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Effective Safety Communication Strategies to Reduce Workplace Accidents in High-Risk Industries

Hanifah Handayani[1]✉
Institut Teknologi Petroleum Balongan, Indonesia
Correspondence Author: hanifahhandayani17@gmail.com✉

Abstract:

Occupational Health and Safety (OHS) is a crucial issue in high-risk industries due to the high potential for work accidents that impact worker productivity and welfare. One of the important factors that affect the effectiveness of OHS implementation is the quality of safety communication in the work environment. This study aims to analyze the influence of safety communication strategies on work safety behavior and understand safety communication practices and barriers at the operational level. The research uses a mixed methods approach with a sequential explanatory design. Quantitative data was collected through a survey of 55 purposively selected production workers, then analyzed using regression analysis to test the relationship between variables. Furthermore, qualitative data were obtained through in-depth interviews with 4 key informants consisting of production workers, supervisors, and OHS officers, which were analyzed using thematic analysis to explain the quantitative findings. This research was carried out in a high-risk industry located in Subang Regency, West Java, as one of the industrial estates with intensive operational activities. The results showed that message clarity, consistency of delivery, and two-way communication in safety communication strategies had a significant effect on improving safe work behavior and reducing the risk of work accidents. Qualitative findings reveal that time constraints, differences in worker understanding, and dominance of one-way communication are the main challenges in the implementation of safety communication. This study concludes that strengthening participatory and contextual safety communication strategies is a key element in increasing the effectiveness of OHS implementation, as well as making a practical contribution to the development of occupational safety policies and programs in the industrial sector.

Keywords: Occupational Health and Safety, Safety Communication, Workplace Accidents, High-Risk Industries.

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Introduction

High-risk industries globally face increasingly complex pressures as demands for productivity, operational efficiency and the implementation of stricter occupational safety standards increase (Akano et al., 2024). In this context, Occupational Health and Safety (OHS) not only serves as a normative obligation, but also becomes a strategic element that determines operational sustainability and workforce protection. International reports show that occupational accidents and occupational diseases still cause significant economic and social losses in various industrial sectors (Takala et al., 2024). The high intensity of production activities, the use of risky machines, and a target-based work system reinforce the urgency of implementing a more systematic, adaptive, and sustainable OHS.

The development of OHS studies at the global level shows a paradigm shift from a purely technical approach to an approach that emphasizes behavioral and organizational dimensions (Nugraha et al., 2024). Within this framework, safety communication is understood as a key mechanism in transforming safety policies, procedures, and standards into daily work practices. Empirical research shows that safety communication failures often play a role as a latent factor in the occurrence of work accidents, even when technical control systems are in place (Neves et al., 2024). Therefore, the effectiveness of safety communication strategies is a determining factor in the formation of safe work behavior and strengthening safety culture in high-risk industries.

In the national context, the implementation of OHS in Indonesia's industrial sector still faces significant challenges, especially at the operational level (Amrin & Purwojatmiko, 2025). The characteristics of labor-intensive industries, the pressure to achieve production targets, and the heterogeneity of workers' educational backgrounds affect the effectiveness of conveying and understanding safety messages. Studies have shown that safety communication practices in many companies in developing countries are still top-down and administrative, so they have not fully encouraged active worker engagement (Zara et al., 2023). This condition has the potential to create a gap between the safety policies formulated by management and the work practices that take place in the field.

Previous research has extensively examined the relationship between safety communication and OHS performance, particularly in relation to safety culture and safe work behavior. Quantitative studies show that clear, consistent, and easy-to-understand safety communication has a positive relationship with compliance with safety procedures as well as a reduction in occupational accident incidents (Oct, 2024). However, most of these studies still emphasize the measurement of relationships between variables statistically and relatively lack of exploration of the context of the implementation of safety communication at the operational level. These limitations show the need for a research approach that is able to capture the dynamics of safety communication more comprehensively.

The main research gap lies in the lack of studies that simultaneously analyze the influence of safety communication strategies on occupational safety behavior while explaining the process and dynamics of these communication based on real conditions in the field. Many previous studies have assumed that safety messages are received and understood uniformly by all workers, without considering labor relations factors, organizational hierarchical structures, and feedback mechanisms (Ishdorj et al., 2024). In fact, the effectiveness of safety communication is greatly influenced by the social, organizational, and interaction between actors in the workplace (Lee et al., 2021).

