

# Evaluating Occupational Exposure and Decontamination Practices Among Active-Duty Texas Firefighters

Isabella Smetana, Amelia (Yi-Hsuan) Chen, Juan M. Alvarez, Paulina Romero, Quanjiang Li, Jingyu Liang, Jooyeon Hwang  
UTHealth Houston, School of Public Health

Post-fire decontamination is an important strategy for reducing firefighters' exposure to harmful combustion byproducts. However, despite guidance recommending prompt gross decontamination and showering, factors influencing decontamination practices including tenure, workload, and fire-exposure characteristics remain poorly characterized among Texas firefighters.

## Objective

This study examines whether occupational exposure and decontamination practices influence decontamination/PPE compliance and symptom burden.

## Methods

A cross-sectional questionnaire of active-duty Texas firefighters assessed tenure, workload, fire exposure, decontamination practices, and 24-hour symptoms. Fisher exact tests and logistic regression evaluated associations with decontamination practices and compliance. Negative binomial regression assessed associations of fire-scene duration and fire type with symptom count. Decontamination thoroughness was evaluated using Spearman correlations and adjusted count regression, including analyses stratified by fire-scene duration (<2, 2, and >2 hours) and an exposure-level interaction test.

## Results

Among 409 firefighters, SCBA doffing timing did not differ by tenure ( $p=0.32$ ), and no individual decontamination method remained associated with tenure after multiple-comparison correction. Combined use of gross decontamination and/or soap/water increased with tenure (OR per 5 years=1.24, 95% CI 1.05–1.46,  $p=0.0098$ ), while workload was not associated with decontamination compliance ( $p=0.74$ ). Fire-scene duration and fire type were not associated with symptom count ( $p=0.28$  and  $p=0.38$ , respectively). Decontamination thoroughness was not associated with symptom count overall ( $p=0.018$ ,  $p=0.71$ ) or within exposure groups ( $p=0.76$ ).

