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The Impact of Emergency Planning and First Aid Communication on Injury Rates in the New Zealand Mining Industry: A Rapid Review

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1.Abstract

The mining industry is considered hazardous and dangerous, requiring robust emergency planning systems and effective first aid communication to mitigate injury severity. In New Zealand, the Pike River coal mine disaster was a catastrophic accident due to systemic weaknesses in emergency preparedness, communication systems and organisational safety leadership failure. Effective and linguistically appropriate communication is considered and important factor in safety management systems, particularly in complex high-risk, culturally diverse work environments. However, despite its acknowledged importance, there is limited research on how communicating emergency planning and first aid directly influences injury frequency and severity within the New Zealand mining sector. This limitation is particularly critical given the sector's remote operational settings, dependency on modern technology, reliance on rapid peer-to-peer response during an emergency situation.

The University library database was used to retrieve relevant research articles using Boolean keyword combinations related to communication, emergency preparedness, first aid response, and injury outcomes. Search results that met the inclusion criteria are screening underwent data extraction. Findings were analysed using thematic synthesis to identify common themes and patterns. Interpretation was guided by Safety culture theory and System accident theory, allows to critically analyse emergency preparedness and first aid communicating and overall health outcome.

The findings suggest that effective communication is a harm mitigation mechanism rather than injury rate determinant. However, the review found inconclusive evidence demonstrating emergency planning and first aid communicating could reduce the injury rate, also studies shows there is close associations in terms of communicating emergency planning and injury severity. By implementing clear escalation pathways, simulation-based emergency exercises, integrated communication technologies, and peer dependency on first aid support in remote operations were associated with enhanced injury mitigation.

This review positions communication not only as an operational tool but also an implication on practitioners, policy perspective. While local research is limited, this review offers theoretically informed principles to support future investigation within the New Zealand mining sector.

Key words

Emergency planning; injury prevention; Effective Communication; Safety culture, First aid communication, New Zealand

2. Introduction

The Pike river coal mine disaster of 2010 is still one of the most significant industrial tragedies in New Zealand's history, resulting in the loss of 29 workers (Royal commission of Inquiry, 2012) and transforming national view on mining safety and regulations (HSWA, 2015). The disaster explains that in high-risk environments such as underground mining, communication failures can compromise response effectiveness and exacerbate harm outcomes (Gyllencreutz et al., 2020). Effective emergency preparedness and communication is therefore not merely an administrative requirement but a foundational component of emergency preparedness and harm mitigation (Jack & Garry, 2024; Karlsson et al., 2020).

The aim of this paper is to investigate critically how the communication of emergency planning and first aid influence injury frequency and severity within the New Zealand mining industry. This aim is motivated by the need to focus on gaps and strengthen injury prevention through improved communication systems in New Zealand mining operations (WorkSafe New Zealand, 2022). Also the geographical location where the new Zealand is positioned on the fault line which further makes this high risk operations further dangerous (Robinson, 2004).Workers operate in environments where

exposure to toxic gas, rock falls, fires, and equipment failures and in New Zealand earthquake risk is significantly higher (Kwazu & Chang-Richards, 2022). International articles identify safety communication, integrated emergency planning, and effective first aid systems as essential mechanisms for reducing harm and improving survival outcomes (Aléx et al., 2017; Cruz-Ausejo et al., 2024; Nyoni et al., 2019). Therefore, the research question of this paper is:

What are the effects of communicating emergency planning and first aid on injury rates in the New Zealand mining industry?

The research in this review paper delimited to peer reviewed international literature examining the communication of emergency planning and first aid within high risk mining environments. The review targets specifically on underground and remote mining contexts, where communication systems and peer delivered first aid are operationally critical. Consequently, due to the limited direct, New Zealand-specific research data, this study relies primarily on a synthesis of international peer-reviewed literature but need through evaluation regarding their transferability to New Zealand's unique operational, regulatory, and socio-cultural landscape. Furthermore, as a rapid qualitative literature review, this study prioritises identifying overarching themes and conceptual relationships over an exhaustive quantitative analysis of effect sizes, thereby focusing on *how* and *why* rather than *by how much* in a statistically measurable sense.

In the following paper, a conceptual overview of communication in emergency planning and first aid within high-risk mining environments is first presented. The methodological approach guiding this rapid literature review is then outlined. Subsequently, the results derived from thematic synthesis are presented and analysed. The discussion interprets these findings in relation to injury frequency, injury severity, and safety culture. The paper then considers implication for practitioners, acknowledges limitations, and concludes by identifying directions for future research and policy development in the New Zealand mining sector.

