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Impact of the type and severity of accidents on medical care costs in Ecuadorian companies in the manufacturing sector in zone 8

Impacto de la tipología y gravedad de los accidentes en los costos por atención médica en empresas ecuatorianas del sector manufactura en la zona 8

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Abstract

This study examines the impact of the typology and severity of occupational accidents on the costs associated with medical care in manufacturing companies in Zone 8 of Ecuador. It analyzes the importance of accident prevention and occupational safety management in reducing these costs and improving the health and well-being of workers. A quantitative investigation was carried out that included the collection of data on accidents, medical costs and other related factors. The results reveal the significant relationship between accident typology and medical care costs, highlighting the importance of prevention and occupational safety management.

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Keywords: Occupational accidents, Occupational diseases, Health care costs, Occupational safety, Accident severity, Manufacturing sector.

Resumen

Este estudio examina el impacto de la tipología y gravedad de los accidentes laborales en los costos asociados a la atención médica en empresas del sector manufacturero en la Zona 8 de Ecuador. Se analiza la importancia de la prevención de accidentes y la gestión de la seguridad en el trabajo para reducir estos costos y mejorar la salud y bienestar de los trabajadores. Se llevó a cabo una investigación cuantitativa que incluyó la recopilación de datos de accidentes, costos médicos y otros factores relacionados. Los resultados revelan la relación significativa entre la tipología de los accidentes y los costos de atención médica, lo que destaca la importancia de la prevención y la gestión de la seguridad laboral.

Palabras clave: Accidentes Laborales, Enfermedades profesionales, Costos atención médica, Seguridad laboral, Gravedad de accidentes, Sector manufactura.

Introduction

The manufacturing sector plays a crucial role in the Ecuadorian economy, generating employment and contributing significantly to the country's Gross Domestic Product (GDP) (INEC, 2021) (Macias et al., 2020; Pacheco et al., 2018; Pinzón, 2018).. However, this sector also faces considerable challenges in terms of job security that can have a significant economic as well as human impact.

Occupational accidents are a global problem that affects workers and employers worldwide. According to the International Labor Organization (ILO), it is estimated that an occupational accident

occurs every 15 seconds worldwide, resulting in more than 2.3 million deaths per year (ILO, 2020; Cuello Ramírez & Lastra Muñoz, 2023; Peláez Barranco & Garzón Moreno, 2020).. In addition to the human cost, occupational accidents generate substantial economic costs for companies, including medical care expenses, compensation, lost time, and decreased productivity (OSHA, 2021; Kavouras et al., 2022; Rikhotso et al., 2022; Sadeh et al., 2022)..

Workplace safety is a critical issue for companies in Ecuador's manufacturing sector. Workplace accidents not only affect the health and well-being of workers, but also have a substantial impact on health care costs and productivity of companies (Chillakuri & Vanka, 2020; Jain et al., 2018; Sorensen et al., 2021).. In addition, the severity and typology of accidents can vary widely, leading to different levels of health care expenditures (Benlagha & Charfeddine, 2020; Mokhtarimousavi et al., 2019).. Therefore, it is essential to understand how these factors relate to and affect health care costs in the specific context of Zone 8.

In the Ecuadorian context, it is essential to understand how the typology and severity of occupational accidents affect health care costs in manufacturing companies in Zone 8. This region, which includes provinces such as: Bolivar, Guayas, Los Rios, Santo Domingo, Manabi, Galapagos and Santa Elena, is characterized by its important industrial and manufacturing presence, it is a region where the manufacturing industry has experienced sustained growth in recent years (INEC, 2021).

In this context, it is imperative to understand the impact of the typology and severity of accidents on health care costs in companies in this area, focusing on the province of Guayas, specifically in the cantons of Guayaquil, Duran and Samborondón, in order to provide valuable information for companies, workers and regulatory authorities.

This research seeks to answer the behavior of occupational accidents and how they affect the costs related to medical care in Ecuadorian companies in this manufacturing sector. This research is justified by

the need to improve safety at work, reduce the costs associated with occupational accidents and promote a healthier and safer work environment for workers.

The definition of some authors has been considered to define certain important concepts within this research.

