

Mental health and neurodevelopmental factors relevant to recreational fitness-to-dive assessment: a structured review and clinical considerations

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Abstract

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Introduction: Mental health and neurodevelopmental factors, including psychiatric disorders and psychotropic medication use, are commonly identified during recreational diving medical screening. However, guidance for fitness-to-dive assessment in this context remains limited and often relies on diagnostic categories and theoretical risk, contributing to variability in clinical decision-making.

Methods: A structured review of the literature was conducted to identify evidence relevant to fitness-to-dive assessment where mental health and neurodevelopmental factors may be relevant. Searches of PubMed were supplemented by manual review of key references. Studies addressing cognitive function, behaviour, psychiatric stability, medication and substance effects and environmental influences in recreational diving were included and synthesised thematically.

Results: Twenty-nine studies were included. The evidence base was heterogeneous and comprised primarily observational studies, experimental research on cognitive performance under diving conditions and a smaller number of reviews and guidance-oriented publications. Across the literature, functional capacity, behavioural responses under stress and psychiatric stability emerged as central determinants of diving safety. Cognitive performance is reduced under diving conditions, suggesting limited cognitive reserve and increased vulnerability to impairment. Panic and maladaptive behavioural responses represent key pathways to adverse outcomes. Medication use alone is not a consistent predictor of risk, although side effects and periods of clinical instability are relevant. Environmental factors inherent to diving may further amplify underlying vulnerabilities.

Conclusions: Fitness-to-dive assessment in the context of mental health and neurodevelopmental factors cannot be determined by diagnosis alone. The available evidence supports a multidimensional, context-dependent approach incorporating functional capacity, behavioural reliability, psychiatric stability, medication effects and environmental demands. Assessment should be individualised and grounded in clinical judgement, recognising that risk is probabilistic rather than binary. These findings may support more consistent and clinically relevant decision-making in recreational diving.

Introduction

Medical fitness-to-dive assessments aim to identify health conditions that may increase the risk of injury, illness, or death in the underwater environment. Contemporary fitness-to-dive assessments are health risk assessments that aim to minimise medical risk rather than provide absolute certifications of safety.^{1–3} Scuba diving imposes distinctive physiological, cognitive and behavioural demands, requiring

emotional regulation, situational awareness, problem-solving and reliable behavioural responses under stress, including during emergencies.^{1,4,5}

While many physical risk factors in diving, such as pulmonary function, cardiovascular fitness, or seizure risk, can be assessed against physiological thresholds or defined markers of severity, psychiatric risk is more context-dependent and less readily quantifiable. Psychiatric disorders are heterogeneous, often fluctuate over time and may interact

with stress, cognition and behaviour in ways that are difficult to predict in dynamic environments such as diving.^{6,7}

Current approaches to fitness-to-dive assessment where mental health or neurodevelopmental factors may be relevant remain inconsistent. Diver medical screening processes routinely identify psychiatric diagnoses and psychotropic medication use as indications for further evaluation.^{2,3} However, clinicians often lack structured guidance on how to interpret psychiatric diagnoses, medication effects, functional impairment and symptom stability in relation to diving risk.^{8,9} Moreover, psychiatric diagnosis alone has limited predictive value for real-world functioning, as individuals with the same diagnosis may differ substantially in symptom severity, stability, insight and functional capacity.^{6,10}

This review focuses on fitness-to-dive assessments in recreational (no-decompression) compressed air diving, as distinct from occupational, military and technical diving where operational demands, training requirements and environmental exposures differ, limiting generalisability. Within this scope, the review considers mental health and neurodevelopmental factors relevant to fitness-to-dive assessments, encompassing psychiatric disorders, neurodevelopmental conditions and associated cognitive, behavioural and functional considerations.

