Occupational Medicine & Health Affairs
ISSN: 2329-6879

Delgado-Rospigliosi et al., Occup Med Health Aff
2016, 4:5
DOI: 10.4172/2329-6879.1000251

Research Article OMICS International

Effort-Reward Imbalance, Mental Health and Accidents in Offshore Petroleum Workers

Juan Delgado-Rospigliosi, **Denise Siqueira de Carvalho**, **Katja Radon and Ronald Herrera***

Center for International Health at the Institute and Outpatient Clinic for Occupational, Social and Environmental Medicine, University Hospital Munich (LMU), Munich, Germany

***Corresponding author:** Herrera R, Center for International Health at the Institute and Outpatient Clinic for Occupational, Social and Environmental Medicine, University Hospital Munich (LMU), Munich, Germany, **Tel:** +4989440052794; **E-mail:** rherrera@med.lmu.de

Received: September 23, 2016; **Accepted:** October 21, 2016; **Published:** October 28, 2016

Abstract

Background: Occupational accidents are an aspect of concern in every industrial sector, including the offshore petroleum industry. Little is known about the associations between psychosocial distress and the prevalence of incidents in this sector.

Aim: To evaluate the association between effort-reward imbalance (ERI), psychological distress, and the prevalence of occupational incidents (accidents and near misses) in offshore petroleum workers in Peru.

Methods: This cross sectional study included 242 (response rate of 67%) male offshore petroleum workers in a gas and oil petroleum company in Peru. Workers answered the short version of the European Working Condition Survey, the Effort-Reward-Imbalance (ERI) questionnaire; Goldbergs general health questionnaire (GHQ-12) and prevalence of occupational accidents or near-miss were reported. After imputation, the association between psychological distress, working activity and working stability and occupational incidents (accidents or near misses) was assessed.

Result: The prevalence of effort-reward imbalance was 30%, fourteen percent reported distress based on GHQ-12. The 12-month prevalence of occupational incidents was 9%. Adjusted odds ratio for incidents was 4.3 (95% CI, 1.3-14.0) for those with psychological distress compared to those without it.

Conclusion: Psychological distress was related to the prevalence of occupational incidents in this offshore petroleum population. Actions on employment and working conditions to prevent psychosocial distress and the incidence of mental health problems should be implemented for the prevention of occupational accidents in this industry.

Keywords: Offshore workers; Effort-reward imbalance; GHQ-12; Occupational accidents; Peru

Introduction

Latin America contains some of the world largest hydrocarbon reserves. In the last decade, the oil and gas market changed, resulting in new investments for the economy of some Latin American countries, like Peru [1]. This new trade panorama increased offshore oil and gas production, involving big challenges including logistics, large investment requirements, and more workforce [2]. High-risk activities, like those in the oil and gas industry, need to implement high safety standards to prevent such occupational accidents, especially in more adverse working conditions like offshore operations. Offshore petroleum employees must face more difficult working conditions, compared with their onshore peers.

Some offshore work environment conditions like exposure to noise, vibrations, radiation, chemicals, ergonomic risk factors, personnel transportation, weather conditions, and mobilization of objects have been identified as health hazards, as well as associated with the incidence of accidents [3-5]. In addition, human factors and working conditions such as work overload, isolation, atypical workdays and shift work have been also related to occurrence of accidents in this activity [6,7]. Occupational accidents are an aspect of concern in every industrial sector and involve health damage to the workers, substantial costs for medical care, absenteeism, low productivity, replacement needs, property damage and poor working environment [8,9]. Research in petroleum workers has shown that accidents can be a consequence of risk perception or precisely, a lack of accurate risk perception [10]. In the same direction, Rundmo [11,12] showed that perceived risk and dissatisfaction with safety status are associated with job stress. In particular, offshore workers experience greater level of anxiety have a higher prevalence of sleeping problems and higher work overload [13,14]. The hypothesis that risk perception and job stress are associated with accidents could be a mechanism explaining the importance of taking into account mental health variables to study accidents in offshore workers [11,12,15]. In this sense, different studies showed how labour conditions, personal characteristics and psychosocial stressors in the working environment greatly influence mental health, which plays a major role in the occurrence of occupational accidents. Risk analyses in this and other sectors have shown that reduced mental well-being is a significant predictor of work-related accidents [16-19]. In Peru, the oil and gas industry is an important economic activity, and in recent years offshore fields have

increased in numbers and production capability in the coast and in the continental shelf [20]. Previous international studies have analyzed the relationship between psychosocial risk factors and their consequences on physical and mental health [21,22].