3. Theoretical Framework

The high-risk characteristic of mining industry, as seen in pike river coal mine disaster, implicates the essential need of application of suitable theoretical framework to understand the complex issue. This could be interpreted using the theoretical lenses of Safety Culture Theory (Sundström & Nygren, 2023) and Safety system Accident Theory (Lenné et al., 2012), to examine how communication in emergency planning and first aid influences injury rates within the New Zealand mining sector.

Safety culture theory propose that organisational safety performance is fundamentally shaped by shared values, beliefs, norms, and behavioural expectations concerning risk and hazard management. Rather than attributing accidents solely to individual error, the theory emphasises the collective assumptions and priorities embedded within organisational structures and leadership practices (Zara et al., 2023). Safety culture is reflected through everyday practices on how hazards are reported, how procedures are followed, and how safety concerns are addressed (National Academies of Sciences et al., 2016). Communication operates as a central mechanism within this framework (Arifin et al., 2026). It functions both formally, through policies, training, and emergency protocols, and informally, through peer interactions and supervisory dialogue (Ebrahimi et al., 2024; Ismail Haloui, 2025). Transparent, consistent, and credible communication strengthens psychological safety, promotes reporting of near-misses, and reinforces shared commitment to safe work practices (Frazier et al., 2013; Jon Newton, 2024). In high-risk industries such as mining, where uncertainty and environmental unpredictability are inherent, communication becomes indispensable in sustaining a proactive and learning-oriented safety culture (Li et al., 2019).

System Accident Theory further deepens this analysis by conceptualising accidents as emergent properties of complex, tightly coupled systems rather than as isolated events (Lenné et al., 2012). Major disasters arise from the interaction of latent organisational conditions, flawed decision-making processes, technological vulnerabilities, and breakdowns in oversight (Pons, 2016) .The Pike River disaster illustrates the systemic nature of catastrophic failure, highlighting deficiencies in communication pathways, emergency planning structures, and organisational governance (Royal commission of Inquiry, 2012). Within such systems, communication is not only a supportive tool but a structural component of risk control.

Failures in information flow whether through inadequate escalation of concerns, ambiguous emergency protocols, Non-aligned coordination can activate latent weakness and transform

manageable hazards into catastrophic events (Aléx et al., 2017; Jack & Garry, 2024). From a systems perspective, communication integrity is therefore central to resilience and adaptive capacity.

Together, Safety Culture Theory and System Accident Theory provide a complementary explanatory framework. Safety culture explains how communication shapes behavioural norms and collective commitment to safety, while systems theory clarifies how communication failures influences across organisational levels and interact with technical and environmental factors. Effective communication in emergency planning and first aid integrates safety values into routine practice and ensures coordinated action during crises (Waring et al., 2024; Zara et al., 2023). Conversely, weak communication infrastructures may undermine safety vigilance, inhibit reporting, and exacerbate systemic limitations. This theoretical foundation informs four interrelated areas of investigation. First, the study examines the relationship between communication effectiveness and safety culture maturity within New Zealand mining operations. Clear, trusted, and consistent communication structures are hypothesised to correlate with stronger safety culture indicators, including reporting behaviours and procedural compliance (Jack & Garry, 2024). Second, the research investigates how communication strategies such as simulation-based training (mobile alert), peer-led first aid instruction, and integrated emergency communication technologies enhance preparedness and response capability (Naik et al., 2024; Ngwenyama & Webber-Youngman, 2024; Repanovici et al., 2022). Third, it differentiates between the effects of communication on injury frequency and injury severity, exploring whether communication functions as a preventive mechanism or as a harm-mitigation strategy once incidents occur (Shittu et al., 2018). Fourth, the study considers the implications of Te Tiriti o Waitangi, examining how principles of Partnership, Protection, and Participation may strengthen communication inclusivity and contribute to culturally responsive safety governance in the mining context (NZ, 2017; Ruwhiu & Carter, 2016).

The literature review synthesises empirical evidence that supports this integrated framework. Research demonstrating the importance of resilient emergency communication systems (Slashchov et al., 2020), peer-dependent first aid in remote operations (Ngwenyama & Webber-Youngman, 2025), and the stronger association of communication with reduced injury severity rather than frequency (Nyoni et al., 2019) collectively reinforce the central proposition of this study. The communication is a structural determinant of safety performance. This review seeks to address this gap by conducting rapid literature review (Snyder, 2019) exploring and synthesising the effects of communicating emergency planning and first aid on injury rates in the New Zealand mining industry. Insufficient New Zealand specific evidence, this review synthesises international peer-reviewed articles to extract transferable mechanisms and system-level principles relevant to high-risk mining contexts.

