

## **The National EMS Advisory Council**

Submitted on May 30, 2012

**Committee: Safety**  
**Title: Fatigue in Emergency Medical Services**

### **Issue Synopsis**

#### **A: Problem Statement**

There is reason to believe that a high proportion of Emergency Medical Services (EMS) workers suffer from fatigue, and as a result, poor safety outcomes.<sup>1,2</sup> Poor sleep, which is a precursor to short term or chronic fatigue, affects between 29% and 35% of U.S. adults.<sup>3,4</sup> Fatigue affects one in every four U.S. workers (38%; 95%CI 37.4, 38.5).<sup>5</sup> Poor sleep and fatigue can reduce attention, impair normal functions of the central nervous system, and have a negative impact on cognition, reaction time, and health.<sup>6-9</sup> Furthermore, research has identified a strong association between poor sleep, fatigue, and poor safety outcomes.<sup>1,2,10-12</sup>

There is limited research that examines fatigue and poor sleep among EMS providers.<sup>1,2,13-15</sup> However, there is widespread concern that EMS providers and patients are at an increased risk of poor safety outcomes related to fatigue.<sup>15</sup> Factors believed to increase this risk include the atypical work schedule (shift work),<sup>16,17</sup> providers holding multiple jobs,<sup>2</sup> unpredictable nature of EMS call volume which affects ability to rest,<sup>18,19</sup> increased need and demand for EMS responses tied to increased productivity requirements limiting opportunities for rest,<sup>20</sup> a high prevalence of poor sleep and fatigue among EMS workers,<sup>1,2</sup> a high prevalence of occupational stress and burnout,<sup>19,21-24</sup> poor health status among EMS workers,<sup>25,26</sup> high risk of occupational injury and mortality,<sup>27-32</sup> and wide variation in workplace safety culture.<sup>33,34</sup>

EMS is a vital public health resource, providing care for more than 30 million ill and injured patients annually.<sup>35</sup> Poor sleep and fatigue among EMS workers represent potential threats to patient care, provider wellbeing, and the public's health and trust in EMS.

The overarching goals of this advisory are to:

- 1: provide a brief summary of gaps in research and evidence of deficits in current efforts to address the observed problems of fatigue and safety; and
- 2: advise NHTSA address a list of feasible recommendations for combatting the impact of fatigue on EMS patient and provider safety.