The effort reward imbalance (ERI) model, proposed by Siegrist [23] has been widely used in several countries and in different working activities to evaluate work-related stress, where high-cost/low-gain conditions are considered stressful. The method also includes the analysis of personal aspects ("overcommitment"), what makes it able to identify potential stressful situations. According to Siegrist, employees with high levels of over-commitment are at high risk of developing stress-related disorders [24]. Additionally, the short version of the General Health Questionnaire (GHQ-12) is used as a screening instrument for common mental disorders such as anxiety and depression [25,26].

Only a limited number of studies address the relationship between effort-reward imbalance, mental health symptoms and the prevalence of occupational accidents in this Peruvian sector [27,28]. Therefore, the objective of this study was to evaluate the association between common mental health problems measured both with the GHQ-12 questionnaire and the effort-reward imbalance (ERI) model, and the prevalence of occupational incidents (accidents and near-misses) in offshore workers of an oil and gas enterprise in Peru.

Methods

Subjects

A cross-sectional study was conducted in a Peruvian oil and gas company in January 2014. All 360 workers in offshore platforms and vessels were invited to participate. Trained medical personnel working in the offshore facilities conducted the personal interviews. 242 offshore petroleum workers (67:2% response) participated in the study. All participants were informed beforehand about the aim of the study and the study procedures and provided informed consent and anonymously was guaranteed. Study protocols were approved by ethics committee of Santa Maria Catholic University of Arequipa in Peru and the Medical Faculty of the Ludwig-Maximilians University in Munich, Germany.

Questionnaire instrument and variable definition

Workers general information and working conditions were assessed using a survey on working conditions and health [29-32] conducted using a personal interview. Socio-demographic characteristics included age (20-29 years vs. 30-39 years, 40-49 years and >50 years). Education level categorized in incomplete or complete secondary education vs. higher education (technical career or university studies).

Employment characteristics included working activity (riggers vs. maintenance and repair and others), time working for the company in years (less than 1 year vs. 1-2 years, 3-5 years and more than 5 years), working stability (low vs. mid-high) and type of working contract (fixed term vs. indefinite term and others).

Following the Effort-Reward-Imbalance (ERI) model, the applied questionnaire was included to examine psychosocial risk factors [23,24]. The effort-reward imbalance (ERI) ratio was calculated from the sum of the three effort items (numerator) and the seven reward items (denominator), multiplied by the correction factor=0.43, this is given the difference between the numbers of questions in the two scales (3 questions corresponding to effort scale and 7 to the reward scale) [23]. An ERI ratio >1 was defined as imbalance between efforts and rewards. Over commitment results were also dichotomized defining the upper tertile as high risk scores as recommended by Bjørn [33].

Goldbergs general health questionnaire (GHQ-12) [34,35]; a screening instrument to measure common mental health disorders (anxiety, depression) was used to measure distress The general mental health score was formed using the 0-0-1-1 scaling method. No existing studies validating the GHQ-12 for Peru were found, and then we used the Chilean cut-off of 4 or more to define workers suffering from psychological distress [36].

The prevalence of work-related incidents (accidents and near-misses) was measured using questions from the Central American Survey of Working and Health Conditions. Questions were originally directed to evaluate the occurrence of accidents were reformulated to inquire about the occurrence of near-misses. This approach was done because near-misses and accidents only differ by the presence or absence of injury. Using near-misses as an additional measurement, we increased the number of incidents reaching higher statistical power. Finally, the outcome consisted of the self-reported of occupational incidents or near-misses accidents in the past 12 months.