4. Methods

4.1 Study design

This study underwent a rapid qualitative literature review to examine how communicating emergency planning and first aid affects injury rates within the New Zealand mining industry. A rapid review method was selected due to the time constraints and New Zealand based research, while providing useful insights for both academic and policy makers (Snyder, 2019). Rapid reviews maintain systematic principles of transparency and methodological rigor while streamlining processes to enable efficient synthesis of existing evidence (Grant & Booth, 2009).

A qualitative methodology was applied to explore how emergency planning and first aid communicating effects the injury outcome in specific to New Zealand mining industry (Marcucci, 2024). Mining environments constitute complex systems because of remote workplace, working at confined spaces in which safety outcomes are shaped by organisational culture, structural design, human factors, and technological integration (National Academies of Sciences et al., 2016). Consequently, an interpretive synthesis approach was more appropriate than only quantitative aggregation, as it facilitates understanding of how communication functions within broader organisational and systemic contexts (Nyoni et al., 2019; Waring et al., 2024).

4.2 Search Strategy

A structured and comprehensive search strategy was developed to identify relevant literature across interdisciplinary domains. Searches were conducted across major academic databases and regulatory site including Scopus, Science direct, Open access journal and Worksafe NZ selected for their Supplementary searches were undertaken Google Scholar to maximise retrieval of relevant studies.

Search terms were developed to capture the multidimensional nature of the research question. Keyword combinations addressed four principal domains: mining and high-hazard industries; communication processes; emergency planning and preparedness; and injury outcomes.

Boolean operators were used to search keywords related to mining, communication, first aid and injury outcome. No strict temporal limits were imposed initially in order to capture foundational theoretical contributions relevant to safety culture and systems-based accident analysis. However, greater analytical weight was given to literature published from 2010 onwards to ensure relevance in light of evolving communication technologies and emergency management practices

4.3 Eligibility Criteria

Eligibility criteria were established prior to screening to ensure methodological consistency and relevance to the research objective. Included studies were required to be published in peer-reviewed academic journals, and reputable scholarly books to ensure academic rigor. Only English-language publications were included to facilitate accurate data extraction and synthesis. Studies were required to address at least one core domain central to the research question: communication processes in safety or emergency crisis contexts; emergency preparedness systems; first aid medical response and pre hospital care; mining and other high-hazard industries such as oil and gas and measurable injury outcomes including frequency, severity, morbidity, or mortality.

Both empirical research designs and high-quality review articles were considered eligible. Quantitative, qualitative studies were included to provide a comprehensive evidence base. Theoretical papers were included where they offered conceptual frameworks directly applicable to communication, safety culture, or systems-based accident causation. Studies were excluded if they focused exclusively on occupational disease without relation to acute injury events, environmental sustainability outcomes without safety implications. Editorials, opinion pieces, and non-academic commentary were excluded unless they represented authoritative analyses of major industrial incidents, such as official disaster investigations. These criteria ensured alignment with the research objective while maintaining academic quality.

4.4 Screening and Selection Process

Search results were imported into reference management software endnote and duplicates were removed. Titles were reviewed in line with inclusion and exclusion criteria. Potential articles where filtered and included. A PRISMA-informed flow process was conceptually followed to enhance transparency and reproducibility (Grindlay & Karantana, 2018)

4.5 Data Extraction

A structured data extraction framework was developed to ensure systematic capture of relevant information. For each included study, bibliographic details, country of study, industry context, and research design were recorded. Particular attention was given to the nature of communication examined, including formal safety communication systems, emergency communication protocols, simulation-based training, peer-to-peer reporting mechanisms, and technological communication infrastructures. Emergency preparedness frameworks, incident command systems, and evacuation protocols were documented. First aid variables, including training intensity, peer response methods, and remote medical support systems, were also extracted.

Outcome measures were recorded where available, including injury severity percentage, lost-time due to injury, near-miss reporting, and mortality measures. Extraction emphasised mechanisms linking communication practices to safety outcomes rather than solely descriptive findings.

4.6 Data Synthesis

Extracted data were synthesised using thematic analysis. This involved familiarisation with the data, open coding of relevant findings, identification of recurring patterns, and development of themes. The synthesis sought to critically analyse and interpret how communicating emergency planning and first aid operates within organisational structures and broadly in terms of cultural and nation specific.

