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Evaluation of the Proper Use of Personal Protective Equipment by Construction Workers in the Chone Canton, Ecuador, Period 2025-2026

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Abstract---*In the construction sector, personal protective equipment (PPE) is essential to protect workers from potential occupational hazards. However, it is common to find that PPE is frequently misused or even not used at all by construction workers. Therefore, it was deemed necessary to conduct research to evaluate the proper use of PPE by construction workers in the canton of Chone, Manabí province, during the year 2026. The research methodology employed a quantitative approach, with a non-experimental, field-based design, collecting empirical data through the application of the questionnaire from the First Survey on Occupational Safety and Health in Ecuador. It was considered to apply the items of the workplace safety dimension to a representative sample of 283 construction workers in Chone. This descriptive, cross-sectional study revealed complex risk factors faced by construction workers, who, in 89.8% of cases, do not use personal protective equipment properly. This highlights a significant need requiring attention, as construction workers lack the knowledge to use protective equipment effectively.*
Keywords---*Personal protective equipment, construction, workers, safety, risks.*

Introduction

Over time, the construction sector has grown into a workforce that now represents 7.5% of the global population. Providing the necessary tools and resources to protect construction workers is fundamental, and they must have access to the universal right to use personal protective equipment (PPE) to protect themselves from potential workplace injuries (Hameed et al., 2021). Based on this, the International Labour Organization (ILO) (OIT, 2022) has stated that employers in this sector have an obligation to provide their workers with appropriate instructions and training on the proper use of PPE. This includes ensuring the proper maintenance, cleaning, and disinfection of PPE at appropriate intervals, as well as its correct use, all of which contribute to reducing workplace risks.

Despite the above, it is important to note that approximately three million people die each year worldwide from workplace accidents and illnesses (Gómez-de-Gabriel et al., 2023). Construction is among the top three most dangerous sectors globally, with up to 200,000 fatal injuries annually, representing 63% of the total. The Asia-Pacific region is the most affected globally, with figures that continue to rise, posing a significant challenge that must be overcome to safeguard the health and safety of workers (OIT, 2023).

Similarly, it is important to note that in the Latin America and Caribbean region, there is currently a high rate of workplace accidents due to a lack of training on the importance of the proper use of personal protective equipment (PPE). Inadequate use of PPE, and even its complete absence, is common (Chávez & Calderón, 2021). Furthermore,

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another study demonstrated that in the Republic of Colombia, construction workers are three times more likely to be killed or injured than those working in other sectors. This situation arises from risk factors such as the lack of PPE. Workers frequently express a lack of knowledge about its correct use and report discomfort, interference, and difficulty putting it on, as most of the PPE is old and damaged (Villota et al., 2023).

Regarding Ecuador, it was found that most workplace accidents among construction workers are preventable with the proper use of personal protective equipment (PPE). However, this phenomenon occurs due to a lack of commitment from employers, who should provide the necessary tools and strategies for employees to receive ongoing training in this area. Such training would foster a sense of workplace and collective safety, contributing to a reduction in potential risks and vulnerability to accidents caused by unsafe practices on construction sites (Sichiqui & Gárate, 2024).

Following on from the above, it is important to note that the Ecuadorian Social Security Institute (IESS) (IESS, 2024) revealed a significant number of workplace accidents in the construction sector in 2022, resulting in 14,429 cases of disability and 126 deaths. Among the most common injuries suffered by workers were fractures, contusions, internal trauma, and amputations, primarily affecting the upper and lower extremities and the head. The IESS also indicated that Guayas and Pichincha are the two provinces with the highest number of workplace accidents in the construction sector.

A study conducted in the city of Ambato, Tungurahua province, revealed that 5% of construction companies exhibit high-risk situations that lead to serious injuries among workers. This is because these employees only receive superficial safety talks for five (5) minutes before each workday. As a result, 49% of the workers in these companies face moderate risks, and 22% face significant risks due to a lack of training and follow-up. This leads to the improper use of personal protective equipment (PPE) and contributes to workplace accidents. The 46 workers participating in the study commonly stated that the accidents could have been prevented but occurred due to the lack of PPE use (Balladares et al., 2023).