Statistical analysis

Data were double entered in an EpiInfo Database [37] and subsequently analyzed using SPSS Vs. 23. To handle missing data, imputation technique with SPSS function "person mean substitution" was used and we estimated the missing values of the ERI and GHQ-12 scales by using the individual mean score. Values for participants with more than 50% of missing data in one scale were not imputed. For ERI scale, imputation was done separately for each dimension (effort, reward, over commitment). Contingency tables were used to analyze the distribution of the variables and the outcome, additionally the statistical significance was tested using Chi^2-test or Fisher exact test if necessary. Possible confounding factors were elected based on the statistical significant using a significance level of 90% in this step.

Confounding factors resulting from the contingency tables were used in subsequent multivariate logistic regressions.

Logistic regression models were estimate to calculate the association between ERI, psychological distress (GHQ-12), potential confounding factors and the 12-months prevalence of occupational incidents. The association between ERI and common mental health disorders was also analyzed.

As sensitivity analyses, we used the 2/3 and 6/7 cut-off for the Goldberg scale (GHQ-12) and comparing them to the 4/5 cut-off initially established. Finally, complete case analyses were also performed and compared to the subset with complete and imputed values.

Results

Total sample included 242 offshore petroleum workers. 170 answered all questionnaire items. 52 participants had missing information in GHQ-12 or ERI (both main exposures) were imputed. Descriptive data of the total study population, those with complete data and those with complete or imputed data showed slightly differences, mainly because the imputation process (Table 1). All main analyses were based on the sub-set of 222 subjects with complete or

imputed information, in order to reach higher statistical power. In this group, all workers were male; age was equally distributed across age categories. 60% of the workers had higher education (technical or university education). About one quarter of participants was riggers. 49% of the population worked since more than five years for the company and 92% reported a medium to high working stability and only two thirds of the population had an indefinite duration employment contract.

	Total population	Subset with complete data	Subset with complete and imputed data
	N = 242	N = 170	N = 222
Variables of study	n (%)	n (%)	n (%)
Age			
20-29 yrs.	49 (20)	33 (20)	45 (20)
30-39 yrs.	83 (34)	66 (39)	78 (35)
40-49 yrs.	40 (17)	31 (18)	39 (18)
>50 yrs.	69 (29)	39 (23)	59 (27)
Missing	1	1	1
Education			
School education	97 (40)	66 (39)	89 (40)
Higher education (technical, university)	145 (60)	104 (61)	133 (60)
Working activity			
Rigger	57 (24)	41 (24)	51 (23)
Maintenance and repair	43 (18)	29 (17)	39 (18)
Others	137 (58)	98 (58)	128 (59)
Missing	5	2	4
Duration of employment (years)			
< 1 year			
1-2 years			
3-5 years			
> 5 years	119 (50)	78 (46)	107 (49)
Missing	2	2	2
Working stability			
Low			
Mid-High	216 (92)	153 (93)	198 (92)
Missing	8	5	6
Working contract			
Fixed term contract			
Indefinite term contract	157 (66)	109 (65)	143 (65)
Others			
Missing	5	2	3
Effort-reward imbalance[a]			
Yes	58 (28)	46 (27)	66 (30)
Missing	37	0	0
Over commitment[b]	55 (26)	42 (25)	60 (27)
Missing	33	0	0
Psychological distress[c]			
GHQ-12 (2/3)	74 (35)	62 (37)	78 (35)
GHQ-12 (4/5)	27 (13)	22 (13)	30 (14)
GHQ-12 (6/7)	3 (1)	3 (2)	4 (2)
Missing	33	0	0
Occurrence of incidents[d]	20 (9)	15 (9)	19 (9)
Missing	9	0	6

[a]Effort-reward imbalance: ERI ratio >1 was defined as imbalance between efforts and rewards;

[b]Over commitment scale (binary variable): upper tertile scores = high risk;

[c]GHQ-12 (2/3), GHQ-12 (4/5): binary variables, scores over 2 and 4 mean presence of mental health problems respectively;

[d]12-month prevalence of occupational accidents and/or near misses.

