



SHIFT WORK AND FIRE FIGHTERS

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The International Association of Fire Fighters (IAFF) does not take an official position on a particular shift schedule. Shift length and scheduling are matters determined at the Local level.



TABLE OF CONTENTS



Overview 2

Health Implications 3

Cardiovascular & Metabolic Health 3

Sleep & Fatigue 3

Research on Shiftwork 4

Research Limitations 5

Operational Considerations 5

Leave Usage 5

Mental Health Support 6

Mitigation Strategies 6

Conclusion 6

References 7



SHIFT WORK & FIRE FIGHTERS

OVERVIEW

Shift work is an integral part of the 24/7 nature of the fire service, enabling continuous operational readiness and emergency response.

The National Institute for Occupational Safety and Health (NIOSH) defines shift work as any schedule outside the hours of 7 a.m. to 6 p.m. shift work. Fire fighters commonly work extended shifts, with 24-hour schedules being the most prevalent across departments. These shifts are designed to accommodate the unpredictable timing and nature of calls, and can vary based on staffing, resources, and departmental decisions.

There are many considerations that come into play when contemplating shift schedules, including start time and shift duration. The International Association of Fire Fighters (IAFF) does not take an official position on a particular shift schedule and shift work and considers shift length and scheduling to be matters determined at the Local level. Some common shift schedules are shown in Table 1 below.

Shift work can pose unique physiological challenges, such as disruptions to sleep cycles and circadian rhythms, and adverse effects on cardiovascular and immune system health. Extended hours can also affect fire fighters' family and social lives. These effects may contribute to increased cancer risk and decreased cognitive and physical performances.¹ Understanding these factors is critical when evaluating the occupational impacts of shift work on fire fighter health, safety, and overall well-being.

This document provides a summary of existing research on shift work in the fire service, examining associated considerations on health, social well-being, physical and emotional impacts.

TABLE 1. COMMON SHIFT SCHEDULES

24-hour on/48-hour off	Workers are on duty for 24 consecutive hours, followed by 48 hours off duty.
48-hour on/96-hour off	Workers are on duty for 48 consecutive hours, followed by 96 hours off duty.
Kelly Schedule	24 hours on, 24 hours off, 24 hours on, 24 hours off, 24 hours on, followed by 96 hours off.
Forward Rotating Shift Schedule	Shift start time rotate in a forward direction, typically from morning to afternoon to night.
6-Day Schedule	Two day shifts and two night shifts, followed by two days off.
9-Day Schedule	Three day shifts and three night shifts, followed by three days off.
21-Day Schedule	Four consecutive days on, followed by three consecutive days off, rotating among day, swing, and night shifts over a 21-day cycle.
10-hour on/14-hour off	Seven 10-hour shifts and seven 14-hour night shifts in a 28-day period.
12-hour Shifts	Four consecutive 12-hour shifts, followed by four days off.
California Swing Shift	24 hours on, 24 hours off for five consecutive days, followed by 96 hours off.
24-hour on/72-hour off	24 hours on followed by 72 hours off



SHIFT WORK & FIRE FIGHTERS

HEALTH IMPLICATIONS

Research has demonstrated that shift work is associated with adverse health outcomes, including metabolic syndrome (increasing the risk of heart disease, stroke, and diabetes), digestive troubles, poor mental health and wellbeing, cancer, cardiac, and sleep problems. Shift work can also affect cognitive function, performance, family dynamics, and off-shift habits. Recent reports by the National Toxicology Program (NTP) and the International Agency for Research on Cancer (IARC) highlighted evidence that suggests night shift work may cause cancer, with the IARC defining night shift work as a Group 2A, Probable Human Carcinogen agent.^{2,3} Relatedly, recent literature has seen trends with increased cardiovascular issues, negative psychological and social impacts, and physiological concerns.⁴ These health concerns should be considered when identifying the best shift schedule for your department.

