Document Title:	**Developing, Implementing, and Evaluating a Police Fatigue Risk-Management Strategy for the Seattle Police Department**
Author(s):	**Lois James, Ph.D.**
Document Number:	**309959**
Date Received:	**January 2025**
Award Number:	**2019-R2-CX-0022**

Cover Page

Federal Award Number: 2019-R2-CX-0022

Project Title: Developing, Implementing, and Evaluating a Police Fatigue Risk-Management Strategy for the Seattle Police Department

Principal Investigator: Lois James, PhD.

Contact Information: lois_james@wsu.edu (509) 385-9386

412 E Spokane Falls Blvd, Spokane WA, 99223

Award Recipient Organization: Washington State University

Project Period: 01/01/2020 – 12/31/2023 (including 12 month no cost extension)

Award Amount: $668,663

Summary of the Project

Major Goals and Objectives

The long-term goal of this project was to improve officers' sleep, health, safety, and wellness, and in so doing positively influence the quality of police services. Using a multi-phase and mixed method approach, our core objectives were to 1) measure the effects of work schedules and sleep loss on SPD officer health, wellness, safety, and quality of life; 2) develop a fatigue risk management strategy, informed by the data collected during objective 1; 3) using an RCT design, implement the resulting fatigue risk management strategy across the SPD, which is a large municipal police department (approximately 1,500 sworn officers); and 4) measure the effectiveness of the fatigue risk management strategy.

Research Questions and Study Hypotheses

The main research questions for the current study were as follows:

1) What are the effects of shift work, work hours, sleep loss, and fatigue on police officers' safety, health, and quality of life?

2) Can a fatigue risk management strategy *influence* these effects?

The specific study hypotheses related to the randomized control trial (RCT):

H_1: Treatment group officers receiving fatigue risk management training will have improved sleep outcomes following the intervention.

H_2: Treatment group officers receiving fatigue risk management training will have improved health and wellness outcomes following the intervention.

H_3: Treatment group officers receiving fatigue risk management training will have improved safety outcomes following the intervention.

Research Design

This study used a mixed-method multi-phase design:

Phase 1: Baseline Data Collection

We conducted baseline data collection on officer sleep, health, safety, wellness, and quality of life. We used wrist actigraphy to provide an objective measure of sleep quantity and quality. Actigraphs measure activity in the form of activity counts and subsequently use an algorithm to score sleep and wake. The actigraphy device we used was the ReadiBand by Fatigue Science. The Readiband provides objective measurements of sleep quantity (estimated using activity levels minute-by-minute epochs throughout the 24-hour cycle) and sleep quality (efficiency or fragmentation of sleep).

We also surveyed SPD employees using a battery of validated instruments designed to assess multiple aspects of sleep, health, and quality of life. These instruments were the Pittsburg Sleep Quality Index – PSQI (Buysse, 1989), the Epworth Sleepiness Scale – ESS (Johns, 1994), the PTSD Checklist for DSM-5 – PCL-5 (Weathers et al, 2013), the Patient Health Questionnaire-9 – PHQ-9 (Kroenke & Spitzer, 2002), the General Anxiety Disorder-7 – GAD-7 (Spitzer et al., 2006), and the World Health Organization Quality of Life – WHOQOL (Bonomi et al, 2000).

Phase 2: Strategy Development

We reviewed data collected at baseline to tailor and customize a fatigue risk management strategy. The resulting training was an eight-week (one 15-minute online module per week with at home action items) course that covered risks involved with fatigue, sleep restriction and shift work, the science of sleep, nutrition and exercise tips, stress management techniques, principles of sleep hygiene, and fatigue countermeasures.

Phase 3: Strategy Implementation

We randomly assigned SPD officers to treatment or wait-listed control groups. Treatment group officers received the online fatigue-management training via the department's Learning Management System (LMS) immediately after baseline testing. Wait-listed control officers were provided with the same training at the completion of the study period. Random assignment of officers to treatment or control groups was so that officers on various shift schedules, with differing cumulative work hours were represented within each group.

