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REVIEW ARTICLE

Risks, injuries, and illnesses among professionals working on offshore platforms: an integrative review

Riscos, agravos e adoecimentos entre trabalhadores atuantes em plataformas offshore: uma revisão integrativa

Isabela Lina Maciel Bastos[1], Magda Guimarães de Araujo Faria[1], Fabiana Ferreira Koopmans[1], Luciana Valadão Vasconcelos Alves[2], Alex Simões de Mello[1], Helena Maria Scherlowski Leal David[1]

ABSTRACT

This work aimed to identify in the scientific literature the risks, injuries, and illnesses among professionals working on offshore platforms. This is an Integrative Literature Review whose initial search found 894 publications in the electronic databases Web of Science, Scopus, CINAHL, SciElo, and Lilacs. After applying the inclusion criteria and reading in full, seventeen articles were selected for the corpus of analysis. The analysis culminated in the creation of two categories: risks and injuries related to working on offshore platforms, and risks and injuries related to the lifestyle of offshore platform workers. Working on offshore platforms leads to illnesses, such as hearing loss, sleep disorders, mental disorders, cancer, cardiovascular disorders, and multiple sclerosis. Disease prevention and health promotion activities are essential for this population, in particular those linked to the work of health teams capable of guiding workers, especially in encouraging the practice of healthy habits.

Descriptors: Petroleum; Occupational Health; Occupational Risks; Extraction and Processing Industry; Oil and Gas Industry.

RESUMO

Objetivou identificar na literatura científica os riscos, agravos e adoecimentos entre trabalhadores atuantes em plataformas *offshore*. Revisão Integrativa de Literatura cuja busca inicial possibilitou a captação de 894 publicações nas bases de dados eletrônicas: Web of Science, Scopus, CINAHL, SciElo e Lilacs. Após aplicação de critérios de inclusão e da leitura na íntegra, foram selecionados 17 artigos para o córpus de análise. A análise culminou na criação de duas categorias: riscos e agravos relacionados ao trabalho em plataformas offshore; riscos e agravos relacionados ao estilo de vida dos trabalhadores de plataformas offshore. A atividade laboral em plataformas *offshore* acarreta adoecimentos, tais como perda auditiva, distúrbios de sono, transtornos mentais, câncer, distúrbios cardiovasculares e esclerose múltipla. As atividades de prevenção de doenças e promoção da saúde são essenciais, sobretudo vinculadas à atuação de equipes de saúde capazes de orientar trabalhadores, principalmente no estímulo à prática de hábitos saudáveis.

Descritores: Petróleo; Saúde do Trabalhador; Riscos Ocupacionais; Indústrias Extrativas e de Processamento; Indústria de Petróleo e Gás.

[1]Rio de Janeiro State University – Rio de Janeiro (RJ), Brazil. E-mails: isabelalinamb@gmail.com, magda.faria@live.com, fabianakoopmans@gmail.com, axmello@gmail.com, helenalealdavid@gmail.com

[2]Fluminense Federal Institute of Education Science and Technology – Macaé (RJ), Brazil. E-mail: lucianavvalves@hotmail.com

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INTRODUCTION

Risks, injuries, and illnesses resulting from working on offshore platforms were the object defined for this study. The term offshore, means at a distance from the shore, on a body of water[1], and it can refer to activities carried out on the high seas in the oil industry, such as prospecting, exploration, and production[2].

The exploration of oil sources underwent a reconfiguration between the middle of the 20th century and the beginning of the 21st century with the use of innovative resources, which are technological, managerial, and productive for offshore exploration. Individuals who work in these spaces face daily the risk of accidents, such as explosions from the handling of flammable materials, and conditions that can lead to illness, such as weather change. In addition, the nature of this activity exposes workers to atypical situations, such as confinement on platforms during working hours[2].

In addition, it is important to emphasize that the work process on offshore platforms involves situations of high potential for disaster and discomfort for those involved, such as 12-hour shifts daily for up to 14 consecutive days, susceptibility to weather conditions that may even indicate the interruption of activities, work at heights or submerged, noises related to machinery or instruments for displacement such as helicopters, limited privacy due to the sharing of rest spaces, and possible stormy interpersonal relationships aggravated by isolation and distance from family members[3].

