

**Performance Audit  
Use of 24-Hour Shifts for  
Ambulance Crews**

February 2013

**City Auditor's Office**

**City of Kansas City, Missouri**

CITY OF FOUNTAINS  
HEART OF THE NATION



KANSAS CITY  
MISSOURI

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February 27, 2013

Honorable Mayor and Members of the City Council:

This performance audit of the Fire Department's use of 24-hour shifts for ambulance crews was initiated by the city auditor pursuant to Article II, Section 216 of the city charter. We focused on whether the use of 24-hour shifts for ambulance crews is common.

We found that the Fire Department's use of 24-hour shifts for ambulance crews is common in fire department-based emergency medical services systems. While using 24-hour shifts may be beneficial in some professions, studies have shown long shifts can result in fatigue and increased errors in tasks requiring alertness, vigilance, and quick decision-making. Other studies have linked shift length and sleep loss to a variety of health problems for workers. Some emergency medical services systems have attempted to mitigate the risks of fatigue by considering workload as well as shift length when structuring shift plans.

To reduce the risks associated with working long shifts, we recommend the Fire Department evaluate ambulance crew workloads and consider staffing strategies that reduce the effects of fatigue on crew performance and safety.

We shared a draft of this report with the fire chief and city manager on January 2, 2013. The fire chief's response is appended. We would like to thank Fire Department staff for their assistance and cooperation during this audit. The audit team for this project was Joan Pu, Julia Webb-Carter, Douglas Jones, and Deborah Jenkins.

A handwritten signature in black ink that reads 'Gary L. White'.

Gary L. White  
City Auditor

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# Use of 24-Hour Shifts for Ambulance Crews

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## Introduction

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### Objective

We conducted this audit of the use of 24-hour shifts for ambulance crews under the authority of Article II, Section 216 of the Charter of Kansas City, Missouri, which establishes the Office of the City Auditor and outlines the city auditor's primary duties.

A performance audit provides findings or conclusions based on an evaluation of sufficient, appropriate evidence against stated criteria. Performance audits provide objective analysis to assist management and those charged with governance and oversight in using the information to improve program performance and operations, reduce costs, facilitate decision making, and contribute to public accountability.<sup>1</sup>

This report is designed to answer the following question:

- Are 24-hour shifts for ambulance crews common?

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### Scope and Methodology

This review focuses on the use of 24-hour shifts for ambulance crews. Our audit methods included:

- Interviewing Fire Department staff and the Emergency Medical Services Medical Director to learn about the use of 24-hour shifts for ambulance crews.
- Reviewing EMS literature and making inquiries into other cities' practices to determine whether 24-hour shifts for ambulance crews are commonly used, and what, if any, risks are associated with the use of 24-hour shifts.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a

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<sup>1</sup> Comptroller General of the United States, *Government Auditing Standards* (Washington, DC: U.S. Government Printing Office, 2011), p. 17.

reasonable basis for our findings and conclusions based on our audit objectives. No information was omitted from this report because it was deemed privileged or confidential.

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## **Background**

Before April 2010, the city contracted with the Metropolitan Ambulance Services Trust (MAST) for ambulance services. On April 25, 2010, ambulance services were integrated into the city's Fire Department (KCFD).<sup>2</sup>

**Most ambulance crews are on 24-hour shifts.** Following integration, the Fire Department phased in the use of static, 24-hour shifts and now has 22 ambulances on this type of shift. Ambulance crews on static, 24-hour shifts are posted to a specific fire station rather than gas station or grocery store parking lots throughout the city.<sup>3</sup> In addition to responding to emergencies, ambulance crews on 24-hour shifts re-stock their ambulance, clean the ambulance, perform light vehicle maintenance, or participate in training during their shift.

KCFD also has a number of dynamic posted ambulances on two types of shifts — 10 hours Monday through Thursday and 13.3 hours Friday through Sunday. There are generally seven dynamic posted ambulances in service on any given day and time of day. Crews in dynamic posted ambulances spend their shift in the ambulance and are moved to different fire stations in the urban core throughout their shift to meet the demand for ambulance services.