Therefore, research that integrates quantitative and qualitative approaches is needed to bridge the gap between statistical findings and operational reality.

Based on the background and gaps of the study, this study aims to analyze the influence of safety communication strategies on safe work behavior and identify safety communication practices and barriers in high-risk industries. In particular, this study focuses on the relationship between message clarity, delivery consistency, and two-way communication with occupational safety behavior. In addition, this study seeks to explain how safety communication strategies are implemented and interpreted at the operational level based on the perspective of production workers, supervisors, and OHS officers. This research was carried out in a high-risk industry located in Subang Regency, West Java. This approach is expected to provide a more contextual understanding of the effectiveness of safety communication.

The contribution of this research theoretically lies in strengthening behavior-based OHS studies by placing safety communication as a strategic variable in the formation of safe work behavior. Practically, the results of this research are expected to be the basis for companies to design safety communication strategies that are more participatory, contextual, and oriented to the needs of workers. The findings of this study are also expected to support the development of OHS policies and programs that are more adaptive to field conditions, so as to reduce the risk of work accidents and improve the sustainability of high-risk industrial operations.

Method

Research Type and Design

This study uses a mixed methods approach with sequential explanatory design, which is a research design that combines quantitative and qualitative methods sequentially (Haynes-Brown, 2023). The quantitative stage is carried out first to statistically test the influence of safety communication strategies on work safety behavior, while the qualitative stage is used to explain, deepen, and interpret quantitative findings based on real conditions in the field. This design was chosen because the effectiveness of safety communication strategies needs to be empirically proven through statistical analysis, while communication processes, contexts, and barriers require an in-depth understanding that can only be obtained through qualitative data.

Population and Sampling Techniques

The population of this study includes production workers, supervisors, and Occupational Health and Safety (OHS) officers in high-risk industries in the West Java region, especially in industries located in Subang Regency, such as heavy manufacturing industries and high-intensity production sectors. At the quantitative stage, the sampling technique used non-probability purposive sampling, with respondent criteria including: active production workers, having a minimum working period of six months, and directly involved in activities related to safety communication. Based on these criteria, 55 respondents were obtained from production workers, a number that was considered realistic and adequate for regression analysis in the context of industrial field research (Arkes, 2023).

At the qualitative stage, the sampling technique uses role-based purposive sampling to select key informants who have experience and authority in safety communication (Makwana et al., 2023). The qualitative informants were four people, consisting of two production workers, one supervisor, and one OHS officer. This

composition was chosen to represent the perspective of operations, supervision, and safety policy, so as to provide a holistic understanding of safety communication practices in the workplace.

Types and Sources of Research Data

The research data consists of quantitative data and qualitative data. Quantitative data was obtained from a survey of production workers as the main source to measure the effectiveness of safety communication strategies. This data includes three groups of variables, namely independent variables, dependent variables, and control variables. The independent variable is the safety communication strategy, which is measured through indicators of safety message clarity, safety briefing frequency, safety communication media (posters, SOPs, and digital media), and feedback opportunities. The dependent variable is occupational safety behavior, which is measured through indicators of compliance with safety procedures, frequency of work accidents, and incidents. Control variables included age, length of employment, education level, and hours worked, which were used to minimize bias in regression analysis.

Qualitative data was obtained from in-depth interviews with key informants to explore workers' experiences in receiving safety messages, safety communication barriers, communication strategies that are considered effective, as well as explanations of quantitative results, such as conditions when communication frequencies are high but work accidents still occur. Additional data in the form of company documents, such as OHS SOPs, safety briefing records, and safety training materials, were used as supporting and triangulated data.

Data Collection Instruments and Techniques

The quantitative instrument is a closed questionnaire with a five-point Likert scale, which is compiled based on the theory of safety communication and adaptation from previous research instruments that have been tested. The questionnaire was compiled in several parts, including respondent demographic data, indicators of safety communication strategies, and indicators of occupational safety behavior. Before being used in the main data collection, the instrument was tested for content validity through OHS expert assessment and tested for construct validity using item-total correlation. An internal reliability test was performed with Cronbach's Alpha, with an acceptable minimum value of 0.70, to ensure measurement consistency (Willems et al., 2023).