Table 1: Sociodemographics, employment characteristics, psychosocial working conditions and distress 242 offshore workers in Peru. Total, before and after imputation values.

Regarding psychosocial working conditions, 30% of participants reported effort-reward imbalance. The upper tertile of the over commitment scale was 15 (range: 6-22). Based on the GHQ-12 questionnaire, 14% of the population reported common psychological distress. Prevalence of occupational incidents was 9% (7 accidents and 12 near-misses).

In the bivariate analysis, work stability and working activities were associated with a higher prevalence of effort-reward imbalance (P-value<0.01, Table 2). Duration of employment showed association with over-commitment (P-value<0.05, Table 2). Education and effort-reward imbalance were statistically significant associated with psychological distress using the 4/5 GHQ-12 cut-off, however using the 2/3 cut-off point for GHQ-12 showed no association with the all other covariates. Given the small size sample and the low prevalence of psychological distress using the 6/7 cut-off group were too small for meaningful analyses. Bivariate P-values showed association among working activity (P-value<0.001; Table 2), working stability (P-value<0.05; Table 2) and psychological distress using 4/5 as cut-off for GHQ-12 (P-value<0.01; Table 2) with occupational incidents (Table 2).

Variables of study	Effort-reward imbalance	Over commitment	GHQ-12 (2/3)	GHQ-12 (4/5)	Occupational incidents
	n (%)	n (%)	n (%)	n (%)	n (%)
Age	NS	NS	NS	NS	NS
20-29 yrs	12 (27)	10 (22)	13 (29)	8 (18)	5 (12)
30-39 yrs	23 (30)	17 (22)	29 (37)	13 (17)	8 (11)
40-49 yrs	14 (36)	10 (26)	16 (41)	4 (10)	2 (5)
>50 yrs	16 (27)	23 (39)	19 (32)	5 (9)	3 (5)
Education	NS	NS	NS	P-value<0.001[e]	NS
School education	24 (27)	28 (32)	25 (28)	4 (5)	5 (6)
Higher education (technical, university)	42 (32)	32 (24)	53 (40)	26 (20)	14 (11)
Working activity	P-value<0.01	NS	NS	NS	P-value<0.001
Rigger	7 (14)	10 (20)	17 (33)	3 (6)	2 (10)
Maintenance and repair	12 (31)	12 (31)	13 (33)	7 (18)	9 (24)
Others	47 (37)	37 (29)	47 (37)	20 (16)	5 (4)
Duration of employment (years)	NS	P-value<0.05	NS	NS	NS
< 1 year	2 (10)	5 (24)	7 (33)	4 (19)	1 (5)
1-2 years	10 (29)	12 (34)	11 (31)	5 (14)	6 (17)
3-5 years	21 (37)	7 (12)	20 (35)	10 (18)	5 (9)
> 5 years	33 (31)	35 (33)	40 (37)	11 (10)	6 (6)
Working stability	P-value<0.001	NS[e]	NS	NS[e]	P-value<0.05[e]
Low	12 (67)	3 (17)	7 (29)	4 (22)	4 (22)
Mid-High	50 (25)	53 (27)	69 (35)	24 (13)	13 (7)
Working contract	NS	NS	NS	NS	NS
Fixed term contract	16 (27)	17 (29)	18 (31)	9 (15)	9 (16)
Indefinite term contract	43 (30)	41 (29)	53 (37)	17 (12)	9 (7)
Others	7 (41)	2 (12)	6 (35)	3 (18)	1 (6)
Effort-reward imbalance[a]			NS	P-value<0.05	
No			50 (32)	15 (10)	13 (9)
Yes			28 (42)	14 (21)	6 (9)
Over commitment[b]			NS	NS	NS
No			59 (36)	20 (12)	12 (8)
Yes			19 (32)	10 (17)	7 (12)
Psychological distress[c]					
GHQ-12 (2/3)					NS
GHQ-12 (2/3) No					9 (6)

