v. 4, n. 16, 2024

Journal of
Engineering
Research

STATE OF THE ART OF THE APPLICATION OF THE NORDIC KUORINKA QUESTIONNAIRE IN THE CONSTRUCTION INDUSTRY IN SONORA, MEXICO

Joaquín Vásquez Quiroga
UNIVERSIDAD DE SONORA
Campus Caborca

Enrique de la Vega Bustillos
INSITUTO TECNOLOGIO DE HERMOSILLO

Jesús Martin Cadena Badilla
UNIVERSIDAD DE SONORA
Campus Caborca

Joaquín Vásquez Tachiquín
UNIVERSIDAD DE SONORA
Campus Caborca

Rafael Hernández León
UNIVERSIDAD DE SONORA
Campus Caborca

Francisco Javier León Moreno
UNIVERSIDAD DE SONORA
Campus Caborca

Rosana Tachiquín Perez
UNIVERSIDAD DE SONORA
Campus Caborca

Abstract: The research described deals with Ergonomics as a management tool in the construction industry for the identification and search for reduction of musculoskeletal disorders in micro-enterprises in the construction industry of the State of Sonora. One of the tools used to identify possible musculoskeletal disorders and areas of the body affected by exposure to construction work was the Nordic Kuorinka questionnaire. The study design was cross-sectional and correlational/ causal. The variables were the chances of injury from worker exposure to a potential cumulative trauma or musculoskeletal disorder over a period of time as a result of their construction activities. The article presented corresponds just with the evidence found in the bibliography corresponding to the subject and those studies that have been developed over time, which contribute to the work in question.
Keywords. Nordic Kuorinka Questionnaire, Construction Industry, TME.

INTRODUCTION

The first inhabitants of the planet climbed the trees to protect themselves from wild beasts, over time, the Neanderthal and then the Cro-Magnon man came to occupy the caves. However, during the summer, when the first ones emigrated and the second ones went on a hunting trip, they used tents made of branches and animal skins as their homes. It is believed that as they reached areas where they didn`t find caves, they had to find ways to create closed and limited spaces. It has been verified that, from the beginning of the Neolithic, they use caves as natural refuges spread. During this period, man developed his knowledge about the climate, for the correct location of their habitats based on the direction of the wind, the rain and the solar orientation. However, the use of caves as shelters fell into disuse from the moment in which human beings had the first tools, experience, courage and organization to build their own homes. (Institute, 2015).

At the moment of having the need to build, the workforce was used and history began, where workers made up of slaves or people of low social status were used. The lack of specialization and training of the workers; Both in the past and at present, it has contributed to the increase in accidents at works, due to the fact that the origin of the risks lies both in technical failures and errors or carelessness of the human being. (Oladipo, 2015).

When you want to build in a lasting way, stable materials such as carved stone or rock are used, over time the technique was improved by making horizontal rows of stones in a homogeneous way without any conglomerate. Clay was later used to join the layers of these stones (Cordero et al., 2012).

The construction industry has been part of the development and technological advances in the world's civilization and continues to be relevant in the economies, since it considers a large number of inputs, generates direct and indirect jobs, and supports the formation of capital for countries (Ortega et al., 2016). Similarly, it is demonstrated by the study carried out by Haan et al. (2020) called "in figures: the construction industry in Canada from 1986 to 2016", in the study it is indicated that Canada occupies the fifth position of labor force in construction in the world, employing more than 1.3 million people, approximately 1 in 14 workers are in this sector.

Given some characteristics of the construction industry, such as common problems, repetition of errors and the lack of organizational learning, it has been considered to implement knowledge management that can bring benefits in productivity and quality of services. (Vera et al., 2009).

Undoubtedly, the construction industry

has developed and progressed over the years, but it still takes time to reach the level required by industry 4.0. In a study carried out by Alaloul et al., (2020) they identified the factors that intervene for the construction industry to enter this era 4.0, demonstrating that the critical factors (social and technical) found in the survey applied to itself, can migrate to industry 4.0 and be in the same conditions as the manufacturing and automotive. In the same way, growth is being sought in the construction industry in the ecological field; This is demonstrated by a study carried out by Chen (2017), which indicated that the adoption of ecological construction technologies are an alternative for the future of sustainable construction. They propose that appropriate strategies should be designed to promote the adoption of this technology, such as: financial incentives, availability of better information on costs and benefits, mandatory government policies and regulations, eco-classification and labeling.

