

Quality Utilization of Safety and Hygiene Facilities for the Prevention and Control of Occupational Health Hazards among Mineworkers in Rulindo District, Rwanda

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Abstract

Occupational health hazards remain a major challenge in the mining sector globally and in Rwanda, despite the availability of safety and hygiene (SH) facilities intended to protect workers. This study assessed the utilization of safety and hygiene facilities for the prevention and control of occupational health hazards among mineworkers in Rulindo District, Rwanda. Specifically, the study determined the level of SH facility utilization, examined institutional and infrastructural factors influencing utilization, and assessed sociocultural factors associated with the use of SH facilities. A descriptive cross-sectional study design employing mixed methods was used. Quantitative data were collected using structured questionnaires administered to mineworkers, while qualitative data were gathered through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). A total of 366 participants were targeted, of whom 360 responded, yielding a response rate of 98.4%. Quantitative data were analyzed using SPSS to generate frequencies, percentages, cross-tabulations, Chi-square tests, and logistic regression results, while qualitative data were analyzed thematically. The findings revealed that 70.0% of respondents were male and 30.0% were female. Most respondents (93.9%) reported having access to personal protective equipment (PPE). Based on Bloom's cut-off criteria, 83.3% of mineworkers demonstrated high utilization of safety and hygiene facilities, 6.9% moderate utilization, and 9.8% low utilization. Institutional and infrastructural support was generally strong, with 86.1% reporting the availability of functional handwashing stations, 82.8% access to operational first-aid kits, and 92.5% indicating that management provided free PPE. Sociocultural factors also influenced utilization, as 81.1% expressed the need for additional PPE, while peer influence and workplace attitudes affected compliance with safety regulations. The study concludes that utilization of safety and hygiene facilities among mineworkers is significantly influenced by institutional support, infrastructural availability, and sociocultural factors. Although most mineworkers reported high utilization of SH facilities, challenges related to equipment maintenance, workplace attitudes, and behavioral compliance remain. The study recommends strengthening occupational health and safety training, improving maintenance of safety infrastructure, enhancing management support, and addressing sociocultural barriers to improve compliance and reduce occupational health hazards in the mining sector.

Keywords: Occupation health hazards, safety and hygiene facilities, personal protective equipments.

Introduction

Occupational health and safety (OHS) remains a critical concern globally, particularly in high-risk sectors such as mining. Mining activities contribute significantly to economic growth through employment creation, export earnings, and industrial development; however, they also expose workers to various occupational hazards including dust inhalation, chemical exposure, excessive noise, vibration, accidents, injuries, and poor sanitation conditions. According to the International Labour Organization (ILO, 2023), millions of occupational accidents and work-related illnesses occur annually worldwide, with workers in extractive industries facing a disproportionately high level of risk compared to many other sectors.

Safety and hygiene facilities are essential workplace interventions designed to prevent occupational injuries and illnesses. These facilities include personal protective equipment (PPE), handwashing stations, sanitation facilities, first-aid kits, occupational safety training programs, and regular workplace inspections. Recent studies have demonstrated that effective utilization of safety and hygiene facilities significantly reduces workplace accidents, improves employee well-being, and enhances organizational productivity (WHO, 2024; ILO, 2023). However, the availability of safety facilities alone does not guarantee their proper utilization, as institutional, infrastructural, behavioral, and sociocultural factors often influence workers' safety practices.

In Africa, occupational health and safety challenges remain prevalent in the mining sector due to limited resources, inadequate enforcement of safety regulations, insufficient training, and poor workplace infrastructure. Recent evidence indicates that many mining workers continue to experience occupational injuries and health complications despite the existence of safety guidelines and protective measures (Moyo & Ncube, 2022; Mensah et al., 2023). Factors such as management commitment, availability of PPE, workplace culture, peer influence, and safety awareness have been identified as key determinants of safety compliance among mineworkers.