Sleep and Fatigue

Sleep disturbances are often a result of extended shifts, affecting both the quality and duration of fire fighters' sleep. Fire fighters frequently report difficulties achieving adequate sleep during 24-hour shifts due to interruptions from emergency calls, stress, and the challenges of resting in environments with noise pollution, like the firehouse. Sleep fragmentation during shifts can also result in cumulative sleep debt, which impairs cognitive performance and decision-making. Fatigue impairs reaction time and may increase the likelihood of suboptimal job performance and accidents on the job.

Sleep issues and fatigue do not end when the shift is over. Many fire fighters find it challenging to return to a regular sleep schedule when off shift, which can contribute to chronic sleep deprivation. Sleep also affects mental and emotional well-being. Fire fighters should adopt healthy sleep practices, when possible, both on and off shift.

Cardiovascular & Metabolic Health

A significant body of research has demonstrated that irregular work hours are associated with an increased risk of cardiovascular disease. For example, studies show that evening-shift workers have elevated levels of inflammatory markers such as C-reactive protein and interleukin-6 compared to day-shift workers. These markers are risk factors for cardiovascular diseases.⁵ Circadian misalignment, or the body's inability to synchronize physiological activities with the actual time of day, is another consequence of shift work and may negatively impact heart health.⁶

Nutrition is also a concern, as fire fighters often eat irregularly and can struggle to maintain a balanced diet due to job duties. Recent studies find associations between shift work and gastrointestinal issues, such as gastro-esophageal reflux disease (GERD).⁷ Eating large meals late at night or skipping meals during shifts may contribute to these problems. These irregular patterns contribute to an increased risk of metabolic syndrome, a condition characterized by high blood pressure, high blood sugar, and abnormal cholesterol levels.⁸

Cancer Risk

Cancer is one of the leading causes of fire fighter fatalities, and night shift work and circadian disruptions may increase this risk further.

In 2019, IARC classified night shift work as "probably carcinogenic to humans." The classification was based on limited evidence of cancer in humans, sufficient evidence in experimental animals, and strong mechanistic evidence in experimental animals. In this context, "limited evidence" means positive associations have been observed, but other explanations could not be ruled out.

In 2021, the NTP separately concluded that night shift work can cause breast, prostate, and colorectal cancer.⁹ Evidence also supported several mechanisms by which night shift work could promote cancer, including immunosuppression, chronic inflammation, and increased cell proliferation, as well as disrupted estrogen levels in female shift workers.

The combination of interrupted sleep, exposure to carcinogens during fires, and circadian misalignment compounds risks of shift work. As mentioned, research has suggested a link between those predominantly on



SHIFT WORK & FIRE FIGHTERS

night shifts and a higher incidence or risk of breast, prostate and colorectal cancer.¹⁰ In a collection of investigations conducted through the Nurses' Health Study, they found that female nurses who worked night shifts (hours between midnight through 5 am) had an increased incidence of heart disease and breast cancer. This risk increased the longer time was spent working on night shifts.^{11,12} Analysis of multiple studies worldwide for men and women found that the risk of cardiovascular disease increases by 71% every five years spent engaging in shift work.¹³

RESEARCH ON SHIFT WORK

Research on shift work among fire fighters and emergency medical workers is limited. A significant portion of this current research primarily focuses on populations within the healthcare sector, particularly resident physicians, nurses, and other healthcare providers. These studies typically explore the effects of shift work on patient care quality and medical errors, and examine how the providers themselves manage the impacts. This does offer valuable insight, since these individuals have somewhat similar schedules to fire fighters and ultimately will aid in helping gain a better understanding of job performance and health impacts of sleep deprivation. However, the occupations are not directly comparable, and the existing literature is divided on which shift schedule is more beneficial for fire fighters. Ultimately, continued and ongoing research regarding shift work in the fire service is necessary to gain a better understanding of its overall impact.

