

# Acute and Short-Term Perceived Recovery Benefits of Shiftwave in Firefighters: A Real-World Evaluation at Albuquerque Fire Rescue

Jeff Rouse, MD

Principal Investigator

Shiftwave

Evan Berns, SFC

Project Lead

Shiftwave

Lt. Jonathan M. Hanna

Data Collection

Albuquerque Fire Rescue

Dehan Elcin, MS

Data Analysis and Report Preparation

Shiftwave

January 2026

Version 1.0

# Executive Summary

## Purpose

Evaluate (1) immediate pre-to-post effects of a single Shiftwave session on subjective measures of recovery and stress, and (2) 3-day follow-up perceptions among firefighters at Albuquerque Fire Rescue.

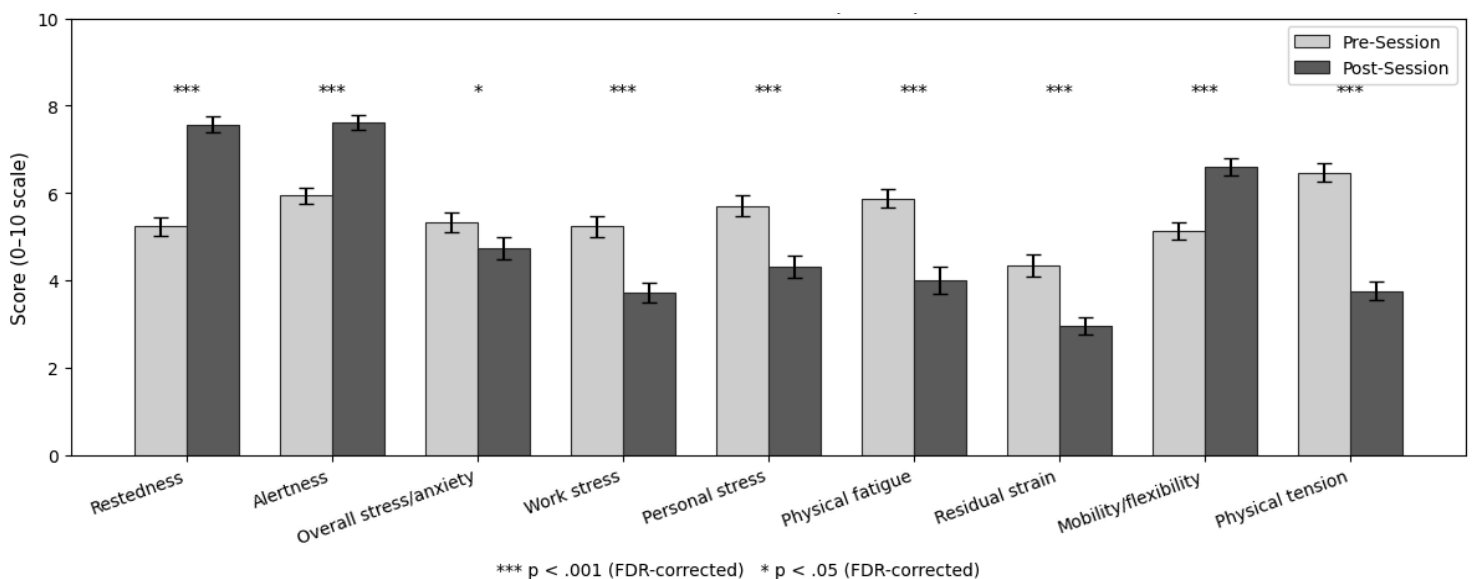
## Design

Prospective, single-arm, real-world evaluation conducted during normal operations at Albuquerque Fire Rescue. Participants completed brief pre- and post-session ratings (N=101). A 3-day follow-up survey was completed by a subset of participants (N=31).

## Key Findings

**Acute Effects:** All 9 acute outcomes showed statistically significant improvement after false discovery rate (FDR) correction (Figure 1).

**Figure 1.** Acute Effects of A Single Shiftwave Session



**3-Day Follow-Up:** Among follow-up respondents (N = 31), ratings suggested generally favorable recovery and symptom burden over the next three days.

