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The Impacts of Extended On-Call Hours on the Functioning of Paramedics

Paramedics in some regions are scheduled for extended work hours, being on-duty for four consecutive shifts of 24 hours. This essentially results in a 96 hour shift, which was referred to in one article as “egregious practices” (i.e. on-call duty exceeding 24 to 30 hours; Gaba & Howard, 2002, p. 1253). This characterization of extended on-call work schedules recognizes the partial sleep deprivation or sleep fragmentation that occurs, even when workers have the opportunity to rest during the shift. These sleep disturbances have extensively been linked to disturbances in cognitive functioning, which will consequently impact the effectiveness of paramedics.

Partial Sleep Deprivation and Sleep Fragmentation

A lot of research into the impacts of sleep deprivation on cognitive functioning examined total sleep deprivation. However, there are very few real-life situations that result in total sleep deprivation. Research has more recently examined partial sleep deprivation and sleep fragmentation, which is representative of the sleep disturbances faced by many individuals including paramedics. Research to date suggests that the effects of total and partial sleep deprivation are qualitatively similar (Bonnet & Arand, 2003), therefore findings in studies of total sleep deprivation are also applicable to situations involving partial sleep deprivation.

Relevant terms are defined below.

Total Sleep Deprivation. Total sleep deprivation refers to continuous wakefulness for long periods of time (Lockley et al., 2007), generally ranging from 24 to 72 hours (Hutchins, Laux, Wickens, & Sebok, 2013). In relation to consecutive 24 hour shifts for paramedics, acute total sleep deprivation has the possibility of occurring when they are called out after a period of wakefulness. This results in the potential for paramedics to respond to calls when they had expected to sleep and therefore maintain wakefulness for an extended period.

Partial Sleep Deprivation. Partial sleep deprivation occurs with repeated failure to obtain an amount of sleep per day that is sufficient to recover from the previous wake cycle (Lockley et al., 2007). This can be characterized by obtaining less sleep than a person would spontaneously obtain. Chronic partial sleep deprivation results in a buildup of sleep pressure resulting in detrimental effects that are similar to acute total sleep deprivation. Partial sleep deprivation will occur with paramedics on extended work schedules when their sleep is interrupted prior to obtaining an optimal amount of sleep (i.e. less than 7 to 8.5 hours, depending on individual needs).

Sleep Fragmentation. Sleep that is shorter, more interrupted, and less restful than desired. This leads to an interruption of the sleep cycle, which can result in negative effects similar to total sleep deprivation (Orzel-Gryglewska, 2010).

Note that sleep deprivation does not necessarily involve cognitive or physical exertion. Sleep deprivation can occur simply by the presence of extended wakefulness that is not taxing to the individuals. This may be similar to a state of resting in a state of readiness, when paramedics are awake but not responding to calls. The effects of sleep deprivation described below have been observed as a function of wakefulness or sleep fragmentation.

Cognitive Effects of Partial Sleep Deprivation and Fragmentation

Sleep deprivation has a negative effect on various cognitive functions that impact the functioning of paramedics. These impacts are summarized in Table 1 and discussed below.

Table 1. Cognitive effects of partial or total sleep deprivation.

Increased:	Decreased:
• Medical errors; • Stress; • Negative mood; • Risk of motor vehicle accidents	• Vigilance; • Attention & concentration; • Reaction time; • Flexibility & creativity; • Performance

Research has found that sleep deprivation is associated with decreased vigilance (Alhola & Polo-Kalhola, 2007; Casagrande, Martella, Di Pace, Pirri, & Guadalupi, 2006). Vigilance is defined as sustained attention, during which people remain alert and focused on a target while also disregarding irrelevant information. This effect was found even when participants were awake for only 24 hours and not required to participant in cognitively taxing activities during wakefulness (Casagrande et al., 2006). The decreased vigilance suggests that sleep deprived people have difficulty disregarding irrelevant information, which may be linked to the tendency for distractibility and lapses in attention when sleep deprived (Bonnet & Arand, 2003; Orzel-Gryglewska, 2010). It has been shown that people who are sleep deprived experience twice as many attentional failures as people who are rested (Lockley et al., 2007). Paramedics are required to identify and integrate relevant information to assess patients' needs and determine treatment. Therefore, decreased vigilance and increased distractibility may impede their abilities to effectively and quickly provide appropriate treatment.

In addition to vigilance, effective assessment and treatment of patients requires executive functioning and flexibility. However, sleep deprivation impairs executive functioning abilities (Alhola & Polo-Kantola, 2007). People who are sleep deprived have a tendency to depend on schematic

reasoning processing (Orzel-Gryglewska, 2010), which involves rigidly evaluating situations based on rules or an already established framework. While this type of reasoning is appropriate in some situations, patient care sometimes requires flexibility and divergent thinking. Paramedics will need to integrate information in dynamic situations at times, adapting as the situation changes and more details become apparent. The ability to do this is impaired by sleep deprivation and subsequently may impact the effectiveness of patient care.

The concerns about effective treatment are also highlighted by research findings that indicate medical errors are more frequent at times of sleep deprivation. For example, physicians in training who work recurrent 24 hour shifts make 36% more serious medical errors than physicians in training who are limited to 16 hour shifts (Lockley et al., 2007). These same physicians also make five times more diagnostic errors when working 24 hour shifts. Similarly, nurses were two to three times more likely to make medical errors when working 12.5 hours or more. A meta-analysis by Orzel-Gryglewska (2010) reports a 20 to 32% increase in errors after only one night of sleep deprivation. In addition to the previously identified potential link between medical errors and decreased vigilance, errors may also be linked to tendency to forget known facts when sleep deprived (Orzel-Gryglewska, 2010). The increase in medical errors with long shifts or one night of wakefulness was found in both physicians and nurses. Therefore, the results may extend to paramedics who experience extended periods of wakefulness or long shifts.

