

**Review****DEHYDRATION AS AN OVERLOOKED SAFETY RISK IN THE PERIOPERATIVE ENVIRONMENT: PHYSIOLOGICAL, COGNITIVE AND ORGANIZATIONAL IMPLICATIONS FOR HEALTHCARE PROFESSIONALS****Valentina Ješić, Sabina Babić****Sestre milosrdnice University Hospital Center, Zagreb, Croatia****Received:** November 29, 2025; **Revised:** May 4, 2026; **Accepted:** May 9, 2026**Published:** May 18, 2026**DOI:** 10.5937/annnur4-63113**Abstract**

Dehydration remains one of the most overlooked occupational risks in the perioperative environment, despite its substantial influence on cognitive performance, physiological stability, and clinical safety. Operating rooms are characterized by low ambient humidity, intense cognitive load, prolonged standing, and restrictive protective clothing, all of which accelerate insensible fluid loss while simultaneously suppressing the perception of thirst. As a result, clinicians frequently experience gradual dehydration without recognizing its early symptoms, which are often misattributed to fatigue or stress. Even mild fluid deficits can impair cerebral oxygenation, slow neural processing, reduce attention, and diminish psychomotor precision, thereby increasing the likelihood of clinical errors in time-sensitive situations. More pronounced dehydration exacerbates cardiovascular strain, thermoregulatory imbalance, mucosal dryness, and musculoskeletal fatigue, all of which compromise endurance, communication, and team coordination during complex procedures. Emotional stability is also affected, with heightened irritability and reduced tolerance to stress further undermining teamwork. Despite these well-documented effects, hydration status is not routinely monitored in perioperative safety protocols, reflecting a systemic underestimation of basic physiological needs within a culture that often valorizes endurance over self-care. Addressing this gap requires organizational measures such as establishing accessible hydration stations, integrating micro-breaks into workflow planning, providing targeted staff education, and incorporating hydration checks into safety checklists. Recognizing dehydration as a legitimate component of perioperative safety is essential for protecting both staff well-being and patient outcomes. By fostering a culture that acknowledges physiological stability as a prerequisite for clinical excellence, healthcare institutions can reduce avoidable risks and strengthen the resilience of perioperative teams.

**Keywords:** dehydration, operating rooms, cognitive function, occupational health

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**Key messages:**

1. Even mild dehydration in the perioperative staff impairs attention and reaction time.
2. Dehydration is not routinely monitored in the perioperative safety protocols.
3. Simple organizational measures can significantly reduce dehydration-related risks.

**Introduction**

The perioperative environment represents one of the most demanding workplaces within the healthcare system, characterized by high technical complexity, intense procedural dynamics, and the necessity for flawless interdisciplinary coordination.<sup>1</sup> In such settings, every member of the surgical team must maintain sustained concentration, precision, and psychophysiological stability, as even minor errors may result in serious consequences for patient safety.<sup>2</sup> Although numerous factors influencing safety and work performance have been extensively investigated and incorporated into standard perioperative protocols—including infection prevention, microclimate regulation, ergonomics, and team communication—one fundamental physiological factor remains largely overlooked: the hydration status of healthcare professionals.<sup>3-7</sup>

Dehydration develops gradually and often imperceptibly, yet it can substantially impair cognitive performance, psychomotor function, and decision-making capacity, thereby increasing the likelihood of errors during perioperative work.<sup>3-7</sup> Its significance is

frequently underestimated in operating rooms because the early manifestations of dehydration—such as fatigue, reduced alertness, headache, irritability, and impaired concentration—closely resemble common symptoms associated with stress and workload, making timely recognition difficult.<sup>3</sup> Furthermore, perioperative personnel are routinely exposed to environmental and occupational conditions that promote fluid loss, including low ambient temperatures, extremely low humidity, prolonged standing, and multilayered protective clothing.<sup>8</sup> At the same time, opportunities for regular fluid intake are often limited during lengthy procedures. Studies have shown that many physicians and nurses intentionally avoid drinking fluids during operations because they perceive breaks as disruptive to workflow or as an additional burden on colleagues.<sup>9-11</sup>

Such a culture of endurance may gradually contribute to physiological strain, reduced work efficiency, impaired well-being, and diminished cognitive resilience among healthcare professionals, ultimately posing an indirect threat to patient safety. In light of these concerns, this paper aims to examine dehydration as a significant yet insufficiently

recognized occupational and patient-safety issue in perioperative care. It further seeks to explain the physiological and cognitive mechanisms through which dehydration affects healthcare professionals and to discuss organizational strategies that may reduce this pervasive but often invisible risk.