**Acceptability:** 100% of participants who completed the 3-day follow-up stated they would use Shiftwave again.

## Implications

Results support Shiftwave as an effective acute recovery and relaxation tool in station settings; stronger inferences will require improved follow-up completion and controlled comparisons.

# **Introduction**

## **First Responder Wellness Context**

Firefighters operate in high-demand environments that combine acute stress exposure, unpredictable schedules, physical exertion, and recovery disruption. These occupational conditions are associated with elevated stress burden, fatigue, sleep disruption, and musculoskeletal strain, which can affect both health and readiness.

## **The Shiftwave Intervention**

Shiftwave is a wellness platform that delivers synchronized vibrotactile stimulation and audio content while users recline in a zero-gravity position. The system applies programmed vibration patterns along the posterior body surface, with intensity varying across locations and over time, and is coordinated with audio elements, including guided breathing, body awareness cues, music, and ambient soundscapes. Narrative content varies across protocols and may include guidance on visualization, mindset coaching, or relaxation instruction. Sessions range from 5–60 minutes, depending on the application (typically 10–20 minutes in this study), and are designed to guide users through structured audio-tactile experiences intended to shift mental and physical states.

## **Study Rationale**

Real-world first responder organizations require wellness tools that are feasible within operational constraints and deliver measurable benefits within short timeframes. This evaluation aimed to quantify immediate pre-post changes using brief measures and to capture exploratory follow-up impressions of recovery and stress during the days after a session.

## **Research Questions**

This study examined four primary questions:

1. Do participants show acute improvements from pre- to post-session ratings of recovery and stress?
2. What levels of perceived recovery, sleep improvement, and stress burden are reported 3 days after a session?
3. Do participants indicate willingness to use Shiftwave again, and do they report global improvement relative to pre-session status?

# Methods

## Study Design

Prospective, single-arm, within-person evaluation conducted at Albuquerque Fire Rescue during normal operations. Data were collected via brief surveys administered immediately before and after the session, as well as an optional 3-day follow-up.

## Setting and Participants

The study was conducted at Albuquerque Fire Rescue. Participants were active firefighters. Recruitment was open to all active members of the department via an invitation distributed by department leadership. No monetary compensation was provided.

Inclusion criteria were: (1) active member of Albuquerque Fire Department, (2) age 18 or older, and (3) able to provide informed consent.

## Intervention

*Hardware configuration.* Participants interfaced with the Shiftwave platform, which delivers synchronized vibrotactile and audio stimulation via 18 bilateral transducers distributed along the posterior body surface from occiput to calf. Transducers interface with the body through a suspended fabric surface. Users are positioned in a zero-gravity recliner configuration with visual occlusion via an eye mask and audio delivered via headphones. User-adjustable intensity (0–100% scale) introduces variability in absolute vibrotactile dose; participants were instructed to begin at 60% and adjust to the maximum comfortable level.

*Protocol content.* Protocols included instrumental music, ambient soundscapes, and spoken narrative content. Narrative elements varied across protocols and could include breath guidance, body awareness cues, visualization guidance, and relaxation instruction. Vibration intensity patterns were choreographed with audio content, with breath-synchronized vibration as a primary design feature (rising intensity aligned with inhalation cues, falling intensity with exhalation).

*Session parameters.* Sessions lasted approximately 10–20 minutes. Multiple protocols were used during the study period, based on participant preferences and availability, reflecting typical use conditions; therefore, effects are attributable to the platform experience as implemented rather than to any single standardized protocol.

## Outcome Measures

**Acute (session-level) outcomes** were assessed immediately before and after each session with the following questions, on a 1–10 scale.

- How rested do you feel right now?
- How physically alert and ready for activity do you feel right now?

- How much overall stress or anxiety are you currently feeling?
- Rate the work-related stress you are currently experiencing.
- Rate your non-work-related (personal) stressors you are currently experiencing.
- How physically fatigued do you currently feel?
- Do you feel any residual strain from previous shifts or calls?
- How would you rate your current mobility/flexibility?
- How much physical stress or tension are you currently carrying?