Phase 4: Measure Strategy Effectiveness

We conducted post-intervention data collection, consisting of the same measures collected at baseline. Our RCT design allowed us to compare data collected pre- and post-intervention, and between treatment and control groups to determine strategy effectiveness. Importantly, our randomized approach also allowed us to compare strategy effectiveness based on shift schedule, for example, whether the intervention was more or less beneficial for officers assigned to night shifts. Differences in officer sleep, health, wellness, and quality of life between treatment and control groups and before and after the training were analyzed using multi-level mixed models.

This analytical approach can account for multiple observations per participant over time, while reducing risks of Type 1 error due to potential lack of independence among data points.

Expected Applicability of the Research

Policing agencies around the country are becoming more and more concerned about the problem of police fatigue, burnout, stress, health risks, and poor quality of life from shift work, stress, and long work hours. This problem can become self-reinforcing, where insufficient staffing to meet community needs results in over-work and job stress, which leads to decreased resilience and poorer health and wellness. This in turn results in fewer officers (due to sick leave, accident and injury rates), which puts greater strain on remaining officers, and the cycle goes on.

The good news is that if reversed the cycle becomes self-reinforcing in the opposite direction. For example, promoting resilience, health and wellness can increase officer work capacity and reduce the number of officers on sick leave, being injured etc. This will start to close the understaffing gap so that actual services provided meet community service needs. The strategy that we developed, implemented, and evaluated in this project—based on a solid understanding of the nature of the problem within the SPD—has the potential to do exactly this. By educating participants on sleep, coping with domestic life, maximizing nutrition and exercise, dealing with circadian highs and lows, and providing practical and useable recommendations on how to counter fatigue and stress we start to benefit individual members of the organization. Thus, we believe the results of this study have widespread applicability and implication for US policing.

Furthermore, findings from this study contribute significantly to the research literature by answering critical questions that are as-of-yet unexplored: How are safety, health, wellness and quality of life outcomes influenced by work schedules? Can a cost-effective and low-burden fatigue-management strategy be implemented across a department? What is the impact of an online training program on promoting sleep, health, safety, and wellness outcomes among police? We believe that our study fills a critical gap in the literature and propels us forward in our ability to understand police fatigue, identify potential solutions, target interventions, and establish evidence-based best practices for nationwide adoption.

Participants and Other Collaborating Organizations

This project was conducted in collaboration with our partner police agency, the Seattle Police Department (SPD). Phase 1 began in the fall of 2020. At the time of baseline testing, the service had approximately 1,950 employees, all of whom were surveyed. No exclusion criteria were specified. 419 responded, with 319 filling in survey questions completely (allowing for generation of global / total scores for survey instruments), resulting in a total response rate of 21% with 16% providing complete responses. This was a lower response rate than anticipated, but understandable given the additional burden of the Covid-19 pandemic, the social unrest following the murder of George Floyd, and the consequent understaffing. This project was approved by the WSU Institutional Review Board prior to participant recruitment. Of our phase 1 participants, 237 participated in the experiment (Phase 4). We were sufficiently powered to detect treatment effects.

Characteristics of our phase 1 sample are depicted in table 1. During the month of October 2020, the agency employed approximately 1,950 employees, of which 67% were sworn police officers and the remainder (33%) a mix of civilian FTE and temporary civilian (not sworn). Just over 75% of *our* respondents were sworn officers, slightly higher than the service makeup (the remainder were civilian staff). A majority of the sample was white (72%) and male (67%). The modal age range was, 35-44, and 83% of the sample were between 25-54. The average years of experience within the police service was 12 (SD=5). 29% of the sample had prior military experience.

About 36% of the sample worked a standard 8-hour day shift (9am-5pm). Civilian staff largely fell into this category, as well as executive level employees. Sworn personnel predominantly worked one of the following: 14% worked night shift (3am-11am), 16% worked day shift (11am-8pm), and 16% worked evening shift (8pm-3am). The remainder of the sample worked some other shift schedule (for example one division in the service worked rotating shifts). Shift length typically ranged from 7-10 hours.