Neurodevelopmental conditions warrant particular consideration due to their distinct developmental and neurocognitive characteristics. These conditions typically emerge in childhood and are characterised by enduring differences in attention, executive functioning, cognitive flexibility and behavioural regulation. This contrasts with many other psychiatric disorders, which may present with more episodic changes in mood, perception or behavioural control.^{11,12} Although these domains overlap with broader functional considerations relevant to diving safety, the implications for fitness-to-dive assessment may differ, with greater emphasis placed on adaptation, environmental structure, task management and individual variability in functioning.^{13–15}

Existing guidance from diving medicine organisations recognises that the diagnosis of a psychiatric disorder, particularly when associated with sustained stability and preserved functional performance, is not in itself a contraindication to recreational diving.^{9,16} Guidance provides general recommendations regarding fitness-to-dive, including consideration of psychiatric disorders; however, it remains largely framed in diagnostic terms and does not consistently address how functional capacity, symptom stability, behavioural responses and medication effects should be interpreted in relation to diving risk. While this approach may be appropriate for certain physical health conditions with defined physiological parameters, it is less readily applicable to mental health and neurodevelopmental conditions, where risk is often more context-dependent and

shaped by interactions between cognition, behaviour and environmental demands.⁶ Concerns regarding inconsistent assessment or perceived automatic exclusion may contribute to under-disclosure, with potential implications for diver safety and may be compounded by broader stigma associated with psychiatric diagnoses and treatment.^{17–19} Together, these challenges create tension between promoting safe access, avoiding inappropriate exclusion and meeting medico-legal responsibilities.

Diving-related risk arises from the interaction between individual characteristics and environmental demands, including cognitive impairment associated with depth and gas effects, increased task load and the potential for rapid escalation of stress responses.^{1,4,5} Evidence from diving medicine and human factors research indicates that behavioural factors such as situational awareness, decision-making under pressure and behavioural reliability (the ability to maintain consistent and self-preservative behaviour under stress), are central to diving safety even in the absence of diagnosed psychiatric disorder.^{4,5,20} Panic and anxiety represent specific expressions of these broader mechanisms and are widely recognised contributors to recreational diving incidents and fatalities.^{4,20–22} These findings highlight the importance of not relying on diagnostic categories alone.

Currently, clinicians are often required to rely on individual judgement when assessing fitness-to-dive in individuals where mental health and neurodevelopmental considerations may be relevant.⁸ This review presents a structured examination of the literature relating to mental health and neurodevelopmental factors relevant to fitness-to-dive in recreational scuba diving. The review is intentionally structured around functional domains while recognising that diagnostic categories remain clinically relevant. This reflects the clinical reality that diving-related risk cannot be determined by diagnosis alone, but requires consideration of broader cognitive, behavioural, functional and contextual factors. Findings are synthesised to support clinical interpretation and more consistent decision-making.

Methods

This review was conducted using a structured literature search and study selection process informed by PRISMA guidelines.²³ The objective was to identify and synthesise evidence relevant to mental health and neurodevelopmental factors in recreational fitness-to-dive assessment, with a focus on clinically relevant interpretation rather than formal quantitative synthesis.

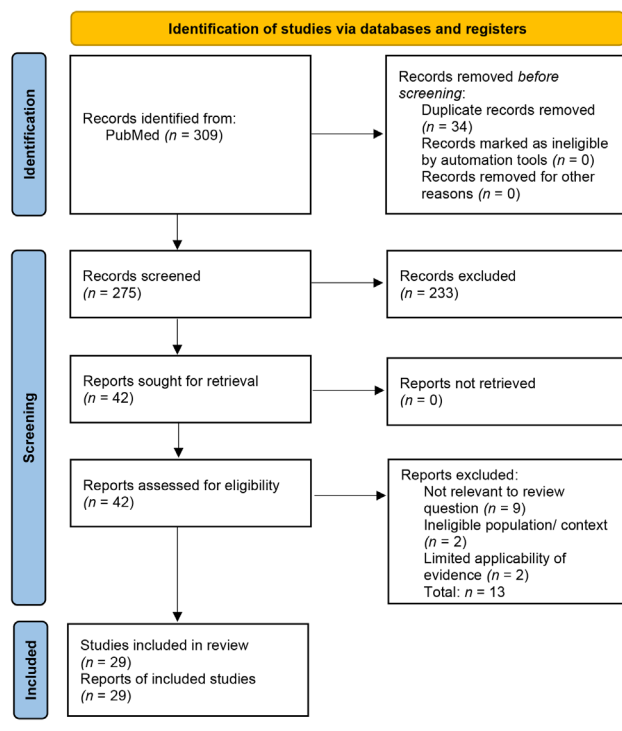
The PubMed database was searched from inception to April 2026 using a structured, multi-stage approach combining Medical Subject Headings (MeSH) and targeted supplementary searches. A primary search using MeSH terms for “*diving*” and “*mental disorders*” was conducted to identify core literature. Additional targeted searches were conducted to capture relevant domains not consistently

