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Differences in paramedic fatigue before and after changing from a 24-hour to 8-hour shift schedule: A case report

P. Daniel Patterson, PhD, NRP¹, Sharon Klapac, NRP³, Matthew D. Weaver, PhD, EMT-P², Francis X. Guyette, MD, MS², Thomas E. Platt, EdD, NRP³, and Daniel J. Buysse, MD⁴

¹Department of Emergency Medicine, Carolinas HealthCare System Medical Center, 1000 Blythe Blvd, 304J MEB, Charlotte, NC, 23203; (PDP)

²Department of Emergency Medicine, University of Pittsburgh School of Medicine, 3600 Forbes Avenue, Iroquois Bldg., Suite 400A, Pittsburgh, PA 15261

³Program in Emergency Medicine, School of Health & Rehabilitation Sciences, University of Pittsburgh. 230 McKee Place, 5th Floor. Pittsburgh, PA 15213

⁴Department of Psychiatry and Clinical Translational Science, University of Pittsburgh School of Medicine, Pittsburgh, PA (DJB)

Abstract

Emergency Medical Services (EMS) clinicians often work 24-hour shifts. There is a growing body of literature, with an elevated level of concern amongst EMS leaders that longer shifts contribute to fatigued workers and negative safety outcomes. However, many questions remain about shift length, fatigue, and outcomes. We describe a case of a 26-year-old male paramedic who switched shift schedules during the mid-point of a randomized trial that addressed fatigue in EMS workers (clinicaltrials.gov identifier: NCT02063737). The participant (case) began the study working full-time with a critical care, advanced life support EMS system that utilized 24-hour shifts. He then transitioned to an EMS system that deploys workers on 8-hour shifts. Per protocol for the randomized trial, the participant completed a battery of sleep health and fatigue surveys at baseline and at the end of 90-days of study. He also reported perceived fatigue, sleepiness, and difficulty with concentration at the beginning, every 4-hours during, and at the end of scheduled shifts, for a total of ten 24-hour shifts and twenty-four 8-hour shifts. We discuss differences in measures taken before and after switching shift schedules, and highlight differences in fatigue, sleepiness, and difficulty with concentration taken at the end of all 34 scheduled shifts stratified by shift duration (24-hours versus 8-hours). Findings from this case report present a unique opportunity to: 1) observe and analyze a phenomenon that has not been investigated in great detail in the EMS setting; and 2) address an issue of significance to employers and EMS clinicians alike.

Address correspondence and requests for reprints to: Department of Emergency Medicine, Carolinas HealthCare System Medical Center, 1000 Blythe Blvd, 304J MEB, Charlotte, NC, 23203 paul.patterson@carolinas.org.

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Keywords

Sleep; fatigue; shiftwork

Introduction

Longer or extended work shift durations contribute to negative safety outcomes and poor performance.^{1–3} Numerous studies have linked medical errors or injury/illness to shift work and work related fatigue, and there is growing concern for the impact of extended shift duration on the safety of patients and clinicians in the Emergency Medical Services (EMS) setting.^{4–6} EMS clinicians commonly work in shifts that last 12 or 24 hours.^{6–9} Recent data show that a large percentage of EMS clinicians report poor sleep quality, daytime sleepiness, and high levels of work related fatigue.^{6–8} Research exploring the relationships between shift work, fatigue, and safety in EMS is limited.⁶

We used a case report study design of a single individual who participated in the SleepTrackTXT randomized controlled trial, which examined sleep health, sleep quality, and intra-shift fatigue indicators in EMS shift workers.¹⁰ The participant in question experienced a change in employment and shift scheduling from extended shifts (24-hour shifts) to shifts of shorter duration (8-hour shifts) at day 46 – the mid-point of the 90-day study period. This change in scheduling was isolated to this case only and is therefore particularly illustrative. The sleep health and fatigue data from this case presents a unique opportunity to observe and analyze a phenomenon that has not been investigated in great detail in the EMS setting.¹¹

The Case

The participant (case) was a 26-year-old male paramedic who had full-time employment with a critical care, advanced life support EMS system. The participant voluntarily enrolled in the SleepTrackTXT randomized controlled trial, which sought to determine the performance characteristic of a mobile-phone text-message based fatigue assessment and intervention tool.¹⁰ The trial was approved by the University of Pittsburgh Institutional Review Board (IRB) and registered with clinicaltrials.gov (Identifier: NCT02063737).¹⁰ At baseline, the participant was required to work in shifts scheduled for 24-hours. His body mass index was measured at 29.5 (overweight), his self-rated health status was ‘excellent,’ and medical history included a report of migraine headaches. The participant’s Pittsburgh Sleep Quality Index (PSQI) score at baseline was 8 (poor sleep quality).¹² His baseline score on the Epworth Sleepiness Scale (ESS) was 16 (excessive daytime sleepiness).¹³ The participant’s responses to the validated Chalder Fatigue Questionnaire (CFQ) and Occupational Fatigue Exhaustion Recovery (OFER) scales indicated “severe fatigue” at work, chronic fatigue, acute fatigue, and limited recovery between shifts.^{14,15} The participant also completed the Sleep Fatigue and Alertness Behavior (SFAB) survey; a 50-item survey that measures eight components of alertness behavior while on duty.¹⁶ The participant’s scores on the PSQI, ESS, CFQ, and OFER indicate he suffers from poor sleep quality, excessive daytime sleepiness, severe work related fatigue, and high levels of acute fatigue, chronic fatigue, with possibly poor recovery between scheduled shifts. The SFAB

survey tool is new, and at the present time there is no benchmark or base rate from which to compare the participant's SFAB score taken at baseline.