The qualitative instrument is a semi-structured interview guideline, which is designed flexibly so that informants can explain their experiences and views in depth. The interviews were conducted live, recorded with the consent of the informant, then transcribed verbatim for analysis purposes. This approach allows researchers to obtain rich and contextual data on safety communication practices at the operational level.

Research Implementation Procedure

The research procedure begins with the preparation and testing of quantitative instruments, followed by the collection of survey data at the research site after obtaining permission from the company's management. Surveys are conducted directly to ensure a high response rate and minimize filling errors. After quantitative data was collected, statistical analysis was carried out to identify patterns of relationships between safety communication variables and occupational safety behavior.

The results of the quantitative analysis are then used as a basis for determining the focus and selection of informants at the qualitative stage. The interview stage is conducted

after the regression results are obtained, so that the interview questions can be directed to explain significant and insignificant statistical findings. The entire research process iscarried out by paying attention to the principles of research ethics, including participant consent, identity confidentiality, and the use of data only for academic purposes.

Quantitative Data Analysis Techniques

Quantitative data analysis was performed using multiple linear regression analysis with the help of IBM SPSS Statistics software (Habes et al., 2021). The analysis stage begins with a test of the validity and reliability of the instrument, then continues with a classical assumption test which includes a normality test, a multicollinearity test, and a heteroscedasticity test to ensure the feasibility of the regression model.

The main analysis was conducted to test the influence of safety communication strategies on work safety behavior. The t-test was used to determine the partial influence of each safety communication indicator, the F-test was used to test the simultaneous influence of all independent variables on the dependent variables, and the determination coefficient (R^2) was used to assess the strength of the model in explaining variations in occupational safety behavior. The results of the regression analysis were used to identify the most dominant safety communication variables influencing safe work behavior.

Qualitative Data Analysis Techniques

Qualitative data analysis was carried out using thematic analysis, which began with the interview transcription process (Perera, 2023). The first stage is open coding, which is identifying the main concepts and issues that arise from the data. The next stage is axial coding, to group and connect interrelated themes. The final stage is selective coding, which is the extraction of core meanings that explain safety communication patterns in the workplace.

Results

1. The Effect of Safety Message Clarity on Safe Work Behavior

Based on the results of data processing of a five-point Likert scale closed questionnaire that has gone through validity and reliability tests, multiple linear regression analysis shows that the clarity of safety messages has a positive and significant effect on safe work behavior. The construct of safety message clarity measured through indicators of language clarity, suitability of message content with work, and ease of understanding showed a positive regression coefficient with a significance level below $\alpha = 0.05$. These findings indicate that the clearer the safety message workers receive, the higher the level of compliance with safety procedures and occupational accident risk prevention behaviors.

Table 1. Multiple Regression Results of Safety Message Clarity on Safe Work Behavior

Variable	B	Std. Error	t-value	Say.
Safety Message Clarity	0.412	0.098	4.204	0.000
Control Variables	—	—	—	—

The results in Table 1 confirm that the clarity of safety messages is a significant predictor of safe work behavior. The positive coefficient shows that safety messages delivered in a simple, specific, and easy-to-understand manner contribute directly to improved worker safety behavior, as reflected in the consistent questionnaire responses between indicators.

The quantitative findings were deepened through the results of semi-structured interviews that were analyzed using thematic analysis. At the open and axial coding stages, safety message clarity emerged as the dominant theme related to workers' understanding of risks and safe work procedures. The informants emphasized that safety messages become more meaningful when they are conveyed directly and relevant to daily work activities. This view is reflected in the following statement: *"If the explanation is clear and directly connected to daily work, we will quickly understand and do not hesitate to follow the rules"* (A-1, November 12, 2025). Conversely, the coding results also show that the overly technical use of terms can hinder comprehension at the operational level. One informant revealed that the non-contextual language actually caused confusion: *"Sometimes the rules are important, but the language is too technical, so in the field they are confused about what they mean."* (A-2, November 14, 2025). In high-pressure work situations, the unclear safety message is perceived to increase the risk of mis-decision-making, as other informants have revealed: *"If the message is not clear, especially when work is busy, it can make people make the wrong decision"* (B-1, November 15, 2025). Integratively, the results of the thematic analysis reinforce the regression findings by showing that the clarity of safety messages is not only technical, but also strongly influenced by the context of delivery and the suitability of language with the characteristics of workers.