**3-day follow-up measures** were as follows:

- How rested or recharged have you felt overall since your session?
- Have you noticed an increase in your quality or duration of sleep since your session?
- How has your work-related stress been over the past 3 days?
- How has your non-work-related (life) stress been over the past 3 days?
- How physically fatigued have you felt over the past 3 days?
- Have you noticed any improvements in your mobility or flexibility since the session?
- How would you rate your overall muscle soreness or tension over the past 3 days?

**Continued Effects and Acceptability** were assessed with the 3-day follow-up through two items: (1) "Compared to before your Shiftwave session, how would you describe how you feel now?" (Improved/About the Same/ Slightly Worse / Significantly Worse), (2) "Would you consider using the Shiftwave chair again?" (Yes/No)

## **Procedures**

Participants completed a brief pre-treatment survey prior to each Shiftwave session, which captured basic contextual and demographic information (e.g., shift/age group) and assessed current ("right now") state on nine 1–10 items spanning restedness, alertness/ready for activity, overall stress/anxiety, work stress, life stress, physical fatigue, residual strain, mobility/flexibility, and physical tension; the survey also included an item on localized tightness/discomfort. Immediately after the session (typically 10–20 minutes), participants completed a post-treatment survey that repeated the same "right now" items to quantify within-session change. A 3-day follow-up survey was offered to assess perceived recovery and symptom burden over the subsequent three days (rested/recharged, sleep quality/duration, work and life stress, fatigue, mobility/flexibility, and soreness/tension), along with a global change item ("how do you feel now vs. before the session"), and a use-again acceptability item.

## Statistical Analysis

*Acute effects (primary).* For each acute outcome assessed immediately before and after a Shiftwave session, we tested within-session change using a linear mixed-effects model to account for repeated observations within participants. Time was coded with pre as the reference level and post as the contrast of interest. Results are reported as Pre and Post means (SE), the mean change ( $\Delta$ , with SE), Cohen's  $d$  (paired standardized change computed from raw within-session difference scores), and two-tailed  $p$ -values from the mixed-effects model. To address multiplicity across the nine acute outcomes, false discovery rate (FDR) correction was applied using the Benjamini–Hochberg procedure, and both raw and FDR-adjusted  $p$ -values are reported.

*3-Day Follow-Up (exploratory):* Three-day follow-up outcomes were analyzed descriptively because the follow-up instrument was designed to capture perceived status over the subsequent days rather than to reproduce a paired pre/post change structure. For the 1–10 follow-up items, we report the mean (SE), median (IQR), and percentage favorable using direction-appropriate thresholds (higher-is-better items summarized as percentage  $\geq 7$ ; lower-is-better items summarized as percentage  $\leq 4$ ). In addition, the follow-up survey included two categorical items—(1) a global change rating ("Compared to before your Shiftwave session, how would you describe how you feel now?") and (2) an acceptability item ("Would you use Shiftwave again?")—which are summarized as response proportions.

## Ethical Considerations

Informed consent was obtained from all participants prior to enrollment. Participation was voluntary with no monetary compensation and no impact on employment status. Data were collected using de-identified participant codes via password-protected online forms; only the study team had access to identifiable information. No institutional review board oversight was obtained.

## Results

### Acute Session Effects (Pre vs. Post)

Across 100 matched pre- and post-survey pairs, participants reported statistically significant and practically meaningful improvements from immediately before to immediately after Shiftwave sessions on all nine acute outcomes, after FDR correction (Table 1). In particular, participants endorsed feeling more rested following sessions (Pre: 5.24 [SE 0.20] vs. Post: 7.57 [SE 0.17];  $\Delta = +2.34$  [SE 0.20];  $d = +1.15$ ; FDR- $p < .0001$ ) and more physically alert/ready for activity (Pre: 5.94 [0.19] vs. Post: 7.61 [0.17];  $\Delta = +1.67$  [0.19];  $d = +0.89$ ; FDR- $p < .0001$ ). Mobility/flexibility also increased (Pre: 5.13 [0.21] vs. Post: 6.59 [0.20];  $\Delta = +1.47$  [0.21];  $d = +0.69$ ; FDR- $p < .0001$ ).

