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Evaluation of Work Accidents in Colombia and Antioquia According to Economic Activity. 2019

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Abstract: Workplace accidents in Colombia have a frequency with little variability over time periods, despite investments in protection, the statistics continue to be considerable, in the last period from 2018 to 2019, the percentage of work accidents decreased, this would lead to conclude that in this period, health promotion and disease prevention measures, such as activities related to training implemented in companies, have had a greater impact, however they remain insufficient, while people have a greater perception of risk and They develop skills that promote their self-care. Based on what was stated, the objective was formulated: Determine the behavior of work accidents and their severity, according to economic activity in Colombia and Antioquia during the year 2019. The methodology used for the research was: Descriptive analysis, chi square, and models logistic regression. The main findings: Similar behavior at both territorial levels. Concentration of accidents in few economic activities, predominantly in men, but in Antioquia significantly in women, workers at an early age and with little seniority had more accidents. The main variables associated with the occurrence of accidents were: Injuries and multiple injuries, contusions, and violent circumstances for Colombia. In Antioquia accidents are mainly due to: multiple injuries and violent circumstances. Conclusions: Actions to promote and prevent occupational accidents should be generated in a general way for all territories, prioritizing the prevention and attention of accidents in the male working population, intervening only three variables and five economic activities, around 85% of accidents would be prevented. accidents throughout the country.

Keywords: Accidents, Occupational, Risk Factors, Occupational Health, Health Promotion, Accident Prevention, Working Environment, Health Risk Behaviors

1 Introduction

Workplace accidents are presented as events that affect the integrity of people in the exercise of their duties, the level of risk depends on the economic activity of the company; Manufacturing companies and companies dedicated to industrial and transportation processes have a higher rate than office and administrative activities. In the face of negative events on people's well-being, aspects that intervene in the

generation of accidents within organizations stand out from the workers' perspective, such as education and training on latent risk, safety elements for carrying out the activity, and economic activity. [1] Carrying out activities focused on improving the work environment and promoting training on the risk of carrying out tasks, promotes the reduction of workplace accidents and guarantees the well-being of people. [2]

In economic activities related to food handling, it was found that training and education in occupational risks is very low, as well as risk perception, however, occupational accidents with respect to the lack of education are not They are related, while the infrastructure and protection elements, as well as adequate utensils for cooking, cause a greater risk of occupational accidents, the anthropometric aspects of people increase the occupational risk for these people [3], in these industrial food handling processes in industrial contexts, collection and transportation represent a high risk, storage, cutting and weighing and selection have a moderate risk [4].

Guaranteeing good working conditions for people and socializing people to increase the perception of risk, reduces the possibility of suffering from diseases that affect throughout the course of life, which is reflected in different aspects that reduce the quality of life. personal and business, such as a person's lower productivity, a decrease in mental health, and increases in operational costs. [5]

In agricultural activities, people are exposed to high risks, derived from their repetitive activities, pain and different ailments accompany them throughout their lives, reducing their ability to perform different tasks, they tend to acquire lower back pain, and frequently pain in the back. the knees. [6]

It is important to consider aspects related to occupational accidents caused by the movement of people from home to work and vice versa, in this there is a greater risk than at work, it was found in an exploratory study that in men the risk of accidents, while in women it is six times higher, an aspect to be taken into account to improve and reduce the risk of extramural accidents. [7] According to research in manufacturing companies, it has been found that through good education and training it is possible to significantly reduce accidents; this entails reinforcing responsibilities within organizations in planning, implementation, monitoring and follow-up [8]

Situations related to formality at work are significantly associated with the protection of people, guaranteeing less vulnerability to accidents within the workplace. The fact of generating legal documents between a person and a company makes it possible to delegate high-level functions. risk, without adequate protection that guarantees safety to an individual, accidents in this situation can occur, doubling the frequency between formal employees versus informal ones [9]. In a study carried out in Chile, no significant differences were found between the perception of risk that people who carry out jobs from informality and formality have, there are aspects that influence changes in mentality to carry out work, it was found that people with Formal jobs have higher levels of dissatisfaction than

informal jobs, which influences low morale that can generate accidents or injuries in the development of their work [10].