Regarding the province of Manabí, specifically in the city of Manta, a study conducted at Bravo Construcciones identified several risk factors that compromise the safety of its 20 workers. The study found that respiratory illnesses are very common, followed by falls, blows, and cuts among the staff. These occur primarily due to awkward postures, exposure to particulate matter, working at heights, and the improper use of sharp objects. Furthermore, it was found that construction workers and their assistants are at the highest risk of workplace accidents. Therefore, the research highlighted the need to provide them with personal protective equipment (PPE) in optimal condition to prevent occupational hazards that affect the safety and health of these workers (Parraga, 2025).

Multiple studies show a complex need in the construction sector, driven by non-compliance with national and local regulations and a lack of preventive culture in construction companies, which increases risks to workers' safety and health (Behera et al., 2014).

Methodology

The research was approached from a quantitative perspective, which, according to the author Hernández-Sampieri (2018), is considered a research approach that involves a set of systematic, empirical, and critical research processes, appropriately estimated when assessing the magnitude or occurrence of the phenomenon and verifying hypotheses, with the corresponding statistical analysis. Based on this quantitative approach, the study could analyze and measure the level of personal protective equipment use by collecting statistical data.

Research Design

The design of the investigation was considered non-experimental, since this research process was developed without the manipulation of the variables. In addition, it is a descriptive and cross-sectional research, with the collection of empirical information at a single point in time during the period 2025-2026 (Kobes et al., 2010).

Regarding the study population, it is important to note that it consisted of a total of 1,075 construction workers employed on various projects in the Chone canton, Manabí province. The sample represents a fraction of the population and is therefore considered a subset of this population. It has a series of characteristics that reproduce a portion of the population as accurately as possible. Given this, the participation of those workers actively employed on the construction sites during the data collection period and who voluntarily agreed to participate in the research was taken into consideration. Equation one was applied to calculate the sample size.

$$n = \frac{N * Z2 * p * q}{e^2 * (N-1) + Z^2 * p * q} \qquad (1)$$

Where:
n →Sample size
N →Population size = 1,075 Construction sector workers
Z →Confidence level of 95% = 1.96
p →Probability of success = 0.50
q →probability of failure = 0.50
5% precision = 0.05 n →= 283.21

It is also relevant to note that the sample size was obtained with a level of trust of 95% and a margin of error of 5%, and it was formed by n= 283 construction workers in Chone, obtained based on equation 1; therefore, we worked with 283 construction workers in the Chone canton.

Measuring instruments and techniques

The measurement instrument used was the questionnaire, part of the survey as a data collection technique. Direct observation and both techniques allowed the obtaining of statistically significant results from the responses to the items presented in the questionnaire of the First Survey on Safety and Health at Work (I-ESST) for Ecuador in its original version, approved by more than 40 experts (researchers, university teachers and professionals) at the national and international level. Regarding the work safety dimension, it is structured into 2 sub-dimensions: exposure to mechanical risks and personal protective equipment, making up a total of 17 items, applied to the participants (Gómez, 2017).

Procedures

The investigation was carried out in several phases:

1) Literature review of scientific studies related to occupational safety and personal protective equipment in the construction sector.
2) Diseño y validación de herramientas de recolección de datos.
3) Application of surveys and observations to the workers of the selected construction works in the Chone canton.
4) Collection and organization of the data obtained during fieldwork.
5) Statistical analysis of the information, using tables and graphs to interpret the results.
6) Interpretation of the results based on the objectives set in the research.

Results

The results obtained from the survey technique applied to construction workers in the Chone canton, Manabí province, yielded a series of findings. Initially, statistical information was gathered on the sociodemographic data of the participants. Subsequently, data focused on the items presented in the questionnaire of the First Survey on Occupational Safety and Health (I-ESST) for Ecuador, in its original version, were revealed, providing important information on the variables of the study. Table 1 shows the sociodemographic characteristics of the construction workers.