Research has consistently shown that reaction times or speed of responding decreases with sleep deprivation. There is a linear relationship that shows reaction times continuously decrease as the length of sleep deprivation or wakefulness increases (Alhola & Polo-Kantola, 2007; Bonnet & Arand, 2003; Hutchins et al., 2013; Orzel-Gryglewska, 2010), an effect that has been observed with both continuous wakefulness (Casagrande et al., 2006) and restriction of sleep to 5 hours per night (Bonnet & Arand, 2003). Paramedics likely engage in many activities that require quick reaction times, such as emergency situations and driving. This suggests that decreased reaction times is one factor that negatively impacts paramedic performance.

The research supports the supposition that sleep deprivation has a negative effect on performance, to the extent that it has repeatedly been compared to performance while impaired by alcohol (Lockley et al., 2007). Accuracy on tasks decreases linearly as wakefulness increases, indicating a continuous reduction in performance with increased sleep deprivation (Alhola & Polo-Kantola, 2007; Hutchins et al., 2013). Deficits in performance are apparent after only one night during which sleep is restricted to 5 hours (Bonnet & Arand, 2003). Performance after 18 to 24 hours of continuous wakefulness is equivalent to performance with a blood alcohol content of 0.10 (Bonnet & Arand, 2003; Gaba & Howard, 2002). Specifically, performance on a task involving hand-eye coordination at 8 a.m.

after being awake all night was equivalent to performance with a blood-alcohol content of 0.10 (Bonnet & Arand, 2003). Tasks requiring visual tracking and psychomotor performance are similarly impacted by sleep deprivation (Bonnet & Arand, 2003; Gaba & Howard, 2002). Performance impairments have been noted particularly with long, difficult, or externally paced tasks, as well as with reduced light or sound (Bonnet & Arand, 2003). These are characteristics of situations in which paramedics may be required to respond.

Paramedics are required to drive as a function of their roles, transporting patients to hospitals or between communities. However, sleep deprivation and wakefulness are associated with an increased risk of being involved in motor vehicle accidents. One study found that medical residents had a 9.1% increased risk of accidents when working shifts that were longer than 24 hours and involved limited opportunities to sleep (Lockley et al., 2007). Another study found that participants who completed a driving course after 1 night of sleep deprivation hit more cones than participants who were not sleep deprived (Bonnet & Arand, 2003). The same result was found for participants who were restricted to 5 hours of sleep over 7 nights. This is particularly applicable to paramedics, as their safety and the safety of their patients are directly impacted by their driving.

Paramedics necessarily interact with patients, members of the public, and other professionals. Therefore, their 'bedside manner' is important for the comfort of patients, as well as patients' family and friends. Paramedics' interactions with others will also influence the public perception of EMS. These interactions will be negatively impacted by extended wakefulness of the paramedics. Research has shown that sleep deprivation is linked to poor mood, including anger, anxiety, irritability, and confusion (Bonnet & Arand, 2003; Gaba & Howard, 2002; Orzel-Gryglewska, 2010). People who are sleep deprived also have higher levels of stress, as it appears to activate the sympathetic nervous system and result in secretion of cortisol (Alhola & Polo-Kantola, 2007). Therefore, paramedics will be less likely to calmly engage with patients after sleep deprivation.

Application to Paramedic Extended On-Call Schedule

Paramedics who are working on-call for 96 hours may have difficulty avoiding sleep deprivation. They do not know when they will be called so they cannot plan a sleep schedule that will ensure they are rested when responding. For example, paramedics going into this shift may naturally sleep overnight then be awake throughout the first day. If they are called during the following night, they will be awake for an extended period and start experiencing some of the effects. There is also the potential that sleep will be interrupted throughout the 96 hour shift, resulting in an absence of continuous sleep that results in recovery from the wake cycle. This indicates that they will experience partial sleep deprivation or sleep fragmentation and the detrimental effects noted above.

References

Alhola, P., & Polo-Kantola, P. (2007). Sleep deprivation: Impact on cognitive performance. *Neuropsychiatric Disease and Treatment, 3, 5, 553 – 567.*

Bonnet, M.H., & Arand, D.L. (2003). Clinical effects of sleep fragmentation versus sleep deprivation. *Sleep Medicine Reviews, 7, 4, 297 – 310.*

Casagrande, M., Martella, D., Di Pace, E., Pirri, F., & Guadalupi, F. (2006). Orienting and alerting: Effect of 24 h of prolonged wakefulness. *Experimental Brain Research, 171, 184 – 193.*

Gaba, D.M., & Howard, S.K. (2002). Fatigue among clinicians and the safety of patients. North England *Journal of Medicine, 347, 16, 1249 – 1255.*

Hutchins, S.D., Laux, L., Wickens, C.D., & Sebok, A. (2013). The effect of continuous wakefulness on complex cognitive task performance: A quantitative synthesis of research. *Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting, 793 – 797.*

Lockley, S.W., Barger, L.K., Ayas, N.T., Rothschild, J.M., Czeisler, C.A., & Landrigan, C.P. (2007). Effects of health care provider work hours and sleep deprivation on safety and performance. *The Joint Commission Journal on Quality and Patient Safety, 33, 11, 7 – 18.*

Orzel-Gryglewska, J. (2010). Consequences of Sleep Deprivation. *International Journal of Occupational Medicine and Environmental Health, 23, 1, 95 – 114.*