Themes were developed inductively but interpreted in relation to the study's theoretical framework, particularly Safety Culture Theory and System Accident Theory. Communication emerged as a central determinant of safety culture maturity, influencing reporting behaviours, procedural adherence, and organisational learning processes. Studies demonstrated that strong emergency preparedness and communication systems were associated with enhanced injury mitigation, in terms of severity reduction rather than primary incident prevention (Arifin et al., 2026; Frazier et al., 2013). Research on

remote and underground operations highlighted the critical importance of peer-dependent first aid capacity, where immediate co-worker response substantially influenced survival and recovery outcomes (Ngwenyama & Webber-Youngman, 2025; Nyoni et al., 2019; NZ, 2017). Evidence further suggested that multidisciplinary communication during emergency preparedness exercises improved coordination and crisis scenarios (Gyllencreutz et al., 2020; Jon Newton, 2024; Karlsson et al., 2020). The methodological approach was explicitly designed to address the research question concerning the effects of communicating emergency planning and first aid on injury rates in the New Zealand mining industry

4.7 Methodological Rigor and Limitations

Although rapid reviews streamline certain procedural elements, rigor was maintained through predefined inclusion criteria, systematic searching, structured extraction, and transparent thematic synthesis. There are limitations include potential publication bias, exclusion of non-English literature, and reliance on international studies due to limited New Zealand-specific empirical research. Findings should therefore be interpreted as theoretically informed extrapolations that warrant contextual validation within New Zealand mining operations.

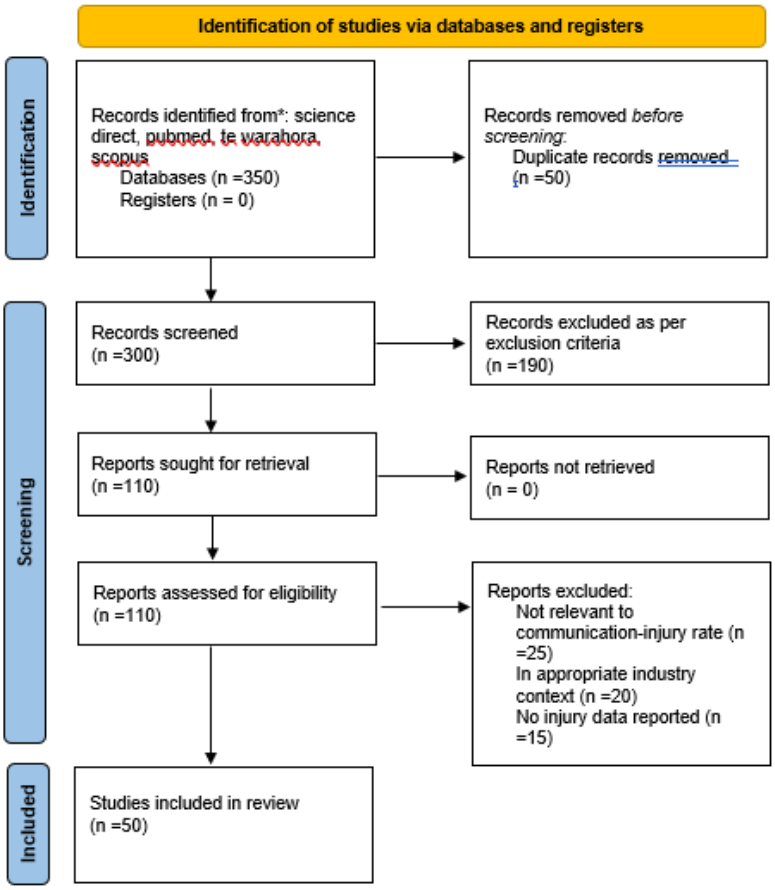

Fig1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

5. Results

The outcome concerning the effects of communicating emergency planning and first aid on injury rates, from review articles primarily within the mining industry. The findings are organised into thematic categories for the research question.

5.1 Emergency management system and their influence on injury outcomes

Emergency planning and first aid communication is crucial in reducing injury severity in high-risk mining industry. Beyond the protocol and documented plans, it is the clarity, reliability of communication that brings crisis outcomes effective (Zara et al., 2023). The Pike River coal mine

disaster of 2010 in New Zealand reports that fundamental communication breakdowns, including poorly understood procedures, poor effective rescue efforts which contributes to loss of 29 lives (Royal commission of Inquiry, 2012). This emphasis, preparedness depends fundamentally on how communication is enacted, directly influencing health outcome of the individual.