## Results

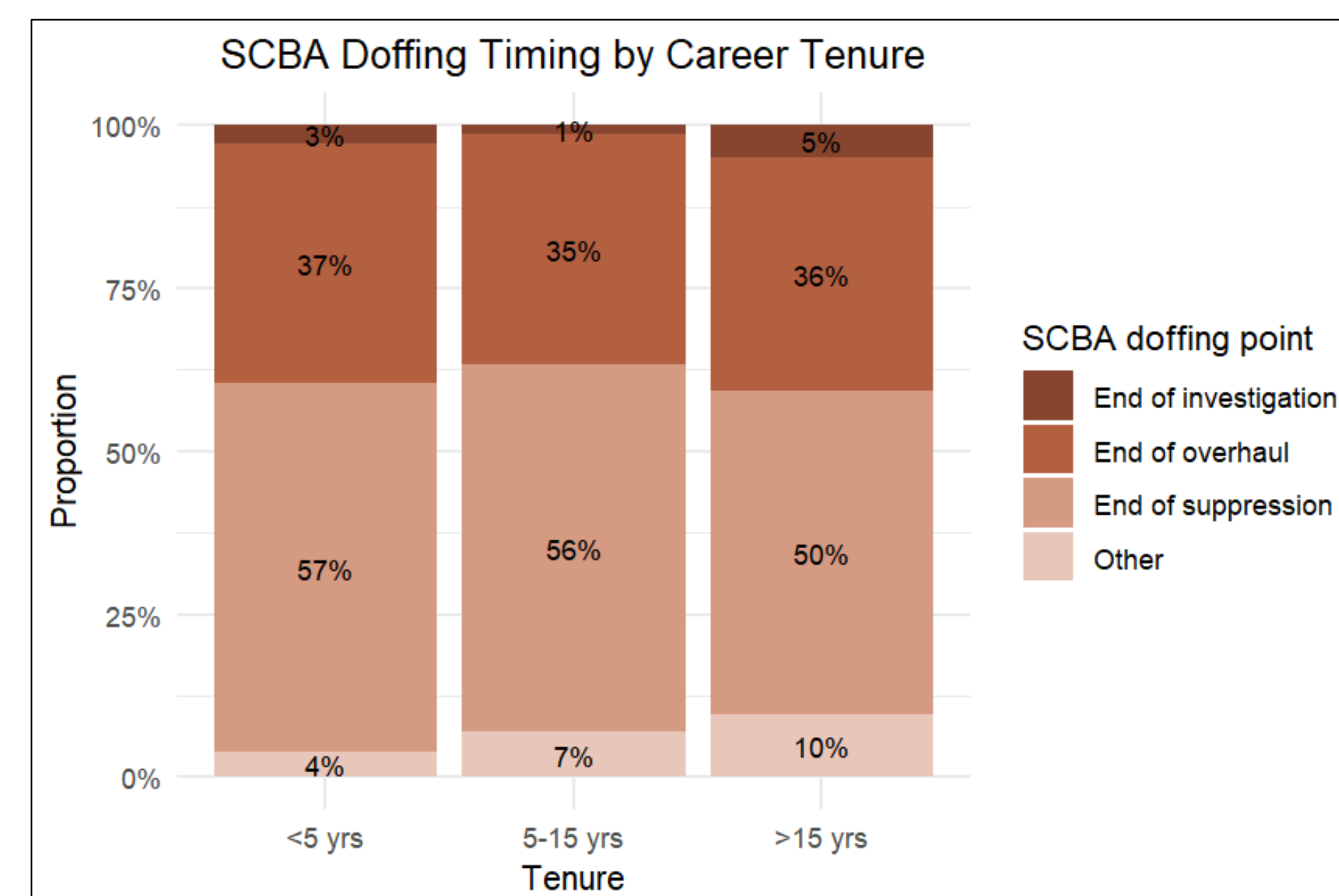


**Figure 1:** Stacked bar chart for each tenure group (<5, 5–15, >15 years) shows the proportion who doff SCBA at end of suppression, end of overhaul, end of investigation, or other. Fisher-Freeman-Halton exact test ( $p = 0.32$ ).

