Standards for Hyperbaric Oxygen Therapy (HBOT) Services

Version 2

Issue date: 14/10/2021

Effective date: 14/10/2021

Health Policies and Standards Department

Health Regulation Sector (2021)

INTRODUCTION

Health Regulation Sector (HRS) forms an integral part of Dubai Health Authority (DHA) and is mandated by DHA Law No. (6) of 2018 to undertake several functions including but not limited to:

- Developing regulation, policy, standards, guidelines to improve quality and patient safety and promote the growth and development of the health sector.
- Licensure and inspection of health facilities as well as healthcare professionals and ensuring compliance to best practice.
- Managing patient complaints and assuring patient and physician rights are upheld.
- Managing health advertisement and marketing of healthcare products.
- Governing the use of narcotics, controlled and semi-controlled medications.
- Strengthening health tourism and assuring ongoing growth.
- Assuring management of health informatics, e-health and promoting innovation.

The Standards for Hyperbaric Oxygen Therapy Services aims to fulfil the following overarching DHA Strategic Objectives and Program within the Dubai Health Strategy (2016–2021):

- **Objective 1:** Position Dubai as a global medical destination by introducing a value-based, comprehensive, integrated and high-quality service delivery system.
- **Objective 2:** Direct resources to ensure happy, healthy and safe environment for Dubai population.
- **Strategic Program 10:** Excellence & Quality, which promotes excellence in healthcare service delivery in Dubai while enhancing patient happiness, experience, satisfaction and trust.

ACKNOWLEDGMENT

The Health Policy and Standards Department (HPSD) developed this Standard in collaboration with Subject Matter Experts. HPSD would like to acknowledge and thank these healthcare professionals for their dedication toward improving quality and safety of healthcare services in the Emirate of Dubai.

Health Regulation Sector

Dubai Health Authority

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The purpose of this document is to assure the provision of the highest levels of safety and quality *Hyperbaric Oxygen Therapy (HBOT) services* at all times. The standards have been developed to align with the evolving healthcare needs and international best practice. The standards include several aspects required to provide effective, efficient, safe and high-quality HBOT Services. The standards include the Registration and licensure procedure, health facility and healthcare professional requirements, management of HBOT service, equipment and maintenance and fire safety.

The key updates on Version 2 are set out below:

1. Addition of definitions- Informed Consent, Inside Attendant and legal guardian
2. Additions of policies for management of pediatric patients (if applicable), management of critically ill patients and management of patients with known infections.
3. The standard shall align with the following:
    a. DHA, Health Facility Guidelines (HFG), 360 Outpatient Unit.
    b. DHA Guidelines for Managing Health Records
    c. DHA Guidelines for Patient Consent
    d. DHA Communicable Disease Notification Policy
    e. DHA Clinical Privileging Policy
    f. Any DHA COVID-19 related policies, standards or guidelines that may be relevant.
    g. Unified Professional Qualification Requirements

4. Standard three elaborates the healthcare professional requirements. There is amendment of the Physician required to provide HBOT service and there is addition of Inside Attendant and Outside Attendants and Patient Care Coordinator.
5. Standards five: management of HBOT elaborates the STOP process.
6. Addition of standards six and seven, elaborating the discharge and post-operative care and equipment and maintenance of equipment.
7. Addition of Standard nine, elaborating the management of HBOT during a pandemic
8. Appendix 4 elaborates the staffing matrix for Class A and B chambers.
9. Appendix 5 elaborates the disqualifying conditions for Internal Attendants (IAs).
10. Appendix 6 enlists the medical tests required for IAs to be fit to work in the HBOT chambers.
11. Appendix 7 elaborates the factors that may increase the complexity of HBOT.
12. Appendix 9 elaborates the recommendations for cleaning and prevention of cross infection in HBOT facilities.
13. Appendix 10 enlists criteria for selection of cleaning agents.

DEFINITIONS

Healthcare Professional: are healthcare personal working in healthcare facilities and required to be licensed as per the applicable laws in United Arab Emirates.

Healthcare Workers: is an individual employed by the hospital, (whether directly, by contract with another entity), provide direct or indirect patient care, this includes but not limited, healthcare professionals, medical and nursing students, administrative staff and contract employees who either work at or come to the hospital site.

Hyperbaric Oxygen Therapy (HBOT): is a treatment in which the patient is placed in a chamber and breathes oxygen at higher than local atmospheric pressure.

Hyperbaric therapeutic chamber: is a pressure vessel capable of accommodating one or more persons with the purpose of providing medical treatment.

Incompetent patient: is a patient who either lack the full legal capacity or have the full capacity, but unable to provide an Informed Consent.

Informed Consent: is an agreement or permission accompanied by full information on the nature, risks and alternatives of a surgical or interventional procedure before the physician begins the procedure/treatment. Accordingly, the patient either consents to or refuses treatment.

Inside Attendant (IA): is a DHA licensed Healthcare Professional who is assessed physically and mentally and declared medically fit to provide direct care and observation in a HBOT chamber during the treatment.

Legal guardian: is a person appointed by the law to consent in place of an incompetent patient based on UAE federal laws and/ or local regulation, when the patient is unable to provide Informed Consent due to an illness or incompetency.

Licensure: is a process of issuing an official permission to operate a health facility to an individual, government, corporation, partnership, Limited Liability Company (LLC), or other form of business operation that is legally responsible for the facility's operation.

OHM: is the electric unit of resistance.

Patient: is any individual who receives medical attention, care or treatment by any healthcare professional or admitted in a health facility.

ABBREVIATIONS

ACLS	:	Advanced Cardiac Life Support
ARTG	:	Australian Register of Therapeutic Goods
ASME	:	American Society of Mechanical Engineers
BLS	:	Basic Life Support
CE	:	Conformité Européenne
CPC	:	Clinical Privileging Committee
DCD	:	Dubai Civil Defence
DHA	:	Dubai Health Authority
DM	:	Dubai Municipality
FDA	:	Food and Drug Administration
HFC	:	Health Facility Guidelines
HRS	:	Health Regulation Sector
HBOT	:	Hyperbaric Oxygen Therapy
IA	:	Inside Attendant
IV	:	Intravenous
MFDS	:	Ministry of Food and Drug Safety
MITI	:	Ministry of International Trade and Industry
MOHAP	:	Ministry of Health And Prevention
NEBOSH	:	National Examination Board in Occupational Safety and Health
NFPA	:	National Fire Protection Association
O_2	:	Oxygen

OSHA	:	Occupational Safety and Health Administration
PALS	:	Pediatric Advanced Life Support
Psi	:	Pound per square inch
PVHO	:	Pressure Vehicles for Human Occupancy
RN	:	Registered Nurse
STOP	:	Safety Time Out and Pause
TFDA	:	Taiwan Food and Drug Administration
UAE	:	United Arab Emirates

1. BACKGROUND

Hyperbaric Oxygen Therapy (HBOT) is a treatment in which the patient is placed in a chamber and breathes Oxygen (O_2) at higher-than-atmospheric pressure. Initially, HBOT was designed for patients in Pulmonary Hospitals and for divers and miners. In recent times, it has evolved and is a thriving and appreciated branch of medicine that is indicated for the treatment of an increasing number of acute and chronic conditions (**Appendix 1**), but it is contraindicated in certain conditions (**Appendix 2**).