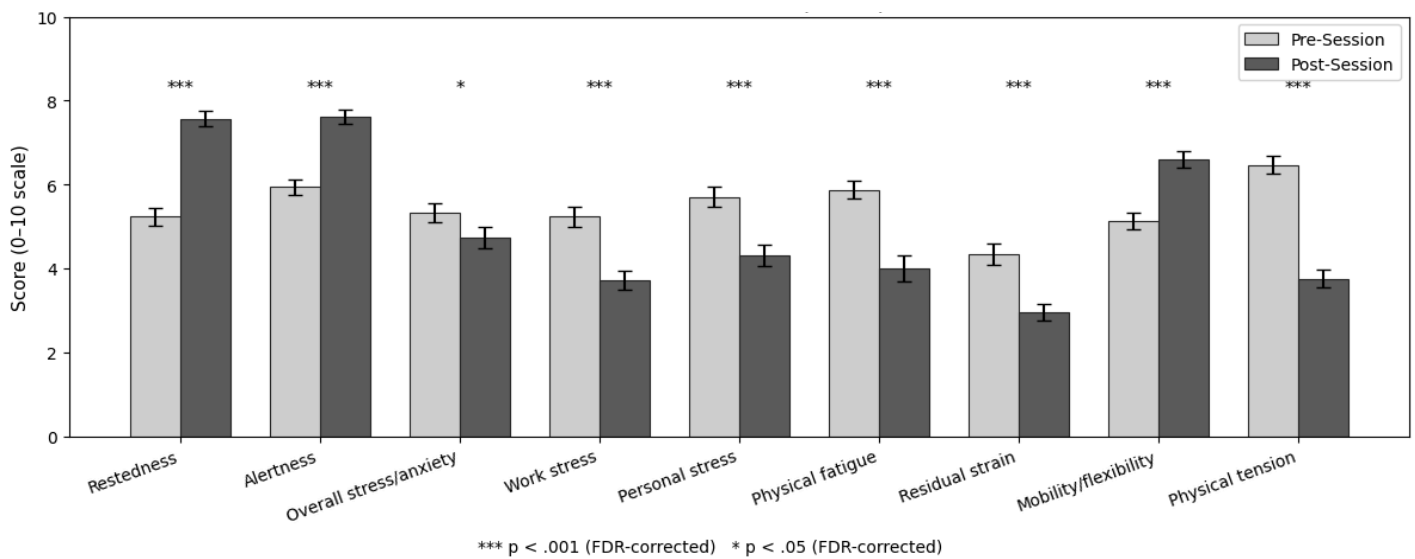
Symptom-burden outcomes showed corresponding reductions. Participants reported lower work-related stress after sessions (Pre: 5.24 [0.24] vs. Post: 3.72 [0.23];  $\Delta = -1.51$  [0.20];  $d = -0.76$ ; FDR- $p < .0001$ ) and lower non-work-related stress (Pre: 5.70 [0.24] vs. Post: 4.33 [0.25];  $\Delta = -1.38$  [0.22];  $d = -0.63$ ; FDR- $p < .0001$ ). Physical recovery-relevant items also improved, including reduced fatigue (Pre: 5.88 [0.21] vs. Post: 4.01 [0.32];  $\Delta = -1.87$  [0.38];  $d = -0.49$ ; FDR- $p < .0001$ ), reduced residual strain from prior shifts or calls (Pre: 4.34 [0.25] vs. Post: 2.96 [0.20];  $\Delta = -1.38$  [0.21];  $d = -0.66$ ; FDR- $p < .0001$ ), and reduced physical stress/tension (Pre: 6.47 [0.22] vs. Post: 3.76 [0.22];  $\Delta = -2.70$  [0.25];  $d = -1.08$ ; FDR- $p < .0001$ ). Overall stress/anxiety also decreased modestly (Pre: 5.34 [0.22] vs. Post: 4.74 [0.25];  $\Delta = -0.59$  [0.28];  $d = -0.21$ ; FDR- $p = 0.0355$ ).

