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CRITICAL EXAMINATION OF WORKPLACE ACCIDENT ASSOCIATIONS WITH PERSONAL PROTECTIVE EQUIPMENT DEMAND IN THE CONSTRUCTION SECTOR

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ABSTRACT: The construction industry is an area with high rates of workplace accidents, given the presence of a large workforce and the need for extreme human attention during activities. However, the implementation of practices and research in occupational safety management can contribute to mitigating dangers and risks of accidents on construction sites. The purpose of this investigation was to analyze the current situation of workplace accidents in building construction, establishing correlations between different body parts affected and the growth of the Personal Protective Equipment (PPE) market. The results revealed that among the body areas affected during workplace accidents, the head/cranium region has the highest fatality rate for workers. Additionally, it was noted that despite the increase in investments in PPE in recent years, the number of fatal accidents remains considerably high in the country. In light of this scenario, it is imperative to implement more effective actions to ensure the safety of workers on construction sites.
KEYWORDS: Workplace accidents. Construction industry. Work safety.

INTRODUCTION

The crucial sector for national economic development is the construction industry, although it is recognized for facing considerable challenges in the realm of workplace safety. Construction sites in this industry expose workers to occupational hazards that,

without proper preventive measures, can result in irreversible damage and even fatalities. Therefore, it is imperative to develop action plans and implement preventive and protective measures to manage these occupational risks.

In addition to penalties, non-compliance with standards, both by workers and employers, can lead to serious and, in some cases, fatal accidents. In 2019, the national death rate was 11.76 cases per 100,000 workers, as reported by the National Association of Occupational Medicine (ANAMT). Faced with this reality, the priority for construction site managers should be the health and safety of workers to prevent the development of occupational diseases and the occurrence of workplace accidents. However, it is regrettable to observe that in many construction sites, workers often neglect the occupational risks they are exposed to. An aggravating factor is that several companies in the sector do not provide adequate training or create healthy and safe conditions for their workers.

This highlights the importance of occupational safety, as emphasized by Silva, Santos, and Amaral (2018). Occupational safety plays a crucial role in the life of the worker, aiming to promote and preserve their health. This perspective is essential in a globalized discussion that spans various areas of civil engineering analysis, being vital for any sector of activity. Thus, the need for more comprehensive meetings and detailed studies on data and cases in this environment is evident, contributing to its development. Studies indicate that investing in occupational safety and health not only sets a company apart but also results in better team performance and a positive image in society, as highlighted by Silva et al. (2016).

Given the presented context, this study analyzed data on workplace accidents recorded in Brazil, specifically related to building construction, as provided by the Digital Observatory of Health and Safety at Work (SMARTLAB). Subsequently, this information was correlated with data from the Personal Protective Equipment (PPE) market, obtained from the National Association of the Safety and Protection Material Industry (ANIMASEG). The purpose is to provide an updated view of the health and safety of workers involved in building construction and highlight the need for

improvements in the effective implementation of preventive and protective measures on construction sites.

METHODOLOGY

The research requires a careful analysis of available knowledge, along with the meticulous application of methods, techniques, and other scientific procedures (Gil, 2009). This approach emphasizes the importance of critically examining the existing knowledge base and the need to employ robust methods to ensure the validity and reliability of research results. Based on Gil's conceptual foundations (2009), this study is categorized as descriptive-exploratory concerning its objectives. The adopted procedures involve bibliographic and documentary research, using secondary data. The methodological approach is qualitative-quantitative, indicating an analysis that incorporates qualitative and quantitative aspects for a more comprehensive understanding of the studied phenomenon. This classification and methodology choice suggest a search for in-depth understanding, supported by literature review and analysis of existing documents.

The observation and analysis of the phenomenon were conducted through the Digital Observatory of Health and Safety at Work (SMARTLAB), accessed through its website, delimited by the period between 2018 and 2022. This observatory results from collaboration between the Ministry of Labor Public Prosecutor's Office, the International Labor Organization (ILO), and the University of São Paulo (USP). The online portal systematically gathers data and information, facilitating access to statistics that were previously scattered across different government database sources. Simultaneously, annual data on the occupational safety market and the Personal Protective Equipment (PPE) market were collected through the portal of the National Association of the Safety and Protection Material Industry (ANIMASEG).