In economic activities oriented to transportation, one of the aspects that arise are accidents related to drowsiness derived from long journeys in distance and time, which produce drowsiness in people dedicated to this type of work, in which obesity increases the risk approximately four times compared to a person without this condition, in overweight people with 10 or more years of experience, the risk is three times greater compared to people without overweight and with less experience [11]. In workers dedicated to transportation, it should be noted that they carry out constant work and during rest times such as weekends, they also work, and do not comply with rest hours that are stipulated at the organization level, they tend to be people with little motivation for work. work, this can be reflected in low productivity and poor assertiveness in receiving guidelines focused on safety and personal protection[12].

In activities in which wood is worked, the majority of accidents occur in parts of the body such as the waist and hands, in the waist, derived from prolonged uncomfortable positions, while in the hands they are cuts, 21% of workers perceive who have adequate personal protection elements for their work [13] In Argentina, in a 2018 investigation, of the participants, 17% presented at least one work accident, as a result of cutting tools that generated different types of cuts, due to chainsaws of chain, the handler of this tool, was generally the affected one, it is to be emphasized that according to the perception of the participants, companies do not always guarantee personal protection elements. [14], of the work accidents, they were frequently cuts due to different mechanisms, mainly by short sharp tools, which at the time of their occurrence lack any protection element to reduce the risk, generally by not carrying the protection element, despite being provided by the employer. [15].

In mining, workers, in addition to work accidents that mainly affect the lungs due to silica particulate material, the lumbar region due to long periods of work in uncomfortable positions, and musculoskeletal disorders due to repetitive movements, there is a population with involvement in their mental health due to jobs that reduce the possibility of sleeping, long hours that generate fatigue [16]. Mining activities represent a high risk for people dedicated to this profession, different tasks that require machinery to perform them, in addition to activities that involve the use of explosives, this requires efforts to keep these people protected, in this same situation. position is intended to improve working conditions, which are not the best given their spatial characteristics that require uncomfortable positions, as well as the different chemical and biological risks [17]. In research carried out on miners, there are results where LDL (bad cholesterol)), is associated with the occurrence of occupational accidents, as well as people with hypoglycemia, in which it presented a significant association [18]. This is similar to what happens in the construction sector, where there are long work hours, high levels of fatigue and lack of sleep, generating a decrease in response capacity in risk situations that

can trigger a work accident. There is a high possibility that the fewer hours one sleeps, the less effective the person's response capacity will be. In a previous study, a significant statistical relationship was not found. However, in response tests with a specific sample of the construction population, the reaction was slower in people with fewer hours of sleep[19].

In the construction sector it is also possible to find that accidents arise from inadequate conditions in the workplace, technical factors, and aspects related to personal behaviors and compulsive behaviors; compulsivity is significantly related to extensive workloads. [20]. The needs that arise in the population and market opportunities to obtain housing, infrastructure projects, will generate an incremental supply of work in this economic activity, because having these characteristics of vulnerability and danger in people, it is necessary to consider strategies aimed at guaranteeing appropriate conditions and well-being, where the conditions and behavior of the individual lend themselves to reducing occupational risks [21], It is important to mention the perception that employers of construction workers have, where the importance of risk socialization in the event of an accident at work is recognized, regarding the direct relationship that exists between the premise that in the event of an With less training, the worker will have less discernment about the risks of their activities or tasks, while permanent and relevant training will generate better safety practices among employees [22].