In Rwanda, the mining sector is among the country's important economic sectors and contributes substantially to foreign exchange earnings and employment opportunities. The Government of Rwanda has implemented policies and regulations aimed at promoting occupational health and safety in mining operations through institutions responsible for labor inspection, mining regulation, and workplace safety monitoring. Despite these efforts, occupational hazards continue to pose risks to mineworkers due to challenges associated with access to safety facilities, infrastructure limitations, and behavioral factors affecting compliance with safety procedures (Rwanda Mines, Petroleum and Gas Board [RMB], 2024).

Rulindo District hosts several mining sites employing a significant number of workers who are regularly exposed to occupational risks. Although mining companies provide various safety and hygiene facilities, limited empirical evidence exists regarding the extent to which these facilities are utilized by workers and the factors influencing their utilization. Institutional support, workplace infrastructure, cultural beliefs, peer behavior, and individual perceptions may all influence safety practices among mineworkers. Therefore, this study assessed the utilization of safety and hygiene facilities for the prevention and control of occupational health hazards among mineworkers in Rulindo District, Rwanda.

Recent literature suggests that improving the utilization of safety and hygiene facilities can significantly reduce workplace injuries, improve workers' health outcomes, and contribute to sustainable mining operations (WHO, 2024; ILO, 2023; RMB, 2024). Understanding the factors associated with utilization is therefore essential for strengthening occupational health and safety interventions and promoting safer working environments in Rwanda's mining sector.

Materials and methods

This study employed descriptive cross-sectional research design to examine the use of safety and hygiene (SH) facilities for preventing and controlling occupational health hazards among mineworkers at Rutongo Mines in Rulindo District. The study applied triangulation techniques through surveys, focus group discussions (FGDs), and key informant interviews (KIIs). Sampling methods included stratified sampling for the quantitative survey and purposive sampling for the qualitative participants. Quantitative data were analyzed using SPSS, while qualitative data were analyzed thematically

Research Design

The study employed descriptive cross-sectional research design. The design was appropriate because it allowed the researcher to collect data at a single point in time, providing a snapshot of mineworkers' knowledge, attitudes, and practices (KAP) in relation to SH facility utilization. Both quantitative and qualitative approaches were integrated to ensure a comprehensive understanding of the phenomenon. Quantitative data were gathered through structured questionnaires to measure the frequency, accessibility, and proper use of SH facilities, while qualitative insights were obtained through interviews and observations to capture contextual factors, perceptions, and challenges faced by mineworkers. This design facilitated the identification of relationships between SH facility utilization and occupational health outcomes without manipulating variables, making it suitable for assessing real-world practices in the mining environment.

Population and Sampling

The target population comprised 5,507 staff, encompassing mineworkers, occupational health officers, site leaders, and local officials. Using Yamane's simplified formula with a 5% margin of error, a sample size of 366 was calculated. Stratified purposive sampling was utilized for the quantitative survey of mineworkers, while purposive sampling was used to select participants for qualitative interviews.

Data Collection Instruments

Quantitative data were gathered via structured questionnaires categorized into demographics, SH utilization levels, institutional factors, and sociocultural factors. Qualitative insights were collected through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) to explore workplace norms, cultural beliefs, and management practices

Data Analysis

Quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS). Frequencies and percentages were used for descriptive analysis, while binary logistic regression was applied to determine the Adjusted Odd Ratios (AOR) of variables influencing SH utilization, with significance established at $p < 0.05$. Qualitative data underwent thematic analysis to triangulate and contextualize the quantitative results.

Ethical Considerations

Ethical clearance was granted by the School of Postgraduate Studies at Mount Kigali University. Institutional authorization was secured from Trinity Metals Ltd., and informed consent was obtained from all participants

Results

The study achieved a 98.4% response rate, with 360 out of 366 targeted mineworkers successfully participating. The workforce was predominantly male (70.0%), reflecting the industry's physically demanding nature. The majority of respondents (42.8%) were aged 31–40 years. Educationally, 69.7% possessed a primary education, 22.5% had secondary education, and 3.9% had completed tertiary education.