In recent times, digital technologies significantly enhance safety and management (Slashchov et al., 2020). In underground mines, specialized Through-The-Earth communication systems are vital for rescue due to difficult to access region and confined spaces, providing critical information for effective operations (Carreño, 2016; Ngwenyama & Webber-Youngman, 2024). Crucially, these systems are fundamental for activating and coordinating onsite first aid (Kim et al., 2023).Research shows that providing onsite first aid for industrial accidents led to participants visiting outpatient clinics 16.16% less often than those without onsite first aid treatment (Karlsson et al., 2019; Kim et al., 2023). Furthermore, effective communication is linked to life-saving potential, In emergency situation reduction in response time by one minute can increase survival (Repanovici et al., 2022). Studies further report that emergency communication is associated with improved coordination between underground workers and surface control centres during high-risk incidents (Jon Newton, 2024). Real-time information exchange enhances situational awareness, facilitates rapid hazard identification, and supports structured activation of evacuation and first aid protocols in confined mining environments (Carreño, 2016; Jack & Garry, 2024).

5.2 First aid preparedness as peer-dependent system

First aid preparedness in mining increasingly relies on a peer-dependent system, where trained mineworkers act as immediate responders. This is crucial as time-consuming rescue operations can be fatal for severely injured victims (Karlsson et al., 2019). The catastrophic Pike River Coal Mine disaster of 2010 detail highlights that limitations of any first responder availability along with systemic communication failures and inaccessible environments prevent immediate intervention, contributing to the fatalities (Ismail Haloui, 2025; Royal commission of Inquiry, 2012). This disaster suggest that a solid emergency preparedness and training is required to mitigate such a catastrophic situation.

The urgency of immediate care is crucial, critically injured persons have a higher chance of survival if medical care is rendered within the first hour - golden hour policy of emergency medical treatment (Karlsson et al., 2019; Ngwenyama & Webber-Youngman, 2025). This necessitates mineworkers possessing essential knowledge, skills, and equipment to provide care until professional help arrives (Ismail Haloui, 2025; Kim et al., 2023). Mineworkers trained in equipment use were significantly more likely to perceive themselves as prepared to respond before emergency medical services arrived. These findings demonstrate that first aid response in mining is structurally peer-dependent due to delayed rescue access in underground environments. Preparedness is therefore a solely individual competency developed with training systems, communication processes, and shared risk understanding (Karlsson et al., 2020). Mines implementing routine refresher training and scenario-based simulations report higher perceived readiness among workers and greater confidence in equipment usage prior to external emergency service arrival (Karlsson et al., 2020; Kim et al., 2023).

5.3 Communication as a mechanism shaping safety culture and injury severity

The literature indicates that communication in emergency planning and first aid operates not only as an operational response tool but also as a mechanism shaping safety culture and influencing injury severity outcomes (Jack & Garry, 2024). Organisational safety culture is reinforced through repeated communication about clear escalation procedures, open hazard reporting systems, and consistent leadership involvement (Frazier et al., 2013; Zara et al., 2023).Effective communication bring shared risk perception, strengthens procedural compliance, and notices the reporting of near-misses (Arifin et al., 2026). Where communication channels are trusted and responsive, workers are more likely to escalate emerging hazards promptly, thereby reducing the likelihood of severity of injury sustained (Sundström & Nygren, 2023; Zara et al., 2023) . Conversely, incomplete loop of communication weakens collective risk awareness and may delay decisive action.

Beyond cultural influence, communication demonstrates a stronger empirical association with injury severity reduction than with injury frequency reduction. Emergency planning and first aid systems function primarily as harm mitigation mechanisms activated when preventive controls fail (Aléx et al., 2017) ,which says that on-site first aid provided by effective communication significantly reduces downstream health impacts. A four-year study reported that workers receiving onsite first aid visited outpatient clinics 16.16% less frequently than those who did not receive immediate treatment, suggesting reduced injury progression (Kim et al., 2023).

While overall incident frequency may decline in some contexts, however injuries continue to occur in mining environments (Aléx et al., 2017). These findings illustrate that communication systems are critical not only in holding a proactive safety culture but also in mitigating critical events. However, direct empirical evidence linking communication interventions solely to reductions in injury frequency remains limited (Arifin et al., 2026).
Research additionally demonstrates Communication of first aid training can contribute to shaping safety culture within a Te Tiriti informed framework (Ruwhiu & Carter, 2016). The principles of partnership, participation, and protection emphasise equitable safeguarding of Māori health and meaningful involvement in decision-making processes Integrating culturally responsive communication in emergency preparedness may strengthen relational trust, collective responsibility, and shared accountability for worker wellbeing (Ruwhiu & Carter, 2016). Integrating these principles into safety communication can therefore enhance inclusivity, reporting behaviours, and coordinated response during emergencies within mining safety culture (Sundström & Nygren, 2023).