In this sense, actions of occupational health are indispensable to maintain the healthy state of the professionals working in this scenario, since the environment presents constant risks to their physical and mental health. In order to minimize health-related risks and damages, the Brazilian Regulatory Standard No. 37 establishes the presence of at least one health professional on board for 31 to 250 workers on board, whether that professional is a nursing technician, under the supervision of a nurse, a nurse, or a physician. The number of health professionals shipped to meet needs is increased according to the total number of workers on board[4].

There is a large knowledge gap on the subject because of the small amount of research and publications in this area, as well as few review studies similar to this one in the scientific literature. Therefore, this work is justified by the need to identify and assess risks, injuries, and illnesses on offshore platforms and, consequently, contribute to the construction and implementation of occupational health programs and the planning of protective and therapeutic strategies.

Given the above, this research aims to identify in the scientific literature the risks, injuries, and illnesses among professionals working on offshore platforms.

METHODS

This is an Integrative Literature Review (IRL), whose purpose is in the grouping of scientific productions related to a certain subject in order to systematize, organize the knowledge already published, and summarize the different knowledges in a new study[5].

For this construction, the six steps of the IRL were followed. In the first one, to identify the subject and construct the research question[5], the PICo (Population, Phenomenon of interest, and Context) strategy was used[6]. Workers were identified as Population (P), risks and injuries were the Phenomenon of Interest (I), and offshore platforms were the Context (Co). Thus, the following research question was reached: to what work-related risks, injuries, and illnesses are offshore platform workers subject?

In the second step, establishment of inclusion and exclusion criteria[5], the following inclusion criteria were considered: complete articles available online, published in Portuguese, English, or Spanish, in the last 10 years (2009–2019), in order to cover a larger number of publications. The exclusion criteria were: duplicate articles in the databases, literature reviews, theoretical manuscripts, and articles that do not answer the research question (thematic impertinence).

Next, the databases were searched via the CAPES website, namely: Web of Science, Scopus, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scientific Electronic Library Online (SciElo), and Latin American & Caribbean Health Sciences Literature (Lilacs). The descriptors chosen were: Occupational Health; Petroleum and Occupational Exposure, to which we used the Boolean phrase – (Occupational exposure) AND (Occupational health) AND (petroleum) and their respective equivalences with terms in Portuguese available in MeSH. The search was carried out in February 2020 by two independent reviewers. In addition, the publications in English and Spanish were freely translated by the researchers.

For the third step, that is the need to define the information that was extracted and analyzed from the listed studies[5], a table was organized with the data from the collected articles containing the following information: title of the article, country of publication, year of publication, database, objective of the study, and level of evidence.

This step includes the analysis of the level of evidence and for that, we used the hierarchical classification in which the studies are classified into: meta-analysis studies of multiple controlled studies; individual study with experimental design; study with experimental design, as study without randomization with a single group, pre- and post-test; study with non-experimental design as descriptive correlational and qualitative research or case study; case reports or data obtained systematically, of verifiable quality or program evaluation data; and opinion of respectable authorities based on clinical

competence or opinions of expert committees, including interpretations not based on research[7].

In the fourth step of the IRL, evaluation of the studies, the PRISMA (Main Items for Reporting Systematic Reviews and Meta-analyses) flowchart was used, presented in four stages:

- Identification: number of texts found per database and the remaining total when removing duplicates from the databases;
- Selection: number of selected and excluded publications;
- Eligibility: analysis of the complete texts, presenting those selected and excluded, with a view to the inclusion in the qualitative synthesis; and
- Inclusion: total number of studies included in the qualitative synthesis[8].

The flowchart with the representation of the eligibility and inclusion of articles in the selection of studies is shown in Figure 1.