#### **B: References**

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1. Patterson PD, Weaver MD, Frank R, et al. Association between sleep, fatigue, and safety outcomes in Emergency Medical Services providers. *Prehosp Emerg Care*. 2012;16(1):86-97.
2. Patterson PD, Suffoletto BP, Kupas DF, Weaver MD, Hostler D. Sleep quality and fatigue among prehospital providers. *Prehosp Emerg Care*. 2010;14(2):187-193.
3. Prevention CfDCa. Perceived insufficient rest or sleep among adults - United States, 2008. *MMWR Morb Mortal Wkly Rep*. 2009;58(42):1175-1179.
4. CentersforDiseaseControlandPrevention(CDC). Unhealthy sleep-related behaviors--12 States, 2009. *MMWR Morb Mortal Wkly Rep*. 2011;60(8):233-238.
5. Ricci JA, Chee E, Lorandeanu AL, Berger J. Fatigue in the U.S. workforce: prevalence and implications for lost productive work time. *J Occup Environ Med*. 2007;49(1):1-10.
6. Moore-Ede MC, Richardson GS. Medical implications of shift-work. *Annu Rev Med*. 1985;36:607-617.
7. Costa G. The impact of shift and night work on health. *Appl Ergon*. 1996;27(1):9-16.
8. Lamond N, Dawson D. Quantifying the performance impairment associated with fatigue. *J Sleep Res*. 1999;8(4):255-262.
9. Flo E, Pallesen S, Mageroy N, et al. Shift work disorder in nurses - assessment, prevalence and related health problems. *PloS One*. 2012;7(4):e33981.
10. Dorrian J, Tolley C, Lamond N, et al. Sleep and errors in a group of Australian hospital nurses at work and during the commute. *Appl Ergon*. 2008;39(5):605-613.
11. Lockley SW, Barger LK, Ayas NT, et al. Effects of health care provider work hours and sleep deprivation on safety and performance. *Jt Comm J Qual Patient Saf*. 2007;33(11 Suppl):7-18.
12. Fisman DN, Harris AD, Rubin M, Sorock GS, Mittleman MA. Fatigue increases the risk of injury from sharp devices in medical trainees: results from a case-crossover study. *Infect Control Hosp Epidemiol*. 2007;28(1):10-17.
13. Sofianopoulos S, Williams B, Archer F. Paramedics and the effects of shift work on sleep: a literature review. *Emerg Med J*. 2012;29(2):152-155.
14. Fernandez AR, Crawford JM, Wilkins JR, et al. The influence of shift length and sleepiness on error-related events in EMS (Abstract #72). *Prehosp Emerg Care*. 2012;16:152-187.
15. Elliot DL, Kuehl KS. *Effects of Sleep Deprivation on Fire Fighters and EMS Responders*. Portland, OR: Oregon Health & Sciences University, Portland, OR;2007.
16. Bolvin DB, Tremblay GM, James FO. Working on atypical schedules. *Sleep Med*. 2007;8(6):578-589.
17. Caruso CC, Hitchcock EM, Dick RB, Russo JM, Schmit JM. *Overtime and Extended Work Shifts: Recent Findings on Illnesses, Injuries, and Health Behaviors*. Cincinnati, OH: National Institute for Occupational Safety and Health (NIOSH);2004.

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18. Brown LH, Lerner EB, Larmon B, LeGassick T, Taigman M. Are EMS call volume predictions based on demand pattern analysis accurate? *Prehosp Emerg Care*. 2007;11(2):199-203.
19. Karlsson K, Niemela P, Jonsson A. Heart rate as a marker of stress in ambulance personnel: a pilot study of the body's response to the ambulance alarm. *Prehosp Disaster Med*. 2011;26(1):21-26.
20. Strange GR, Chen EH. Use of emergency departments by elder patients: A five-year follow-up study. *Academic Emergency Medicine*. 1998;5 (12):1157-1162.
21. Bowron JS, Todd KH. Job stressors and job satisfaction in a major metropolitan public EMS service. *Prehospital Disaster Med*. 1999;14 (4):236-239.
22. Boudreaux E, Mandry C, Brantley PJ. Stress, job satisfaction, coping, and psychological distress among emergency medical technicians. *Prehospital Disaster Med*. 1997;12 (4):9-16.
23. Donnelly E. Work-related stress and posttraumatic stress in emergency medical services. *Prehosp Emerg Care*. 2012;16(1):76-85.
24. Roth SG, Moore CD. Work-family fit: the impact of emergency medical services work on the family system. *Prehosp Emerg Care*. 2009;13(4):462-468.
25. Studnek JR, Bentley M, Crawford JM, Fernandez AR. An assessment of key health indicators among emergency medical services professionals. *Prehosp Emerg Care*. 2010;14(1):14-20.
26. Studnek JR, Crawford JM, Wilkins JRr, Pennell ML. Back problems among emergency medical services professionals: the LEADS health and wellness follow-up study. *Am J Ind Med*. 2010;53(1):12-22.
27. Maguire BJ, Hunting KL, Smith GS, Levick NR. Occupational fatalities in emergency medical services: a hidden crisis. *Ann Emerg Med*. 2002;40(6):625-632.
28. Maguire BJ, Hunting KL, Guidotti TL, Smith GS. Occupational injuries among emergency medical services personnel. *Prehosp Emerg Care*. 2005;9(4):405-411.
29. Suyama J, Rittenberger JC, Patterson PD, Hostler D. Comparison of public safety provider injury rates. *Prehosp Emerg Care*. 2009;13(4):451-455.
30. Reichard AA, Jackson LL. Occupational injuries among emergency responders. *Am J Ind Med*. 2010;53(1):1-11.
31. Ray AM, Kupas DF. Comparison of rural and urban ambulance crashes in pennsylvania. *Prehosp Emerg Care*. 2007;11(4):416-420.
32. Kahn C, Pirrallo R, Kuhn E. Characteristics of fatal ambulance crashes in the United States: An 11-year retrospective analysis. *Prehosp Emerg Care*. 2001;5(3):261-269.
33. Patterson PD, Huang DT, Fairbanks RJ, Simeone SJ, Weaver MD, Wang HE. Variation in emergency medical services workplace safety culture. *Prehosp Emerg Care*. 2010;14(4):448-460.
34. Weaver MD, Wang HE, Fairbanks RJ, Patterson PD. Association between EMS workplace safety culture and safety outcomes. *Prehosp Emerg Care*. 2012;16(1):43-52.
35. FICEMS, NHTSA, NASEMSO. *National EMS Assessment*. Washington, DC: Funded by the National Highway Traffic Safety Administration;2011.