GHQ-12 (2/3) Yes					10 (13)
GHQ-12 (4/5)					P-value<0.01
GHQ-12 (4/5) No					13 (7)
GHQ-12 (4/5) Yes					6 (22)

[a]Effort-reward imbalance: ERI ratio >1 was defined as imbalance between efforts and rewards; [b]Over commitment scale (binary variable): upper tertile scores = high risk;

[c]GHQ-12 (2/3), GHQ-12 (4/5): binary variables, scores over 2 and 4 mean presence of mental health problems respectively;

[d]12-month prevalence of occupational accidents and/or near misses;

[e]Fisher's exact test P-Values

NS: Non Significant

Table 2: Bivariate statistical measurements between studied covariates and psychosocial working conditions, psychological distress and occupational incidents for offshore workers in Peru.

For purpose of a sensitivity analysis, the bivariate models described above were compared to the complete cases dataset without imputation of the data (n=170). Despite the loss of power due to data restriction, results showed similar trend and same differences as incomplete and imputed data (n=222) (Table 2) data not showed.

In the multivariate logistic regression, we considered three potential confounding factor as was suggested in the bivariate analysis of the outcome variable: working activity, working stability and psychological distress. Crude odds ratios that working as maintenance and repair had more odds or reporting 12 months occurrence of occupational incidents in the offshore petroleum company (odds ratio: 4:8; 95% confidence interval: 1.2-19.3); (Table 3). Once we controlled by the other two covariates the association diminished, but still the association was considerable (OR: 3:4; 95% CI: 0.8-14.8). Work stability was not associated with 12 months occurrence occupational incidents. Finally, offshore petroleum company with psychological distress measured using the 4/5 cut-off point GHQ-12 scale showed statistically significant 4:2 (95% CI: 1.3-14.0) more changes of 12 months occupational incidents as compared with those that did not reported psychological distress.

	Occupational incidents[a]	
Potential related factor	**Crude OR (95% CI)**	**Adjusted OR (95% CI)**
Working activity		
Rigger	1	1
Maintenance and repair	4.8 (1.2-19.3)	3.4 (0.8-14.8)
Others	0.7 (0.2-2.8)	0.5 (0.1-2.3)
Working stability		
Mid-High	1	1
Low	3.9 (1.1-13.4)	2.8 (0.7-11.2)
Mental health problems[b]		
GHQ-12 (4/5) No	1	1
GHQ-12 (4/5) Yes	4.6 (1.5-13.8)	4.2 (1.3-14)

[a]12-months prevalence of occupational accidents and/or near misses;

[b]Over commitment scale (binary variable): upper tertile scores = high risk;

[b]GHQ-12 (4/5): scores over 4 mean presence of common mental health problems.

Table 3: Odds ratios for the prevalence of common mental health problems, potential confounding factors and the 12-months prevalence of occupational incidents (N=206).

Discussion

This survey characterizes the first time the prevalence of psychological distress and common mental health disorders in the offshore petroleum workers of Peru, and their relationship with the prevalence of occupational incidents.

The results of this study suggest that the presence of common mental health problems is significantly related to the prevalence of occupational incidents in this offshore petroleum population. At the same time, we could confirm an association between effort-reward-imbalance and an increased prevalence of common mental health problems. The results remained consistent after adjusting for working activity and work stability. These findings add to the conclusions of previous studies that mental illness could increase the risk of occupational injury [18], although the current report did not quantify the use of psychotropic treatment as in others studies [19,38]. None of them has evaluated this association in the offshore oil and gas industry. This finding gives an important key point to start considering psychological distress and mental health factors when managing occupational accidents in this industry.

