁸</i>
Diet	<i>“Specific recommendations for a healthy diet include: eating more fruit, vegetables, legumes, nuts and grains; cutting down on salt, sugar and fats. It is also advisable to choose unsaturated fats, instead of saturated fats and towards the elimination of trans-fatty acids”⁹</i>
Physical activity	<i>“Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure”¹⁰</i>
Musculoskeletal disorder	<i>“The term MSD covers any injury, damage or disorder of the joints or other tissues in the upper/lower limbs or the back”¹¹</i>
Smoking	<i>Not applicable</i>
Alcohol and drug use	<i>Not applicable</i>
Shift work	<i>“shift work can be defined as employment in any work schedule that is not a regular daytime schedule (that is, approximately 0900 to 1700)”¹²</i>

Occupational stress

Ten quantitative studies (Table 2) reported occupational/work related stress. Frequently induced via exposure to physical and psychosocial stressors, stress pertaining to the workplace is reportedly a key source of discontent among industry personnel. For example, Bjerkan ¹³ reports that offshore workers were significantly more likely to perceive their work environment as hazardous when compared with their onshore counterparts.

Sources of occupational stress in the offshore industry

Wong et al ¹⁴ applied the Chinese Occupational Stress Scale, to assess the nature of work-related stress in offshore workers. A number of stressors reported, the four most prominent relating to the physical environment, safety, the interface between job and family/social life, and career and achievement.

Factors associated with occupational stress and its impact on the offshore industry

Associations between experiences of occupational stress and a number of variables have been demonstrated: low social support; Type A personality (characterised by a competitive, urgent and hostile nature) ¹⁵; musculoskeletal pain ¹⁶; engagement in health behaviours ¹⁷; poorer mental health ¹⁸.

Moreover, personnel who have sustained injuries whilst at work perceived a higher risk, reported greater dissatisfaction with safety, and experience pronounced overall occupational stress than those not injured in the workplace ¹⁹. The findings in relation to risk were verified in another study demonstrating a significant association between near misses and higher levels of risk perception ²⁰. Occupational stress has been associated with greater job dissatisfaction and increased strain in the workplace. Further, workplace strain has been significantly related with an increased likelihood of absenteeism ²¹.

Table 2. Occupational stress in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Bjerkan, A.M. (2011) (13)	To evaluate onshore and offshore employees perceptions of psychological and physical health.	Cross-sectional survey of Norwegian offshore workers and onshore employees working within the same organisation.	A purposive sample of on and offshore workers were mailed the questionnaire, n=414 (47.1%: onshore: n=290 70%; offshore: n=90 21.7%).	Offshore workers were significantly more likely than their onshore counterparts, to perceive their work environment as hazardous.
Chen, W.Q., et al. (2003) (15)	To identify the determinants of perceived occupational stress among Chinese offshore workers.	Cross-sectional survey, using the Occupational Stress Scale, of Chinese offshore workers within the same organisation.	A purposive sample of offshore workers returning from their offshore rotation completed the questionnaire, n=561 (96.6%).	Social support was associated with stress: lower perceived levels were associated with greater stress. Type A personalities experienced higher perceived occupational stress.
Chen, W.Q., Yu, I T-S., Wong, T.W. (2005) (16)	To determine the impact of occupational stress and psychosocial factors on musculoskeletal pain.	Cross-sectional survey, using the Occupational Stress Scale, of Chinese offshore workers within the same organisation.	A purposive sample of offshore workers returning from their offshore rotation completed the questionnaire, n=561 (96.6%).	56.3% of respondents reported multiple symptoms of musculoskeletal pain. Six sources of occupational stress were significantly associated with musculoskeletal pain.
Chen, W.Q., Wong, T.W., Yu, I T-S. (2008) (17)	To explore the relationship of occupational stress and social support with health-related behaviours.	Cross-sectional survey, using the Occupational Stress Scale, of Chinese offshore workers within the same organisation.	A purposive sample of offshore workers returning from their offshore rotation completed the questionnaire, n=561 (96.6%).	Association between aspects of occupational stress and engagement in risky health behaviours.

