



# Patient Safety: Fatigue, Sleep, and Work Schedule Effects

## *Practice and Policy Considerations*

### Introduction

Certified Registered Nurse Anesthetists (CRNAs) provide anesthesia care for surgical, therapeutic, and diagnostic procedures at any hour 365 days per year. Based on facility and patient needs, CRNAs and other anesthesia professionals are often required to be on call with unpredictable case loads and irregular work hours. Fatigue in anesthesia practice is mostly ignored or is accepted as the norm due to persistent, high-intensity work demands and expectations.<sup>1</sup> CRNAs and healthcare professionals often prefer extended shifts in order to work fewer days, further highlighting the issue of safety consequences related to fatigue.<sup>2</sup> As anesthesia professionals have an ethical and professional responsibility to provide safe patient care by assuring they are well-rested and fit for duty, CRNAs should be cognizant of the number of hours worked and the implications of those work patterns.<sup>3</sup>

The American Association of Nurse Anesthesiology (AANA) *Standards for Nurse Anesthesia Practice*<sup>4</sup> emphasize that continuous clinical observation and vigilance are the foundation of safe anesthesia care. Vigilance is “a state of readiness to detect and respond to small changes occurring at random intervals in the environment.”<sup>5</sup> Fatigue may lead to impaired vigilance, which necessitates the development of policies and initiatives that promote healthy sleep habits and work environments as well as overall wellness.

### Purpose

The purpose of this document is to provide guidance to AANA members, healthcare professionals, healthcare facilities and nurse anesthesia programs regarding sleep deprivation and fatigue. This document provides evidence-based information that promotes fatigue management and work-life balance.

- The AANA is committed to promoting and promulgating patient safety strategies to prevent and reduce errors in healthcare.
- The AANA embraces the practices in this document for planning and improvement efforts, recognizing that there may be extenuating circumstances (e.g., mass casualty incidents) that may require greater flexibility.
- The AANA encourages CRNAs to participate in the development of facility policies and education regarding practices that promote safety.

### Sleep and Fatigue

According to the National Sleep Foundation, healthy adults typically need between seven and nine hours of sleep per night; however, absolute sleep needs vary by individual.<sup>6</sup> Sleep homeostasis and circadian rhythms are the two bio-physiological mechanisms that regulate sleep-wake cycles and impact the quality and quantity of sleep.<sup>7,8</sup> These mechanisms may be influenced by light exposure, sleep-wake history, age, diet, genetics, disease (infectious and chronic), chronic pain, and various primary sleep disorders (e.g., narcolepsy, sleep apnea, insomnia), all of which may make individuals vulnerable to sleep loss.<sup>1</sup>

Fatigue is described as an overwhelming sense of tiredness, lack of energy, and feelings of exhaustion associated with impaired physical and/or cognitive function.<sup>9</sup> Symptoms of fatigue include but are not limited to:

- Conducting multiple rechecks of completed tasks<sup>1,7,10</sup>
- Tiredness during the day, which may be compounded with vague symptoms such as a headache<sup>11</sup>
- Drooping eyelids or red eyes<sup>1,7</sup>
- Nodding off while awake<sup>1,7</sup>
- Diminished reaction time<sup>10</sup>
- Increased restlessness, lethargy, irritability, and/or anxiety<sup>1,7</sup>
- Impaired concentration or memory
- Diminished reflexes<sup>7</sup>
- Impaired decision-making<sup>7</sup>
- Increased snoring<sup>7,12</sup>
- Difficulty awakening after adequate sleep<sup>1,7</sup>
- Unawareness of surroundings<sup>7</sup>
- Indecisiveness<sup>7,10</sup>
- Decreased situational awareness<sup>7,12</sup>
- Microsleep: a brief involuntary episode of physiological sleep, which may last up to 30 seconds, occurring without warning and typically manifesting as head nods, drooping eyelids, and/or brief episodes of memory loss<sup>1</sup>

## Effects of Fatigue on Human Performance and Health

Numerous studies have shown that prolonged sleep deprivation decreases reaction times as well as diminishes reasoning skills and performance. Fatigued individuals have impaired language, retention of information, short-term memory, and motor skills. It is estimated that 18 hours or more of wakefulness is equivalent to a blood alcohol concentration (BAC) of 0.05 percent and 24 hours of wakefulness is equivalent to a BAC of 0.10 percent, as evidenced by a significant decrease in hand-eye coordination.<sup>7,12,13</sup> A BAC of 0.08 percent is considered legally impaired for driving.<sup>14</sup>