Table 1
Sociodemographic Characteristics of Construction Sector Workers

State Civil	Single	Count	109	109
		% of total	38.5%	38.5%
	Married	Count	108	108
		% of total	38.2%	38.2%
	Free Union	Count	66	66
		% of total	23.3%	23.3%
Total		**Count**	**283**	**283**
		% of total	**100.0**	**100.0**
			Place of Residence	

			Chone	Total
Sex	Male	Count	283	283
		% of total	100.0%	100.0%
Total		**Count**	**283**	**283**
		% of total	**100.0%**	**100.0%**
Age	From 18 to 25 years old	Count	75	75
		% of total	26.5	26.5
	From 26 to 35 years old	Count	108	108
		% of total	38.2	38.2
	From 36 to 45 years old	Count	74	74
		% of total	26.1	26.1
	From 46 to 60 years old or more	Count	26	26
		% of total	9.2	9.2
Total		**Count**	**283**	**283**
		% of total	**100.0**	**100.0**
Time Worked in it sector of the construction	From 1 month to 6 Months (Short Experience)	Count	146	146
		% of total	51.6%	51.6%
	From 7 months to 1 Year (Average Experience)	Count	96	96
		% of total	33.9%	33.9%
	From 2 years old or More (Advanced Experience)	Count	41	41
		% of total	14.5%	14.5%
Total		**Count**	**283**	**283**
		% of total	**100.0%**	**100.0%**

Through the statistical representation in Table 1, which focuses on the sociodemographic characteristics of the construction workers who participated in the study, all 283 participants (100%) live in Chone and are all male. Regarding age range, the largest group (38.2%) was between 26 and 35 years old, followed by 26.5% between 18 and 25 years old, and 26.1% between 36 and 45 years old.

Regarding marital status, it is evident that the majority, 38.5%, are single, followed by 38.2% who are married. The majority, represented by 51.6%, have short-term experience, less than 6 months, working in the construction sector. Furthermore, 96.8% work a standard workday. Table 2 shows the duration of noise exposure during the workday for construction workers.

Table 2
Exposure to Noise During the Working Day of Construction Sector Workers

For how much of your usual workday are you exposed to noise so loud that you have to raise your voice to talk to someone one meter away?			
		Frequency	**Percentage**
Selected option	Almost always	99	35.0%
	Sometimes	144	50.9%
	Hardly ever	24	8.5%
	Never	16	5.7%
	Total	**283**	**100.0%**

Note: Prepared by the author, based on data obtained from a survey applied to construction workers in the Chone canton

The statistical analysis, which reveals significant data on the amount of time construction workers are routinely exposed to high noise levels—to the point where they are forced to constantly raise their voices to speak to colleagues at a short distance of one meter—showed that this is a common phenomenon, occurring sometimes in 50.9% of cases and almost always in 35%. This finding highlights a complex reality that violates their right to work in a safe environment. Furthermore, workers in this sector are subjected to numerous risk factors, as illustrated in Figures 1 and 2 of this research. Figure 1. Exposure to Risk Factors During the Workday

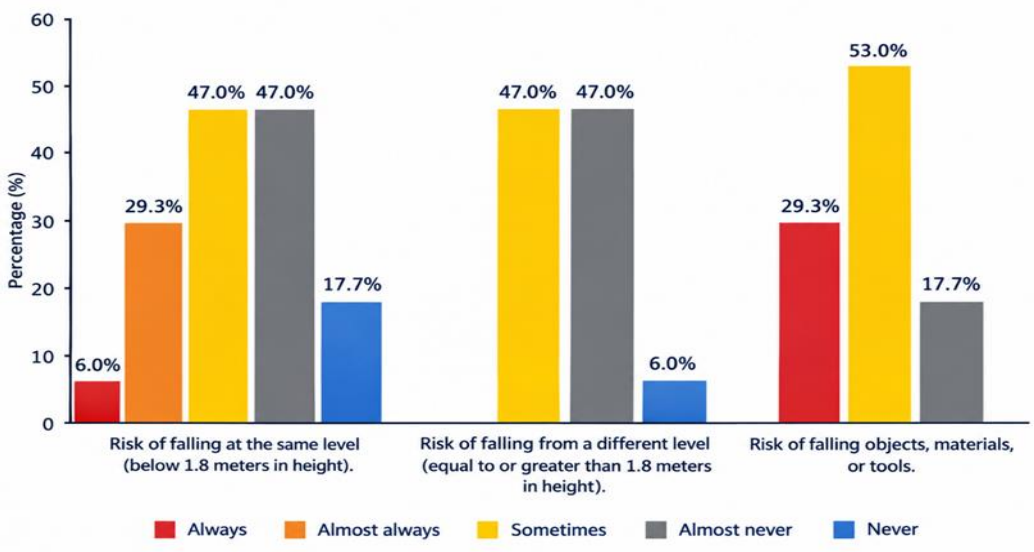


Figure 1. Exposure to Risk Factors During the Workday

Note: Prepared by the author, based on data obtained from a survey applied to construction workers in the Chone canton.