Table 2 (continued)				
Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Chen, W.Q., Wong, T.W., Yu, I T-S. (2009) (18)	To explore the influence of occupational stress on mental health in offshore workers.	Cross-sectional survey, using the Occupational Stress Scale, of Chinese offshore workers within the same organisation.	A purposive sample of offshore workers returning from their offshore rotation completed the questionnaire, n=561 (96.6%).	Nine domains of occupational stress associated with mental health and accounting for 19.9% of the total variance: "interface between job and family/social life"; "career and achievement"; "safety"; "management problems and relationships with others at work"; "physical environment of the workplace"; "ergonomics"; "organisational structure".
Nielsen, M.B., Tvedt, S.D., Matthiesen, S.B. (2011) (20)	To determine the association between risk perception and positive psychological safety to job satisfaction.	Cross-sectional survey of Norwegian offshore workers.	A random sample of offshore employees were sent a questionnaire via post (no information on randomisation process), n=1017 (59%).	High levels of perceived risk are associated with near misses.
Rundmo, T. (1995) (19)	To assess the effect of injury on risk perception, job satisfaction and stress.	Cross-sectional survey of Norwegian offshore workers.	Questionnaire method and sampling strategy unknown, n=915 (92%).	Injured employees may perceive higher risk, dissatisfaction with safety and higher levels of occupational stress.
Ulleberg, P., Rundmo, T. (1997) (21)	To examine how job stress may affect workers' experience of strain.	Cross-sectional survey of Norwegian offshore workers.	Questionnaire distributed on-board installations using a purposive sampling technique, n=1137 (87%).	Job stress associated with job satisfaction and strain. Social support from supervisor mediated strain. Experience of workplace strain was significantly associated with employee absenteeism.
Wong, T.W. (2002) (14)	To explore the perceived sources of occupational stress.	Cross-sectional survey, using the Occupational Stress Scale, of Chinese offshore workers within the same organisation.	A purposive sample of offshore workers returning from their offshore rotation completed the questionnaire, n=561 (96.6%).	Five main stressors included: unpleasant working condition due to noise; feeling isolated from home and world events whilst offshore; awareness that safety of others may be compromised as a result of misjudgement; disruption to social life whilst working offshore; cannot play family roles while offshore.

Mental health

Three quantitative studies (Table 3) explored the prevalence and nature of poor mental health.

Exploring poor mental wellbeing in the offshore industry

Three studies explored the effects of individual and psychosocial work factors on mental distress. One reported an association between poor mental health and several domains of the Chinese Occupational Stress Scale¹⁸. In addition, further developments in the area note the association of reduced mental wellbeing with gender (male employees are more likely to experience mental distress than female personnel), increasing job demands, poor social support and lack of satisfaction with the home/work interface²². Similarly, in a longitudinal survey analysis of psychological distress, it was concluded that the strongest predictors of distress at follow-up were distress at baseline, exposure to bullying in the workplace and management by leaders who utilise a *laissez-faire* managerial approach (characterised by providing workers with full autonomy in decision making)²³.

Table 3. Mental Health in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Chen, W., Wong, T.W., Yu, I. (2009) (18)	To explore the influence of occupational stress on mental health.	Cross-sectional survey of Chinese offshore workers working within the same organisation.	A purposive sample of offshore workers returning from their offshore rotation completed the questionnaire, n=561 (96.6%).	Poorer mental health associated with occupational stress and avoidant/negative behaviour coping styles.
Ljosa, C.H., Tyssen, R., Lau, B. (2011) (22)	To investigate the association between individual and psychosocial work factors and mental distress.	Cross-sectional survey of Norwegian offshore workers working within the same organisation.	A purposive sample of offshore workers were invited to complete a web-based questionnaire, n=1336 (56%).	High scores on quantitative demands, low scores on social support and high scores on shift work home-interface were all associated with mental distress.
Nielsen, M., Tvedt, S., Matthiesen, S. (2013) (23)	To investigate the prevalence of psychological distress and stressors in the work environment as prospective predictors of distress.	Longitudinal survey, administered at two time points 6 months apart, of Norwegian Continental Shelf workers.	A purposive sample was mailed the questionnaire. Baseline: n=1017 (59%); Follow-up: n=741 (72%).	8-9% suffered from psychological distress. Strongest predictors of psychological distress at follow-up were baseline distress, exposure to workplace bullying and laissez-faire leadership.