Fatigue and drowsiness are associated with increased rates of motor vehicle accidents. The Centers for Disease Control and Prevention (CDC) estimates that roughly 5,000 fatal crashes a year are attributed to drowsy driving.<sup>15,16</sup> If drivers exhibit any signs of drowsy driving, they should pull over and rest.<sup>15,17</sup> In addition to the symptoms of fatigue listed above, common indications of drowsy driving may include but are not limited to:

- Trouble remembering the last few miles driven<sup>15,17</sup>
- Missing exits or disregarding traffic signs<sup>15,17</sup>
- Drifting from the lane, tailgating, hitting the shoulder strip<sup>15,17</sup>

Sleep deprivation is also associated with an increased risk of disease and all-cause mortality.<sup>18</sup> Chronically sleeping for less than five hours of sleep has been linked to an increased likelihood of developing chronic health conditions, such as obesity, hypertension, high cholesterol, stroke, heart attacks, diabetes, gastrointestinal disorders, and depression.<sup>18-21</sup> Lack of sleep has also been linked to inhibited production and response of immune cells and cytokines, limiting the immune system's ability to respond and fight infections.<sup>22</sup>

Long and excessive work hours can influence risky behaviors. A meta-analysis published by Virtanen et al. showed that individuals who constantly worked more than 48 hours a week were 13 percent more likely to be risky users of alcohol (defined as 14 or more drinks per week for women and 21 or more drinks per week for men).<sup>23</sup> While this statistic may not seem drastic, the finding suggests that some individuals may be prone to unhealthy coping strategies in order to deal with working excessive hours.<sup>23,24</sup>

## **Fatigue, Extended Work Hours and Safety**

CRNAs and healthcare professionals often work variable and extended hours outside of regular daytime working hours.<sup>8,25</sup> Long and strenuous shifts lasting over 12 hours, recurrent emergency calls, and/or night work limit opportunities for adequate rest and contribute to the onset of fatigue.<sup>1,26</sup> In a survey of 1,284 CRNAs across the United States, 15.7 percent reported falling asleep while providing anesthesia care and 48.8 percent reported observing a colleague engaging in sleep-related behaviors while providing anesthesia care.<sup>12</sup> Sleep-related behaviors were more frequently reported while providing continuous anesthesia care for more than 16 hours and during the night among the respondents.<sup>12</sup>

As work hours become prolonged or extended into the night, hostility, tension, anxiety, and depression tend to increase while energy, empathy, and happiness decrease.<sup>21,27</sup> These states of mind that result from extended work hours may be a contributing factor to disruptive behavior in the workplace, cause excessive stress, and eventually lead to burnout.<sup>28</sup> Stress and burnout are two factors that contribute to declines in empathy and patient-centered communication.<sup>29</sup> Results of a study performed by Kang et al. demonstrated a correlation between exhaustion and depersonalization in physician residents and interns, which resulted in 11 percent more medical errors.<sup>30</sup> Nurses also experienced decreased job satisfaction and clinical decision regret, which are contributing factors to burnout, from fatigue and extended shifts.<sup>31-33</sup> Such dissatisfaction can increase job turnover, which can negatively impact patient care.

Prolonged wakefulness influenced by extended hours and night shifts impacts alertness, clinical performance, and cognitive function. Using computerized testing, O'Brien et al.<sup>34</sup> demonstrated that orthopedic surgeons had a 72 percent increase in odds of making at least one error on tasks related to attention, concentration, and memory after only a single night of sleep deprivation. Anderson et al.<sup>13</sup> showed that chronic sleep deficiency caused progressive degradation in neurobehavioral performance in medical residents, including a 20-49 percent slowed reaction time, during extended duration shifts lasting between 24-30 hours. Both acute and chronic sleep deprivation after long work hours have notable impacts on vigilance, which can subsequently impact safety.

Accidents and errors are more likely to occur when an individual is fatigued, especially after working long hours. After nine consecutive hours of work, the risk for unintentional accidents increases exponentially with each subsequent hour worked.<sup>1</sup> According to a meta-analysis by Sinha et al. residents who worked 24-hour recurrent shifts were responsible for a 36 percent increase in serious preventable adverse events and five times as many serious diagnostic errors compared with individuals working shifts 16 hours or less.<sup>1</sup> There were also 300 percent more fatigue-related preventable adverse events that led to a patient's death when a clinician was fatigued.<sup>1</sup> In addition, medication errors are more prevalent with increased shift length, with nurses making double the amount of errors in shifts greater than 12.5 hours.<sup>10,26</sup>

Fatigue also contributes to the elevated rates of workplace injuries. Working 12 hours a day is associated with a 37 percent increased risk of workplace injuries.<sup>35,36</sup> Needle-stick injuries are the most frequently reported injury in the healthcare setting and are usually due to carelessness from fatigue, particularly during night shifts.<sup>26</sup> Another common error that results from fatigue is the improper donning and doffing of personal protective equipment.<sup>36</sup> These events increase the risk of adverse health effects, such as the potential transmission of bloodborne pathogens.