Our case participated in the randomized controlled trial for the full 90-day study period and documented 34 total work shifts, of which 10 shifts were 24 hours in duration and 24 shifts were 8 hours in duration.¹⁰ Details of the study protocol are published elsewhere.¹⁰ Briefly, the participant reported: 1) total hours of sleep prior to start of scheduled work shifts, 2) perceived fatigue, sleepiness, and difficulty with concentration at the start, every 4-hours during, and at the end of scheduled shift work; and 3) hours of sleep obtained during shiftwork. End of shift reports were missing for two of ten 24-hour shifts and five of twenty-four 8-hour shifts. We calculated the mean, median, minimum, and maximum for these measures and tested for differences in median values between 8-hour and 24-hour shifts using the test of medians. The mean and median hours of sleep obtained prior to start of scheduled shifts were not different between 24-hour and 8-hour shifts (5.8 hours and 5.0 hours for 24-hour shifts; 5.7 hours and 5.0 hours for 8-hour shifts, respectively; p -value=0.74). The mean and median hours of sleep obtained during 24-hour shifts (5.3 hours and 6.0 hours, respectively) was greater than the mean and median hours of sleep obtained during 8-hour shifts (0.3 and 0.0 hours, respectively; p <0.01). The mean and median number of patient encounters per shift was lower for 24-hour shifts (1.1 and 0.5 patients, respectively) compared to 8-hours shifts (3.1 and 3.5 patients, respectively; p -value=0.03). The approximated Unit Hour Utilization (UHU) based on mean patient encounters was 0.05 for the 24-hour shifts and 0.39 for the 8-hour shifts. Figure 1 shows a comparison of self-rated fatigue, sleepiness, and difficulty with concentration at the beginning, during, and end of scheduled shifts stratified by shift duration. A comparison of reports taken at the end of scheduled shifts show that fatigue, sleepiness, and difficulty with concentration reported at the end of 24-hour shifts were higher than that reported for 8-hour shifts (p <0.05).

The participant completed a battery of standardized and validated questionnaires at 90 days of study participation. His PSQI sleep quality score improved from 8 at baseline to 5 at 90 days (PSQI scores greater than or equal to 6 signify poor sleep quality).¹² His score on the ESS dropped from 16 to 12, which is classified as "situational sleepiness."¹³ Scores on the OFER scale scores at baseline were 83.3 for chronic fatigue, 93.3 for acute fatigue, and 36.7 for intershift recovery. Scores at 90 days were substantially lower for chronic fatigue (56.7) and acute fatigue (60.0), with no change in intershift recovery (36.7). The change in scores over time suggests improvements in fatigue symptoms.

Changes on the participant's SFAB survey tool were mixed. Scores on some SFAB subscales showed improvement implying factors that impact the participant's intent to engage in alertness behaviors at work improved. For example, scores on the normative beliefs subscales increased over time (NB-one subscale at baseline=45.0 to 75.0 at 90 days, and NB-two subscale score at baseline=36 to 64 at 90 days). These changes imply that the participant strengthened his perception of society's/peer's negative views of EMS clinicians working while fatigued. In addition, the participant's self-efficacy score improved from 30.0 at baseline to 50.0 at 90-days. An increase in self-efficacy implies the participant gained self-confidence to engage in behaviors that may improve alertness while on duty. Scores on other subscales decreased. For example, scores on the attitudes sub-scale decreased over time

(ATT-one subscale at baseline=86.7 to 63.3 at 90 days, and ATT-two subscale at baseline=53.3 to 40.0 at 90 days). This decrease may be interpreted as the participant developing a less positive or less favorable attitude about maintaining alertness on duty.

Discussion

This case report describes detailed sleep and fatigue indicators pre and post change in shift scheduling from shifts of longer to shorter duration. This case report adds to the current literature in several ways. First, there is limited longitudinal research on EMS clinician work fatigue as it relates to shift work duration. Findings from this case report suggest the importance of shift work scheduling on symptoms related to sleep, fatigue, and recovery. These symptoms, in turn, may relate to quality of life and long-term health and function in EMS workers.