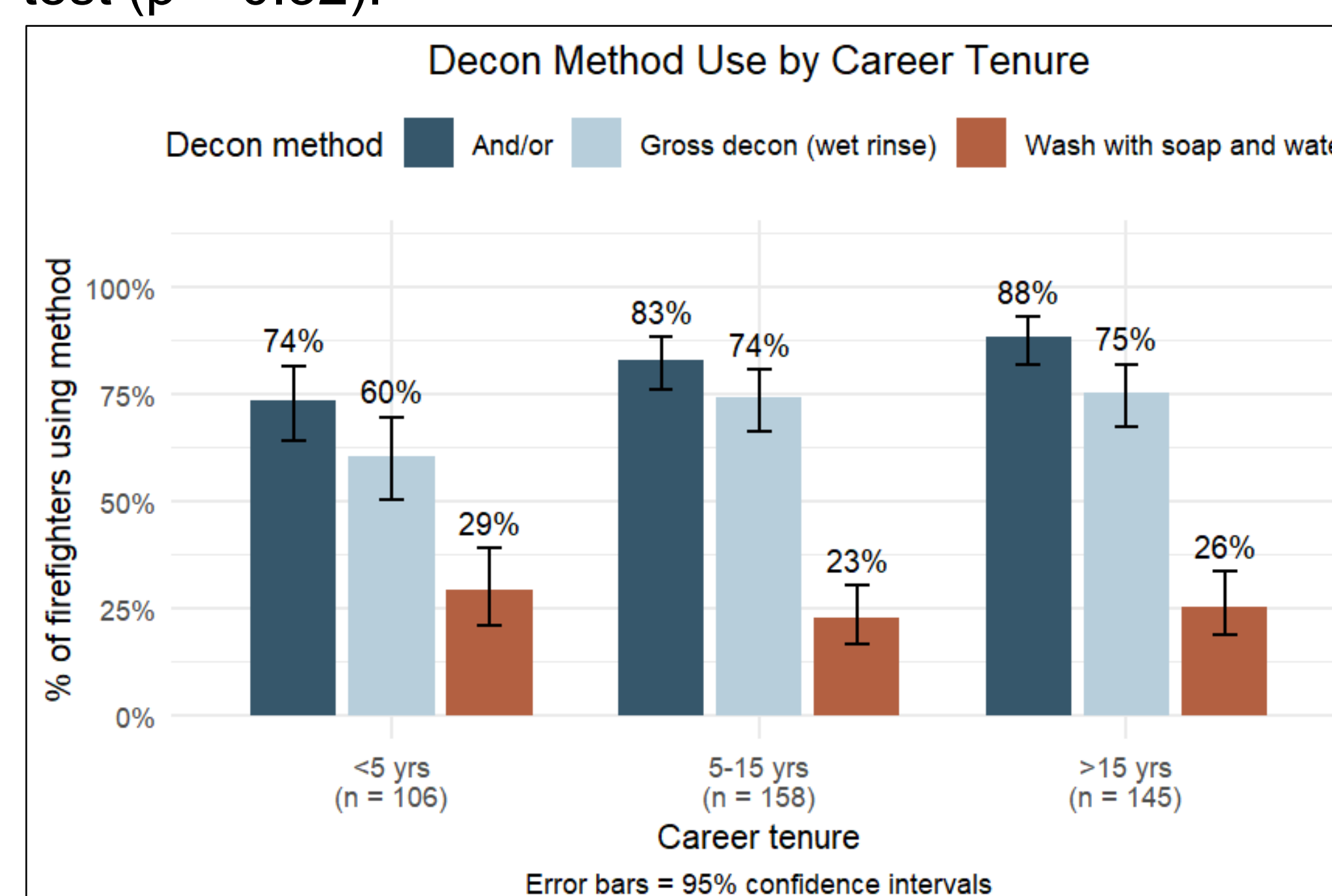


**Figure 2:** A horizontal bar chart, one bar per decontamination method, with each bar's height being the % of participants who use that method. Trend by tenure: Gross decon ( $p: 0.08$ ), Soap/water ( $p: 0.39$ ), Both ( $p: 0.0098$ ).