Regarding the statistical representation in Figure 1, it can be observed that the risk of falls on the same level is very low for workers, as the majority (47%) are rarely exposed to this risk. The situation changes with the risk of falls from a height, which is more frequent, occurring sometimes in 47% of cases. Meanwhile, the risk of falling objects, materials, or tools increases in probability, occurring sometimes in 53% of cases and almost always in 29.3%, making this last risk very common among construction workers in the Chone canton

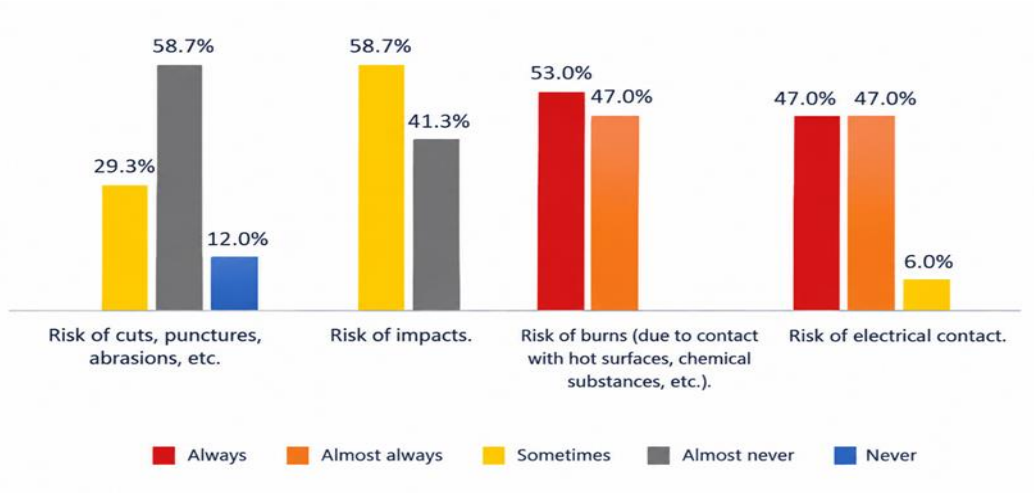


Figure 2. Diversity of Risks Exposed to Workers in the Construction Sector

Note: Prepared by the author, based on data obtained from a survey applied to construction workers in the Chone canton.

Continuing with the diverse range of risk factors to which construction workers in the Chone canton are exposed, it is evident that these risks can vary considerably. This can be argued because, in most cases (58.7%), workers rarely experience risks of cuts, punctures, or abrasions. However, the reality differs regarding the risk of blows, which occurs more frequently (58.7%).

Similarly, it is important to point out that there are other, more common and concerning risks. Among these, the risk of burns from potential contact with hot surfaces and chemicals stands out. Construction workers are exposed to this risk in 53% of cases, followed by another group of 47% who experience it almost always. Therefore, it is essential to consider this factor and the biosafety measures that should be used to avoid exposure. Another common risk experienced by construction workers is exposure to electrical shock, which is experienced by 47% of participants always and by another 47% almost always. Given this reality, it is necessary to emphasize the importance of the proper use of personal protective equipment. Figure 3 shows the main personal protective equipment used by workers in the construction sector.