Table 1. Characteristics of the sample (N=319)

		Frequency	*Percent*
Race	American Indian	1	0.3
	Asian	24	7.6
	Black	17	5.4
	Hispanic	20	6.4
	White	226	72
	Other	26	8.3
Gender	Female	102	32.3
	Male	210	66.5
	Other	4	1.3
Age	Under 25	3	1
	25-34	60	19.1
	35-44	115	36.6
	45-54	87	27.7
	55-64	42	13.4
	Over 65	7	2.2
Job Type	Civilian	78	24.5
	Sworn	241	75.5
Prior Military	Yes	69	29
	No	169	71
Shift	3am-11am	33	13.8
	11am-8pm	39	16.3
	8pm-3am	39	16.3
	9am-5pm	87	36.4
	Other	30	17.2
		Mean	*Std. Deviation*
Years of Experience		11.56	5.478

Changes in Approach from Original Design

No notable changes were made to the original design, however a one-year no cost extension was requested to recruit sufficient numbers of research participants to achieve statistical power (due predominantly to understaffing from the Covid 19 Pandemic).

Outcomes

Activities / Accomplishments

All major activities were accomplished. The study period was extended by 12 months given various delays experienced due to the Covid-19 pandemic.

Results and Findings

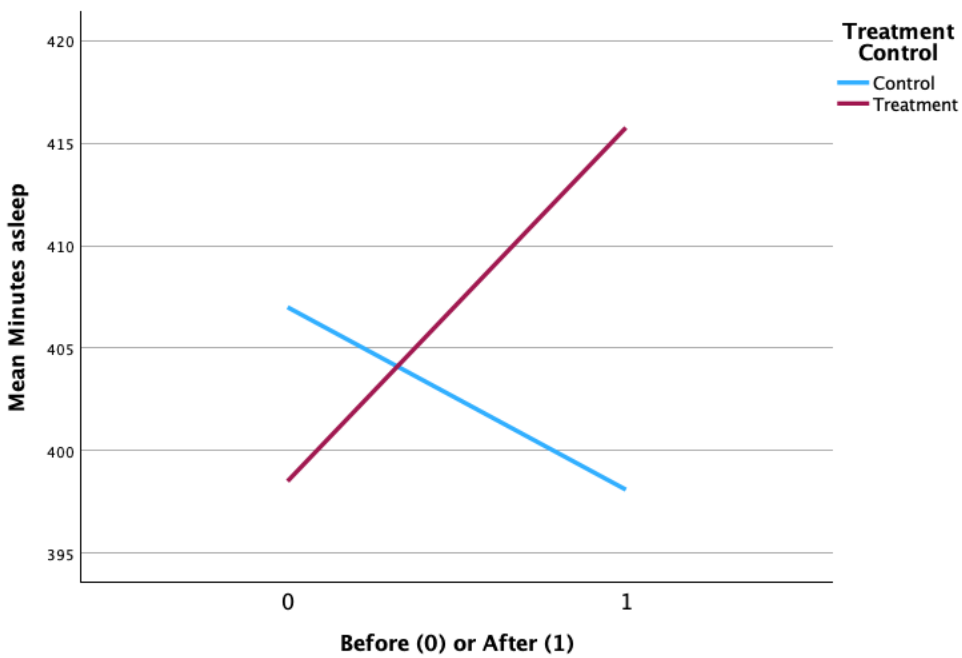
At baseline, we found 77.4% of police employees had poor sleep quality, 25.7% had excessive daytime sleepiness, 50.2% had PTSD symptoms, 51.9% had depressive symptoms, and 40.8% had anxiety symptoms. Working night shifts significantly decreased sleep quality (f=7.52; df=2,280; p<.05) and increased excessive sleepiness (f=9.86; df=2,318; p<.01). Furthermore, employees working night shifts were significantly more likely to report falling asleep at the wheel while driving home than employees working other shifts (Chi^2 =15.30.93; df=2; p<.001).

Results of the fatigue training experiment are presented by study hypothesis:

H_1: Treatment group officers receiving fatigue risk management training will have improved sleep outcomes following the intervention.