Hyperbaric chambers are classified according to occupancy as follows:

- Class A- Human, multiple occupancy (Multiplace Chamber)
- Class B- Human, single occupancy (Monoplace Chamber)
- Class C- Animal, no human occupancy.

Because of the unique atmospheric conditions to which the patient is exposed, there are concerns about the safety aspects of this therapy. Possible complications during HBOT include baro-traumatic lesions (middle ear, nasal sinuses, inner ear, lung and teeth), oxygen toxicity (central nervous system, lung), confinement anxiety, and ocular effects (myopia, cataract growth).

Safe HBOT requires special equipment, specially trained physicians and other professionals, adequate infrastructure and detailed organizational arrangements, policies and operating procedures. These standards are hence developed to ensure provision of safe, high quality and appropriate hyperbaric medical care for patients with conditions likely to benefit from HBOT.

2. SCOPE

2.1. HBOT services in DHA licensed health facilities.

3. PURPOSE

3.1. To assure provision of the highest levels of safety and quality HBOT services in Dubai Health Authority (DHA) licensed health facilities.

4. APPLICABILITY

4.1. DHA licensed healthcare professionals and health facilities providing HBOT services.

5. STANDARD ONE: REGISTRATION AND LICENSURE PROCEDURES

5.1. All health facilities providing HBOT services shall adhere to the United Arab Emirates (UAE) Laws and Dubai regulations.

5.2. Health facilities aiming to provide HBOT services shall comply with the DHA licensure and administrative procedures available on the DHA website https://www.dha.gov.ae .

5.3. Licensed health facilities opting to add HBOT services shall inform Health Regulation Sector (HRS) and submit an application to HRS to obtain permission to provide the required service and shall meet the following requirements:

5.3.1. Employ a Consultant/Specialist Physician in Undersea Hyperbaric Oxygen Medicine.

5.3.2. Employ DHA licensed healthcare professionals to satisfy the functional program of the health facility.

5.3.3. Install equipment for the provision of HBOT service.

5.3.4. Have appropriate equipment and trained healthcare professionals to manage critical and emergency cases.

5.4. The health facility should develop and maintain the following policies and procedure; that are read and signed off by all staff:

5.4.1. Emergency action plan

5.4.2. Fire safety and evacuation

5.4.3. Incident reporting

5.4.4. Infection control measures

5.4.5. Management of Pediatric Patients (if applicable)

5.4.6. Management of Critically ill patients

5.4.7. Management of patients with known infections

5.4.8. Medication management

5.4.9. Patient education and Informed consent

5.4.10. Patient acceptance criteria

5.4.11. Patient health record

5.4.12. Patient privacy and confidentiality

5.4.13. Patient discharge/transfer

5.4.14. Staffing.

5.5. The health facility shall provide documented evidence of contracts for the following:

5.5.1. Contract with a nearby hospital in case of any complication or emergency.

5.5.2. Clinical laboratory services

5.5.3. Equipment maintenance with manufacturing company or an authorised dealer

5.5.4. Housekeeping services

5.5.5. Laundry services

5.5.6. Medical waste management as per Dubai Municipality (DM) requirements.

5.6. The health facility shall maintain charter of patients' rights and responsibilities posted at the entrance of the premise in two languages (Arabic and English).

5.7. The health facility shall have in place a written plan for monitoring equipment for electrical and mechanical safety, with monthly visual inspections for apparent defects.

5.8. The health facility shall ensure it has in place adequate lighting and utilities, including temperature controls, water taps, medical gases, sinks and drains, lighting, electrical outlets and communications.

5.9. Relocation of the HBOT chamber shall be possible only with DHA approval.

6. **STANDARD TWO:** HEALTH FACILITY REQUIREMENTS

6.1. HBOT services shall only be provided in:

6.1.1. Hospitals

6.1.2. Day surgical centers

6.1.3. Outpatient care facilities that includes at least one (1) of the specialities as mentioned above.

6.2. The HBOT facility shall not be located in a mall or an industrial area.

6.3. Class A (multiplace chambers) shall be used only in hospitals and shall be located on the ground floor.

6.4. Class B (Monoplace chambers) shall be used in approved health facilities as mentioned above.

6.5. Class C chambers shall not be used in health facilities.

6.6. For general health facility requirements the health facility should meet the relevant requirement as per the DHA, Health Facility Guidelines (HFG), 360 Outpatient Unit.

6.7. A HBOT facility shall have an emergency exit with visible signs directing patients in case of an emergency.

6.8. The health facility shall ensure easy access to the health facility and treatment areas for all patient groups.

6.9. The specific HBOT service area shall include, but not limited to:

6.9.1. Reception and waiting area

6.9.2. Consultation/examination room

6.9.3. Holding area

6.9.4. Patient changing facility

6.9.5. HBOT treatment room

6.9.6. Gas storage room

6.9.7. Compressor room

6.9.8. Gurney/stretcher storage

6.9.9. Clinical and non-clinical storage

6.9.10. Clean and dirty utility

6.9.11. Administrative activities area.

6.10. HBOT treatment room shall:

6.10.1. Conform to National Fire Protection Association (NFPA) 99, Chapter 14 and Dubai Civil Defence (DCD) requirements.

6.10.2. Have an antistatic, impervious, fire proof, monolithic, joint free and washable flooring, with no carpets or wooden flooring.

6.10.3. Have window(s) with an outside view.

6.10.4. Be adequately ventilated with a smoke evacuator.

6.10.5. Have easy access for wheelchairs.

6.10.6. Have access to toilets.

6.10.7. Be provided by approved sprinkler heads equipped with fusible and temperature elements that have ratings as low as possible.

6.10.8. Have "No smoking" signs visibly displayed.

6.10.9. Preferably provide a metal detector at the entrance of the HBOT treatment room to ensure that the patient do not carry any form of metal into the chamber.