Considering these systems as reliable sources of information, it was possible to collect important datasets, including the Annual Communication of Occupational Accident Report (CAT), the annual number of body parts affected, the annual estimate of underreported accidents, and the annual evolution of the PPE market, both globally and

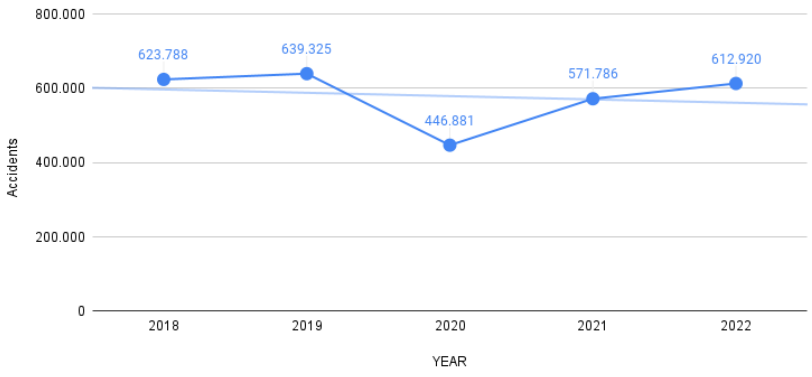
for each selected equipment. The data obtained from the Digital Observatory of Health and Safety at Work were filtered for the "Building Construction" industry.

The analysis of the data from the Digital Observatory of Health and Safety at Work and the National Association of the Safety and Protection Material Industry (ANIMASEG) was conducted through descriptive statistics, with the aid of Microsoft Excel software used for formulating tables, graphs, and diagrams presented in the research results.

RESULTS AND DISCUSSION

Figure 1 presents the number of workplace accidents recorded between 2018 and 2022, using data from the Digital Observatory of Health and Safety at Work. Considering the year 2019 as a reference, which recorded the highest in the analyzed period, there is approximately a 5% reduction compared to 2022. It is important to note an interruption in the graph in 2020 due to the outbreak of the COVID-19 pandemic, resulting in a significant decrease in jobs, especially in its initial stage. According to information from the Brazilian Institute of Geography and Statistics (IBGE, 2020), the commercial sector lost about 400,000 jobs in the first year of the pandemic.

Figure 1 - Variation in the Number of Workplace Accidents in Brazil between 2018 and 2022.

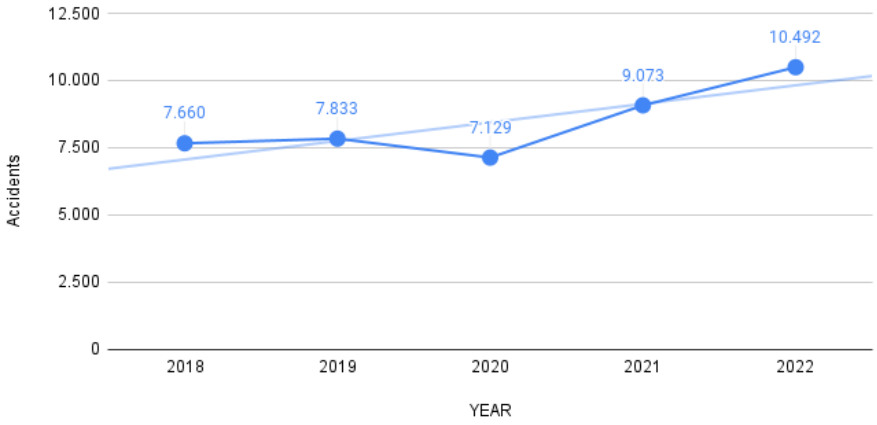


Source: Digital Observatory of Health and Safety at Work

Based on comprehensive data on workplace accidents in the country, a focused analysis was conducted on incidents occurring during building construction, given the notable increase in the number of accidents in this specific activity. As evidenced in

Figure 2, even after a reduction in accidents due to the COVID-19 pandemic, the number of incidents in 2022 reached 10,492, significantly higher than the year before 2020, which recorded 7,833 accidents, representing a percentage growth of 25.3%.

Figure 2 - Variation in Building Construction Accidents between 2018 and 2022.