Applying Bloom's cut-off criteria, 83.3% of the mineworkers demonstrated high utilization of SH facilities. A smaller segment exhibited moderate (6.9%) or low (9.8%) utilization. General access to PPE was remarkably high at 93.9%. Among users, 89.7% felt gumboots provided adequate support, 86.7% found helmets comfortable for long shifts, and 83.6% noted that gloves allowed sufficient flexibility.

Institutional mechanisms served as critical enablers of workplace safety. A vast majority of workers, representing 97.2%, reported receiving regular capacity-building training on occupational hazards. Regarding physical safety infrastructure, 92.5% of respondents reported that management provided free personal protective equipment (PPE). Additionally, foundational hygiene and medical support systems were widely accessible, with 86.1% of workers confirming the availability of functional handwashing stations and 82.8% noting the presence of operational first-aid kits at their worksites. Despite these strong provisions, a slight gap in infrastructural upkeep was identified, as only 73.3% of respondents reported the prompt repair of broken safety equipment.

Sociocultural factors presented both protective and obstructive influences on safety behaviors. While basic safety provisions were generally met, 81.1% of mineworkers expressed a need for supplemental PPE, such as safety glasses and earplugs, to address specific occupational risks. Social dynamics also played a role in compliance; notably, 18.1% of workers admitted to occasionally ignoring safety rules due to non-compliance by their peers, highlighting the negative impact of peer influence. Furthermore, cultural beliefs significantly intersected with formal safety protocols, as 63.3% of respondents acknowledged relying on spiritual practices for protection during work. Conversely, the organizational reporting culture remained generally open and positive, with 84.2% of respondents stating they do not hesitate to report unsafe working conditions.

Logistic regression confirmed that age, education, institutional support, and sociocultural influences were significant independent predictors ($p < 0.05$). High institutional support was the strongest predictor, making workers 3.85 times more likely to utilize SH facilities (AOR = 3.85, 95% CI: 1.94–7.63). Positive sociocultural influence also strongly predicted utilization (AOR = 2.91, 95% CI: 1.46–5.82).

Table 1: Demographic Characteristics of Respondents (N = 360)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	252	70
	Female	108	30
Age Group (Years)	18–30	66	18.3
	31–40	154	42.8
	41–50	80	22.2
	51–60	45	12.5
	≥ 61	15	4.2
Education Level	No Formal Education	14	3.9
	Primary Education	251	69.7

	Secondary Education	81	22.5
	Tertiary Education	14	3.9

Table 2: Bivariate Analysis of Factors Associated with SH Facility Utilization

Variable	χ^2 Value	p-value	Association with SH Utilization
Gender	1.85	0.396	Not Significant
Age Group	9.42	0.041*	Significant
Education Level	11.67	0.023*	Significant
Institutional Support	18.54	<0.001*	Significant
Sociocultural Influence	21.76	<0.001*	Significant

Table 3: Multivariate Analysis of Factors Associated with Utilization of Safety and Hygiene (SH) Facilities among Mineworkers

Variable	AOR	95% CI	p-value
Age Group (31–40 years)	1.89	1.02–3.51	0.043*
Education Level (Secondary/Tertiary)	2.37	1.18–4.75	0.015*
Institutional Support (High)	3.85	1.94–7.63	<0.001*
Sociocultural Influence (High)	2.91	1.46–5.82	0.002*

Figure 1: Distribution of Utilization of Safety Hygiene Mitigations in Non Pharmaceutical Protective Devices in the Study Area