BMI

Four quantitative studies (Table 4) have been published and endeavoured to determine the prevalence of overweight and obese BMI profiles in the offshore population and the associated factors.

The body profile of offshore workers

Two longitudinal studies sought to evaluate trends in the weight and BMI of offshore workers in the UK have reported that the average weight has increased from 79.4kg to 87.6kg²⁴, and similarly, that BMI has significantly increased over the same seven year period²⁵. Further, it has been reported, from two separate cross-sectional studies on health in the UK offshore workforce, that 52% of the sample was classified as overweight, and a further 12-15% categorised as obese. Consequently, the data are indicative that 64-67% of employees are of a weight which is out with the upper limits of a BMI within the normal range^{26, 27}.

Predictors of BMI

One study explored the association between BMI and other key health variables. Using longitudinal analysis, smoking was identified as the strongest predictor of BMI (cessation increased and starting, decreased BMI)²⁵. In addition, it was reported that those with higher BMIs were more likely to be working in sedentary roles²⁷.

Table 4. Body mass index in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Civil Aviation Authority. (2011) (24)	To compare the weight estimates of offshore workers from one time period to another.	Analysis of UK offshore workers' records.	Data not available.	Average weight of a male passenger had increased from 79.4kg to 87.6kg.
Mearns, K., Hope, L. (2005) (26)	To explore the health related practices of workers on offshore installations.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=1928 (57.2%).	64% respondents with a BMI classified as overweight (52%) or obese (12%).
Mearns, K., Hope, L., Reader, K. (2006) (27)	To explore health and wellbeing of offshore workers	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=703 (35%).	67% respondents classified as overweight (52%) or obese (15%)
Parkes, K.R. (2003) (25)	To examine BMI of offshore workers in relation to known predictors.	Longitudinal survey research conducted in 1995 and 2002 amongst UK offshore workers.	A purposive sample of workers were recruited by researchers who were on-board the installation. Baseline: n=1598, 82.6%; follow-up: n=354 (34.9%).	Significant increase in BMI from 1995-2002. Proportions of increments were found to be no higher than population averages. BMI increased in those who stopped smoking and decreased in those who started. Smoking greatest predictor of BMI within the sample. Sedentary work associated with higher BMI, when all other factors were controlled.

Diet

Despite the current interest in intervening to stabilise or reduce the increasing BMI of offshore workers, there is only a small body of research, comprising three quantitative studies (Table 5), exploring the dietary choices of personnel.

Exploring diet in the offshore workforce

Findings from three studies indicate that, amongst workers operating in the UK Continental Shelf (UKCS) that self-reported diet was unhealthy^{26,27,28} with under one third report eating healthily each day²⁷.

Table 5. Diet in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Horsley, H. (1996) (28)	To explore the prevalence of risk factors for coronary heart disease amongst offshore workers.	Cross-sectional survey completed during offshore survival training conducted in the North East of Scotland.	A purposive sample of workers completed the questionnaire whilst in attendance at offshore survival training, n=507 (93%).	Significant differences in diet on and offshore: healthier onshore.
Mearns, K., Hope, L. (2005) (26)	To explore the health practices of offshore workers.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=1928 (57.2%).	Offshore diet was perceived to be less healthy (23% classified their diet as unhealthy or not very healthy) than onshore (8% classified their diet as unhealthy or not very healthy).
Mearns, K., Hope, L., Reader, K. (2006) (27)	To explore health and wellbeing of offshore workers.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=703 (35%).	Only 29% respondents reported healthy eating habits everyday on the installation

Physical activity

Three quantitative studies and one qualitative report (Table 6) exploring physical activity have been published. Research by Bell et al²⁹ outlined the combined effect of reduced physical activity and long periods of sitting on increasing the incidence of obesity. Accordingly, determining the degree to which offshore personnel engage in physical activity is pertinent to any evaluation of the health of the workforce.