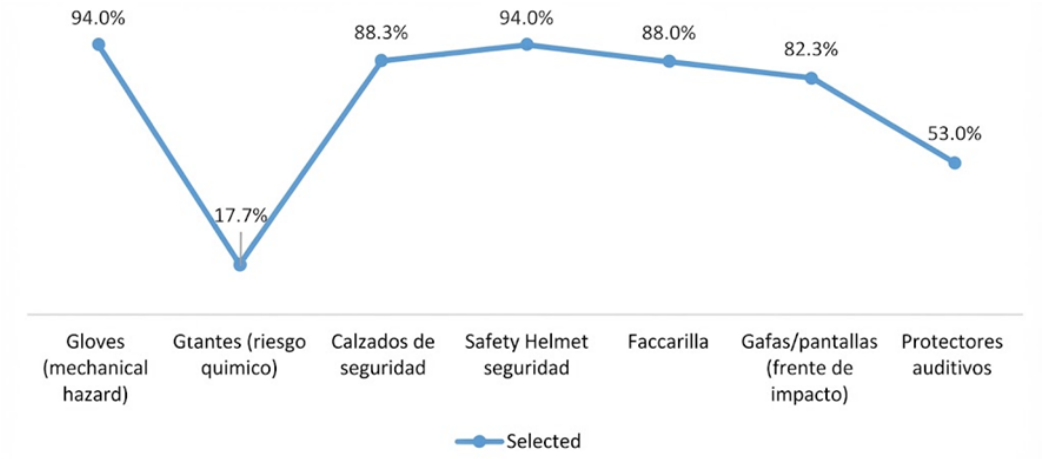


Figure 3. Main Personal Protective Equipment Used by Workers in the Construction Sector

Note: Prepared by the author, based on data obtained from a survey applied to construction workers in the Chone canton.

In the field research process, it was found that in 100% of cases, the 283 participating workers indicated that they are required to use personal protective equipment (PPE). Regarding the use of the 14 options presented in the questionnaire about the various types of PPE used by these workers, only 7 material resources used as PPE were highlighted. Among these, mechanical risk gloves were the most frequently selected, with 94% of the participating workers indicating their mandatory use. Chemical risk gloves, on the other hand, were significantly less frequently used, with only 17.7% reporting that their use was mandatory. Safety footwear was also strongly recommended, with 88.3% of the workers stating that its use was mandatory.

Similarly, other personal protective equipment (PPE) most commonly used by construction workers includes safety helmets, required by 94% of participants. Face masks are also required on construction sites for 88% of this group of workers. Impact-resistant safety glasses are another product that participants are required to use, in 82.3% of cases. Hearing protection is required to a lesser extent, by a representative group of 53% of the construction workers who participated in the study. This demonstrates that the most basic protective equipment is consistently used. However, equipment such as safety harnesses and fall arrest devices were not selected, even though the risk of falls from different levels is quite common. Likewise, electrically insulating gloves and footwear were not selected by any of the participants, but the risk of electrical contact is an alarming phenomenon that is almost always present in construction, which is important to consider. Figure 4 shows an evaluation of the proper use of the main personal protective equipment used by workers in the construction sector.

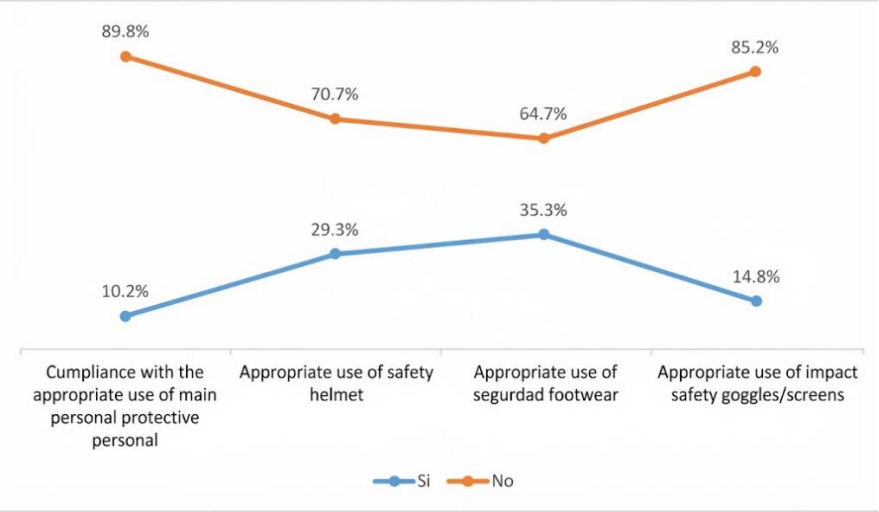


Figure 4. Proper Use of Main Personal Protective Equipment by Workers

Note: Prepared by the author, based on data obtained from a survey applied to construction workers in the Chone canton.