The first sleep outcome variable we analyzed was sleep quantity, measured via actigraphy. Before the intervention, control group participants received an average of 407 minutes (SD=60 minutes) or 6.8 hours of sleep. Treatment group participants received an average of 398 minutes (SD=69 minutes) or 6.6 hours of sleep. Following the intervention, treatment group participant sleep increased by 18 minutes per 24h period, while control group participant sleep decreased by 9 minutes during this same time frame. When analyzed using multi-level mixed models to account for multiple observations per participant, this group*time difference was significant (f=15366; df=1,31; p<.001). This significant effect was observed even controlling for shift, although day shift appeared to have the largest increase in average sleep time (34 minutes). Although this increase in minutes might not seem large for treatment group participants, post-intervention they bumped up to 7 hours on average, which put them into the "sufficient" or "typical" sleep range of 7-9 hours which is the recommended sleep amount for most adults.

Figure 1: Sleep quantity in minutes per 24h period pre and post intervention for treatment and control groups



The second sleep outcome variable we analyzed was sleep quality, also measured by actigraphy. Sleep quality is an estimate of time in bed actually spent sleeping (or fragmentation of sleep). For control group participants, this was 83% at baseline, while for treatment group participants, this was 82%. Following the intervention, control group participant sleep quality dropped to

82%, while treatment group sleep quality raised to 83%. When tested using multi-level mixed models, the effect of the intervention was only significant for day shift, who went from 81% to 84% ($f=11.29$; $df=5,20$; $p<.001$).

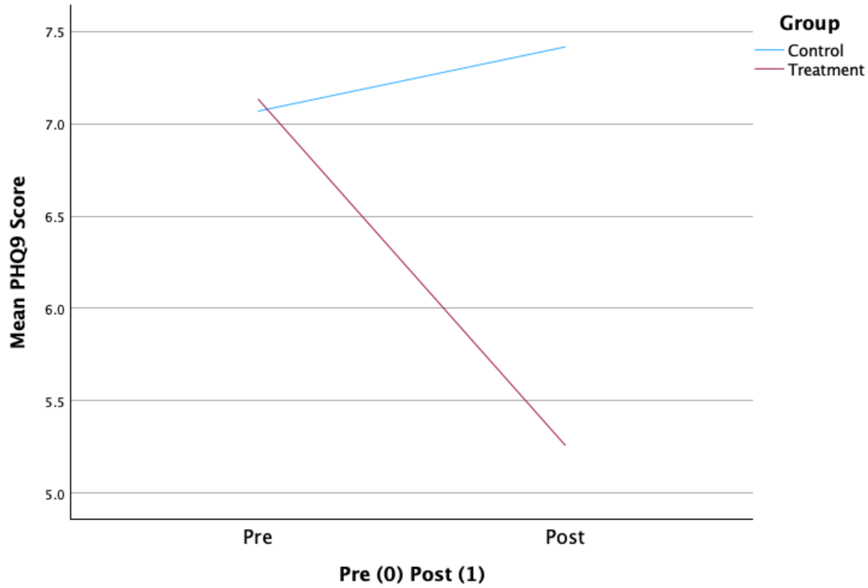
The final sleep variable we analyzed was the PSQI score (self-reported sleep quality). Here we saw a reduction in PSQI score for treatment group participants (8 to 6 on the scale – where greater than 5 is considered "poor" sleep quality) compared to control group participants who remained at an average of 8 pre and post training. Although "trending", this result did not reach statistical significance ($p=.06$).

H_2: Treatment group officers receiving fatigue risk management training will have improved health and wellness outcomes following the intervention.

Health and wellness outcomes included scores on the WHOQOL (quality of life), PHQ-9 (depression), GAD-7 (anxiety), and PCL-5 (post-traumatic stress). WHOQOL score remained at 74% for treatment group participants before and after the training, while dropped from 72% to 70% for control group participants. This difference however did not reach statistical significance ($p=.11$), indicating that the training did not affect quality of life.

