Safety, Health and Wellbeing

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Safety, health, and wellbeing

Fire and Emergency commissions research to support its main functions:

- Reducing the likelihood of unwanted fires.
- Reducing consequences from emergencies.
- Helping build resilient communities.

Evidence Briefs summarise this research, on specific topics. They are the initial port of call for decision makers, policy makers and operational staff looking to influence fire-related outcomes.

Summary

Systems and processes for safety, health, and wellbeing

- Effective safety, health, and wellbeing systems require different components to work together. It involves legislation; partnerships with stakeholders; organisational leadership; plans and policies; organisational culture; fire station management; and commitment from individual staff.
- Health and safety attitudes and behaviours in volunteer brigades are improving. However, a systemic approach is needed to address under-reporting of near-misses and non-injury accidents.

Mental health and wellbeing

- Firefighters are increasingly attending more traumatic non-fire events, and these events can have negative effects on their mental health and wellbeing.
- Firefighters have a higher risk of sleep disorders and the resulting physical and mental fatigue.
- Some volunteers have experienced negative fire brigade culture (including bullying and discrimination), with negative effects on their mental wellbeing.
- Women make up an increasing proportion of career firefighters, but they have experienced varying levels of acceptance.
- Families play an important role in supporting volunteer firefighters' wellbeing. However, some face challenges, including anxiety and uncertainties from the unpredictable on-call nature of volunteering.

Managing fatigue

- Firefighters have a higher risk of injury with increased hours and overtime.
- Firefighters are more likely to get injured as they get older.
- The effects of long COVID on physical and psychological health can affect firefighters' ability to perform their duties safely.

Physical health and fitness, and exposure

- A different approach for medical and physical testing may be needed in order to recruit and retain volunteers.
- Firefighters are exposed to high levels of carbon monoxide. As well as presenting health risks, this can also affect firefighters' performance.
- Firefighting instructors are exposed to high heat environments more often than general firefighters. Merino undergarments and hoods may protect against exposure to carcinogens and heat.

Hapori Māori

- Māori firefighters continue to be a small group, but are growing, especially in volunteer brigades. Training of new recruits is putting more emphasis on diversity, inclusion, and tikanga Māori. However, cultural safety could be further improved within Fire and Emergency.

SAFETY, HEALTH, AND WELLBEING

Summary

EVIDENCE BRIEF | 04/23

RECOMMENDATIONS FROM THE RESEARCH

Comprehensive systems and processes for safety, health, and wellbeing

1. Ensure Fire and Emergency's safety, health, and wellbeing system includes strategic plans and policies; recognises leaders and champions and provides for leadership; and there is adequate resourcing.

Preparation and support for responding to medical emergencies

1. Improve the preparation and training of firefighters.
2. Strengthen support for firefighters who are affected by stress and trauma, including better education and support for their families.
3. Foster a culture where it is OK to "ask for help", and reinforce the importance of looking out for each other

Support for a more diverse and inclusive workforce

1. Provide appropriate and responsive support to ensure the safety, health, and wellbeing of an older and more diverse workforce.
2. Build a more inclusive frontline culture, and attend to cultural safety, including better understanding of Te Tiriti, the value of diversity, and cultural protocols.
3. Ensure adequate training, equipment, and support for volunteer firefighters, and adequate information and support for their families.
4. Provide ongoing support to brigade leaders and better monitoring of brigades in order to effectively identify, confront, and manage unacceptable behaviours such as bullying and discrimination
5. Ensure Fire and Emergency's safety, health, and wellbeing system includes strategic plans and policies; recognises leaders and champions and provides for leadership; and there is adequate resourcing.

Physical health and safety, and exposure

1. Increase awareness of, and support for, Fire and Emergency services and benefits that enhance firefighters' performance, safety, health and wellbeing.
2. Ensure there is an effective fatigue management policy and that it is monitored and evaluated.
3. Firefighters should be screened for sleep disorders and, if needed, provided with treatment pathways.
4. Regularly monitor exposure to carbon monoxide, and ensure firefighters are trained in the hazards of smoke and in mitigating smoke exposure.

