Factors Influencing Unsafe Miner Behavior and Impact on Accident Severity: Serious, Major, Minor, and Non-Accidental

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***Abstract*—Unsafe worker behavior is a significant contributing factor to accidents in the mining industry, which is considered one of the most hazardous globally (Paul &Maiti, 2007; J. Zhang et al., 2020). This study categorizes incidents into minor, major, and serious classifications and examines the variables influencing the hazardous behaviors of Indian miners. Descriptive analysis reveals substantial variation in miner demographics and safety attitudes, emphasizing the necessity for tailored interventions. Correlation studies indicate a positive association between education level and safety awareness, while temporary workers exhibit increased risk-taking behavior. Regression analysis demonstrates that worker type, education, job dissatisfaction, and risk-taking behavior significantly influence accident severity, whereas psychological factors such as negative affectivity and external support mitigate risks. Multinomial logistic regression confirms that experience and work dissatisfaction have no significant impact on accident outcomes, but age, education, and family safety recommendations do**.

***Index Terms*—Mining, Accident, Behavior.**

1. INTRODUCTION

According to J. Zhang et al. (2020), the mining sector is recognized as one of the most hazardous industries globally, with a high probability of accidents or catastrophic events. Numerous studies have focused on safety management theories in an effort to investigate the causes of safety incidents and have demonstrated that employees' unsafe behavior is the primary factor contributing to safety mishaps (Paul &Maiti, 2007). There are certain commonalities between mining accidents, hazards, and disasters in terms of their substantial effects on the victims (Lyra, 2019), mine owners (Li et al., 2019), mine workers (Aliabadi et al., 2018), governments (Pons, 2016), policy-makers (Kong et al., 2018), economy (Fu et al., 2019), and local communities (Lyra, 2019), as well as the environment and human health (Omachi et al., 2018; Y. Zhang et al., 2016).

Inadequate safety culture has been cited as the cause of the majority of significant incidents in the mining industry in recent years (J. Zhang et al., 2020). Developing a safety culture is one practical strategy to mitigate mining accidents. According to the study, the factors that had the most significant impact on developing a positive safety culture were the behavioral component (47%), the situational dimension (29%), and psychological dimension (24%) (Ismail et al., 2021).

Previous research has primarily focused on identifying the variables which influence employees' behavior, and there remains disagreement over the extent to which these factors impact employees' risky behavior, particularly in the context of my safety. Thus, the present study, which utilizes survey data based on miners in India, aims to categorize these various aspects and investigate the major factors influencing miners' unsafe behavior and categorize accidents into three types: minor, major, and serious.

2. LITERATURE REVIEW

This section will define and categorize the influencing elements based on previous research, and examine their relationships to systematically elucidate the connection between influencing factors and miners' behavior.

2.1. Factors affecting workers' unsafe behavior

To investigate the primary causes of workers' risky behavior development, researchers have examined a wide range of influencing elements. The main individual factors are personal characteristics

(Amponsah-Tawiah & Mensah, 2016; Seo et al., 2015), occupational stress (Duma et al., 2014; Melamed et al., 1989), and educational level (Choudhry & Fang, 2008). The primary organizational factors are safety climate (DeJoy et al., 2010; Glendon &Litherland, n.d.; Kapp, 2012; Neal et al., n.d.), safety culture (DeJoy et al., 2010; Flin et al., n.d.; Mohaghegh&Mosleh, 2009), and safety management system (Han et al., 2014; Tharaldsen et al., 2008). However, these researchers disagree on the critical elements that influence workers' risky behavior.

Moreover, these scholars present divergent views on the critical elements that influence workers' risky behavior (DeJoy et al., 2010; Mohaghegh&Mosleh, 2009). Han et al. (2014) identified the system, work pressure, and work intensity as the primary determinants of employee behavior. Using factor analysis, Glendon &Litherland, n.d. (2001) further emphasized the significance of supervision and guidance in workers' safety behavior. A strong correlation between coal mine fatigue and accidents necessitated additional caution (Duma et al., 2014).