36. Jha AK, Duncan BW, Bates DW. *Chapter 46: Fatigue, Sleepiness, and Medical Errors*. San Francisco: University of California at San Francisco (UCSF)-Stanford University Evidence-based Practice Center;2001.
37. InstituteOfMedicine(IOM). *Resident Duty Hours: Enhancing Sleep, Supervision, and Safety*. Washington, DC: The National Academies Press;2008.
38. JointCommission. *Sentinel Event Alert: Health care worker fatigue and patient safety*. Chicago, IL2011.
39. Federal.Aviation.Administration.(FAA). Flightcrew Member Duty and Rest Requirements. In: Administration FA, ed. Vol 14 CFR Parts 117, 119, and 121. Washington, DC: Department of Transportation (DOT); 2011.
40. Owens JA. Sleep loss and fatigue in healthcare professionals. *J Perinat Neonatal Nurs*. 2007;21(2):92-102.
41. McCallion R, Fazackerley J. Burning the EMS candle: EMS shifts and worker fatigue. *JEMS*. 1991;16(10):40-41, 43-47.
42. Chang YS, Wu YH, Hsu CY, Tang SH, Yang LL, Su SF. Impairment of perceptual and motor abilities at the end of a night shift is greater in nurses working fast rotating shifts. *Sleep Med*. 2011;12(9):866-869.
43. Anderson C, Dickinson DL. Bargaining and trust: the effects of 36-h total sleep deprivation on socially interactive decisions. *J Sleep Res*. 2010;19(1 Pt 1):54-63.

### **C: Crosswalk with other standards or related documents**

Our understanding of sleep, fatigue, and safety has been shaped by numerous scientific studies, reviews, statistical analyses, as well as new government rules and regulations - some of which (but not all) are highlighted below.

In 2001, the Agency for Research on Healthcare (AHRQ) published an evidence-based report raising awareness of poor sleep, fatigue, and its impact on patient and provider safety (Chapter 46).<sup>36</sup> The Chapter (literature review) is comprehensive but lacks discussion of fatigue amongst EMS clinicians and its effect on patients.

In 2004, the National Institute for Occupational Safety and Health (NIOSH) supported a review of the literature that discovered a lack of research exploring the impact of shift work and long hours on worker health.<sup>17</sup> The report was a review of studies involving nurses, police officers, electricians, white-collar workers, air-traffic controllers, taxi drivers and other shift worker populations. The report did not include research involving EMS clinicians or patients. Authors concluded that some types of shift work are linked to negative health effects and deficits in performance leading to injury and error. The authors also concluded that there is limited, and sometimes contradictory evidence, supporting or refuting a particular shift structure as harmful.