Key findings that add to the EMS literature include:

- a. regardless of shift duration, there was no difference in sleep hours obtained prior to start of shift work;
- b. the participant was able to obtain substantial amounts of sleep during 24-hour shifts compared to little or no sleep during shifts of 8 hours in duration;
- c. end of shift fatigue, sleepiness, and difficulty with concentration were worse at the end of 24-hour shifts compared to 8-hour shifts. Changes in measures of sleep quality, daytime sleepiness, and general indicators of work related fatigue after changing shift duration from longer to shorter were positive; and
- d. measures on the tool that measures behavioral aspects of fatigue (the SFAB tool) suggest complex changes may occur in attitudes, beliefs, and other factors that may impact the intent to adopt alertness promoting behaviors during shift work. Workplace culture and safety culture in particular may play a prominent role in the case's attitudes, beliefs, and intent to adopt alertness promoting behaviors. We did not measure workplace safety culture as part of this study, however, it is important factor and previous research shows wide variation in culture between EMS agencies.¹⁷ Changes in some behavioral indicators were positive while others were negative.

Second, findings from this case report highlight the complexity associated with shift work, fatigue, and the role of shift duration in EMS practice. Our presumptions or biases related to shift work, shift duration, and fatigue may lead us to assume that longer shifts equal less rest, greater work duties, and greater patient volume. In this case report, we observed the opposite, which test our assumptions based on personal experiences or interpretation of findings from research of other occupations. These data raise several questions for future research and add to the literature by informing hypotheses and honing research questions for the future. What factors other than the number of patients seen during a shift contribute to work-related to fatigue? During the longer 24-hour shifts, our participant saw fewer patients and obtained more sleep than reported for the shorter 8-hour shifts. What amount and quality

of rest or sleep during extended work shifts leads to reductions in perceived fatigue and/or improvements in sleep health indicators for EMS workers?

There is limited research involving EMS workers to address these questions. Courtney and colleagues surveyed 150 paramedics in Australia and discovered increased levels of fatigue and poor sleep quality among paramedics in rural areas (with presumed lower workload) compared to paramedics in urban areas.¹⁸ One study by Takeyama and colleagues allowed a select number of EMS workers in Japan to take longer versus shorter rest/nap periods during extended shifts (24-hour shifts).¹⁹ Their findings show no statistical improvement in fatigue at the end of shift work between workers with longer versus shorter rest periods.¹⁹ Does rest during extended shifts reduce work related fatigue and improve worker alertness? Workers who obtain rest and sleep during work experience improvements in perceived fatigue and performance.^{20–24} Further study with EMS workers that adhere to a variety of shift work schedules is needed to confirm or refute findings from research of other occupations, and to test our assumptions and hypotheses of relationships between shift work, fatigue, and outcomes. Specifically, we need research to investigate the amount and type of rest/sleep obtained at work and the amount and type of rest/sleep between shifts. This research is needed to determine how EMS employers may incorporate scheduled rest as a policy or program for fatigue risk management.

What is the impact of patient workload, intensity, or duration of patient care on EMS clinician fatigue across different shift characteristics? There is no prescribed method for measuring workload in the EMS setting. Counting patient contacts such as “Dispatches” or “Transports” may be too crude and fail to capture aspects of workload such as intensity or duration of care. A measure familiar to many EMS administrators, Unit Hour Utilization (UHU), may be bridge measure between current and future measurement of workload in EMS for projects germane to fatigue risk management. Future studies are needed that capture detailed measures of workload, including yet not limited to, patient volume.

Our case report study also raises the issue of worker health, stress, and tolerance for shift work. Our participant self-reported a history of migraines and a self-evaluated health status of ‘excellent.’ Despite a lack of multiple medical conditions and presence of ‘excellent health status,’ our participant may not be tolerant of shift work, especially extended duration shift work. It may also be possible that our participant was experiencing an elevated amount of job-related stress and possibly burnout prior to changing employment and shift schedules. The case switched employment from one where patient acuity was often higher than acuity at his new place of employment. It is widely known that the EMS occupation is stressful and numerous studies show a strong association with stress and occupational burnout.^{25–30} Chronic work related stress could have detrimental effects on worker health and tolerance for work.³¹ In addition to stress, previous research suggest that numerous individual characteristics, including social and environmental factors, may influence an individual’s adaptation and adjustment to shift work.³² Sex, age, physical fitness, partner/marital status, children, domestic obligations, social support, and other factors have been linked to tolerance for shift work.³² We did not specifically measure tolerance in this study, but it could plausibly play a role and help explain some of our findings. Future studies of EMS

shift work should consider tolerance as key mediator or moderator between the duration of shift work and outcome measures, including self-reported fatigue.

Conclusion

This case report demonstrates that shift duration may play a role in self-rated indicators of sleep health and fatigue for EMS clinicians. Causality between shift duration and measures of sleep and fatigue cannot be inferred from a single case and future research using prospective designs with representative samples are needed.

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Findings from the SleepTrackTXT trial that include data from all participants are scheduled for presentation at the 2015 annual National Association of EMS Physicians (NAEMSP) meeting in New Orleans, LA.

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Figure 1. Differences in Fatigue, Sleepiness, and Difficulty with Concentration (Mean STD) between 24-hour and 8-hour shifts