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Written but not heard: A rapid review of first aid and emergency communication in New Zealand forestry

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Research Question : What is the impact of communication of first aid and emergency

Abstract

Forestry is one of New Zealand's most hazardous industries, with fatality rates 20 times the national average and a disproportionate burden of harm experienced by Māori workers. Despite comprehensive regulatory requirements, serious injury rates have remained persistently high. This paradox suggests a gap between regulatory compliance and practical effectiveness. This rapid review investigates how the communication of first aid and emergency planning, rather than the mere presence of equipment or documented procedures, influences injury outcomes.

Approximately 300 records were screened, with 30 included in the final synthesis. A consistent compliance-effectiveness gap emerged. While forestry operations generally meet formal regulatory requirements, communication failures are repeatedly implicated in serious injuries and fatalities. Analysis of over 6,500 New Zealand forestry incidents found that approximately 70% were attributed to worker-related factors, with fatigue indicators present in 78% of cases. Research has similarly identified persistent miscommunication between contractors and forestry workers, with crews often failing to recognise or apply safety training.

Applying a Chain of Survival framework adapted from emergency medicine highlights how forestry safety systems frequently fracture at the point of knowledge transfer. In remote forestry settings, where the first and often only responders are co-workers, the quality of communication that shapes their response capability is critical to survival. This review establishes communication as the central determinant of effective first aid and emergency response, providing a clear direction for future empirical research and practice-focused intervention.

Keywords: forestry safety, first aid, emergency planning, safety communication, Chain of Survival, Health and Safety at Work Act 2015

1. Introduction

1.1 The Clinical Perspective: Why This Research Matters

A 23-year-old forestry worker died in a fatigue-related crash after working approximately 197 hours over 14 days. The court in WorkSafe New Zealand v Micheal Vining Contracting (2018) found the breach was not due to a lack of training, but from failure to ensure workers understood fatigue-related risks. The failure was one of communication rather than provision.

Clinical literature demonstrates that the period immediately following injury, commonly described in trauma literature as the "golden hour", is critical to survival and injury severity (Lilley et al., 2021). Intervention quality during this window profoundly affects survival, long-term prognosis, and quality of life.

In forestry, the first responder is rarely a paramedic; it is a co-worker in a remote location with basic training. Whether that worker can recognise an emergency and respond effectively depends fundamentally on the quality of safety communication received. A stark contrast exists between comprehensive regulations and consistently high harm rates, raising the question of whether communication represents the missing link between safety systems that exist on paper and those that function when injuries occur.

This rapid review examines how communication of first aid and emergency planning influences injury outcomes in New Zealand's forestry sector.

1.2 The Scale of the Problem

Forestry fatality rates are approximately 20 times the all-industry average (WorkSafe NZ, 2024). Between 2009 and 2024, 60 workers died, and 150 suffered serious injuries.

Injury patterns remain consistent. Gaskin and Parker (1993) identified felling and trimming as the most hazardous, causing over half of injuries, predominantly traumatic lacerations to extremities. Hinze et al.'s (2021) analysis of 6,584 incidents found 70% attributable to worker-related factors, including poor hazard evaluation, technique, and communication, with 78% showing fatigue indicators.

Forestry injuries, such as crush trauma, severe haemorrhage, falls from height and chainsaw lacerations, demand rapid response. In remote operations, where access to definitive medical care may be significantly delayed, initial response rests with co-workers who may be shocked, fatigued, or uncertain. The combination of remoteness, time-critical injuries, and peer-delivered care means effective safety communication determines survival.

1.3 Inequitable Outcomes and Te Tiriti Obligations

Harm is not evenly distributed. Māori workers comprise approximately one-third of the workforce yet experience serious injuries at substantially higher rates than non-Māori workers (WorkSafe NZ, 2024; Ministry of Business, Innovation and Employment, 2021). This raises questions about whether prevailing safety communication approaches adequately serve Māori workers.

Training models grounded in Western, classroom-based pedagogies may not align with Māori learning preferences or tikanga when communication approaches assume particular cultural contexts, literacy levels, or learning styles. They risk creating differential protection, with structural inequity persisting even when regulatory compliance appears uniform.

Addressing this inequity is both a safety imperative and a Te Tiriti o Waitangi obligation. Article 2 affirms tino rangatiratanga over taonga, including health and wellbeing, while Article 3 guarantees equal rights and protection. Ensuring effective safety communication for Māori workers requires moving beyond translation toward genuine consideration of how communication methods may need to differ to achieve equivalent protective outcomes.