The International Association of Fire Chiefs (IAFC) funded a review of the literature on sleep and fatigue, that when published in 2007, shed light on numerous elements of sleep, fatigue, and negative impacts of both on shift workers.<sup>15</sup> The authors concluded that "*Fire fighters and EMS responders are at risk for the decrements in mental and*

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*physical performance that have been well documented among others working long hours and during the night...* however, *“there is a paucity of available well done studies, and many investigations have been done in countries other than the U.S.”* The report provided a series of recommendations germane to shift work for fire fighters and emergency responders.

Other informative reports include the 2008 Institute of Medicine (IOM) report *“Resident Duty Hours: Enhancing Sleep, Supervision, and Safety.”*<sup>37</sup> In this report, the common practice of new physicians working long hours was criticized as a contributing factor to poor safety and poor performance.

More recently, the Joint Commission issued a Sentinel Event Alert raising awareness of the growing body of evidence linking health care worker fatigue and adverse events.<sup>38</sup> The alert stressed the common practice of working long / extended shifts contributed to poor patient and provider outcomes.

Finally, in 2011, Secretary of Transportation, Ray LaHood, announced sweeping new rules that impact how commercial passenger airline pilots obtain rest.<sup>39</sup> The new rules emerged from action taken by Congress in 2010 mandating airlines develop Fatigue Risk Management Plans and Programs informed by guidelines adopted by the Federal Aviation Administration (FAA).

## D: Analysis

There is an abundance of research and information that highlights the prevalence and dangers of poor sleep and fatigue. We believe that poor sleep and fatigue are conceivably common problems amongst EMS workers that threaten the health and safety of the workers and their patients.<sup>1,2,17,40</sup> Unfortunately, research involving EMS workers and patients is limited and our understanding of these issues in the context of EMS care delivery is unclear.<sup>1,2,41</sup>

Specifically:

- We believe that a lack of substantial data and research on poor sleep fatigue in EMS is problematic. Lack of data may foster attitudes among EMS workers and leaders that poor sleep and fatigue are non-EMS problems. Research is needed to quantify the magnitude and nature of these problems in the EMS setting.
- Second, there is considerable evidence that links shift characteristics to fatigue and poor safety outcomes.<sup>11,16,42</sup> We acknowledge that EMS clinicians work atypical shift schedules that vary in length, structure, and over time. Further, many EMS clinicians work multiple jobs and the structure of shifts across occupations may not be comparable.<sup>1</sup> Unfortunately, there is limited research that describes variation in EMS shift characteristics and how these characteristics are linked to sleep, fatigue, and safety outcomes.<sup>1,2</sup>
- Third, operating emergency vehicles and equipment are fundamental to day-to-day delivery of EMS care. In other industries that involve vehicle or equipment operations, concerns for fatigue and safety have resulted restrictions on duty time and rest requirements (**See Table 1 below**). We believe efforts to address fatigue and vehicle operations safety in EMS is affected by a lack of data describing the relationship between fatigue and emergency vehicle operations.
- Fourth, there is considerable evidence linking poor sleep and fatigue to deficits in motor and cognitive functioning, trust and decision making, and poor safety outcomes.<sup>42,43</sup> We recognize that EMS work requires paramedics and Emergency Medical Technicians (EMTs) to work long hours which may impact their fatigue and in ultimately their clinical judgment and approach to safety. However, EMS is unique in that decisions are made in a rapid fashion with limited information and in stressful conditions uncommon or unfamiliar to other commonly studied occupations.
- Finally, EMS administrators and individual EMS workers are in uniquely different but instrumental positions to address poor sleep and fatigue. Administrators may directly or indirectly dismiss fatigue over concerns for the economic viability and productivity of individual EMS workers. Individual EMS workers may directly or indirectly place personal economic and family well being ahead of poor sleep and fatigue and the threats that each present for personal and patient safety. Research and information

that explores these issues is needed to inform the development of fatigue management programs in EMS.