Table 1
PubMed search queries

Core search ("Diving"[MeSH]) AND ("Mental Disorders"[MeSH])
Cognitive and behavioural domain ("Diving"[MeSH]) AND ("Mental Disorders"[MeSH]) AND (cognition[tiab] OR cognitive[tiab] OR behaviour[tiab] OR behavior[tiab] OR "human factors"[tiab] OR executive[tiab])
Psychotropic medication domain ("Diving"[MeSH]) AND ("Psychotropic Drugs"[MeSH] OR psychotropic[tiab] OR antidepressant*[tiab] OR anxiolytic*[tiab] OR benzodiazepine*[tiab] OR SSRI[tiab] OR SNRI[tiab] OR lithium[tiab])
Fitness-to dive domain ("Diving"[MeSH]) AND ("fitness to dive"[tiab] OR "fit to dive"[tiab] OR "medical clearance"[tiab] OR "risk assessment"[tiab] OR "diving medical"[tiab]).

Figure 1

PRISMA diagram for the search and study selection



indexed under these headings, including cognitive and behavioural factors, psychotropic medication use and fitness-to-dive and medical clearance terminology. These supplementary searches used the combinations of MeSH and free-text terms within titles and abstracts shown in Table 1. Search terms were developed from key conceptual domains and iteratively refined to balance sensitivity and specificity.

Duplicate records were removed prior to screening. Records were screened by title and abstract, followed by full-text review and assessed for eligibility according to predefined inclusion and exclusion criteria. Studies were included if they examined recreational scuba diving or closely related contexts and addressed mental health or neurodevelopmental factors, psychotropic medication, cognition, behaviour, or functional performance relevant to diving safety.

Studies were excluded based on lack of relevance to the review question, ineligible population or context, or limited applicability of the evidence (e.g., animal studies or single case reports). The study selection process is summarised in a flow diagram (Figure 1) that follows PRISMA terminology, distinguishing between “records” (search results), “reports” (full-text articles assessed) and “studies” (included articles).²³

Study characteristics and findings relevant to fitness-to-dive assessment were reviewed and synthesised. Given heterogeneity in study design and outcomes, formal quantitative synthesis was not undertaken. Findings were synthesised thematically using domains reflecting key constructs relevant to fitness-to-dive assessment, including functional capacity, psychiatric stability, behavioural responses, medication and substance effects, neurodevelopmental conditions and environmental influences. These domains were refined iteratively in the process of reviewing the included studies.

No formal quality appraisal tool was applied due to heterogeneity of study designs.

Results

A total of 309 records were identified through database searching. After removal of duplicates, 275 records were screened by title and abstract and 42 full-text articles were assessed for eligibility. Following application of inclusion and exclusion criteria, 29 studies were included in the final analysis (Figure 1).

The included literature varied in design, methodology and outcome measures, comprising primarily observational studies and experimental research examining the cognitive effects of diving, alongside a smaller number of narrative reviews, position statements and guidance-oriented publications. Direct evidence relating to mental health and neurodevelopmental factors in diving contexts was limited, with much of the literature focusing on broader cognitive, behavioural and human factors relevant to diving safety.

The available evidence varied in scope, methodology and study population.

Across the included studies, fitness-to-dive assessment is best understood as a multidimensional construct in which risk arises from the interaction between domains, rather than from any single factor in isolation. To support clinical interpretation, findings were synthesised across six thematic domains relevant to mental health and neurodevelopmental considerations in fitness-to-dive assessment. These domains were identified through iterative review of the included studies and reflect clinically relevant constructs associated with diving safety and risk. Five domains relate primarily to individual factors relevant to diving safety, while 'Environmental demands' was considered as a contextual domain that may impact on the expression and significance of vulnerabilities identified across other domains. A recurring finding was that diagnosis alone appeared insufficient to explain diving-related risk.