1.4 Regulatory Framework and the Compliance-Effectiveness Gap

New Zealand's health and safety regulatory framework emerged following the Pike River mine disaster. The Health and Safety at Work Act 2015 introduced persons conducting a business or undertaking (PCBUs) as primary duty holders and embedded communication within core duties. Section 36(3)(f) requires PCBUs to provide information, training, instruction, or supervision necessary to protect workers, recognising that safety systems only function when understood and applied.

The Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 mandate adequate first aid provision and emergency plans, including communication procedures. Despite clear statutory obligations and industry initiatives following the Independent Forestry Safety Review (McKinnon, 2014), serious injury rates have remained persistently high.

This persistence indicates a gap between compliance (documented systems) and effectiveness (systems that function in practice). A PCBU can satisfy requirements yet fail to protect workers if crew members do not know where equipment is located, cannot remember procedures under stress, or lack the confidence to act.

1.5 Theoretical Framework and Review Purpose

This review adopts the position that communication is the critical mechanism through which safety systems translate into protective outcomes. Drawing on organisational behaviour (Zohar, 2010) and health psychology (Burke et al., 2006), communication is understood as a sociotechnical process involving comprehension, retention, confidence, and social reinforcement, not merely information delivery.

From this perspective, communication failures represent system failures. When a worker does not know how to respond to an emergency, the question concerns how safety knowledge was transferred, whether it was designed for retention under stress, and whether the work environment supported its application.

The central research question is: What is the impact of first aid and emergency planning communication on injury outcomes in New Zealand's forestry sector?

1.6 Operational Definitions

For this review, communication refers to processes by which first aid knowledge and emergency planning information are transferred to workers, including formal training, induction processes, toolbox talks, written procedures, supervisor instruction, and peer-to-peer learning. Effective communication encompasses information delivery, worker comprehension, retention, confidence to act, and ongoing reinforcement.

Injury outcomes refer to the severity and consequences of workplace injuries, including fatalities, serious harm requiring hospitalisation, injuries requiring medical treatment, and near-misses. The review focuses on outcomes influenced by emergency response quality, including survivable injuries that become fatal due to inadequate first aid, and serious injuries where timely intervention could reduce severity.

2. Methodology

2.1 Methodological Approach

This review adopts a rapid review methodology, guided by Snyder's (2019) typology. Rapid reviews are appropriate for conceptually fragmented research areas examined across multiple disciplines, where the aim is to synthesise evidence, identify patterns, and inform future inquiry rather than estimate intervention effect sizes. This approach is well-suited to safety communication in forestry, a topic spanning safety science, organisational behaviour, health psychology, forestry studies, and occupational health.

The approach of this review is to synthesise existing evidence, identify recurring mechanisms, highlight gaps specific to the New Zealand forestry context, and provide a conceptual foundation for future empirical research. This approach is consistent with established guidance on integrative and rapid review methodologies (Grant & Booth, 2009; Snyder, 2019).