### **Recommended Actions or Strategies:**

#### **National Highway Traffic Safety Administration Office of EMS**

**Recommendation #1:** The NHTSA Office of EMS (OEMS) should work with its local, state, and federal partners, and national organizations and individual provider (i.e. NAEMT, NAEMSP) to encourage an effort to cross-validate findings from studies and reports of fatigue in other professions with that of fatigue in EMS. The effort would attempt to clarify the role of fatigue in EMS patient care, provider health and safety, and in the public's safety. The effort may be a new project led by NHTSA or a collaborative effort linked to an ongoing effort led by NHTSA or other organizations.

**Recommendation #2:** The NHTSA Office of EMS (OEMS) should work with its federal and non-federal partners to develop a measurement tool and check list to aid in identifying the role of fatigue in EMS ambulance / aircraft / other forms of EMS delivery accidents / crashes. NHTSA should consider undertaking a new project or work collaboratively with partners on an existing project that would (or is currently) investigating the reliability and validity of the tool for widespread use. Once validated that tool should be made available to local authorities for use in locally led investigations.

**Recommendation #3:** The NHTSA Office of EMS (OEMS) should work to disseminate (evidence-based) information to EMS employers that can be used to aid in developing fatigue management programs / interventions to fit local needs.

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**Table 1: Federally Mandated Work Hour Limitations (adopted from table found in the IOM Report on Resident Duty Hours)<sup>37</sup>**

Industry	Weekly Limitations	Limits of Single Shift Duration (h)	Minimum Rest Between Shifts	Minimum Rest Period Given Weekly	Regulatory Agency	Enforcement
Part 121 Scheduled Airlines Pilots	30h of flying time in any consecutive days	8 h flight time per 24 h	11 h of continuous rest in the 24 h prior to 9+ h of scheduled flight time	none	Federal Aviation Administration	FAA and certificate holder
Part 135 Pilots On-demand commuter.	500 hours actual flight time in a calendar quarter 1400 hours actual flight time in a calendar year	8 hours of flight time in a single 24 hour period 14 hours maximum duty shift	10 hours prior to being scheduled for shift.	Must be scheduled for at least 13 24 hour rest periods in a calendar quarter	Federal Aviation Administration Federal Aviation Regulations (FAR) Part 135. 267 and Part 135.271 (HEMES)	FAA and Certificate Holder
Shipboard Personnel on Tankers	84 h per week	15 h per every 24 h and 36 h per 72 h	none	none		
Railroad Conductors	none	12h	10 consecutive hours after a 12 h shift and 8 consecutive hours during the 24 h prior to any shift	none	Federal Railroad Administration (FRA)	Currently hours are recorded by hand; 4 major railroads have upgraded to electronic record keeping.
Long-haul truck drivers	60 or 70 h driving time per 7 or 8 day shift	14 h on duty with a maximum of 11 h spent driving	10 consecutive hours, drivers with sleeper berth must spend minimum of 8 consecutive hours in berth and 2 h in berth or off duty in any combination.	34 h continuous rest period prior to any 7- or 8- day working period	Federal Motor Carrier Safety Administration (FMCSA)	Drivers are required to record a log of hours for each 24 hour period, including a record of the prior 7 days. Record can be electronic or handwritten, depends on motor carrier



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Medical Residents	80 h per week averaged over 4 weeks	24 h + 6 h transition time	10 consecutive hours (recommended but not required)	One continuous 24 h rest period per week	ACGME	ACGME
Flight crew for Air-Medical EMS	No maximum	Not to exceed 24 hours on schedule with requirements for rest periods	Must have 8 hours minimum rest between shifts	Cannot be scheduled for more than 16 hours actual clinical time in 24 hour period.	CAMTS Standards Version 8	CAMTS and Agency