Occupational accidents are defined as unplanned events that occur in the workplace and result in physical injury or occupational illness. These accidents can vary in severity and typology, from minor injuries to fatal accidents. Their impact is not limited to physical and emotional consequences for workers, but also has significant economic implications for companies and society in general, (Izadi et al., 2019; Masinaei et al., 2022; McKinnon, 2023; Probst et al., 2019; Raza et al., 2022; Saranjam et al., 2022; OSHA, 2021)..

The occurrence of occupational accidents has a considerable economic impact. Direct costs include medical expenses, workers' compensation, rehabilitation and replacement of injured workers. In addition, there are indirect costs related to lost productivity, absenteeism, replacement training, and company reputation (Consunji et al., 2022; Leigh, 2011; Malekzadeh et al., 2022; Mustard & Yanar, 2023; Nai'em et al., 2020).. These costs may be especially relevant in the manufacturing sector, where injuries may be more severe and costly to treat.

Academic literature has extensively documented the economic impact of occupational accidents. According to a study by the International Labour Organization (ILO), the direct and indirect costs of occupational accidents can account for up to 4% of a country's gross domestic product (GDP) (Bađun, 2017; Palaz & Çolak, 2017; Fuller, 2019; ILO, 2020; Hadi, 2022)..

Influencing Factors in the Severity and Type of Accidents:

Factors such as working conditions, employee safety training, compliance with safety regulations, and the safety culture of the company can influence the type and severity of accidents (Bayram, 2022; Nævestad et al., 2020; Syed-Yahya et al., 2022; Zhang et al.,

2020).. Identifying these factors is critical to developing effective accident prevention strategies.

According to Zhang et al., (2020) lack of adequate training and lack of compliance with safety regulations are common factors contributing to serious accidents. For these authors Fu et al., (2020); Rodas & Sanchez, (2019), companies that provide safety training and promote a safety culture tend to experience fewer serious accidents.

In the work environment, medical care plays an essential role in the response to accidents (Lawn et al., 2020). According to the Ministry of Public Health of Ecuador (2021), companies are legally obliged to provide adequate medical care to injured workers in the workplace.

Medical care in the workplace is essential for the well-being of workers and the prompt recovery of those who suffer injuries. The costs associated with medical care include doctor visits, hospitalization, surgeries, medications and rehabilitation therapy. This care can vary depending on the severity of the injury and the type of care required (Sorensen et al., 2021).. Understanding how these costs vary by accident type and severity is essential for occupational safety management and business decision making.

Some companies implement workplace health care programs to reduce costs associated with accidents and improve employee recovery (Reif et al., 2020; Somani et al., 2021)..

Medical care in the work environment includes the provision of first aid, hospitalization, and rehabilitation (OSHA, 2021).

Medical care in the work environment is essential to ensure a rapid and effective response to accidents. This includes the availability of medical services in the workplace and care protocols (MSP, 2019).

Previous studies in Ecuador and Zone 8:

In Ecuador, the topic of occupational safety in the manufacturing sector has been previously investigated, but a deeper understanding of how health care costs are affected by the typology and severity of accidents in Zone 8 specifically is required (Gomez et al., 2018).

Perez et al. (2019), conducted a research on safety and accidents in Ecuador, where the relationship between safety training and the incidence of accidents in manufacturing companies in the Zone 8 region was analyzed.

For Ríos, (2019)states that, although there is previous research on occupational accidents in Ecuador, there is a knowledge gap specific to Zone 8 and its manufacturing sector, which needs to be analyzed in order to generate control and mitigation policies.

In addition, for this research the following questions were posed "is there any practical utility in segregating the figures of occupational accidents and diseases by each Manufacturing subsector?", "what advantages are obtained from such segregation compared to the overall figures published by the IESS in its annual Newsletter?", The recent enactment of Executive Decree 255 "Workers' Safety and Health Regulations" published on May 9, 2024 and Resolution CISHT 2018-001, will it have any impact on the controls exercised by the competent authority in risk prevention matters?

In order to answer these questions, several field works have been carried out in researches that have allowed us to have a real knowledge about the occupational accident rate in the different subsectors, as described by junior researchers in their works such as: Laínez León, (2022); Ana Bajaña, (2022); Quintero Becerra, (2022); Vásconez Abad, (2022); Reategui Cordova, (2022); Sánchez Alvear, (2022); Boza Baquerizo, (2022); Calderón Tenorio, (2022); García Samaniego, (2022); Veintimilla Franco, (2022); Méndez Pástor, (2022); Sánchez Flores, (2022); Úrgiles Zúñiga, (2022); Vera Carvajal, (2022); Martinez Arguello, (2023); Carranza Montalván, (2023); Chalán Michay, (2023); Altamirano Mayorga, (2023); Curimilma Jara, (2023); Mendez Velez, (2023); Villegas Quinde, (2023)..

