



REAL WORLD

PREPARING FOR EXTREMES: SPORTS SCIENCE CHALLENGES AND SOLUTIONS FOR THE 2026 WORLD CUP

Drs James Malone MCASES, Chris Carling and Prof. Peter Krstrup explore how the scale of the 2026 FIFA World Cup introduces new performance challenges, from extreme environmental conditions to extensive travel demands and how sport science support will be critical in helping teams prepare for and adapt to these pressures.

The 2026 FIFA World Cup will be the largest tournament in football history, expanding to 48 teams and hosted across three countries in North America. The geographical scale of the tournament means teams may encounter substantial variation in environmental conditions, long-distance travel and logistical complexity between matches.

Modern elite football already places significant physiological demands on players, with increased match intensity, greater high-speed running distances and congested competition schedules (Nassis *et al.*, 2020). Tournament environments amplify these demands further through short recovery windows, travel across time zones and heightened psychological pressure.

For sport and exercise scientists working with national teams, preparing for these extremes will require an integrated approach that combines

environmental preparation, recovery strategies, monitoring systems and close collaboration with coaching and medical staff.

ENVIRONMENTAL EXTREMES: HEAT, HUMIDITY AND ALTITUDE

The 2026 FIFA World Cup presents significant environmental challenges, with matches played across North America in conditions ranging from moderate to high heat and varying altitudes. Ambient temperatures between 21°C and 35°C are expected in several host cities, which may negatively impact both physical and technical performance, particularly during high-intensity phases of play.

Altitude is an additional consideration, particularly in Mexico City (~2,240 m). Previous World Cup data indicates reductions in total distance covered at moderate altitude compared to sea

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level, alongside potential impairments in repeated high-intensity efforts. These effects highlight the importance of appropriate acclimatisation strategies and careful management of training load in the lead-up to matches played at elevation.

Tournament structure may further exacerbate these challenges. Teams can play up to eight matches, including the possibility of extra-time in knockout fixtures. Extended match durations increase physiological strain, with evidence showing substantial muscle glycogen depletion and impaired physical and cognitive performance during extra-time (Mohr *et al.*, 2023).

These combined stressors place greater emphasis on recovery, squad rotation and in-game management. Practitioners must account for environmental conditions alongside match demands when planning across the tournament. Evidence from previous World Cups suggests that insufficient rotation can lead to declines in running performance in later knockout matches, whereas teams that effectively rotate players are better able to maintain high-intensity output and offensive effectiveness in the latter stages of the tournament.

In practice, interventions include heat acclimation strategies, scheduling training to avoid peak temperatures, and implementing individualised hydration and cooling protocols. For altitude, teams may consider early arrival or adjust pacing and substitution strategies to manage reduced high-intensity capacity.

TRAVEL LOAD AND CIRCADIAN DISRUPTION

Another defining challenge of the 2026 tournament will be travel. North America's geographical scale means teams may travel thousands of kilometres between matches, often crossing multiple time zones. Such travel can disrupt circadian rhythms, impair sleep quality and reduce recovery.

Sleep disruption following travel can influence cognitive performance, mood and physiological recovery processes. For players competing in high-pressure environments with limited recovery windows, reduced sleep quality may contribute to fatigue accumulation across the tournament.

Travel fatigue can also influence neuromuscular performance and decision-making during training and matches. Even when physical workloads are well managed, the cumulative impact of travel and sleep disturbance can

reduce readiness to perform. As elite football schedules continue to expand globally, managing these logistical and physiological demands has become an increasingly important component of performance preparation.

Sport science staff can mitigate these challenges through carefully planned travel strategies. Adjusting travel timing, managing light exposure and implementing sleep hygiene protocols are commonly used approaches to reduce circadian misalignment. Recovery strategies following travel may also include low-intensity physical activity, nutritional interventions and targeted sleep opportunities to facilitate adaptation to new time zones (Fullagar *et al.*, 2015).

PSYCHOLOGICAL AND COGNITIVE LOAD

Tournament football places unique psychological demands on players and staff. High expectations, global media attention and the knockout nature of the competition can create intense cognitive and emotional pressure.

Mental fatigue has been shown to influence decision-making, technical execution and physical performance in team sports. In football, where rapid perceptual and tactical decisions occur continuously throughout the match, cognitive fatigue may affect performance outcomes.

The tournament environment also introduces additional stressors such as unfamiliar surroundings, travel routines and reduced recovery time. These factors may contribute to cognitive overload, particularly in later stages of the tournament. As the physical and organisational complexity of elite football continues to increase, practitioners must consider not only physiological demands but also the cognitive and psychological stress placed on players and staff (Nassis *et al.*, 2020).

Sport science teams can support players by integrating psychological recovery strategies alongside physical recovery protocols. Simplifying tactical communication, managing information flow and creating consistent daily routines may help reduce cognitive load during the tournament.

Collaboration with sport psychologists can also provide players with tools to manage pressure and maintain focus in high-stakes matches.

DATA INTEGRATION AND DECISION-MAKING

Modern elite football generates vast quantities of monitoring data. During

international tournaments such as the FIFA World Cup, environmental sensors, GPS tracking, wellness questionnaires and sleep wearables can provide multiple concurrent data streams across a competition characterised by heat, altitude and significant travel demands. The challenge is not the absence of information, but its integration into timely and actionable decisions.

Teams therefore require clear workflows before the tournament begins. These should define what is measured, who is responsible for interpretation and which decisions the monitoring system is intended to support. Without this clarity, medical, performance and coaching staff may interpret the same data differently, leading to inconsistent decisions. In practice, data governance and shared frameworks can be as important as the monitoring technologies themselves.

Monitoring should focus on simple, robust measures that provide actionable insights into player readiness (Robertson *et al.*, 2017). Daily metrics such as body mass, hydration status and wellness questionnaires can offer a rapid overview of player condition, with additional measures such as heart-rate variability used selectively when needed.

Match data also requires careful interpretation. Players may maintain external load despite elevated internal stress, while reductions in high-intensity running may reflect tactical context rather than fatigue.

Ultimately, the challenge is not collecting more data, but making better use of a limited number of well-chosen metrics interpreted within each player's individual profile.

INTEGRATING PERFORMANCE, MEDICAL AND COACHING STAFF

Tournament environments require close collaboration between performance, medical and coaching staff, but effective integration depends on more than structure alone. Psychological safety is a key foundation, particularly in high-pressure settings where ego, power dynamics and reluctance to challenge decisions can undermine collaboration. Shared values are therefore not a cultural luxury but an operational requirement when decisions are time-critical.

Integration challenges may also begin before the tournament. Poorly coordinated handovers between club and national team environments can affect training adaptation and increase injury risk, making early communication with clubs an essential part of preparation.



Structural barriers within national teams can further complicate collaboration. Staff often operate within vertical disciplines, which may encourage departments to prioritise their own perspectives rather than shared objectives. Under tournament pressure, these tendencies can intensify, particularly when preparation time is limited and environmental demands are high. Clear prioritisation frameworks can help align decision-making across staff groups.

The consequences of poor communication are well established, with reduced player availability linked to ineffective collaboration between medical and coaching staff (Ekstrand *et al.*, 2019). In practice, short, structured daily briefings with predefined action thresholds can help maintain alignment and support timely decisions.

SUMMARY

The 2026 FIFA World Cup will present a unique combination of environmental, logistical and physiological challenges for teams and practitioners. Heat stress, altitude exposure, long-distance travel and congested match schedules may all influence player performance and recovery.

Sport and exercise scientists will play an essential role in preparing players for these demands. Effective strategies will require a combination of environmental preparation, travel management, monitoring systems and interdisciplinary collaboration.

Importantly, the goal of sport science in tournament settings is not simply to collect data but to translate evidence into practical decisions that support performance. By integrating physiological knowledge, monitoring technologies and collaborative decision-making processes, practitioners can help teams navigate the extremes of modern tournament football. ■



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REFERENCES

- Ekstrand, J. *et al.* (2019).** Communication quality between the medical team and the head coach/manager is associated with injury burden and player availability in elite football clubs. *British Journal of Sports Medicine*, 53, 304-308.
- Fullagar, H.H. *et al.* (2015).** Sleep and recovery in team sport: current sleep-related issues facing professional team-sport athletes. *International Journal of Sports Physiology and Performance*, 10, 950-957.
- Mohr, M. *et al.* (2023).** Extended match time exacerbates fatigue and impacts physiological responses in male soccer players. *Medicine & Science in Sports & Exercise*, 55, 80-92.
- Nassis, G.P. *et al.* (2020).** Elite football of 2030 will not be the same as that of 2020. *Scandinavian Journal of Medicine and Science in Sports*, 30, 962-964.
- Robertson, S., Bartlett, J.D., & Gastin, P.B. (2017).** Red, amber, or green? Athlete monitoring in team sport: the need for decision-support systems. *International Journal of Sports Physiology and Performance*, 12, S2-73.