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<sup>2</sup> Committee Substitute for Ordinance 100122 became effective on April 25, 2010.

<sup>3</sup> MAST posted ambulances in various locations, such as grocery store or gas station parking lots, throughout the city.

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## **Findings and Recommendations**

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### **Summary**

Like many other fire-based EMS systems, KCFD uses 24-hour shifts for ambulance crews. While using 24-hour shifts may be beneficial in some professions, extended shifts are associated with fatigue and may affect performance and safety. Shift length and sleep loss have also been linked to a variety of health problems for employees. Some EMS systems have attempted to mitigate the risks of fatigue by considering workload as well as shift length when structuring shift plans. Regularly evaluating ambulance crew workloads could help the department identify staffing strategies to reduce the effects of fatigue on crew performance and safety.

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### **24-Hour Shifts Common in Fire-Based EMS Systems, But May Carry Risks**

KCFD uses 24-hour shifts for most ambulance crews, which is common in fire-based emergency services systems (EMS). While using extended shift lengths may be beneficial in some professions, long shifts increase fatigue and may impair performance and safety. Shift length and sleep loss are also linked to a general increase in health complaints. A recent study suggests sleep quality and fatigue may be at unhealthy levels for EMS professionals. Some EMS systems have attempted to mitigate the risks of fatigue by considering workload as well as shift length when structuring shift plans.

#### **City's Use of 24-Hour Shifts Common**

An inquiry into other cities' practices and a review of current EMS literature showed that the use of 24-hour shifts is common in fire-based EMS systems. The Fire Department phased in 24-hour shifts for most ambulance crews after integration of ambulance services. When MAST was responsible for ambulance services, crews could work no longer than a 14-hour shift and there had to be at least 10 hours between shifts. After integration, the Fire Department began using 24-hour shifts (24 hours on/48 hours off). Fire still uses shorter shifts at some locations.

### **Extended Shift Lengths May Have Some Benefits**

Longer duration shifts and compressed work weeks may be beneficial for some professions. Management might find using 24-hour shifts facilitates scheduling and is more efficient. Some employees find 24-hour shifts appealing because they provide considerably more time off than traditional eight-hour shifts, allowing them more time for family activities or even a second job.

### **Extended Shift Lengths May Pose Risks to EMS Workers and the Population They Serve**

Our review of literature revealed that studies on the impact of extended shifts, sleep deprivation, and fatigue – specific to EMS professionals – are very limited. However, studies of other professions that require working long hours have associated shift work and sleep deprivation with adverse effects on performance and increased health problems for employees. A recent study suggests sleep quality and fatigue may be at unhealthy levels for EMS professionals. A sleep deprived EMS workforce may pose risks to the population they serve. Emergency medical services workers must have excellent judgment, be able to prioritize decisions, and act quickly in the best interest of the patient.

### **Sleep deprivation and fatigue are associated with increased errors in tasks requiring alertness, vigilance, and quick decision-making.**

Studies of other professions that require working long hours (e.g., in-hospital medical staff, transportation workers), indicate shift workers<sup>4</sup> experience a greater degree of excessive sleepiness than workers with typical daytime schedules do. Consequences of fatigue include slowed reactions, poor judgment, reduced cognitive processing of information, and an inability to continue performing a task, or to carry it out at a high, sustained level of accuracy or safety.<sup>5</sup>

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<sup>4</sup> A shift worker is any person whose work pattern differs from a typical 8 a.m. to 5 p.m. work pattern.

<sup>5</sup> Diane L. Elliot, MD, FACP, FACSM; Kerry S. Kuehl, MD, DrPH, “Effects of Sleep Deprivation on Fire Fighters and EMS Responders,” *International Association of Fire Chiefs Report*, June 2007, p. 5.