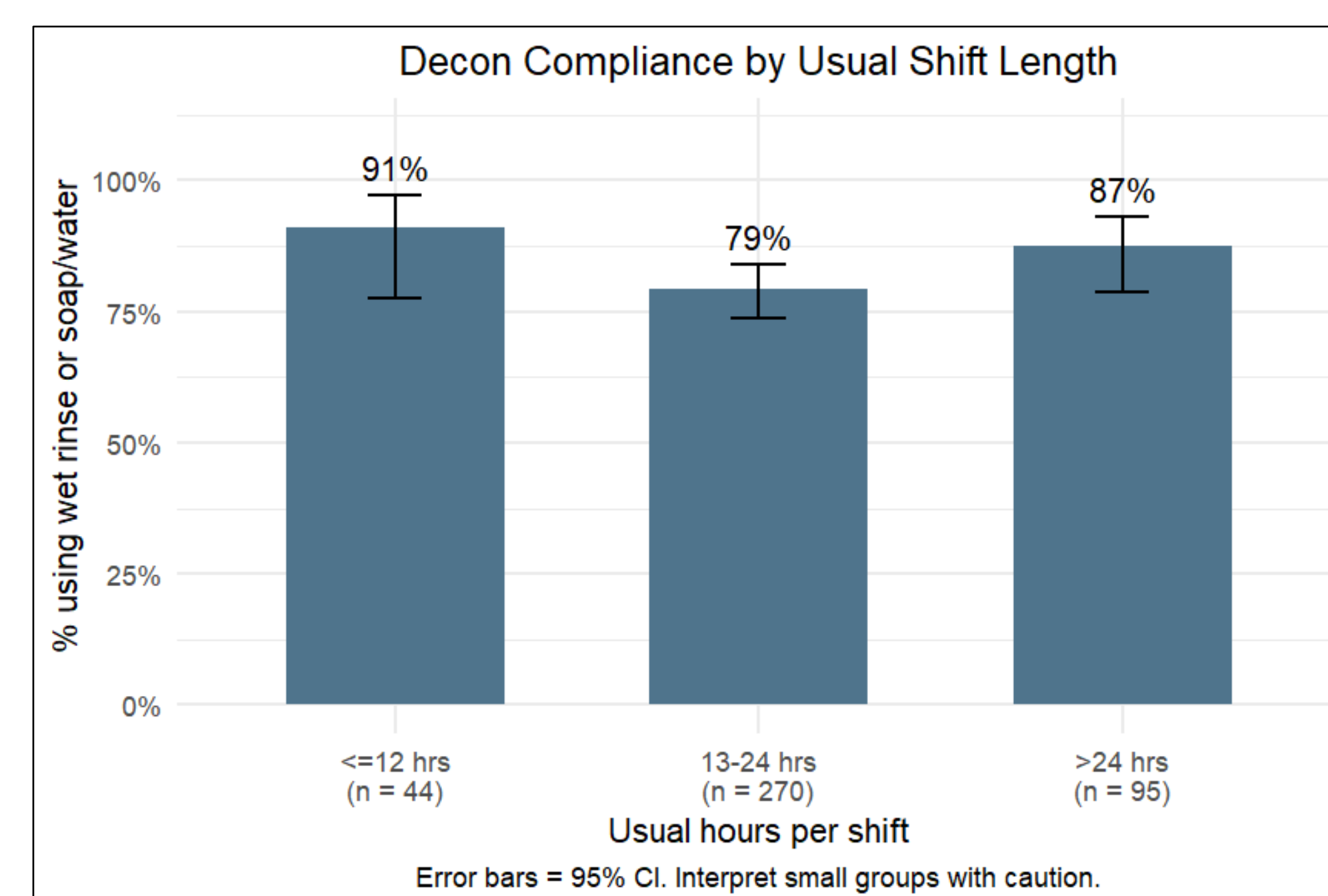


**Figure 3:** A bar graph for decontamination compliance of using wet rinse/soap decontamination versus their shift length. ( $p$  value: 0.741).