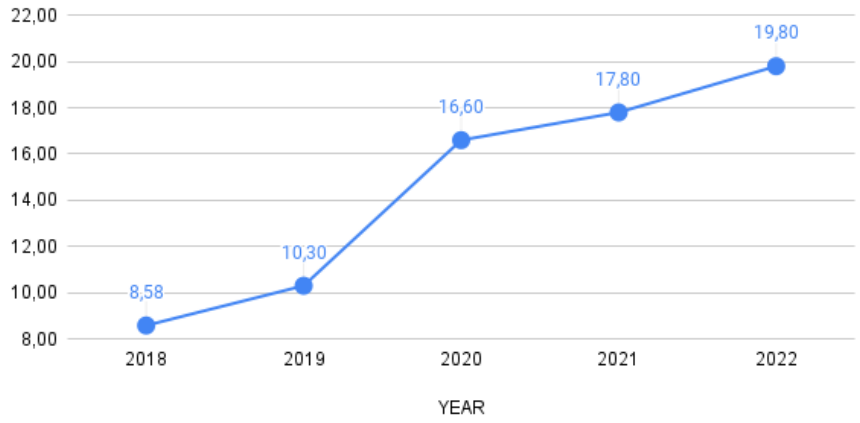


Source: Digital Observatory of Health and Safety at Work

As the number of workplace accidents evolved, there was a growing demand for equipment aimed at ensuring the protection of workers. As illustrated in Figure 3, data provided by the National Association of the Safety and Protection Material Industry (ANIMASEG, 2022) reveals an exponential growth of approximately 230% in investments in the Personal Protective Equipment (PPE) market from 2018 to 2022. It is noteworthy that the highest investment occurred between 2019 and 2020, totaling approximately 6.3 million reais.

It is relevant to highlight that this concentrated increase between 2019 and 2020 is mainly associated with the intensification of the COVID-19 pandemic, which witnessed its first wave of cases in 2020. This first wave extended from February 23rd (9th epidemiological week of 2020) to July 25th, 2020 (45th epidemiological week of 2020), recording 7,677 weekly deaths, according to data from the Ministry of Health (2020). Faced with the demand generated by the pandemic, there was a need to increase the production of Personal Protective Equipment for workers involved on the front lines of the fight against the COVID-19 pandemic. This need is supported by the 327% increase in the production of respiratory protection equipment between 2019 and 2020, as indicated by ANIMASEG (2022).

Figure 3 - Variation in Market Investment in Millions of Brazilian Reais in Personal Protective Equipment (PPE) between 2018 and 2022.

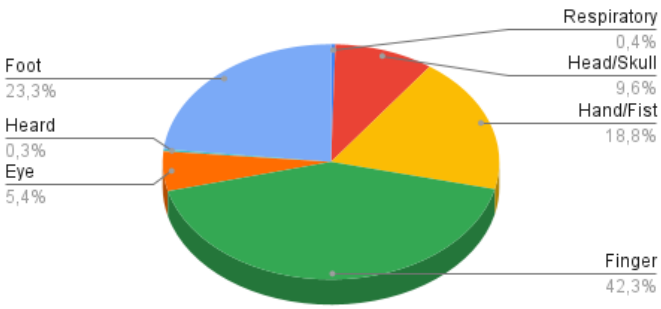


Source: National Association of the Safety and Protection Material Industry (ANIMASEG)

In order to conduct a more in-depth analysis of the comparative scenario between investments in personal protection and the corresponding accidents and risks faced, it is possible to examine the distribution of accidents in the construction industry, considering the different body parts affected, along with their respective fatality rates, as recorded in the Digital Observatory of Health and Safety at Work from 2018 to 2022, as presented in Figures 4 and 5.

Examining Figure 4, which represents the percentage of accidents by body part in the construction industry, a disproportion in the affected areas stands out, with the "Finger" being the most frequently affected part, totaling 9,018 accidents, equivalent to 42.3% of the total accidents, a significant number considering the total recorded of 21,198 accidents. It is relevant to note that the Digital Observatory of Health and Safety at Work, in analyzing the period and the body parts in question, does not make a distinction for the "Finger" category, which creates ambiguity and inconsistency in the data, as it can refer to both upper limbs (hands) and lower limbs (feet).

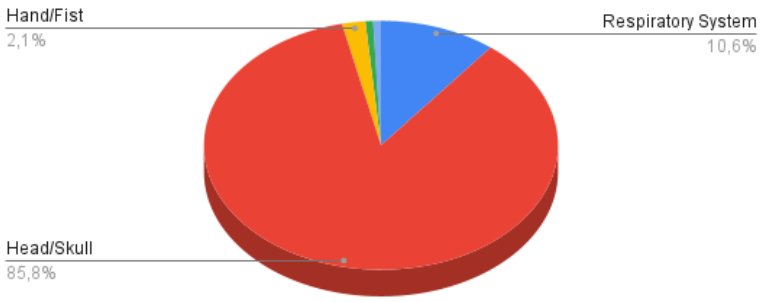
Figure 4 - Number of Accidents by Body Part in Construction Industry (2018-2022).