Despite a high prevalence of psychosocial distress (a combination of high efforts receiving low reward and high over commitment) was not associated with the 12-month prevalence of occupational incidents in this study, the presence of some imbalance between efforts and rewards at workplace was related with the presence of common mental health problems found in this group. In like manner, this study also showed the association between low work stability with effort-reward imbalance and the occurrence of occupational incidents. These associations are in line with results of different studies of different sectors as recorded in the meta-analytic review of Stansfeld and Candy [21], as well as in the offshore and onshore petroleum industry [22,28] and seafarers [27]. Regarding the level of education, the bivariate analyses showed that workers with technical and university studies were more likely to report common mental health problems. This finding was discussed previously by Araya et al. [36], concluding that people with lower level of education tend to report more somatic symptoms than psychological complaints, when comparing with more educated groups.

Maintenance and repair was the working activity in which workers reported higher prevalence of effort-reward imbalance, over commitment, mental health problems and also a higher 12-months prevalence of incidents. This is consistent with findings in other reports, being that maintenance and repair workers are usually exposed to more adverse working conditions with physical demands, using manual tools and working quickly to meet operative requirements [39,40].

This study used international questionnaires to determine psychosocial distress and mental health problems. Even if the ERI and the GHQ-12 questionnaires are still not validated in Peru, their reliability and validity have been proofed in many countries of Europe, Asia and Latin America not only at work, but also in general population [24,26,28,34]. A systematic and meta-analytic review recently compared the prevalence of common mental health disorders in general and occupational studies using the GHQ-12 [41]. The point of cut-off of the GHQ-12 varied among different reports and countries depending on the national validation study and social characteristics of the population.

The analysis in our study was based on the 4/5 cut-off point, that was recommended by Chilean guides for depression suspicion and also used in a Peruvian survey [36,42]. Nevertheless, similar results were obtained when comparing with the 4/5 with the 2/3 cut-off point in our studied population. Interestingly, the overall prevalence of common mental health problems using the 4/5 cut-off was much lower than in previous studies especially in Latin America [36,39]. Using the 6/7 cut-off used in Chile for a clinical diagnosis of depression, only four cases could be identified in our study. Reason for that might be that most of those studies compared general population whereas the sample evaluated in this study is workers of a large company in a high risk activity where the "healthy worker effect" might be present. Moreover, all workers of this group had medical evaluations including psychological assessment that could also segregate those with mental disorders off these high risk activities like offshore work. On that sense, this formal working activity could also be a protective factor for anxiety and depression as workers might feel useful, can share time and experiences with other people, have access to health services and a daily mobile for living.

In this study like in many others and in general, the offshore petroleum population is mostly composed by males, what makes this sample comparative to others and other studies in the same sector [40]. Females in the offshore activities usually do more technical or specialized work, less physical and with different working systems than males. In this study the participants were living offshore under similar conditions, shifts and rotations that make this sample representative of the target population. A potential of an information bias due to underreporting might be also present. Even though instructions of the questionnaire and anonymity of the information was clearly explained to the participants, there might be always certain distrust or omission by oblivion of information, for instance in cases of unreported near-misses or mild accidents. That could mean that what is shown is the best scenario and that prevalence may be even higher if objective measurements of occupational incidents had been done. However, the 3% (7/222) of 12-month prevalence of pure occupational accidents is comparable with findings in similar studies in the same industry in Norway [22,43].

Despite the response rate could reduce power, summed to the elevated number of missing values present in the ERI questionnaire, data imputation resulted effective on increasing sample size obtaining consistent results when compared with the complete data subset.

Conclusion

In conclusion, the results of this study indicate that the presence of common mental health problems and low working stability are associated with high prevalence of occupational incidents. Low work stability is a condition that generates insecurity to workers and is associated with psychological distress and with the occurrence of occupational incidents, as also reported in other large researches. This study gives a baseline of the working situation of the offshore oil and gas industry in Peru and Latin America. Future longitudinal studies should be carried out to verify the cause-effect relationship between exposures and outcome on this population. Meanwhile, actions on employment and working conditions to promote work stability and prevent the incidence of mental health problems should be implemented for the prevention of occupational accidents in this industry.

Conflicts of Interest

There are no conflicts of interest.