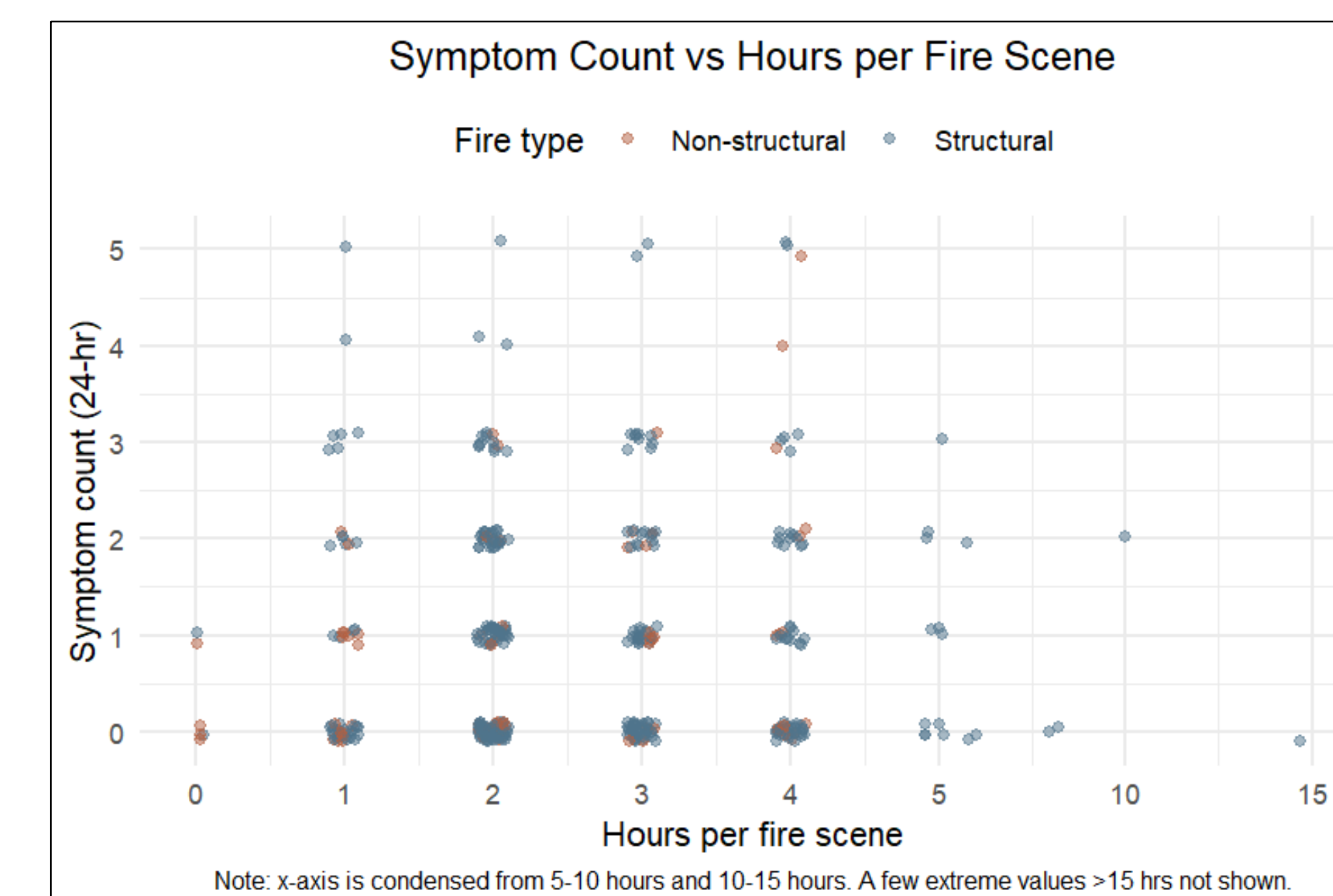


**Figure 4:** A scatter plot of symptom count against hours per fire scene, colored by structural vs. non-structural fire with a condensed x axis between 5–10 hours.