For workers dedicated to construction, it is important to keep in mind that they are people with a lot of experience, but little seniority in the companies, there is high turnover, few remain in stable employment, studies have found that periods of Permanence in companies of 5 or more years reduces the probability of suffering a work accident compared to a person with greater stability in a job [23]. Construction workers with a longer period of experience consider that the fact of performing jobs with uncomfortable postures have a high risk of suffering an accident and an injury, they also perceive that repetitive movements could lead to future accidents [24]. In the construction sector, accidents have a connotation of risk, due to the interaction with machines and tools, makes there a greater probability of more disabling injuries, as well as a fatal outcome, training becomes very important, in research carried out in Chile, half of the accidents occurred in workers with less than one year's experience [25]. From an administrative point of view, it is important to analyze safety at work as an aspect that generates well-being for employers and workers, as soon as a business position is adopted in which, through the prevention of illness and the promotion of health, costs derived from accidents and disability, in addition to progress in spaces conducive to work, where people stay most of their time [26].

2 Methodology

The information analyzed corresponds to a sample of cases, provided by the Antioquia sectional committee for safety and health at work. Taking into account that these were sources of secondary information, it was essential, first of all, to purify the information, guaranteeing that the data associated with each variable of interest were written and categorized in the same way, so that when generating data statistics and present the information there would be no divergences within the same variable.

Variables are defined such as: department of accident occurrence, municipality of accident occurrence, economic activity of the injured party, and economic sector of the company. The variables of: Accident circumstance, place of occurrence, type of injury, agent of the accident, mechanism of the accident, danger associated with the event, and type of accident are recoded. To formulate the statistical models, the original variables were converted to dummy variables, so that the qualitative variables could be included in the logistic regression model. Likewise, the original dependent variable for the study was the type of accident (Severity), and which initially had the classifications mild, serious and fatal, was recoded to Non-fatal and fatal.

The analysis plan included univariate and bivariate analysis. The descriptive analysis was carried out with the following variables: Economic activity, department of occurrence, type of accident, length of service, sex, age, circumstance of the accident, location of the accident, type of injury, agent of the accident, mechanism of the accident, identified danger , with these variables a bivariate analysis was generated to identify the variables that possibly represented an association with the severity of work accidents. Association tests were carried out using the Chi2 statistic, and subsequently contrasted with the model generated through logistic regression. Finally, tree diagrams were designed for Colombia and Antioquia.

3 Results and Discussion

3.1 Distribution of work accidents in Colombia and Antioquia by economic activity.

Antioquia, 232 (42.3%), a finding that coincides with those of Yency García, in 2020, who describes Antioquia as the second territorial entity in the occurrence of work accidents, after the capital-Bogotá district [27].

73% (400) of the accidents occurred in 6 economic activities, out of 20 analyzed: Administrative and support services (office administrative services, collection

agencies, machinery and equipment rental services, employment agencies, supply of human resources); agriculture, livestock, hunting, forestry and weighing; construction; manufacturing industry; transportation and storage, confirming that the majority of accidents are generated in few economic activities, coinciding with what was found by authors such as: Antonio Gómes, through his study "Incidence of work accidents declared in Ecuador in the period 2011-2012, describes that the main activities where workplace accidents occurred were associated with: manufacturing industries, agriculture, forestry, hunting and fishing [28]. Likewise, the research carried out in Brazil by Diana Chagas, found that in manufacturing activities it was vital to evaluate risks, to manage and detect processes in which to prioritize health interventions, derived from its relationship with workplace accidents, several processes associated with accidents, such as cutting, exposure to high auditory decibels, contact with electricity, sanding, contact with flammable chemicals [29].

The predominant sectors in the occurrence of accidents in 2019 were similar to those of previous years. In 2020, at the national university, a study was carried out on accidents in Colombia, evaluating the period 2004-2014, finding that activities such as construction, manufacturing, and agriculture, predominated in the generation of occupational accidents [27], which reveals the low effectiveness of the prevention measures implemented until 2019.

If intervention were made, at least in the 6 activities described above, consequences such as: Absenteeism from work, recognition of compensation, economic losses for companies, consequences for the worker and their families would be avoided, pressure would be taken off the social security system in health, and would reduce healthy and potentially lost years of life. In relation to costs, Laura Araujo highlights the importance of this aspect, finding that, In Brazil, it is possible to demonstrate the aid derived from accidents, for the year 2013, 5.2 million aid was delivered as a result of work accidents. .