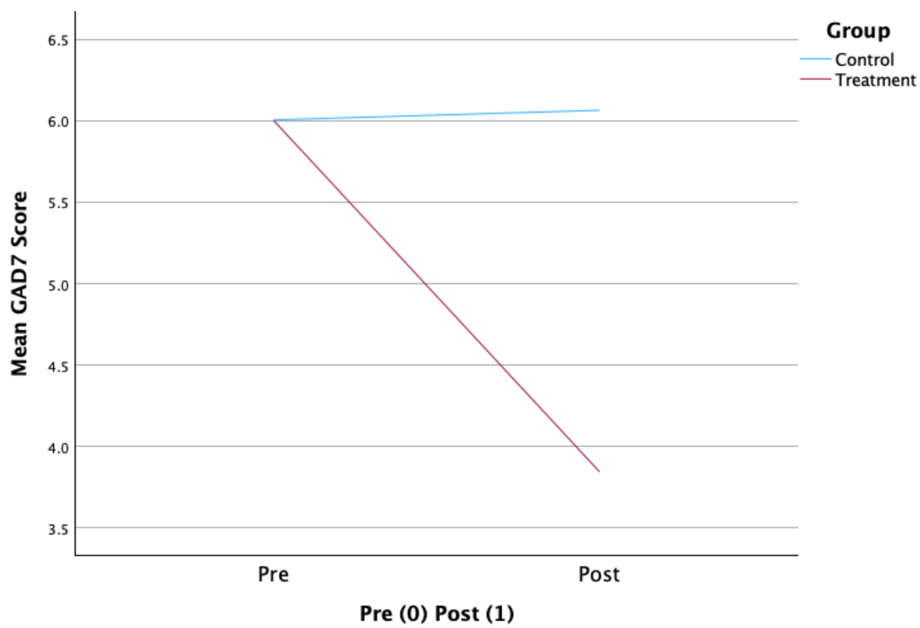
PHQ-9 scores dropped from an average of 7 to 5 for treatment group participants following training, while increased from 7 to 8 for control group participants. This difference was statistically significant ($f=4.05$; $df=1$; $p<.05$) indicating that the training intervention had a positive impact on depression symptomatology.

Figure 2: PHQ-9 (depression) scores pre and post intervention for treatment and control groups



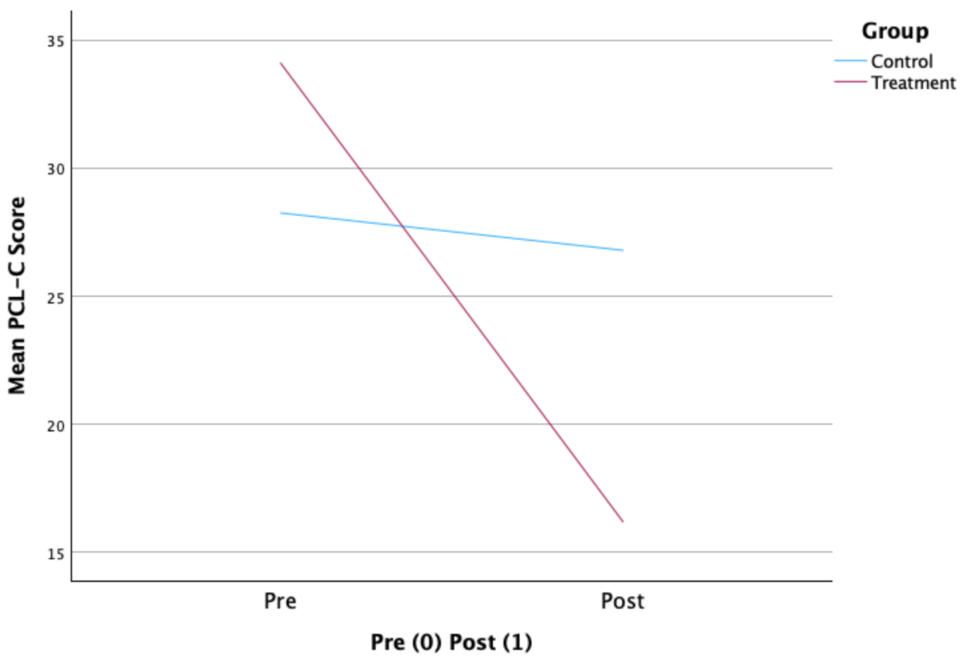
GAD-7 (anxiety) scores went from 6 to 4 for treatment group participants following training, while remaining at 6 for control group participants. This difference was statistically significant (f=4.12; df=1; p<.05) indicating that the training had a positive impact on anxiety.