Recommendations for future research

1. Extend the study of the impact of work hours and overtime on risk of injury to examine the rhythm of work performed over time, the type of work, the number of call-outs, and incident types.
2. Closely monitor the effects of long COVID on firefighters' performance.
3. Carry out further research into the effectiveness of merino undergarments in preventing skin exposure to carcinogens.
4. Carry out regular biometric studies in order to understand the physical health and safety risks of firefighting, and the mental health and safety risks.

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SYSTEMS AND PROCESSES FOR SAFETY, HEALTH, AND WELLBEING

Fire and Emergency is committed to keeping firefighters safe and well

Fire and Emergency is committed to keeping its firefighters safe and well and to supporting them by improving their psychological wellbeing, physical safety, and work-related health. It has a safety, health and wellbeing strategy (Figure 1) articulated in its 10-Year Plan 2020-2030.[1]

Effective safety, health, and wellbeing systems are comprehensive, requiring different components to work together

Best-practice health, safety, and wellbeing systems involve different components working together at multiple levels (Figure 2):[2]

- Societal level: legislation that enforces safer and healthier workplaces
- Community level: effective partnerships with unions and other stakeholders such as other emergency responders, national oversight bodies (like WorkSafe), and health providers
- Organisational level (fire service): leadership; policies and plans; and continuous learning and improvement
- Fire station level: effective mid-level management to implement change, activities, and programmes; and effective engagement with employees and volunteers that increases their ownership of health and safety
- Individual level: commitment to safe behaviour; and their support to achieve change.

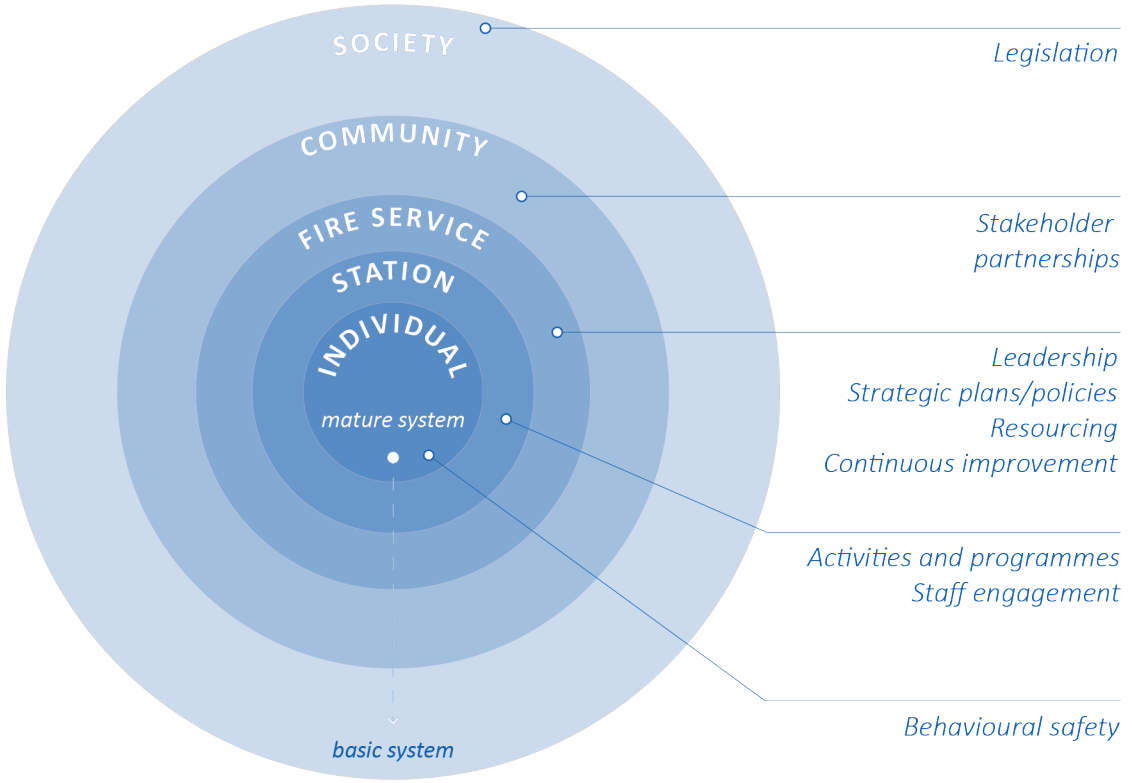
Figure 1. Safety, health and wellbeing strategy

Our objective

To keep our people safe and well, and support them in their work by improving their psychological wellbeing, physical safety and work-related health. Our people work in very challenging environments, often facing critical risks in their day-to-day roles. We want to make sure we support all our people at work, so they go home safe and well every day. We want our people to feel valued, safe, and engaged in the workplace.

