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**RESEARCH**

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# INFLUENTIAL CHARACTERISTICS IN THE ACCIDENTS AT WORK IN HOTEL ESTABLISHMENTS IN ANDALUSIA

## *Características influyentes en la siniestralidad laboral en establecimientos hoteleros de Andalucía*

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## ABSTRACT

The method allowed us to identify the size variables of the company, education level and space to work as the variables predictors of accidents.
This paper aims to show the most predictive variables of accidents in the hotel world of the city of Malaga. The methodology used is logistic regression, using as source of information the survey by UGT Malaga, all workers of the tourism sector of the province limited to the study of the hotel industry. The main result shows that the company size, the schooling level and the work space for workers have an accident-predicting role.

**KEY WORDS:**
Accidents at work - logistic regression - establishments – hotels.

## RESUMEN

El método nos permitió identificar a las variables tamaño de la empresa, nivel de estudios y el espacio para trabajar, como las variables predictoras de siniestralidad.
El presente trabajo tiene la finalidad de exponer las variables más predictiva de la siniestralidad en el mundo hotelero de la comunidad de Málaga. La metodología a utilizar es la Regresión Logística tomando como fuente de información la encuesta realizada por UGT Málaga, al conjunto de trabajadores/as del sector turístico de la provincia limitado al estudio del sector hotelero. El principal resultado indica que el tamaño de la empresa, nivel de estudios y el espacio para trabajar de los trabajadores/as poseen un papel predictor de siniestralidad.

**PALABRAS CLAVE**
Accidentes laborales – regresión logística – establecimientos – hoteles.

**CARACTERÍSTICAS INFLUENTES NA SINISTRALIDADE LABORAL EM ESTABELECIMENTOS HOTELEIROS DE ANDALUZIA**

**RESUMO**

O método nos permitiu identificar os fatores, tamanho da empresa, nível de estudos e o espaço para trabalhar, como os fatores previsíveis da sinistralidade. O presente trabalho tem a finalidade de expor os fatores mais preditivos da sinistralidade no mundo hoteleiro de Málaga. A metodologia a utilizar e a Regressão Logística tomando como fonte de informação uma pesquisa realizada por U.G.T. Málaga, ao conjunto de trabalhadores do setor turístico da província limitado ao estudo do setor hoteleiro. O principal resultado indica que o tamanho da empresa, nível de estudos e o espaço para trabalhar dos trabalhadores possuem um papel preditor da sinistralidade.

**PALAVRAS CHAVE**
Acidentes laborais -Regressão Logística -Estabelecimentos - Hotéis

## 1. INTRODUCTION

Tourism is a sector that operates in an increasingly demanding and competitive environment, leading it to ensure the provision of quality services. With this reality, it is essential to take care of human resources, the human stock, since people are the key asset of a tourist company and, as such, they should be in value by developing training, informing them, motivating them, etc.

However, when talking about Human Resources and Quality of Services Provided, it is often forgotten that it is also necessary to ensure proper and healthy working environment. All this also positively affects the smooth running of the organization and, therefore, the achievement of profits.

The welfare of workers can be studied from different perspectives. If we just study the workers' welfare, correlating it exclusively with wages, we would be reductionists. Thus, issues such as labor welfare, the organizational climate are factors that clearly impinge on the overall welfare of workers.

Similarly, the safety culture should not be reduced to the objectives of absence of diseases and accidents. The concept of labor security is more than just issues related to the physical-technical environment of the workplace. And it consists of several distinct issues: the proper and inherent conditions of the activity and the specific task the worker has to develop, but also the interpersonal relations that arise in the workplace. This means that issues such as how to exercise leadership also have much to do in this regard. Moreover, it is very important that the worker perceives that

occupational health and prevention of occupational risks is encouraged from the direction and from management. Thus, it is considered that a good policy of prevention of occupational risks in the organization is the key to success.

Saarela (1989) goes one step further and adds the characteristics of the individual himself and the interactions among the three aspects (technical, social, demographic profile). To this author, these plots are all key because he considers that each occupational accident is a complex process, the result of risks in the workplace. Moreover, to this author, these aspects are not watertight but are interrelated and their development affects the proper functioning of the rest.

Society has long been aware of this more complex and extensive reality. This is reflected, for example, in the reports of the European Agency for Safety and Health at Work (2000), in which the need to develop a methodological system to control and monitor industrial accidents in the European Union is explained, where aspects that go beyond the technical issues are collected.

Initially, the consecration of the rights related to safety and health at work was carried out with the Universal Declaration of Human Rights of the UN General Assembly in 1945 (Lanzadera, E. 2002). It gathers a set of principles in which the rights and fundamental human freedoms recognized by the international community and based on the dignity and equality of mankind are consecrated.