The aforementioned studies lead to the conclusion that diverse perspectives on the relationships between contributing factors and employees' unsafe behavior have not been fully articulated. Additionally, researchers' examination of influencing factors primarily focuses on two elements: organizational and human characteristics.

2.1.1. Individual factors

Employee behavior is significantly influenced by individual factors, including age, sex, education level, and number of years worked, as per the findings of Martinkoet al., (2002) and Naznin et al., (2016).

Several researchers have also posited that factors affecting employees' behavior include their perception of safety, workplace pressures, and the conduct of their colleagues. The theory of planned behavior (TPB) postulates that an individual's perception of the importance others attribute to safety or a specific behavior may significantly impact both their behavioral intention and subsequent actions (Beck & Ajzen, 1991). Coal miners are more inclined to engage in unsafe behaviors due to the considerable occupational stress they experience.

2.1.2. Organizational factors

Environmental support, encompassing leadership commitment, coworker concern, and safety climate, is a significant component of organizational variables that is garnering increased attention from researchers, as it may be a major contributor to safety incidents (Choudhry & Fang, 2008).

Furthermore, comparable studies have also demonstrated a strong correlation between workers' safety behavior and the attitudes of leaders and colleagues, both qualitatively and quantitatively (Fugas et al., 2012; Mullen, 2004).

The quality, management practices, and regulations of inspectors are the primary means by which the rationality of the organizational safety management system is demonstrated, and it has been identified as a significant factor in deterring workers from engaging in unsafe behaviors (Choudhry & Fang, 2008; Han et al., 2014; Jitwasinkul et al., 2016).

2.2. Relationship among influencing factors and employees' behavior

Upon analysis of the aforementioned research, it was observed that organizational and individual factors are interconnected and interact dynamically to influence employees' behavior. Particularly in organizations exhibiting a lack of organizational synergy, individual characteristics exert a greater influence on workers' safety habits. It was determined that the primary risk factors for safety incidents are personnel with low levels of education or understanding of safety from the transportation and construction sectors (Amponsah-Tawiah & Mensah, 2016). Concurrently, the significance of individual elements is also emphasized, with the assertion that these factors may have a more profound impact on safety behavior (Choudhry & Fang, 2008).

The coal mining sector exhibits the two aforementioned qualities due to the variety of hazardous behaviors displayed by miners as a consequence of the complex nature of their work. Therefore, when modeling, it is necessary to consider both individual and organizational factors to elucidate the dynamic mechanism between influencing factors and miners' risk-taking behavior.

2.3 Hypothesis

H1: Individual characteristics (age, experience, education level, worker's characteristics) significantly influence the unsafe behavior of miners.

H2: Organizational factors (enabling surroundings, safety management system) significantly influence the unsafe behavior of miners.
H3: Behavioral factors (risk-taking, job dissatisfaction, negative affectivity) significantly influence the unsafe behavior of miners.
H4: Organizational factors mediate the relationship between individual characteristics and unsafe behavior of miners.

3. DATA AND ANALYSIS

3.1 Sample

The study was conducted at three proximate mines within a large public sector organization in central India. The mines employ one thousand underground workers actively engaged in production. The sample comprised 272 underground mine employees (response rate: 80%). Among the participants, 48% were employed as face loaders, preparing manganese for tubs; 12% prepared manganese; 14% were involved in transportation; 6% worked as assistants; 7% were employed in the engineering department; and the remaining individuals were engaged in various other tasks.

Questionnaires were utilized to measure the influencing factors and the safety or unsafe behavior of miners, with the objective of identifying and categorizing the critical factors for improving safety behavior or reducing hazardous conduct. In this study, minor accidents were classified into four categories: non-accidental (NA), minor accident, major accident, and serious accident. Subsequently, factor analysis was employed to eliminate co linearity and correlation among all independent variables based on the survey data.

3.2 Instruments

The present study identified 14 independent variables from four dimensions: unique characteristics (4 items), personal impression (2 items), behavioral factors (3 items), enabling surroundings (3 items), and system of safety management (2 items). These variables were derived from previous research and an analysis of my safety. Table 1 presents the primary references for the selected items. Moreover, when miners are confronted with a choice between output and safety, their safety conduct is categorized as their primary consideration. The specific options presented are as follows: "Just work, ignore safety," "Pay attention to safety while working," and "Eliminate hidden dangers before work." Consequently, the binary variables "Safety behavior" and "Unsafe behavior" can be utilized to characterize the safety behavior of miners.

Table 1

Dimensions of measurement, research objects, and sources of literature

Dimensions	Objects	References
BF	Risk taking, Negative affectivity, Job dissatisfaction	(Paul &Maiti, 2007)
UC	Age, Experience, Worker’s characteristics, educational level	(Amponsah-Tawiah & Mensah, 2016)
PI	Worker’s perception, Working pressure	(Mo et al., 2019)
SE	Family, Leader, Co worker	(Donovan et al., 2018)
SMS	Inspector’s quality, Management system	(Choudhry & Fang, 2008)

3.3 Reliability and validity of the collected data

These variables could not be utilized directly due to the potential for multi-collinearity among them, which may be a source of inaccuracy. Consequently, factor analysis is employed to analyze the associations between 14 independent variables and transform them into a smaller number of new, uncorrelated components that are orthogonal to one another.

It is essential to verify that all variables exhibit a sufficiently high correlation level, and the correlation coefficients in the correlation matrix should be demonstrated to exceed the acceptable ranges through visual inspection (Cortes and Porras, 2014). The findings presented in Table 3 indicate that the raw data demonstrates a strong correlation and is suitable for further analysis.

Table 2

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.563
Bartlett's Test of Sphericity	Approx. Chi-Square	150.957
	df	91
	Sig.	.000

3.4. Analysis

3.4.1 Descriptive Analysis

The data analysis commences with descriptive statistics to summarize the key variables, including miners' individual characteristics (age, experience, education level, and worker's status), organizational factors (enabling environment and safety management system), and behavioral factors (risk-taking, job dissatisfaction, and negative affectivity). Furthermore, the dependent variable, categorized into four levels of accident severity—non-accidental (NA), minor accident, major accident, and serious accident—is described. These descriptive statistics provide an overview of the distribution of responses and the frequency of accidents in each category (Choudhry & Fang, 2008).

3.4.2 Correlation analysis

Correlation analysis was conducted to examine the relationships between the independent variables (individual, organizational, and behavioral factors) and the dependent variable (accident severity). This step facilitates the identification of whether factors such as risk-taking, safety perceptions, or working pressure are positively or negatively associated with more severe accidents (Paul &Maiti, 2007). For instance, a positive correlation between risk-taking behavior and serious accidents would indicate that higher levels of risk-taking are associated with an increased likelihood of serious accidents.

3.4.3 Multiple regression analysis

To identify significant predictors of accident severity, multiple regression analysis was conducted, treating accident severity as a continuous variable. The model incorporates individual factors (e.g., age, experience), behavioral factors (e.g., job dissatisfaction, risk-taking), and organizational factors (e.g., management system, leadership reminders). The regression analysis facilitates the identification of factors most strongly associated with varying levels of accident severity, providing insights into the elements that increase the likelihood of progression from non-accidental incidents to more severe accidents (Amponsah-Tawiah & Mensah, 2016).

3.4.4 Multinomial logistic regression

Additionally, a multinomial logistic regression was employed to model the dependent variable as a categorical outcome, with non-accidental (NA) incidents serving as the reference group. This technique elucidates how the odds of experiencing minor, major, or serious accidents vary depending on miners' characteristics and organizational factors. For instance, this analysis can reveal whether workers with greater experience exhibit a lower likelihood of experiencing major or serious accidents compared to those with fewer years of employment (Duma et al., 2014).

This combination of analytical techniques offers a comprehensive approach to examining both individual and organizational factors that influence accident severity, thereby providing critical insights for enhancing safety behavior and mitigating serious accidents in the mining industry.

4. RESULT

4.1 Descriptive Analysis

Descriptive analysis is presented in table 3. Across variables, the kurtosis values are uniformly negative, indicating that the distributions are platykurtic, which suggests lower peaks and broader tails compared to a normal distribution. The variance values demonstrate moderate variability across most variables, particularly in factors such as experience (variance = 1.276), management system (variance = 1.202), and inspector's quality (variance = 1.136), suggesting heterogeneity in miners' perceptions and experiences of these factors. These findings indicate a general variability in miner demographics and perceptions of safety-related behaviors, underscoring the necessity for tailored interventions based on individual and organizational factors.

Furthermore, the negative kurtosis for all variables, including age (-1.222), experience (-1.382), and job dissatisfaction (-2.015), suggests that most distributions are not leptokurtic but rather dispersed, indicating diversity in responses across the workforce. This dispersion may reflect the heterogeneous nature of the workforce in terms of safety attitudes, risk-taking behaviors, and organizational support.

Table 3

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
AGE	272	1	4	2.51	1.063	1.129	-1.222	.294
EXPERIENCE	272	1	4	2.53	1.130	1.276	-1.382	.294
WORKERS TYPE	272	0	1	.49	.501	.251	-2.014	.294
EDUCATIONAL LEVEL	272	1	4	2.52	1.034	1.070	-1.146	.294
RISK TAKING	272	1	4	2.34	.963	.927	-.944	.294
NEGATIVE AFFECTED	272	0	1	.51	.501	.251	-2.013	.294
JOB DISSATISFIED	272	0	1	.50	.501	.251	-2.015	.294
FAMILY'S SAFETY TIPS	272	1	4	2.55	1.012	1.023	-1.083	.294
LEADERS REMINDER	272	1	4	2.50	1.016	1.033	-1.100	.294
CO WORKERS ADVICE	272	1	4	2.46	1.048	1.098	-1.185	.294
WORKER'S PERCEPTION OF SAFETY	272	1	4	2.56	1.064	1.133	-1.227	.294
WORKING PRESSURE	272	1	4	2.47	1.034	1.069	-1.140	.294
INSPECTOR'S QUALITY	272	1	4	2.52	1.066	1.136	-1.232	.294
MANAGEMENT SYSTEM	272	1	4	2.53	1.096	1.202	-1.305	.294
Valid N (listwise)	272							

4.2 Correlation Analysis

The correlation analysis reveals several significant relationships among the variables related to miner demographics, behaviors, and safety perceptions, as presented in table 4.

Age demonstrates a significant negative correlation with management system ($r = -0.156$, $p = 0.010$), indicating that older miners may possess a less favorable perception of the management system. Worker type (permanent vs. temporary) exhibits a negative correlation with risk-taking ($r = -0.144$, $p = 0.017$), suggesting that temporary workers are more inclined to engage in risk-taking behaviors compared to permanent workers. Furthermore, worker type shows a positive correlation with coworkers' advice ($r = 0.133$, $p = 0.028$), signifying that temporary workers may receive a greater amount of advice from their colleagues. Educational level exhibits positive correlations with leaders' reminders ($r = 0.218$, $p = 0.000$), coworkers' advice ($r = 0.168$, $p = 0.006$), and worker's perception of safety ($r = 0.145$, $p = 0.017$), suggesting that miners with higher education levels are more likely to receive safety-related advice and possess stronger perceptions of safety. Risk-taking behavior demonstrates positive correlations with job dissatisfaction ($r = 0.190$, $p = 0.002$) and negative affectivity ($r = 0.088$, $p = 0.149$), indicating that miners who engage in more risk-taking behaviors are more likely to report dissatisfaction and negative emotions. Job dissatisfaction exhibits a significant association with negative affectivity ($r = 0.191$, $p = 0.002$), reflecting a relationship between work dissatisfaction and negative emotions. Management system shows positive correlations with educational level ($r = 0.170$, $p = 0.005$) and worker's perception of safety ($r = 0.134$, $p = 0.027$), suggesting that miners with higher educational backgrounds and better safety perceptions tend to hold a more favorable view of the management system.

These relationships provide insights into the influence of demographic factors and workplace experiences on miners' safety perceptions, risk-taking behaviors, and overall satisfaction.

Table 4

Correlations

		AGE	EXPERIENCE	WORKERS TYPE	EDUCATIONAL LEVEL	RISK TAKING	NEGATIVE AFFECTED	JOB DISSATISFIED	FAMILY'S SAFETY TIPS	LEADERS REMINDER	CO WORKERS ADVICE	WORKER'S PERCEPTION OF SAFETY	WORKING PRESSURE	INSPECTOR'S QUALITY	MANAGEMENT SYSTEM
AGE	Pearson Correlation	1	-.029	-.010	.032	.099	-.056	-.014	-.009	.060	.042	-.027	-.080	-.034	-.156
	Sig. (2-tailed)		.628	.866	.603	.103	.360	.821	.881	.326	.493	.661	.187	.572	.010
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
EXPERIENCE	Pearson Correlation	-.029	1	.033	-.061	.030	.061	-.036	.044	.010	.045	.049	-.020	.042	.036
	Sig. (2-tailed)	.628		.588	.320	.625	.313	.558	.471	.874	.464	.420	.744	.487	.549
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
WORKERS TYPE	Pearson Correlation	-.010	.033	1	.093	-.144	-.007	-.066	.030	.007	.133	.046	-.125	.042	.111
	Sig. (2-tailed)	.866	.588		.126	.017	.908	.276	.624	.905	.028	.451	.039	.493	.067
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
EDUCATIONAL LEVEL	Pearson Correlation	.032	-.061	.093	1	-.032	-.075	-.110	.105	.218	.168	.145	-.122	.030	.170
	Sig. (2-tailed)	.603	.320	.126		.603	.216	.069	.085	.000	.006	.017	.044	.626	.005
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
RISK TAKING	Pearson Correlation	.099	.030	-.144	-.032	1	.088	.190	.006	.066	.011	.038	-.026	-.067	-.054
	Sig. (2-tailed)	.103	.625	.017	.603		.149	.002	.915	.278	.861	.527	.665	.273	.371
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
NEGATIVE AFFECTED	Pearson Correlation	-.056	.061	-.007	-.075	.088	1	.191	-.048	-.054	-.010	-.071	.036	-.052	-.028
	Sig. (2-tailed)	.360	.313	.908	.216	.149		.002	.426	.372	.873	.246	.552	.390	.651
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
JOB DISSATISFIED	Pearson Correlation	-.014	-.036	-.066	-.110	.190	.191	1	-.105	-.040	.017	-.110	.057	.017	-.047
	Sig. (2-tailed)	.821	.558	.276	.069	.002	.002		.083	.513	.776	.069	.351	.775	.442
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
FAMILY'S SAFETY TIPS	Pearson Correlation	-.009	.044	.030	.105	.006	-.048	-.105	1	.061	.075	.074	-.060	.136	.057
	Sig. (2-tailed)	.881	.471	.624	.085	.915	.426	.083		.316	.218	.223	.320	.025	.352
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
LEADERS REMINDER	Pearson Correlation	.060	.010	.007	.218	.066	-.054	-.040	.061	1	.055	.107	-.097	-.116	.031
	Sig. (2-tailed)	.326	.874	.905	.000	.278	.372	.513	.316		.363	.077	.112	.056	.605
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
CO WORKERS ADVICE	Pearson Correlation	.042	.045	.133	.168	.011	-.010	.017	.075	.055	1	-.006	-.108	-.151	.003
	Sig. (2-tailed)	.493	.464	.028	.006	.861	.873	.776	.218	.363		.919	.075	.013	.965
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
WORKER'S PERCEPTION OF SAFETY	Pearson Correlation	-.027	.049	.046	.145	.038	-.071	-.110	.074	.107	-.006	1	-.099	.039	.134
	Sig. (2-tailed)	.661	.420	.451	.017	.527	.246	.069	.223	.077	.919		.103	.517	.027
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
WORKING PRESSURE	Pearson Correlation	-.080	-.020	-.125	-.122	-.026	.036	.057	-.060	-.097	-.108	-.099	1	.096	-.061
	Sig. (2-tailed)	.187	.744	.039	.044	.665	.552	.351	.320	.112	.075	.103		.114	.315
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
INSPECTOR'S QUALITY	Pearson Correlation	-.034	.042	.042	.030	-.067	-.052	.017	.136	-.116	-.151	.039	.096	1	.020
	Sig. (2-tailed)	.572	.487	.493	.626	.273	.390	.775	.025	.056	.013	.517	.114		.744
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272
MANAGEMENT SYSTEM	Pearson Correlation	-.156	.036	.111	.170	-.054	-.028	-.047	.057	.031	.003	.134	-.061	.020	1
	Sig. (2-tailed)	.010	.549	.067	.005	.371	.651	.442	.352	.605	.965	.027	.315	.744	
	N	272	272	272	272	272	272	272	272	272	272	272	272	272	272

4.3 Multiple regression analysis

The results of the regression analysis demonstrate (table 5) the influence of various factors on the non-accidental, minor, major, and serious categories of mining accidents.

Worker Type and Educational Level exhibited significant positive correlations with accident types ($B = 0.259$, $p = 0.002$ and $B = 0.146$, $p = 0.000$, respectively). This indicates a higher probability of accidents involving temporary workers and individuals with lower educational attainment. The likelihood of non-accidental outcomes is reduced by risk-taking ($B = -0.085$, $p = 0.049$), negative affectivity ($B = -0.315$, $p = 0.000$), and job dissatisfaction ($B = -0.235$, $p = 0.005$), all of which display negative coefficients. These variables illustrate how psychological and emotional factors may influence accident severity; increased risk-taking and dissatisfaction are associated with more severe accidents. The following factors demonstrated significant positive effects: coworkers' advice ($B = 0.094$, $p = 0.017$), worker perception of safety ($B = 0.091$, $p = 0.019$), leader's reminders ($B = 0.112$, $p = 0.006$), and family safety tips ($B = 0.223$, $p = 0.000$). These variables suggest that strong safety perceptions and support from coworkers, supervisors, and family members decrease the probability of accidents. The significant negative correlation between working pressure (B = -0.168, p = 0.000) and more serious accidents indicates that increased working pressure is associated with more severe accidents. The Inspector's Quality and Management System do not appear to have a significant impact on the types of accidents.

In conclusion, factors such as worker type, education, emotional and psychological states, and external support systems (family, leaders, co-workers) significantly influence the type and severity of accidents experienced by miners.

Table 5

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.803	.311		5.792	.000
	AGE	.043	.038	.054	1.130	.260
	EXPERIENCE	.011	.035	.015	.317	.751
	WORKERS TYPE	.259	.082	.152	3.166	.002
	EDUCATIONAL LEVEL	.146	.041	.177	3.534	.000
	RISK TAKING	-.085	.043	-.096	-1.982	.049
	NEGATIVE AFFECTED	-.315	.081	-.185	-3.874	.000
	JOB DISSATISFIED	-.235	.083	-.138	-2.821	.005
	FAMILY'S SAFETY TIPS	.223	.040	.265	5.536	.000
	LEADERS REMINDER	.112	.041	.133	2.753	.006
	CO WORKERS ADVICE	.094	.039	.116	2.393	.017
	WORKER'S PERCEPTION OF SAFETY	.091	.038	.113	2.357	.019
	WORKING PRESSURE	-.168	.039	-.205	-4.266	.000
	INSPECTOR'S QUALITY	.009	.039	.011	.233	.816
	MANAGEMENT SYSTEM	.003	.038	.004	.073	.942

a. Dependent Variable: accident_type

4.4 Multinomial logistic regression

The results of the Likelihood Ratio Test for the Multinomial Logistic Regression analysis are presented in Table 6. This analysis aims to assess the impact of various predictor variables on a categorical outcome. Each row corresponds to a predictor variable, and the test evaluates whether the removal of that variable significantly reduces the model's goodness of fit.

The key findings from the analysis are as follows:

4.4.1 Age

The Chi-square value is 20.851 with a p-value of 0.013, indicating that age has a statistically significant effect on the outcome.

4.4.2 Experience

With a p-value of 0.350, experience does not significantly contribute to the model.

4.4.3 Worker Type

The Chi-square value is 11.656, with a significant p-value of 0.009, suggesting a substantial effect.

4.4.4 Educational level, Risk Taking, Family's safety tips

These variables have highly significant effects ($p < 0.001$), indicating a strong influence on the dependent variable.