Taken together, the acute pattern is consistent: participants reported feeling more rested and ready for activity after sessions, alongside lower stress-related and physical tension/strain indicators (Table 1, Figure 1).

**Table 1. Acute Session Effects (Mixed-Effects Models; FDR-corrected p-values)**  
(Positive percentage change indicates an increase; negative percentage change indicates a decrease. Percentages are given based on the questionnaire scale.)

Outcome	Pre M (SE)	Post M (SE)	% Change	Cohen's d	p (corr.)
How rested do you feel right now?	5.24 (0.20)	7.57 (0.17)	44.5%	+1.15	<.0001
How physically alert and ready for activity do you feel right now?	5.94 (0.19)	7.61 (0.17)	28.1%	+0.89	<.0001
How much overall stress or anxiety are you currently feeling?	5.34 (0.22)	4.74 (0.25)	-11.2%	-0.21	0.0355
Rate your work-related stress you are currently experiencing?	5.24 (0.24)	3.72 (0.23)	-29.0%	-0.76	<.0001
Rate your non-work-related (personal) stressors you are currently experiencing?	5.70 (0.24)	4.33 (0.25)	-24.0%	-0.63	<.0001
How physically fatigued do you currently feel?	5.88 (0.21)	4.01 (0.32)	-31.8%	-0.49	<.0001
Do you feel any residual strain from previous shifts or calls?	4.34 (0.25)	2.96 (0.20)	-31.8%	-0.66	<.0001
How would you rate your current mobility/flexibility?	5.13 (0.21)	6.59 (0.20)	28.5%	+0.69	<.0001
How much physical stress or tension are you currently carrying?	6.47 (0.22)	3.76 (0.22)	-41.9%	-1.08	<.0001

**Figure 1.** Acute Session Effects (N=100 Respondents)



### 3-Day Follow-Up

Among participants who completed the 3-day follow-up survey (N = 31), responses suggested generally favorable recovery and symptom-burden profiles in the days after a session (Table 2). Benefit-oriented items (higher = better) averaged in the ~6–7 range (e.g., rested/recharged: 6.84 [SE 0.33]; sleep quality/duration: 6.71 [0.42]), while burden-oriented items (lower = better) averaged in the ~3–4 range (e.g., work stress: 3.58 [0.40]; soreness/tension: 3.81 [0.40]), with most items meeting prespecified “favorable” thresholds in a majority of respondents (Table 2). Because these follow-up items characterize perceived status over the subsequent three days rather than a paired pre/post change score, results are presented descriptively.

**Table 2.** 3-Day Follow-Up Descriptive Outcomes (N = 31 respondents)  
(% favorable uses prespecified thresholds: favorable  $\geq 7$  for higher-is-better; favorable  $\leq 4$  for lower-is-better.)

Outcome	N	Mean (SE)	% favorable
How rested or recharged have you felt overall since your session?	31	6.84 (0.33)	61.30%
Have you noticed an increase in your quality or duration of sleep since your session?	31	6.71 (0.42)	58.10%
How has your work-related stress been over the past 3 days?	31	3.58 (0.40)	71.00%
How has your non-work-related (life) stress been over the past 3 days?	31	4.32 (0.42)	58.10%
How physically fatigued have you felt over the past 3 days?	31	4.06 (0.31)	61.30%
Have you noticed any improvements in your mobility or flexibility since the session?	31	5.97 (0.36)	38.70%
How would you rate your overall muscle soreness or tension over the past 3 days?	31	3.81 (0.40)	74.20%