However, despite the importance of the climate of safety and occupational risks is clear to society and its need for the proper development of tourist services has been proven from the perspective of research, this issue has some gaps.

The topic studied so far has been more fruitful to create guidelines and manuals for the purpose of clarifying the rules to be followed by a worker of that sector in order not to have an occupational accident and in descriptive studies on the occurrences of these events for general cases. While in the scientific literature, though it has been a subject remarkably dealt with, its study has rather focused mostly on specific research on how specific factors influence these issues by sub-sectors.

As mentioned above, manuals have been made through the years to prevent occupational risks in the hotel industry through institutions related to it, but little has been made in applying statistical techniques to observe the factors that influence the occurrence of occupational accidents, particularly in the hotel sector.

This paper has made use of one of these few descriptive studies. Specifically, the survey by UGT Malaga to all workers of the tourism sector in the province limited to study the hotel industry. The final sample with which we have worked, once references to non-hotel companies have been removed, is 515 surveys. That fieldwork was the basis for a project resulting from the collaboration agreement between the University of Malaga and that labor union, in which it was intended to describe the situation regarding occupational risks in hotels in this province. This work proved to be very timely because it provides a complete database, matching the variables we had selected in the preceding stage, all this from the point of view of workers. We should keep in mind that the study of occupational risks from the perspective of workers is key because it gathers first-person information on the subject of accidents and occupational risks related to their tasks; and as for the organization and preventive actions taken by the company, it entails valuing them from the subject

whom they target. Which certainly more realistically reflects the atmosphere of occupational security.
However, although the data provided by this survey have been the basic source of information, we have used surveys to employees related to occupational risks and interviews with people responsible for these matters and we have obtained official data mainly from the National Statistics Institute (INE, 2015 ) and the Institute for Tourism Studies and Data for the analysis and dissemination of statistical information on tourism in Spain (IET, 2015). Annually, these institutes keep a compendium of occupational accidents in every sector including the hotel-related, and through their web portals they provide such information which has been useful.
We must emphasize that, in order to detect relationships between variables and joint influences on the occurrence of occupational accidents and diseases, the central theme of this study, multivariate techniques are much more appropriate. These techniques deal with the variables together, without neglecting the fact that they interact with each other, so it seems more appropriate to choose such techniques. Among them, we selected logistic regression to achieve the objective in mind.
The aim of this paper is to discuss the most predictive variables, for which reason we used logistic regression. First, the methodology to be used will be described, then the analysis and discussion of results is displayed, and finally the main conclusions are mentioned.

## 2. METHODOLOGY

In order to obtain the proposed objective, we carried out a study of Logistic Regression (for more detail see Jovell, 1995 and Ayçaguer 1994), taking the survey conducted in the community of Malaga as a source of information.
With this methodology, we aim to predict that an employee with certain characteristics considered to be risk factors is more likely than another employee to have an occupational accident, which may make it possible to take preventive measures to minimize the occurrence of occupational accidents.
In order to adjust the model to be studied, the variables identified in the survey that showed significant association with the dependent or response variable were selected: During the last year, he/she has had some kind of accident in his/her workplace, through the method of selection *stepwise* (Steyerberg et. al, 1999).

## 3. ANALYSIS AND DISCUSSION

The analysis for the determination of the main variables that influence occupational accidents is made by using data from the Survey of UGT and using logistic regression.
In the steps of the selection method via *stepwise*, we eliminated the variables: satisfaction in the workplace, overtime, Journey from home to work, continuous physical load, painful or forced positions involved in working, post a high degree of responsibility, he/she carries problems beyond the working hours, ergonomics in designing the workplace, improper or inadequate maintenance or design of facilities, speed, evaluation of occupational risks in the workplace, training and information of

the company on the issue of occupational risks and gender.
After this first phase, we can say that the variables that best predict the possibility of having an accident were company size (TAM), educational level of the worker (P4) and lack of space at work (P17_2). Wald coefficients indicate that the three variables must be retained since they contribute significantly to predicting the probability of accidents in the workplace.

Table 1. Análisis de los Efectos

| Effect | DF | Wald Chi-Square | Pr > ChiSq |
|---|---|---|---|
| **TAM** | 3 | 8.1246 | 0.0435* |
| **P4** | 4 | 13.1273 | 0.0107* |
| **P17_2** | 1 | 8.5675 | 0.0034** |

* The effect is significantly different from zero at the 0.05 level
** The effect is significantly different from zero at the 0.01 level.