This literature review provides a solid basis for understanding the context and key elements related to the impact of accident typology and severity on health care costs in the manufacturing sector in Zone 8 of Ecuador.

Methodology

This study adopted a quantitative approach. The target population consisted of manufacturing companies in Zone 8. Data on occupational injuries and health care costs were collected through records and employee surveys. The data were categorized by types of injuries associating each type with the cost of worker health recovery.

This research seeks to process statistical information on occupational accidents - accidents and related costs - published annually by the Ecuadorian Institute of Social Security (Instituto Ecuatoriano de Seguridad Social). The published figures refer to accidents and cases of occupational morbidity occurring in the nine productive sectors into which the C.I.I.U. (International Standard Industrial Classification) is divided.

The present study is oriented to eight of the twenty-four (8/24) subsectors, which comprise the Manufacturing sector.

Results

ANALYSIS 1: AVERAGE DAYS OF INCAPACITY DUE TO WORK-RELATED ACCIDENTS

There are two indicators in Industrial Safety that measure the degree of coverage or protection against occupational accidents that companies have: one is the Accident Frequency Rate and the other is the Severity Rate. The calculation of the Severity Index involves the days of incapacity, which is the time that the affected worker will remain with medical rest or under treatment due to the injury or health affectation suffered. Based on this data it is possible to calculate the average number of days of incapacity per accident and per subsector, as shown in TABLE 1 and TABLE 2, where the data correspond to the year 2019, whose information is obtained from the research of the following authors such as, Boza Baquerizo, (2022); Calderón Tenorio, (2022); Carranza Montalván, (2023); Chalán Michay, (2023); García

Samaniego, (2022); Laínez León, (2022); Martinez Arguello, (2023); Veintimilla Franco, (2022)..

Table 1: *Economic Subsectors*

No.	ISIC	PRODUCTIVE ACTIVITY
1	C-10	Manufacture of food products
2	C-11	Beverage processing
3	C-13	Manufacture of textile products
4	C-14	Garment manufacturing
5	C-16	Manufacture of wood products
6	C-17	Paper production
7	C-22	Rubber and plastic manufacturing
8	C-25	Manufacture of metal products

SOURCE: Own

Table 2: *Accident severity*

No.	ISIC	D	A	P
1	C-10	52776	885	59.63
2	C-11	5869	78	75.24
3	C-13	6844	89	76.89
4	C-14	6981	48	145.43
5	C-16	1252	40	31.3
6	C-17	4175	70	59.64
7	C-22	10755	137	78.50
8	C-25	7935	318	24.95

D: days of disability

A: number of accidents

P: average number of days per accident

SOURCE: Various authors

The values obtained in column (P) of TABLE 2 are the result of dividing column (D) by column (A). It measures the average time that an injured worker is absent from the company. Some accidents require more days of recovery (depending on whether they require surgical interventions, medical treatment, therapies, rest, etc.) than others.

By ordering the information recorded in TABLE 2, taking as a reference the analysis variable (P) average number of days per accident, TABLE 3 is obtained, which presents the ranking of the subsectors based on the average number of days per accident of the subsectors.

Table 3: *Ranking of sub-sectors based on average days of disability*

No.	ISIC	PREVIOUS	D	A	P
4	C-14	3	6981	48	145.43
7	C-22	9	10755	137	78.50
3	C-13	10	6844	89	76.89
2	C-11	8	5869	78	75.24
6	C-17	5	4175	70	59.64
1	C-10	4	52776	885	59.63
5	C-16	2	1252	40	31.3
8	C-25	6	7935	318	24.95

SOURCE: Own

ANALYSIS 2: REACTIVE INDICATORS vs. RISK LEVEL RATING.

The 3 subsectors with the highest average number of days per accident for 2019 are: C-14, Apparel manufacturing; C-22 Rubber and plastic manufacturing; and C-13 Textile product manufacturing. From these 3 subsectors we will select C-13 (Manufacture of textile products) and C-14 (Manufacture of clothing) in order to make a comparative analysis and show the varied behavior of the Severity Index depending on the type of productive activity.

