

The Undersea and Hyperbaric Medicine Milestone Project

A Joint Initiative of

The Accreditation Council for Graduate Medical Education
and
The American Board of Emergency Medicine



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The Milestones are designed only for use in evaluation of the fellow in the context of their participation in ACGME-accredited residency or fellowship programs. The Milestones provide a framework for assessment of the development of the fellow in key dimensions of the elements of physician competency in a specialty or subspecialty. They neither represent the entirety of the dimensions of the six domains of physician competency, nor are they designed to be relevant in any other context.

Undersea and Hyperbaric Medicine Milestones

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Milestone Reporting

This document presents Milestones designed for programs to use in semi-annual review of fellow performance and reporting to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME competencies organized in a developmental framework from less to more advanced. They are descriptors and targets for fellow performance as a fellow moves from entry into fellowship through graduation. In the initial years of implementation, the Review Committee will examine Milestone performance data for each program's fellows as one element in the Next Accreditation System (NAS) to determine whether fellows overall are progressing.

For each period, review and reporting will involve selecting milestone levels that best describe a fellow's current performance and attributes. Milestones are arranged into numbered levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert in the subspecialty.

Selection of a level implies that the fellow substantially demonstrates the milestones in that level, as well as those in lower levels (see the diagram on page v).

Level 1: The fellow demonstrates milestones expected of an incoming fellow.

Level 2: The fellow is advancing and demonstrates additional milestones, but is not yet performing at a mid-fellowship level.

Level 3: The fellow continues to advance and demonstrate additional milestones, consistently including the majority of milestones targeted for fellowship.

Level 4: The fellow has advanced so that he or she now substantially demonstrates the milestones targeted for fellowship. This level is designed as the graduation target.

Level 5: The fellow has advanced beyond performance targets set for fellowship and is demonstrating "aspirational" goals which might describe the performance of someone who has been in practice for several years. It is expected that only a few exceptional fellows will reach this level.

Additional Notes

Level 4 is designed as the graduation *target* and *does not* represent a graduation *requirement*. Making decisions about readiness for graduation is the purview of the fellowship program director. Study of Milestone performance data will be required before the ACGME and its partners will be able to determine whether milestones in the first four levels appropriately represent the developmental framework, and whether Milestone data are of sufficient quality to be used for high-stakes decisions.

Examples are provided with some milestones. Please note that the examples are not the required element or outcome; they are provided as a way to share the intent of the element.

Some milestone descriptions include statements about performing independently. These activities must occur in conformity to the ACGME supervision guidelines, as well as to institutional and program policies. For example, a fellow who performs a procedure independently must, at a minimum, be supervised through oversight.

Answers to Frequently Asked Questions about Milestones are available on the Milestones web page:

<http://www.acgme.org/acqmeweb/Portals/0/MilestonesFAQ.pdf>.

The diagram below presents an example set of milestones for one sub-competency in the same format as the ACGME Report Worksheet. For each reporting period, a fellow's performance on the milestones for each sub-competency will be indicated by selecting the level of milestones that best describes that fellow's performance in relation to those milestones.

Self-Directed Learning – Practice-based Learning and Improvement				
Level1	Level2	Level3	Level4	Level5
<ul style="list-style-type: none"> Acknowledges gaps in personal knowledge and frequently asks for feedback Understands the importance of setting learning and improvement goals 	<ul style="list-style-type: none"> Develops learning and improvement goals, based on feedback Utilizes online data resources appropriately 	<ul style="list-style-type: none"> Performs on-going self-assessment and implements individual learning plans Critically appraises scientific literature and applies evidence-based medicine principles for self-improvement as a clinician Participates in a quality improvement project 	<ul style="list-style-type: none"> Engages in performance improvement by incorporating feedback from multiple stakeholders (e.g. patients, members of the health care team, third-party payors) Demonstrates best clinical practice, including use of evidence-based pathways 	<ul style="list-style-type: none"> Creates novel ways to assess performance Applies results from self-directed learning to educating others Completes scholarly activity (e.g., scientific presentation, publication, research)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				

Selecting a response box in the middle of a level implies that milestones in that level and in lower levels have been substantially demonstrated.