The resulting estimated model is shown below:

$$ln\left[\frac{p(x)}{1-p(x)}\right] = -1.4236 + 0.504EM + 0.3942EP - 1.4916EUP + 0.4879PE$$

For the model, MS (medium enterprise) and EP (Small Business) categories increase the likelihood that the individual has an occupational accident, the big company does not increase the risk of having this condition, so it is not included in the model, in educational levels (P4) the illiterate / elementary, secondary and FP middle and higher categories do not increase or decrease the likelihood of an occupational accident, instead, having have college or graduate (EUP) schooling decrease this probability and, finally, the space being small increases or contributes to the likelihood of having an accident at work.

| **Residual Chi-Square Test** | | |
|---|---|---|
| **Chi-Square** | **DF** | **Pr > ChiSq** |
| 25.9011 | 29 | 0.6308 |

The Chi-square mildness of adjustment test states that there is not sufficient evidence to reject the proposed model ($\chi 2$ (df = 29) = 25.9011; p = 0.6308), which is stated with 99% confidence. The Score, Wald and Ratio plausibility tests show significance values associated with the statistic <0.01 test, indicating that the hypothesis of overall nullity is rejected at the 0.01 level.

| Test | Chi-Square | DF | Pr > ChiSq |
|---|---|---|---|
| **Likelihood Ratio** | 32.8771 | 8 | <.0001 |
| **Score** | 30.0573 | 8 | 0.0002 |
| **Wald** | 25.8980 | 8 | 0.0011 |

The $\chi 2$ Wald test to individually verify the effect of variables on the risk for an accident at work indicates that, for all variables included in the model, the estimated risk differs from value one, the probability increasing or decreasing if the sign of the estimated parameter is positive or negative respectively.

Table 2. Classification table

| Prob Level | Correct **Event** | **Non-Event** | Incorrect **Event** | **Non-Event** | Percentages **Correct** | **Sensi-tivity** | **Speci-ficity** | **False POS** | **False NEG** |
|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 61 | 0 | 247 | 0 | 19.8 | 100.0 | 0.0 | 80.2 | . |
| 0.020 | 60 | 7 | 240 | 1 | 21.8 | 98.4 | 2.8 | 80.0 | 12.5 |
| 0.040 | 59 | 15 | 232 | 2 | 24.0 | 96.7 | 6.1 | 79.7 | 11.8 |
| 0.060 | 58 | 55 | 192 | 3 | 36.7 | 95.1 | 22.3 | 76.8 | 5.2 |
| 0.080 | 57 | 60 | 187 | 4 | 38.0 | 93.4 | 24.3 | 76.6 | 6.3 |
| 0.100 | 52 | 74 | 173 | 9 | 40.9 | 85.2 | 30.0 | 76.9 | 10.8 |
| 0.120 | 52 | 92 | 155 | 9 | 46.8 | 85.2 | 37.2 | 74.9 | 8.9 |
| 0.140 | 50 | 104 | 143 | 11 | 50.0 | 82.0 | 42.1 | 74.1 | 9.6 |
| 0.160 | 46 | 118 | 129 | 15 | 53.2 | 75.4 | 47.8 | 73.7 | 11.3 |
| 0.180 | 37 | 137 | 110 | 24 | 56.5 | 60.7 | 55.5 | 74.8 | 14.9 |
| 0.200 | 37 | 157 | 90 | 24 | 63.0 | 60.7 | 63.6 | 70.9 | 13.3 |
| 0.220 | 35 | 163 | 84 | 26 | 64.3 | 57.4 | 66.0 | 70.6 | 13.8 |
| 0.240 | 33 | 166 | 81 | 28 | 64.6 | 54.1 | 67.2 | 71.1 | 14.4 |
| 0.260 | 29 | 171 | 76 | 32 | 64.9 | 47.5 | 69.2 | 72.4 | 15.8 |
| 0.280 | 25 | 182 | 65 | 36 | 67.2 | 41.0 | 73.7 | 72.2 | 16.5 |
| 0.300 | 18 | 205 | 42 | 43 | 72.4 | 29.5 | 83.0 | 70.0 | 17.3 |
| 0.320 | 16 | 222 | 25 | 45 | 77.3 | 26.2 | 89.9 | 61.0 | 16.9 |
| 0.340 | 15 | 228 | 19 | 46 | 78.9 | 24.6 | 92.3 | 55.9 | 16.8 |
| 0.360 | 15 | 230 | 17 | 46 | 79.5 | 24.6 | 93.1 | 53.1 | 16.7 |
| 0.380 | 15 | 231 | 16 | 46 | 79.9 | 24.6 | 93.5 | 51.6 | 16.6 |
| 0.400 | 15 | 236 | 11 | 46 | 81.5 | 24.6 | 95.5 | 42.3 | 16.3 |
| 0.420 | 15 | 236 | 11 | 46 | 81.5 | 24.6 | 95.5 | 42.3 | 16.3 |
| 0.440 | 15 | 238 | 9 | 46 | 82.1 | 24.6 | 96.4 | 37.5 | 16.2 |
| 0.460 | 9 | 238 | 9 | 52 | 80.2 | 14.8 | 96.4 | 50.0 | 17.9 |
| 0.480 | 8 | 238 | 9 | 53 | 79.9 | 13.1 | 96.4 | 52.9 | 18.2 |
| 0.500 | 3 | 238 | 9 | 58 | 78.2 | 4.9 | 96.4 | 75.0 | 19.6 |
| 0.520 | 0 | 242 | 5 | 61 | 78.6 | 0.0 | 98.0 | 100.0 | 20.1 |
| 0.540 | 0 | 245 | 2 | 61 | 79.5 | 0.0 | 99.2 | 100.0 | 19.9 |
| 0.560 | 0 | 247 | 0 | 61 | 80.2 | 0.0 | 100.0 | . | 19.8 |