FUNCTIONAL CAPACITY

Across the literature, functional capacity emerged as a key determinant of diving safety. Diving requires sustained attention, executive functioning, situational awareness and the ability to manage task load while responding to unexpected events.^{9,13,24}

Experimental studies demonstrated measurable impairments in cognitive performance under diving conditions, including reductions in attention, working memory, psychomotor speed and information processing.²⁵⁻³¹ These effects have been observed even at recreational depths and are consistent with the combined effects of increased partial pressure of inert gases, including nitrogen narcosis and environmental task loading.^{26,31} Cognitive impairment under these conditions may reduce error detection, slow reaction time and impair information processing relevant to decision-making.^{32,33}

These findings suggest that, in the underwater environment, divers may operate with reduced cognitive reserve, understood here as the finite cognitive resources available to an individual to maintain effective cognitive performance despite competing task demands, environmental stressors and physiological impairment.^{25,26,29} Individuals with pre-existing vulnerabilities, including those related to psychiatric disorders, neurodevelopmental differences or medication effects, may have reduced capacity to compensate for additional environmental stressors.^{9,14,15,34,35} This has direct implications for fitness-to-dive assessment, as individuals who function adequately in routine environments may demonstrate reduced cognitive performance under diving conditions.^{25,29}

Clinical and review-based literature emphasised that fitness-to-dive assessment should prioritise the ability to understand procedures, plan and execute tasks, maintain situational awareness and adapt to changing

conditions.^{9,13,36,37} Impairments in these domains are not always apparent in routine clinical settings but may become functionally significant in dynamic and time-sensitive underwater environments.^{21,26} Functional capacity reflects an individual's ability to process information and manage task demands. However, diving-related risk is not determined by capacity alone, but also by how that capacity is expressed under conditions of stress, where behavioural responses become a key determinant of safety.

BEHAVIOURAL RESPONSES AND RELIABILITY

Behavioural responses under stress are identified as critical determinants of diving safety.^{13,24} Panic and acute anxiety represent well-recognised pathways to adverse outcomes, including rapid ascent, loss of buoyancy control and deviation from established dive procedures.^{19,24}

Evidence from behavioural models and observational studies suggests that adverse events in recreational diving often arise from a chain of behavioural and cognitive errors rather than single-point failures.^{24,26} Under conditions of stress, cognitive impairment may occur, contributing to reduced situational awareness and problem-solving capacity and thereby increasing the likelihood of maladaptive responses.^{25,26} Panic may further amplify these processes, leading to loss of behavioural control and unsafe actions.²⁴

These behavioural responses are not confined to individuals with diagnosed psychiatric disorders or neurodevelopmental conditions;¹⁹ however, some conditions may increase susceptibility to heightened stress reactivity, panic, or impaired emotional regulation.^{13-15,34,38} Prior panic episodes, difficulty tolerating physiological sensations such as dyspnoea, or reduced capacity to maintain behavioural control under pressure are therefore clinically relevant considerations in fitness-to-dive assessment.²⁴

Survey and qualitative studies demonstrated that divers may underestimate risk or rationalise unsafe behaviours, particularly in the context of substance use or overconfidence.^{19,39,40} These findings underscore the importance of assessing stress tolerance, behavioural reliability and prior responses to challenging situations as part of fitness-to-dive assessment.

PSYCHIATRIC STABILITY

Evidence indicates that psychiatric diagnosis alone appears to have limited predictive value for diving safety. Clinical relevance lies in psychiatric stability, including sustained symptom control, treatment adherence, preserved insight and consistent day-to-day functioning.^{9,34,38,41}

Instability, fluctuating symptoms, or impaired insight may increase vulnerability to impaired judgement or behavioural dysregulation underwater, particularly in environments where stress may escalate rapidly. Conditions associated

with impaired reality testing and/or dissociation may carry higher potential risk due to the possibility of compromised situational awareness or behavioural control.^{24,34,38,41}

The literature emphasises that fitness-to-dive assessment should focus on current functioning and stability over time, rather than diagnostic category alone.⁹ This includes consideration of relapse patterns, early warning signs and the individual's ability to recognise and respond to deterioration. In episodic psychiatric conditions, functional recovery and restoration of reliable judgement may lag behind symptomatic improvement, underscoring the importance of longitudinal assessment rather than reliance on symptom status alone.^{34,38}

MEDICATION AND SUBSTANCE EFFECTS

Medication use is increasingly encountered among recreational divers and represents an important consideration in fitness-to-dive assessment.^{9,42} Observational data indicate that many divers with medical comorbidities take regular medications, often across multiple classes and may continue to dive safely, suggesting that medication use alone is not a sufficient determinant of risk.⁴² Rather than acting as absolute contraindications, medications are best understood in terms of their potential impact on cognitive function, physiological stability and behavioural responses under stress.⁹