Source: Fire and Emergency New Zealand (2020)[1]

Figure 2. Framework of levels and components of best practice



Source: Duckworth et al (2016)[2]

SYSTEMS AND PROCESSES FOR HEALTH, SAFETY, AND WELLBEING

A mature system involves all components of safety, health, and wellbeing and has the following key features:[2]

- Safety, health, and wellbeing is integrated into every part of the organisation and becomes business as usual.
- There is a high degree of ownership at all levels of the organisation.
- All managers and staff are well-informed and are proactive in identifying risks and eliminating problems before they occur.
- The organisation has a zero injuries target.
- The organisation focuses on staff health and wellbeing as well as safety.

Health and safety attitudes and behaviours in volunteer brigades are improving

There had been under-reporting of near-misses and non-injury accidents within the volunteer rural fire forces (VRFF). A 2016 study of this problem found that:[3]

- The formal health and safety systems varied across VRFFs.
- Volunteers disliked or resented the paperwork involved in reporting near-misses and accidents. However, they were prepared to either report orally or to complete paperwork if the process was simple and easily accessible and if they were told what happens as a result.
- Attitudes and behaviours towards health and safety are strong and improving. But a systemic approach is required for change, and responsibility and accountability falls to everyone in the system:
  - For volunteers: address personal attitudes and behaviours to recognise the importance of reporting near-misses
  - For VRFFs: develop an enabling culture that encourages near-miss reporting
  - For Fire and Emergency: develop usable systems and approaches that enable VRFFs and individual volunteers to report and see value in reporting.

MENTAL HEALTH AND WELLBEING

Firefighters are increasingly attending more traumatic non-fire events, which can have negative effects on their mental health and wellbeing

In 2014, Fire and Emergency agreed with St John and Wellington Free Ambulance to attend all life-threatening, cardiac, and respiratory arrest emergencies as co-responders.[4] This is in line with international trends where firefighters are increasingly working as first responders to non-fire medical calls.[5]

In 2021 and 2022, out of more than 85,000 incidents attended, about 22% were fires, 16% were medical emergencies, and 11% were motor vehicle collisions (Figure 3).

Research[4,6] has found that responding to medical emergencies can be traumatic for career and volunteer firefighters and can affect their mental health, particularly for those who do not feel well prepared. Some reported that cases involving life-threatening situations and little chance of success ("purple calls") contribute to anxiety about their performance and self-doubt (feeling they could have done better or might have made mistakes).[4]

Volunteers experienced interrupted sleep and negative psychological effects as a result of traumatic call-outs involving children or fatalities.[6]