## Fatigue Countermeasures

CRNAs are ethically responsible for adhering to the AANA *Code of Ethics for the Certified Registered Nurse Anesthetist*<sup>3</sup> by assuring they are well rested and fit for duty. Personal obligations, scheduling needs, and the commute to a job should be considered prior to accepting a position. Consider single or multi-modal approaches to fatigue management on an individual basis. The following fatigue countermeasures may be helpful preventing or mitigating fatigue:

- **Naps:** Naps are beneficial for many individuals and may minimize fatigue. Taking a prophylactic nap prior to beginning a shift is preferable; however, rest should be encouraged when symptoms of fatigue arise while on the job.<sup>1,37</sup> During extended shifts, short naps of less than a half hour (i.e., power napping) may help maintain alertness and vigilance and are effective in preventing sleep inertia, a state of grogginess after an abrupt awakening.
- **Caffeine:** Caffeine (e.g., coffee, tea, energy drinks, supplements) has been shown to improve alertness, but consumption should be managed as it may impact vigilance and deter the opportunities for adequate sleep.<sup>7</sup> Caffeine consumption should be monitored, especially four to seven hours prior to sleep.<sup>1</sup>
- **Exercise:** Regular exercise may play a role in managing fatigue. Rigorous exercise within three hours before sleep may adversely influence quality of sleep.<sup>1,7</sup>
- **Consistent sleep-wake patterns:** Establishing a regular sleep-wake routine may help prevent issues with falling asleep and waking up. If possible, prevent altering bed and wake up times by more than an hour.<sup>1</sup> Drastic changes in shifts may deter healthy sleep patterns and should be managed.
- **Recovery between shifts:** Fatigue and sleepiness progresses when working consecutive extended shifts. The ability to recover from fatigue and rest between consecutive extended shifts is important for preventing fatigue on the job.<sup>33,38</sup>
- **Electronic devices:** Electronic device use during periods of rest should be minimized to avoid possible distractions.
- **Bright lights:** Artificial bright lights alter circadian rhythm timing of traditional sleep-wake periods enabling individuals to stay awake during typical periods of rest, especially for workers who frequently work night shifts. While exposure to bright light may improve vigilance and the ability to stay awake, it may inhibit the ability to initiate intended sleep.<sup>39,40</sup>
- **Medications:** Medications have been approved by the U.S. Food and Drug Administration (FDA) for certain disorders related to sleep and fatigue (e.g., narcolepsy, shift work disorder).<sup>40-42</sup> Individuals should be aware of the side effects (e.g., cardiovascular, neurological, psychomotor) of such medications, as they may impair individual health and performance.<sup>1,42,43</sup> Seeking medical consultation for fatigue and sleep disorders can help prevent or manage these conditions.

## Considerations

Fatigue and sleep deprivation are professional and patient safety issues. Anesthesia care requires services at all hours of the day and the intensity of work varies based on setting, case load, and patient acuity. Table 1 presents considerations that may be used to inform practice, educational programs, and facility policies related to fatigue, safety, and wellness.