5.4 Emergency preparedness requires multidisciplinary system

Effective emergency preparedness in mining industry greatly dependent on multidisciplinary system (Gyllencreutz et al., 2019). Mining incidents, particularly underground and in remote areas, present extraordinary challenges for rescue services, demanding a high level of inter-organizational cooperation among disaster management team, emergency personnel, rescue services, and the mining industry (Li et al., 2019). Successful emergency management requires communication that transcends organisational boundaries and integrates different systems and protocols to ensure effective response (WorkSafe New Zealand, 2022). Challenges include maintaining clear communication channels underground, ensuring effective collaboration between responders and dispatch centre (Karlsson et al., 2019).

A lack of communication or inadequate interaction significantly affects collaboration during injury incidents (Jack & Garry, 2024). Therefore, integrating mine emergency management with national disaster systems, through liaison with authorities and external parties, is critical (Pramayu et al., 2025). This multi-stakeholder involvement, transparent communication, and preparedness training are essential for coordinated decision-making, reducing conflict, and optimizing patient outcomes during major incidents (Arifin et al., 2026; Gyllencreutz et al., 2019). Effective emergency preparedness requires governance integration and linguistic inclusivity. Regulatory oversight, clear command hierarchies, and due diligence mechanisms ensure coordinated response across agencies (HSWA, 2015). Simultaneously, language barriers within diverse mining workforces can undermine hazard comprehension and escalation processes (Ruckstuhl et al., 2013). Multidisciplinary systems must therefore incorporate culturally and linguistically responsive communication strategies to ensure equitable safety outcomes for employees.

6. Discussion

The results obtained from the review shows the significant effects of communicating emergency planning and first aid on injury rates within the mining industry, providing a base knowledge in context with the New Zealand mining sector.

6.1 Interpreting the results: Answering the Research Question

The review outlines the emergency preparedness as a determinant of injury outcomes in mining, rather than a preventive control. The literature suggests that emergency preparedness is responsive rather than preventive measure (Karlsson et al., 2020; Mavhura, 2019). In high-hazard industries such as mining, residual risk can only be reduced but not prevented. Emergency preparedness can therefore be seen as a proactive strategy to prevent life threating incident (Nyoni et al., 2019) . The result indicates that organisations demonstrate routine scenario testing, clear communication, and accessible first aid resources exhibit more behavioural responses under stress conditions, therefore reducing injury severity (Aléx et al., 2017).

The emergency preparedness and communication in the workplace determine the safety culture in the organisation. Safety culture extends beyond procedural check of documents to proactive risk management, leadership characters, open communication, team accountability and proactive risk management also contingency readiness (National Academies of Sciences et al., 2016). The literature reviewed suggests that sustained emergency training and post-drill reflective debriefing cultivate sustainable safety culture and reduces the injury rate and improves the worker’s health (Bautista-Bernal et al., 2024). Emergency preparedness provide behavioural conditioning and cognitive readiness.

By enhancing preparedness and reducing harm, repeated drills and simulation-based training indirectly support primary prevention through sustained cognitive awareness of catastrophic risk (Jon Newton, 2024).

First aid preparedness further modifies injury outcomes in remote operations, immediate on-site response is mostly a co-worker and clear communication and well equipped emergency preparedness determines the overall health and wellbeing of the individual (Waring et al., 2024). The importance of preparedness in mining industry extends beyond evacuation planning to execution of confident action which encompass physiological stabilisation of injured individual. The capacity of workers to control bleeding, manage airway compromise, or immobilise fractures directly influences injury severity (Karlsson et al., 2019).
Communication emerges not as an individual factor but as a mediating mechanism that translates preparedness into operational performance and their purpose is not hazard elimination but harm reduction (Worksafe, 2026a). Effective communication enables rapid hazard escalation, clarifies responsibilities, supports coordinated evacuation, and activates first aid and rescue mechanisms (Zara et al., 2023). These processes directly affect exposure duration, physiological deterioration, and the timeliness of medical stabilisation. Consequently, communication primarily shapes the trajectory of harm rather than the likelihood of incident occurrence (Arifin et al., 2026). This explains why communication improvise survival probability and recovery outcomes.

The Pike River incident is a strong evidence supportive of importance of emergency preparedness and effective communication is an important determinant of workplace health outcome. Investigations identified failures in hazard escalation, procedural clarity, and communication between operational levels (Royal commission of Inquiry, 2012).Methane accumulation constituted the immediate technical hazard; however, ineffective communication pathways prevented timely intervention and constrained adaptive decision-making. The catastrophe therefore reflected not only engineering weaknesses but systemic breakdowns in information flow and escalation protocols.