The construction sector is one of the most demanded worldwide, this income-generating area in the economies of all countries has an important place since it constitutes with direct jobs in labor and indirect with the consumption of inputs necessary for the development of this. According to data from INEGI 2018, in Mexico there were a total of 19,501 companies dedicated to this field, having various activities such as construction, restoration of homes, buildings, hotels, shopping centers, banks, schools, hospitals, streets, sidewalks, dams, cinemas, parks and theaters.

Of the workforce involved in the construction sector at the national level according to INEGI 2018 data, 676,301 people were registered, of whom 87% are men and 13% women.

In the same way, the percentage that the construction sector contributed to the National Gross Domestic Product is approximately 7% (INEGI, 2019). In the same sense, the information corresponding to the subsectors of the construction sector is found: Building with 47.4%, Construction of civil engineering works with 42% and specialized works for construction with 10.6% of all construction in Mexico.

The International Labor Organization (2018) reported that 374 million accidents or non-fatal occupational diseases occurred each year and more than 2.78 million deaths at work, that is, every 15 seconds 150 workers have a work accident and a worker dies.

In the construction sector there is a very unfortunate safety record, because workers have a greater risk of accidents and injuries Buckley et al., (2016). The Statistics Offices of the European Union reported in 2015 that more than 20.9% of deaths registered at work occurred in the construction industry (Eurostat, 2018). Likewise, the United States Bureau of Labor Statistics reported that there were 9.5 deaths per 100,000 full-time workers in the construction industry in 2017 (Bureau of Labor Statics, 2017). According to data presented by the Mexican Institute of Social Security (IMSS) in Mexico (2019), in a total of 966,574 companies there were 399,809 work accidents out of a total of 19,974,508 registered workers.

Regarding the business of the company or Division of Economic Activity according to the data presented by IMSS (2019), it can be observed that in the construction industry there were 47,094 cases of occupational hazards and 41,144 cases of occupational accidents out of a total of 1,618,594 workers registered under the work risk insurance.

Occupational illnesses and permanent disabilities by groups of economic activities registered by the IMSS (2019), in the first place is the building construction industry and civil engineering works with a total of 399,809

cases of work accidents, 15,744 permanent disabilities due to initial work accidents and 906 deaths due to work accidents.

Given the previous data, risk assessment in the construction industry is undoubtedly an important element that must be considered; since there are a large number of them, for this reason it is important to develop methods that result in correct decision-making in the protection measures to continue reducing the possibility of an accident.

The construction industry stabilizes based on the development of the safety of its workers. For this reason, a study carried out in Ontario Canada considered that it is important to define the concept of safety climate, since there may be differences in the concept and its use according to the geographical location. The objective of that study was to examine the role of safety climate and individual resilience on safety performance and job stress in the Canadian construction industry. They developed 837 surveys, obtaining as a result that it is important that organizations not only monitor the performance of employee safety but also evaluate psychological well-being, consider programs that improve the psychological health of employees, since, with this, they promote a positive safety climate in the organization (Chen et al., 2017).

The Kuorinka Nordic Questionnaire, published in 1987, has been one of the most widely used tools internationally for the detection of musculoskeletal symptoms in workers from different economic sectors. Its application makes it possible to obtain data on symptoms prior to the appearance of a declared disease, which is why it is useful for taking preventive actions. This questionnaire can be used as a self-applied survey or as an interview. This tool was initially designed for the evaluation of painful symptoms of all musculoskeletal disorders (Martínez et al., 2017). In the publication of the questionnaire carried out in 1987 by Kuorinka et al. Reliability and validity data were presented for various studies in which the results of its application are compared with the medical records of workers, obtaining concordances of between 80% and 100% between both evaluations.