**Table 1.** Considerations for practice, policies, and educational programs.

Consideration	Considerations for Practice	Considerations for Policies and Programs
Scheduling	<ul style="list-style-type: none"> <li>• Providing anesthesia patient care for more than 16 consecutive work hours without adequate breaks for meals and respite is not advised.<sup>1,9,12,44</sup> <ul style="list-style-type: none"> <li>○ <i>Consecutive work hours</i> refers to the time during which continuous anesthesia patient care is provided.<sup>44</sup></li> <li>○ CRNAs working extended duration shifts should allocate time in their schedule for rest. These rest periods should be used in accordance with facility policies.<sup>43</sup></li> </ul> </li> <li>• Schedule and use break time during work hours for rest, meals, and other personal activities.<sup>43</sup></li> <li>• Self-monitor the number of on-call hours worked to mitigate excessive work hours from building up over a short period of time.<sup>45</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Comply with federal and state statutes and regulations for providing breaks during shifts.               <ul style="list-style-type: none"> <li>○ Providing patient care for more than 16 consecutive work hours without breaks for meals and respite is not advised.<sup>1,9,12,44</sup></li> <li>○ <i>Consecutive work hours</i> refers to the time during which continuous patient care is provided.<sup>44</sup></li> </ul> </li> <li>• Try to align schedules with employee preferences to minimize interference with non-work lives while meeting the operational needs of the facility.<sup>2</sup></li> <li>• Outline exceptions for extenuating circumstances (e.g., mass casualty incidents) in institutional policies. Such circumstances may require greater flexibility in scheduling.<sup>1</sup> <ul style="list-style-type: none"> <li>○ Consider time needed for responding to urgent, emergent or unplanned events when scheduling regular work hours.</li> </ul> </li> <li>• Consider provisions for adjusting times of scheduled procedures that immediately follow extended on-call hours worked by anesthesia professionals, especially during the night or early morning, particularly when there are limited anesthesia providers available.</li> </ul>
Safety	<ul style="list-style-type: none"> <li>• Monitor safety recommendations from organizations, such as the AANA, Agency for Healthcare Research and Quality (AHRQ), Institute for Healthcare Improvement (IHI), and Institute of Medicine (IOM), for updated</li> </ul>	<ul style="list-style-type: none"> <li>• Provide space for employees to obtain adequate rest and conduct personal business during breaks.<sup>1</sup></li> <li>• Develop a process for staff to address concerns regarding scheduling and allow them to provide feedback on facility policies that impact scheduling and work/life balance.<sup>1,10</sup></li> </ul>

Consideration	Considerations for Practice	Considerations for Policies and Programs
	<p>resources that inform practice.</p> <ul style="list-style-type: none"> <li>• Maintain an understanding of behavioral implications associated with fatigue and their impact on patient care.</li> </ul>	<ul style="list-style-type: none"> <li>• Consider fatigue as a factor when reviewing adverse events to identify opportunities to improve processes and eliminate or reduce the likelihood of reoccurrence.<sup>1,10</sup></li> <li>• Encourage teamwork as a strategy to support staff working extended hours and to protect patients from harm.<sup>10,46</sup></li> <li>• Monitor safety recommendations from organizations such as the AANA, Agency for Healthcare Research and Quality (AHRQ), Institute for Healthcare Improvement (IHI), and Institute of Medicine (IOM), for updated resources that inform practice.</li> <li>• Maintain an understanding of the behavioral implications of fatigue on health care providers and their impact on patient care.</li> </ul>
Education	<ul style="list-style-type: none"> <li>• Provide in-services to colleagues regarding safety concerns of fatigue as documented in the literature.</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporate topics such as sleep science, sleep deprivation, fatigue counter measures, extended shift work, and the impact of fatigue on clinical performance and patient safety in nurse anesthesia programs.<sup>47</sup></li> </ul>
Wellness	<ul style="list-style-type: none"> <li>• Recognize the early symptoms of fatigue and take appropriate steps to prevent and/or mitigate symptoms.</li> <li>• Use benefits and services offered by employers, such as wellness programs, worksite fitness centers, and designated rest areas.</li> <li>• Adopt healthy habits, such as proper nutrition, exercise, and stress management techniques, to promote healthy sleep.</li> <li>• Seek professional help if experiencing personal and/or professional problems due to fatigue.</li> <li>• Refer to <a href="http://www.AANA.com/Fatigue">www.AANA.com/Fatigue</a> for more information.</li> </ul>	<ul style="list-style-type: none"> <li>• Post checklists to help employees recognize:             <ul style="list-style-type: none"> <li>○ Early symptoms of fatigue and take appropriate steps to prevent and/or mitigate symptoms.</li> <li>○ Personal and/or professional problems due to fatigue to seek professional help.</li> </ul> </li> <li>• Consider offering wellness programs and resources for employees and encourage the use of these initiatives.</li> <li>• Refer to <a href="http://www.AANA.com/Fatigue">www.AANA.com/Fatigue</a> for more information.</li> </ul>



## Summary

The consequences of fatigue have serious implications for patient safety and the overall wellness of anesthesia professionals. Wellness is the foundation of safe anesthesia practice and CRNAs should maintain familiarity with strategies that prevent and mitigate fatigue and consider recommendations set forth by the AANA and other recognized organizations that promote and promulgate practices for safe anesthesia care. Such organizations include The Joint Commission, Anesthesia Patient Safety Foundation, and Institute for Healthcare Improvement. CRNAs are encouraged to become involved within their departments and facilities to help develop and implement policies that promote safety for both healthcare professionals and patients in their care. Managing fatigue has the potential to improve the quality of patient care and outcomes to spur excellence in clinical and professional practice.

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