Acknowledgments

The authors thank the members of the offshore medical team that worked on-site during the fieldwork and Jean Carlo Ancajima for their collaboration in data collection. We are also grateful to the offshore

petroleum company for the facilities for conducting this study and to the offshore workers for their active participation on this project.

References

1. Udaeta MEM, dos Reis AG, Grimoni JAB, de Abreu Junior AC (2015) Energy integration in South America region and the energy sustainability of the nations. Energy and Power Engineering 7: 161-173.
2. Victor DG, Jaffe AM, Hayes MH (2006) Natural gas and geopolitics: from 1970 to 2040. Cambridge University Press.
3. Niven K, McLeod R (2009) Offshore industry: management of health hazards in the upstream petroleum industry. Occup Med (Lond) 59: 304-309.
4. Ponsonby W, Mika F, Irons G (2009) Offshore industry: medical emergency response in the offshore oil and gas industry. Occup Med (Lond) 59: 298-303.
5. Centers for Disease Control and Prevention (2013) Fatal injuries in offshore oil and gas operations-United States, 2003-2010. MMWR Morb Mortal Wkly Rep 62: 301-304.
6. Gould KS, Ringstad AJ, van de Merwe K (2012) Human reliability analysis in major accident risk analyses in the Norwegian petroleum industry. Proceedings of the Human Factors and Ergonomics Society Annual Meeting 56: 2016-2020.
7. Bjørkum AA, Pallesen S, Holsten F, Bjorvatn B (2004) Shift work and accidents - relevance for the offshore industry. Tidsskr Nor Legeforen 124: 2773-2775.
8. Battaglia M, Frey M, Passetti E (2014) Accidents at work and costs analysis: A field study in a large Italian company. Ind Health 52: 354-366.
9. Smith S (2010) Injuries, illnesses, and fatal injuries in mining in 2010. Beyond the Numbers: Workplace Injuries.
10. Rundmo T (1995) Perceived risk, safety status, and job stress among injured and noninjured employees on offshore petroleum installations. J Safety Res 26: 87-97.
11. Rundmo T (1992) Risk perception and safety on offshore petroleum platforms-Part I: Perception of risk. Safety Science 15: 39-52.
12. Rundmo T (1992) Risk perception and safety on offshore petroleum platforms-Part II: Perceived risk, job stress and accidents. Safety Science 15: 53-68.
13. Nielsen M, Tvedt S, Matthiesen S (2013) Prevalence and occupational predictors of psychological distress in the offshore petroleum industry: a prospective study. Int Arch Occup Environ Health 86: 875-885.
14. Parkes KR (1998) Psychosocial aspects of stress, health and safety on North Sea installations. Scand J Work Environ Health 24: 321-333.
15. Kvalheim SA, Dahl O (2016) Safety compliance and safety climate: A repeated cross-sectional study in the oil and gas industry. J Safety Res 59: 33-41.
16. Cooper CL, Sutherland VJ (1987) Job stress, mental health, and accidents among offshore workers in the oil and gas extraction industries. J Occup Med 29: 119-125.
17. Fossum IN, Bjorvatn B, Waage S, Pallesen S (2013) Effects of shift and night work in the offshore petroleum industry: A systematic review. Ind Health 51: 530-544.
18. Hilton MF, Whiteford HA (2010) Associations between psychological distress, workplace acci-dents, workplace failures and workplace successes. Int Arch Occup Environ Health 83: 923-933.
19. Haslam C, Atkinson S, Brown SS, Haslam RA (2005) Anxiety and depression in the workplace: Effects on the individual and organisation (a focus group investigation). J Affect Disord 88: 209-215.
20. Surendra K, Takara D, Hashimoto AG, Khanal SK (2014) Biogas as a sustainable energy source for developing countries: Opportunities and challenges. Renew Sustainable Energy Rev 31: 846-859.
21. Stansfeld S, Candy B (2006) Psychosocial work environment and mental health: a meta-analytic review. Scand J Work Environ Health 32: 443-462.