Physical activity in the offshore workforce

Three quantitative studies exploring the prevalence of physical activity in the offshore workforce published results on engagement. Only 27% of workers were reported to undertake physical exercise three or more times per week when offshore. Further, findings indicate that personnel are more likely to engage in physical activity when onshore^{26,28}. For example, Mearns and Hope²⁶ report that 50% respondents engage in light to moderate physical activity when offshore compared with 69% exercising to the same degree onshore.

Barriers to physical activity in the offshore workforce

Barriers to physical activity amongst offshore personnel have been explored using both quantitative and qualitative methods. One quantitative study reported that the majority of workers who completed a questionnaire on barriers were either too tired after work (43%) or disliked working out in gyms (25%)²⁷. Further, in a series of interviews with participants working offshore, it was recounted that there is a sense of inequality on-board installations between operating and contracting employees. The author noted that company, or operator employees are granted exclusive access of the gym outwith core working hours, whilst contracting personnel are not. In addition, one of the female respondents discussed her initial reluctance to visit the gym on-board the installation due to the perception that it was a masculine domain. The restrictions with regard to employment status and perceived gendered environments may serve as a barrier to the use of recreational facilities and as a means to reinforce inequality within the population³⁰.

Table 6. Physical activity in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Collinson, D. (1998) (30)	To explore the power relations and inequalities inherent within the offshore industry.	Semi-structured interviews with offshore personnel.	Participants were purposively selected based on their occupation and were invited to participate, all interviews were conducted on the offshore installation recruitment site, n=85.	Inequality between contractors and operators. Gendered physical activity environments affect participation.
Horsley, H. (1996) (28)	To explore the prevalence of risk factors for coronary heart disease.	Cross-sectional survey completed during offshore survival training conducted in the North East of Scotland.	A purposive sample of workers completed the questionnaire whilst in attendance at offshore survival training, n=507 (93%).	41% and 49% respondents exercised regularly offshore and onshore respectively.
Mearns, K., Hope, L. (2005) (26)	To explore the health practices of offshore workers.	Cross-sectional survey of UK offshore workers.	A purposive sample of workers completed the survey whilst on the installation, n=1928 (57.2%).	Respondents were less likely to participate in low to moderate physical activity offshore (50%) than when onshore (69%). 43% of those who stated they did no or very little exercise when offshore were too tired after work. A further 25% disliked using gyms.
Mearns, K., Hope, L., Reader, K. (2006) (27)	To explore health and wellbeing.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=703 (35%).	27% respondents exercised 3x p/w; 18% rarely, 20% occasionally and 10% never used the gym when on-board an installation.

Musculoskeletal disorder

Two studies (Table 7) on the prevalence and causes of musculoskeletal disorder in offshore workers have been published. The Health and Safety Executive, a UK regulatory body, cite back pain and musculoskeletal disorder as a major cause of work related absence³¹. The prevalence of such has significant implications for labour intensive workplaces and particularly for the offshore industry since musculoskeletal disorder is one of the main causes of medical evacuation³².

Exploring musculoskeletal disorder in the offshore industry

Thirty six percent of offshore workers report experiencing muscular pain, of which 67% believe this has been aggravated by their work offshore²⁷. A retrospective analysis of health records is indicative that the majority of reported disorders related to the upper limbs (53%) and back (20%). In addition, 40% of cases had been filed by maintenance workers³³.

Table 7 Musculoskeletal disorder in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Mearns, K., Hope, L., Reader, K. (2006) (27)	To explore health and wellbeing of offshore workers.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=703 (35%).	36% respondents reported muscular pain, and noted that this was aggravated by their work offshore (67%),
Morken, T., Mehlum, I.S., Moen, B.E. (2007) (33)	To analyse the number of reported work-related musculoskeletal disorders and risk factors amongst offshore workers.	Retrospective analysis of a registry of work-related diseases offshore from 1992 to 2003 obtained from the Petroleum Safety Authority.	3131 new cases of musculoskeletal disorders (6725 cases in total reported)	Majority were disorders of the upper limbs (53%); back pain (20%); neck disorders (8%); disorders of the lower limbs (16%); knee injuries 12%. 40% of cases were reported by maintenance workers. 38% perceived to be caused by a high physical workload.

Smoking

Three quantitative studies (Table 8) have been published which report on the prevalence of smoking within the offshore workforce. According to the World Health Organisation³⁴, smoking tobacco is a major cause of premature mortality. Increasing wellness with regard to smoking stands to benefit the individual and employers.