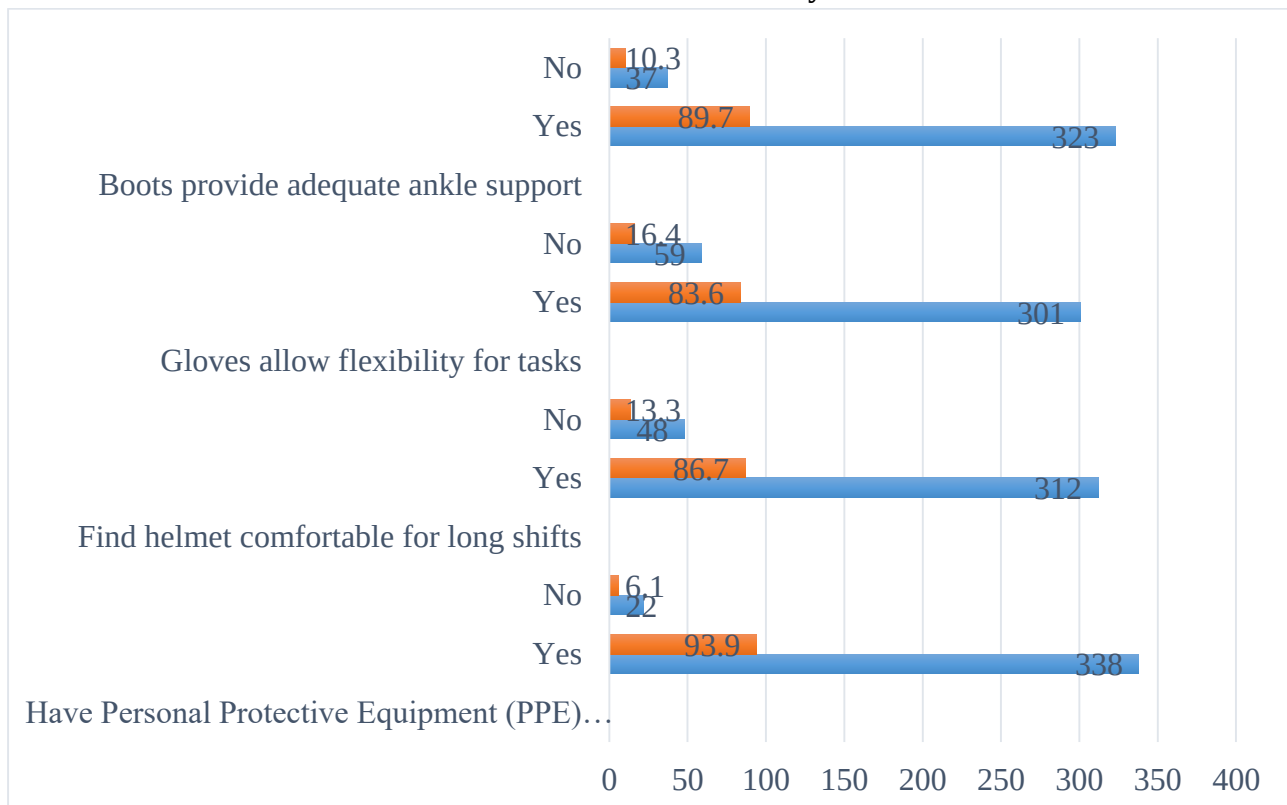


Figure 2: Safety Hygiene Utilization by Bloom's Cut-Off Criteria

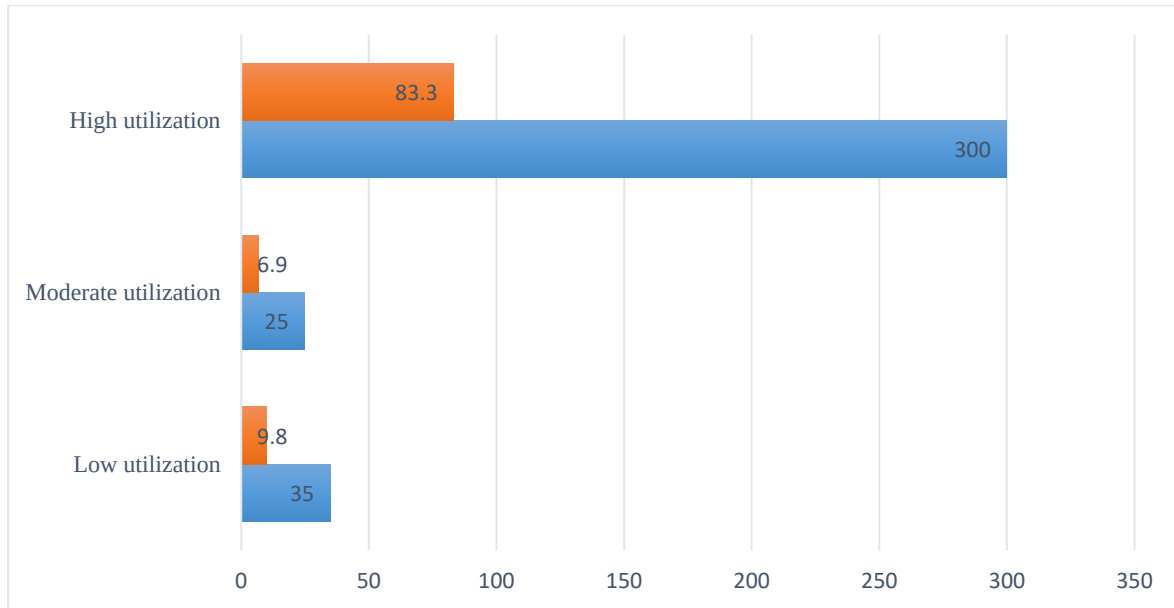


Figure 3: Distribution of Intuitional Infrastructural Factors to Mitigate Safety Hygiene in Mining Industry