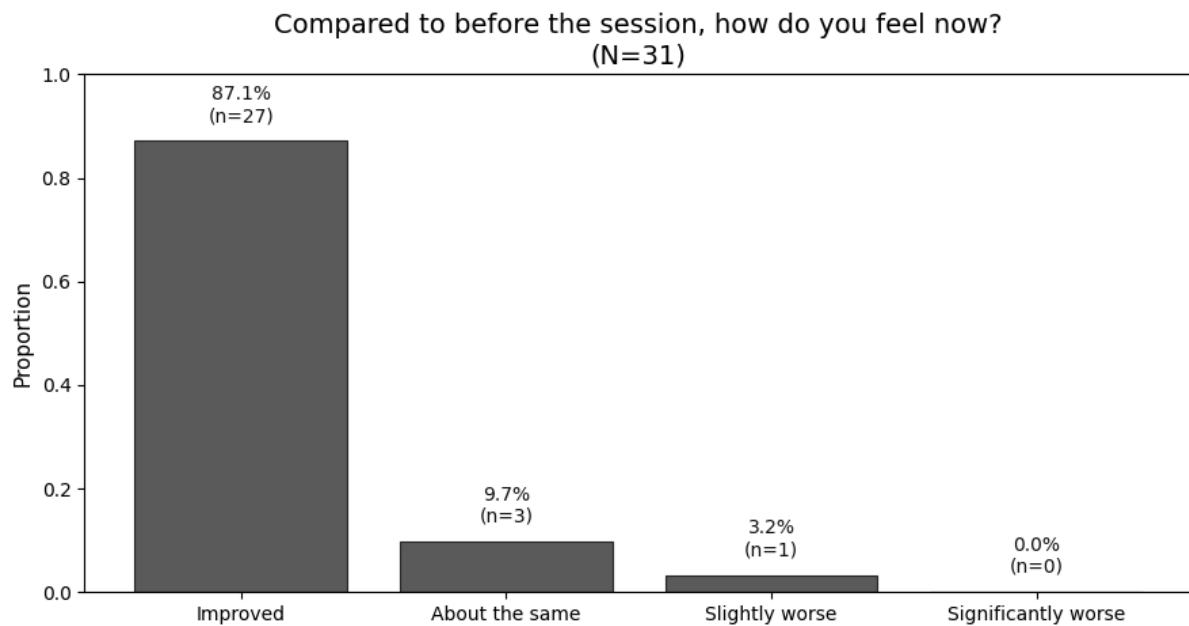


## Continued Effects and Acceptability

As shown in Figure 2, most respondents who completed the 3-day follow-up reported feeling better at follow-up than before their Shiftwave session. Specifically, 87.1% (27/31) endorsed "Improved," 9.7% (3/31) reported feeling "About the same," and 3.2% (1/31) reported feeling "Slightly worse"; no respondents selected "Significantly worse" (0%, 0/31).

Acceptability was uniformly high: all follow-up respondents (100%, 31/31) indicated they would consider using Shiftwave again.

**Figure 2.** Continued Effects at 3-Day Follow-Up



## Discussion

This real-world evaluation at Albuquerque Fire Rescue found a clear and coherent pattern of acute, within-session improvements following Shiftwave use, paired with favorable short-term perceptions among the subset who completed a 3-day follow-up. Across 100 pre- and post-session pairs, all nine acute outcomes improved significantly after false discovery rate correction (Table 1; Figure 1). The largest acute effects were concentrated in domains most directly aligned with recovery and downregulation: participants reported substantial reductions in physical stress/tension ( $\Delta = -2.70$ ,  $d = -1.08$ ,  $\text{FDR-}p < .0001$ ) and strong increases in restedness ( $\Delta = +2.34$ ,  $d = +1.15$ ,  $\text{FDR-}p < .0001$ ). Work-related stress also showed a large and consistent reduction ( $\Delta = -1.51$ ,  $d = -0.76$ ,  $\text{FDR-}p < .0001$ ). In practical terms, the acute results suggest that a single Shiftwave session delivered meaningful, immediately perceived changes in how participants felt “right now,” spanning readiness (restedness, alertness, mobility) and symptom burden (work stress, life stress, fatigue, residual strain, tension).