The prevalence of smoking in the offshore workforce

The prevalence of smoking amongst offshore workers, according to the published data of multiple large scale studies, is typically higher than population averages that have been taken at the time^{26,28}. The most recent data from the UKCS indicate that around one third smoke (31-32%) and a further quarter classified as ex-smokers (24-27%)^{26,27}. The figure is less than what has been previously reported²⁸ and is indicative of a decreasing trend in the prevalence of smoking within the offshore workforce.

Table 8. Smoking in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Horsley, H. (1996) (28)	To explore the prevalence of risk factors for coronary heart disease amongst offshore workers.	Cross-sectional survey completed during offshore survival training conducted in the North East of Scotland.	A purposive sample of workers completed the questionnaire whilst in attendance at offshore survival training, n=507 (93%).	37.2% were classified as smokers. Significant decrease in frequency of smoking whilst onshore.
Mearns, K., Hope, L. (2005) (26)	To explore the health practices of offshore workers.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=1928 (57.2%).	32% respondents were smokers; 27% previously smoked.
Mearns, K., Hope, L., Reader, K. (2006) (27)	To explore health and wellbeing of offshore workers.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=703 (35%).	31% were classified as smokers.

Alcohol and drug Use

Typically offshore installations operate a zero-tolerance policy on alcohol and drug abuse, whereby employees are subject to random testing at heliports². Regular testing, does not however, preclude engagement in risky behaviours onshore. Three studies have focussed on alcohol use within the industry (Table 9).

The prevalence of alcohol and drug use within the offshore workforce

The most recent data on alcohol use in offshore workers indicated that around one third (32%) consumed alcohol either 5-6 days per week (17%), or everyday (15%) when onshore²⁶. A qualitative interview study outlined a pattern of alcohol use which is congruent with the opportunity to over-indulge viewpoint, and notes that offshore workers had described heavy onshore alcohol use as a release, and method of expressing freedom³⁰.

Table 9. Alcohol and drug use in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Collinson, D. (1998) (30)	To explore the power relations and inequalities of the offshore industry.	Semi-structured interviews conducted on-board with contract workers.	Participants were purposively selected based on their occupation and were invited to participate, all interviews were conducted on the offshore installation recruitment site, n=85.	Alcohol used to express a sense of freedom and as release.
Horsley, H. (1996) (28)	To explore the prevalence of risk factors for coronary heart disease in offshore workers.	Cross-sectional survey completed during offshore survival training conducted in the North East of Scotland.	A purposive sample of workers completed the questionnaire whilst in attendance at offshore survival training, n=507 (93%).	32% respondents reported consuming more than 21 units per week, which was higher than the national average at the time.
Mearns, K., Hope, L. (2005) (26)	To explore the health practices of offshore workers.	Cross-sectional survey of UK offshore workers. Questionnaire distributed by medics.	A purposive sample of workers completed the questionnaire whilst on the installation, n=1928 (57.2%).	32% reported consuming alcohol on either 5-6 days a week or ever day when on shore leave.

Shift work

Perhaps one of the most extensively researched areas within the field of offshore health relates to shift work. Five studies in total have been published on exploring the effects of shift work within the offshore industry and include: two systematic reviews; three quantitative studies (Table 10).

Shift work and health

Evidence suggests that shift work disrupts the normal circadian system and has subsequent effects on: reducing sleep quality; impairing alertness; decreasing performance. Further, offshore night shift work is associated with poorer sleep quality, gastric issues, increased risk of injury and reduced mental wellbeing³⁵. In contrast, however, Fossum et al³⁷ report no association between shift work and poor mental health.