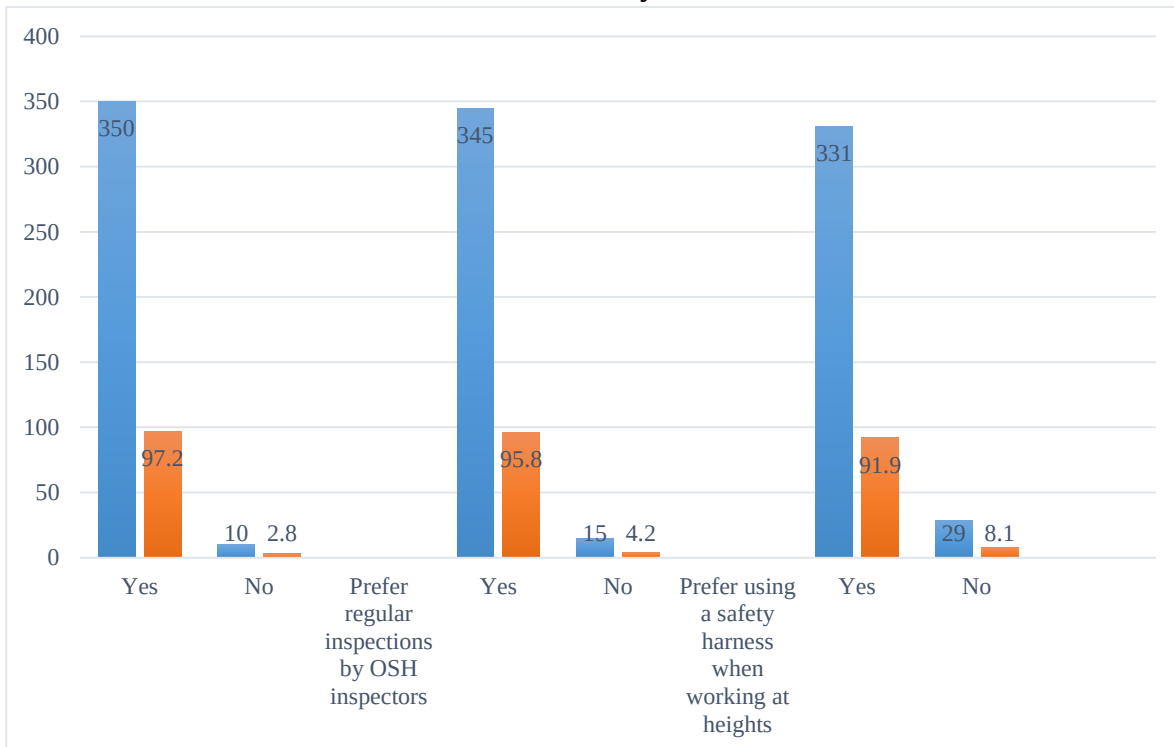
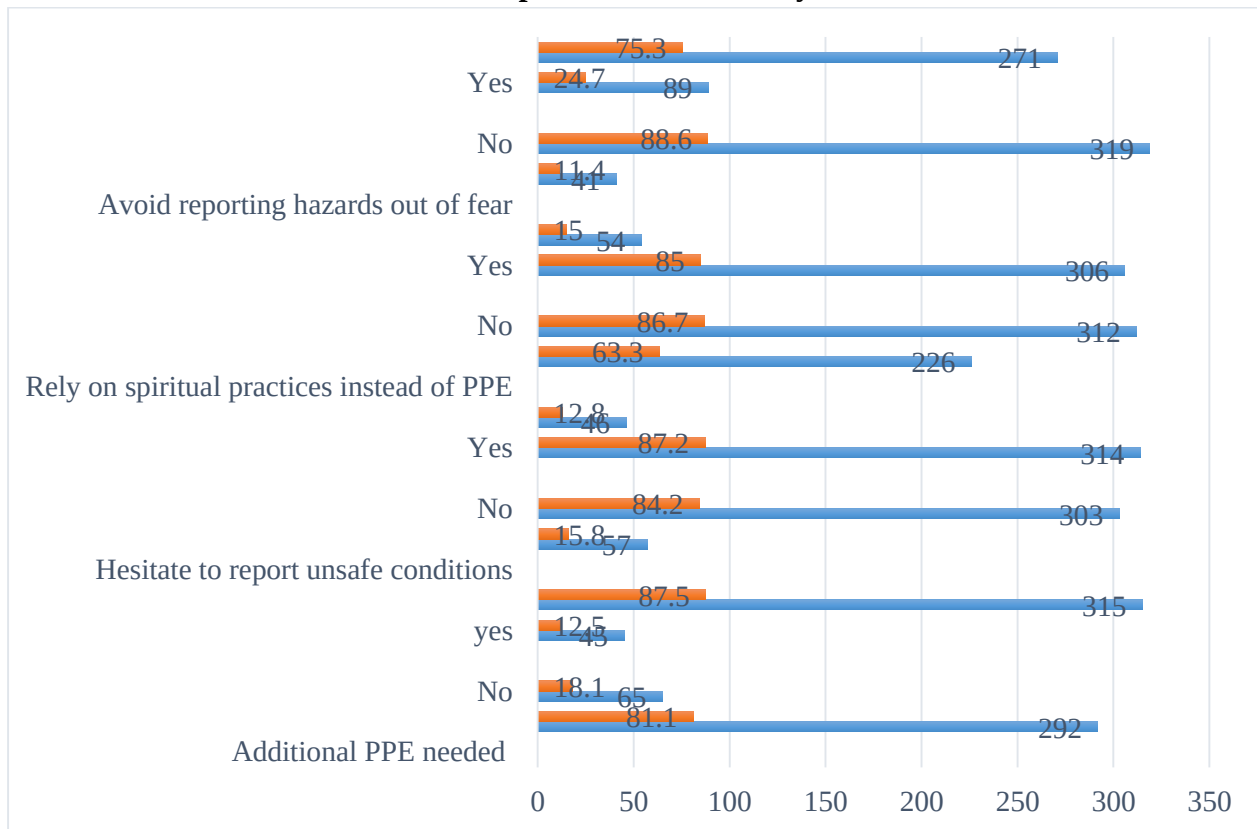


Figure 4: Distribution of social cultural and beliefs on Utilization of safety mitigations to prevent occupational health safety



Discussion

The findings of this study revealed a high level of utilization of safety and hygiene facilities among mineworkers in Rulindo District. Based on Bloom's cut-off criteria, 83.3% of respondents demonstrated high utilization of safety and hygiene facilities, while only 9.8% and 6.9% were categorized under low and moderate utilization levels, respectively. The findings suggest that most mineworkers consistently utilize personal protective equipment, comply with workplace safety procedures, and participate in occupational health and safety activities.