**Performance Impairment Due to Fatigue Is Similar to That Caused by Alcohol Intoxication**

Individuals who stay awake for 17 hours show impairment on simple reaction time tests similar to research subjects with blood alcohol concentrations of 0.05 percent. Individuals who stay awake for 24 hours show impairment similar to subjects with a blood alcohol concentration of roughly 0.10 percent. In Missouri, a person is considered legally drunk with a blood alcohol concentration of .08 percent.

Sources: Drew Dawson and Kathryn Reid, "Fatigue, Alcohol and Performance Impairment," *Nature*, July 1997, p. 235 and Revised Statutes of Missouri §577.012 (2010).

**Extended shifts increase fatigue and may impair performance and safety.** In a recent study of EMS professionals, both sleepiness and shift length were significantly associated with error-related events.<sup>6</sup> Almost 25 percent of the study population reported that they had difficulty remembering EMS protocols or had completed an incident report due to making a patient care error. In addition, the study significantly associated working extended shifts with occupational injury. But, the researcher suggests more robust study designs are needed to establish causality between sleepiness, extended shift lengths, and adverse events in EMS workforces.

Another recent study suggests sleep quality and fatigue may be at unhealthy levels for EMS professionals.<sup>7</sup> However, the researchers point out that the current peer-reviewed literature on sleep and fatigue specific to EMS professionals is limited, and that their own study may not be generalizable to the larger EMS population considering the variations in shift lengths and operational structures.

Research on other healthcare occupations has linked extended shift lengths and sleepiness to patient care errors. Nurses who work 12.5 hours or longer are three times more likely to make a patient care error, and experience higher rates of occupational injury.<sup>8</sup> Medical interns and residents who work shifts of 24 hours or more have been shown to

<sup>6</sup> Antonio Fernandez, MS, NREMT-P, "An Assessment of the Relationship between Emergency Medical Services Work-life Characteristics, Sleepiness, and the Report of Adverse Events," Ph.D. dissertation, Ohio State University, 2011, pp. 50, 70.

<sup>7</sup> P. Daniel Patterson, PhD, MPH; Brian P. Suffoletto, MD; Douglas F. Kupas, MD; Matthew D. Weaver, NREMT-P; David Hostler, PhD, "Sleep Quality and Fatigue Among Prehospital Providers," *Prehospital Emergency Care*, April 6, 2010, pp. 187-193.

<sup>8</sup> "Health Care Worker Fatigue and Patient Safety," *The Joint Commission Sentinel Event Alert*, December 14, 2011.

commit more medical errors and diagnostic errors, sometimes resulting in patient fatalities.<sup>9</sup> Excessive sleepiness among medical residents has also been linked to less empathy and increased burnout.

**Shift work and chronic sleep loss are also associated with health problems for employees.** Chronic sleep loss is associated with a general increase in health complaints, musculoskeletal problems, digestive problems, higher body weights, type 2 diabetes, a greater risk of obstructive sleep apnea, depressed immune system, and increased levels of cardiovascular disease and cancer.<sup>10</sup> Other issues that have been related to shift work include mood swings, depression, chronic fatigue, a sense of being “stressed,” and an increased risk of substance abuse.<sup>11</sup>

### **Staffing Strategies That Consider Workload as Well as Shift Hours May Mitigate Risks**

Call volume and workload, in addition to shift hours, were considered when the Austin Travis County (Texas) Emergency Medical System (ATCEMS) developed a new shift plan in 2006. An outside firm’s study of ATCEMS staff health, sleep, and lifestyles concluded the lack of sleep was beginning to affect employees’ quality of life. The staffing change created shorter shifts for the busiest areas of the city to allow a better distribution of workload and more down time. In the new shift plan, EMS crews work 12-hour shifts on busy units for two days followed by a 24-hour shift on a slower unit, followed by four days off. An employee can work on a busy unit a maximum of 14 hours. In addition, employees are not allowed to work two shifts in a row. In 2007, the ATCEMS reported that since the shift plan had changed, there had been a decrease in the number of clinical errors reported, a decrease in the seriousness of reported errors, and fewer complaints from hospitals.<sup>12</sup>

San Francisco, California, replaced 24-hour shifts for EMS workers with 10-12 hour shifts after a Fire Department paramedic died when she fell asleep driving home from work following a long, busy shift. In addition to this incident, the Fire Department recognized some “clinical issues

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<sup>9</sup> “An Assessment of the Relationship between Emergency Medical Services Work-life Characteristics, Sleepiness, and the Report of Adverse Events,” p. 35.

<sup>10</sup> “Effects of Sleep Deprivation on Fire Fighters and EMS Responders,” pp. iii, 9-11.

<sup>11</sup> Dominick Swinhart, EMT-P, “The 24-Hour Shift: Impact on Health and Safety,” 2007. Retrieved August 6, 2012, <http://www.fireengineering.com/articles/print/volume-160/issue-5/departments/fire-service-ems/the-24-hour-shift-impact-on-health-and-safety.html>.

<sup>12</sup> “24-Hour Shifts May Endanger Patients and Employees,” *Journal of Emergency Medical Services*, August 28, 2007. Retrieved July 9, 2012, <http://www.jems.com/print/4041>.

and demeanor issues”<sup>13</sup> occurring during the latter part of the 24-hour shifts. The Fire Department found the call volume had become too exhausting for EMS personnel to function with the longer shifts.<sup>14</sup>

The fire chief should regularly evaluate ambulance crew workloads and consider staffing strategies that reduce the effects of fatigue on crew performance and safety.

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## **Recommendation**

1. The fire chief should regularly evaluate ambulance crew workloads and consider staffing strategies that reduce the effects of fatigue on crew performance and safety.

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<sup>13</sup> Email from Mindy Talmadge, Public Information Officer, San Francisco Fire Department to Deborah Jenkins, Audit Manager, City of Kansas City, Missouri, August 9, 2012.

<sup>14</sup> Effects of Sleep Deprivation on Fire Fighters and EMS Responders,” p. 48.

*Use of 24-Hour Shifts for Ambulance Crews*

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## **Appendix**

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### **Fire Chief's Response**

*Use of 24-Hour Shifts for Ambulance Crews*



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**TO:** Gary White, City Auditor**SUBJECT:** Response to 24 Hour Shift Report**DATE:** February 8, 2013

KCFD is in full agreement with the City Auditor's recommendation and appreciates the hard work and diligent effort of the audit team in researching a complex and evolving issue.

Evaluation and monitoring of workload factors throughout our emergency medical services delivery system has been a priority within KCFD since the Council directed consolidation of EMS delivery systems in 2010. Three iterations of our deployment system have been implemented since that point; workload balancing has been a driving factor in each. Based on industry best practices for workload analytics, we continue to track data regarding mission time for all transport units in the system; our relatively conservative targets are now being met for more than 95% of our units.

We continue to seek to improve our capacity to examine and improve workload distribution and manage its implications for patient and employee safety. As the report has noted, data specific to emergency medical services are limited. Data developed in other fields, while useful to illuminate areas of potential concern, cannot be applied directly to a field that differs in very critical ways. Medical residents, for example, work in settings that demand extended and often uninterrupted attention to multiple patients while making critical and complex decisions across a range of variables while emergency medical care is episodic and focused on time limited contacts with focused issues and responsibilities. Long haul truckers and railway locomotive engineers, as other examples, are constantly engaged on the operation of equipment for extended periods rather than responding to discrete calls with varying periods of engagement. Accordingly, KCFD is also engaged with projects and programs seeking to provide the quality and comprehensiveness of data and analysis needed to advance our capacity to responsibly and safely manage our system. KCFD personnel were recently invited to address a specialty program at Harvard School of Public Health addressing sleep and fatigue in shift work occupations, being recognized as leaders in advancing this cause in fire, rescue and emergency medical response services.

We again thank the City Auditor's staff for their work on this project and commit KCFD to continuing and advancing its efforts to protect the health, safety, and efficacy of our professional employees as they work to protect our citizens.