This presents relevant information on the proper use of personal protective equipment (PPE) by construction workers in the Chone canton, whom the researcher analyzed using direct observation. It was observed that the majority of participants (89.8%) were unaware of and failed to use the main PPE items correctly. This was a common issue with safety helmets, which were not used properly by 70.7% of the workers. Regarding safety footwear, 64.7% of the workers did not fasten the toes correctly. Similarly, 85.2% of the participants did not know the proper way to use face shields.

Based on the multiple results obtained in this research process, a series of challenges regarding the knowledge and proper use of safety equipment by construction workers in the Chone canton are evident. The reality is that these workers are continuously exposed to various risk factors that compromise their well-being and physical health. However, most have adapted to these diverse risks and are frequently exposed to a wide range of hazards without having sufficient knowledge or the necessary tools to protect themselves from these potentially dangerous situations, which could lead to accidents and prevent them from continuing to work in the construction sector.

Discussion

Given the diverse results in the investigation, an analogy is demonstrated. The findings of this study were compared to those of previous research on the same topic. It was deemed important to highlight the common risks of falls from heights and falling objects. Alarmingly, this research also found that workers are frequently, almost always, and always exposed to the risk of burns and electrical shock. However, regarding these latter risks, workers do not use the necessary protective equipment, such as safety harnesses, fall arrest devices, and electrically insulating gloves and footwear.

As stated above, it is necessary to indicate that in the study presented by the authors Villota et al. (2023), it was demonstrated that there is a significant lack of compliance with the use of personal protective equipment (PPE) among most construction workers, who are not accustomed to using such equipment and have a poor understanding of biosafety measures. It was also noted that these workers do not receive sufficient training and instruction on the importance of the proper use of PPE. This situation poses a major challenge to the safety and health of this group of workers, who require better training and preparation to work safely and effectively.

For their part, Sichiqui & Gárate (2024) demonstrated in their study that in 32% of cases, construction workers are exposed to accidents on building sites due to the incorrect use of personal protective equipment (PPE). Falls from heights are a frequent risk, occurring in 47% of cases in this study. These researchers indicated that such risks result from a lack of attention to weather conditions and overconfidence in routine tasks on the part of construction workers. Furthermore, they stated that it is urgent to strengthen the safety measures that workers must apply when using PPE, ensuring its proper maintenance and selection, along with timely safety awareness, to guarantee their safety and health on various construction sites. This can be achieved through appropriate training.

Furthermore, the results of this research are very similar to those found in the study by Balladares et al. (2023), who conducted their research in the Andean region of Ecuador and demonstrated a moderate risk of 49% for falls from heights and falling objects due to collapse or toppling. They also emphasized that workers are more vulnerable in jobs that generate higher risks, such as electrical linemen. Similarly, they indicated that although employers do provide workers with PPE to perform their jobs in safe environments, unfortunately, there is a lack of oversight and continuous monitoring of the condition of this equipment.

Conclusions

The research process revealed several risk factors to which construction workers in the Chone canton, Manabí province, are exposed. They are frequently exposed to risks such as burns and electrical shock. However, they lack the knowledge and access to personal protective equipment to ensure maximum safety from these common workplace hazards.

Regarding the mandatory use of personal protective equipment (PPE), it was found that everyone is required to use various PPE items. However, only the most basic items, such as work gloves, safety shoes, hard hats, face shields, and hearing protection, are frequently used. Furthermore, there are other types of PPE whose importance is not widely understood.

It was analyzed and determined in detail that the majority of construction workers do not comply with the proper use of essential personal protective equipment (PPE). This presents a complex challenge regarding safety, health, and the environment, as it reveals a significant lack of knowledge among these workers. This lack of knowledge, resulting from insufficient training and education provided by qualified professionals, makes them vulnerable to a wide range of risks that compromise their safety and health. This vulnerability stems from a lack of knowledge, compliance, training, and follow-up regarding the use of PPE in their work within the construction sector

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