6.11. Class A (Multiplace) treatment room requirements:

6.11.1. The health facility housing a Class A chamber shall be designed not to obstruct egress of patients and staff. The rapid or emergency removal of a patients or healthcare professional from one chamber shall not restrict the orderly, rapid and simultaneous removal of patients or healthcare professional from other chambers.

6.11.2. A minimum of two (2) exits shall be provided for the treatment room unless a single exit opens directly to a primary evacuation route

6.11.3. Doorways of egress shall have a minimum opening of one (1) meter.

6.11.4. The Class A chamber room should have a minimum clearance of 2.5 meters in front of a chamber entry door, that is intended for gurney/stretcher access.

6.11.5. There shall be a minimum of 0.9 meter clearance around any part of the chamber system that defines an exit pathway.

6.11.6. If the chamber control console is immediately adjacent to the chamber, there should be a minimum clearance of 0.9 meter between the control console and any obstruction.

6.11.7. There should be a minimum clearance of 0.6 meters in a pathway that allows access to valves used in chamber operation.

6.11.8. There should be a minimum clearance of 0.6 meters in a pathway that allows access to areas of the chamber that require cleaning or maintenance.

6.11.9. Entries designed for wheelchairs or wheeled gurneys should have access ramps. A ramp should be a minimum width of 45 inches, a maximum of height of 0.75 meters, have a maximum slope of 1 in 12, and have handrails on both sides.These ramp specifications are not necessary if the slope of the ramp is no steeper than 1 in 20.

6.11.10. The chamber shall have breathing equipment for all occupants, and an extra spare one.

6.11.11. All material inside the chamber shall be fire resistant and HBOT environment compatible.

6.12. Class B (Monoplace) treatment room requirements:

6.12.1. The health facility housing a Class B chamber shall be designed not to obstruct egress of patients and staff.

6.12.2. In the case of multiple Class B chambers installed in a single setting, the rapid or emergency removal of a patient from one chamber shall not restrict in any way the rapid and simultaneous removal of patients from other chambers.

6.12.3. Exit doorways of egress shall have a minimum opening of one (1) meter.

6.12.4. The space required to house Class B chambers and supporting equipment shall not be less than eighteen (18) sq. meters to host one (1) monoplace hyperbaric chamber and patient-transfer gurney.

6.12.5. There shall be a minimum clearance of 0.9 meters around any part of the chamber system that defines an exit pathway.

6.12.6. If the chamber control console is integrated into or immediately adjacent to the chamber, there shall be a minimum clearance of 0.9 meters between the control console and any obstruction.

6.12.7. There shall be a minimum clearance of 0.6 meters in a pathway that allows access to valves or controls used in chamber operation. If the chamber has a patient loading device, this clearance shall be maintained when the patient loading device is extended out of the chamber.

6.12.8. Any part of the chamber that must be accessed shall be at least 0.3 meters away from any obstruction, unless the chamber is fitted with casters.

6.12.9. There shall be an O_2 shut-off valve for each chamber, which is accessible to the chamber operator.

6.12.10. Any electrical service outlets located within three (3) meters of the Class B chamber entrance shall be located no less than 0.9 meters above floor level.

6.12.11. Lighting over the Class B chamber shall be incandescent, preferably with dimmer control.

6.12.12. Fluorescent lighting installed in rooms housing Class B chambers shall not be located directly over the chambers.

6.12.13. If the room housing Class B chambers has windows, the chambers should be protected from direct exposure to sunlight.

6.12.14. There shall be screens between chambers to ensure patient privacy.

6.12.15. There shall be a 0.3 meters clearance at the foot of the chamber for unobstructed gas connection at the foot of the chamber.

6.13. Class B (Monoplace Chambers), it shall:

6.13.1. Not be located in direct sunlight or close to a heat source.

6.13.2. Be easily accessible to the patient and staff.

6.13.3. Be free of cracks internally or externally.

6.13.4. Be free of corrosion, damage, dents, gouges or other damage internally and externally.

6.13.5. Have an atmosphere free of toxic or flammable gases.

6.13.6. Have alarms for low-pressure gas monitoring panel, which are tested and maintained routinely.

6.13.7. Be equipped with audible and visual alarms.

6.13.8. Have a warning sign displaying prohibited material inside the hyperbaric chamber, which shall be posted at the chamber entrance **Appendix 3.**

6.13.9. Have an external breathing air source in case of emergency evacuation from the chamber.

6.13.10. Have acrylic windows with certification such as a "U"/a partial "U2" ASME stamp, with PVHO-1 or an equivalent certification.

6.13.11. Have viewing ports if not completely transparent.

6.13.12. Have a manual access for the operating controls for pressurization, depressurization, parameter condition monitoring and safety interlocking.

6.13.13. Have external exhaust termination with the pipe elbow facing down.

6.13.14. Have a dedicated vent line to release the O_2 after treatment.

6.13.15. Have earth grounding system with a regular documented maintenance.

6.13.16. Be grounded to a common building (pipe/steel) or true earth ground.

6.13.17. Have the resistance between the grounded chamber hull and electrical ground not exceeding one (1) Ohm (DO NOT use the building electrical panel or wall outlet ground to ground the chamber).

6.13.18. Have a quick release access door.

6.13.19. Have all openings leading from the chamber to external fittings or controls and shall be free from obstruction.

6.14. Gas cylinder storage room shall

6.14.1. Be large enough able to store enough (H) cylinders and manifolds for the reserve breathing gases required for chamber operations.

6.14.2. Have a minimum of six (6) medical O_2 tanks.

6.14.3. Have a minimum of one (1) 400-liter liquid O_2 tank with vaporizer.

6.14.4. Be designed to comply with DCD and NFPA 99 requirements.

6.14.5. Have explosion proof electrical fittings.

6.14.6. Have an external exhaust ventilation provided outside the building area.

6.14.7. Have an automatic gas manifold monitored by alarm.

6.14.8. Maintain an alarm that monitors the high and low gas pressure.

6.14.9. Maintain documentation of staff training in emergency procedures in the event of any incident related to gas pressure release.