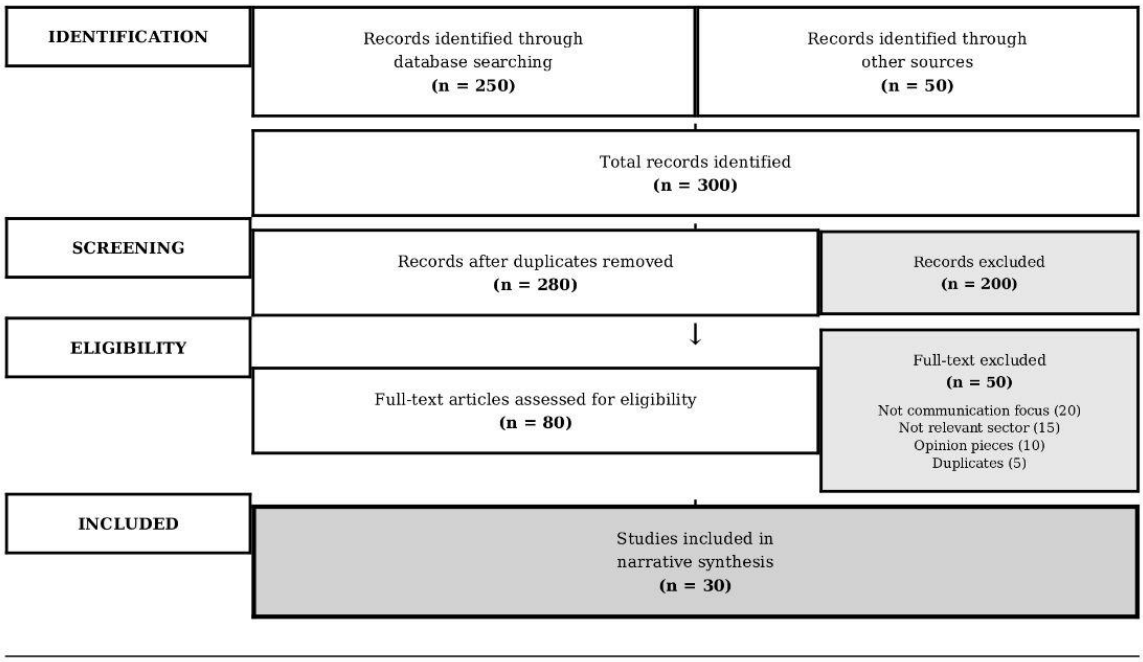
2.2 Search Strategy

A comprehensive search was conducted across multiple source types. Academic databases searched included Google Scholar, Scopus, and PubMed. New Zealand-specific sources included WorkSafe NZ, Accident Compensation Corporation (ACC), Ministry of Business, Innovation and Employment (MBIE), Stats NZ, Health and Safety Association of New Zealand (HASANZ), Forest Growers Research, Safetree NZ, New Zealand Legislation, the New Zealand Legal Information Institute (NZLII), and university repositories.

Search terms combined four domains: forestry work (forestry, logging, forest workers, tree felling, harvesting), first aid and emergency planning (first aid, emergency response, emergency planning, emergency preparedness), communication and training (communication, training, safety communication, safety training), and context (New Zealand, Aotearoa, injury, accident, fatality).

Studies were included if they comprised empirical studies (quantitative/qualitative), regulatory and guidance documents, sector reports and reviews, relevant New Zealand court decisions involving forestry safety, English language publications, and materials published between 1990 and 2025. Studies were excluded if they were opinion pieces without empirical or documentary evidence, technical forestry literature without a safety focus, or duplicate records.

Approximately 300 records were screened by title and abstract by a single reviewer. Of these, 80 underwent full-text review, and 30 were included in the final synthesis. Searches were conducted between November 2025 and February 2026. Figure 1 presents the PRISMA 2020 flow diagram for this review.



Note. Adapted from Page et al. (2021). PRISMA 2020 flow diagram template. Searches conducted November 2025 to February 2026.

Figure 1. PRISMA 2020 Flow Diagram

2.3 Analysis and Synthesis

The included literature was read in full and coded for how communication was defined, how it was delivered, what outcomes were measured, and the forestry context. Particular attention was paid to mechanisms linking communication to injury outcomes, contextual factors that might strengthen or weaken communication effectiveness, and evidence specific to New Zealand forestry.

Findings were synthesised narratively and thematically, enabling empirical studies, regulatory material, and legal findings to develop a coherent account of how communication may influence first aid and emergency response outcomes.

Findings are presented in four parts: (1) mechanisms linking communication to outcomes, (2) contextual factors affecting communication effectiveness, (3) the New Zealand evidence landscape and gaps, and (4) a Chain of Survival framework synthesis that integrates the evidence.

3. Evidence Synthesis: Mechanisms Linking Communication to Outcomes

Five interconnected mechanisms emerge that suggest how the communication of first aid and emergency planning may influence injury outcomes. These mechanisms do not operate independently. Rather, they interact to determine whether safety systems function effectively or merely exist on paper.

3.1 The Compliance-Effectiveness Gap

The presence of safety systems does not guarantee their effectiveness during an emergency. While operations may satisfy formal regulatory requirements by providing first aid kits and training, a gap often persists between documented compliance and practical response capability. Nkomo et al. (2018) highlighted this disconnect, finding that while 95% of workers had received safety training, 79% did not fully understand the procedures, and 30% did not even know the emergency contact numbers. This suggests that safety systems can exist as a formal 'shell' without being effectively internalised by the workers they are meant to protect. Furthermore, Zohar (2010) emphasises that the effectiveness of these systems is determined more by on-site supervisor behaviour and 'safety climate' than by formal written policies.

3.2 Behaviour Change Through Training

Several studies suggest that first aid training can change how people behave long before an emergency occurs. In controlled UK factory studies, McKenna and Hale (1981, 1982) found that workers who received emergency first aid training had fewer subsequent accidents than matched controls. Training heightened awareness of injury consequences and altered attitudes toward risk.

Lingard (2002) found similar patterns among Australian construction workers. In her study, first aid training was associated with higher safety motivation and better risk control behaviour. Importantly, training quality was critical. Training that was engaging and relevant produced observable behavioural change, while poorly delivered or routine training had little effect. Burke et al. (2006) found that active approaches such as demonstrations, practice, and role play produced greater improvements in knowledge and performance than passive methods such as lectures.