2. The Role of Consistent Safety Communication in Reducing Accident Risk

The results of multiple linear regression analysis of survey data showed that the consistency of safety communication had a positive and significant effect on safe work behavior. These variables are measured through indicators of message repetition, alignment between written rules and field practice, and continuity of messages between organizational levels. Significant regression coefficient values indicate that the consistency of safety communication contributes to the internalization of safety values by workers.

Table 2. Regression Analysis of Consistent Safety Communication and Safe Work Behavior

Variable	B	Std. Error	t-value	Say.
Consistent Safety Communication	0.367	0.112	3.276	0.002

Based on Table 2, the consistency of safety communication has been shown to have a significant effect on safe work behavior. Safety messages that are delivered in a sustainable and consistent manner reinforce workers' compliance with Occupational Safety and Health standards.

The results of the interviews analyzed through the open and axial coding stages show that inconsistency in safety messages is one of the main sources of confusion at the operational level. The distinction between formal direction and practice in the field often leaves workers hesitant to determine the safest course of action. The condition was described by an informant as follows: *"Sometimes in the briefing it is said that one thing is done, but in the field the practice is different, so I am confused about which one to join"* (A-1, November 12, 2025). Conversely, perceived consistency of messages helps to form safer work habits and reduces hesitation in action, as another informant revealed: *"If the rules are consistent from start to finish, work becomes more accustomed and you don't need to rethink it every day"* (A-2, November 14, 2025). However, thematic analysis also identified that the consistency of safety communication tends to weaken when the organization is under pressure to achieve work targets. In these conditions, the focus on

safety often shifts: *"If the target goes up, the safety message sometimes becomes inconsistent because the focus is on chasing results"* (C-1, November 18, 2025). These qualitative findings deepen the quantitative results by showing that the consistency of safety communication plays a role as a mechanism for the formation of safe work habits, while message inconsistencies have the potential to undermine the effectiveness of safety systems.

3. The Influence of Two-Way Safety Communication on Safe Work Practices

The results of multiple linear regression analysis showed that two-way safety communication had the strongest influence on safe work behavior compared to other safety communication indicators. This construct is measured through indicators of the opportunity to ask questions, provide input, and report of unsafe conditions without fear of negative consequences. The highest regression coefficient values show that the active involvement of workers in safety communication contributes significantly to the improvement of safe work behavior.

Table 3. Regression Results of Two-Way Safety Communication on Safe Work Behavior

Variable	B	Std. Error	t-value	Sig.
Two-Way Safety Communication	0.489	0.091	5.373	0.000

The coefficient value in Table 3 confirms that two-way communication is a factor dominant in improving safe work behavior, which is reflected in the high participation and awareness of workers to work risks.

Thematic analysis of interview data showed that although safety communication was carried out regularly, practice in the field was still dominated by one-way communication patterns. At the selective coding stage, the limitation of dialogue space emerges as a major issue that limits the effectiveness of safety communication. The experience was conveyed by the following informants: *"Usually I only listen to instructions, rarely given the opportunity to ask questions or give opinions"* (A-2, November 14, 2025). Conversely, when two-way communication is implemented, workers feel more courageous and responsible in reporting potential hazards before an accident occurs: *"If we can have a two-way discussion, we will be more courageous to report dangerous conditions before the incident"* (A-1, November 12, 2025). However, the analysis also revealed structural constraints in the implementation of two-way communication, especially time constraints and production schedule demands: *"Discussions are important, but they often get stuck in production time and schedules"* (B-1, November 15, 2025). Integratively, the qualitative findings explain contextually why two-way communication has the most statistically significant influence, as it is able to increase workers' sense of ownership and responsibility for occupational safety.