RESOLUTION IESS CD 513.

According to Resolution CD 513 of the Ecuadorian Institute of Social Security (IESS), there are three "reactive" indicators in Ecuador to evaluate the occurrence of accidents in companies: Frequency Index (FI), Severity Index (SI) and Risk Rate (RR). TABLE 4 shows the values of the Severity Index for eight manufacturing subsectors during the period 2011-2021.

Table 4: *Severity Index by Accident Sub-sectors*

Severity Index								
Productive Subsectors								
Year	C-10	C-11	C-13	C-14	C-16	C-17	C-22	C-25
2011	11,2	7,4	7,4	12,4	12,4	8,6	7,6	18,7
2012	12,2	6,9	6,9	14,2	14,2	6,9	6,9	24,8
2013	16,9	9,8	9,8	18,8	18,8	9,8	9,9	35,9
2014	73,4	42,3	42,3	81,6	19,8	42,3	42,5	156,1
2015	37,9	21,8	21,9	42,8	23,6	21,8	22,6	80,3
2016	41,9	25,6	25,6	47,2	27,6	25,6	26,3	92,0
2017	45,5	21,9	21,9	46,9	29,2	21,9	28,8	68,4
2018	41,7	27,3	85,0	45,2	24,7	27,3	84,9	76,9
2019	32,2	59,3	59,3	73,0	41,4	48,0	59,9	88,1
2020	1,5	3,3	5,5	12,0	2,2	6,3	4,0	6,8
2021	3,2	5,1	6,2	16,1	2,6	6,9	6,4	8,7

Source: Own research

Resolution CISHT 2018-001, on the other hand, assigns a risk level (high, medium, low) to each activity; in this case, the textile manufacturing activity (C-13) is rated HIGH RISK and apparel manufacturing (C-14) is rated MEDIUM RISK.

TABLE 5 shows the values of the average number of days per accident and the Severity Index for two subsectors, contrasting them with the risk rating.

TABLE 5: REACTIVE INDICATORS YEAR 2019

ISIC	AVERAGE DAYS	GRAVITY INDEX	RISK LEVEL
C-13	76.89	59.3	ALTO
C-14	145.43	73.0	MEDIO

*Source: Resolution CISHT 2018-001: Classification, categorization and level of occupational risk.

As can be seen, when comparing the figures for 2019, the risk level rating assigned by Resolution CISHT 2018-001 to the two activities analyzed is not related to the respective Severity Index nor to the average days per accident, which could imply an adjustment of the Table of Occupational Risk Levels.

The same analysis can be made for the rest of the manufacturing subsectors.

ADJUSTMENTS TO THE RISK RATING.

There are currently two criteria for assessing risk prevention management in a productive activity. On the one hand, there are the reactive indicators and on the other hand the risk rating conferred by Resolution CISHT 2018-001 to any economic activity.

In every company, occupational risk prevention activities seek to reduce the incidence of accidents in the workplace. To achieve this objective, risk prevention management systems must be effective in reducing the number of accidents, their severity or their consequences.

This research suggests that for the analysis and qualification of the risk levels of productive activities, the results of the reactive indicators, and more specifically, the Severity Index, should be included as an input.

In order to carry out a more complete exercise for the periodic updating of risk levels, the criteria proposed for such updating are as follows:

The evolution of the reactive indicators, Frequency Index, Severity Index and Risk Rate in each economic activity.

The evolution of the Effectiveness Index or Checklist of the Ministry of Labor regarding compliance with legal provisions on risk prevention.

Pearson's correlation coefficient between the variables: historical behavior of occupational accidents by economic activity and the Efficiency Index.

This involves the segregation of the accident statistics published by the IESS, separating the data by each manufacturing subsector.

COMPARATIVE STUDY OF THE NUMBER OF ACCIDENTS IN THE MANUFACTURING PRODUCTION SUBSECTORS.

In order to carry out a study of which productive subsector presents the highest number of accidents during the period 2011-2022, a comparative study of the number of accidents among the eight subsectors was carried out. A comparative study of the number of accidents was carried out among the eight subsectors, which are ISIC code C-10 manufacture of food products, ISIC C-11 manufacture of beverages, ISIC C-13 manufacture of textile products, ISIC C-14 manufacture of clothing, ISIC C-16 manufacture of wood, manufacture of wood and cork products, ISIC C-17 manufacture of paper and paper products, ISIC C-22 manufacture of rubber and plastic products, ISIC C-25 manufacture of fabricated metal products, as shown in TABLE 6.