For forestry, where work is dispersed across remote sites and training delivery varies widely, these findings highlight that how first aid and emergency content is communicated may shape both everyday safety behaviour and emergency response capability.

3.3 Emergency Preparedness and Response Capability

International forestry studies emphasise that emergency first aid capability is not a luxury in remote operations; it is a basic requirement. Rosecrance et al. (2017), drawing on focus groups with loggers in Montana and Idaho, reported that workers viewed emergency first aid training as a critical component of logging safety due to long delays in accessing professional medical care. Lagerstrom (2018) developed and evaluated an emergency first aid training programme for loggers and found that inexperienced workers accounted for more than 25% of workers' compensation claims. This finding emphasised the importance of communication strategies that support newer workers, not only experienced crews.

Research from other forestry contexts reinforces similar concerns. Park and Nam (2022), studying Korean forestry workers, found that many participants were uncertain about appropriate actions during emergencies. They proposed a structured emergency response framework emphasising situational assessment, on-site first aid, and coordination with emergency medical services. Together, these studies suggest that emergency preparedness depends not only on training provision but also on whether communication equips workers with clear, practical, and rehearsed response strategies.

3.4 The Pre-Hospital Gap

Other research highlights the gap between what happens at the forestry work site and what happens once professional medical care becomes available. Enez et al. (2014), surveying 378 logging workers in Turkey, found that 70.4% of injured workers received only first aid on site and were not taken to any health facility. In such cases, the quality of on-site care may determine whether an injury remains survivable.

Oliver et al. (2017), looking more broadly at pre-hospital trauma deaths, found that bystander actions can significantly improve survival in key situations such as major bleeding, airway obstruction, and tension pneumothorax. Their work was not forestry-specific, but it reinforces the idea that in remote environments where ambulances may be delayed, co-workers' understanding of what to do in the first minutes after injury is crucial. However, a co-worker's response is contingent on successful activation. Nkomo et al. (2018) found that 30% of forestry contractors did not know emergency contact numbers, indicating that even well-trained responders may be unable to summon professional assistance if communication protocols have not been effectively conveyed.

3.5 Non-Technical Skills and Psychological Safety

Communication is embedded within a wider set of non-technical skills that shape emergency response. Irwin et al. (2023), in interviews with 25 UK forestry workers, including chainsaw operators, supervisors, and managers, identified six key skill areas: situation awareness, decision-making, task management, cognitive readiness, teamwork and communication, and leadership. Emergency planning is featured within task management, particularly in relation to pre-job preparation, access planning, communication methods, and emergency contacts.

A key finding from Irwin et al. was the role of psychological safety. Workers who felt able to speak up, question decisions, and express uncertainty without fear of blame were more likely to engage in safe behaviours. In the context of emergency response, psychological safety influences whether workers feel able to stop work, call for help, or say 'I'm not sure what to do here' rather than improvising

silently. Formally communicating procedures is only part of the picture; the everyday climate of the crew determines whether people will use that information when it matters.

4. Factors Affecting Communication Effectiveness

Safety communication in forestry does not happen in a vacuum. Several contextual factors shape whether first aid and emergency planning messages reach workers and translate into action.

Training quality matters as much as training coverage. Nkomo et al. (2018), surveying 300 harvesting contractors in South Africa, found that while 95% of respondents had received some form of health and safety training, 79% did not fully understand safe work procedures, and 30% did not know emergency contact numbers. At the same time, 83% rated their training as good or excellent, while 80% believed that training quality still required improvement. This disconnect suggests that workers may recognise that training occurs, yet struggle to translate it into practical understanding. The issue lies less in the existence of training and more in how clearly and practically it is communicated.

Supervisor behaviour strongly shapes how safety messages are interpreted. Zohar's (2010) review of three decades of safety climate research demonstrated that workers judge the importance of safety primarily through the actions of their immediate supervisors rather than through written policies or formal statements. When supervisors rush safety discussions or fail to model expected behaviours, workers quickly learn that procedures are flexible or optional. Neal and Griffin (2006) similarly found that supervisor safety behaviour was a stronger predictor of worker safety behaviour than formal training alone. In forestry, where supervisors lead dispersed crews in challenging environments, the way emergency procedures are discussed and reinforced on site can be as influential as the content of any formal plan.