6.14.10. Have a concrete or tiled flooring.

6.14.11. Have a visibly displayed "No smoking" sign in this room.

6.14.12. Provide a door to the room with door vents for O_2 to pass in case of leakage from cylinders.

6.14.13. Provide access for a truck to refill the O_2 in case the health facility uses liquid O_2 for the treatment.

6.15. The health facility shall maintain the following medical equipment and supplies:

6.15.1. Apparatus to measure blood pressure.

6.15.2. Electrocardiographic monitoring equipment.

6.15.3. Resuscitation trolley equipped with relevant resuscitation equipment and apparatus, medical O_2 and medications.

6.15.4. Intravenous (IV) supplies such as syringes, needles, tape, etc.

6.16. The health facility shall maintain a record of HBOT chamber:

6.16.1. Installation checklist

6.16.2. Assessment checklist

6.16.3. Operational checklist

6.16.4. Cleaning checklist

6.16.5. Maintenance log

6.16.6. Log of use of the chamber.

7. **STANDARD THREE:** HEALTHCARE PROFESSIONALS REQUIREMENTS

7.1. Only a DHA licensed Consultant/Specialist Physician in Undersea Hyperbaric Oxygen Medicine can provide the HBOT Service.[1]

7.2. The team providing HBOT services could comprise of the following; elaborated in **Appendix 4.**

7.2.1. Physician responsible for the HBOT service provision

7.2.2. HBOT Chamber Operator (HBOT Technicians)

7.2.3. Inside Attendant (IA)- for class A chamber

7.2.4. Outside Attendant- for class A chamber

7.2.5. Registered Nurse (RN)

7.2.6. Safety Officer

7.2.7. Patient Care Coordinator/Administrator

7.2.8. Fire Marshal.

7.3. Physician responsible for the HBOT service provision shall:

[1] The eligibility criteria for subspecialties is elaborated in the Unified Professional Qualification Requirements.

7.3.1. Prescribe and supervise the safe provision of HBOT services.

7.3.2. Be responsible for the overall medical care of the patient receiving the service.

7.3.3. Be responsible for the quality assurance of the HBOT service.

7.3.4. Be responsible for patients follow up after the hyperbaric treatment.

7.3.5. Define the protocol, procedures for the treatment and ensure they are adhered to.

7.3.6. Ensure healthcare workers in the facility are qualified and competent to perform their duties and knowledgeable of the risks and hazards.

7.3.7. Ensure policy and procedure manuals for the administration of the HBOT facility, the operation of equipment, and the management of patients are prepared, maintained and readily accessible to staff.

7.3.8. Assess the suitability and the fitness of the patient for HBOT.

7.3.9. Determine the risk benefit profile.

7.3.10. Interpret any related diagnostic testing.

7.3.11. Generate a therapeutic dosing profile.

7.3.12. Evaluate subsequent clinical course.

7.3.13. Manage any related side effects and complications.

7.3.14. Be present at the premises and immediately available at all times that the chamber is occupied and promptly respond and manage any critical events.

7.3.15. Ensure the safe and ethical care of patients.

7.4. Chamber Operator (HBOT Technician)

7.4.1. Registered Nurses (RNs) with recognised training and adequate experience could be appointed as a Chamber Operator or a healthcare professional with minimum forty (40) hours face-to-face recognised training with certification and an experience for at least six (6) months as hyperbaric technicians could operate the chamber.

7.4.2. The Chamber Operator shall be trained to safely implement prescribed therapy.

7.4.3. Since the Chamber Operator is in-charge of operating the multiplace or monoplace hyperbaric chamber(s), his/her presence is essential during the working hours of the health facility providing HBOT services.

7.4.4. There shall be one (1) chamber operator for every two (2) monoplace chambers during all working hours of the health facility providing HBOT services.

7.4.5. At least one additional staff, preferably the Physician responsible for HBOT in addition to the Chamber Operator must be present during the treatment.

7.4.6. If necessary (as determined by the hyperbaric physician), it is acceptable for an Inside Patient Attendant or an Accompanying person, such as the parent of a small child, to accompany a patient inside a monoplace chamber.

7.4.7. There shall be two (2) Chamber Operators for every multiplace chamber during all working hours of the facility.

7.4.8. The Chamber Operator operating Class B chambers shall ensure the following:

a. Conduct a general check-up of the patient, including vital signs and the initial assessment and file this in the medical records.

b. Maintain visual and audio contact with patient during their treatment.

c. Notify the physician immediately in case a patient complains or shows signs suggesting an unanticipated change in status.

d. Not assume any of the responsibilities of the Hyperbaric Physician.

e. Not carry out hyperbaric treatment without patient-specific hyperbaric physician signed medical orders.

7.4.9. The Chamber Operator of a multiplace chamber must be qualified and trained to carry out the specialized chamber operations. The Chamber Operator, operating the multiplace chamber shall be responsible to ensure the following:

a. Operate the internal and external devices of the chamber in-between sessions.

b. Control and operate the mechanisms for compression and decompression, and deliver gas mixtures and O_2.

c. Control and application of the safety regulations concerning prevention of fire and O_2 toxicity.

d. Calculate, apply and control of compression and decompression schedules for patients, specialists and/or physicians, nurses and attendants, apply decompression stops, when necessary.

e. Intervene inside the chamber under pressure, in order to control or check the correct operation of the pneumatic circuits or devices.

f. Adapt and check the medical instruments carried by the patients before being introduced into the chamber, in order to assure their correct operation, and to avoid dangerous or undesirable effects.

g. Control and check the operation of auxiliary facilities of the chamber: air compressors, sources of compressed air or medical gases, air reserves, pneumatic circuits, control systems.

h. Maintain the facility by doing small repair jobs or technical interventions in case of problems which may occasionally occur, and which do not require the intervention of highly specialized technical staff.

7.5. Inside Attendant (IA)

7.5.1. The physician responsible for the HBOT service shall ensure that the IA is DHA Registered Nurse (RN) and/or HBOT Technician who is mentally and physically fit to work in a Class A multiplace chamber with compressed air. The minimum patient to IA ratio for optimal operational safety should typically be as follows:

a. For uncomplicated ambulatory patients, minimum patient to IA ratio of 6:1.

b. For complicated patients requiring increased level of personal care, minimal patient to IA ratio of 4:1.

c. For critical care patient, minimum patient to IA ratio of 1:1 (ventilated patients may require 2-staff per patient).

I. When critical care patients are treated along with either uncomplicated or complicated patients, staffing ratios for non-critical

patients remain as above, regardless of the number of staff necessary to safely and effectively treat critical patients.

II. For critically ill patients or intubated patients it is recommended that a RN experienced with hyperbaric medicine be present inside the chamber with the patient at all times. The patient: IA ratio should be 1:1.

7.5.2. The IA shall be exposed to a maximum of ninety (90) minutes in the chamber per day and the time gap between two sessions shall be at least 8-10 hours.