Table 6: *NUMBER OF ACCIDENTS BY SUBSECTORS.*

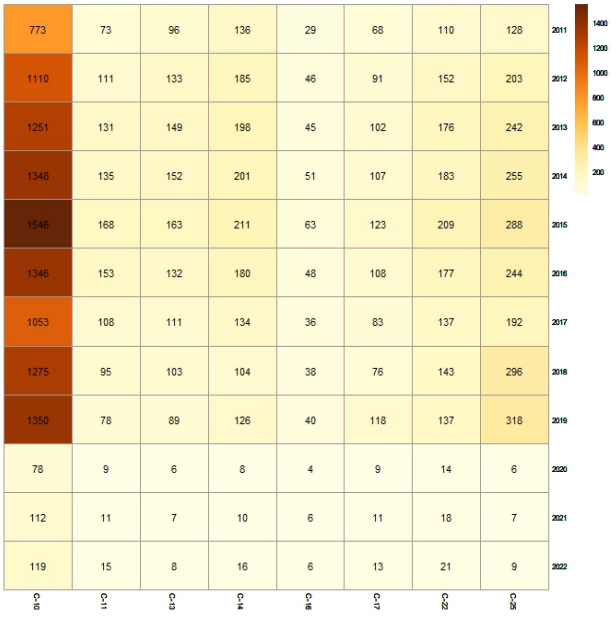
Number of Accidents								
Productive Subsectors								
Year	C-10	C-11	C-13	C-14	C-16	C-17	C-22	C-25
2011	773	73	96	136	29	68	110	128
2012	1110	111	133	185	46	91	152	203
2013	1251	131	149	198	45	102	176	242
2014	1348	135	152	201	51	107	183	255
2015	1546	168	163	211	63	123	209	288
2016	1346	153	132	180	48	108	177	244
2017	1053	108	111	134	36	83	137	192
2018	1275	95	103	104	38	76	143	296
2019	1350	78	89	126	40	118	137	318
2020	78	9	6	8	4	9	14	6
2021	112	11	7	10	6	11	18	7
2022	119	15	8	16	6	13	21	9

Source: Own research

A heatmap is a type of graph used to represent information in a matrix, where each cell of the matrix is colored according to a scalar value. Heatmaps are useful for visualizing patterns and trends in multivariate data, especially when there is a lot of data and a summary representation is sought.

The heat map or heatmap, GRAPH 1, is a graphic tool that will allow us to see which areas present a greater interest on a scale from lower to higher where the lower value numbers are represented with lighter shades such as yellow and the higher value numbers are represented with darker shades such as brown. (Torres, 2023).

Graph 1: NUMBER OF ACCIDENTS BY SUBSECTORS.



The heatmap tool shows that of all the productive subsectors studied, the one with the highest number of accidents is the C-10, whose activity is the production of food products in the period 2011-2022, with 2015 being the year with the highest number of accidents with 1546 accidents. On the other hand, we have the productive subsector with the lowest number of accidents which is the C-16 dedicated to the production of wood and manufacture of wood products and corks.

Processes in the Faculty of Industrial Engineering.

As a previous step, it is required the tabulation of occupational accidents in a segregated way, by manufacturing subsector. It is also required the tabulation of the performance of the companies' OHS Management Systems by means of the tool known as "Effectiveness Index" or "Checklist"; this control must be carried out for each Manufacturing sub-sector.

Once these two requirements have been met, the following can be done with the new information generated by the IESS Annual Information Bulletin:

Calculation of Pearson's correlation coefficient using the information collected for the variables: historical sequence of accidents and Effectiveness Index, in order to establish the effectiveness of the prevention strategies of each manufacturing subsector.

Identification of sub-sectors that merit intervention by the competent authority due to their low performance.

Determination of preventive and corrective measures to be applied in each manufacturing subsector.

The following are the questions posed at the beginning of the document:

"Is there any practical utility in segregating occupational accident and illness figures by each Manufacturing subsector?"

The results of the research will yield new data on the behavior of the occupational accident rate by productive activity, which will allow:

To alert companies in the different manufacturing subsectors about the historical behavior of accidents.