Fatigue further weakens both comprehension and response capability. Hinze et al. (2021) found that 70% of incidents in their New Zealand forestry dataset were attributed to worker-related factors, with 78% showing indicators consistent with fatigue. Incident timing clustered around 10 am and 2 pm, reflecting long early starts and demanding physical work. Fatigue not only increases the likelihood of injury but also impairs memory, attention, and decision-making during emergencies. Communication strategies, therefore, need to account for fatigue, both in how training is delivered and in how frequently key messages are reinforced.

High workforce turnover presents additional challenges. Moffat (2000) reported an average crew tenure of 2 years and 9 months in New Zealand forestry and described the industry as highly mobile and transient. When people move frequently between crews and employers, communication systems relying on long-term relationships or infrequent training are insufficient. This is consistent with broader evidence showing training effects fade without reinforcement (Burke et al., 2006). Together, these findings point to the limits of a one-off training session in a fatigued and mobile workforce. Safety messages need to be simple, repeated, and embedded in day-to-day conversations and practices if they are going to stick.

Language, literacy, and culture also influence how well safety communication is received. In New Zealand forestry, where Māori workers and migrant workers make up a substantial share of the workforce, communication that assumes high literacy, fluent English, and Western classroom norms can easily miss its mark. The Māori Workers Health and Safety Strategy 2021-2026 (MBIE, 2021) explicitly recognises that standard approaches may not serve Māori workers well and highlights concepts such as hauora (holistic wellbeing), whānau (collective responsibility), and kaitiakitanga (guardianship) as important for thinking about safety. These concepts offer broader and more relational ways of framing safety that extend beyond narrow compliance-focused models. Communication barriers also manifest operationally. Irwin et al. (2023) identified pre-job preparation of communication methods and emergency contacts as core non-technical skills, yet evidence suggests these are inconsistently practised or reinforced across culturally diverse crews.

Finally, the organisational structure of the forestry industry creates additional communication challenges. Forestry worksites often involve multiple PCBUs, including forest owners, principal contractors, subcontractors, and labour hire firms. A worker may receive first aid training from one organisation while operating under an emergency plan developed by another. Where communication across these boundaries is unclear, gaps and overlaps in responsibility are inevitable. In such settings, clarity about emergency roles, procedures, and accountability is essential if first aid and emergency planning are to function effectively in practice.

5. The New Zealand Forestry Evidence Landscape

A search of New Zealand sources reveals a substantial body of work on forestry safety, but very little research that directly examines how communication of first aid and emergency planning influences injury outcomes. Most New Zealand studies focus on incident patterns, risk factors, or regulatory compliance rather than on how safety messages are understood, remembered, and acted upon during emergencies.

Moffat's (2000) training needs analysis remains the most substantial New Zealand study that examines safety communication in forestry. Surveying 396 crew members, 48 contractors, and 23 trainers across three regions, Moffat found that safety training was often ineffective in delivering safety messages, with evidence of miscommunication between contractors and logging workers. Crew members reported fewer safety topics as having been covered in their training than contractors and trainers said they had delivered. This suggests that workers sometimes did not recognise safety training when it happened or did not retain it in the way trainers expected. This disconnect between what is taught and what is received is a core communication problem that sits at the heart of this review's concerns.

Subsequent New Zealand forestry research has largely shifted away from communication processes and toward incident analysis and risk identification. Hinze et al. (2021) attributed approximately 70% of incidents to worker-related factors, frequently involving fatigue. Gaskin and Parker (1993) provided earlier baseline data on injury patterns, identifying high rates of traumatic injuries associated with felling and trimming activities. More recently, Boocock et al. (2023) surveyed chainsaw users and found that 70% reported musculoskeletal symptoms, while chainsaw kickback (74%) and lack of experience (70%) were identified as major contributors to injury risk. Together, these studies deepen understanding of how and where forestry workers are being injured, but they offer limited insight into how first aid and emergency plans are communicated or practised at the work site.

On the regulatory and policy side, New Zealand has a well-developed framework governing forestry safety. Key documents include the Health and Safety at Work Act 2015, the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016, guidance from WorkSafe NZ on first aid (2020) and emergency plans (2018), the Approved Code of Practice for Forestry Operations (2023), and relevant NZQA unit standards such as Unit Standard 40056: Respond to an emergency in a forestry operation. The Independent Forestry Safety Review (McKinnon, 2014) identified persistent weaknesses in safety culture and communication across parts of the sector, while the Māori Workers Health and Safety Strategy (MBIE, 2021) highlighted the need for approaches that better reflect Māori workers' experiences and realities.