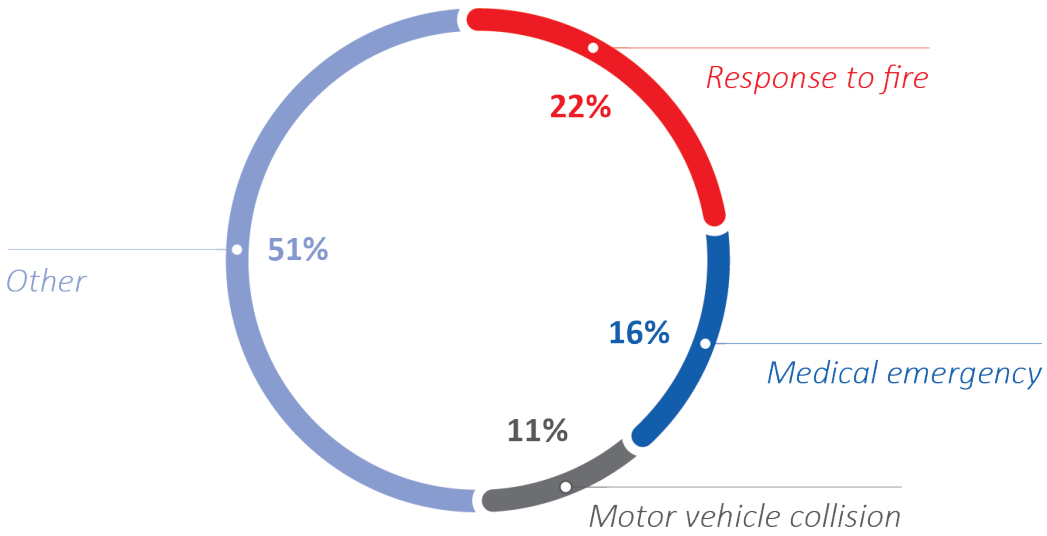
A 2020 study of the preparation of new recruits to career firefighting reported that at the National Training Centre, recruits received seminars and training on medical emergencies by St John, and education about available support and counselling services.[7] However, challenges remain:

- Many career firefighters still felt inadequately prepared for co-responding to medical calls.[7] There was no ongoing medical training in the Qualified Firefighter programme.
- There were not enough proactive support services to help firefighters struggling with the negative effects of responding to medical emergencies.
- Though they were aware of available support services, most firefighters were still reluctant to seek help because of stigma based in macho attitudes and stoicism.[4,7] Some female firefighters also talked about not wanting to seem weak compared with the men.[4]

For volunteers, the research found that wellbeing was enhanced when:[6]

- there was high-quality training and support from brigades
- there were opportunities for development and progression
- the principles in Fire and Emergency's Volunteerism Strategy 2019–2029 were followed.

Figure 3. Types of incidents attended by Fire and Emergency



In 2021-22, out of 85,425 incidents attended, about 22% were in response to fires, 16% were medical emergencies, 11% were motor vehicle collisions

MENTAL HEALTH AND WELLBEING

Firefighters have a higher risk of sleep disorders and the resulting physical and mental fatigue

A review of international research found that as a result of their work patterns, firefighters are at greater risk of sleep difficulties or disorders.[8] The studies found that sleep disorders can significantly increase health and safety risks for firefighters:

- It leads to physical and mental fatigue, which affects their physical and cognitive performance.
- Sleep disturbances, particularly insomnia, increase the risks of mental health problems (for example, burnout, depression, anxiety, alcohol misuse, post-traumatic stress disorder (PTSD), and suicidal thoughts).
- Fatigue is reported as a significant health and safety risk for volunteer firefighters both while firefighting and in their regular jobs outside the fire service.

Some volunteers have experienced a negative fire brigade culture that affects their mental wellbeing

A longitudinal study in 2018 aimed at a better understanding of the journey and experiences of volunteers found that some had experienced a toxic and negative brigade culture, with bullying, discrimination, nepotism, or favouritism.[6]

Women make up an increasing proportion of career firefighters but they have experienced varying levels of acceptance

Though still a small minority, the proportion of females among career firefighters has almost doubled – from 3.5% in 2017 to 6% in 2022. The proportion of females among volunteer firefighters has not increased (15.9% in 2017 compared to 15% in 2022). Female firefighters have experienced varying levels of acceptance across different brigades, with firefighting still often seen as a man's domain.[4]

Families have an important role in supporting volunteer firefighters' wellbeing

Families play an important role in enabling volunteer firefighters to serve their communities. A literature review and interviews with Fire and Emergency volunteers and their families reported that families not only cover household tasks but also provide emotional support.[5] The research found that families of volunteers can face a range of challenges, to varying levels:

- tension and uncertainties from the unpredictable on-call nature of volunteering
- disruption and strain on firefighters' relationships with their partners and children, including because of trauma
- negative effects on family members' physical and emotional health and wellbeing, such as anxiety and disrupted sleep
- less financial security, because of lost earnings and out-of-pocket expenses for families when volunteers are attending training or when they need to use sick or annual leave at their regular job when they are too tired to work.