Selecting a response box on the line in between levels indicates that milestones in lower levels have been substantially demonstrated as well as **some** milestones in the higher level(s).

Fitness to Dive (Divers and Attendants) – Patient Care				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Performs a complete history, physical, and neurological examination 	<ul style="list-style-type: none"> Orders appropriate tests to determine fitness to dive Recognizes physical and psychological signs and symptoms that impact fitness to dive 	<ul style="list-style-type: none"> Interprets routine diagnostic testing (e.g., pulmonary function tests, radiographs) to determine fitness to dive 	<ul style="list-style-type: none"> Applies the results of clinical examination and diagnostic tests to determine fitness to dive Completes a comprehensive evaluation for return to diving following a change in medical condition 	<ul style="list-style-type: none"> Interprets advanced diagnostic studies (e.g., echocardiographic bubble studies)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments: <div style="text-align: right;"> Not yet achieved Level 1 <input type="checkbox"/> </div>				

Dysbarism and Decompression Illness – Patient Care				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Performs a history and physical examination to evaluate for dysbarism 	<ul style="list-style-type: none"> • Performs targeted physical examination to evaluate for dysbarism • Orders diagnostic evaluations for pressure disorders • Differentiates between decompression sickness and barotrauma • Stabilizes a patient and initiates treatment for dysbarism 	<ul style="list-style-type: none"> • Interprets clinical findings and diagnostic tests relevant to dysbarism • Differentiates between dysbaric and non-dysbaric disorders • Uses treatment tables and protocols appropriately for decompression illness 	<ul style="list-style-type: none"> • Diagnoses and manages patients with dysbarism based on current best evidence 	<ul style="list-style-type: none"> • Participates in injury prevention strategies for dysbarism • Acts as an undersea medical consultant on diving operations
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Hyperbaric Chamber Operations – Patient Care				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Prepares a stable patient for routine hyperbaric oxygen therapy 	<ul style="list-style-type: none"> Selects appropriate patients for hyperbaric oxygen therapy Diagnoses adverse effects and complications of hyperbaric oxygen therapy 	<ul style="list-style-type: none"> Monitors patients during hyperbaric oxygen therapy Treats acute complications (e.g., embolism, oxygen toxicity, pneumothorax) of hyperbaric oxygen therapy Manages adverse effects of hyperbaric oxygen therapy 	<ul style="list-style-type: none"> Manages a critical care patient in the hyperbaric chamber Provides comprehensive care of the routine hyperbaric oxygen therapy patient 	<ul style="list-style-type: none"> Performs specialized procedures in the hyperbaric chamber
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments: <div style="text-align: right;"> Not yet achieved Level 1 <input type="checkbox"/> </div>				