The acute effect profile also shows useful differentiation across constructs. Improvements were strongest for physical tension, restedness, and alertness/ready-for-activity, with additional moderate reductions in work and non-work stress, fatigue, and residual strain (Table 1). In contrast, the “overall stress or anxiety” item showed a smaller but statistically detectable reduction ( $\Delta = -0.59$ ,  $d = -0.21$ ,  $\text{FDR-}p = 0.0355$ ). This pattern is not inherently inconsistent; it may indicate that Shiftwave’s most immediate perceived impact is on somatic and recovery-linked states (tension, fatigue, readiness), with more modest immediate shifts in global stress/anxiety appraisal. From an operational standpoint, that distinction is relevant: tools that reliably reduce physical tension and increase perceived recovery readiness may be particularly valuable in fire station environments where time is limited, and the goal is to return to duty feeling more regulated and physically prepared.

The exploratory 3-day follow-up results provide complementary context about perceived status in the days after a session. Among follow-up respondents ( $N = 31$ ), ratings indicated generally favorable recovery and symptom burden profiles over the subsequent three days (Table 2). Benefit-oriented items (higher is better) were in the mid-to-high range for rested/recharged and perceived sleep improvement, whereas burden-oriented items (lower is better) clustered closer to the low-to-moderate range for work stress, fatigue, and soreness/tension, with a majority of respondents meeting prespecified “favorable” thresholds on most items (Table 2). These findings are best interpreted as descriptive indicators of post-session experience rather than as evidence of sustained change measured through a matched longitudinal design; however, they are consistent with an acute pattern, suggesting that participants often perceived meaningful recovery-related benefits extending beyond the immediate session window.

The follow-up categorical items reinforce the practical salience and acceptability of the intervention in this setting. Most follow-up respondents reported feeling improved relative to pre-session at the time of follow-up (87.1% improved; 9.7% about the same;

3.2% slightly worse; 0% significantly worse; Figure 2), and all follow-up respondents indicated they would use Shiftwave again (100% yes). Taken together, the combination of large immediate shifts on key recovery indicators (Table 1; Figure 1) and uniformly positive willingness to reuse the platform at follow-up (Figure 2) suggests strong feasibility and user-perceived value within routine station operations.

Several considerations and study limitations should guide interpretation and next steps. First, this was a single-arm, real-world evaluation, so the observed pre-to-post improvements cannot be uniquely attributed to Shiftwave-specific mechanisms. Plausible contributors include the combined experience of recumbent rest in a dedicated setting, expectation effects, and the integrated audio-guided relaxation context in addition to vibrotactile stimulation. Second, the 3-day follow-up reflects a subset of participants who completed the follow-up survey; while their responses are informative for implementation learning and hypothesis generation, they should not be assumed to represent all users. Third, outcomes were intentionally brief and pragmatic single-item ratings, which is a strength for operational feasibility but limits construct specificity compared to longer validated inventories.

Even with these constraints, the results meaningfully inform how Shiftwave may be used in fire service contexts. The strongest and most consistent acute changes—reduced physical tension, increased restedness and readiness, and reduced work stress—map directly onto near-term station-relevant use cases such as post-call decompression, between-call downregulation, and recovery support during demanding operational periods. Future evaluations that maintain real-world feasibility while strengthening inference would include a comparison condition (e.g., matched-duration recumbent rest with audio-only), standardized follow-up capture methods (e.g., QR-based access as planned), and predefined follow-up time points to better characterize how long perceived benefits persist and whether they accumulate with repeated use.

## **Conclusion**

In summary, this evaluation provides consistent evidence that Shiftwave sessions were associated with substantial immediate improvements across multiple self-reported recovery and stress indicators in firefighters at Albuquerque Fire Rescue (Table 1; Figure 1), alongside favorable descriptive follow-up impressions and very high acceptability among follow-up respondents (Table 2; Figure 2). The findings support Shiftwave's practical role as an acute recovery and relaxation tool in station settings and highlight the need for more controlled, higher-retention follow-up studies to isolate device-specific effects and better quantify short-term trajectories.