In the fifth stage of the IRL, the studies were analyzed in a descriptive and interpretive manner, taking into account the ethical aspects and respecting the authorship of the ideas, concepts, and definitions pointed out by the authors. The selection of relevant studies was performed based on the inclusion and exclusion criteria, in the first search result, followed by the reading of titles and abstracts and, subsequently, of the publication as a whole. We highlight that the assessment process was carried out by three researchers, and only the publications relevant to at least two evaluators were included in the analysis corpus.

The sixth and final step of the construction of the IRL is the elaboration of the document with the steps taken in the research and the synthesis of the results found[5], which in this work was carried out through the categorization of the thematic findings and discussions, according to the data analysis developed.

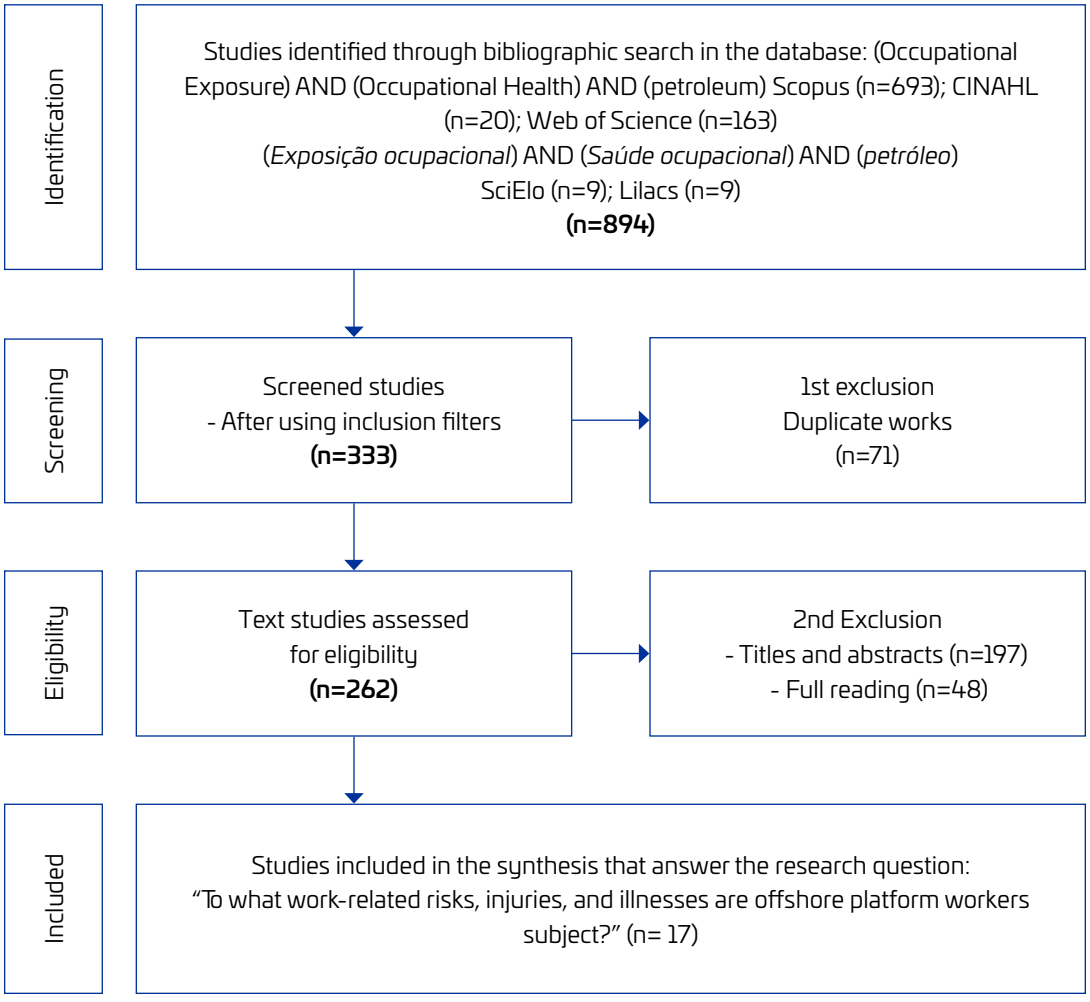

Figure 1. Flowchart of the study selection process – Brazil, 2020

RESULTS

Approximately 894 publications were found. In the first exclusion stage, only manuscripts that met the inclusion criteria were considered, which made a sample of 333 articles. In the second exclusion stage, duplicate articles, literature review articles, theoretical and impertinent essays were discarded by reading titles and abstracts, which resulted in a sample of 65 articles. After reading these publications, the final sample of 17 articles was achieved, as described in Table 1.

The articles were organized and interpreted according to their thematic elements evidenced in the sections "results" and "discussion", using interpretive reading for this purpose. The analysis culminated in the creation of two categories, namely: Risks and injuries related to working on offshore platforms; and Risks and injuries related to the lifestyle of offshore platform workers.

DISCUSSION

Risks and injuries related to working on offshore platforms

Some publications indicate the presence of physical risk on offshore platforms, more precisely exposure to high levels of noise. This exposure occurs more intensely during transport in helicopters to the platforms[21], but it is also related to all instruments used in the work activities and, especially, the underwater noise caused by wind turbines. In the latter case, the sound can be masked by the intensity of the tides, but it becomes noticeable even by the mechanical vibration of the platform tower[26].

In addition, the signs of hearing loss are frequent in offshore platform divers[12], as they regularly face situations of pulmonary barotrauma and otitis from their activities, which results in a greater risk of progressive hearing loss.

Proper training and encouraged use of hearing protection reduces the risk of hearing loss. The fit test for this personal equipment is efficient to achieve a particular level of protection, meeting the characteristics of each worker[21].

One of the studies observed the occupational exposure of workers to chemical risk associated with chemical agents involved in oil production and refining, and it also pointed out this contact as a suggestive factor for the development of multiple sclerosis[16].

Submission to chemicals such as benzene and aromatic hydrocarbons, for example, are highlighted as the main risk factor for the development of several types of cancer, with a greater degree of malignancy between six and fourteen years after exposure[11,20,23]. Aromatic hydrocarbons are observed in high urinary concentration up to three days after the work shift[27]. Exposure to benzene results in a higher incidence of lymphohematopoietic cancers, such as myeloid leukemia, multiple myeloma, and lymphocytic leukemia, in addition to esophageal, larynx, lung, and prostate cancer[20].

The chemical risk experienced by workers in this context can be proven through changes in the concentrations of blood markers. The modifications of these markers vary according to the time of day and the intensity of exposure to chemicals used in the entire oil extraction process. Such exposure can cause local damage, such as skin irritation, and also systemic processes, the latter being catalysts for the emergence of various diseases[23,25].

Ergonomic risks have also been identified in publications with sleep deprivation being frequent in this scenario, which has repercussions beyond the workplace. Onboard workers commonly work on a shift schedule. This schedule sometimes leads the employee to work at times when the body is not used to it, thus changing the circadian cycle. It is not uncommon, according to the production need, for shifts to double[10].

In Brazil, shifts mostly take place for 14 days on board for every 21 days on land, or 14 days on duty for 14 days on land; however, foreign workers are often subjected to greater shifts on board in relation to resting time on land, which results in important risks for the organism, plus the stress demanded by the work and the shorter period of family life(10,28). The tired individual, deprived of sleep, or even reaching cases of fatigue, has their alertness and attention reduced, which can increase the risks to safety and the possibility of accidents on board[10].

One of the studies indicates that night work is associated with high cardiovascular risk in workers on offshore platforms[15]. We highlight that this is not a particular characteristic of the work on offshore platforms, as the increased cardiovascular risk related to night service is also evident in teaching[29] and health[30] professionals.

Changes in metabolic parameters, such as increased body mass index and serum cholesterol, of offshore workers continue to affect them even after years away from this type of work[22]. We can observe that these professionals had health problems up to three decades after they stopped working on board[20], with worse effects in night workers[15].

In a comparative study between workers in the offshore and onshore oil industry, greater satisfaction and autonomy with the tasks were observed for onboard workers, who perform activities perceived as less repetitive. On the other hand, because of the risk of accidents on offhsore platforms, a higher level of anxiety, stress, and mental fatigue could be observed in these workers[13].

Mental health is a topic of significant representativeness in research on work on oil platforms. Stress associated with work is the main risk factor for illness in mental health[9]. Stress on board not only arises from the work activity itself,

Table 1. Summary of the articles included in the study. Brazil, 2020.

Title, year, country	Objective	Level of Evidence
Influence of occupational stress on mental health among Chinese off-shore oil workers (2009, China)[9].	To explore the influence of occupational stress on mental health in offshore oil production.	3
Aspectos do regime de embarque, turnos e gestão do trabalho em plataformas offshore da Bacia de Campos (RJ) e sua relação com a saúde e a segurança dos trabalhadores (2010, Brazil)[10].	To highlight the potential risks associated with the organization of work, in particular the boarding regime and the shift system adopted on oil platforms.	4
Increased risk of oesophageal adenocarcinoma among upstream petroleum workers (2010, United Kingdom)(11).	To investigate cancer risk, particularly esophageal cancer, among male workers on a maritime platform.	2
Hearing symptoms and audiometry in professional divers and offshore workers (2010, USA)[12].	To compare hearing loss between professional divers and offshore workers, and to study whether the symptoms of hearing loss result in physical disorders.	2
Work and health: A comparison between Norwegian onshore and offshore employees (2011. Norway)[13].	To assess the relationship between work and self-reported health complaints by Norwegian onshore and offshore workers.	2
Saúde mental e diferentes horários de trabalho para operadores de petróleo (2011, Brazil)[14].	To identify the mental health profiles of Petrobras oil operators working in the Potiguar Basin, differentiated by working hours.	4
Determinación de los factores de riesgo cardiovascular em trabajadores a turnos em shifts of an oil una petrolera del Norte del Perú (2011, Peru)[15].	To determine the frequency of cardiovascular risk factors in offshore platform workers and to assess the association with the jobs and work company in the north of the country.	2
Risk of MS is not associated with exposure to crude oil, but increases with low level of education (2011, United Kingdom)[16].	To investigate whether the risk of multiple sclerosis increased among workers exposed to chemical risk factors compared to the general worker population.	2
Working in verticalized platform vessel: an ergonomic approach in the oil industry (2012, Netherlands)[17].	To assess the difficulties and restrictions of working in offshore units in the oil industry.	4
Prevalence and occupational predictors of psychological distress in the offshore petroleum industry: a prospective study (2013, Germany)[18].	To investigate the prevalence of psychological stress and stressors in the workplace, as prospective predictors of stress in workers of the offshore oil industry.	3
Dynamics of stress as a predictor of health consequences in Polish drilling platform workers. Longitudinal study (2014, Poland)[19].	To assess the relationship between work-related stress adaptation and health indicators chosen in drilling rig workers in Poland.	3
Benzene exposure and risk of lymphohaematopoietic cancers in 25 000 offshore oil industry workers (2015, United Kingdom)[20].	To examine the risks of HL cancer in male offshore workers exposed to a low average concentration of benzene.	3
Hearing protector fit testing with off-shore oil-rig inspectors in Louisiana and Texas (2016, USA)[21].	To assess noise reduction with individual hearing protectors, to demonstrate the effectiveness of protection training, and to measure the time required to implement the hearing protector fit testing in the work environment.	3
Cardiovascular Diseases Risk Factors in oil and gas workers: a ten years observational retrospective cohort (2016, Italy)[22].	To examine the trend of the main clinical biochemical factors associated with cardiovascular diseases and the onset of dyslipidemia over a 10-year period in oil and gas workers.	3

Continue...

Quadro 1. Continuation.