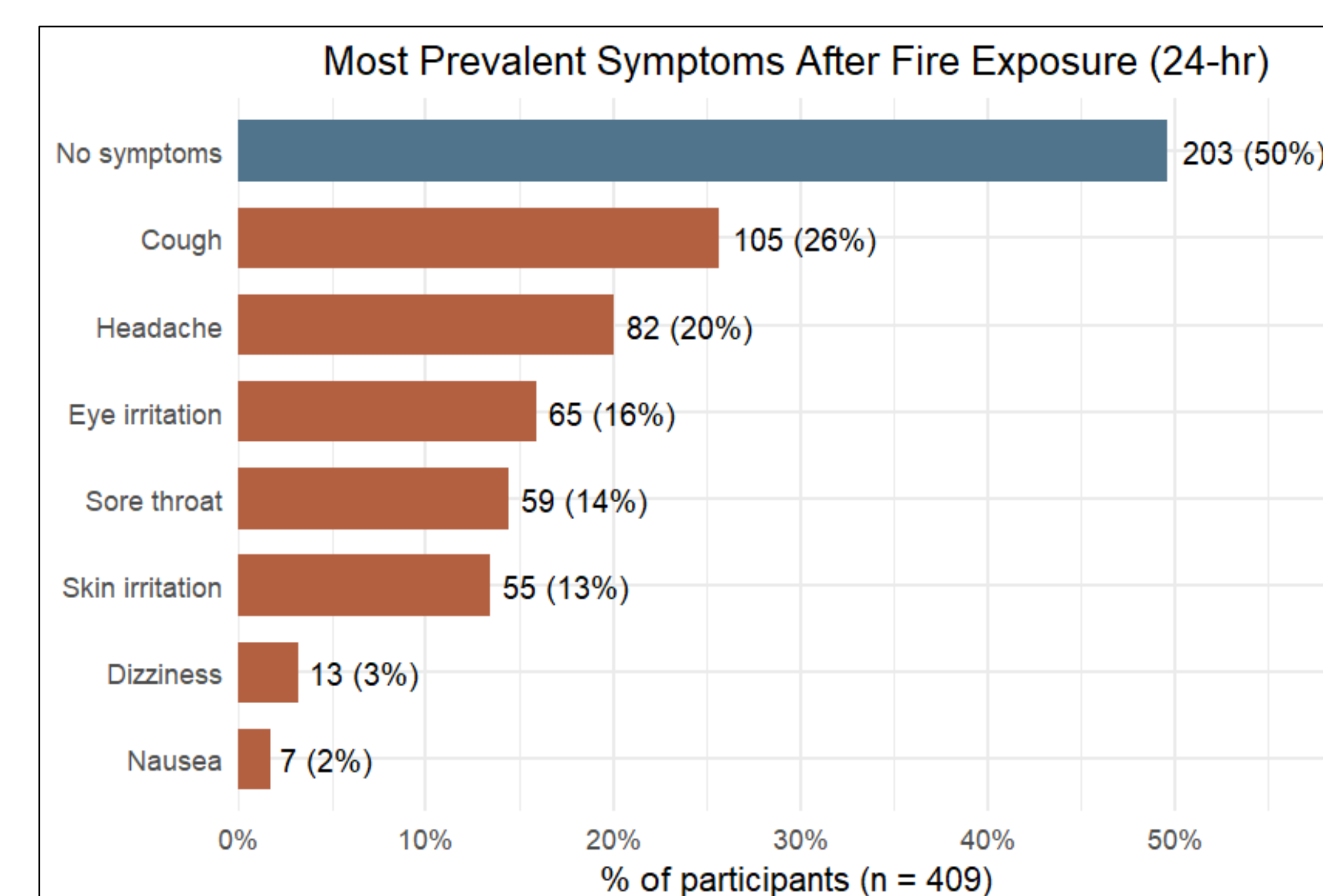


**Figure 5:** A bar graph of prevalent symptoms shown by percentage of participants experiencing them from high to low.

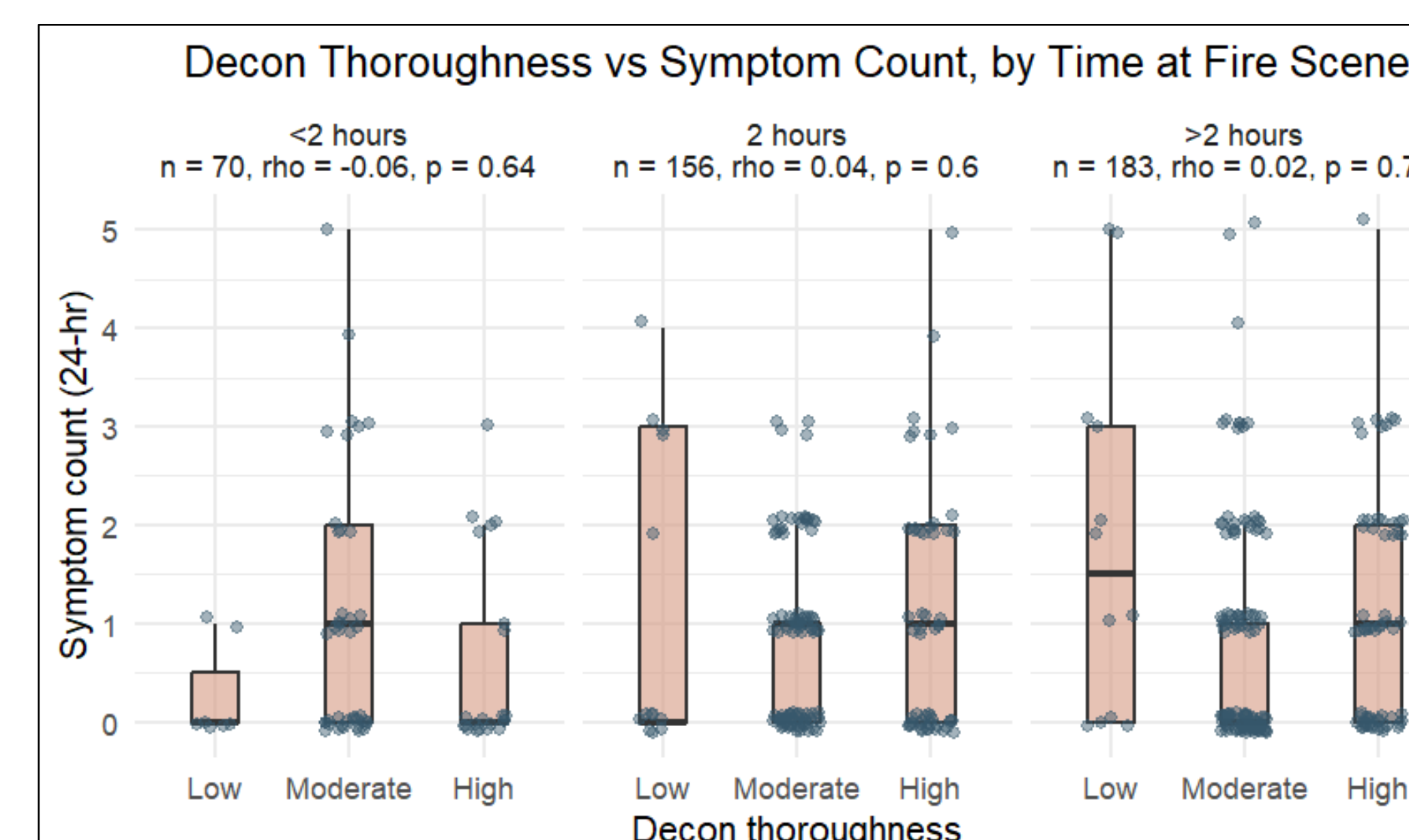


**Figure 6:** Black point and bar = mean symptom count  $\pm$  1 SE. Decon thoroughness: Low = showered but did not clean gear, or cleaned gear but did not shower; Moderate = showered and cleaned gear by only one decon method, High = showered and cleaned gear by two or more methods. Overall spearman rho = 0.018 ( $p=0.714$ ).

## Conclusions

- Career tenure was associated with decontamination method selection, particularly increased use of gross decontamination and/or soap and water with greater tenure.
- Occupational workload was not associated with overall decontamination compliance.
- Fire-scene duration and fire type were not associated with acute symptom burden.
- Decontamination thoroughness was not associated with acute symptoms, regardless of fire-scene exposure duration.

## Recommendations

- Investigate factors driving differences in decontamination practices across firefighter career stages and stations.
- Reinforce consistent, evidence-based decontamination training throughout a firefighter's career.
- Develop practical, standardized protocols that can be easily incorporated into routine post-fire operations.
- Conduct larger, longitudinal studies to evaluate which decontamination practices most effectively reduce occupational exposures and improve health outcomes.

## Acknowledgement

Isabella Smetana was supported by the Firefighters across Texas participating in the study, the Houston Fire Department, Chief Marino, Captain Dominguez, UTHealth Houston, the Coordinating Center for Clinical Trials team, The Human Genetics Center, and Texas State of Texas Senate Bill 1, 89<sup>th</sup> Legislature.