Discussion

The results of this study show that safety communication strategies have a significant role in shaping safe work behavior in high-risk industries, especially in the industrial context in Subang Regency, West Java. In particular, message clarity, consistency of delivery, and two-way communication have been shown to have a positive effect on workers' compliance with safety procedures. These findings are in line with the perspective of safety behavior theory which emphasizes that communication is the main mechanism in transforming safety policy into concrete actions at the operational level (Aderamo et al., 2024). Thus, this study strengthens the argument that the effectiveness of the Occupational Safety and Health system

is not only determined by technical aspects, but also by the quality of organizational communication.

The significant influence of safety message clarity on safe work behavior supports the information processing theory, which states that individuals tend to obey rules when information is conveyed in a clear, specific, and understandable manner. These findings are consistent with the research of Zhang et al. (2020) which showed that clarity of safety instructions is directly related to increased worker compliance and reduced work errors (Barrett et al., 2023). In the context of high-risk industries, message clarity is becoming increasingly important as workers are often faced with work situations that demand quick decision-making. Therefore, safety messages that are ambiguous or overly technical have the potential to increase the risk of accidents.

The results of this study also confirm the importance of consistency of safety communication in forming safe work habits. Consistency of messaging allows workers to internalize safety values as part of a work routine, not just an administrative obligation. These findings are in line with the concept of safety climate, which states that alignment between policies, messages, and field practices creates a collective perception of safety priorities in organizations (Barrett et al., 2023). When safety messages are delivered inconsistently, especially under the pressure of production targets, workers tend to prioritize productivity over safety.

Two-way safety communication emerged as the most dominant factor in influencing safe work behavior, suggesting that the active participation of workers is a key element in an effective OHS system. These findings support participatory theory in occupational safety, which emphasizes that worker involvement increases a sense of ownership and responsibility for safety (Botti et al., 2022). Previous studies have also shown that two-way communication allows for early detection of unsafe conditions and encourages proactive hazard reporting (Ejaz et al., 2025). Thus, the results of this study reinforce the empirical evidence that dialogical safety communication is more effective than a one-way approach.

However, qualitative findings show that the implementation of two-way communication still faces structural constraints, such as time constraints and production schedule pressures. This condition shows that there is a gap between the safety policies designed by management and the operational reality on the ground. The phenomenon is in line with the findings Wang et al. (2022) which states that safety communication practices in many emerging industries are still dominated by a top-down approach. This difference provides a logical explanation why, although two-way communication has a strong statistical influence, its implementation has not been optimal at the operational level.

From a methodological perspective, the use of a mixed methods approach in this study makes an important contribution to the development of safety communication studies. Multiple linear regression analysis allows for quantitative identification of relationships between variables, while thematic analysis provides a contextual understanding of how and why safety communication works or encounters obstacles. This integrative approach is in line with the recommendations Amadi (2023) which emphasizes the importance of a combination of quantitative and qualitative data to examine complex organizational phenomena. Thus, this study not only confirms the statistical relationship, but also explains the social dynamics behind it.

However, this study has several limitations that need to be observed. First, the relatively limited number of respondents and the use of purposive sampling techniques limit the generalization of findings to a broader industry context. Second, the measurement of safety behavior still relies on respondent perception data, which has the potential to contain

subjective bias. Therefore, further research is suggested to involve direct observation of work behavior and expand the location of the research in various high-risk industrial sectors. In addition, further research can explore the role of safety leadership and organizational culture as mediating variables in the relationship between safety communication and safe work behavior.

Conclusion

This study confirms that safety communication strategies have a fundamental role in improving safe work behavior and reducing the risk of work accidents in high-risk industries. Message clarity, consistency of delivery, and two-way communication have been shown to have a significant effect on workers' compliance with Occupational Health and Safety (OHS) procedures, both statistically and contextually. These findings show that the effectiveness of OHS implementation is not only determined by the existence of regulations and technical tools, but also by the quality of communication that is participatory, contextual, and in tune with the realities of work in the field. Thus, strengthening safety communication strategies that encourage active worker engagement is key in building a sustainable OHS system that is responsive to high-risk industry dynamics.

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