

Characterization of Musculoskeletal Disorders in the manufacturing industry in northwest of México

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Abstract— *The aim of this work is to characterize occupational injuries in northwestern Mexico. To make this work resorted to the original source, the Mexican Social Security Institute (IMSS), who certifies labor lesions generated in the workplace. On the other hand, 706 workstations of the Manufacturing Industry were evaluated to determine the level of ergonomic risk. The results are: In the period between the years 2010-2014 its shows the increase of Musculoskeletal Disasters (MSD), from 84 in the year 2010 to 310 in 2014. The prevalence of injury is greater in women than in men. In the early years (2010-2012) the shoulder was the most affected part of the body, but in the entire series of years, the wrist has a positive trend that exceeds the shoulder in recent years. In reviewing injuries by industry can be seen that the wrist has prevalence in the electronics industry, the shoulder in the automotive industry, but MSD injuries decreased in the textile industry. Also a positive relationship between the data obtained from IMSS and assessments made in companies considering a correlation coefficient of 0.758 was found.*

Keywords— *Ergonomics, Musculoskeletal Disasters, Manufacturing Industry, Northwest México*

I. INTRODUCTION

In the eighteenth century the work of the Italian physician Bernardino Ramazzini "De Morbis artificum diatriba" in which the most common injuries of the craftsmen of that time are described [1]. As we can see, from that time the relationship between the type of work and injuries is known. Unfortunately, in Mexico there is no reliable statistical basis of the lesions that develop in the workplace. Currently, more than half of the countries do not provide adequate statistics on occupational diseases and the available data relate mainly to injuries and deaths. This not only makes it difficult to identify specific injuries or diseases of men and women, but also hinders the development of effective measures for all prevention. Globally, more than half of the countries do not provide statistics on occupational diseases. Many countries have social security systems including compensation schemes for occupational accidents and diseases; however, its coverage is limited to workers in the formal economy, where it is not effective because systems for recording and reporting are deficient. Therefore, it is reported and indemnifies few numbers of occupational accidents. The situation regarding occupational diseases is even more complicated. In fact, in most countries, it is only covered a portion of the actual cases, reflecting the difficulty of definition, recognition and reporting [2].

In Mexico there is little information and it is not well classified, as seen in the data submitted in 1998-2002 by the Instituto Mexicano del Seguro Social (Mexican Institute of Social Security, IMSS) where it appears that the total of Musculoskeletal Disasters (MSD) were 217 for a total of 12,232,301 affiliates workers [3].

1.1 Objective

Given the lack of information it was decided to go to the original data source, the local medical units of the IMSS and identify the dependent and independent study variables and certificates injury cases were obtained and were characterized it by number of lesions, type of injury by industry and injuries by gender.

On the other hand, 706 workstations representing 3543 operators of the manufacturing industry of Sonora were evaluated to determine the risk of MSD. This evaluation was done using the Rodgers Muscle Fatigue Analysis [4]. Subsequently, the degree of correlation was sought between the two results.

II. MATERIALS AND METHODS

The research was limited to the years 2010-2014, and only the manufacturing industry that is predominant in the region. The dependent variable was the MSD and the independent variables were: Classification of company, type and anatomical

region of injury and gender. First, we have the IMSS data and moreover we have data obtained by the Rodgers method. With these data we may characterize the MSD of manufacturing industry of Sonora; in addition we can test the hypothesis of relationship between dataset.

III. RESULTS

In the period between the years 2010-2014 its shows the increase of MSD, from 84 in the year 2010 to 310 in year 2014 (Figure 1). This increase may be due to the lack of a public policy of prevention of occupational injuries.

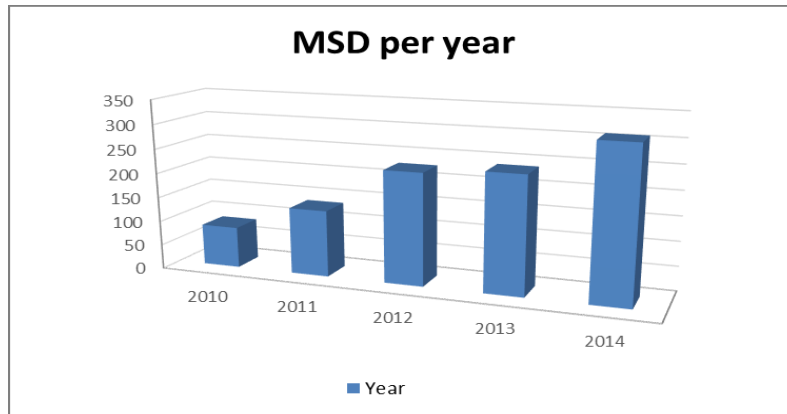


FIGURE 1. MSD PER YEAR 2010-2014

In the other hand, the prevalence of injury is greater in women than in men (Figure 2). However, it is greater the proportion of women than men in the manufacturing industry. In the early years (2010-2012) the shoulder was the most affected part of the body, but in the entire series of years, the wrist has a positive trend that exceeds the shoulder in recent years (Figure 3).