Diving Medicine – Patient Care				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Recognizes the importance of supplemental oxygen in the treatment of diving illness or injuries Initiates management of the ill or injured diver (e.g., warming, hydrating) 	<ul style="list-style-type: none"> Elicits the appropriate history and physical examination from an ill or injured diver 	<ul style="list-style-type: none"> Provides consultation for transport of ill or injured divers Develops a plan of care for ill or injured divers 	<ul style="list-style-type: none"> Manages diving casualties, including drowning Recognizes and treats marine envenomations, toxic ingestions, and injuries from marine animals 	<ul style="list-style-type: none"> Develops protocols for evaluation and treatment of ill or injured divers Manages personnel in extreme diving and hyperbaric environments (e.g., caisson, tunnel, submarines)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Physics and Physiology of Hyperbaric and Hypobaric Exposures – Medical Knowledge				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Understands buoyancy as applied to diving • Demonstrates knowledge of oxygen under normobaric conditions • Shows familiarity with units of pressure, volume, and temperature 	<ul style="list-style-type: none"> • Describes alterations in vision and acoustics under water • Demonstrates knowledge of gas laws • Comprehends human physiology and the pharmacology of oxygen under hyperbaric conditions, including oxygen toxicity • Explains the mechanism of action of hyperbaric oxygen 	<ul style="list-style-type: none"> • Comprehends the mechanism of gas entry and distribution into tissue • Comprehends decompression physiology • Understands human physiology under hypobaric conditions • Describes the pharmacological and physical properties (e.g., density, solubility) of gases other than oxygen 	<ul style="list-style-type: none"> • Explains the physiology of immersion and saturation • Comprehends physiology and complications of breath-hold diving • Demonstrates application of the decompression tables • Describes high pressure nervous syndrome 	<ul style="list-style-type: none"> • Demonstrates mastery of physiology and pharmacology of mixed gases • Comprehends the physiology of saturation
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments: Not yet achieved Level 1 <input type="checkbox"/>				

Fitness to Dive – Medical Knowledge				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Acknowledges that diving is a physical activity with various standards for different classifications of divers • Recognizes that medical conditions or medications affect fitness to dive 	<ul style="list-style-type: none"> • Understands the physical requirements for diving • Demonstrates knowledge of the effect of the diving environment on organ systems • Explains contraindications to diving • Understands the medical requirements for hyperbaric chamber attendants 	<ul style="list-style-type: none"> • Cites recreational diving standards • Comprehends the implications of acute and chronic medical conditions, including medications, on diving • Lists the criteria for return to diving 	<ul style="list-style-type: none"> • Describes commercial diving standards • Knows the implications of disabilities on diving • Demonstrates knowledge of waivers for diving and hyperbaric chamber attendants 	<ul style="list-style-type: none"> • Defines international diving standards • Demonstrates knowledge of technical diving
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Indications for Hyperbaric Oxygen Therapy – Medical Knowledge				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Is aware of hyperbaric oxygen therapy for specific disorders 	<ul style="list-style-type: none"> • Describes approved routine indications (e.g., selected wounds, irradiated tissue) for hyperbaric oxygen therapy • Aware of different treatment protocols based on condition • Comprehends absolute contraindications to hyperbaric oxygen therapy 	<ul style="list-style-type: none"> • Explains approved emergent indications (e.g., decompression illness, trauma, toxic exposure, infections) for hyperbaric oxygen therapy • Comprehends relative contraindications, complications, and adverse effects of hyperbaric oxygen therapy 	<ul style="list-style-type: none"> • Describes other indications for hyperbaric oxygen therapy or demonstrates knowledge of investigational indications for hyperbaric oxygen therapy • Explains evidence that supports hyperbaric oxygen therapy guidelines • Discusses appropriate utilization reviews 	<ul style="list-style-type: none"> • Researches and develops emerging indications for hyperbaric oxygen therapy • Develops new hyperbaric oxygen therapy protocols
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Dysbarism and Decompression Illness – Medical Knowledge				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Is aware of environments that relate to dysbarism 	<ul style="list-style-type: none"> Recognizes differences between decompression and barotrauma-related disorders 	<ul style="list-style-type: none"> Differentiates between decompression illness and non-decompression disorders Understands implications of altitude on dysbarism 	<ul style="list-style-type: none"> Demonstrates comprehensive knowledge of decompression illness (e.g., decompression sickness, barotrauma, gas embolism) Understands the long-term effects of diving 	<ul style="list-style-type: none"> Investigates the prevention and treatment of dysbarism
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Hyperbaric Chamber Operations – Medical Knowledge				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Recognizes the hazards of the hyperbaric environment 	<ul style="list-style-type: none"> Differentiates between the types of chambers Identifies equipment and items prohibited in a hyperbaric chamber 	<ul style="list-style-type: none"> Demonstrates working knowledge of emergency procedures Assesses the safety of equipment and devices used in hyperbaric chambers 	<ul style="list-style-type: none"> Demonstrates knowledge of the national standards and regulations for safe operation of hyperbaric chambers Explains the use of critical care equipment and devices in the hyperbaric environment 	<ul style="list-style-type: none"> Participates in developing new standards and regulations Independently supervises or operates a hyperbaric chamber
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Diving Medicine – Medical Knowledge				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Recognizes basic diving systems and equipment • Recognizes the effects of altitude on diving 	<ul style="list-style-type: none"> • Lists the differences between various types of diving (e.g., surface decompression diving, saturation diving, bounce diving, breath hold diving) • Comprehends the thermal effects of diving 	<ul style="list-style-type: none"> • Demonstrates knowledge of diving support equipment (e.g., scuba, rebreather, mixed gas) • Cites protocols for flying after diving • Demonstrates knowledge of hazardous marine life • Cites quality standards for breathing gases 	<ul style="list-style-type: none"> • Explains risks and benefits of diving support equipment • Understands systems and procedures for saturation diving • Comprehends effects of diving at altitude 	<ul style="list-style-type: none"> • Demonstrates comprehensive knowledge of systems and procedures for saturation diving • Modifies diving tables for diving at altitude • Understands how to manage a pressurized caisson or tunnel operation
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Patient Safety – Systems-based Practice				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Recognizes the importance of advocating for quality care and optimal patient care systems Acknowledges that medical errors and health care system failures are a significant cause of morbidity 	<ul style="list-style-type: none"> Understands key concepts related to health care quality improvement Recognizes potential sources of system failure in health care systems, such as medication errors 	<ul style="list-style-type: none"> Advocates for optimal individual patient care in the hyperbaric chamber environment Recognizes and reports lapses in medication safety, medication errors, and near misses 	<ul style="list-style-type: none"> Understands and directs department protocols for patient safety in the hyperbaric chamber Advocates for quality care and supports an environment of safety Participates in a team-based approach to evaluate medical errors and system-based failures 	<ul style="list-style-type: none"> Acts as a safety officer for a hyperbaric chamber facility Participates in the development of national standards for safety in the hyperbaric chamber environment Leads a team to evaluate medical errors and system-based failures and improve processes and systems
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Systems-based Management – Systems-based Practice				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Identifies the members and roles of the hyperbaric team 	<ul style="list-style-type: none"> Recognizes need for participation in a multidisciplinary care team Understands principles of hyperbaric-related procedure coding 	<ul style="list-style-type: none"> Coordinates multidisciplinary care of the hyperbaric patient Practices cost-effective hyperbaric care Understands the role of utilization review 	<ul style="list-style-type: none"> Coordinates system resources and transitions of care for a complicated hyperbaric patient Effectively manages the hyperbaric team Engages in utilization review 	<ul style="list-style-type: none"> Creates appropriate use criteria for hyperbaric therapy Participates in national decision-making for coding and reimbursement of hyperbaric therapy
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Self-directed Learning – Practice-based Learning and Improvement				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Acknowledges gaps in personal knowledge and frequently asks for feedback • Understands the importance of setting learning and improvement goals 	<ul style="list-style-type: none"> • Develops learning and improvement goals based on feedback • Utilizes online data resources appropriately 	<ul style="list-style-type: none"> • Performs ongoing self-assessment and implements individual learning plans • Critically appraises scientific literature and applies evidence-based medicine principles for self-improvement as a clinician • Participates in a quality improvement project 	<ul style="list-style-type: none"> • Engages in performance improvement by incorporating feedback from multiple stakeholders (e.g., patients, members of the health care team, third-party payors) • Demonstrates best clinical practice, including use of evidence-based pathways 	<ul style="list-style-type: none"> • Creates novel ways to assess performance • Applies results from self-directed learning to educating others • Completes scholarly activity (e.g., scientific presentation, publication, research)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Professional Values – Professionalism				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Demonstrates behavior that conveys caring, honesty, genuine interest, and tolerance when interacting with a diverse population of patients, families, and other members of the health care team 	<ul style="list-style-type: none"> • Engages in patient-centered care, including demonstrating compassion, integrity, respect, sensitivity, and responsiveness • Consistently recognizes ethical issues in practice, including conflicts of interest 	<ul style="list-style-type: none"> • Consistently manages own values and beliefs to optimize relationships and medical care • Engages in shared decision making to develop alternate care plans when patients' personal decisions/beliefs preclude the use of commonly accepted practices 	<ul style="list-style-type: none"> • Develops and applies a consistent approach to evaluating appropriate care • Evaluates possible barriers to care, and creates strategies that consistently prioritize the patient's best interests • Effectively analyzes and manages ethical issues in challenging clinical situations (e.g., end-of-life, unexpected outcomes) 	<ul style="list-style-type: none"> • Develops institutional and organizational strategies to protect and maintain professional and bioethical principles
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Accountability to Patients, Society, Profession, and Self – Professionalism				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Demonstrates basic professional responsibilities, such as timely reporting for duty, responsiveness to consultation requests, appropriate dress/grooming, timely chart completion, and duty hour reporting • Maintains patient confidentiality • Uses social media ethically and responsibly 	<ul style="list-style-type: none"> • Identifies basic principles of physician wellness, including sleep, hygiene, and fatigue mitigation • Consistently recognizes limits of knowledge in common and frequent clinical situations, and asks for assistance 	<ul style="list-style-type: none"> • Consistently recognizes limits of knowledge in uncommon and complicated clinical situations; develops and implements plans for the best possible patient care • Recognizes and avoids inappropriate influences of marketing and advertising 	<ul style="list-style-type: none"> • Understands how to identify and confidentially report impairment in self or a colleague • Manages medical errors consistent with principles of responsibility and accountability in accordance with institutional policy • Serves as a role model for other physicians and health care providers 	<ul style="list-style-type: none"> • Develops institutional and organizational strategies for physician professional responsibilities • Trains physicians and educators regarding responsibility, wellness, fatigue, and physician impairment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Patients, Families, and Public – Interpersonal and Communication Skills				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> Recognizes the importance of effective communication with patients, families, and the public across a broad range of socioeconomic and cultural backgrounds 	<ul style="list-style-type: none"> Demonstrates effective communication with patients, families, and the public Engages in shared decision making when obtaining informed consent 	<ul style="list-style-type: none"> Educates patients and the public regarding issues related to diving and hyperbaric medicine Effectively communicates with vulnerable populations, including patients at risk and their families 	<ul style="list-style-type: none"> Communicates with patients and families regarding confidential medical information Educates the public regarding environmental risks (e.g., safe diving practices, toxic gas exposure) 	<ul style="list-style-type: none"> Consults on undersea and hyperbaric issues outside of the local health care environment, such as with regional and national health care agencies
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Communication with Health Care Professionals – Interpersonal Communication Skills				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Recognizes the importance of effective, timely consultation and communication with the health care team • Ensures transitions of care are accurately and efficiently communicated • Ensures clear communication and respect among health care team members 	<ul style="list-style-type: none"> • Demonstrates effective, timely consultation and communication with the health care team in clinical situations • Develops working relationships across specialties with other health care professionals 	<ul style="list-style-type: none"> • Provides effective, timely consultation and communication with the health care team in stressful/crisis situations • Provides education to the health care team • Participates in peer review 	<ul style="list-style-type: none"> • Adapts communication strategies to resolve challenges with consultants and other health care professionals • Provides undersea and hyperbaric education to other specialties within own institution 	<ul style="list-style-type: none"> • Seeks leadership opportunities within professional organizations • Delivers presentations advocating for undersea and hyperbaric medicine to regional or national audiences
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>