Figure 3: GAD-7 (anxiety) scores pre and post intervention for treatment and control groups



Finally, treatment group participants saw a statistically significant and large drop in PCL-5 (post-traumatic stress) scores from an average of 34 to 16 following the training (f=22.85; df=1; p<.001). In addition to being a notable drop, this also moved them below the cutoff for probable PSTD (which ranges from 25-35 depending on physician interview and determination). Furthermore, treatment group explained 30% of the variance in PCL-5 score (R^2=.03). Control group participants went from an average of 28 to 27 during this same time frame, indicating that the training intervention had a positive impact on post-traumatic stress symptoms.

Figure 4: PCL-5 (post-traumatic stress) scores pre and post intervention for treatment and control groups



H_3: Treatment group officers receiving fatigue risk management training will have improved safety outcomes following the intervention.

Safety outcomes were measured by the ESS (subjective sleepiness) and in particular the likelihood of reporting falling asleep at the wheel. Overall, there was no significant difference in ESS score before or after the training for either treatment or control group. However, looking specifically at risks of falling asleep while driving, 20% of treatment group participants reported falling asleep while driving at baseline measurement which dropped to 11% following training. Control group participants remained stable with 15% reporting falling asleep while driving at baseline, and 16% at post-intervention measurement. This difference was statistically significant (Wald=9.23; df=1; $p<.01$), indicating that the training intervention had a positive impact on driving safety.

Overall, our study hypotheses were supported. The training intervention had a significant and positive impact on officer sleep (quantity and for day shift quality), health and wellness (depression, anxiety, and post-traumatic stress), and safety (likelihood of falling asleep while driving). The training did not however significantly affect self-reported quality of life.

Limitations

These study results represent a substantial contribution to the research literature. It is encouraging that a fatigue training intervention improved officer sleep, health, wellness, and safety outcomes. However, a notable limitation needs to be addressed, and results need to be interpreted and caveated with this in mind.

The effects of the Covid-19 pandemic might have influenced results in ways that are difficult to control. The presence of a control group within this study prevents the data from being potentially meaningless in the face of temporal changes between baseline and post-intervention data collection periods. However, these influences may impact the generalizability of study results. Seattle Police Department's experiences with the pandemic might not be the same as other departments' experiences, and this should be kept in mind when considering the national applicability of study results. Seattle Police Department underwent extreme staffing shortages during the pandemic, operating at as low as 70% of their required personnel. It is possible that the added burden for employees influenced their ability to engage in the training (either by reducing their availability or by convincing them of the need for training) in ways that are difficult to predict or control.

Artifacts

Products, Datasets, and Dissemination

Manuscripts:

"The Effects of Shift-Work Schedules on the Sleep, Health, Safety, and Quality of Life of Police Employees during the COVID-19 Pandemic" (published in Frontiers). James, L., James, S., & Atherly, L. 2023

"The Results of a Police Fatigue Training Experiment: Impacts on Sleep, Health, Wellness, and Safety" (being prepared for submission to Police Quarterly). James, L., James, S., & Atherly, L.

Presentations:

"The Results of a Police Fatigue Training Experiment" (October 2023, International Association of Chiefs of Police). James, S. & Atherly, L.

“The Results of a Police Fatigue Training Experiment” (Upcoming – May 2024, American Society of Evidence Based Policing). James, L.

Datasets:

The first data set contains the pre and post training actigraphy data.

The second dataset contains the pre and post training survey data.

References

Bonomi AE, Patrick DL, Bushnell DM, Martin M. (2000). Validation of the United States' version of the World Health Organization Quality of Life (WHOQOL) instrument. *Journal of Clinical Epidemiology*, 53(1), 1–12.

Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*, *28*(2), 193-213.

James, L., James, S., & Atherly, L. (2023) The effects of shift-work schedules on the sleep, health, safety, and quality of life of police employees during the COVID-19 pandemic. *Frontiers*.

Johns, M. W. (1994). Sleepiness in different situations measured by the Epworth Sleepiness Scale. *Sleep*, *17*(8), 703-710.

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric annals*, *32*(9), 509-515.

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine*, *166*(10), 1092-1097.

Weathers FW, Litz BT, Keane TM, Palmieri PA, Marx BP, Schnurr PP. (2013). The PTSD Checklist for DSM-5 (PCL-5). National Center for PTSD http://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp.