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REVIEW

A narrative review of the impact of work hours and insufficient rest on job performance

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Abstract

Objective: This review discusses the scientific evidence regarding effects of insufficient rest on clinical performance and house officer training programs, the associations of clinical duty scheduling with insufficient rest, and the implications for risk management.

Study design: Narrative review.

Methods: Several literature searches using broad terms such as "sleep deprivation," "veterinary," "physician," and "surgeon" were performed using PubMed and Google scholar.

Results: Sleep deprivation and insufficient rest have clear and deleterious effects on job performance, which in healthcare occupations impacts patient safety and practice function. The unique requirements of a career in veterinary surgery, which may include on-call shifts and overnight work, can lead to distinct sleep challenges and chronic insufficient rest with resultant serious but often poorly recognized impacts. These effects negatively impact practices, teams, surgeons, and patients. The self-assessment of fatigue and performance effect is demonstrably untrustworthy, reinforcing the need for institution-level protections. While the issues are complex and there is no one-size-fits-all approach, duty hour or workload restrictions may be an important first step in addressing these issues within veterinary surgery, as it has been in human medicine.

Conclusion: Systematic re-examination of cultural expectations and practice logistics are needed if improvement in working hours, clinician well-being, productivity, and patient safety are to occur.

Clinical significance (or Impact): A more comprehensive understanding of the magnitude and consequence of sleep-related impairment better enables surgeons and hospital management to address systemic challenges in veterinary practice and training programs.

1 | INTRODUCTION

Insufficient rest has well-understood effects on human functioning,[1] which in healthcare professions such as veterinary surgery impacts patient safety and practice function. Occupational practices such as extended workdays, on-call schedules, inadequate staffing levels, and poorly scheduled overnight shifts result in lack of physiological rest and recovery, with acute and chronic sleep deficits affecting surgeons' performance. Too often, hospital systems rely on fatigued clinicians and trainees to cover services without assessing potential impairment.[2–4] While this topic is poorly discussed in veterinary-specific literature, veterinary surgeons should understand how fatigue affects their capabilities and patient safety. The objective of this review is to summarize the evidence documenting the impact of occupational sleep insufficiency on functions relevant to veterinary surgeons such as work performance, patient safety, and team dynamics. A secondary objective is to suggest ways to mitigate the occupational pressures associated with impaired performance and clinician burnout.

1.1 | Search strategy

Two search procedures were followed to find publications that informed the goals of this narrative review. One author (MS) searched online databases Medline and Google Scholar using combinations of "sleep deprivation and veterinary" and "sleep deprivation and surgeon." We restricted the initial search to the past 5 years (2017–2022) to select contemporary evidence. Manual scoping focused on original research manuscripts, meta-analyses, systematic reviews, and recent physician sleep society consensus statements. The paucity of profession-specific reports prompted us to expand the search to include the terms "sleep loss", "sleep insufficiency", "fatigue", "chronic", "acute," "performance impact", "healthcare", "physician", "resident", "surgical", "surgery", "on call", "extended work hours" and "medical error." We incorporated fundamental research obtained by manual scoping of cited studies from articles identified in the initial searches and subsequent date-unconstrained focused topic searches as needed to improve understanding. Eligibility criteria included peer-reviewed, full-text articles written in the English language examining occupational causes of sleep insufficiency and their professional impacts on veterinarians and physicians. Manuscripts that focused on nonoccupational stressors that might impact sleep, general insomnia, nonoccupational circadian rhythm disorders, parasomnia, hypersomnia, sleep-related breathing disorders, and sleep-related movement disorders were excluded.

1.2 | Labor law and veterinary medicine

The federal Fair Labor Standards Act[5] created the right to a minimum wage, overtime pay eligibility, child labor standards for private and governmental employees, and defined the workday (8 h) and week (40 h). These rights apply to "any individual employed by an employer," but not to business owners, independent contractors, or volunteers.[5] White collar or "professional" employees were also exempted from these mandatory overtime provisions under this legislation. When the law was enacted in 1938, most work involved physical labor, so the Act's focus was on physical fatigue as the primary cause of reduced work performance and safety. Because physical fatigue accumulates steadily across the duration of physical work and dissipates progressively during rest breaks, regulations focused on prescribing maximum durations for work shifts and minimum durations for time off related to the effects of physical labor.[6] Healthcare professionals such as physicians and veterinarians have been exempted from these standards because their work was not perceived as "physical", which classified them as white-collar professionals. In addition, attending physicians have historically practiced as independent contractors rather than hospital employees. Exempt status has generally been considered desirable within the medical profession, providing more autonomy to set individual schedules balancing patient care and personal needs. However, this attitude has been evolving in response to changes in working patterns and corporate ownership. In addition, white collar work, especially healthcare, is now recognized as having equally consequential physical, physiological, and mental health impacts as physical labor.

Resident clinicians lack the professional autonomy of an independent contractor as well as legal protections associated with student classification (rather in most residency programs they are hospital employees who are also

apprentice trainees), exposing them to excessive work hours. The impacts of long work hours by resident physicians on patient care and safety were broadly re-evaluated by the public and the medical profession after a highly publicized patient death in 1984. This incident and subsequent discussion led to the enactment of the Libby Zion law, legally mandating resident physician work hour restrictions in New York state. Work hour restrictions for resident physicians were subsequently enacted nationally in 2003 by the Accreditation Council for Graduate Medical Education (ACGME). However, these restrictions remain controversial as they were not fully data-driven and do not include all physicians.[7,8] The current culture in medicine tends to venerate sleep deprivation as a sign of strength, dedication, ambition, and endurance.[9,10] "Sleep is for the weak" or "I'll sleep when I'm dead" are refrains of a machismo culture[10] perpetuated through all levels of medical and veterinary training programs.

2 | SLEEP LOSS AND OCCUPATIONAL IMPACTS

Quantitative sleep loss is most commonly characterized as either acute continuous loss (sleep deprivation) or chronic, partial loss or restriction. However, this classification does not fully characterize insufficient rest, which also encompasses disruption of sleep continuity, irregular sleep schedule, circadian disruption, extended work hours, after-hours shifts, and on-call duty.[1,11] Regardless of its cause, insufficient rest has dose- and time-related cognitive and emotional effects affecting function in the clinical setting. Impairments affect emotion regulation and recognition, executive function and decision-making, as well as capacity for risk–benefit analysis. Associated signs in affected individuals include increased risk-taking behavior, reduced higher cognitive functioning and throughput, reduced multitasking abilities, and reductions in attention, alertness, and memory, with increases in sleepiness and fatigue.[12–16]

2.1 | Extended work hours, acute and chronic sleep loss

2.1.1 | Acute sleep loss

Acute sleep insufficiency is generally defined as a reduction in the usual total duration of sleep over a short period (usually 1–2 days), with an awake state extending beyond 16–17 hours/day. An individual who remains awake for 17 hours has the same cognitive performance as someone with a blood alcohol concentration of 0.05%.[17] A similar decline in hand-eye coordination has been reported after 28 hours without sleep or a blood alcohol concentration of 0.10%.[17] As a reference, a blood alcohol concentration of 0.08% is considered legally drunk in most U.S. states. The performance of clinical and nonclinical tasks by physicians working consecutively for 24 hours was rated 1.5–2 standard deviation below that of rested individuals in a meta-analysis of sleep loss and physician performance.[18] In another study, sleeping ≤6 hours per night ($\chi^2 = 4.34$, relative risk(RR) = 1.3) or working ≥70 hours weekly ($\chi^2 = 8.74$, RR = 1.5) were associated with higher rates of medical errors among physicians.[19] In this study, each hour of sleep reduction corresponded to a 27% increase in the odds of reporting medical errors (odds ratio (OR) = 1.27, 95% CI = 1.27–1.53).[19] Surgeons who were awake the night prior to testing took 14% longer to complete a simulated laparoscopic task and made 20% more errors than colleagues who slept undisturbed.[20] In another study of 220 surgeons and gynecologists, sleep restriction (<6 h) was associated with complications in 82/1317 (6.2%) post-night duty procedures compared to 19/559 (3.4%) when physicians had more than 6 hours of sleep (OR = 1.72, 95% CI = 1.02–2.89).[21]

2.1.2 | Chronic sleep loss

Chronic sleep insufficiency often goes under-recognized, but leads to similar, dose-dependent reductions in cognitive performance as acute sleep deprivation. Even a mild acute reduction (of only a few hours) of sleep over a few days can impact neurobehavioral function. For example, subjects undergoing a 10-day period of daily 30% sleep reduction universally exhibited deterioration in all recorded behavioral, motor, and neurophysiological measures.[22] A week of recovery subsequent to the studied sleep restriction did not fully restore function.[22] In another study, sleeping <6 hours/night and <4 hours/night for 2 weeks resulted in cognitive abilities similar to individuals with one and two nights of total sleep deprivation, respectively.[23] Importantly, these individuals did not perceive their level of sleepiness despite objectively measured performance deficits, illustrating the inability of individuals with chronic sleep insufficiency to detect their own impairment.[23] In physician house officers, response times deteriorated both over a single 24–30 hour shift and also cumulatively with successive overnight/extended work shifts.[24] The exacerbation of performance loss when chronic sleep deficiency is superimposed with acute deprivation can be extrapolated to periods of after-hours duties for surgeons who may already be chronically sleep restricted for professional or personal reasons. By contrast, increased alertness and reduction in medication errors have been documented when continuous duty is limited to 16 hours.[25,26]

2.1.3 | On-call and overnight shifts

Healthcare needs are not limited to regular business hours, requiring extended coverage via either 8–12 hour long shifts, or on-call duty rotas. Workers assigned to after-hours shifts cover a set number of nontypical hours (commonly characterized as occurring between 6 p.m. and 7 a.m.), with defined periods of rest in between shift assignments. By contrast, offsite or "home" on-call duties are commonly used as an alternative to provide veterinary surgical care out of regular business hours. Clinicians may sleep while on-call but must be reachable and available to work if needed. However, home on-call time is not physiologically equivalent to rest time. While on call, individuals experience disrupted sleep and poor quality rest, whether called to duty or not.[27,28] In addition to sleep loss, the employees' experience of being on-call translates into stress, fatigue, work-home interference, and high work strain.[29] In a study of 34 pediatric residents, individuals assessed after on-call duties sustained deficits in attention, vigilance, and driving abilities that are comparable to those associated with blood alcohol levels of 0.04%–0.05%.[30] The impacts of extended duty hours were demonstrated in a study of 20 medical interns who slept 5.8 hours per week more ($p < .001$) and exhibited a >50% reduction in attentional failures ($p = .02$) when on a limited duty hours schedule (mean weekly work hours = 65.4, range = 57.6–76.3) compared to the traditional schedule (mean = 84.9, range = 74.2–92.1).[25] Surgery residents on call for 17 hours and with disturbed sleep performed more unnecessary movements and committed twice as many errors during simulated laparoscopic procedures than well-rested peers.[31] Sleep debt accumulates rapidly when on-call duty is combined with regular day scheduling. Cognitive and neurobehavioral consequences of chronic partial sleep insufficiency are difficult to overcome and last longer than one might expect.[22] Fatigue impacts empathy and executive functioning, exacerbating workplace tensions and stressors, extending its impact beyond the sleep-deprived individual.

Although poorly documented, several factors, such as genetics, gender, and age, seem to influence the stress caused by on-call work.[1,32] Younger workers seem more susceptible to a single night of acute sleep loss, whereas older workers are more vulnerable to sequential sleep loss.[1] Individuals exhibit considerable intrinsic differences in sleep needs and patterns, which are further influenced by a complex interplay between chronological age, maturation stage, concurrent medical illness, behavioral, environmental, and social factors, all fluctuating with time.[1]

2.2 | Sleep inertia

Functionality during on-call duties may also be impacted by sleep inertia, described as a state of impaired cognition, grogginess, and disorientation commonly experienced when awakening.[33] Sleep inertia is particularly relevant to surgeons, who are required to complete complex processes immediately after waking at night, including evaluative thinking and quick, high-impact decision-making. These effects are most apparent during the initial 10–15 minutes after awakening; they can take hours to dissipate and are more pronounced when combined with sleep debt.[34,35] The impairment of sleep inertia is occupationally relevant, as changes in cognitive performance are comparable with those due to alcohol intoxication and can exceed those seen after 24 hours of continuous wakefulness.[33] Clinicians making vital decisions shortly after waking up are predisposed to fatigue-related errors. This evidence should prompt health organizations to question the value of on-call duties and consider structured shifts to provide quality after-hours medical care.[28]

2.3 | The fatigue paradox

Healthcare team members are generally reluctant to acknowledge the negative impact of fatigue on patient care. Contrary to published evidence, most clinicians are not cognizant of the inaccuracy of one's own assessment of fatigue-related impairment and underestimate the cognitive impact of their own sleep restriction. Instead, they tend to overestimate their own performance readiness while sleep restricted, a phenomenon termed the "fatigue paradox."[15,36] This paradox was detected in residents participating in a sleep study: When asked whether they had fallen asleep during formal study testing, their self-perception of whether they had remained awake or not was no better than chance.[37] The common belief that fatigue-related impairment can be overcome by motivation and personal stamina is not supported by evidence. Instead, several reports document the inability of human beings to adapt or "learn to function" on inadequate sleep.[16,38] This fatigue paradox is sustained among healthcare professions by the construct of 'the indefatigable clinician,' dismissal of fatigue-related events, and framing of fatigue as a personal failure, contrasted by the celebration of fatigue as evidence of hard work.[36] In a recent publication, clinicians felt confident that their methods of practice ensured that fatigue did not affect patient care, but conversely, acknowledged their tendency to deviate from their usual practices when tired.[36] The veterinary profession has not yet assessed the causative role of fatigue when reviewing adverse events or near misses, although fatigue is among the first considerations when undesirable outcomes are audited in other professions.[39,40] The absence of explicit discussions about fatigue contributes to the blind spot maintaining the fatigue paradox in healthcare.[36]

3 | HOUSE OFFICER TRAINING PROGRAMS

3.1 | Human medicine

Physician residency programs must adhere to the maximum weekly work hours required by the ACGME to maintain accreditation in the U.S. These regulations, established in 2003, were revised in 2011 and again in 2016. The current ACGME regulations are outlined in Table 1.

3.2 | Veterinary medicine

No guidelines have been established regarding work hours for U.S. veterinarians. In a recent survey of veterinary house officers, most reporting working 11–13 hours per weekday, and approximately one-third had clinical responsibilities 7 days/week.[2] The number of consecutive workdays and the frequency of late finishes are known to affect fatigue levels.[50] House officers working 8–10 hours/day were more likely to report ≥7 hours of sleep (Pearson's correlation coefficient = −0.54; $p < .001$).[2] In the same survey, house officers reported reduced duration of sleep per night during clinical weeks compared to off-clinic rotations, sleeping approximately 6 hours/night after 11–13 hour workdays.[2] Most assessed that fatigue had affected their technical skills, clinical judgment, and ability to empathize at some point during the 4 weeks preceding the survey.[2] Eighty percent of those respondents also reported sleeping <7 hours/night when on clinic duty, with poorer quality of sleep when on-call.[2] The number of reported hours worked per day was negatively associated with sleep quantity (Pearson's correlation coefficient = −0.54; $p < .01$).[2] Small animal surgery residents were more likely to work 7 days/week than other residents (OR = 9.17; 95% CI = 3.93–21.43; $p < .001$) and were more likely to receive ≥3 calls/night (OR = 4.96; 95% CI = 2.25–10.93; $p < .001$).[2] Conversely, only 6% of house officers felt that their training program did not interfere with their sleep schedule in the preceding 4 weeks.[2] While most house officers (68% [198/290]) reported that their current sleep habits were somewhat or much worse than prior to their program, small animal surgery residents were even more likely to report "much worse" sleeping habits (OR = 4.33; 95% CI = 2.01–9.33), and that their training program "extremely" interfered with current sleep habits (OR = 4.12; 95% CI = 1.75–9.69).[2] In another report, veterinary trainees in corporate

TABLE 1 Best scheduling practices in human healthcare and other industries at risk for fatigue impacting human health and safety.[41–49]

	Maximum work time/week	Maximum consecutive work hours	Minimum consecutive rest time between shifts	Minimum time off/week	Other specifications
US railroad operators	6 d consecutive	12 h	8–10 h		
US airplane pilots (1–2 pilot airplanes)	34 h flight time	8–10 h flights, 16 h total duty	10–12 h		10 h minimum rest immediately before duty
US interstate truck/bus drivers	60 h	10–11 h driving, 14–15 h total duty	8–10 h	34 h consecutive every 7 d	
US nuclear power plant operators	72 h	16 h	8 h	34 h consecutive every 9 d	
Physicians: European Union and UK	48 h	13 h	11 h		
Physicians: Australia	50 h	10 h	Minimum of 8 h continuous sleep	24 h consecutive every 7 d	
Physicians: US	80 h	24 h (+4 h if needed to manage necessary care transitions)	10 h	24 h consecutive every 7 d	On call not scheduled more than 1 in every 3 nights

Abbreviations: d, days; h, hours.

and private practice received 2–3 more days off per month and 3–4 hours more sleep in the prior 48 hours than those in academia.[51] Forty percent of trainees expressed concerns over making major medical errors in the 3 months prior to the survey.[51] Current evidence suggests that programmatic moderation of veterinary surgery resident working hours is needed. Discussion on whether acceptable limits should also be clarified at the national level (similar to the ACGME regulations for resident physicians) or left to individual program oversight is warranted.

4 | RISK MANAGEMENT

Analyses of human error focus either on the person or the system.[52] In the first case, the blame is placed on an individual whereas the second approach accepts that humans are fallible and focuses on building defenses into the system to increase safety. The 'blame culture' has long been the typical style of risk management in U.S. healthcare, including veterinary medicine. While mistakes and near misses occur, fear of punishment inhibits disclosure and discussion.[53] Medical errors, adverse events, and near misses likely occur at similar rates in veterinary medicine than in human healthcare, but lack of reporting prevents statistical analyses, development of classification tools, and understanding of the causes and predisposing factors.[39,54–57] Fear and belief that incident reporting will make no difference are cited as the two most important barriers to error reporting, affecting individual and organizational learning, and therefore prevention of recurrences.[39]

5 | REGULATIONS RELEVANT TO THE SCHEDULING OF CLINICAL DUTIES

5.1 | Regulations of physicians' schedule in Europe and Canada

In Europe and the United Kingdom, physicians follow the European Working Time Directive (details provided in Table 1). While these physicians may work longer hours than specified by signing an opt-out clause, this option is only recommended for independent physicians who can determine their own working hours.[41,42,58] The Australian Medical Association Code of Practice (last revised in 2016), is a voluntary national code that recommends thresholds for unsafe hospital work practices (details provided in Table 1) and is accepted as the working standard for all hospital doctors and trainees. Monitoring the health of physicians exposed to after-hours work and extended working hours is also recommended.[43] Physician work hours are not nationally regulated in Canada; instead, contracts are negotiated between residents' associations and the provincial jurisdictions in which they train.[59]

5.2 | Regulations of physicians' schedule in the United States

The duration of work performed by nonresident physicians is not monitored or regulated by most U.S. medical institutions. However a 2016 review found that physician residency programs implementing duty hour restriction interventions and allowing time for them to take effect prior to assessment identified improvement in patient safety and resident well-being.[60] In a study of 15 276 resident physicians comparing cohorts before and after ACGME duty reform, motor vehicle crashes were reduced by 24% (RR = 0.76, 95% CI = 0.67–0.85), percutaneous injuries by more than 40% (RR = 0.54, 95% CI = 0.48–0.61), and attentional failures by 18% (incidence rate ratio = 0.82, 95% CI = 0.78–0.86).[61] Although aiming in the right direction, ACGME regulations are not founded on ethical and evidence-based practice, prompting debate regarding the magnitude of restrictions proposed.[7,62–64] Changing these regulations may be impeded by cultural norms and concerns about discontinuity of care, apprehension of the possibility of reduced case exposure affecting resident training, fiscal concerns, and insufficient evidence of reductions in medical error rates or resident stress in some studies.[3,40,65–68]

Long working hours during clinical training programs have traditionally been considered inevitable to ensure competency and instill professionalism. Surgeons have voiced concerns about possible compromise in the quality of resident training and operative experience if working hours are limited during the set number of years assigned to the program.[3,65,68] As a result, many physician training programs have implemented the ACGME duty hour restrictions in manners that have used a workload compression strategy (attempting to fit similar clinical responsibilities into fewer working hours).[69] Workload compression, however, increases risks of fatigue and burnout, and a variety of aspects of modern practice (rising patient numbers, increased case complexity and intensity of care per admission, more intensive medical record documentation) already lead to healthcare professional work compression irrespective of duty hour limits.[70–72] Limiting work hours without commensurately

decreasing workload logically can only exacerbate the existing work compression experienced by clinicians. The training effect of potential cumulative clinical exposure reductions with work hour restriction during residency remains poorly examined. However, it must also be recognized that inadequate rest negatively impacts learning and memory consolidation.[1] The benefit of exposure to clinical knowledge by virtue of longer hours must be balanced against increased fatigue as well as reduced opportunities for didactic study and the consolidation of knowledge that occurs only during sleep. A review published in 2011 provided evidence of the positive impact of work hour limits for surgical residents without adversely affecting operating room experience.[73] In a subsequent study, physicians trained for 90–100 hours/week had no better patient outcomes (readmission rates, mortality, or cost of care, in a study of nearly 500,000 patients), than those whose training hours were limited by ACGME restrictions.[74] Despite theoretical concerns of reduced inpatient admissions volumes negatively impacting trainee education and clinical care, another study emphasizing workload reduction strategies (reducing the number of patient encounters per trainee), found that education and care quality outcomes were improved.[69] Although limited, this evidence justifies efforts to reduce fatigue while maintaining training experience. Such approach focuses on improving educational resources, including skills courses and the use of simulators.[42,75]

The acquisition of professional values, attitudes and behaviors through observation of mentors and role models has been termed the "hidden curriculum" in healthcare education.[76] Conflicts between the hidden and formal curricula create dilemma for trainees; such situation occurs when the behaviors trainees observe in their mentors are at odds with the education received about best practices.[77] Resistance by mentors to reasonably restrict their work hours may be considered a lost opportunity to lead by example, perpetuating long-term patterns of behavior that are no less strong for being informally communicated or unspoken.

Critics of work hour limits note that some well-known studies such as the Flexibility In duty hour requirements for Resident Trainees (FIRST) or individualized Comparative Effectiveness of Models Optimizing Patient Safety and Resident Education (iCOMPARE) trials did not detect a reduction in recorded medical errors by resident groups on reduced work hour schedules.[67,68] However, the validity of these conclusions is affected by several limitations. First, risks of type 2 errors due to insufficient sample size affect the value of the iCOMPARE trial.[68,78] Second, study design should be considered in terms of level of training and conditions of work; methodologies were inconsistent with notable impacts. The FIRST trial reported no change in the incidence of death or serious surgical complications associated with shift limits among first-year physician surgical residents.[67] However, these residents' roles would be similar to those of rotating veterinary interns, with limited to no primary procedural responsibility. Additionally, studies comparing shifts with a minimum of 12 hour duration are already associated with fatigue and elevated risk; comparing longer shifts of more than 12 hours simply compares fatigued clinicians with more fatigued clinicians.[79] Unpredictability and variability of compliance with resident work hour regulations and ACGME monitoring[80] is another variable confounding the ability to statistically detect outcome differences. Finally, circadian rhythm disturbances and the specifics of handover processes should be taken into consideration when comparing studies. Indeed, more medical errors were documented when ICU resident physicians worked 62 hours/week compared to residents working 68 hours/week, but the former rotated between between day and night shifts.[66] Impacts of circadian rhythm disturbances due to shift-switching on quality of rest, is an important performance-influencing variable that may have affected study results.[44,66,81] Handover processes were not standardized and the study authors noted that variation in medical error outcomes between study sites may have also been related to site-specific differences in handover processes.[66] The authors also noted that the residents working 62 hours carried a heavier daily workload than those following 68 hour shifts, and reported evidence that "when ICU physicians care for more than seven patients per day, patient safety may deteriorate."[66] It should be noted that it is generally more difficult to statistically demonstrate a positive association rather than to fail to demonstrate an association, and many of these difficulties are associated with study design constraints.

Evidence supporting regulations of work hours in healthcare was summarized in a systematic review, where safety outcomes were improved by shorter physician shifts in 74% of the studies included while worse outcomes associated with shorter shifts were documented in 6% of the studies.[62] Failure to identify outcomes differences with work hour restrictions may be associated with a lack of perceived benefit as limiting clinicians' work hours commonly result in work compression. Unless responsibilities are concurrently adjusted, clinicians must complete their normal workload within the reduced time, increasing stress and affecting the perception of benefit.[51] Notably, surveyed physicians preferred their own family members to be cared for by a team working on a shift schedule rather than traditional call schedule.[82]

5.3 | Veterinary medicine

The occupational structures and logistics of most practicing veterinarians (from an institutional employment relationship context) could be considered as most equivalent to physicians in general practice (who do not usually have after-hours coverage requirements) or emergency rooms. These physicians generally work under a defined schedule, typically in 8–12 hour shifts, which differs from most veterinary surgeons with after-hours responsibilities. Also by contrast with physicians, the adoption of universal work hour recommendations is further complicated in veterinary medicine by costs of staffing relative to client costs, as well as a variety of species- and specialty-specific practice styles and needs. As legally-exempt employees, institutionally employed veterinarians that are not trainees (whether academic faculty or practice associates) lack labor code protections.[5] They also lack self-protections inherent to work as independent contractors, as well as established cultural norms provided by national duty hour oversight for training programs. These employees are therefore at higher risk for excessive work hour requirements. In a survey about adverse events experienced in veterinary medicine, 65% (368/564) of veterinarians surveyed indicated a desire to reduce their work hours.[55] Veterinarians and physicians who perceive they have had adverse events or near misses in their care of patients commonly experience stress and anxiety, reduced job satisfaction, sleeping difficulties, reduced professional confidence, and even depression and professional burnout.[55]

6 | PRACTICE MANAGEMENT ISSUES AND SUGGESTIONS

The magnitude of interindividual differences in the effect of sleep loss on occupational performance and personal health raises complex ethical dilemmas for practice management. How should scheduling occur to ensure patient safety and protect clinician mental and physical health while still providing necessary coverage? Despite cultural portrayals of surgeons as "indefatigable", there is no evidence that surgeons as a population are over-represented in the relatively small subset of humans that exhibits a relative resistance to the effects of prolonged wakefulness.[45] Individual surgeons are just as prone to the normal human variations that convey an increased vulnerability to sleep deprivation effects, including genetic trait polymorphisms, sleep disorders, health conditions, and other interindividual differences.[45] In general, veterinary surgeons are highly committed and hardworking professionals, however, practice management should not depend on individual altruism and professional dedication as a chronic baseline for practice logistics, nor put associates or trainees in the position of having to compromise personal health and professional capability to regularly ensure coverage. Limiting work hours alone may not eliminate fatigue but mitigates the likelihood that work schedules alone will cause unacceptable levels of fatigue.[83] While the dangers of ≥24-hour shifts and insufficient sleep have been well established in a wide variety of occupations including human healthcare, conversely, little to no objective data support the necessity or safety of such scheduling. Poor work schedules have a profoundly negative impact on employees, resulting in performance, effectiveness, productivity, job satisfaction, morale, and safety reductions, increased medical errors, absenteeism, presenteeism, ineffective teamwork, and degraded quality of life.[6] The evidence summarized above documents levels of impairment due to sleep deprivation that are similar to those induced by alcohol, yet the latter would lead to dismissal while similar impacts of sleep deprivation are tolerated by veterinary surgeons and their employers. Management must already accommodate and plan for a certain amount of allowable time off and staff illness. The principle for sleep is the same; it is a matter of affirming that excessive clinician fatigue (whether acute or chronic) is not acceptable and that a certain amount of rest is imperative, not negotiable.

Another contribution to chronic clinician fatigue could result from the incomplete use of allocated personal time off. Without overtly limiting individual time off, contract language in production-based compensation systems in particular may discourage or inhibit full use of personal time due to clinician concerns for the consequences of negative accrual, leading to situations where clinicians only feel comfortable using time off right before the calendar year ends in order to ensure that residual negative accrual has been erased. Clinicians and practice management may wish to consider mechanisms whereby appropriately allocated personal time off is excluded from calculations that result in negative accrual. Institution of quarterly time off check-ins by management could also help to ensure that clinicians are aware of their personal time off reservoir and feel empowered to benefit from these allowances. Appropriate practice staffing and mechanisms to ensure trusted continuity of patient care are also fundamental to clinician utilization of personal time.

While poorly managed changes in care assignment between shifts (known as handovers) could undermine patient safety benefits achieved by reducing clinician fatigue, handovers can be done safely and effectively with emphasis on formal handover rounds and practical electronic sign-over systems.[65,66] Implementation of formal handover programs is associated with reductions in medical-error rates and improvements in communications

at change of shift.[84–86] Routine use of a structured electronic handover tool resulted in a decrease in communication errors among surgery residents by 50% (from 13 ± 3% to 7 ± 2%; $p = .04$).[87] Concerns over handover can therefore be addressed through protocols and training, by contrast with the negative impacts of fatigue, which cannot.

Given the lack of evidence in veterinary medicine, consideration of alternative scheduling of work duties requires some extrapolation from professions where errors also carry significant consequences. Among these, management of occupational risks in aviation include regulations regarding rest and scheduling practices that take circadian variables into consideration.[50] Strategies found beneficial to physician surgeons include the re-organization and redistribution of after-hours care by addition of surgical nocturnist, "night-float," and/or hospitalist positions, recognition of on-call as work time rather than rest time, and maintenance of adequate surgical staffing.[41,88] Consecutive on-call duties (e.g., ≥3 days) are discouraged due to the likelihood of cumulative sleep deprivation impacts despite the common inability of clinicians to personally note these effects.[66] For the same reasons, scheduling elective procedures should be avoided after overnight call duties; alternatively, sleep loss should be disclosed and options to reschedule offered to the patient (or client).[44,89]

At the instruction of Congress, the Institute of Medicine/National Academy of Medicine[90] examined the scientific evidence surrounding the impact of sleep deprivation in healthcare.[91] Recommendations derived from this review included new scientifically-based limits on resident physician work hours and workload, increased supervision, a heightened focus on physician safety, training in structured handovers and quality improvement, and more rigorous external oversight of work hours (details provided in Table 2).[42] However, the subsequently revised ACGME 2011 and 2016 regulations fell short of these recommendations, an ongoing source of controversy and discussion among U.S. physicians. In academic settings, resident duty hour limits without concurrent staffing and systems changes can negatively affect faculty workload, teaching, and risks of burnout, leading to serious issues with clinician retention.[69,92–94]

Residents and faculty in veterinary academic settings report higher working hours and fewer hours of sleep than their counterparts in the private sector.[51] These differences may reflect declining state support and other budget limitations, organizational fiscal structures, operational efficiencies, and staffing levels relative to caseload. Other management decisions, differences in residency structures, conflicting holdovers in institutional cultures, and administrative expectations may also contribute to these differences. However, these findings should prompt serious and urgent consideration of strategies to remedy these limitations and ensure adequate workforce to train future veterinarians and surgeons.

