

QUALITY AND PATIENT SAFETY

Effects of fatigue on anaesthetist well-being and patient safety: a narrative review

Mariachiara Ippolito^{1,2} , Sharon Einav^{3,4} , Antonino Giarratano^{1,2} and Andrea Cortegiani^{1,2,*} 

¹Department of Precision Medicine in Medical, Surgical and Critical Care (Me.Pre.C.C.), University of Palermo, Palermo, Italy, ²Department of Anaesthesia Intensive Care and Emergency, University Hospital Policlinico 'Paolo Giaccone', Palermo, Italy, ³Maccabi Healthcare Services Regional Director Hod HaSharon, Jerusalem, Israel and ⁴Hebrew University Faculty of Medicine, Jerusalem, Israel

*Corresponding author. E-mail: andrea.cortegiani@unipa.it

Summary

The elements that render anaesthesia a captivating profession can also foster stress and fatigue. Professionals considering anaesthesia as a career choice should have a comprehensive understanding of the negative consequences of fatigue and its implications for clinical performance and of the available preventive measures. Available evidence suggests that factors unrelated to patient characteristics or condition can affect clinical outcomes where anaesthetists are involved. Workload, nighttime work, and fatigue are persistent issues in anaesthesia and are perceived as presenting greater perioperative risks to patients. Fatigue seems to negatively affect both physical and mental health of anaesthetists. Existing evidence justifies specific interventions by institutions, stakeholders, and scientific societies to address the effects of anaesthetist fatigue. This narrative review summarises current knowledge regarding the effects of fatigue on anaesthetist well-being and patient safety, and discusses potential preventive solutions.

Keywords: anaesthesia; fatigue; nighttime work; well-being

Editor's key points

- Fatigue amongst healthcare staff is a known risk factor for poor outcomes, for both patients and staff members themselves.
- Addressing issues of fatigue amongst clinical staff working in complex healthcare systems remains challenging.
- The authors summarise existing evidence on this topic from the specific context of anaesthetists, and explore potential solutions.

Anaesthesia is a profession which combines efficient management of routine planned care and the need to recognise and manage quickly changing and sometimes complex clinical situations. It requires non-technical skills, multi-tasking, constant

vigilance, and preparedness, with the understanding that overnight shift work is inevitable at times. The appeal of a career in anaesthesia often lies in the practicalities of the approach towards patient management, in the stimulating nature of working with deranged pathophysiological conditions, and in the successful performance of complex procedures.¹

Yet, the very elements that render this profession captivating also foster stress and fatigue. Indeed, many anaesthetists report feeling fatigued.² The feeling of fatigue seems to hinge on an equilibrium between external factors (e.g. workload demands organisational culture, the presence of social support, societal expectations) and intrinsic factors (e.g. deriving a sense of purpose from work, personal ethics, and value judgements), and also on the degree of success in integrating one's work with personal life.³

In civil aviation, fatigue has been described as 'a physiological state of reduced mental or physical performance capability

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resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety-related duties'. In the setting of anaesthesia, fatigue seems related to working schedules. The repercussions of fatigue in the setting of anaesthesia extend also to the safety and quality of care delivered to the patient.⁴

The aim of this narrative review is to summarise current knowledge regarding the effects of fatigue on anaesthetist well-being and on patient safety. For this narrative review, a literature search was performed on PubMed using 'anaesthesiology' or 'anaesthetist' or 'anaesthesia' and 'fatigue' as key terms and the relevant records were narratively summarised by the authors.

Effects of provider fatigue on the patient

Whether a fatigued physician places their patient at risk is a question that seemingly remains unanswered. However, most providers feel the answer to this question is yes. Recently, nearly 6000 anaesthetists worldwide were asked 'Do you believe that your fatigue during night work may increase the peri-operative risk of your patients?'; 74% responded 'very much' or 'to some degree'. In the same study, 81% of the respondents agreed that 'Night work represents an additional risk per se for the patient'. Sleep deprivation was perceived as affecting professional performance 'extremely' or 'significantly' by 71% of the respondents.

Responses such as these suggest the presence of a strong perceived interconnection between fatigue, nighttime work, and sleep deprivation. These perceptions must be taken into consideration when interpreting clinical evidence related to nighttime perioperative activities.^{5–7}

Several studies have investigated the association between timing (i.e. day time vs nighttime) of clinical activities (e.g. surgery, ICU admission, extubation) and clinical outcomes.⁷ The results of these studies demonstrate that patient outcomes are worse from nighttime and out-of-hours surgery, but do not identify the causes of differences in clinical outcomes. The secondary analysis of the Las Vegas study showed that the incidence of important intraoperative adverse events was higher during nighttime surgery vs daytime surgery in unmatched analysis (43.6% vs 34.1%; $P < 0.001$) and after propensity score matching (43.7% vs 36.8%; $P = 0.029$).⁶ Nighttime surgery was associated with a higher risk of intraoperative adverse events (odds ratio [OR] 1.44; 95% confidence interval [CI] 1.09–1.90; $P = 0.01$) independent of patient characteristics, type of surgery, or type of anaesthesia.⁶ In a systematic review on the topic, meta-analysis of data from 18 studies and nearly 3 million patients⁵ revealed an association between night/after-hours surgery and a likelihood of death (OR 1.16; 95% CI 1.06–1.28; $P = 0.002$). Nearly all of the studies included in this meta-analysis adjusted their results for relevant surgical and patient characteristics and the authors pooled the best adjusted estimated from these studies. The authors concluded that surgical and patient characteristics do not fully explain the higher adjusted risk of death in patients undergoing surgery at night/after-hour. However, none of these studies collected data on operator performance or fatigue and the authors noted that the certainty of the evidence for this association remains low despite the large amount of research on the topic.⁵

Another meta-analysis investigated the risk associated with nighttime admission to ICUs. The likelihood of death was

similar in daytime vs nighttime admission to the ICU (OR 1.04 [0.98–1.11]; $P = 0.18$). However, ICU admission during the weekend was associated with a higher likelihood of death than ICU admission during weekdays (OR 1.05 [1.01–1.09]; $P = 0.006$). Differences in staffing were put forward as the potential cause for this finding.⁸ This body of evidence suggests that factors unrelated to patient characteristics or condition may also affect clinical outcomes where anaesthetists are involved.

When asked open-ended questions, anaesthetists anonymously shared that when they are fatigued, they are more likely to deliver rushed, disorganised, and incomplete handovers, and that their team dynamics and communication also suffer. These interviews were often accompanied by examples of real events,⁹ but although the anaesthetists recognised that they are fatigued, they did not identify clear relationships between patient harm and their tiredness in their interviews.⁹ An individual clinician may adopt strategies intended to buffer the effects of fatigue (e.g. spending more time on monitoring tasks during cases when fatigued or adjusting workload distribution), the degree to which such strategies affect outcomes remains unmeasured.¹⁰

Magnitude of fatigue-related issues in anaesthesia

Anaesthetists are expected to work long day and night shifts. An integral part of the work of an anaesthetist is the management of emergencies (e.g. emergency surgeries, intra-hospital emergencies, critically ill patients) and the provision of services that require constant availability (e.g. transplantations). Regular work that requires constantly changing irregular schedules, long shifts, or on-call duties has raised interest related to occupational well-being and the risk of fatigue over the last decades. Gravenstein and colleagues¹¹ pioneered the investigation of desirable vs existing work patterns in anaesthesia with a cross-sectional study conducted with the support of ASA which was published in 1990. The study surveyed fatigue, existing and desirable work, and rest patterns of anaesthetists, residents in anaesthesia, and anaesthesia nurses using a 10-question survey. The surveyed participants described a mean work-week of 47.5 h (nurses) to 69.8 h (residents). A substantial number of respondents believed that they worked at least occasionally beyond their perceived self-limitations, thus describing the condition known today as *fatigue*. The participants declared that the number of hours they would consider safe for administering anaesthesia without breaks was well below the number of hours they usually spent working without breaks. Almost all the respondents (94%), including anaesthesia physicians, residents, and nurses, declared that their institution applied no formal limits to the number of hours to be worked per day or per week. Since 1990, several changes have occurred in occupational laws worldwide, but the problem still exists. The 2016 Australian Medical Association Safe Audit showed that 75% of intensivists and 31% of anaesthetists have workloads that place them at a significant/high risk of fatigue.¹²

Many European countries have adopted the European Working Time Directive (Directive 2003/88/EC) that imposes a 48-h limits on the maximum weekly working time and a minimum daily period of rest of 11 consecutive h per each 24-h period. Yet, recent studies have identified that workload and fatigue remain persistent issues in anaesthesia. In a national survey conducted in Ireland and the UK on out-of-hours

working and fatigue in anaesthesia and paediatric intensive care, only 15% of the respondents reported constantly having 11 h of rest between their on-call and their next clinical duty, and only 24% described no arrangement for scheduled clinical duties after a night on-call if they had been in the hospital overnight. Unsurprisingly, overall, 91% of the surveyed consultants reported work-related fatigue.¹³ McClelland and colleagues¹⁴ also surveyed anaesthetists in training in the UK, identifying night shifts as the main cause of reported fatigue. Scientific societies have recently promoted cross-sectional studies and surveys to further investigate the issue. In a study conducted with the support of the European Society of Anaesthesiology and Intensive Care (ESAIC) and the European Board of Anaesthesiology (EBA), 91.6% of the 1508 surveyed anaesthetists (from 32 European countries) described work-related fatigue.¹⁵

Fatigue in anaesthesia was perceived to be related to shift work, clinical and non-clinical workloads, staffing issues, and excessive work hours. Another survey conducted with the support of ESAIC (nearly 6000 respondents) focused on peri-operative nighttime work and reported a median of 4 (inter-quartile range [IQR] 3–6) monthly night shifts and a high prevalence of irregular night shift schedules. Almost half of the respondents (47%) declared that they always work overnight after a full day's work, and 40% declared that their median shift duration when working nighttime is 24 h.¹⁶ A single-centre study also reported that anaesthesia trainees at a typical major metropolitan teaching hospital in Australia were awake for more than 20 h by the conclusion of their first night shift. Using the Karolinska Sleepiness Scale, these authors also showed that by the end of any single night shift these trainees were significantly affected by fatigue.¹⁷

Effects of provider fatigue on the anaesthetist

Fatigue negatively affects both physical and mental health. In one study, more than 70% of the surveyed anaesthetists reported negative effects of work-related fatigue on their physical and mental health, emotional well-being, and safe commuting.¹⁵ In an earlier study, trainees reported that fatigue interferes with both their professional and personal lives (68%), has negative effects on their physical health (74%) and psychological well-being (71%), and ultimately impairs their ability to function properly.¹⁴ Another, more recent, European study on both consultants and trainees showed that around 60% of the respondents perceive a significant negative impact of nighttime work on their own quality of life.¹⁸ Fatigue stemming from a high workload and nighttime work implies disruption of the circadian rhythm. The effect of cumulative sleep deprivation and shift work seems to increase the risk of cardiovascular diseases, promote inflammation, oncogenesis, and immunosuppression.¹⁹ Thus, the risk of developing various chronic medical conditions have been shown to be higher among night shift workers than among workers 'never exposed to shift work' or working 'regular day shift'.¹⁹ Drivers with sleep disorders, including shift work sleep disorders, have been described as at risk for crash or near-crash events.^{20,21} An old hospital-based survey showed also that nurses working shifts, including night shift, had a higher risk of nodding off while driving to or from work and were more likely to report accidents than nurses who worked day/evening shifts only.²² Such risk has been recently

highlighted in public campaigns for anaesthetists (e.g. Fight Fatigue).

There may be a relationship between tiredness, chronic fatigue, and exhaustion. Medical professionals suffer from tiredness after work, but this can be effectively relieved by resting. However, a maladaptive response to chronic tiredness can lead to fatigue and exhaustion. An inadequate response to tiredness can, over time, lead to fatigue, and chronic fatigue can itself lead to a level of exhaustion which can make it difficult to respond to stressors. Burnout comprises the triad of exhaustion, depersonalisation, and lack of job satisfaction, and the relationship between fatigue and burnout is complex.³ Among 3898 anaesthetists members of the ASA who were recently surveyed, 59.2% were at high risk of burnout, and 13.8% met the Maslach Burnout Inventory–Human Services Survey criteria for burnout syndrome.²³ Multivariable analysis identified a perceived lack of support at work (OR 6.7; 95% CI 5.3–8.5) and working ≥ 40 h per week (OR 2.22; 95% CI 1.80–2.75) as factors associated with a higher risk of burnout. Perceived lack of support at work (OR 10.0; 95% CI 5.4–18.3) and home (OR 2.13; 95% CI 1.69–2.69) were most strongly associated with burnout syndrome. The role of nighttime work on anaesthesiologists' quality of life has also been recently investigated in an international survey. Overall, 77% of the respondents rated the impact of their nighttime work on the quality of their daily life as extreme or significant.¹⁶

Additional studies have examined the prevalence and possible causes of burnout syndrome among anaesthesia practitioners.^{23–26} The COVID-19 pandemic increased interest in the topic when it became evident that self-care should not be considered an optional luxury for anaesthetists, who are expected to give more, rather than less, of themselves during crises.^{27,28} Campaigns are already being used to raise both public and professional awareness to fatigue. These campaigns also suggest tools for identifying fatigue specifically among anaesthetists. *Fight Fatigue* is one such example. *HALT: take a break* is another campaign which emphasises the need for regular work breaks if delivery of safe, effective, and efficient care is to be achieved.^{28,29} Breaks during shift work are not a luxury, but they are pivotal to protect patients, as the need for rest can also be accompanied by irritability, fatigue, pain, and impaired reasoning.²⁸

The impact of fatigue, exhaustion, and burnout remains challenging to measure. Recent evidence suggests a relationship between physicians' 'intention-to-leave' and professional fulfilment. More than 18 000 physicians in the USA were asked to indicate the likelihood of leaving their current institution within 2 yr, with five-point Likert scale response options from 'none' to 'definitely'. Among all the medical specialties, anaesthetists had the highest rate of intention-to-leave their current institution (46.8%, 95% CI 42.5–51.0%).³⁰ Among the anaesthetists who responded to the survey, 43% also met the professional fulfilment and burnout criteria for burnout syndrome, and only 34% met criteria for professional fulfilment. Multivariate analysis of factors associated with a lower intention-to-leave (after adjusting for demographic characteristics, burnout, and professional fulfilment) identified these to be supportive leadership behaviours, peer support, personal–organisational values alignment, perceived gratitude, COVID-19 organisational support, and electronic health record helpfulness.

Table 1 Examples and characteristics of commonly available tools to monitor fatigue and sleepiness and the population they were applied to.

Name	Tool	Description	Original population
Fatigue Severity Scale of Sleep Disorders	Nine-items seven-point Likert scale, with worst case associated to higher points	Measures the impact of fatigue on motivation, exercise, physical functioning, carrying out duties, work, family, or social life, independent of self-reported depressive symptoms	Multiple sclerosis and systemic lupus erythematosus but also used for chronic fatigue syndrome
Australian Medical Association Fatigue Risk Assessment Tool	7-day online tool with a points-based calculation scoring. Points are added or subtracted based on duration of shifts, work breaks taken during shifts, on-call commitments, presence/absence of full days off in a week, and presence/absence of break between shifts of less than 10 h. Points are weighted for hours worked at night and based on work schedules in the previous and forthcoming week.	The tool allows to classify doctors into three different risk levels—lower, significant, and higher—to determine their risk of fatigue, more than a precise measurement of fatigue	Doctors, both hospital-based (including anaesthesiologists and intensivists) and general practitioners
Karolinska Sleepiness Scale (KSS)	Nine-point self-reported scale with worst case associated to higher points	The tool measures the level of situational sleepiness. Not sensitive for sleepiness as general trait.	Healthy female subjects
Sleep, Activity, Fatigue, and Task Effectiveness for Aviation (SAFTE)	SAFTE is a mathematical complex model composed of different interactive factors, including sleep history, circadian factors, and sleep inertia	The model predicts an individual's risk of fatigue and performance effectiveness level, and provides data on how much critical duty time is spent at low effectiveness	US Army and Aviation
Epworth Sleepiness Scale	ESS is a self-administered questionnaire with eight questions assessed with a four-point scale. The higher the ESS score, the higher sleepiness in daily life	The tool evaluates the excessive daytime sleepiness	General healthy population, patients with narcolepsy or chronic obstructive pulmonary disease
Samn–Perelli fatigue Scale (SPS)	Seven-points subjective scale ranging from 1 ('fully alert, wide awake') to 7 ('completely exhausted, unable to function effectively')	It assesses alertness and fatigue, identifying 'Fatigue Class II' for scores from 5 to 6 and 'Fatigue Class I' for scores of 7	Aircraft pilots

Monitoring of fatigue and implementation of preventive measures

Several studies have recently reported concerning findings related to a consistent lack of institutional monitoring, training, and education of physicians regarding fatigue and nighttime work in anaesthesia. Survey respondents generally did not feel supported by their institutions¹⁵ and almost none declared their workplace has a programme to monitor stress or fatigue.¹⁶ Because identifying fatigue is clinically challenging, there is justification for regular use of validated monitoring tools to identify when staff are fatigued.³¹ Drowsiness can similarly be monitored using a variety of scales. **Table 1** presents a list of these tools with their characteristics.

Implementation of preventive measures is even more difficult than monitoring fatigue. At the individual level, measures exist to cope with fatigue. Indeed, there is evidence that power naps of brief duration (i.e. 30 min at 04:00) may be useful to preserve performance and reduce sleepiness during a long night shift^{32–35} and may also prevent circadian rhythm disruption and heart rate alterations.^{34,36} However, self-care cannot be implemented without institutional and team support. Eating healthily and staying hydrated³⁷ is only possible with access to appropriate nutrition and water. Power naps

can be taken only during allowed work breaks. Excessive use of caffeine should be avoided rather than encouraged, despite the challenge of remaining vigilant to meet work requirements. The use of public transportation to avoid involvement in motor vehicle accidents when returning home after a night shift is only possible if public transportation exists.^{37–40}

Education on the risks of fatigue, chronic occupational stress, and burnout should be provided early during any anaesthesia career (i.e. before or during the first year of residency), as recently stated by an ESAIC consensus document on sustainability and well-being.³⁹ Alongside their developing competencies, technical and non-technical abilities, and levels of responsibility, young anaesthetists should also develop a constructive mentality towards prevention, identification, and management of fatigue. Anaesthesia training should include training in assessment of fatigue, and early recognition of cognitive impairment and reduced performance.³⁹ The first step in the prevention of mistakes can be to unashamedly offer or request double checking of clinical decisions to a colleague and refusal to collude with a demand to create an illusion of perfect performance.

Anaesthetists themselves may also provide interesting opinions and proposals to solve or alleviate the burden of nighttime work and fatigue in their institutions. Such

proposals, when identified in surveys of anaesthetists, have included organisational level ideas such as adherence to the provision of emergency services only during night shifts (e.g. life- and limb-saving surgeries)² and avoiding elective activity, implementation of existing legislation on rest periods and the allowable number of work hours, and increasing resource availability, including adequate rest facilities, food, and drink. Although these 'demands' may seem costly, the price of such resources is negligible when compared with a single mismanagement lawsuit. In some countries, medical insurance companies could stipulate that the institutions they recommend to patients, provide evidence that they use good Fatigue Risk Management Systems (FRMS) and processes. Finally, the daily anaesthesia workload (including introduction of fixed breaks) should perhaps be more carefully considered and wisely distributed.²

At an organisational and team level, the very first step towards making a meaningful change should be promotion of a shared 'no-blame' culture and a policy of non-criticism with regards to the need to rest.³⁹ The choice to temporarily postpone a high-risk procedure should also be acceptable when the anaesthetist that is expected to manage the case has worked a lengthy period of time or is clearly fatigued. At the team level, all members of all working teams should be aware that communication, mood, and teamwork deteriorate most when people are sleep deprived or fatigued. Adoption of specific communication techniques (e.g. closed-loop communication) is also highly advisable.³ Conducting a periodic fatigue-check of teammates can be established as common practice.

However, the most important level of implementation remains institutional. Hospital administrators need to adopt structured systems for monitoring and managing fatigue, such as FRMS.³⁹ These systems have been defined as '*data driven and scientifically based processes that allow for continuous monitoring and management of safety risks associated with fatigue-related error*'. FRMS should be adopted by institutions as part of their safety enhancement programme, despite such adoption requires long-lasting institutional efforts.³¹ Overall, leaders and institutions have a duty to care for their employees, and this duty has been formalised in employment legislation. This duty should include assurance of employees' safety and well-being, and mitigating the impacts of fatigue should not be put aside.