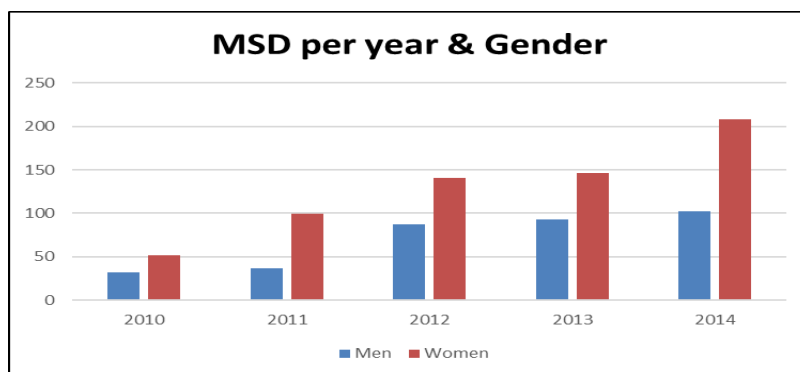


FIGURE 2. MSD PER GENDER AND YEAR 2010-2014

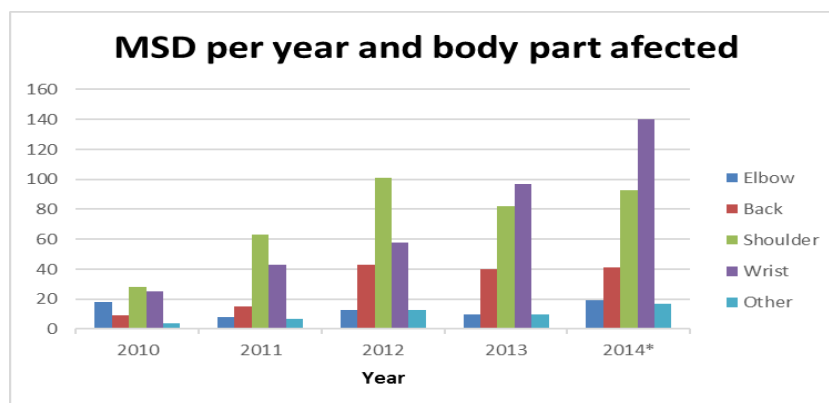


FIGURE 3. MSD PER AFFECTED BODY PART

In reviewing injuries by industry can be seen that the wrist has prevalence in the electronic industry (Figure 4), the shoulder in the automotive industry (Figure 5).

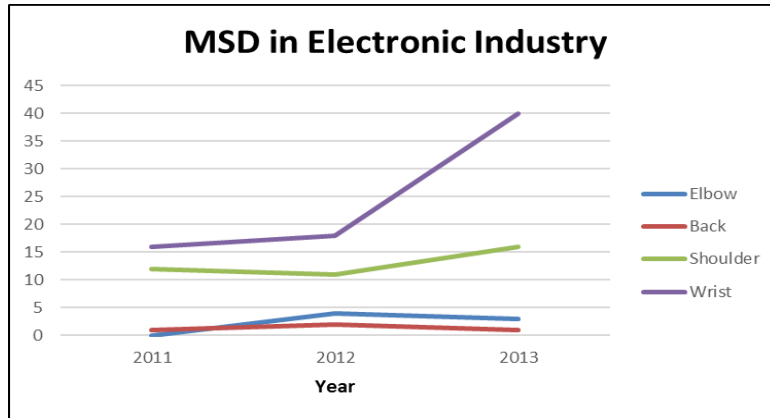


FIGURE 4. MSD PER YEAR IN ELECTRONIC INDUSTRY

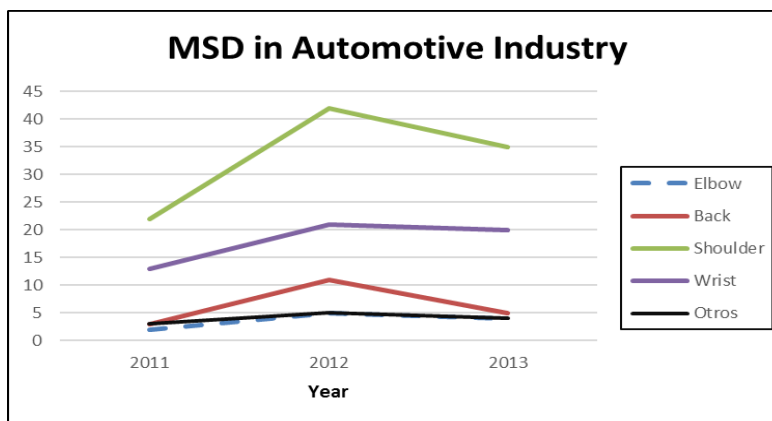


FIGURE 5. MSD PER YEAR IN AUTOMOTIVE INDUSTRY

But MSD injuries decreased in the textile industry. Since 2011 a program was started in the textile industry for reducing MSD, mainly on the shoulders, in subsequent years the beneficial effect of this program is shown (Figure 6).

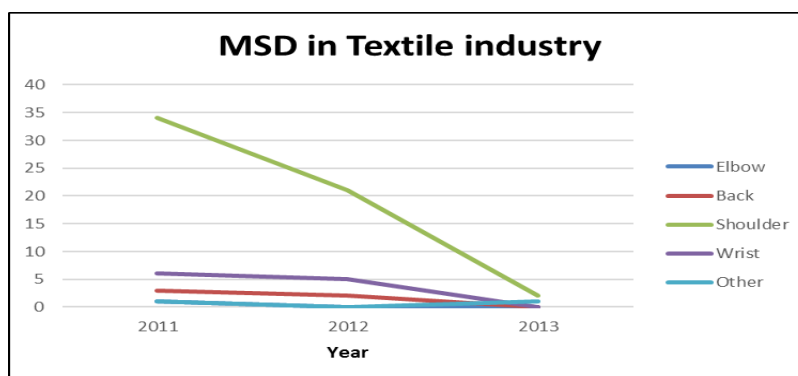


FIGURE 6. MSD PER YEAR IN TEXTILE INDUSTRY

In addition, we are interested in testing the hypothesis that data from IMSS and data from Rodgers Muscle Fatigue Analysis are independent. Table 1 shows data obtained using Rodgers method. If we reject this hypothesis, we conclude there is some interaction between the two data set [5]. So the result is:

$$\text{Pearson chi-square} = 14.162, \text{FD} = 4, \text{P Value} = 0.007$$

So we reject the null hypothesis and can conclude that there is a relationship between the two datasets. Another aspect that is of interest is to know the degree of relationship between the data sets. For this job is necessary to use the correlation coefficient [5] and is obtained:

$$\text{Pearson Correlation between SR and IMSS} = 0.758$$

This result indicates that there is a weak relationship between both datasets

IV. CONCLUSION

The lack of reliable information does not allow occupational health policies that reduce the MSD and improve the quality of life of workers. Currently in Mexico the importance given to Ergonomics issues is very little when designing products or processes in manufacturing companies because there is no appropriate legislation and this lack of interest causes the growth of MSD. In 2015 it will be introduced the new Regulation of Health and Safety at Work, a federal law. This new law establishes the obligation for all companies to make a map for ergonomic risks (MSD) and an improvement plan, which would diminish the MSD in a short term. Moreover, if it is known what kind of disorder (MSD) is the most common in each industry, then is possible to design control plans to avoid high costs of labor compensation and improve the work environment.

TABLE 1
WORKSTATION PER INDUSTRY AND TYPE OF RISK

INDUSTRY	Automotive 1	Automotive 2	Electronic	Textile	Other
Workstations	304	34	331	19	18
Low Risk	247	15	281	6	5
Medium Risk	53	15	45	5	11
Neck	1	8	9	9	1
Shoulder	7	9	27	7	11
Elbow	5	6	4	9	7
Wrist	9	15	12	3	5
Back	7	7	12	8	3
High Risk	4	4	5	7	2
Neck	2	0	0	0	0
Shoulder	3	0	0	7	1
Elbow	3	2	1	3	1
Wrist	3	1	7	6	0
Back	2	4	1	0	1
Legs	0	0	0	0	2
Very High Risk	0	0	0	1	0
Wrist	0	0	0	1	0

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REFERENCES

- [1] (Instituto Nacional de Seguridad e Higiene en el Trabajo, 2011)
- [2] International Labor Organization. (2013). *La prevencion de las enfermedades profesionales*. Ginebra, Suiza: International Labor Organization.
- [3] División Técnica de Información Estadística en Salud, IMSS. (2004). El IMSS en cifras: Indicadores de salud en el trabajo. *Revista Médica del Instituto Mexicano del Seguro Social*, 79-88.
- [4] Chengalur, S., Rodgers, S. H., & Bernard, T. E. (2004). *Kodak's ergonomics Design for People at Work* (Second ed.). Hoboken, New Jersey, U.S.A.: John Wiley and Sons.
- [5] Montgomery, D. C., & Runger, G. C. (2003). *Applied Statistics and Probability for Engineers*. Danvers, MA: John Wiley & Sons