TABLE 2 Summary of recommendations from the Institute of Medicine report (2009) on sleep physiology and physician work hours: Healthcare facility work redesign and cultural changes.[89]

Summary of recommendations from the Institute of Medicine report on sleep physiology and physician work hours
• Maximum shift length:12–16 h
• Minimum off-duty time between shifts:10 h
• Actively solicit clinician input into work redesign
• Design schedules to adhere to principles of sleep and circadian science; consider carefully effects of multiple consecutive night shifts and provide adequate time off after night work
• Do not schedule clinicians up to the maximum permissible limits; anticipate that emergencies frequently occur that will lengthen scheduled shifts
• Anticipate the need for iterative improvement with new schedules; be prepared to learn from the initial phase-in, and change the plan as needed
• Bring "home call" under the overall limits of working hours; monitor workload and hours to ensure that clinicians on home call are getting sufficient sleep
• Formalize a moonlighting policy. Include internal and external clinical moonlighting work hours in working hour limits and actively monitor
• Educate clinicians fatigue-related injury prevention, including increased risks of motor vehicle crashes when driving home after longer shifts and that clinicians' ability to judge their own level of impairment is compromised when fatigued
• Provide transportation to all clinicians who report feeling too tired to drive safely
• Train attending and resident clinicians in effective handovers of care
• Create uniform processes for handovers, tailored to meet each clinical setting; handovers should be done verbally and face-to-face, but also utilize written tools
• When possible, integrate hand-over tools into electronic medical records
• When feasible, handovers should be a team effort including nursing care providers
• Quality improvement/patient safety concepts should be integral to the (veterinary) medical school curriculum and reinforced throughout internship/residency

Abbreviations: h, hours.

For resident physicians, ACGME-accredited programs are expected to monitor and comply with established residency guidelines in order to maintain program accreditation. This is usually accomplished by having residents self-report duty hours on a weekly basis, information which is aggregated at the program level and then reported to the ACGME for review.[95] Oversight is dependent upon accurate reporting by both individual residents

and programs. Reported deterrents to accurate duty hour reporting by residents has included fear of programmatic punitive measures, poor peer perception or judgment, desire to retain control of their surgical education, and frustration with the administrative burden following violations.[95] In addition, studies have demonstrated effects of recall bias associated with distorted time perception resulting from long work hours and inconsistencies in the accuracy of self-reported work hours, with self-reported work hours for the week prior consistently 9 hours (SD = 8.6) lower than those that were automatically app-recorded ($p < .001$).[96] Improvements in duty hour compliance were seen with programmatic intervention in major domains including (1) improving the accuracy and transparency of work hour reporting, (2) facilitating more timely interventions, and (3) structural schedule changes that included transition to a night float model, providing additional time off for more junior residents, and redesigning the model of clinical coverage.[97] These types of issues should be considered in the structuring of duty hour oversight programs.

Because of the complexity of fatigue prevention, local systems of fatigue risk management that are broader, more flexible and better tuned to modern scientific findings on fatigue may be preferable to one-size-fits-all legislated work hour regulations.[50] It has been suggested that rather than application of strict universal duty hour limits, residency program accreditation could instead be contingent on measures of resident workload, indirectly permitting a reduction in work hours with greater flexibility in scheduling.[70,72] This concept holds promise but requires individual clinician and organizational management buy-in that sleep is a practice quality indicator that must be prioritized. Best practices and working patterns that require review and risk management (Figure 1) have been defined in other industries. Scientific evidence informing design of safe and effective workplace practices has grown substantially in recent years, and global methods have evolved.[6,9,79,98] Cultural change has already occurred in aviation and other industries; once the concept of appropriate rest as an occupational imperative becomes normalized, the system demonstrably adapts.

We do not minimize the impacts of altered practice logistics on staffing, budgets and training, and in the face of cost of care concerns, practice economic impacts, and staffing shortages, solutions are neither simple nor universal. However, while there are strong economic and practical arguments for long duty hours, work