Importantly, the findings demonstrate a stronger relationship between emergency preparedness and injury severity mitigation than between preparedness and incident occurrence rates (Arifin et al., 2026). While hazard elimination and engineering controls primarily target incident occurrence, modern communication technique moderates harm magnitude once incidents occur (Aléx et al., 2017; Repanovici et al., 2022).

This distinction aligns with layered defence models of accident causation, wherein emergency response capacity constitutes a downstream barrier within the Swiss cheese framework (Wiegmann et al., 2022). Therefore, preparedness should be not merely be as an administrative requirement but as a dynamic protective barrier within multi-layered safety systems.

Within the New Zealand context, seismic activity introduces additional systemic vulnerability to underground mining operations. Earthquakes can disrupt ventilation, power supply, and communication infrastructure simultaneously (WorkSafe New Zealand, 2022). In such scenarios, incident occurrence may be unavoidable; however, effective emergency preparedness systems determine efficient evacuation coordination, and first aid activation, thereby decrease injury severity (Naik et al., 2024)

Methodological limitations in the current research limit the establishment of causative mechanism. Many studies rely on retrospective case analyses and also cross-sector convergence (Karlsson et al., 2019; Kim et al., 2023). Studies across mining, oil and gas consistently associate structured preparedness with improved coordination and reduced harm escalation. While sectoral transferability must be interpreted cautiously with the structural contextual relevance as relatability (Cruz-Ausejo et al., 2024).
Within the regulatory context of Aotearoa New Zealand, due diligence obligations under the Health and Safety at Work Act 2015 emphasise verification of effective systems (HSWA, 2015). However, the literature suggests that verification practices priorities documentation over functional readiness (Aléx et al., 2017). Audit mechanisms often confirm the existence of emergency plans without assessing behavioural competence or response efficiency. For the New Zealand mining industry, this distinction suggests that evaluation of emergency preparedness should prioritise response timeliness, escalation effectiveness, and severity indicators rather than relying solely on aggregate injury frequency metrics. Strengthening communication systems may not eliminate incidents entirely, but it substantially determines the severity of injuries.

From a Te Tiriti o Waitangi perspective, emergency preparedness and communication within the New Zealand mining industry must also be understood through the principles of partnership, protection,

and participation (Maui Hudson, 2010). Effective safety communication is not solely a technical or operational function but a relational process that requires meaningful engagement with Māori workers and communities connected to mining operations and integrating Te Tiriti obligations into emergency preparedness brings out better health outcome for the indigenous workers (HRCNZ, 2019). The principle of protection implies that employers and regulators must actively safeguard Māori health and wellbeing by ensuring equitable access to clear, culturally responsive emergency information and first aid training (NZ, 2017). Participation requires that Māori voices are included in safety planning, consultation processes, and emergency response design, rather than treated as passive recipients of directives. A partnership-based approach strengthens trust, improves hazard reporting, and enhances collective resilience (Worksafe, 2026a).

6.2 Implications for Practitioner

The findings of this review suggest that emergency preparedness within the New Zealand mining industry must be operationalised as a coordinated and actively practiced rather than a compliance framework (Jackson & Quinlan, 2024). Emergency plans should be executed through regular scenario-based training, multidisciplinary approach, rehearsal of escalation pathways and first aid activation under stress conditions. Particular attention should be given to underground environments where delayed external medical access requires workers to act as immediate responders. Strengthening peer-based first aid communication, clarifying role can reduce response delays and limit injury severity during high-consequence events (Ismail Haloui, 2025; Jack & Garry, 2024)

The findings of this review indicate that emergency communication should be treated as a core operational capability rather than a procedural compliance requirement within the New Zealand mining industry (Arifin et al., 2026). Given its stronger association with injury severity mitigation, practitioners should prioritise strengthening escalation pathways, ensuring redundancy in underground communication infrastructure, and improving coordination between operational teams and emergency responder (Shittu et al., 2018). Emergency plans must be embedded through regular multidisciplinary simulations and scenario-based exercises to ensure activation under stress conditions (Karlsson et al., 2020).

By adopting a systems-based approach that integrates communication, training, leadership, and inter-agency coordination, practitioners can enhance harm reduction and reduce the severity of adverse outcomes in high-risk mining environments.
Emergency preparedness in the New Zealand mining industry should align with Te Tiriti o Waitangi principles of partnership, participation, and protection. Practitioners must ensure that emergency planning and first aid communication are culturally responsive and equitable(NZ, 2017). Protection requires safeguarding Maori health through accessible and inclusive safety systems. Partnership involves meaningful engagement with Maori representatives in designing and evaluating emergency protocols (Maui Hudson, 2010). Participation ensures Maori workers are actively involved in safety committees and preparedness exercises. Embedding Te Tiriti values contributes to more equitable and resilient emergency management practices in high-risk mining environments (HRCNZ, 2019).