*Dehydration in the Perioperative Environment:  
A Hidden Risk and Its Specific Features*

Dehydration in the operating room results not only from inadequate fluid intake but also from the distinctive environmental and organisational characteristics of perioperative work that accelerate fluid loss while simultaneously reducing the perception of thirst. Protective garments, particularly during complex or prolonged procedures, create a microclimatic layer around the body that increases perspiration despite the relatively low ambient temperature.<sup>12</sup> Consequently, healthcare professionals may remain unaware of ongoing fluid loss because of cooler air temperatures diminish the sensation of heat and suppress physiological thirst signals. In addition, operating rooms are typically maintained at very low relative humidity levels, which further enhance evaporative fluid loss, contribute to mucosal dryness, and increase the body's physiological demand for hydration, even when this need is not consciously perceived.<sup>13</sup>

Simultaneously, perioperative teams often operate within a professional culture in which hydration and rest breaks are not regarded as priorities. Many clinicians intentionally avoid fluid intake in order to prevent the need to

leave the operating room during procedures. Such behaviour is frequently interpreted as a sign of professionalism, dedication, and endurance; however, it may in fact contribute to cumulative physiological strain, reduced functional capacity, and impaired occupational performance. During lengthy surgical procedures, emergency interventions, or situations involving high cognitive demand, dehydration can therefore become an invisible occupational hazard that frequently remains unrecognized until performance has already deteriorated.<sup>6</sup>

Despite these risks, hydration status is rarely incorporated into standard perioperative safety protocols. While sophisticated monitoring systems routinely assess parameters such as ambient temperature, airflow, sterility, and ventilation, the fundamental physiological needs of healthcare personnel are seldom considered relevant to patient safety.<sup>14</sup> This imbalance reflects a broader systemic neglect of occupational well-being and highlights the need to redefine perioperative safety frameworks in a manner that explicitly recognizes the healthcare professional as a critical component of the overall safety system.

## **Materials and Methods**

This manuscript was designed as a narrative review aimed at synthesizing current scientific and clinical evidence regarding dehydration-related risks in perioperative environments. Relevant literature was identified through searches of the PubMed, ScienceDirect, and

Google Scholar databases using combinations of keywords related to dehydration,

Hydration status, cognitive performance, occupational physiology, surgical staff, and perioperative safety.

The review primarily included peer-reviewed articles published between 2010 and 2025, with particular emphasis placed on high-quality clinical, experimental, observational, and cohort studies relevant to healthcare professionals working in perioperative settings. Additional references of historical or conceptual importance were included when necessary to provide broader context. Studies addressing the physiological, cognitive, behavioral, and occupational effects of dehydration, as well as organizational aspects of hydration management in healthcare environments, were preferentially considered.

## Results and Discussion

### *Dehydration in the perioperative environment: specific features*

Although dehydration develops gradually, several early manifestations can be recognized and addressed before significant physiological impairment occurs. The most common symptoms include dry mouth, mild headache, fatigue, a sensation of heaviness in the legs, reduced skin turgor, blurred vision, and transient episodes of impaired concentration.<sup>15</sup> In perioperative settings, healthcare professionals frequently attribute these symptoms to fatigue, stress, or workload, despite the fact that they may represent early physiological indicators of fluid deficit.

Failure to recognize these warning signs may contribute to progressive dehydration and subsequent deterioration in cognitive and functional performance. Therefore, systematic education aimed at improving awareness and early recognition of dehydration-related symptoms could play an important role in reducing occupational strain and supporting safer execution of clinical tasks.

### *Physiological Mechanisms of Dehydration and Their Clinical Implications for Staff*

Dehydration initiates a series of physiological changes that can directly impair the ability to perform precise, cognitively demanding, and physically sustained tasks required in perioperative care. Even mild fluid loss corresponding to approximately 1–2% of body mass may alter circulating blood volume and reduce tissue perfusion, thereby compromising oxygen delivery to the brain and peripheral tissues.<sup>16</sup> In response to this deficit, the body activates compensatory mechanisms such as increased heart rate and peripheral vasoconstriction in order to maintain circulatory stability.<sup>17</sup> These adaptive responses require additional physiological effort and may accelerate the onset of fatigue, particularly during prolonged procedures requiring sustained vigilance and rapid decision-making. Such effects may be especially critical for anesthesia personnel, who must continuously monitor patient status and remain prepared for immediate intervention.