In 2013, researchers assessed the prevalence and severity of sleepiness in a random sample of 458 career fire fighters across the United States using the Epworth Sleepiness Scale, a questionnaire-based measure. The researchers found that fire fighters did not report high rates of daytime sleepiness despite working extended shifts. When compared with the general population, rates of daytime sleepiness among fire fighters in the study were similar to or lower than rates among other shift workers, including medical residents and long-haul truck drivers. It is worth noting that the study did find fire fighters who were on a 48-hour shift had significantly higher rates of on-duty EDS compared with those on a 24-hour shift.¹⁴

A study conducted in 2016 assessed sleep quality among 109 male fire fighters across six fire departments in three states in the southwestern United States. Using a sleep quality index derived from questionnaires, results indicated the 24-on/48-off schedule, 48-on/96-off schedule, and the Kelly Schedule all disrupted circadian rhythms to varying degrees. The 24-on/48-off shift was reported by participants to have the best sleep quality, though it was not statistically significantly better than the 48-hr on/96-hr off shift. The Kelly schedule resulted in statistically worse sleep quality. One limitation of the study was that it did not evaluate fire fighter performance between different types of shift schedules.¹⁵

A 2020 study conducted in South Korea assessed the association between shift work and neurocognitive function. This was a prospective before-and-after study on 352 firefighters using neurocognitive function testing. The measures were based on central nervous system vital sign measurement, a well-known screening instrument that measures neurocognitive performance by calculating standardized scores for various tests. The study examined shift work neurocognitive function in fire fighters before and after night shifts. The study attempted to account for potential confounding factors, such as insomnia and depression. Findings revealed that in all types of shift rotations studied, whether the 3-day, 6-day, 9-day, or 21-day schedules, neurocognitive function significantly decreased in composite memory, verbal memory, visual memory, complex attention, psychomotor speed, and motor speed the day after nighttime work.¹⁶

More recently, a 2024 study examined shift work sleep disorder (SWSD), a condition among shift workers that disrupts circadian rhythms and sleep patterns. This disorder has significant psychological consequences like depression, anxiety, and cognitive impairment. The article reviewed research on SWSD and its relationship with mental health from neurobiological, sociological, and psychological perspectives. The study also identified risk factors such as backward-rotating schedules and quick returns between shifts. SWSD was found to be associated with circadian disruption, sleep reactivity, depressive symptoms, and anxiety. However, the study notes that it lacked objective measurement of sleep and circadian rhythms. While it is valuable to include the impacts of individual self-perceptions and experiences, it is also valuable to have studies that account for those variables.¹⁷



SHIFT WORK & FIRE FIGHTERS

Although these summaries do not cover all published research, they illustrate the widespread impact of shift work and the importance of ongoing research to ensure a comprehensive understanding and awareness when it comes to this topic.

Research Limitations

When reviewing studies and literature, it's important to consider potential biases and limitations. Biases may arise from the timing of measurement, the metrics used, or the scientists and institutions themselves. It is also valuable to consider whether a study acknowledges the time needed for a disease to develop, whether there are acute or chronic exposures, and/or impacts of learned behaviors. Efforts are continuing to address these biases and limitations, and researchers are utilizing tools like biometric watches and products to better observe shift work on health and performance.

Limitations in research studies include confounding factors, which are external variables (behaviors or metrics) that impact exposures, outcomes, and may be unrelated to what the study is evaluating. When it comes to shift work, some confounding factors may include fire fighters' off-duty lifestyles and home environments, which may affect sleep and mental well-being outside of their on-duty occupational exposures.

Additionally, individual differences among fire fighters should be considered because, just like in the general population, fire fighters may need different amounts of sleep. Moreover, fire fighters may also display different levels of adaptability to shift work and not all studies are able to represent those differences.

Research into the health effects of shift work and sleep deprivation among fire fighters is ongoing. Current evidence does not establish one shift schedule as more beneficial for all fire fighters or across all fire departments.

OPERATIONAL CONSIDERATIONS

There remains debate over which shift schedule is preferable, partly because multiple factors must be considered beyond health effects. Staffing availability, response times, and budgets are critical, along with handoff risks, fatigue, the inclusion of sleep time, and flexibility to adjust crews for different shifts during peak periods.