6.3 Limitation

Despite offering valuable insights, this rapid qualitative literature review is subject to limitations. Firstly, as a rapid review, our methodological approach prioritised efficiency over comprehensiveness. While a rapid review search was conducted, this accelerated process carries the risks overlooking studies which could be relevant but lesser indexed which implies the review might not encompass every relevant publication. Secondly, a significant limitation arises from the scarcity of direct, peer-reviewed empirical research specifically focused on the New Zealand mining industry. This necessitated drawing extensively from broader international literature. Consequently, while general findings regarding communication's role in safety culture, preparedness, and injury severity are broadly applicable, their direct transferability to New Zealand's unique operational, geological, regulatory, and socio-cultural context requires critical analyses of interpretation and local validation. Finally, the qualitative nature of our thematic analysis, while providing rich insights into communication's processes and impacts, does not yield quantitative measures of effect size.

6.4 Suggested Future Research

This review identifies several important gaps that warrant further investigation, particularly within the New Zealand mining context. Although international evidence demonstrates meaningful associations between emergency preparedness, first aid communication and injury outcomes, there is limited empirical research directly examining these relationships within New Zealand mines. Future studies

should prioritise context-specific case studies, longitudinal analyses, and to validate the applicability of international findings and explore organisational, regulatory, and operational process unique to New Zealand.

There is also a need for stronger quantitative measurement of communication and health outcome. Future research should develop robust indicators such as escalation pathway efficiency, clarity of emergency documentation, frequency of safety briefings to injury rate, statistical relationship. Such approaches may clarify pathways that remain conceptually suggested but empirically underdeveloped. Further investigation into advanced underground communication technologies and their influence on response time and injury mitigation. Additionally, research exploring the cultural and social dimensions of safety communication, including workforce diversity and Maori perspectives, would enhance understanding of inclusive and contextually responsive emergency preparedness strategies within high-risk mining environments.

7. Conclusions

This literature review searched the effects of communicating emergency planning and first aid on injury rates within mining environments, with particular attention to the New Zealand context. The synthesis of international evidence demonstrates that communication functions as a critical component of emergency preparedness systems, primarily influencing injury severity rather than directly reducing injury frequency (Cruz-Ausejo et al., 2024). While engineering controls and hazard elimination strategies predominantly shape incident occurrence, emergency communication systems determine the severity of harm sustained in the event (Aléx et al., 2017; Arifin et al., 2026).

Effective escalation protocols, peer-dependent first aid activation, and multidisciplinary coordination significantly affect response time, injury stabilisation, and survival outcomes in high-risk underground environments (Gyllencreutz et al., 2019).

The findings further indicate that communication operates as linking mechanism of technical infrastructure, human competence, organisational leadership, and regulatory oversight (Pramayu et al., 2025). Emergency preparedness reflects the operational readiness through training protocols, use of communication channels, and coordinated inter-agency engagement (Mavhura, 2019). The review also highlights the relative scarcity of New Zealand-specific empirical research and special attention should be focused on indigenous community workers health. The strong understanding of global events to validate and transferability towards New Zealand context. In a seismically active country such as New Zealand, emergency communication resilience is not optional but structurally essential (Worksafe, 2026b). While hazards cannot always be prevented, communication integrity determines response timeliness and harm containment (Shittu et al., 2018). Strengthening culturally responsive communication systems is therefore central to reducing injury severity in mining operations (Sundström & Nygren, 2023; Zara et al., 2023).

Importantly, the analysis suggests that injury frequency metrics alone may inadequately capture preparedness effectiveness (Li et al., 2019). From a Te Tiriti o Waitangi perspective, inclusive and culturally responsive communication practices are essential to ensure equitable protection and meaningful participation within emergency systems (Maui Hudson, 2010).

The communicating emergency planning and first aid constitutes a resilience-enabling mechanism within mining operations. By embedding communication within integrated, actively practiced preparedness systems, mining organisations can improve injury outcomes and reinforce both operational safety and ethical governance in high-risk industrial environments.

8. Funding

This research was conducted as part of postgraduate coursework and received no external funding.

9. Ethical committee approval

This study was based exclusively on publicly available, peer-reviewed articles. No formal ethical approval required.

10.Conflicts of Interest

The author declares no actual or potential conflicts of interest in relation to the research, authorship, and publication of this literature review.

11. Generative AI use

The author declares no generative artificial intelligence tools were used in the preparation, writing, analysis, or editing of this literature review.

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