Title, year, country	Objective	Level of Evidence
Aromatic hydrocarbons and risk of skin cancer by anatomical site in 25000 male offshore petroleum workers (2017, USA)[23].	To examine the risk of skin cancer by anatomical site according to the exposure metrics for crude oil, benzene, mineral oil, and ionizing radiation among offshore oil workers.	3
Offshore workers and health behavior change: an exploration using the Theoretical Domains Framework (2018, Poland)[24].	To explore the perceived causes of self-care behavior in offshore workers.	3
Pneumoproteins in Offshore Drill Floor Workers (2019, Switzerland)[25].	To evaluate pneumoproteins and a certain biomarker of systemic inflammation in workers exposed to airborne contaminants generated during offshore drilling, taking into account serum biomarkers of smokers, such as nicotine (S-Nico) and cotinine.	2

Authors' elaboration.

but also from interpersonal relationships, distance from the family, and safety, seen by the constant risk of a potentially lethal accident[13].

In addition to the impact on mental health, stressors are potential risks for the development of other diseases, such as hypertension and obesity[19]. The reduction of stressors decreases health risks and cooperate to maintain a more pleasant working environment[18].

Greater emotional stability could also be observed in workers with longer service time, while younger ones tended to experience oscillating phases. The justification is in the accumulation of professional experience, where the worker comes to understand the labor mechanisms more clearly[14].

The psychological and physical demand of the activities on offshore platforms demands a lot from workers, especially in relation to the responsibilities regarding the safety of everyone on board resulting from errors that can happen during production, which often generates the prioritization of production instead of their health care[17].

Thus, workers in this scenario usually have more than one health problem at the same time, and the association of comorbidities such as stress, obesity, and hearing damage are common[19].

Risks and injuries related to the lifestyle of offshore platform workers

Regarding the lifestyle of these workers, the publications point to a low adherence to physical activities and maintenance of a healthy diet, underestimating the risks for the development of diseases[22]. Smoking was more evident in night workers compared to day workers, despite the restriction on smoking on board from the risk of fires and explosions[15]. For alcoholism, the habit was not associated with greater risks when compared to professionals not working in this scenario, considering the risk for liver diseases[11].

It was evident that workers in this scenario have a tendency to be overweight and obese, in addition to a small reduction in average cholesterol[22]. Absenteeism is higher among obese people, because of the frequency of illnesses[22]. The relationship between obesity and general production at work (combination of absenteeism and presenteeism) in the scientific literature points to the impairment of almost 38% of Class 3 obese persons[31].

The authors recognize the importance of disease prevention and health promotion in this scenario[24,32]. Educational actions and encouragement to the use of personal protective equipment stand out, mainly in relation to protective devices against noise, vibrations, and high temperatures[9].

In addition, the studies show that education has a direct impact on workers' health, because the higher the education level, the lower the incidence of diseases, such as multiple sclerosis, lung cancer, squamous cell carcinoma, and other diseases[11,16].

Among the actions for harm reduction and monitoring, workers selected to act in this scenario must undergo periodic medical examinations to monitor their health status[18]. These health education actions and periodic examinations, which include tests performed on the pre-boarding, reduce the frequency of occupational diseases[13].

In this sense, occupational health plays an important role for healthy lifestyle habits. These habits reduce the risk of developing diseases from this work environment, as well as stimulate physical activities that lead to the socialization of colleagues on board[22].

CONCLUSION

The analysis of risks, illnesses, and health problems in professionals working on offshore platforms points to a mismatch between possible practices and the production of scientific knowledge, especially in the Brazilian scientific literature, which was incipient on the subject.

The risks evidenced in the research point to the existence of work processes that involve the exposure of workers to chemicals that can cause damage to health. In addition, the ergonomic risk to which these professionals are exposed stands out, which affect, above all, the sleep patterns of the workers.

Working on offshore platforms leads to injuries and illnesses, such as hearing loss, sleep and rest disorders, mental health disorders, cancer, cardiovascular disorders, and multiple sclerosis. The incidence ratio of many of these diseases and illnesses was inversely proportional to the level of education.

Disease prevention and health promotion activities for this environment proved to be essential for the reduction of these risks and injuries, in particular those linked to the work of health teams capable of guiding workers, especially in encouraging the practice of healthy habits.

As a limitation of this investigation, we can mention the scarcity of studies addressing mental illnesses and social discoveries of professionals working in the offshore scenario. Finally, it is necessary to encourage the production of new scientific evidence that can explain the care practices in this scenario to help to minimize the risks, injuries, and illness processes.

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