In both Colombia and Antioquia, the behavior by activity is the same, activities related to construction and manufacturing industries prevail, with the tertiary sector responsible for around 57% of the total accidents. In Antioquia there are numerous construction projects, especially in the capital and nearby municipalities, attractive for their tourist and development characteristics. In turn, important maquila projects are being developed in many municipalities, which may explain the number of related accidents. with these activities.

With respect to sex, in Antioquia women have accidents a little more (18.1%), compared to the national figure (15.5%). This may be related to a greater participation of women in the labor market in Antioquia compared to the national one, as well as the type of activities carried out by them; Antioquia possibly accepts in a better way that they carry out activities that have traditionally been carried out by men.

There are three activities that concentrate accidents for women: Accommodation and food services, wholesale and retail trade; repair of motor vehicles and motorcycles and manufacturing industries, represent 9% at the national level (47 cases), compared to 12% (27 cases) in Antioquia. As for men, for Colombia, they were presented in activities of: Construction, industrial manufacturing, transportation and storage, administrative activities, agriculture, hunting and livestock, and wholesale and retail trade; in Antioquia, in addition to the previous ones, also in the exploitation of mines and quarries. Similarly, the study carried out by Denise Álvarez describes how in industrial sectors it is necessary to take into account different specific activities in which work accidents occur, within those classified as serious and fatal; in Brazil it has been possible to identify Activities related to the extraction of oil and gas, which have a high fatal accident rate, these types of events have been associated with risk conditions such as excessive workload, the design of inappropriate jobs, noise, vibrations. , inadequate ventilation, contaminated air [30].

Regarding age, a decrease in cases was noted in the later age groups, perhaps due to a greater perception of risk or greater responsibility when carrying out work activities. The group of 18-28 years old was the one that contributed the most accidents, where the highest number of accidents occurs in construction, according to the above, it is necessary to work in a common way to prevent workplace accidents regardless of the age of the workers.

Regarding the type of accident (Severity), the majority corresponded to serious accidents (72% for Colombia and 78% for Antioquia), followed by fatal ones (25% for Colombia and 21% for Antioquia), and finally minor ones.

Work seniority was another important factor; accidents predominated in workers with less time worked, decreasing the frequency as workers spent more years in the organization. The above is related to the belief that, the shorter the time worked, there is also a lower perception of risk regarding the tasks performed, compared to those who stay longer in the companies, have a greater sense of belonging, and better mastery of the task they perform, reducing the number of accidents. Based on the above, training and coaching programs take great importance, especially for people who have been in the companies for the shortest time.

The predominant danger was that of safety conditions, at the national level it was in 84% of the accidents, compared to 88% in Antioquia, this danger is associated with all work activities, since it is related to conditions such as electrical, locative, mechanical, public order, technological, and work at heights. Secondly, the physical, chemical, biomechanical and psychosocial danger. According to these data, hazard intervention cannot focus on just one hazard, but the need to prioritize safety conditions in all activities is evident. However, more than half of the accidents associated with the danger of safety conditions occur in only five activities: Construction, manufacturing industries, transportation and storage, administrative and support services activities, and wholesale and retail trade. ,

representing 65% of accidents associated with safety conditions in Colombia, compared to 70% in Antioquia.

It is necessary to intervene in all hazards, but if safety conditions are prioritized and, furthermore, in the five main activities described, the mitigation of occupational accidents would be extremely representative and important.

In the mechanisms associated with accidents, the collapse of people and objects, blows, and it is associated with safety conditions, exposures associated with temperatures are associated with physical dangers. Some authors such as Fatemi, through his study: Analysis of work accidents in the manufacturing sector in the province of Semman, found accident generators among others; falls from heights and objects, electric shocks, coinciding with the findings of the present investigation [31].

The main agent identified was tools, which is related to the danger of safety conditions and the mechanism of falling objects and impacts. The presence of the agents coincide at the national and departmental level: Tools, materials and the work environment. At the national level, the following also appear: animals, EPP and radiation. In the study carried out by Fentahun, in Ethiopia, they obtained similar results, finding that the use of tools represented an association with occupational injuries [32].