Families identified the following protective factors:

- flexible brigades and strong leadership
- brigade leaders recognising and mitigating fatigue and stress by providing flexible shifts, ensuring volunteers and families are aware of professional support available, and providing pastoral care to families
- brigades recognising the importance of volunteer families.

Some brigades **hold social activities and events for families,** which develops a sense of community and helps with image building. Stations were becoming more family-friendly but could still improve.

MANAGING FATIGUE

Firefighters had a higher risk of injury if they worked more overtime

A recent analysis of Fire and Emergency data based on 18,000 shift records, including 509 injuries, found the following:[9]

- The risk of injury increases significantly, at an accelerating rate, as the number of hours worked increases, particularly when this includes overtime. For example, if a firefighter's hours over a 28-day period, including overtime, are doubled, the likelihood of them being injured increases by around 2.5 times.
- Where an employee is in breach of the Fire and Emergency fatigue policy, there is a lower risk of injury. This is because employees tend to reduce their working hours, and in turn avoid injury. This suggests that the fatigue policy is effective in mitigating injuries.

Increasing age was correlated with increasing likelihood of injury

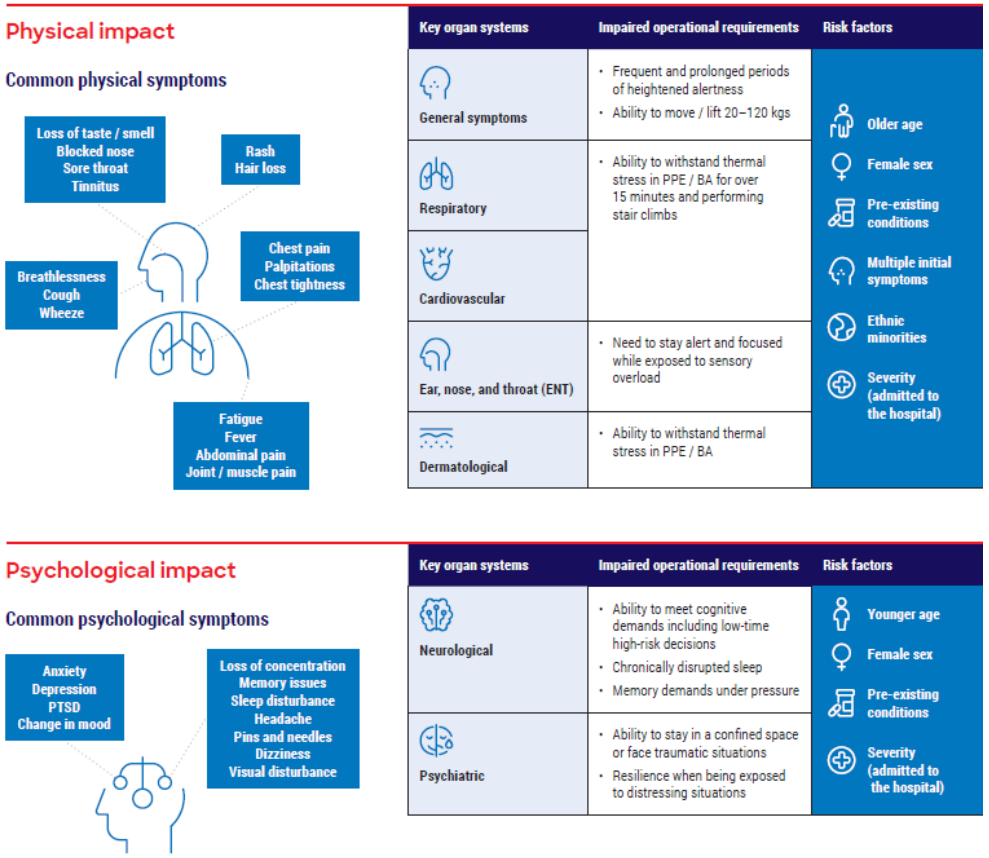
A review of international research found that, in general, the firefighter workforce is growing older.[5] In New Zealand, the average age for a Fire and Emergency firefighter is mid-40s and the average length of service is over 10 years.[10]