Determine the costs generated by the recovery of the health of injured workers, taking into account that such costs are associated with the severity of occupational accidents and that, in turn, the latter is a function of the degree of control exercised over the risks.

To carry out comparative analyses between subsectors with respect to the costs of recovering the health of their workers TABLE 7.

The heat map tool shows that the productive subsector with the highest level of medical care costs is ISIC code C-10. Similarly, in the year 2021 the highest cost for medical care is recorded at $910781. CHART 2.

Table 7: *COSTS FOR MEDICAL CARE.*

Costos por Atención Médica								
	Subsectores Productivos							
Año	**C-10**	**C-11**	**C-13**	**C-14**	**C-16**	**C-17**	**C-22**	**C-25**
2011	$31.991	$4.531	$5.939	$5.048	$1.072	$4.253	$7.051	$3.390
2012	$28.012	$4.955	$5.938	$4.041	$1.002	$4.096	$6.889	$2.455
2013	$44.506	$8.034	$9.176	$6.320	$1.427	$6.272	$9.436	$3.997
2014	$221.393	$38.337	$43.309	$29.744	$7.510	$30.448	$52.211	$19.529
2015	$122.617	$23.123	$22.360	$14.827	$4.442	$16.917	$28.055	$10.521
2016	$157.642	$29.356	$25.409	$18.758	$4.971	$20.730	$33.191	$12.421
2017	$135.071	$28.924	$29.608	$16.679	$4.543	$22.267	$29.540	$11.835
2018	$179.993	$23.478	$25.776	$21.619	$7.980	$30.131	$38.379	$15.149
2019	$427.101	$52.330	$61.017	$50.558	$15.994	$47.275	$94.942	$33.987
2020	$494.062	$55.985	$35.411	$54.017	$26.883	$55.522	$89.744	$40.350
2021	$910.781	$90.488	$57.206	$81.851	$47.689	$87.118	$146.696	$55.338
2022	$879.183	$111.337	$61.433	$115.423	$41.128	$98.222	$158.610	$63.877
Total	**$3.632.358**	**$470.893**	**$382.586**	**$418.889**	**$164.647**	**$423.256**	**$694.747**	**$272.854**

Source: Own research

Another aspect to highlight are the costs involved during the period of medical rest due to injury or occupational disease. These costs are twofold: on the one hand, there are the unproductive times due to the worker's absence from work; this implies the payment of additional wages to replacement workers, which increases production costs.

On the other hand, medical care for each patient has protocols that depend on the type of injury or occupational pathology that has been generated. Both the cost overruns due to extra remuneration and medical care expenses are vital to determine the real cost of an accident in the workplace. In future research it will be appropriate to address both topics in detail, in order to reflect more fully the consequences of occupational accidents and illnesses.

Calculate the occupational accident rates (number of accidents per ten thousand workers) for comparison purposes between manufacturing subsectors, as shown in TABLE 8 and GRAPH 3, with respect to the accident rate by subsector.

Table 8: *ACCIDENT RATE BY PRODUCTIVE SUBSECTORS. PERIOD 2011 - 2022*

	Accident Rate							
	Productive Subsectors							
Year	C-10	C-11	C-13	C-14	C-16	C-17	C-22	C-25
2011	10,09	6,72	6,75	11,25	11,28	6,67	6,51	15,76
2012	15,72	8,89	8,89	18,16	18,20	8,82	8,75	32,80
2013	16,95	9,83	9,79	18,89	19,01	9,81	11,25	36,51
2014	17,08	9,88	9,85	18,96	19,05	9,86	9,83	36,63
2015	19,28	11,11	11,15	21,76	21,69	11,12	11,39	41,86
2016	16,35	9,98	9,95	18,37	18,48	9,97	10,21	37,61
2017	12,81	6,13	6,16	13,20	13,02	6,12	7,62	26,65
2018	15,06	8,60	8,49	10,22	10,12	5,36	7,92	41,53
2019	16,71	7,88	7,71	13,18	13,22	13,20	7,63	49,47
2020	1,02	1,03	1,09	0,95	0,96	1,04	1,00	0,96
2021	1,22	1,20	1,21	1,21	1,24	1,25	1,21	1,25
2022	1,49	1,48	1,43	1,53	1,61	1,46	1,46	1,55

Source: Own research

The graph shows that, comparing the results of the accident rate among the eight productive subsectors, there is one that should be taken into account especially because it has a very high rate in contrast to the others, which is subsector C-25 manufacture of fabricated metal products. In addition, for the year 2019 it presents its highest point in its accident rate per 1000 workers with a result of 49.47, not only becoming the highest value of the subsector, but also the highest among all subsectors. On the other hand, it can be noted that the accident rate in the eight subsectors in the year 2020 presented its lowest rates, but from the year 2021 to 2022 it begins to increase, but significantly.