The circumstances under which the accidents occurred were mainly associated with work-related situations, 78% in Colombia and 84% in Antioquia, followed by those related to transportation and violence. The three main activities related to the circumstances of the work were manufacturing industries, construction and agriculture, livestock, hunting, forestry and fishing in Colombia, and in Antioquia, construction, manufacturing industries and wholesale and retail trade. The above could indicate that the management of hazards in work environments is not sufficient. Yuliana Román describes it in her research, Mortality according to types of occupation in Mexico, 2014, describing the need for interdisciplinarity to face and explain the circumstances of work environments, in line with working conditions [33].

Both in Colombia and Antioquia, accidents occur mainly in production areas, and importantly in vehicular circulation areas or parking lots. The economic activities in which the most accidents occurred in production areas were manufacturing industries, construction and agriculture, livestock, hunting, forestry and fishing at the national level, while in Antioquia they were construction activities, manufacturing industries and wholesale and retail trade.

The most frequent injuries were bruises and fractures in Colombia, and in Antioquia bruises and burns, causing mostly serious accidents, and also fatal ones, these injuries are associated with dangerous safety conditions, physical conditions and the mechanisms of collapse of people. , objects and blows, as well as agents of tools or machinery and materials. These results coincide with those found in construction

workers in Cairo Egypt in 2018, where it was determined that two of the most frequent injuries were bruises and fractures, but also abrasions, eye and ear injuries, and prolapse of the neck discs [34].

In general terms, the most frequent injuries were fractures and bruises, varying depending on the economic activity, as follows: In Colombia, professional, scientific and technical activities also generate injuries. In public administration and defense; Mandatory social security plans also present traumas. In those related to accommodation and food services, and manufacturing industries, the main injury is burns. In the construction sector, bruises, fractures and multiple injuries mainly occur. In the educational sector they suffer from multiple injuries, as well as in the exploitation of mines and quarries. Finally, in the transportation and accommodation activity, the most frequent are, in addition to fractures and bruises, multiple injuries. The findings coincide with a study carried out in Ecuador on the epidemiology of work accidents, where they found bruises, internal injuries, wounds. and fractures as the main injuries resulting from work accidents [35].

In Antioquia, the main injuries are bruises, burns and fractures, and according to the economic activities, the behavior is similar to that of Colombia, however, in construction there are also multiple injuries, in the manufacturing industry, injuries, and the activity transportation and storage, also generates injuries such as wounds, multiple injuries and dislocations.

3.2 Accident severity with respect to demographic and work-related variables.

The type of work accident (severity) in Colombia or Antioquia was associated with the following variables: Age group, agent and accident mechanism only generated association for the national territorial level, while the economic sector only showed association at the department level. Antioch. The other variables that were associated are so in both Colombia and Antioquia: Economic activity, gender, circumstance of the accident, area of the accident, type of injury and danger.

Table 1

Demographic and labor variables related to accidents in Colombia and Antioquia

Chi-square tests						
	Colombia			Antioquia		
Variables	Pearson chi-square	gl	Sig. asymptotic (2 caras)	Pearson chi-square	gl	Sig. asymptotic (2 caras)
Economic activity	50,939[a]	19	,000	45,347[a]	19	,001
Gender	21,469[a]	2	,000	13,732[a]	1	,000
Age group	10,365[a]	4	,035			
Circumstance of the accident	57,047[a]	5	,000	32,361[a]	3	,000
Accident area	51,858[a]	7	,000	14,719[a]	6	,023
Type of injury	186,799[a]	10	,000	79,383[a]	10	,000
Accident agent	19,946[a]	5	,001			
Accident mechanism	24,287[a]	8	,002			
Danger	17,256[a]	4	,002	9,948[a]	4	,041
Economic sector				7,838[a]	2	,020

The dependent variable was the type of accident (Severity), classified as fatal and non-fatal. For Colombia, the first predictor was the type of injury, within this predictor three nodes (groups) were generated, and within them no difference was observed, but there was a difference with respect to the others. First node: Bruises, wounds, effects; Second node: Multiple injuries, others, asphyxiation and Third node: Fractures, traumas, burns, dislocations, amputations.