In 2017 the average age of volunteer fighters was 43.7 years while in 2022 the average for volunteers was 46 years for males and 40 for females. An aging workforce has significant implications for Fire and Emergency's health, safety, and wellbeing measures. Increasing age significantly increases the overall odds of injury – for example, up to double the likelihood when comparing a 60-year-old to a 30-year-old working the same number of hours.[9]

Long COVID affects physical and psychological health, which in turn affects performance and safety

A recent review of the impact of long COVID found that, although the research is limited and there are many uncertainties, there is clear evidence that long COVID adversely affects physical and psychological health (Figure 4).[11] This can have a particularly big impact for firefighters because of the nature of their job, with its high physical and cognitive demands. The nature of the work may make some long COVID symptoms worse if these are not properly managed and mitigated before the return to work.

Figure 4. Impact and implications of long COVID



Source: Scarlatti (2023)[11]

PHYSICAL HEALTH AND FITNESS

Firefighting is physically demanding – firefighters have high heart rates while fighting fires, and experience significant fatigue

Biometric studies of fighting active fires in New Zealand find that firefighting is indeed physically demanding. One study recorded average heart rates of more than 120 beats per minute in most tasks.[12] In all tasks there were periods of extremely heavy workload, with heart rates above 150.

Fire and Emergency's physical fitness tests provide a good preview of the physical requirements of the role

Recruitment of career firefighters includes:[7]

- an application form
- unsupervised cognitive testing
- supervised cognitive testing
- a physical pre-entry fitness test (PPT)
- a practical assessment course (PAC)
- interviews, and
- due diligence.

The physical pre-entry fitness test includes several job-related scenarios, with the recruit wearing breathing apparatus, helmet, boots, and gloves.[13] A review of the Fire and Emergency firefighter selection process noted that between 2000 and 2003, only 17% of potential recruits failed the PPT,[13] and that the PPT was also aligned with physical tests used in other countries. However, that review recommended that Fire and Emergency:

- regularly review the PPT to determine whether the strength and endurance tests and job-related scenarios adversely impact female applicants' performance on the PTT
- regularly review the cut-off scores to make sure the test is not excluding people who could successfully perform the firefighter role.

Statistical validation of the recruitment process found that the best predictors of overall firefighter performance were the application form, one of the cognitive tests, and the interview – not the PPT.[14] However, the researchers recommended continuing with the PPT as it rounds out the recruitment process, and it provides potential firefighters with a realistic preview of the physical and health requirements of the role.[14]

A different approach to medical and physical testing may be needed in order to recruit and retain volunteers

An interview-based study of rural fire officers (RFOs) in 2014 found the following:[15]

- Volunteers who were not physically fit enough were not turned away, and were instead assigned to different, more suitable roles.
- Many RFOs did not see the need for any physical testing for their crews as they were mainly called out to flat land vegetation fires, roadside fires, or urban assists.
- A majority of RFOs thought medical assessments provided the best indications of heart and lung capacity, and most supported this as a necessary step for all rural fire force personnel.
- Almost all RFOs thought that if a minimum fitness requirement was applied to all volunteers, half of their fire force would leave.

The study recommended a three-tier minimum fitness test:

- Tier 1: Voluntary medical testing for all firefighters by GPs or other medical professionals
- Tier 2: A voluntary moderate pack test for all frontline firefighters and pump operators
- Tier 3: An arduous pack test that is compulsory for all paid rural firefighters but voluntary for other frontline firefighters.

EXPOSURE TO HIGH TEMPERATURES AND CARCINOGENS

Table 1. Carbon monoxide workplace exposure standard

Carbon monoxide workplace exposure standard (WES) Adopted: 2002 CAS number: 630-08-0	
Time-weighted average (TWA) The average airborne concentration of a substance calculated over an eight-hour working day	20 ppm
Short-term exposure limit (STEL) The 15-minute time weighted average exposure standard. Applies to any 15-minute period in the working day and is designed to protect the worker against adverse effects of irritation, chronic or irreversible tissue change, or narcosis that may increase the likelihood of accidents. The STEL is not an alternative to the TWA; both the short-term and time-weighted average exposures apply. Exposures at concentrations between the TWA and the STEL should be less than 15 minutes, should occur no more than four times per day, and there should be at least 60 minutes between successive exposures in this range.	100 ppm
Ceiling A concentration that should not be exceeded at any time during any part of the working day.	200 ppm