Psychotropic medications, along with other commonly prescribed drug classes, are associated with side effects such as sedation, cognitive impairment, reduced concentration and autonomic or cardiovascular effects. These effects may impair attention, situational awareness and response capacity in the underwater environment. Side effects are often most pronounced during periods of treatment initiation, dose adjustment, or when multiple medications are used concurrently and may introduce variability in cognitive and behavioural function.^{9,35}

Despite these concerns, empirical evidence regarding the interaction between medications and diving-specific risks remains limited. Current literature does not demonstrate a clear or consistent increase in severe narcosis attributable to medication use alone and the mechanisms by which medications interact with the diving environment, particularly conditions of increased ambient pressure, are not well defined.⁴³ Observational studies suggest that it is often difficult to distinguish the effects of medications from those of the underlying medical or psychiatric disorders for which they are prescribed.⁴² This is further complicated through factors such as variability in adherence, under-recognition of side effects and challenges in risk appraisal.⁹ As such, medication effects are best interpreted within a broader clinical context rather than as isolated risk factors.

In addition to prescribed medications, substance use represents a relevant but less well-characterised domain.

Alcohol use has been associated with impaired cognitive performance, reduced reaction time and poorer decision-making, all of which are directly relevant to diving safety.^{40,44} Cannabis use has similarly been associated with altered perception, impaired attention and changes in risk appraisal, which may affect both functional capacity and behavioural responses underwater.³⁹

Evidence regarding other illicit substances in diving is limited. However, given their known effects on cognition, perception and physiological regulation, these substances may be relevant to risk in the diving environment. Patterns of substance use may be associated with risk-taking behaviour, reduced adherence to safety recommendations and variability in decision-making.^{19,39} Beyond its direct pharmacological effects, substance use may reflect underlying psychiatric disorders, psychiatric instability or maladaptive coping strategies and may also meet diagnostic criteria for a substance use disorder.^{11,12} Substance use may further contribute to mental health deterioration, precipitate relapse and interfere with treatment adherence.

These findings support a contextual and individualised approach in which medication and substance use are evaluated alongside the underlying condition, functional capacity and behavioural responses under stress.

NEURODEVELOPMENTAL FACTORS

Although many functional domains relevant to neurodevelopmental conditions overlap with broader fitness-to-dive considerations, these conditions warrant separate discussion due to their enduring developmental and neurocognitive characteristics.

Emerging evidence relating to neurodevelopmental conditions, including attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD), highlights substantial individual variability in functional capacity in the context of diving.^{13–15,45} These conditions are not absolute contraindications to diving and suitability is best considered on an individual basis.^{14,15}

Relevant domains include attention, executive function, cognitive flexibility and the ability to adapt to changing or unexpected situations, all of which have been identified as important for safe diving performance. Difficulties with distractibility, task switching, or cognitive rigidity may affect performance in dynamic underwater environments. However, some individuals demonstrate effective functioning, particularly within structured and predictable contexts.^{14,15,46}

These findings support a functional approach to fitness-to-dive assessment, with emphasis on task management, behavioural regulation and adaptability rather than diagnostic category alone.

ENVIRONMENTAL DEMANDS

Environmental factors inherent to diving, including increased ambient pressure, thermal stress and task load, may impair cognitive and psychomotor performance.^{25,26,29} These effects may not be fully recognised by the diver, creating a mismatch between perceived and actual functioning.³¹

Within a fitness-to-dive assessment, environmental demands are best understood as amplifiers of underlying vulnerability rather than independent determinants of risk.