7.5.3. The IA is recommended medical examinations as mentioned below:

a. Before starting work as an IA.

b. Periodic physical examination every five (5) years.

c. A re-examination after a hyperbaric related injury or illness such as a known decompression sickness, arterial gas embolism, audio-vestibular illness, central nervous system dysfunction, when there is a change on the annual self-report, or as needed to determine fitness to work in hyperbaric conditions. A person should not be allowed to return to work after any significant injury or illness in hyperbaric conditions until released by the hyperbaric specialist to do so.

d. The physician responsible for the HBOT shall provide a written fitness for duty report outlining the IAs medical condition and fitness to work in a compressed air environment or other hyperbaric activities and should

indicate any restrictions that would apply to the IA's work activity in the report.

e. An individual having certain conditions as elaborated in **Appendix 5** should be disqualified from engaging in working as an IA.

7.6. Outside Attendant

7.6.1. This could be a RN available to provide technical or patient support as needed.

7.6.2. The Outside Attendant shall remain in the room at all times when the chamber is pressurized so that the Chamber Operator has no additional responsibilities other than operating the chamber.

7.7. Registered Nurse (RN)

7.7.1. The ratio of the RN to the physician shall be 1:1.

7.7.2. The RN shall conduct the general check-up of the patient, such as vital signs, initial assessment etc. and document it in the health records.

7.7.3. The RN shall be trained and responsible for going through a checklist before placing the patient inside the chamber.

7.7.4. In case of a multiplace chamber, the RN could be the IA during treatment to monitor patients.

7.7.5. The RN shall be responsible to manage any medical emergencies that may arise when the patient is in the health facility.

7.8. Safety officer

7.8.1. Any staff employed by the HBOT facility could be nominated as the safety officer.

7.8.2. The safety officer shall undergo formal and comprehensive training in the safety aspects of hyperbaric medicine and related technology from National Examination Board in Occupational Safety and Health (NEBOSH) or Occupational Safety and Health Administration (OSHA).

7.8.3. The safety officer shall develop, maintain and manage a safety program based upon compliance with recognized standards, which shall demonstrate effective elements of hazard mitigation, while employing recognized risk management concepts.

7.8.4. The safety officer shall be responsible for maintaining a daily, weekly and annual checklist of the HBOT chambers.

7.9. Fire Marshal

7.9.1. Any staff employed by the HBOT facility could be nominated as the fire marshal.

7.9.2. The health facility shall ensure that the fire marshals receives formal training relevant to fire and related hazards and at least one (1) fire marshal is present on the premises during working hours.

7.9.3. The fire marshal shall orient and train the staff on fire safety measures and response to fire events in the health facility.

7.9.4. The training shall be documented and included in staff files.

7.9.5. The fire marshal shall conduct and document fire evacuation drills at least 2-3 times a year.

7.10. The Clinical Privileging Committee (CPC) of the health facility shall privilege the relevant healthcare professionals of the HBOT team aligned with their education, training, experience and competencies. The privilege shall be reviewed and revised at regular intervals, as per the DHA, Clinical Privileging Policy.

7.11. All healthcare professionals shall be trained in HBOT and have Basic Life support (BLS) and Advanced Cardiac Life Support (ACLS).

7.12. Valid certificate of Pediatric Advanced Life Support (PALS) when applicable.

7.13. All staff shall maintain their skills by relevant training and continuous education, which shall be documented.

7.14. Staff working under pressure in the chambers must undergo an appropriate initial and periodic medical examination to be recognised as fit for hyperbaric exposures.

8. **STANDARD FOUR:** PRE-HBOT EVALUATION, PATIENT SELECTION AND INFORMED CONSENT

8.1. In case treating critically ill or unstable patients, HBOT shall be carried out only in hospital setting.

8.2. The patient health records should be maintained as per the DHA Guidelines for Managing Health Records.

8.3. The HBOT physician shall assess the patients for a complete clinical and physical examination, identify conditions that may increase the complexity of the HBOT **Appendix 7** and only then determine the treatment plan.

8.4. The HBOT physician is required to assess and advise each patient prior to commencing HBOT, to ensure the following:

8.4.1. The patient has a medical condition that is likely to benefit from HBOT.

8.4.2. There are no absolute contraindications to HBOT and any relative contraindications are considered and appropriately managed.

8.4.3. Any anticipated or potential risks are considered and a plan is in place to amend them if required.

8.5. All patients or legal guardian of children or incompetent patients shall sign an informed consent form before starting the HBOT.

8.6. The Informed Consent forms shall be in Arabic, English or other language based on community needs, in accordance to the DHA Guidelines for Patient Consent **Appendix 8**.

8.7. If a patient approaches a HBOT facility more than once for different medical conditions then a new informed consent shall be requested due to the change in medical condition and hence change in treatment plan.

9. **STANDARD FIVE:** MANAGEMENT OF HBOT

9.1. Prior of HBOT treatment ensure the following:

9.1.1. Perform a Safety Time Out and Pause (STOP) prior to every HBOT. STOP shall include the following:

a. Verifying "Right patient, Right Treatment and Right Safety".

b. Checking the patient ground (monoplace).

c. Ensuring all prohibited items are removed from the chamber (both monoplace and multiplace).

9.1.2. The treatment profile and staffing plan should be confirmed and the completed STOP checklist dated and signed by two staff members prior to closing the door of the chamber.

9.1.3. Patient has had a shower to ensure that the patient is free of any makeup or other flammable lotions or balms.

9.1.4. Patient wears cotton scrubs without pockets that are provided by the health facility.

9.1.5. Patient wears a grounding device (where required).

10. STANDARD SIX: DISCHARGE AND POST-OPERATIVE CARE

10.1. Specific discharge criteria are recommended for patients receiving sedation.

10.2. Each patient should be periodically reviewed for the following:

10.2.1. Determine progress of condition being treated.

10.2.2. Confirm or modify the treatment plan.

10.2.3. Patient treatment limitations.

10.3. Complications of HBOT should be recorded when indicated.

11. STANDARD SEVEN: EQUIPMENT AND MAINTAINANCE

11.1. The equipment used shall be approved by at least two (2) of the following international authorities:

11.1.1. Food and Drug Administration (FDA)

11.1.2. Health Canada

11.1.3. Conformité Européenne (CE)

11.1.4. Australian Register of Therapeutic Goods (ARTG)

11.1.5. Ministry of Food and Drug Safety (MFDS) Korea

11.1.6. Taiwan Food and Drug Administration (TFDA)

11.1.7. Japans Ministry of International Trade and Industry (MITI)

11.2. The equipment shall be registered with the Ministry of Health and Prevention (MOHAP) in the UAE.

11.3. Inflatable, collapsible or portable chambers shall not be used in any health facility as they are NOT recognised medical devices for hyperbaric oxygen treatment by the FDA and no supporting clinical studies validate their effectiveness.

11.4. The multiplace equipment shall be continuously and accurately monitored for the following:

11.4.1. Oxygen Concentration

11.4.2. Carbon di Oxide Concentration

11.4.3. Humidity

11.4.4. Temperature

11.4.5. Pressure.

11.5. Equipment used for these measurements shall be periodically calibrated according to manufacturer's recommendations and requirements.

11.6. The internal oxygen concentration for the monoplace chambers shall be continuously monitored.

11.7. The inside and outside of the HBOT chambers must be cleaned by a staff who is trained for this purpose with approved cleaning agents **Appendices 9-10**.

12. **STANDARD EIGHT:** FIRE SAFETY

The risk of fire is a major concern in the hyperbaric environment. The potential for accidental ignition of flammable materials is increased in the hyperbaric environment and their burning rate is markedly enhanced by a raised percentage or raised partial pressure of O_2.

12.1. The facility shall exclude flammable material or other sources of ignition from the treatment room by a rigorously enforced “Contraband Policy”.

12.2. Patients when undergoing HBOT treatment should wear only 100% cotton or other hyperbaric compatible materials.

12.3. All the linen used inside the hyperbaric chamber shall be 100% cotton.

12.4. The facility should comply DCD and NFPA 99 (chapter for HBOT) regarding fire safety standards.

12.5. There should be evacuation maps posted in the facility to indicate current locations marked with "You are here" to provide information regarding escape routes, fire exits and fire extinguishers.

12.6. All fire exit doors shall be unobstructed and in proper working condition with exit points marked correctly.

12.7. There shall be “No Smoking” signs visibly displayed all around the facility.

12.8. The facility shall establish a fire safety plan for early detection, confining, extinguishment, rescue, evacuation and alerting the DCD.

12.9. The facility shall maintain fire extinguishers, smoke alarms, sprinkler system and other fire protection equipment and devices as per the DCD requirements.

12.10. Fire extinguishers shall be properly and accessibly located. They must be fixed securely on the wall with safety pins fitted, seals intact, charged and current service record available.

12.11. The facility shall have trained staff as fire marshals and at least one (1) fire marshal shall be present on the premises during working hours.

12.12. Staff shall have fire and safety training to respond to fire events in the building. Orientation on the fire safety measures must be included in new staff induction program.

12.13. All staff shall be aware of the following:

12.13.1. Location and use of fire hose reel/cabinets/blankets

12.13.2. Assembly points

12.13.3. Fire alarms/call points break glass/pull station

12.14. Fire evacuation drill should be conducted and documented at least two (2) times a year.

12.15. Fire in the facility buildings and evacuation procedures including removing patients from the chamber should be documented.

12.16. The installation of additional electrical equipment should be limited only for devices, which comply with hyperbaric conditions.

13. **STANDARD NINE:** MANAGEMENT OF HBOT PATIENTS DURING A PANDEMIC

13.1. Both monoplace and multiplace chambers are constrained spaces to which both patients and staff are exposed. Additionally, monoplace chambers have limited access for cleaning and this requires the use of long-handled cleaning devices. The cleaning

may therefore not be completely effective or may miss some areas, without proper care, hence the Hyperbaric facilities shall ensure the following:

13.1.1. Adopt and implement policies that require effective cleaning after every patient.

13.1.2. Ensure staff wear appropriate PPE especially when opening the HBOT Class B chamber as they could be exposed to contaminated droplets.

13.1.3. Training, practice and simulation of all HBOT staff.

13.1.4. HBOT staff are familiar with all infectious precautions being implemented by the health facility and the health authorities and take additional precautions specific to the hyperbaric service.

13.1.5. Screening of patients and staff before entering the HBOT facility.

13.1.6. Temperature measurements of individuals entering the facility to ensure they are afebrile.

13.1.7. Test each patient to confirm PCR negative result and defer HBOT service in case COVID-19 infection or exposure is identified, to ensure the patient has sufficient recovery of respiratory function and gas exchange before commencing the HBOT treatment.

13.1.8. Deny permission to visitors, family or non-essential staff within the unit.

13.1.9. All breathing equipment including head tents, oxygen masks or BIBS masks must be thoroughly disinfected after each use even if assigned and labelled for individual patients.

13.1.10. Disinfection is also required for gurneys, stretchers, wheelchairs and patient seating after each use.

13.1.11. It is recommended that each hyperbaric facility make a list of items that are commonly touched by hands, such as faucets or door handles, and implement a schedule of frequent disinfection.

13.1.12. Patient personal clothing and other items are also a potential source of infection. Bins for storage of these items during HBOT are best labelled and kept for each individual patient but in any case, must also be disinfected after each use.

13.1.13. Use of alcohol based had sanitizer could pose a risk with O_2 and to chamber acrylics, hence frequent hand washing for staff and patients is recommended.

REFERENCES

1. Aetna (2020/ 2021) Hyperbaric Oxygen Therapy. Available on: http://www.aetna.com/cpb/medical/data/100_199/0172.html (accessed on 03/08/2021).
2. Canadian Undersea and Hyperbaric Medical Association. Guidelines to the Practice of Clinical Hyperbaric Medicine and Provision of Hyperbaric Oxygen Treatment 2015 Available on: https://cuhma.ca/_Library/Documents/CUHMA_Standards_of_Practice_Guidelines_1st_Edition.pdf (accessed on 03/08/2021).
3. Canadian Undersea and Hyperbaric Medical Association. Guidelines for Hyperbaric Medicine: COVID-19 pandemic. Available on: https://cuhma.ca/_Library/Documents/CUHMA_COVID-19_Pandemic_Statement.pdf (accessed on 03/08/2021).
4. Canadian Undersea and Hyperbaric Medical Association Addendum to the CUHMA Guidelines for Hyperbaric Medicine: COVID-19 pandemic (and other highly contagious high fatality respiratory tract infectious agents) Available on: https://cuhma.ca/_Library/Documents/CUHMA_COVID-19_Pandemic_Statement.pdf (accessed on 05/08/2021).
5. Certified Hyperbaric Technologist Training and Certification. National Board of Diving and Hyperbaric Medical Technology Available on: National Board of Diving and Hyperbaric Medical Technology (nbdhmt.org) (accessed on 05/08/2021).
6. Food and Drug Administration, Hyperbaric Oxygen therapy: Get the facts. Available on: https://www.fda.gov/consumers/consumer-updates/hyperbaric-oxygen-therapy-get-facts (accessed on 23/08/2021).