4.4.5 Negative Affected

This variable is also highly significant with a p-value of 0.001.

4.4.6 Job Dissatisfied

With a p-value of 0.171, job dissatisfaction is not a significant predictor.

4.4.7 Leader's reminder, Working pressure

These factors are significant with p-values of 0.020 and 0.031, respectively.

4.4.8 Coworker’s advice

Marginally significant with a p-value of 0.058.

4.4.9 Worker's perception of safety, Inspector's quality, Management System

These variables are not significant predictors (p-values > 0.05).

Overall, the dependent variable is significantly influenced by several variables (such as age, educational attainment, risk-taking, and safety advice from family members), but not by experience or job dissatisfaction. This suggests that certain factors have a more substantial impact on the model than others.

Table 6

Likelihood Ratio Tests

Effect	Model Fitting Criteria: -2 Log Likelihood of Reduced Model	Likelihood Ratio Tests: Chi-Square	df	Sig.
Intercept	280.709[a]	.000	0	.
AGE	301.560	20.851	9	.013
EXPERIENCE	290.717	10.008	9	.350
WORKERS TYPE	292.365	11.656	3	.009
EDUCATIONAL LEVEL	321.193	40.484	9	.000
RISK TAKING	312.961	32.252	9	.000
NEGATIVE AFFECTED	298.306	17.597	3	.001
JOB DISSATISFIED	285.717	5.008	3	.171
FAMILY'S SAFETY TIPS	314.431	33.722	9	.000
LEADERS REMINDER	300.439	19.730	9	.020
CO WORKERS ADVICE	297.151	16.442	9	.058
WORKER'S PERCEPTION OF SAFETY	291.375	10.667	9	.299
WORKING PRESSURE	299.097	18.388	9	.031
INSPECTOR'S QUALITY	290.288	9.580	9	.386
MANAGEMENT SYSTEM	291.937	11.228	9	.260

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

5. CONCLUSION

The study provides valuable insights into the factors influencing mining accidents and miners' perceptions of safety. The descriptive analysis elucidates that miner demographics and safety perspectives vary significantly, necessitating tailored safety measures. Correlation analysis reveals significant associations between attitudes, safety behaviors, and demographic characteristics. For instance, temporary employees exhibit a higher propensity for risk-taking and seeking advice from colleagues, while senior employees demonstrate fewer positive perceptions of the management system. Higher education levels correlate with enhanced safety perceptions and increased frequency of leadership reminders. Regression analysis indicates that several variables, including worker type, education, job dissatisfaction, and risk-taking behavior, exert substantial influence on accident severity. Psychological factors such as negative affectivity and external support networks, including family and colleague counsel, significantly mitigate accident risk. Higher levels of work pressure have been demonstrated to lead to more severe incidents, while inspector quality and management systems show no impact on accident types. The multinomial logistic regression further corroborates that age, worker type, educational attainment, and safety advice from family members significantly influence the outcome of mining accidents. However, experience and work dissatisfaction do not significantly contribute to accident type prediction. This suggests that focusing solely on job experience may not yield the same positive effects on safety outcomes as addressing psychological and demographic variables.

6. FUTURE SCOPE

Future research could benefit from a longitudinal approach to track changes in miners' safety perceptions, behaviors, and accident rates over time. This methodology would provide more comprehensive insights into the long-term effects of safety interventions. Experimental studies could be conducted to evaluate the efficacy of specific safety interventions, such as leadership reminders, safety training, and family safety programs, in reducing accident severity and risk-taking behaviors. Given the significant impact of negative emotions and job dissatisfaction on accident severity, future research should investigate psychological interventions or mental health programs aimed at mitigating workplace stress and dissatisfaction among miners. The current study focuses on a specific mining population. Future studies could extend the analysis to different geographic locations and industries to determine whether similar patterns of safety behaviors and perceptions exist across diverse workforces. Utilizing Structural Equation Modeling (SEM) with more complex models could help further elucidate the relationships between multiple variables and assess the indirect effects of various factors, such as the impact of organizational culture on both job satisfaction and safety outcomes.

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