The interaction between environmental stressors and individual vulnerability is central to understanding diving-related risk. Individuals with reduced cognitive reserve, impaired insight, or increased stress reactivity may be disproportionately affected when environmental demands exceed available compensatory resources.²⁴ This reinforces the importance of assessing not only baseline functioning, but also the likely interaction between individual vulnerability and the anticipated diving environment.^{9,36,37}

Discussion

The results of this review support a multidimensional, function-based model of fitness-to-dive assessment in which diving-related risk is not attributed to diagnostic category alone but emerges from the interaction between individual capacity and the physiological, cognitive and environmental demands of diving. This reflects a broader principle in psychiatric risk assessment, in which functional performance and behavioural reliability provide important information beyond diagnostic labels alone, particularly in dynamic and safety-critical environments.^{6,9}

This does not diminish the clinical relevance of psychiatric or neurodevelopmental diagnoses. Certain disorders may be associated with differing patterns of vulnerability, including impairments in attention, executive functioning, behavioural regulation, insight, reality testing or stress tolerance. However, diagnosis alone provides limited information regarding how these vulnerabilities manifest in practice or how they interact with the demands of the diving environment. The findings of this review support a structured multidimensional approach, elements of which are reflected, to varying degrees, in contemporary diving medicine guidance.^{2,3,47,48} This includes guidance for consideration of multiple factors for case-by-case assessment,^{2,3,47} and guidelines in which principles of a multidimensional approach are integrated.⁴⁸ The present review seeks to make the underlying principles more explicit by integrating diagnostic, functional, behavioural and environmental considerations within a broader multidimensional approach to fitness-to-dive assessment that acknowledges interactions between domains.

From a clinical perspective, the reduction in cognitive reserve under diving conditions has important implications for

clinical assessment.^{31,32} Individuals who function adequately in low-demand environments may not demonstrate equivalent performance underwater, where task load, environmental stressors and physiological factors place additional demands on attention, working memory and decision-making processes.^{25–27}

Assessment should therefore extend beyond baseline functioning to include the ability to maintain performance under increased demand. Relevant considerations include panic vulnerability, behavioural dysregulation, impaired reality testing, executive dysfunction and reduced self-preserved behaviour. Among these domains, self-preserved behaviour represents a clinically important construct that is insufficiently examined in the diving literature. Maladaptive elements may include active suicidality, passive self-endangerment, diminished hazard awareness, or indifference to risk, all of which may be highly consequential in the underwater environment. While such factors may be routinely considered within psychiatric risk assessment, they are rarely incorporated into standard fitness-to-dive screening tools, despite their potential relevance to diving safety.

The findings also highlight the importance of contextual assessment. Environmental stressors may amplify vulnerabilities that are otherwise well compensated for in everyday settings. Fitness-to-dive assessment should therefore consider not only factors relevant to the individual but also the anticipated demands of the diving environment and the extent to which these factors may interact.

These findings have important clinical implications. Fitness-to-dive assessment in the context of mental health and neurodevelopmental considerations is inherently qualitative and probabilistic, requiring clinical judgement applied to a combination of diagnostic, functional, behavioural and contextual factors. This creates an ongoing tension between promoting safe access to diving, avoiding unnecessary exclusion and managing medico-legal responsibilities. Overly rigid or diagnosis-based approaches may contribute to inappropriate restriction or to under-disclosure, while insufficiently structured assessments may fail to identify relevant risks.^{17,18}

The evidence base remains limited and heterogeneous, comprising predominantly observational studies, small experimental studies and expert opinion. Few studies directly examine psychiatric and neurodevelopmental factors in diving contexts and the interaction between these factors and diving-specific stressors remains incompletely understood. Future research should prioritise prospective and interdisciplinary approaches to better characterise these relationships, including the role of stress responses, cognitive performance under load and the effects of medication in hyperbaric environments.

Finally, the findings suggest that development of a structured but flexible framework for fitness-to-dive assessment may be beneficial. Such a framework could provide a shared language for clinicians to integrate diagnostic, functional, behavioural and environmental considerations, articulate the basis of their recommendations and apply proportionate risk mitigation strategies. Where uncertainty exists, a conservative approach remains appropriate but should be balanced against recognition that fitness-to-dive is not a binary state and may evolve over time.

Conclusions

Fitness-to-dive assessment in the context of mental health and neurodevelopmental factors cannot be determined by diagnostic category alone. The available evidence supports a multidimensional approach that integrates diagnostic, functional, behavioural and environmental considerations in fitness-to-dive assessment. While the evidence base remains limited, the findings support an individualised and context-dependent approach to fitness-to-dive assessment.

Development of a structured but flexible framework informed by these domains may support greater consistency, transparency and safety in fitness-to-dive assessment while facilitating appropriate participation and minimising unnecessary exclusion from recreational diving.

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