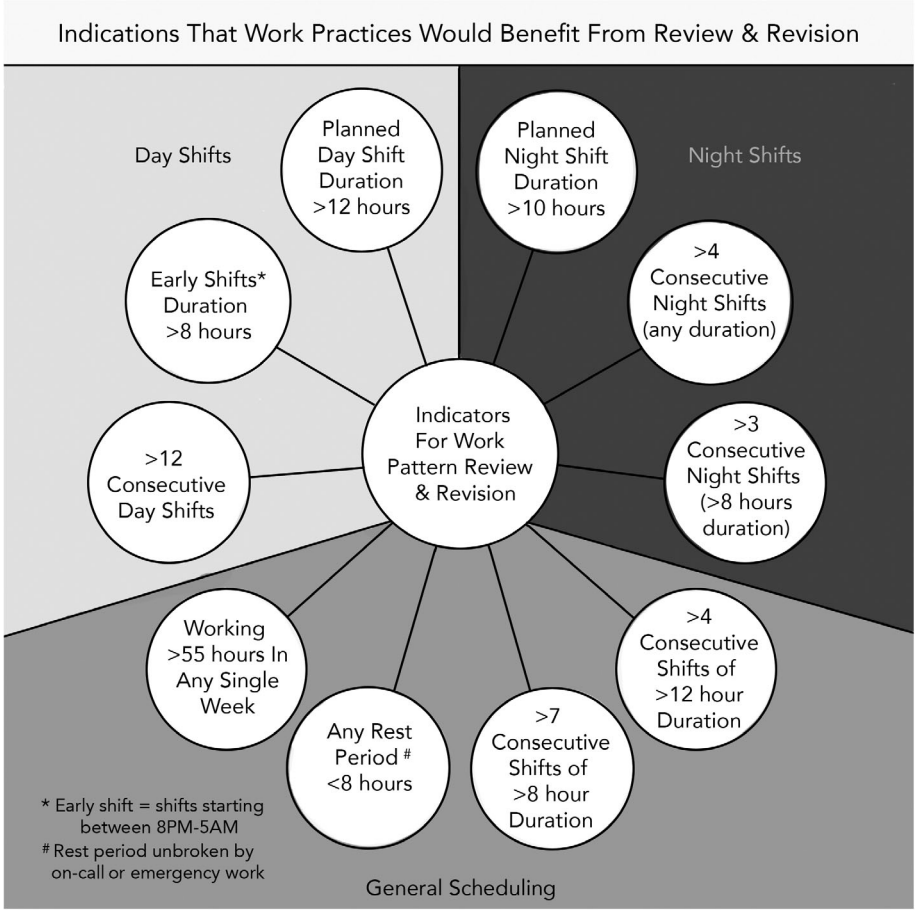

FIGURE 1 Indicators in the rail industry that schedules or working patterns need review and risk management adjustment. Adapted from information provided by Folkard et al.[44]

compression, and limited personal time off as solutions for veterinary surgery practice challenges, the preponderance of scientific evidence does not support such allowances.[83] If adequate clinician rest cannot be accommodated, whether it be in a private or academic setting, this is an unambiguous indicator that the existing practice model of veterinary medicine is fundamentally flawed. Regardless of historical norms within veterinary surgery, evidence should be used to inform creative reassessment of scheduling and coverage while also addressing the integrity and feasibility of workplace operations.[6,9,98] For example, practices that do not have a heavy after-hours caseload sufficient to justify increased staffing and shift assignment, might wish to consider regional multi-practice affiliations for the purpose of after-hours caseload coverage. This would permit aggregation of emergency caseload and resources in order to permit shift assignment of participating veterinarians and support staff, rather than each practice chronically maintaining its own individualized on-call coverage. Anecdotally, there have been increasing numbers of small animal veterinary surgeons who elect mobile surgical practice instead of traditional practice, and a desire to avoid traditional on-call structures and unstructured/unlimited after-hours care responsibilities may be one contributing factor driving this shift. This has the unintended impact, however, of placing increasing after-hours burdens on those who remain in centers that offer 24-hour care.

7 | CONCLUSION

The veterinary profession should recognize the impact of fatigue-related impairments as a management rather than a personal issue, especially in predisposed sectors, such as emergency care and surgery. This step is crucial to enhance patient safety because self-assessments of fatigue and performance are demonstrably as unreliable as those done under the influence of alcohol. This limitation justifies the establishment of professional guidelines and policies to replace self-policing of fatigue. Such restriction would likely be supported by the general public, as a 2016 poll found that across bipartisan lines, 80%–86% of the population opposed physicians working more than 16 hours/shift, regardless of training level.[99] Extrapolating regulations from human to veterinary medicine is complicated by a different economic landscape, shortages in workforce, management styles, and cultural barriers. While solutions may not be quick or simple, attention to the problem and generation of evidence to guide work practices in veterinary surgery are crucial steps in enhancing patient care and mitigating professional stress and burnout.

AUTHOR CONTRIBUTIONS

Steffey MA, DVM, DACVS-SA: Contributed to conception and design, data acquisition, analysis & interpretation, manuscript preparation, and approved the final version of the manuscript. Risselada M, DVM, PhD, DECVS, DACVS-SA: Contributed to analysis and interpretation, manuscript preparation, and approved the final version of the manuscript. Buote NJ, DVM, DACVS-SA: Contributed to analysis and interpretation, manuscript preparation, and approved the final version of the manuscript. Scharf VF, DVM, DACVS-SA: Contributed to analysis and interpretation, manuscript preparation, and approved the final version of the manuscript. Winter AL, BVSc, DACVS: Contributed to analysis and interpretation, manuscript preparation, and approved the final version of the manuscript. Zamprogno H, DVM, MS, PhD, DACVS-SA, DECVS: Contributed to analysis and interpretation, manuscript preparation, and approved the final version of the manuscript. Griffon D, DVM, PhD, DECVS, DACVS: Contributed to analysis and interpretation, manuscript preparation, edited the draft, and approved the final version of the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this report.

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