In addition to circulatory alterations, dehydration significantly affects

thermoregulatory function. Although operating rooms are generally maintained at low ambient temperatures, multilayered protective garments and prolonged standing at the operating table create localized heat accumulation beneath the clothing. When fluid reserves are insufficient to support effective heat dissipation, healthcare professionals may experience exhaustion, headache, reduced alertness, and decreased motivation, all of which may negatively influence performance during lengthy surgical procedures.<sup>18</sup> Furthermore, dehydration contributes to mucosal dryness and irritation, resulting in symptoms such as dry eyes, throat discomfort, and hoarseness, which may impair verbal communication and intensify subjective fatigue.<sup>19</sup>

Reduced fluid availability also affects the musculoskeletal system by compromising muscular endurance, tissue elasticity, and neuromuscular function. As a consequence, dehydration increases the likelihood of muscle cramps, stiffness, and pain, particularly in the lower back and lower extremities.<sup>20</sup> These effects are especially relevant for perioperative nurses and surgical technicians who remain in fixed standing positions for extended periods while simultaneously performing precise fine-motor activities. In this context, dehydration should be regarded not only as a physiological disturbance but also as an important ergonomic and occupational health challenge within the perioperative environment.

### *Cognitive Effects of Dehydration and Their Implications for Patient Safety*

The cognitive consequences of dehydration may be even more significant than its physiological effects because they directly influence clinical judgment, reaction time, concentration, and team communication. Even mild dehydration has been associated with impaired attentional capacity, reduced working memory performance, and slower information-processing speed, all of which are critical in the dynamic and high-risk environment of the operating room.<sup>7,21</sup>

When the brain lacks sufficient fluid to maintain optimal neuronal function, neural signaling efficiency declines, leading to prolonged reaction times and delayed recognition of subtle clinical changes or monitor abnormalities.<sup>7,21</sup> In anesthetic practice, where rapid assessment and immediate intervention are essential, even minimal delays may contribute to serious complications or reduced patient safety. Dehydration also diminishes the ability to sustain focused attention over prolonged periods, thereby increasing susceptibility to brief lapses in concentration, missed alarms, and misinterpretation of clinical data.<sup>22</sup>

In addition to cognitive impairment, dehydration negatively affects emotional regulation and behavioural stability. Dehydrated individuals are more likely to experience irritability, reduced stress tolerance, mental fatigue, and impulsive reactions, factors that may compromise effective interpersonal communication within the

surgical team.<sup>16</sup> Since communication and coordinated teamwork represent fundamental components of perioperative safety, any disruption in these processes may increase the likelihood of adverse events and procedural errors. Consequently, dehydration should not be regarded solely as an individual physiological problem but rather as a broader occupational and patient-safety concern that may affect the overall reliability and performance of the perioperative team.

*Organizational and Safety Considerations:  
Why Dehydration Is Not Monitored and How  
to Address It*

One of the primary reasons dehydration is not systematically monitored lies in the predominant focus of safety protocols on technical and procedural factors. Safety is traditionally conceptualized through equipment, infrastructure, and technological safeguards, while the physiological state of healthcare personnel remains largely invisible within these frameworks.<sup>23</sup> However, modern safety paradigms, including high-reliability organizational models, emphasize that the human factor represents a central and indispensable component of the safety chain.

Addressing this oversight requires the implementation of several organizational measures: establishing short, pre-planned micro-breaks during which fluid intake is mandatory<sup>24</sup>

- positioning easily accessible hydration points outside the sterile field<sup>25</sup>
- providing education on the physiological and cognitive consequences of dehydration<sup>26</sup>
- integrating hydration status checks into safety checklists<sup>23</sup>
- fostering a professional culture in which maintaining one's physiological stability is regarded as an essential aspect of clinical responsibility<sup>26</sup>

These measures do not require substantial resources, yet they offer significant benefits for staff safety, well-being, and long-term operational sustainability. A summary of the key physiological, cognitive, and operational consequences associated with different levels of dehydration is presented in Table 1.