The Nordic questionnaire focuses on the most frequent symptoms that are detected in different economic activities and is mainly used to collect information on "pain, fatigue or discomfort" in different parts of the body. The questionnaire comprises two sections: the first consists of a group of mandatory response questions which identify the areas of pain. The first part has a body map indicating specific anatomical sites (neck, shoulder, thoracic spine, lumbar spine, elbow, hip, leg, knee, ankle, and foot) to help the respondent locate the site of pain. The second section seeks to determine the functional impact of the symptoms reported in the first section, evaluating the duration, whether or not it has been assessed by a health professional, and whether it has recently presented discomfort (Martínez & Santodomingo, 2017). The Nordic questionnaire not only explores in the respondents symptoms present at the time the questionnaire is answered, but also symptoms that have been present throughout the previous year. "It has gained general credit and recognition as a good instrument for surveillance of musculoskeletal disorders, especially if numerical scales for symptom severity are included" (Santos et al., 2018).

OBJECTIVES

Develop research in the area of Ergonomics and propose it as a management tool in construction industry, for reduction of musculoskeletal disorders in micro-enterprises in construction industry of the State of Sonora, which allows the planning of Human Resources and Technology. In

order to prevent workers from being exposed to activities that can cause musculoskeletal disorders, decreased productivity and a burden on society due to their disabilities.

METHODOLOGY

All subsequent paragraphs should be indented as here with no line spacing between paragraphs. Two line spaces (12 pt.) should follow each section.

INTRODUCTION

Research will be carried out in the field of Ergonomics taking into account the possible musculoskeletal disorders that occur in construction workers when carrying out their daily activities and necessary to fulfill their work.

Nordic Musculoskeletal Questionnaire by the authors Kuorinka (1987) better known as Kuorinka's Nordic Questionnaire will be applied.

METHOD DESCRIPTION

The study is non-experimental since the work is observed and study subjects answer a questionnaire given conditions that occur at work, then an analysis of the results of surveys will be made.

On the other hand, the design of the study is transversal or transectional and correlational/causal, since the causes of the variables are analyzed, which in this case are the possibilities of injuries due to the exposure of workers to a potential cumulative trauma or musculoskeletal disorder in a period of time for the development of their construction activities (Hernández et al., 2010).

DESIGN OF THE INVESTIGATION

The collection of information will be through a survey of workers in MSMEs in the construction industry. The secondary sources of the research in the development of the work are represented mainly by local, state, national and international bibliographic material to give a greater depth to the subject.

For the data collection of the MSMEs of the construction, the already validated questionnaire called the Nordic Kuorinka questionnaire will be used with a reliability of Cronbach's Alpha value of 0.85. This questionnaire detects the existence of musculoskeletal symptoms of the body that may be at risk of suffering an injury or are exposed to it at the time of carrying out any work, in this case in construction.

SAMPLE SELECTION

The selection of the sample will be by non-probabilistic sampling of an intentional or conventional type, where the workers of the construction industry who voluntarily wish to answer the Nordic questionnaire will be selected, with a sample size of 200 workers.

MEASURING INSTRUMENT

The instrument used for this research is the Kuorinka Nordic questionnaire, which is an instrument already validated by the author which is sectioned as follows:

1. General data
2. Locomotor organs
3. Lower back
4. Neck
5. Shoulders

The variables and their dimensions that will be part of the investigation who will find the causes or results in question are shown in the table 1.

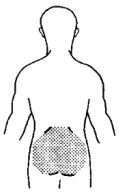
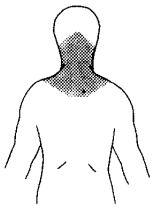
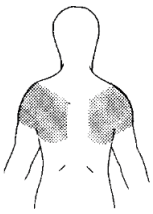
Variable	Dimensión	Factors evaluated
locomotor organ	Neck	Impediment at some time in the last twelve months in doing your normal job. Problems at any time in the last 7 days.
	Shoulder	
	elbows	
	dolls	
	spine	
	Lumbar spine	
	one or both hips	
	one or both knees	
	One or both ankles	
Lower Back 	Inconvenience	Hospitalization Job change Duration time reduction of activities impediment to perform work medical consultation Pain in the last 7 days.
	Pain	
	Disconfort	
Neck 	Inconvenience	accident injuryJob changeDuration timereduction of activitiesimpediment to perform workmedical consultationPain in the last 7 days.
	Pain	
	Disconfort	
Shoulder 	Inconvenience	accident injury Job change Duration time reduction of activities impediment to perform work medical consultationPain in the last 7 days.
	Pain	
	Disconfort	

Table 1. Dimensions of the research variables

DATA COLLECTION

The data collection in response to the Nordic questionnaire will take place in the workplace of different construction sites during working hours. This collection will be by direct interview with the worker with the permission of the contractor, where the objective of the investigation will be explained and that the veracity of the answers is important for the results.