Injuries to the second node were the most related to the occurrence of serious accidents, 72.6%. So that; 73% of serious accidents are explained by the group of: Multiple injuries, other injuries and asphyxiation. Nodes two and three are terminal since they did not generate any subsidiary or subdivision. Within node 1, new associations were detected, in this case with the circumstance of the accident, in turn within this, two new ramifications appear, one related to the circumstances of the work, and the next made up of: traffic, violence, recreational, violence (No differences are detected between these).

Based on the above, for Colombia the profile configured to explain the occurrence of serious accidents could be, first of all: bruises, wounds, effects, circumstances of the accident such as: traffic, violence, recreational and cultural and sporting

circumstances. This model explains at least 84% of the occurrence of accidents (Table 2).

In the case of Antioquia, the first predictor was the type of injury, within this, two nodes (groups) were generated, within which no difference was observed. First node: traumas, fractures, burns, dislocations, amputations, effects and Second node: Other injuries, contusions, multiple injuries, asphyxiation, and wounds. Injuries to the second node were those that had the greatest relationship with the occurrence of fatal accidents, representing 41.2%.

The lesions in node two were directly related to economic activity, which in turn generated two new nodes, being the one composed of the economic activities of construction and exploitation of mines and quarries, transportation, household activities, real estate activities, and construction activities. information and communication that would explain 65.5% of the fatal accidents in Antioquia, the profile that is configured to best explain the materialization of accidents was composed of: Other injuries, bruises, multiple injuries, asphyxiation and wounds, and with the economic activities of construction and exploitation of mines and quarries, transportation, household activities, real estate activities and information and communication activities. This model explains at least 87% of work accidents in Antioquia.

3.3 Predictive model of the type of accident (Severity) in Colombia and Antioquia, through logistic regression.

For the model, the type of accident (Severity) was used as a dependent variable, recoded as fatal and non-fatal. The independent variables were: Economic activity, economic sector, gender, age group, seniority in the company, circumstance of the accident, area where the accident occurred, type of injury (amputations, asphyxiation, bruises, effects of contact with electricity or radiation, fractures , wounds, multiple injuries, dislocations, burns, traumas, other injuries), resulting in the following associated variables, with a significance level of less than 0.05.

Table 2

Regression classification table in Colombia and Antioquia

Regression classification table[a] COLOMBIA	Regression classification table[a] ANTIOQUIA

Pasos	Observed		Forecast			Observed		Forecast		
			BIVARIATE_ACCIDENT_TYPE		Percentage correction			BIVARIATE_ACCIDENT_TYPE		Percentage correction
			MORTAL	NO MORTAL				MORTAL	NO MORTAL	
Step 1	BIVARIATE_ACCIDENT_TYPE	MORTAL	52	84	38,2	BIVARIATE_ACCIDENT_TYPE	MORTAL	13	36	26,5
		NO MORTAL	22	390	94,7		NO MORTA	6	177	96,7
	Overall percentage				80,7	Overall percentage				81,9
Step 2	BIVARIATE_ACCIDENT_TYPE	MORTAL	65	71	47,8	BIVARIATE_ACCIDENT_TYPE	MORTAL	22	27	44,9
		NO MORTAL	26	386	93,7		NO MORTA	8	175	95,6
	Overall percentage				82,3	Overall percentage				84,9
Step 3	BIVARIATE_ACCIDENT_TYPE	MORTAL	81	55	59,6	a. The cutoff value is .700				
		NO MORTAL	32	380	92,2					
	Overall percentage				84,1					
Step 4	BIVARIATE_ACCIDENT_TYPE	MORTAL	81	55	59,6					
		NO MORTAL	32	380	92,2					
	Overall percentage				84,1					