5.1 The Specific Gap

Despite this mix of regulation, incident analysis, and training research, a clear gap remains. Since Moffat's (2000) study, no New Zealand research has directly examined how first aid and emergency planning are communicated in forestry or whether different communication approaches are associated with different injury outcomes.

This gap is significant for several reasons. First, Moffat's study predates the Health and Safety at Work Act 2015 and the current regulatory framework, meaning it is unclear whether the communication problems she identified have improved, persisted, or taken new forms. Second, her work focused on general safety training rather than first aid and emergency response, despite these being the areas most likely to influence survival in remote forestry environments. Third, there is no New Zealand evidence examining whether safety communication works equally well for Māori forestry workers, despite their disproportionate representation in injury statistics and explicit Te Tiriti o Waitangi commitments.

In summary, New Zealand forestry has strong regulatory requirements, detailed data on injury patterns, and longstanding indications that safety messages do not always land as intended. What is missing is empirical research that asks how first aid and emergency plans are actually discussed, understood, and practised on the ground, and whether this communication makes a measurable difference when injuries occur.

6. Synthesis: The Chain of Survival Framework

When evidence from international safety research, training studies, and New Zealand forestry analysis is considered together, communication emerges as the key mechanism that determines

whether safety systems protect workers in practice or remain largely procedural. Rules, equipment, and documented plans are necessary, but they are not sufficient on their own. These elements only become protective when workers understand them, remember them, and feel able to act on them under pressure. The Chain of Survival model from emergency medicine, adapted here as an analytic framework for forestry (see Figure 2), provides a clear way to examine how communication failures at different stages can lead to preventable harm.

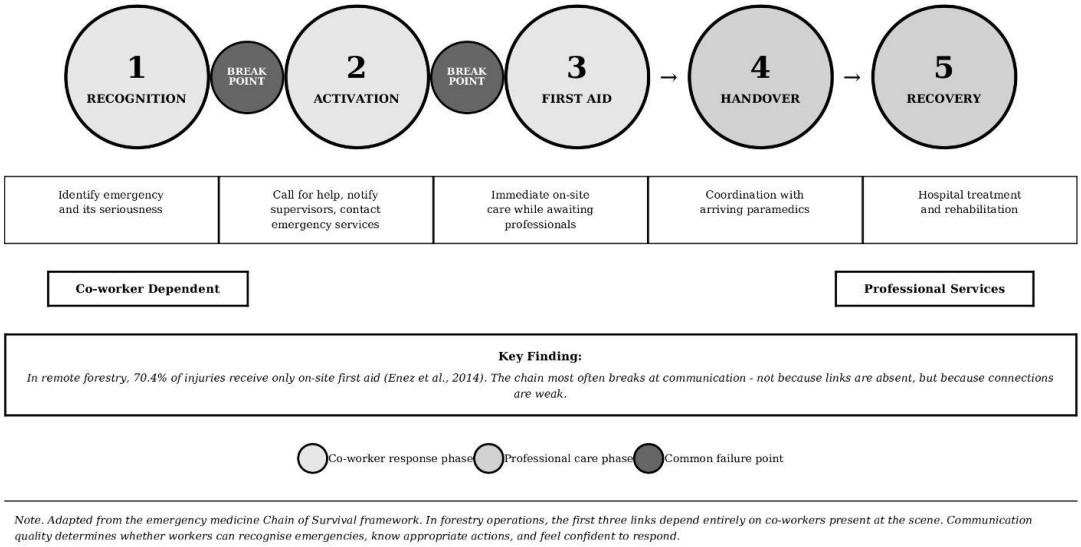


Figure 2. Chain of Survival Adapted for Remote Forestry Operations

In this adapted framework, five interrelated stages are identified. The first is recognition, which involves identifying that an emergency has occurred and understanding its seriousness. This depends on hazard awareness and training that enables workers to interpret what they are seeing. The second stage is activation, including calling for help, notifying supervisors, and contacting emergency services. This relies on clear communication protocols and confidence in using them. Critically, activation requires more than device availability. Workers must know who to contact, by what means, and with what information. Nkomo et al.'s (2018) finding that 30% of forestry workers did not know emergency contact numbers illustrates how communication failures at the induction and training stage directly compromise this link in the chain. The third stage is immediate first aid, which involves providing on-site care while professional help is on the way and depends on how well first aid training has been communicated, understood, and retained. The fourth stage is professional response, including coordination with and handover to emergency medical services. Park and Nam (2022), in their study of Korean forestry workers, explicitly included "coordination with emergency medical services" within their proposed emergency response framework. However, New Zealand research has not examined how such coordination is communicated, who holds responsibility in multi-PCBU worksites, or what information is transferred when helicopter or ambulance crews arrive. The final stage is recovery, encompassing hospital treatment, rehabilitation, and learning from incidents to reduce the risk of recurrence.