Source: Digital Observatory of Health and Safety at Work

Figure 5 displays the percentages of mortality resulting from injuries in different body parts of workers. The data reveals that the head/skull region represents the absolute majority, with 121 deaths, corresponding to 85.8% of the total body parts analyzed during the mentioned period.

Figure 5 - Number of Deaths by Body Part in Construction Industry (2018-2022).



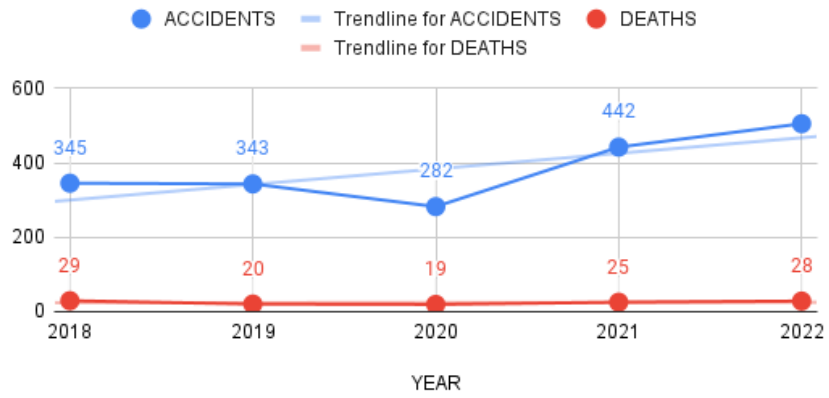
Source: Digital Observatory of Health and Safety at Work

With the intention of deepening the analyses and obtaining more detailed parameters on workplace accident situations, as mentioned earlier, and their correlation with the growth of investment in the Personal Protective Equipment (PPE) market, three specific types of accident occurrences (head/skull, respiratory system, and finger) were selected. This selection was based on the mortality rate and the percentage of accident incidence. These data were then compared with the variation in the manufacturing rate of

PPE related to the mentioned accidents, including safety helmets, respirators, safety footwear, and safety gloves.

Initially, a comparison was made between the quantity of accidents and deaths related to the head/skull region covering the period from 2018 to 2022, as presented in Figure 6. There is an approximate 46% growth between 2018 and 2022, while the number of deaths remained stable over the analyzed period. However, a significant decrease is highlighted in the year 2020, representing a 17.8% drop compared to the previous year. It is important to note that in 2020, there was a reduction in job positions, as mentioned earlier.

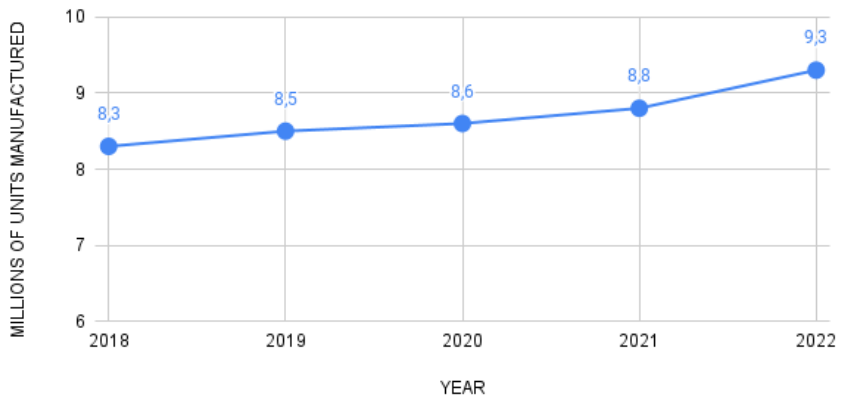
Figure 6 - Variation in Accidents and Deaths Involving Head/Skull in Construction Industry (2018-2022).



Source: Digital Observatory of Health and Safety at Work

Regarding protective measures, the helmet is undoubtedly one of the most widely used Personal Protective Equipment (PPE) on construction sites. As evidenced in Figure 7, there is a consistent increase in the manufacturing of safety helmets, representing approximately 12% from 2018 to 2022. Therefore, when analyzing the intersection of the data, it is observed that despite the considerable increase in accidents over the examined years, the number of deaths remained stable. This phenomenon can be attributed to the significant investment in preventive and protective measures, corroborating with the exponential increase in investment in PPEs, such as helmets designed to protect the heads of workers.