22. Ljosa C, Tyssen R, Lau B (2011) Mental distress among shift workers in Norwegian off-shore petroleum industry-relative influence of individual and psychosocial work factors. Scand J Work Environ Health 37: 551-555.
23. Siegrist J (1996) Adverse health effects of high-effort/low-reward conditions. J Occup Health Psychol 1: 27-41.
24. Siegrist J, Starke D, Chandola T, Godin I, Marmot M, et al. (2004) The measurement of effort reward imbalance at work: European comparisons. Soc Sci Med 58: 1483-1499.
25. D Goldberg PW (1989) User's guide to the general health questionnaire. The NFER-NELSON publishing.
26. Sanchez-Lopez Mdel P, Dresch V (2008) The 12-Item general health questionnaire (GHQ-12): Reliability, external validity and factor structure in the Spanish population. Psicothema 20: 839-843.
27. Kingdom SE, Smith AP (2012) Combined effects of work-related stress in Her Majesty's Coast-guard (HMCG). Int Marit Health 63: 63-70.
28. Eum KD, Li J, Lee HE, Kim SS, Paek D, et al. (2007) Psychometric properties of the Korean version of the effort-reward imbalance questionnaire: a study in a petro-chemical company. Int Arch Occup Environ Health 80: 653-661.
29. National Institute for Safety and Health at Work (2007) VI National Survey of Working Condi-tions (Spain, Europe).
30. Vallebuona C (2011) First national survey of conditions of employment, labor, health and quality of life ENETS 2009-2010. Labor-Ministry of Health Safety Institute.
31. Poverty Advisory Committee (2013) The National Household Survey (ENAHO). National Institute of Statistics and Informatics.
32. Benavides FG, Verdejo MZ, Serna JC, Carmenate JA, Carmenate L, et al. (2010) Basic minimum set of items to design questionnaires on working conditions and health. Archives of Occupational Health and Safety 13: 13-22.
33. Bjørn L (2008) Effort-reward imbalance and overcommitment in employees in a Norwegian municipality: a cross sectional study. J Occup Med Toxicol 3: 9.
34. Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, et al. (1997) The validity of two versions of the GHQ in the WHO study of mental illness in general health care. Psychol Med 27: 191-197.
35. Goldberg D (1985) The detection of psychiatric disorder in primary care settings: Implications for the taxonomy of neurosis. Israel journal of psychiatry and related sciences 22: 245-255.
36. Araya R, Wynn R, Lewis G (1992) Comparison of two self-administered psychiatric question-naires (GHQ-12 and SRQ-20) in primary care in Chile. Soc Psychiatry Psychiatr Epidemiol 27: 168-173.
37. Dean A, Arner T, Sunki G, Friedman R, Lantinga M, et al. (2011) Epi InfoTM, a database and statistics program for public health professionals.
38. Palmer KT, D'Angelo S, Harris EC, Linaker C, Coggon D, et al. (2013) The role of mental health problems and common psychotropic drug treatments in accidental injury at work: a case–control study. Occup Environ Med 71: 308-312.
39. Cezar-Vaz MR, Rocha LP, Bonow CA, da Silva MRS, Vaz JC, et al. (2012) Risk perception and occupational accidents: a study of gas station workers in southern Brazil. Int J Environ Res Public Health 9: 2362-2377.
40. Al-Rubaee FR, Al-Maniri A (2011) Work related injuries in an oil field in Oman. Oman Med J 26: 315-318.
41. Zulkefly SN, Baharudin R (2010) Using the 12-item general health questionnaire (GHQ-12) to assess the psychological health of Malaysian college students. Glob J Health Sci 2: 73.
42. Hid Statistics Report (2014) Offshore injury, ill health and incident statistics report 2012/2013. Health and Safety Executive.
43. Goodwin L, Ben-Zion I, Fear NT, Hotopf M, Stansfeld SA, et al. (2013) Are reports of psychological stress higher in occupational studies? A systematic review across occupational and population based studies. PLoS One 8: e78693.