After 4 steps, through the CHAID method, for Colombia, and 2 steps for Antioquia, through the CHAID method, the model explains 84,1% of the occurrence of accidents for Colombia, through the variables: Multiple injuries, other injuries, violent circumstances and contusions. And 84,9% for Antioquia, through the

variables: Violent circumstances and multiple injuries. The predictive models for Colombia and Antioquia were the following:

Table 3

Binary logistic regression model for accident type in Colombia and Antioquia

Variables in the equation FOR COLOMBIA						**Variables in the equation FOR ANTIOQUIA**					
		B	Sig.	95% C.I. para EXP(B)				B	Sig.	95% C.I. para EXP(B)	
				lower	Superior					Inferior	Superior
Step 3[c]	CIRC_VIOLENCE(1)	2,709	0	5,925	38,04	Step 1[a]	MULTIPLE INJURIES (1)	2,366	0	3,797	29,886
	MULTIPLE INJURIES (1)	2,684	0	8,232	26,067		Constant	-0,773	0,117		
	OTHER INJURIES (1)	3,094	0	6,95	70,045	Step 2[b]	CIRC_VIOLENCE(1)	2,822	0	4,23	66,82
	Constant	-6,572	0				MULTIPLE INJURIES (1)	2,528	0	4,364	35,997
Step 4[d]	CIRC_VIOLENCE(1)	3,173	0	8,832	64,553		Constant	-3,522	0		
	BRUISES (1)	1,502	0	2,516	8,008						
	MULTIPLE INJURIES (1)	3,358	0	14,691	56,239						
	OTHER INJURIES(1)	3,772	0	13,015	145,048						

Variables in the equation FOR COLOMBIA						Variables in the equation FOR ANTIOQUIA				
	B	Sig.	95% C.I. para EXP(B)			B	Sig.	95% C.I. para EXP(B)	
			lower	Superior				Inferior	Superior
Constant	-9,212	0							
a. Variables specified in step 1: MULTIPLE INJURIES.									

The definitive model for predicting work accidents in Colombia would be the following:

BIVARIATE_ACCIDENT_TYPE= -9.212 + 3.772(OTHER INJURIES) + 3.358(MULTIPLE INJURIES) + 1.502(BRUISES) + 3.173(CIRC_VIOLENCE).

Although the majority of studies on workplace accidents correspond to literature review and descriptive studies, some have focused on the creation of explanatory models, such as the case of Iraj, in his study Structural Equation Modeling (SEM) of the size of the occupational accidents based on risk management factors; a field study in process industries, through which a model was formulated, which included variables related to risk management programs and accidents. For this model, those with a value p < were taken as associated variables. of 0.05, highlighting the reliability of said models for the analysis of work accidents and the possibility of preventing them through the intervention of the variables that were representative in the model obtained [36].

The definitive model for predicting work accidents in Antioquia would be the following:

BIVARIATE_ACCIDENT_TYPE= -3.522 + 2.528(MULTIPLE INJURIES) + 2.822(CIRC_VIOLENCE)

In this case, the associated variables can be modifiable, in that order of ideas, designing strategies to intervene in the circumstances of violence and multiple injuries would reduce the severity of work accidents by 85%.

Conclusions

The behavior of work accidents at the two territorial levels analyzed; It was quite similar, of the 20 economic activities evaluated, 5 activities concentrated around

78% of the accidents. Manufacturing industries, construction, transportation and storage, administrative support activities, transportation and food. The tertiary sector dedicated to providing services is where the majority of accidents occur, findings similar to those found in 2006, in the research "Injuries due to work accidents, a priority in public health", developed in Spain. , in which they found that economic activities related to construction, food, drivers, and agriculture and fishing were one of the main causes of work-related accidents [37].

In practical terms this could be positive, given that intervention strategies can be formulated that are generally applicable in any part of Colombian territory.

If the seven economic activities responsible for the majority of workplace accidents were effectively intervened, the country and Antioquia in particular would be able to significantly reduce the occurrence of these accidents, as a consequence of which savings would be derived for companies, a reduction in the pressure on the health system, among other positive effects.