Therefore, they will be asked to be as sincere as possible and that the publication of results will be in a general way and not particular to your company. In the same way, the identity of the worker will be kept and the data will be confidential.

ANALYSIS OF THE INFORMATION

The data obtained from the Nordic questionnaire surveys by Kuorinka et al. (1987) will be organized in data tables grouping all the questions by indicators, identifying each questionnaire by a page to facilitate the exclusion between construction companies. The confidentiality of the answers of the participants will be respected.

The answers of the Nordic questionnaire will be captured in the Excel package, then the analysis will be done with the IBM SPSS Statistic version 23 package, where areas of opportunity for the application of Ergonomics in the construction industry will be sought, identifying possible elements that can cause musculoskeletal disorders through questionnaire response.

REFERENCES

Alaloul, W., Liew, M., Zawawi, N., & Kennedy, I. (2020). Industrial Revolution 4.0 in the construction industry: Challenges and opportunities for stakeholders. Ain Shams Engineering Journal, 11(1), 225–230.

Buckley, M., Zendel, A., Biggar, J., Frederiksen, L., & Wells, J. (2016). Migrant work & employment in the construction sector. International Labour Organization.

Bureau of Labor Statics. (2017). National census of fatal occupational injuries in 2017. https://www.bls.gov/news.release/pdf/cfoi.pdf

Cordero, Á., Abrio, M., & Maqueda, M. (2012). El hormigón: Historia, antecedentes en obras y factores identificativos de su resistencia. Tecnología y Desarrollo, 10, 13.

Chen, Y., McCabe, B., & Hyatt, D. (2017). Impact of individual resilience and safety climate on safety performance and psychological stress of construction workers: A case study of the Ontario construction industry. Journal of Safety Research, 61, 167–176. https://doi.org/10.1016/j.jsr.2017.02.014

Eurostat. (2018). Accidents at work statistics. https://ec.europa.eu/eurostat/statisticsexplained/index.php/Accidents_at_work_statistics

Haan, M., Hewitt, C., & Chuatico, G. (2020). By the numbers: the construction industry in Canada from 1986 to 2016. Labour & Industry: A Journal of the Social and Economic Relations of Work, 30(4), 299–320. https://doi.org/10.1080/10301763.2020.1819181.

Hernández, R., Fernández, C., & Baptista, P. (2010). Metodología de la investigación.

INEGI. (2018). Encuesta Nacional sobre productividad y competitividadde las micro, pequeñas y medianas empresas (ENAPROCE). https://www.inegi.org.mx/programas/enaproce/2018/

INEGI. (2019). Indicador mensual de la actividad industrial. https://www.inegi.org.mx/temas/imai/

Institute, E. E. (2015). Electricity 101 - History. Institute, Edison Electric, 6–8.

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., & Jørgensen, K. (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics, 18(3), 233–237. https://doi.org/10.1016/0003-6870(87)90010-X

Martínez Moreno, P., Aguirre Alemán, M. G., & González José, W. D. (2017). Estudio ergonómico como parte de la responsabilidad social en trabajadores del centro regional de informática de la Universidad Veracruzana. Inquietud Empresarial, 15(2), 87–114. https://doi.org/10.19053/01211048.7611

OLADIPO, O. (2015). Monografía Sobre Historia De La Seguridad En Construcción.

Ortega, K., Sarmiento, V., & Villegas, A. (2016). La construcción alrededor del mundo ¿Qué ha pasado y qué podemos esperar ? 84, 13.

Santos, J., Márquez, Y., López, A., Martínez, J., Guerrero, D. (2018). La implementación de procedimientos estandarizados en la prevención de enfermedades transmitidas por los alimentos. Conteo microbiológico del Staphylococcus aureus en quesos frescos. Revista Médica Electrónica, 4(2).

Vera, M. Villarroel, D. Delgado, Carvajal. A, Guerra, F. D. B. (2009). Influencia de la acción del medio ambiente en la durabilidad del concreto. Duracon, 8, 13–23.