7. UHMS Position Statement. Safety Timeout and Pause "STOP". Available on: https://www.uhms.org/images/Position-Statements/STOP_July_2014.pdf (accessed on 02/08/2021).
8. UHMS Position Statement: Minimum-staffing guidelines of multiplace hyperbaric facilities. Available on: https://www.uhms.org/images/Position-Statements/UHMS_Position_Statement_on_Multiplace_staffing_Ratios_Final.pdf (accessed on 04/08/2021).
9. UHMS Position Statement: The Importance & Recognition of Hyperbaric Certification for Technicians & Nurses. Available on: https://www.uhms.org/images/Position-Statements/position_statement_-_uhms_associates_hyperbaric_certification_recognition_v.10.05.2019_v6_1.pdf (accessed on 02/08/2021).
10. Undersea & Hyperbaric Medical Society. Available on: https://www.uhms.org/resources/position-statements.html (accessed on 02/08/2021).
11. Undersea and Hyperbaric Medical Society 2014. UHMS Guidelines for Credentialing, Privileging and Supervision of Hyperbaric Oxygen Therapy in the U.S.A. Available on: https://www.uhms.org/images/Position-Statements/UHMS_Cred_and_Priv_Guide_Jan_31_2018.pdf (accessed on 05/08/2021).

APPENDICES

APPENDIX 1: INDICATIONS OF HBOT

	Indication for HBOT
1.	Air and gas bubbles in blood vessels
2.	Anemia (severe anaemia when blood transfusions cannot be used)
3.	Burns (severe and large burns treated at a specialized burn center)
4.	Carbon monoxide poisoning
5.	Crush injury
6.	Decompression sickness (diving risk)
7.	Gas gangrene
8.	Hearing loss (complete hearing loss that occurs suddenly and without any known cause)
9.	Infection of the skin and bone (severe)
10.	Radiation injury
11.	Skin graft flap at risk of tissue death
12.	Vision loss (when sudden and painless in one eye due to blockage of blood flow)
13.	Wounds (non-healing, diabetic foot ulcers)

APPENDIX 2: CONTRAINDICATIONS OF HBOT

Contraindications	Condition or Disease
Absolute	1. Nondecompressio pneumothorax (a life threatening condition) 2. Treatment with cytostatic agents such as Adriamycin, disulfiram, cis-platinum, sulphamylon (HBOT increases their side effects)
Relative	Upper respiratory tract infections, Pregnancy (only carbon monoxide poisoning is an indication for HBOT) Epilepsy Emphysema, Fever, Ear surgeries and chest, Metastatic cancer

	Advisable to take proper precautions in the following conditions
1.	Individual with a pacemaker
2.	Pregnant woman
3.	Individual with certain types of lung diseases, because of an increased risk for a collapsed lung
4.	Individual taking certain chemotherapy drugs
5.	Patient with a collapsed lung
6.	Individual taking the drug disulfiram (Antabuse)
7.	Individual using the topical cream sulphamylon
8.	Patient with heart failure; HBOT can make symptoms worse
9.	Individual with a cold or a fever
10.	Individual who is claustrophobic

Note: HBOT should not be used for:

- Conditions not approved by FDA; unless a part of a clinical trial that has been approved by the DHA Research Ethical Committee.
- Unproven purposes such as cure cancer, Autism, Alzheimer's disease or Anti-Aging.

APPENDIX 3: POSTER AT THE ENTRANCE OF THE HBOT CHAMBER

The following is allowed inside the hyperbaric chamber:

1. Yourself; free of hair products, make-up, perfume/cologne, hearing aid, anything on the list below "List of Prohibited Items"
2. Undergarments: Only when permitted on an as needed basis. If permitted, please wear 100% cotton undergarments. (Do not wear Lycra or spandex brassier or underpants)
3. Center issued scrubs or gown
4. Water bottle provided by your chamber technician

List of Prohibited Items- The letter(s) beside each item indicates the general reason for prohibiting it, the coding is elaborated below)

1. Adhesives (F)
2. Aerosols (D, E, F)
3. Aftershave (D, F)
4. Alcohol (D, F, P)
5. Batteries with unprotected leads (F)
6. Chemical cleaners, e.g.; trichloroethylene, 'Freon', etc. (D)
7. Cigarettes, cigars, tobacco of all kinds (F, M)
8. Cleansing powder (C, F, P)
9. Clothing, bedding included blankets, sheets, pillows, mattresses, etc. (F)
10. Drugs, non-prescribed (P)
11. Electrical equipment including tape recorders, radios, etc. (F)
12. Explosives (F)
13. Glass thermometers, including batteries containing mercury (C, D, P)
14. Ink pens (M)
15. Lighters, matches (F)
16. Newspaper (F)
17. Non-diving watches (L, M)
18. Petroleum based lubricants, grease, fluids (F)
19. Sugar and fine powders and other flammable food stuffs (E, F)
20. Thermos flasks (L, P)

- **C** - possibility of damaging the fabric of the chamber
- **L** - could be broken or damaged by pressure

- **D** - contamination of the environment
- **E** - explosion risk
- **F** - fire source (including static charges) or a combustible substance
- **M** - will possibly cause a mess
- **P** - affects ability of diver

More specifically items strictly excluded from the chamber include but not limited to:

1. Shoes/stockings (cotton socks permitted)
2. All flammable fabrics (wool, synthetics, bedding)
3. Street clothing, including undergarments made of wool, nylon, silk or satin
4. Bras with metal under-wiring
5. Any static-producing material (Velcro)
6. Oils and grease (make-up, lipstick, hair preparations, sunscreen, skin lotion)
7. Hairspray/gel
8. Nail polish
9. Perfume/cologne
10. Jewellery (all must be removed or covered with white tape)
11. Chewing gum
12. Dentures
13. Metallic objects (bobby pins, hair clips, car keys)
14. Batteries/battery-powered equipment (headphones, watches, hearing aids)
15. Electronics/MP3 players
16. Phones/pagers
17. Medications
18. Newspapers/magazines
19. Coins/money
20. Petroleum-based dressing (Vaseline gauze)
21. Alcohol-based applications
22. Hand warmers/transdermal heat patches
23. Cigarettes
24. Matches/lighters
25. Sharp toys
26. Unnecessary items