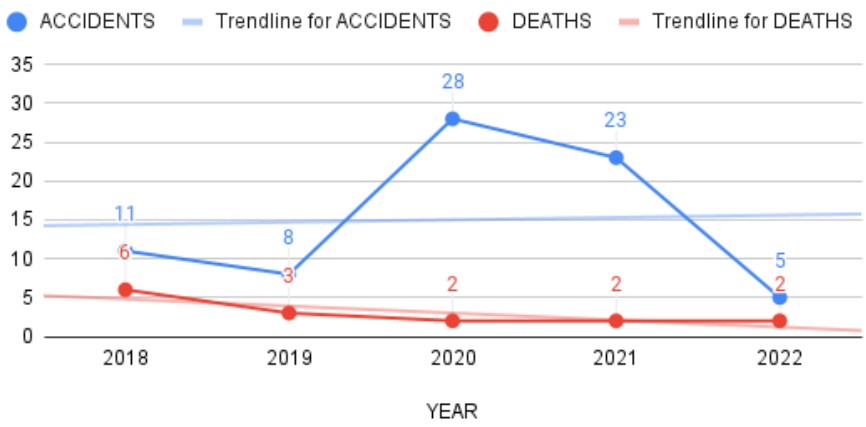
Figure 7 - Manufacturing Variation of Safety Helmets (2018-2022).



Source: National Association of the Safety and Protection Material Industry (ANIMASEG).

Data related to accidents and deaths involving the respiratory system were examined, and these were compared with the number of respiratory protection units, specifically respirators, produced from 2018 to 2022. Analyzing Figure 8, which addresses the quantity of accidents and deaths involving the respiratory system, it can be observed that, although the number of accidents and deaths is not high compared to the previous scenario, there was a significant increase in cases in 2020, representing a 250% increase compared to 2019. This phenomenon may be directly related to the Covid-19 pandemic, which required the widespread use of masks worldwide.

Figure 8 - Variation in Accidents and Deaths Involving Respiratory System (2018-2022).

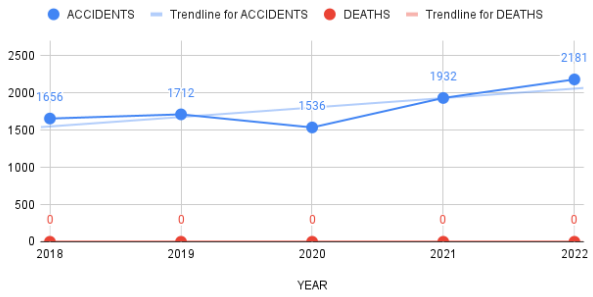


Source: Digital Observatory of Health and Safety at Work

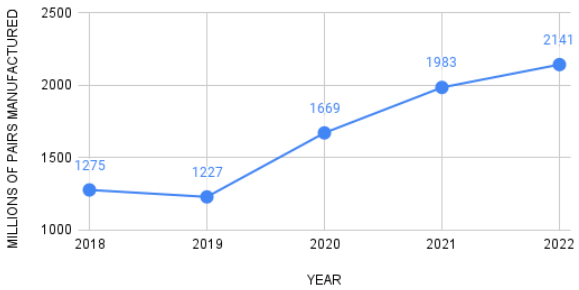
Figure 9(a) displays finger-related accident data from 2018 to 2022 and compares it with the production of safety gloves (Figure 9(b)) and safety footwear (Figure 9(c)). In Figure 9(a), which presents the quantity of finger-related accidents, there is a reduction of approximately 10% in the number of accidents compared to 2019. However, when considering the entire analyzed interval, spanning from 2018 to 2022, there is an increase of 24% in the total cases. During this same period, there is a significant growth in the production of safety gloves (Figure 9(b)) and safety footwear (Figure 9(c)), around 68% for safety gloves and approximately 44% for safety footwear.