In remote forestry operations, the first three stages of the chain depend almost entirely on co-workers. The minutes immediately following an injury are shaped by whether workers recognise an emergency, know what actions to take, and feel confident applying first aid before professional assistance arrives. Evidence from Enez et al. (2014), who found that 70.4% of injured forestry workers received only on-site first aid, highlights how strongly outcomes depend on field response in settings where access to medical care is delayed. In many forestry environments, the nearest co-worker is effectively the only responder during this critical period.

The evidence reviewed suggests that the chain most often fractures not because links are absent, but because connections between them are weak. Communication is that connection. Where workers have been trained well, where messages have been reinforced, and where psychological safety

allows people to speak up and ask questions, the chain holds. Where communication has been perfunctory, infrequent, or culturally misaligned, the chain breaks, and preventable harm follows.

7. Discussion

Across the reviewed literature, five recurring themes emerge that help explain why injury rates in New Zealand forestry remain high despite the presence of formal safety systems.

First, communication gaps in forestry safety training appear to be real, persistent, and consequential. Moffat (2000) identified miscommunication in forestry training more than two decades ago, and more recent analysis suggests that these issues remain unresolved. Worker-related factors continue to dominate incident classifications, with fatigue compounding the problem. Although the regulatory framework has changed substantially since Moffat's research, with the introduction of the Health and Safety at Work Act 2015, no subsequent New Zealand research has examined whether communication effectiveness has improved in practice.

Second, international forestry evidence highlights the importance of effective emergency first aid capability in remote environments. Studies consistently show that injured forestry workers often depend almost entirely on on-site first aid, with limited or delayed access to professional medical care. The pre-hospital phase is often the entire medical response. This places particular importance on how first aid and emergency procedures are communicated, understood, and reinforced within forestry crews.

Third, research on non-technical skills emphasises communication, situational awareness, and psychological safety as central to safe operations and effective emergency response. During emergencies, workers must feel able to ask for help, express uncertainty, or stop work without fear of blame. Communication failures in these moments can have fatal consequences.

Fourth, fatigue emerges as a cross-cutting factor that affects both injury risk and emergency response capability. Incidents cluster at times associated with reduced alertness. Fatigue not only increases the likelihood of an incident occurring but also reduces attention, memory, and decision-making during emergencies. This has direct implications for when and how safety communication and training are delivered.

Fifth, the effectiveness of safety communication in forestry is shaped by context. Training quality, supervisor behaviour, workforce mobility, cultural relevance, and complex contracting arrangements all influence whether messages are understood and acted upon. These moderating factors help explain why issuing additional guidance or running more courses alone is unlikely to close the gap between compliance and real-world safety outcomes.

7.1 Critical Research Gaps

The most striking finding of this review is the absence of New Zealand research examining how first aid and emergency planning are communicated in forestry and whether communication quality affects injury outcomes. Since Moffat's (2000) study, no empirical research has directly addressed this issue.

Several areas warrant further investigation. Descriptive research is needed to understand how forestry crews actually discuss and practise emergency procedures in daily work, rather than how these procedures are described in manuals. Outcome-linked research could explore whether PCBUs with stronger communication practices experience better injury outcomes, controlling for other factors. Equity-focused research, conducted in genuine partnership with Māori and guided by Kaupapa Māori principles, is needed to assess whether current communication approaches serve Māori forestry workers effectively. Intervention studies could test whether approaches such as scenario-based drills, regular refreshers, supervisor-led reinforcement, or culturally grounded communication strategies improve emergency response capability.

Addressing these gaps is critical for moving beyond assumptions and developing evidence-based interventions that can directly save lives and reduce harm in the forestry sector. Without such evidence, policy development and guidance updates will continue to rely on assumptions rather than demonstrated effectiveness.

7.2 Te Tiriti Implications

The disproportionate harm experienced by Māori forestry workers raises clear Te Tiriti o Waitangi considerations. Article 2 affirms tino rangatiratanga over taonga, including health and wellbeing, while

Article 3 guarantees equal rights and protection. Persistent injury disparities suggest that these commitments are not being fully realised in practice.

The Māori Workers Health and Safety Strategy acknowledges that standard safety approaches may not adequately meet Māori workforce needs. Concepts such as hauora, whānau, and kaitiakitanga offer alternative ways of framing safety that emphasise collective responsibility and wellbeing rather than individual compliance. Whether embedding these concepts within safety communication improves outcomes is an empirical question, but one that must be explored with Māori, rather than about Māori, if it is to meet Te Tiriti obligations.