Questions are also commonly raised about whether 24-hour shifts restrict productivity. Operational considerations must be taken into account as well. For example, 24-hour shifts require only one shift change per day, whereas 10-hour/14-hour shifts require two, and eight-hour shifts require three. This impacts staffing requirements and makes scheduling details easier under a 24-hour shift, as fewer shift changes results in reduced disruption to operational readiness. These considerations are also relevant when examining how different shift schedules affect leave usage.

Leave Usage

A 24-hour shift may be a disincentive to use sick leave. Medical appointments are easier to schedule on off days, so fewer sick time hours are used for that purpose. Also, fire fighters working 24-hour shifts are scheduled for fewer workdays, a short-term illness may be less likely to occur on a scheduled workday than under a schedule with shorter, more frequent shifts. The following is a simplified illustration:

- Fire fighter A: Works a 42-hour week on a 10–14-hour shift work approximately 182 days out of the year (not counting vacation days) and therefore, if an illness does occur during a one-year period, there is a 182/365 or 50% chance of it occurring on a workday.
- Fire fighter B: Works a 42-hour week on a 24-hour shift schedule and works approximately 91 days out of the year. Under the same circumstances has a 91/365 or 25% chance of the illness occurring on a workday.

Both fire fighter A and fire fighter B work 42 hours per week, which means they are scheduled to work the same number of hours per year. However, the odds of a one-day illness falling on a workday are far less likely to on a 24-hour shift. Additionally, the 24-hour shift schedule would allow the employee an extra day off to recuperate or to recover from an illness.



SHIFT WORK & FIRE FIGHTERS

Mental Health Support

The effects of shift work extend beyond individual fire fighters, impacting their families and social lives. The demands of irregular shifts can strain relationships and affect quality of life. Fire fighters working 24-hour shifts often miss family events or struggle to maintain consistent involvement in household responsibilities, leading to tension and feelings of guilt. These situations get worse when faced with departmental understaffing and mandatory overtime policies.

The non-traditional hours associated with shift work can also lead to social isolation, as fire fighters' schedules often conflict with those of their friends and family.

Mitigation Strategies

Shift work is essential to the fire service's operational efficiency, ensuring continuous emergency response. However, it is important to balance these operational needs with the health and well-being of fire fighters.

Incorporating structured rest periods during long shifts can significantly mitigate the effects of fatigue. Allowing for naps during downtime has been shown to improve cognitive performance and reduce errors. Evidence suggests that even short naps (20-30 minutes) can significantly improve alertness and reduce fatigue-related errors.¹⁸

Fire fighters should also receive education on the potential health effects of shift work and the importance of sleep, nutrition, and stress management. These efforts can encourage fire fighters to take proactive steps in maintaining their health and performance both on and off shift.

Promoting sleep hygiene practices, such as using blackout curtains, avoiding caffeine, and minimizing noise before bedtime, can help fire fighters maximize their sleep quality at home.

Some fire departments have also introduced family support initiatives, including workshops and family-oriented events that foster community among fire fighters' families.

CONCLUSION

Shift work is an essential part of fire service operations, ensuring that emergency services are available around the clock. However, as demonstrated by the research and the experiences of those on the frontline, the extended and irregular nature of shifts can significantly impact fire fighter health, sleep quality, mental well-being, and family life. Addressing these issues requires a multifaceted approach, including education, support programs, and resources.

The evidence presents a mixed picture of the health and safety risks associated with various shift schedules. There is no clear evidence that 24-hour shifts are better or worse for the health of firefighters and emergency medical workers than shorter or rotating shift schedules.

Each fire department also has unique circumstances that should be considered when determining which shift schedule is most appropriate. These circumstances can change over time. The IAFF has resources available to support and assist affiliates as they navigate shift schedules and consider practices that address associated health concerns.



SHIFT WORK & FIRE FIGHTERS

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SHIFT WORK & FIRE FIGHTERS

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