Figure 9 - (a) Number of Accidents and Deaths Involving Fingers (2018-2022). Manufacturing Variation in Millions of PPE Units: (b) Gloves, (c) Safety Footwear

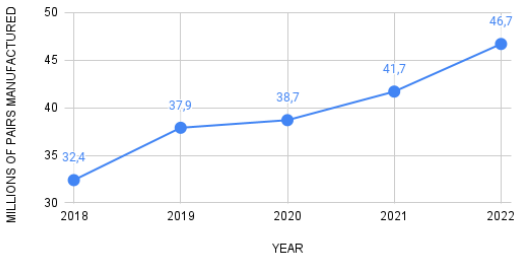
(a)



(b)



(c)



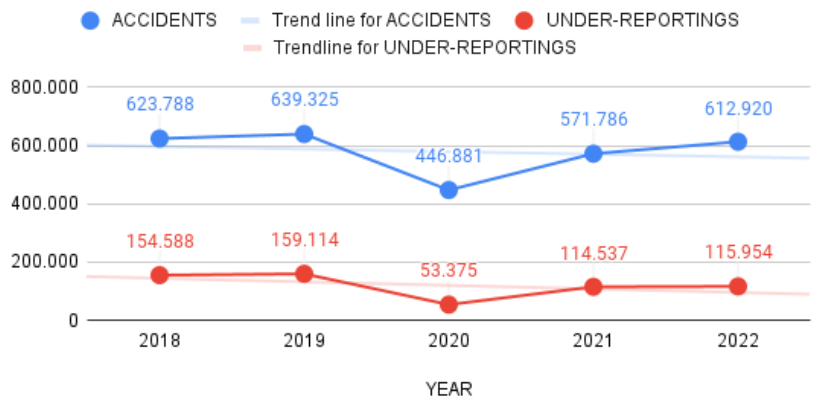
Source: Digital Observatory of Health and Safety at Work, National Association of the Safety and Protection Material Industry (ANIMASEG)

Based on the presented results, it is evident that, although the data indicate an increase in investments in protective measures in recent years, the number of fatal accidents still remains considerably high in the country. This reality is even more pronounced in the construction industry, with an exponential growth of 10% in 2021 and 6.9% in 2022, with an additional increase of 1.5% projected in 2023 (CBIC, 2023). These data reiterate a scenario of increasing demand on construction sites, aligning with the rise in the number of accidents involving workers in the sector.

It is crucial to highlight variations related to the body parts most frequently involved in fatal accidents. Despite the increase in the total number of accidents, especially for the head/skull region, there has been a stabilization in the number of deaths for the same body part. This information supports the expansion in the manufacturing of safety helmets in recent years. Even with a higher number of workers exposed to risks and facing workplace accidents in building construction, there is an observed increase in the gap between the number of accidents and lethality, reflecting a broader distribution of these Personal Protective Equipment (PPE).

However, it is crucial to note that the presented data reflect only workplace accidents registered through the Work Accident Communication (CAT), and in the construction sector, in particular, the rate of underreporting of workplace accidents still remains high. Figure 10 compares the variation in the number of registered accidents with the estimate of underreporting from 2018 to 2022. A reduction in the number of underreportings was observed, with these accounting for 25% of total accidents in 2018, decreasing to 18.5% in 2022, reflecting a 6.5% decrease.

Figure 13 - Comparison of the Variation in the Number of Accidents with the Estimate of Underreporting of Accidents (2018-2022).



Source: Digital Observatory of Health and Safety at Work

CONCLUSIONS

This study provided a comprehensive overview of accidents and fatalities that occurred from 2018 to 2022, examining internal aspects of these events, such as the body parts most frequently affected and those most lethal. This analysis was grounded in data from the Digital Observatory of Health and Safety at Work and correlated with information on investments and PPE production based on data provided by the National Association of the Safety and Protection Material Industry.

Upon analyzing these data, it is observed that, despite a 230% increase in the investment in the occupational safety market during the studied period, there was a 25% increase in the number of accidents in the construction industry. When relating body parts to accident and mortality data, accidents involving the head/skull, with a 46% increase, had a nearly stable number of deaths, registering a minimal 3% increase (one more death in 2022 compared to 2018). This pattern repeated in other less lethal scenarios. Another significant finding, pointing towards an improvement in the workplace accident registration and control scenario, was the approximately 7% decrease in the estimate of underreporting of accidents.

It is crucial to emphasize that both in the Brazilian and global context, there is a pressing need to enhance practices for preventing and protecting against workplace accidents and occupational diseases. This requires increased investments and oversight

by governments, the implementation of more effective initiatives, and the adoption of labor protection measures by employers, along with individual commitment from workers to their own safety and well-being.

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