The descriptive analysis clearly shows the behavior of the variables related to the behavior of work accidents. There are five economic activities in which more than 60% of the accidents analyzed occur: Construction, manufacturing industries, transportation and storage, administrative services activities and wholesale and retail trade and repair of motor vehicles and motorcycles.

Regarding gender, the predominance of men in injured workers is clear, however, there is a participation of women that cannot be ignored, especially in Antioquia, they are injured mainly in wholesale and retail trade activities. retail; repair of motor vehicles and motorcycles and, accommodation and food services, while men in the construction and manufacturing industries. Regarding age, the majority of accidents occur between 18 and 39 years of age, with more than 50% being serious and fatal accidents. Seniority was another variable with a marked behavior; those who had been in the company for less than 5 years had the most accidents. Regarding the severity of accidents, fatal accidents occur mainly in activities related to construction, transportation and storage, while serious accidents occur in construction and manufacturing industries.

The most obvious dangers were safety and physical conditions, and are proportionally related to the severity of the accidents. The main mechanism was the collapse of people and objects, the tools or machinery were the main agent, the circumstances were specific to the work, the main areas were those of production. The injuries associated with fatal accidents were contusions and multiple injuries, while contusions and fractures were associated with serious accidents.

Regarding the analysis of association, through chi square tests, variables were identified with levels of significance that indicate a positive association with the severity of accidents in Colombia: Economic activity, gender, age group, accident circumstance, accident area , type of injury, accident agent, accident mechanism, and hazard; For Antioquia, only seven variables were identified: Economic activity,

gender, circumstance of the accident, area of the accident, type of injury, danger and economic sector.

In tree tests; The identified variables could predict the severity of accidents for Colombia by 84% (injury and circumstances of the accident), while for Antioquia these variables explained 86% (type of injury and economic activities).

Based on these findings, strategies are aimed at intervening in injuries such as bruises, multiple injuries, asphyxiation, wounds and effects related to contact with electricity or radiation, and also whether interventions focus on circumstances related to work activity. , traffic, violence, recreational matters, would have a positive impact on the severity of accidents in Colombia. Likewise, in the case of Antioquia, interventions should prioritize treating injuries such as: bruises, multiple injuries, asphyxiation, and wounds, and at least two groups of work activities. For both Colombia and Antioquia, the logistic regression models, to predict the severity of work accidents, are configured from injuries, followed by violent circumstances.

According to the independent variables used in the project, for Colombia and Antioquia there is a similar pattern with respect to the classification of the accident, circumstances of violence and multiple injuries, both of which are directly related to the type of accident, direct interventions that from the different companies are developed specifically in these categories of type of injury and circumstance of the accident would reduce the accident rate in the department and the country. The classification percentages for Colombia and Antioquia are similar, between 84% and 85%, the explanation between the independent variables and dependents has a high percentage, corroborating that implementing specific actions on these variables would help reduce the severity of the accident.

For Colombia, other types of injuries such as bruises and other injuries are associated with the severity of the accident, while in Antioquia it was burns, it would be important to consider protection for employees, which helps reduce the risks in the severity of accidents.

It is evident that the efforts of companies to carry out promotion and prevention activities are insufficient, as well as the implementation of occupational health and safety management systems and therefore, non-compliance with the minimum standards with which they must be met is very likely. comply with companies in Colombian territory, according to current regulations, as well as the identification of hazards and their management. If all of the above were met, work accidents would probably continue to occur, but of less severity, reducing fatal and serious accidents associated with to greater consequences at a personal, work, business and social level, these findings coincide with what is described by Marino Luis, through his research on the simulation of costs in risk management in relation to work accidents, where he describes that despite the efforts by the Brazilian government and business to prevent workplace accidents, these followed an alarming pace, which highlights that one of the main problems is the way to achieve effectiveness in the promotion and prevention processes and not only their execution [38].

Similarly, Oscar Leal, in his article: “Management systems, tools for controlling occupational risks”, describes the importance of management systems as a tool for preventing accidents and incidents at work, through the management of hazards and risks in work environments [39].

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