7.3 Limitations

This review used a rapid methodology with a single reviewer, which does not provide the same level of rigour as a fully systematic review with multiple reviewers. This limitation was mitigated through iterative searching across multiple databases and source types, as well as backward citation tracking. The central finding, that no New Zealand empirical research links communication of first aid and emergency planning to injury outcomes in forestry, was consistent across all search strategies.

The review was limited to English language sources, and some relevant grey literature or very recent unpublished work may have been missed. These limitations are typical of rapid reviews and should be considered when interpreting the findings.

7.4 Practical Implications

Although this review identifies significant research gaps, it also points to practical considerations for forestry PCBUs seeking to improve safety communication. Evidence suggests that communication effectiveness depends not only on content, but on delivery, timing, and reinforcement. Active and participatory training approaches appear more effective than passive methods. Supervisor involvement in reinforcing messages may be as influential as formal training sessions. Regular refreshers are likely necessary given workforce mobility and the known decline of training effects over time.

Cultural considerations, particularly for Māori workers who comprise a substantial proportion of the workforce, require explicit attention in communication design. Fatigue patterns also suggest that the timing of training and key messages matters, with delivery during periods of higher alertness likely to improve retention.

These considerations do not replace the need for robust New Zealand research, but they represent reasonable inferences from the available evidence. In the interim, PCBUs may benefit from conducting internal checks of how well emergency procedures are understood, using simple methods such as crew discussions or scenario-based exercises to identify communication gaps before they contribute to serious harm.

8. Conclusion

The central finding of this review is both simple and consequential. In New Zealand forestry, the difference between documented safety systems and operational capability resides in the quality of communication connecting them. Regulatory frameworks exist. Equipment is provided. Emergency plans are written. Yet forestry records fatality rates approximately 20 times the national average (WorkSafe New Zealand, 2024), with Māori workers bearing disproportionate harm (MBIE, 2021). These outcomes indicate that procedural adequacy does not ensure protective performance.

Evidence synthesised across international safety research, clinical studies, and New Zealand incident analysis reveals that communication operates as the active mechanism determining whether first aid knowledge translates into competent responses under pressure. Where communication achieves clarity, reinforcement, and integration into daily routines, emergency response becomes reliable. Where it remains episodic or detached from operational realities, systems fail when their function is most critical. Analysis of New Zealand forestry incidents demonstrates this repeatedly: serious harm events frequently implicate breakdowns in how safety information was transferred, understood, or enacted (Hinze et al., 2021; Moffat, 2000).

Remote forestry locations place professional medical assistance beyond immediate reach, making the interval between injury and definitive care decisive for survival. Clinical research on preventable trauma deaths (Lilley et al., 2021) confirms this window demands rapid, informed intervention, precisely the capacity dependent on effective prior communication. Co-workers are first responders by necessity. Their ability to recognise deterioration, manage haemorrhage, and coordinate

evacuation depends not only on technical first aid skills but also on non-technical capabilities, including situational awareness, decision-making under pressure, and psychological safety that enables workers to call for help without fear of blame.

Communication effectiveness is further mediated by contextual factors that shape whether safety messages reach workers and translate into action. Fatigue, which affects both injury risk and cognitive capacity during emergencies, compounds communication challenges when training is delivered at times of reduced alertness. Supervisor behaviour, workforce mobility, training quality, cultural relevance, and complex contracting arrangements all influence whether messages are understood and retained. For Māori workers, whose injury rates signal potential misalignment between standard approaches and culturally grounded learning contexts, these factors carry both practical and Te Tiriti implications.

The persistence of elevated harm rates two decades after communication deficiencies were first documented (Gaskin & Parker, 1993; Moffat, 2000) suggests incremental adjustments have proven insufficient. What remains absent is direct empirical examination of how first aid and emergency planning are actually communicated in contemporary operations, and whether specific communication practices correlate with injury severity.

This review's analytical contribution lies in repositioning communication from a compliance element to a central performance variable. By integrating regulatory analysis, incident data, and international evidence, it establishes a foundation for empirical investigation examining communication as practised behaviour within crews, assessing whether specific strategies correlate with improved outcomes, and developing approaches in genuine partnership with Māori communities. Forestry work remains inherently hazardous, yet progression from hazard to fatal outcome is neither automatic nor inevitable. Advancing understanding requires empirical attention focused not on what safety systems should contain, but on how effectively they function when emergencies emerge.

Author declaration

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