Source: WorkSafe (2022)[17]

There is a lot of research on firefighters' exposure to carbon monoxide and the long-term health risks of occupational smoke inhalation

Continuous exposure to high levels of carbon monoxide (CO) can significantly decrease firefighters' ability to work, particularly physical work. In all the firefighting exposure research, research on the exposure to CO is the most comprehensive.[16] However, the research has mostly been done in lab conditions, rather than in fire call-outs.[12]

Two studies done over 10 years ago, in 2008 and 2010, developed a methodology for measuring physiological workload and fire suppression productivity under New Zealand conditions.[12,16] The studies used a data collection harness that included a video camera, video recorder, GPS, a heart-rate monitor, and a data-logging dosimeter for CO recording.

Because of operational difficulties and small sample sizes, the studies could not gather sufficient data to provide meaningful results that can contribute to guidelines for fatigue and shift length.[12,16] However, the studies did validate the methodology.

The 2010 study found that CO occupational exposure limits (Table 1) were exceeded, similar to results in studies in California and Portugal. The researchers recommended:[16]

- training firefighters on the hazards of smoke
- using electronic CO dosimeters to regularly assess smoke exposure
- using self-contained breathing apparatus, where practical
- modifying planning and tactics to emphasise attacking wildfires from multiple sides, and so minimise the mop-up efforts that can increase exposure.

Firefighting instructors are exposed to high heat environments more often than general firefighters

Firefighting instructors at the National Training Centre experience high heat environments much more frequently than operational firefighters. Biometric testing of six instructors showed that instructors are exposed to carcinogens through inhalation, through ingestion, and through the skin.[18]

To reduce heat strain, the National Training Centre uses the following mitigation methods:

- four live fire evolutions per day
- task and job rotation (rests) within and between sessions
- removing clothing and equipment between sessions
- replacing wet undergarments with dry ones
- radial hand/arm water bath cooling.

Research involving interviews with 14 instructors and a literature review concluded that the methods could be improved to more closely satisfy the requirements of the Health and Safety at Work Act,[18] including biometric monitoring of instructors during live fire burns, and more advanced education on the risks of their role and the importance of hydration.
Merino undergarments and hoods may protect against exposure to carcinogens and heat
The biometric study of the six instructors found that merino undergarments and protective hoods reduce skin exposures, and that their use should be facilitated or encouraged as they do not increase heat strain.[19] However, because of the limitations of that study, further research is needed to confirm this.

WHAT DOES THIS MEAN FOR HAPORI MĀORI?

Recommendations from the research

- Build a more inclusive culture on the frontline, and attend to cultural safety, including better education on Te Tiriti, the history of Aotearoa, the effects of colonisation, the value of diversity, tikanga Māori, and Māori worldviews.

Māori firefighters continue to be a small but growing group, and are growing in particular among volunteers (from 5.1% in 2017 to 7.2% in 2022). The proportion of Māori among career firefighters has also slightly increased (11.2% in 2017 to 12% in 2022).

While the studies commissioned did not focus specifically on the health and safety of Māori firefighters, some studies looked at their wellbeing and their experiences of inclusion.

Acceptance and being able to "be Māori" is important for Māori firefighters

A 2017 focus group found that some Māori firefighters experienced difficulties "being Māori" at Fire and Emergency because of discrimination and because of a lack of cultural awareness and understanding of Te Ao Māori among their non-Māori colleagues.[4]

A more recent study of career firefighter recruits at the National Training Centre reported that training emphasised inclusion and diversity and that the initial training incorporated aspects of tikanga Māori.[7] However, once they started their jobs at the fire station, new career firefighters' expectations of an inclusive and diverse organisation were not met. Many stations are still male-dominated, Pākehā environments that some new recruits find challenging.[7]

Te Ao Māori, and cultural protocols, could be more integrated into Fire and Emergency's system and processes

The term "cultural safety" is used in the health sector to refer to reducing bias and achieving equity within the workforce and working environment. It could be similarly applied to Fire and Emergency and the experience of Māori firefighters and Māori who encounter the organisation.