Table 10. Shift work in the offshore industry

Study	Aims/Objectives	Study design	Setting, participants (response rate)	Key findings
Fossum, I., Bjordvatn, B., Waage, S., Pallesen, S. (2013) (36)	To examine effects of shift and night work in the offshore industry amongst offshore workers.	Systematic review of offshore shift work studies.	29 papers were included in the review.	Poorer sleep quality in offshore nightshift workers. No results from the offshore environment which associate shift work with poorer mental wellbeing, increased BMI or a negative impact on family/social life.
Parkes, K. (2012) (35)	To examine offshore day/night shift patterns in relation to operational safety and individual health risks amongst offshore workers.	Systematic review of offshore shift work studies.	24 papers were included in the review.	Survey: Shift pattern (night work) related to gastric issues, poorer mental health and impaired sleep quality. Field: association between circadian desynchrony and reduced sleep quality, alertness and impaired performance. Official data: Shift work, of day/night nature, linked with higher rates of injury. Re-adaptation from night to day shift typically takes longer than adaptation to night shift, and interventions which have endeavoured to assist with re-adaptation have not demonstrated success to a high level.
Waage, S., et al. (2009) (37)	To examine shift work disorder (SWD) in North Sea offshore workers.	Cross-sectional survey study of Norwegian Continental Shelf Workers.	Workers were recruited whilst on the installation, n=204 (78.8%); 103 were working swing shift and were included in the study.	23.3% met criteria for shift work disorder: characterised by insomnia during sleep cycle (day in the case of night workers). Those with SWD more likely to report subjective health complaints; pseudoneurological; gastrointestinal. Those with SWD demonstrated lower coping scores.
Waage, S., et al. (2012) (38)	To examine sleepiness in three different shift work schedules amongst offshore workers.	Before and after (within-subjects) study of offshore workers working a swing shift, day or night shift rotation.	Objective and subjective measurements were taken on installation, n=28 (87.5%).	Subjective sleepiness higher initially in night shift workers. Higher levels of self-reported sleepiness after night shift when returning home. No differences in objective measures when offshore.
Waage, S., et al. (2013) (39)	To compare subjective sleep and subjective health complaints in offshore workers.	Longitudinal study of Norwegian offshore employees who completed a survey (pre and post rotation).	Workers were sampled onshore, n=188 (72.6).	Those working a swing shift were significantly (p<0.005) more likely to report symptoms of insomnia than shift workers.

Shift work, sleep and health

Additional research has focussed on the effects of shift work disorder (characterised by a significant sleep disturbance). An incidence of 23.3% has been observed within offshore personnel and it has been demonstrated that those with shift work disorder were more likely to report subjective health complaints, pseudo-neurological issues and gastric problems. In addition, workers who met the criteria for diagnosis demonstrated lower coping scores and poorer sleep quality³⁷.

Whilst there is evidence that offshore shift work rotations may induce an array of negative health outcomes, there are conclusions which suggest that the nature of the shift schedule has little effect on

wellbeing. For example, in a study of personnel working three different shift schedules no differences in reaction time tests were observed. However, night shift workers were significantly more likely to experience tiredness than those returning from working day or swing shift rotations³⁸. The study of health outcomes in relation to offshore shift work has also been extended to determine sleep quality before and after a two week work schedule. A reduction in sleep quality and insomnia across the work period was observed. Personnel on a swing shift rotation were significantly more likely to report experiencing symptoms of insomnia than day shift workers³⁹.

Discussion

This narrative review has provided a synthesis of the research literature on the health of offshore workers from an international perspective. The results of the review suggest that, within the offshore workforce, there are multiple key areas which are worth considering for future research. Further, the analysis has demonstrated that there are areas in which there is a paucity of literature. For example, drug use has not been explored within the population and there are a number of domains for which the data is particularly dated. The last study to publish data on BMI, smoking, alcohol use, physical activity and diet was conducted almost a decade ago²⁷. Changes in offshore population demographics and health, such as an increase in female employment and reported rise in BMI, mean that research conducted at regular intervals is important.

Further, whilst there is a body of literature dedicated to exploring the presence of poor mental health within the industry, exploration of mental wellbeing is largely ignored. Mental wellbeing encompasses a broader perspective and has been defined as: *“a dynamic state in which the individual is able to develop their potential, work productively and creatively, build strong and positive relationships with others and contribute to their community. It is enhanced when an individual is able to fulfil their personal and social goals and achieve a sense of purpose in society”*⁴⁰. It is believed to be an important concept since positive mental wellbeing is not necessarily the resultant of a mere absence of poor mental health. Consequently, mental wellbeing within the offshore industry remains unexplored and is deserving of a focus within future work.