"What are the advantages of such segregation compared to the overall figures published by the IESS in its annual Newsletter?"

The application of what is proposed in this project requires the implementation of 2 academic initiatives:

Creation of the extracurricular chair "FCI-042" to disseminate the content and scope of the FCI project, aimed at students of the School of Industrial Engineering interested in participating in internships at the IESS (Division of Labor Risks) and the Ministry of Labor, as a result of the eventual signing of an agreement with these institutions.

Creation of the professional specialty "Forensic analysis of occupational accidents" for the training of experts in:

Application of universally accepted methods for the identification of the root cause(s) of occupational accidents and diseases. It covers all the casuistry originated in the reports to the IESS of occupational accidents and diseases generated by public and private companies in the country.

Application of the method for the classification, categorization and codification of the causes and effects of occupational accidents and diseases.

Presentation of the proposal of preventive and corrective measures for the reduction of occupational accidents in the manufacturing subsectors.

Use of the digital tool "Vademecum of causes and effects of occupational accidents and diseases" and updating of the tool.

The advantages of the proposed situation are:

individual management of occupational accident rates by manufacturing subsector

the presentation of proposals to reduce the frequency and/or severity of occupational accidents and illnesses in the manufacturing sector, based on information from each subsector.

The possibility of creating the professional specialty "Forensic analysis of occupational accidents" that would collaborate in the investigation of occupational accidents and diseases to determine their causes and effects using universally recognized methods, analyzing recurrence, proposing intervention models to subsectors with low results in

prevention and generally contributing to the monitoring of occupational accidents in Ecuador.

Will Executive Decree 255 "Workers' Health and Safety Regulations" published on May 9, 2024 and Resolution CISHT 2018-001 have any impact on the controls exercised by the competent authority in terms of risk prevention?

The Thirteenth Transitory Provision of Executive Decree 255 establishes the application of the "List of Categorization and Levels of Occupational Risk in terms of occupational safety and risk prevention" by virtue of Resolution No. 2018-001 issued by the Interinstitutional Committee on Occupational Safety and Hygiene, which contains the classification by risk level of economic activities in terms of occupational safety and health.

The risk level categorization list shows the status for each manufacturing subsector. The proposal of the present research will show the following:

- The occupational accident rate for each manufacturing subsector.
- The historical behavior of occupational accidents.
- Levels of legal compliance in the area of occupational risk prevention.
- The correlation that exists between legal compliance on risk prevention and the behavior of accidents in a given subsector.

In turn, the above will make it possible:

Establish a ranking of the performance of the country's companies and productive sectors, based on the correlation coefficient between the two trends: labor claims and legal compliance.

Define which sectors should be encouraged based on their accident prevention behavior and which should be intervened by the authority for preventive purposes.

Conclusions

The impact of the type and severity of accidents on health care costs in Zone 8 manufacturing companies is an issue of great relevance. The results highlight the need for more effective preventive measures and safety programs. A larger and more detailed study is recommended to fully understand these dynamics.

On the other hand, when reviewing the "List of Categorization and Levels of Occupational Risk in terms of safety and Occupational Risk Prevention" of Resolution CISHT 2018-001, it is clear that the criteria for segregating the occupational accident rate contemplated in the present investigation should be included in the update of said list, approved in Executive Decree 255: number of accidents and medical care costs due to occupational accidents in eight different Manufacturing subsectors.

As for the validity of these studies, although the present analysis corresponds to the year 2019, if the model presented here is adopted, it can be replicated every year, with the consequent advantage of having an updated analysis of the behavior of occupational accidents. This involves not only accidents but also occupational diseases.

Similarly, the other productive sectors of the ISIC, such as agriculture, construction, mining, etc., can also be analyzed from the point of view of occupational accident figures. The central goal is, in any case, the segregation of information that will allow decisions to be made that will benefit safety in the workplace.

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