The high utilization level observed in this study is particularly relevant in 2024, when occupational health and safety remains a priority within the mining sector due to the continued burden of workplace injuries, respiratory diseases, and other occupational hazards. The findings indicate that occupational health and safety interventions implemented within Rwanda's mining sector are contributing positively to workplace safety and hazard prevention. The findings are consistent with recent studies which report that increased access to safety facilities and regular safety training significantly improve compliance with occupational health and safety requirements (ILO, 2023; WHO, 2024).

The findings also support the Health Belief Model, which suggests that individuals are more likely to adopt preventive behaviors when they recognize the risks associated with occupational hazards and understand the benefits of protective measures. The high utilization of safety and hygiene facilities observed among mineworkers may therefore reflect growing awareness of occupational risks and the importance of preventive interventions within mining environments.

The findings demonstrated that institutional and infrastructural support significantly influences the utilization of safety and hygiene facilities among mineworkers. The majority of respondents reported receiving regular occupational health and safety training, workplace inspections, and access to essential safety infrastructure such as personal protective equipment, handwashing stations, first-aid kits, and sanitation facilities. Furthermore, institutional support was found to be significantly associated with safety and hygiene facility utilization ($p = 0.023$).

The key finding is that management commitment, workplace supervision, and availability of safety infrastructure act as important enablers of occupational health and safety compliance. This finding is highly relevant in 2024 because occupational health policies increasingly emphasize preventive approaches that focus on workplace systems rather than solely individual behavior. Similar findings have been reported in recent occupational health studies, which identify management support, safety training, and regular inspections as critical determinants of safety compliance in high-risk industries (ILO, 2023; WHO, 2024).

The findings further support the Health Belief Model by demonstrating that institutional support can serve as a cue to action, encouraging workers to adopt protective behaviors and utilize available safety and hygiene facilities. Consequently, strengthening workplace safety systems, regular inspections, and continuous training programs remains essential for improving occupational health outcomes among mineworkers.

The study revealed that sociocultural factors significantly influence the utilization of safety and hygiene facilities among mineworkers. The majority of respondents indicated the need for additional personal protective equipment, while a smaller proportion admitted occasionally ignoring safety rules due to peer influence. Although most respondents reported willingness to report unsafe working conditions, cultural beliefs and workplace norms were found to influence some safety-related behaviors.

The findings demonstrate that workers' beliefs, attitudes, perceptions, and social interactions play an important role in shaping occupational health and safety practices. The influence of peer behavior on compliance suggests that workplace culture can either strengthen or weaken the utilization of safety and hygiene facilities. Similarly, reliance on cultural or spiritual beliefs for protection highlights the need for continuous safety education and awareness programs that reinforce evidence-based occupational health practices.

These findings are particularly relevant in 2024 because occupational health and safety experts increasingly recognize that workplace safety depends not only on the availability of infrastructure but also on behavioral and social factors. The findings are consistent with recent studies emphasizing the importance of positive safety culture, peer support, and worker engagement in improving occupational health and safety outcomes (WHO, 2024). The results further align with the Health Belief Model, which acknowledges that individual perceptions and social influences affect the adoption of preventive health behaviors.

Overall, the findings indicate that both institutional and sociocultural factors play critical roles in determining the utilization of safety and hygiene facilities among mineworkers. Therefore, effective occupational health and safety interventions should combine adequate safety infrastructure with continuous training, behavioral change initiatives, and workplace culture improvement strategies to achieve sustainable reductions in occupational health hazards.

Conclusion and Recommendations

The prevention and control of occupational health hazards in the mining industry require a multidisciplinary integration of management commitment, public health education, and sociocultural alignment. While institutional support in Rulindo District successfully drives a high baseline of safety and hygiene facility utilization, persistent behavioral barriers and maintenance gaps require targeted action. To mitigate these risks, mining operators should broaden their personal protective equipment inventory to include specialized gear and establish rigorous, time-bound protocols for repairing safety infrastructure. Concurrently, occupational health officers must design peer-led behavioral change campaigns that directly address negative social influences and harmonize scientific safety practices with local cultural beliefs. Finally, regulatory authorities should enforce comprehensive site audits that evaluate not only the physical presence of safety facilities but also their functional maintenance and the sociocultural integration of safety training programs

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