In an effort to ensure accuracy of findings, it is recommended that researchers include, where possible, validated measures within study designs. It is apparent that a number of studies included within this review did not utilise validated tools to assess either physical activity or diet. Whilst there may have been a number of difficulties in employing use of such, doing so enables comparisons to be made with population averages both within and out-with the offshore workforce. Validated measures ensure robustness in data collection particularly where domains need to be well-defined, such as physical activity, which is particularly vulnerable to subjective interpretation.

Further, Mearns and Hope²⁶ and Horsley²⁸ utilised measures of alcohol consumption which do not permit the data attained to be compared with current government guidelines. The Department of Health's⁴¹ most recent guidance stipulates that harmful drinking is defined by both the frequency of use and the number of units consumed per day. Consequently, the aforementioned either generated data on weekly alcohol consumption in units²⁸ or the weekly frequency of use²⁶.

While the literature on offshore health does provide a broad overview of key issues within the industry, there are key limitations within the current evidence base. A number of studies have focussed on workers operating from a specific geographical location, for example the Norwegian Continental Shelf, and whilst these are helpful in exploring the health and lifestyle of the workforce, they lack generalisability or transferability to other settings due to variation in cultural norms and working patterns. To illustrate, alcohol use within the UK population is a key public health issue, however other cultures, are not affected to the same extent. Consequently, any health evaluations may only be applicable to the population that has been sampled, meaning that there are key developments to be made across a variety of health domains within sector-specific offshore workforces.

Moreover, the literature synthesised within this review has primarily utilised quantitative methods, and

which may be restrictive in terms of exploring health from the individual perspective. The current data have demonstrated a number of associations between variables and has provided some evidence that there may be cause for concern on some health issues, however the reasons as to why are relatively unknown. For example, poor diet has been identified as a health issue and it has been established that offshore eating patterns, and choices, are healthier when workers are onshore. There is however, little in the way of exploring the factors that affect these choices from the worker's perspective. Accordingly, future research should utilise mixed-methods or qualitative techniques, such as interviews or focus groups, to enhance the current findings.

The majority of studies are cross-sectional, using survey methods to gather data, and although this may be a criticism, due to issues with the generalisability of data, the transient nature and wide geographical spread of worksites mean that alternative methods of data collection could prove problematic for researchers. Finally, most of the aforementioned research comprised male dominant samples. Although fewer females work within the offshore industry, their numbers are increasing. Hence, future research would benefit from ensuring a female perspective since it may differ from a male viewpoint, particularly when evaluating health and lifestyle.

Future Research

As evidenced by the outcomes of this narrative review, there is a need for further research within the health of the offshore workforce. Whilst previous work does provide a body of evidence on multiple aspects of health and wellbeing, and as such may prove as a useful comparator, there are key elements which require revisiting due to the significant time lapse since the last publication. In particular, future work should seek to provide an overview of health and wellbeing within the industry.

In light of these recommendations and in an effort to guide future developments in offshore health, the authors of this paper have begun collecting health and wellbeing data on a large sample of offshore workers with the aim to conduct interviews to explore pertinent themes. It is hoped that this mixed methods approach will enable an evidence-base on the health and lifestyle needs of offshore workers to be established, and which will be used to inform future developments which focus on increasing engagement in self care within the population.

Limitations

Whilst the narrative review has endeavoured to synthesise the literature in a structured manner, there are some limitations of the methods utilised. For example, only studies published in English were included in the review and this may have limited the scope. Further, and although attempts were made to include grey literature, due to issues in searching for unpublished sources, there may be a number of studies which have been unintentionally excluded from the review. In an effort to overcome selection bias, which is often an inherent feature in narrative reviews; a structured search strategy was established prior to searching for sources.

Conclusions

The narrative review of the literature provides an overview of the health and lifestyle of offshore workers, covering health domains such as: occupational stress; mental wellbeing; body mass index; diet; physical activity; musculoskeletal disorder; smoking; alcohol and drug use; and shift work. However the methods utilised and limitations with regard to transferability of findings mean that the current data may not be an accurate representation of the current offshore workforce. Further, research studies which take the current limitations into account and employ a mixed-methods approach are needed.

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