Examples exist, such as the Queensland Hospital and Health Service, where an active and prolonged commitment has led to the implementation of the Queensland Health's Health Safety and Wellbeing Management System.⁴¹ The Queensland system is based on six data-driven elements to monitor and manage fatigue-related risks (i.e. governance structure with establishment of local working groups, planning processes, FRMS, incident management, monitoring and assurance, and safety promotion). The Defence in Depth model has been selected within this framework to detect and provide actions to counteract fatigue-related risks at several levels: (1) predictive process (i.e. sleep opportunities assessment), (2) proactive processes (i.e. assess individual level of fatigue and respond to symptoms), and (3) reactive processes (i.e. investigating incidents while developing an error-tolerant system).⁴¹

Canada has also issued evidence-based recommendations for FRMS in Emergency Medical Services.⁴² However, the implementation of FRMS in the pre-hospital setting may encounter obstacles. Reports showed that although frontline personnel understand the potential fatigue-related risks, the use of risk assessment tools remained informal, and education

was essential for creating motivation to support the implementation of FRMS.⁴³ Monitoring is the first step in both the design of preventive measures and requires staff education about fatigue. This is true with regards to the monitoring of clinical events in which fatigue might have played a role, and with regards to the monitoring of staff self-reported levels of fatigue before, during, and after shifts.

New approaches to fatigue

A paradigm shift is ongoing, from an era of neglecting work-related fatigue to an era of awareness. Professionals should no longer be expected to behave like deities or heroes at work, but rather to act as a community of humans.^{44–46}

The past 'era of distress'⁴⁶ was characterised by a lack of awareness, deliberate neglect of physician distress, long shift hours as a 'rite of passage', and medical errors seen as the fault of the individual clinician. Alongside the lack of a *no-blame culture*, anaesthetists believed they must work hard, learn fast, and *never let them see you sweat*.^{44,46} This work culture considered self-meaning at work as only powered by countable achievements and failure was perceived as unacceptable even at the earliest stage of careers.⁴⁷

The most common mindset was that the physician must be perfect and everything must be under their control. Physicians should also be 'indefatigable', with innate characteristics which render them immune to the effects of fatigue.⁹ Such beliefs delegitimised suffering from fatigue and undermined sincere team efforts to deal with the problem.⁹ This precise approach has also been described as preventing recognition of clinical near misses, thereby also suppressing opportunities for learning, education, and practice improvement.⁹ A subsequent era has been described as characterised by awareness, but still was focused on individuals. This era is actually the current era in many countries. The transition to this era is reflected in the results of surveys which highlight the individual perceptions and opinions of anaesthetists on fatigue, well-being, and patient safety.^{2,15,16} The ability to react to stressors in a manner that prevents negative outcomes is now perceived not as an innate trait but as a skill that may be actively learned and honed at the individual level, with focus on competency-based frameworks.⁴⁶

A shift towards a more constructive approach to preventing fatigue is reflected in the work of several vanguard institutions. It is currently limited to some countries, wherein the fundamental importance of physician well-being to healthcare delivery and the profound impact that work characteristics have on well-being has been recognised. In this soon-to-be future, the focus has moved away from individuals towards systems and processes. Relationships between teams and leaders, and attention to appropriate staffing and work conditions are regarded as a joint responsibility of physicians and administrators.⁴⁶

Conclusions

Fatigue may pose important risks for both anaesthetists and their patients. Existing evidence already justifies rapid intervention to address fatigue amongst anaesthetist by institutions, stakeholders, and scientific societies. Several research gaps must also be addressed. Future investigation of the possible association between provider fatigue and patient safety holds a real challenge. Despite the complexity of prospectively researching the intertwined associations between

physician self-reported fatigue, fatigue mitigation measures, and patient-centred clinical outcomes, the authors believe such research can and should be performed.

Authors' contributions

Study conception and design: all authors

Data acquisition and interpretation: all authors

Manuscript drafting and critical revision for important intellectual content: all authors

Final approval of the version to be published: all authors

All the authors agree to be accountable for all aspects of the work, thereby ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Declaration of interest

The authors declare no conflicts of interest.

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