Table 1. Comparative overview of physiological, cognitive and operational effects of mild, moderate and severe dehydration in perioperative healthcare professionals

| Level of dehydration | Physiological effects                         | Cognitive effects                                   | Operational consequences                                       |
|----------------------|-----------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------|
| Mild (1–2%)          | Headache, mucosal dryness                     | Reduced attention, faster mental fatigue            | Slower response to parameter changes                           |
| Moderate (2–4%)      | Tachycardia, muscle cramps, reduced endurance | Impaired working memory, increased error propensity | Weaker team communication and higher risk of procedural lapses |
| Severe (>4%)         | Marked exhaustion, dizziness                  | Disorientation, impaired judgement                  | Potential inability to perform tasks safely                    |

Source: Adapted from Cheuvront and Kenefick<sup>27</sup>

### *Recommendations for Perioperative Practice*

An effective approach to preventing dehydration relies on clearly defined and easily implementable measures that can be seamlessly integrated into the daily workflow of the

operating team. The following key recommendations contribute both to staff wellbeing and to enhancing patient safety:

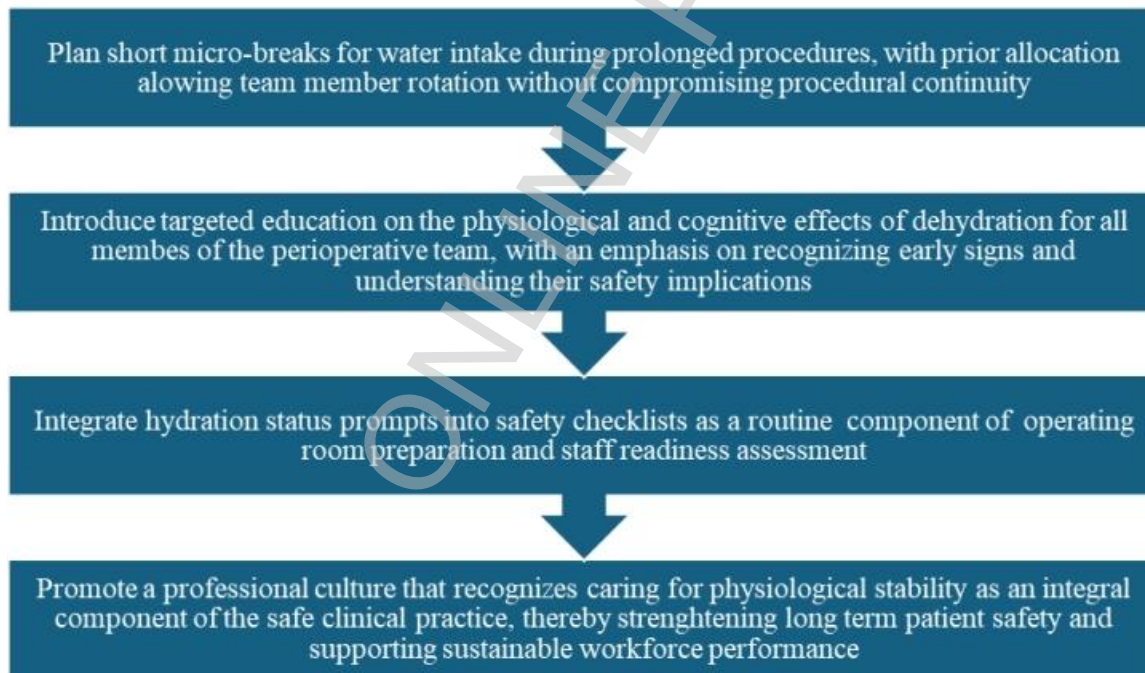


Figure 1. Organizational strategies to reduce dehydration-related risks among perioperative healthcare professionals

## Conclusion

Dehydration in the perioperative environment represents a significant yet persistently underestimated occupational and patient-safety risk that can adversely affect the physiological, cognitive, and emotional functioning of healthcare professionals. Although often perceived as a relatively minor issue, dehydration may have substantial consequences in clinical settings that require sustained precision, vigilance, rapid decision-making, and effective team communication. Even mild fluid deficits may impair concentration, reaction time, physical endurance, and behavioral stability, thereby increasing the likelihood of performance-related errors during perioperative care.

Recognizing, understanding, and preventing dehydration should therefore become an integral component of contemporary perioperative safety culture. Healthcare professionals are able to provide optimal patient care only when they themselves maintain adequate physiological stability, hydration, and cognitive readiness. Accordingly, hydration should not be viewed merely as a matter of personal comfort, but rather as an important determinant of occupational performance and patient safety.

Through the implementation of relatively simple organizational interventions, targeted educational initiatives, and the promotion of a professional culture that values physiological well-being alongside technical excellence, healthcare institutions may substantially reduce dehydration-related risks and strengthen the overall safety and resilience of perioperative practice.

## Conflict of Interest

The authors declare no conflict of interest.

## Ethical Declaration

N/A

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None

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