For example, there can be important cultural dimensions to firefighters' experience of fires and other emergencies, particularly fatalities, both in the impact of these call-outs on the firefighters and in how the firefighters respond to them. In a predominantly Pākehā environment, some new career firefighters have reported saying a karakia privately to themselves after a fatality.[7]

"[Tikanga Māori] is not here at all. I wouldn't feel comfortable or empowered to input tikanga at this station. Some of the older men probably don't have the time for anything like that. They've been in their organisation for a long time and they're set in their ways. It feels a bit stink … There's not a lot of Māori here, not a lot of knowledge of tikanga. It's a very Pākehā institution. It gets very lonely, I miss it."

"There was no karakia after the event. When the woman passed away, I said something to myself but that's for my own wellbeing."

New career firefighter on station for three months[7]

RECOMMENDATIONS FOR ENHANCING SAFETY, HEALTH, AND WELLBEING

Comprehensive systems and processes for safety, health, and wellbeing

1	Ensure Fire and Emergency's safety, health, and wellbeing system includes strategic plans and policies; recognises leaders and champions and provides for leadership; and there is adequate resourcing.

Mental health and wellbeing

1	Improve the preparation and training for responses to medical emergencies[4,5] • Improve awareness and use of available mental health support. • Strengthen support for firefighters who are affected by stress and trauma and foster a culture where it is OK to "ask for help". • Educate families on potential negative effects of medical calls and on ways that family members can support firefighters and reduce the effects on themselves.
2	Support a more diverse and inclusive workplace culture • Provide appropriate and responsive support in order to ensure the safety, health and wellbeing of an older and more diverse workforce. • Build a more inclusive frontline culture that values diversity and different worldviews. • Ensure adequate training, equipment, and support for volunteer firefighters, and adequate information for their families.
3	Provide ongoing support to brigade leaders and better monitoring of brigades so that brigades effectively identify, confront, and manage unacceptable behaviours (such as bullying and discrimination), and facilitate co-operation between all brigade members.[6]

Fatigue management

1	Ensure there is an effective fatigue management policy that focuses not just on career firefighters but also on the different risks faced by volunteers and shift workers.[8] The policy should include a commitment to effective fatigue reporting and a recognition that fatigue-related risks arise from both work and non-work activities. It should also consider risks related to total time worked and the level of overtime.[9]
2	Firefighters should be screened for sleep disorders and, if needed, provided with treatment pathways.[8] Rostering practices should consider the opportunity for sleep, which differs depending on the time of day, rather than on the duration of a work period.
3	To support firefighters experiencing the effects of long COVID, take a multidisciplinary perspective that recognises that people tend to experience long COVID differently with varying physical, psychological, and cognitive effects.[11] Information on an individual's unique long COVID symptoms and pre-existing conditions should be considered when assessing whether they are ready to return to work.

Physical health and safety, and exposure

1	Increase live fire instructors' understanding of the thermal consequences of their role and ensure up-to-date guidelines on how to mitigate the consequences. Ensure optimal work–rest periods and reduce multiple exposures on consecutive days.[18]
2	Regularly monitor exposure to carbon monoxide, and ensure firefighters are trained in the hazards of smoke and how to mitigate smoke exposure.[16]

RECOMMENDATIONS FOR FUTURE RESEARCH

1	Extend the study of the impact of work hours and overtime on the risk of injury, to examine:[9] • the rhythm of work performed over time • the type of work being done • the number of call-outs • incident types.
2	Because research into long COVID effects and mitigation strategies is still in its infancy, continue to closely monitor the research findings in this field to keep up-to-date and form a better understanding of this illness.[11]
3	Carry out further research to confirm the effectiveness of merino undergarments in preventing skin exposure to carcinogens.[19]
4	Carry out regular biometric studies in order to understand the physical health and safety risks of firefighting, and the mental health and safety risks. • This should include a better understanding of the fatigue-related risks for personnel other than career firefighters (such as volunteer firefighters, emergency communications/dispatch personnel, and those in management positions), and any gender and other cohort differences in risks.

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