In the leaderboard, you can determine the cutoff point that allows greater sensitivity or specificity according to the interest of the study. In this case, because of the limited information or low incidence of accidents at work, the model only allows us to detect a maximum of 60.7% of people who will have an accident at work, but indicating 74.8% of times that the person will have an accident when in fact the person will not

(false positives) when the probability generated by the model exceeds 0.18 (cutoff point).
If the cutoff point is taken at 0.24, the model will correctly identify 67.2% of people who will never have an accident at work (specificity or true negatives) while it will produce 71.1% of false positives.
Overall, the adjustment of the model is considered good because the ROC curve (Cave Feature Receiver Operations) shows an area under the curve of 0.72 (<.70).
The estimation equation for the probability of an accident at work last year is given by:

P(Patient =work accident)

$$= \frac{1}{1 + \exp[-(-1.4236 + 0.504EM + 0.3942EP - 1.4916EUP + 0.4879PE)]}$$

Finally, the exponential of each coefficient of the model is interpreted as the odds ratio or relative risk of having an occupational accident when the other categories and variables of the model are absent, as shown below.

**Wald Confidence Interval for Adjusted Odds Ratios**

| Effect | Unit | Estimate | 95% Confidence Limits | |
|---|---|---|---|---|
| Medium company (between 50 and 250 workers) vs Micro enterprise (up to 10 workers) | 1.0000 | 3.403 | 1.266 | 9.147 |
| Small company (10 to 50 workers) vs. Micro enterprise (up to 10 workers) | 1.0000 | 3.049 | 1.205 | 7.715 |
| University / postgraduate studies vs FP higher level | 1.0000 | 0.115 | 0.025 | 0.534 |
| Little space vs. enough space | 1.0000 | 2.653 | 1.380 | 5.100 |

As a result, we can say that the risk for a person working in a midsize business to have an accident is 3.4 times higher than if he/she worked in a small business, which can range in 95% of cases from 1.266 to 9.14 times.
In small companies, workers are 3 times more likely to have an accident at work than workers of a small business, which has an interval for the true value of the risk ranging from 1.2 to 7.72 times.
An employee with university or graduate schooling is 1 / 0.115 = 8.696 almost 9 times less likely to have an accident at work than a higher level FP, whose real value can range from 1.87 to 40 times.
Finally, a company with little room for the performance of the activities of its workers can increase about three times the likelihood for an employee to have an accident regard the companies where there is adequate or sufficient room, which ranges in 95 % of cases from 1.3 to 5.1 times.

## 4. CONCLUSIONS

With Logistic Regression, we intended to identify the most predictive variables of accident. The method allowed us to identify the size variables of the company, the level of education and space to work, as the accident-predicting variables. We can see that they pose a variable for each policy area (employee and company) and another for the performance of the task itself. While, again, the work environment does not appear as influential.

Thus, it was determined that the risk for a person working in a midsize business to have an occupational accident is greater than if he/she worked in a small business. In addition, in small businesses, workers are 3 times more likely to have an accident at work than workers of a microenterprise. Also, an employee with university or graduate schooling is less likely to have an accident at work than a higher level FP.

Finally, we can say that a company with little room for the performance of the activities of its workers can increase about three times the likelihood for an employee to have an accident regarding businesses where there is adequate or sufficient room.

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