APPENDIX 4: STAFFING MATRIX FOR CLASS A AND CLASS B CHAMBERS

Class A Multiplace HBOT Chamber				
Patient Characteristics	**Stable**	**Intermediate**	**Complex**	**Critical**
Patient complexity level	1 - 2	2 - 3	4	5
HBOT type	Elective	Elective/urgent /emergency	Elective/urgent /emergency	Emergency/urgent
Facility Level	1 - 3	1 - 3	1 - 2	1 - 2
HBOT Physician	1 present, may act as outside attendant	1 present, may act as outside attendant	1 present	1 (consider additional physician if needed inside chamber but not mandatory)
Chamber Operator (HBOT Technician)	1	1	1	1
Safety Director	1 for the facility, need not be present unless acting as supervisor	1 for the facility, need not be present unless acting as supervisor	1 for the facility, need not be present unless acting as supervisor	1 for the facility, need not be present unless acting as supervisor
Inside Patient Attendant	1 for a maximum of 8 stable patients			
Outside Patient Attendant	1 required, but may be the hyperbaric physician	1 required, but may be the hyperbaric physician	1 required	1 required, additional personnel recommended

Class B Monoplace HBOT Chamber				
Patient Characteristics	**Stable**	**Intermediate**	**Complex**	**Critical**
Patient complexity level	1 - 2	2 - 3	4	5
HBOT type	Elective	Elective/urgent/ emergency	Elective/urgent/e mergency	Emergency/ur gent
Facility Level	1 - 3	1 - 3	1 - 2	1 - 2
HBOT Physician	1	1	1	1
Chamber Operator (HBOT Technician)	1 operator for a maximum of 3 simultaneous chambers with staggered start/stop times	1 operator for a maximum of 3 simultaneous chambers with staggered start/stop times	1 operator for a maximum of 2 simultaneous chambers, if both patients complex	1 operator for each chamber and patient
Safety Director	1 for the facility, need not be present unless acting as supervisor	1 for the facility, need not be present unless acting as supervisor	1 for the facility, need not be present unless acting as supervisor	1 for the facility, need not be present unless acting as supervisor
Inside Patient Attendant[2]	N/A	N/A	N/A	N/A
Outside Patient Attendant	Not required	Not required	1 recommended	1 required, 2 recommended for ventilated patients

[2] In case of Pediatric Patients 1 attendant who could also be a family member.

APPENDIX 5: DISQUALIFYING CONDITION FOR IAs

An IA having any of the following conditions should be disqualified from engaging in work in the clinical hyperbaric chamber.

1. History of seizure disorder, other than early childhood febrile seizures
2. Bullous, cystic or cavitary lung disease, significant obstructive or restrictive lung disease, recurrent pneumothorax
3. The requirement for oxygen at sea level is disqualifying.
4. Chronic inability to equalize sinus or middle ear pressure3.
5. Significant central or peripheral nervous system disease or impairment
6. Alcoholism, drug abuse and/or history of psychosis
7. Hemoglobinopathies associated with comorbidities
8. Grossly impaired hearing
9. Significant osteonecrosis
10. Chronic conditions requiring control by medication may be disqualifying4.
11. Pregnancy

[3] This is not an absolute exclusion and should be considered on an individual basis.

[4] Not all such conditions are absolute exclusions. These should be considered on an individual basis.

APPENDIX 6: MEDICAL TESTS FOR INSIDE ATTENDANT (IA) FITNESS TO WORK IN CLINICAL HYPERBARIC CHAMBERS

Test	Initial	Periodic	Comments
Medical History	Yes	Annually	Include predisposition to loss of consciousness, vomiting, cardiac history, low O_2 saturation, CO_2 retention, serious blood loss, or anything that in the opinion of the licensed practitioner would interfere with work in hyperbaric conditions
Physical Examination	Yes	Every 5 years and as deemed necessary	Include predisposition to loss of consciousness, vomiting, cardiac history, low O_2 saturation, CO_2 retention, serious blood loss, or anything that in the opinion of the licensed practitioner would interfere with work in hyperbaric conditions
Pulmonary Function	Yes	As medically indicated	To include FEV1, FVC, PEF, FEF25-75.
Audiogram	Yes	As per OSHA or institutional policy , or as medically indicated	Pure tone audiology
Routine Urinalysis	Yes	As medically indicated	

Haematocrit, Haemoglobin, WBC	Yes	As medically indicated	
Chest x ray	Yes	As medically indicated	PA and LAT
EKG: Standard (12 lead)	Yes	As medically indicated	Required initially to establish baseline
EEG	As medically indicated	As medically indicated	
Visual acuity	Yes	As medically indicated	Vision, near & distant, uncorrected and corrected, to include colour
Toxicology Screen	According to institutional policy	According to institutional policy	

APPENDIX 7: SOME FACTORS THAT MAY INCREASE COMPLEXITY OF HBOT

Airway factors	**Neurologic/psychiatric**
• Tracheostomy	• Seizure disorder
• Intubated/artificial airway	• Unconscious, neurologic deficit
• Airway abnormalities	• Cognitive impairment
• Sleep apnea or anticipated airway difficulty	• Severe/chronic pain
Breathing factors	• Profound anxiety/requirement for sedation
• Mechanical ventilation	• Behaviour disturbances
• PEEP/CPAP requirement	• Psychosis
• COPD/asthma/pneumonia	• Profound sedation or general anesthesia
• Pneumothorax/chest tube	**Organ dysfunction/systemic disease**
• Circulatory factors	• Diabetes
• Cardiac arrhythmia	• Critically ill patients/ICU/CCU
• Hypotension, hypertension	• Continuous bladder irrigation
• Congestive heart failure, poor contractility	• Burns or extensive wounds
• Severe/unstable ischemic heart disease	**Patient characteristics**
• Inotropic or vasoactive medications	• Multiple concurrent medical conditions
• Invasive monitoring (arterial, CVP, PA)	• Emergency cases
• Intravenous fluids	• Infants and small children
Other	• Elderly
• Anaphylaxis, latex allergy	• Morbid obesity
• Drug-resistant organisms (MRSA, etc.)	• Recent or impending major surgery
• Pumps, patches and pacemakers	

APPENDIX 8: SAMPLE INFORMED CONSENT FORM FOR HBOT

I, _____ do hereby authorize _____and its trained staff to treat me with hyperbaric oxygen and to render such other supportive or additional care that their professional judgment may dictate during the course of the above treatment.

The staff have explained to me the protocols and procedures for Hyperbaric Oxygen Therapy (HBOT), and the adjunctive treatments.

I have been provided with an orientation to HBOT which has included (but was not limited to) indications, contraindications, risks and side effects, benefits, safety, equalization techniques, patient rights, flying after treatment, use of tobacco and HBOT and a chamber and facility overview.

I have been made aware of the possible risks and side effects of HBOT including but not limited to: Barotrauma in the ears sinuses or teeth, Pulmonary Barotrauma, Oxygen Toxicity, Fire risks, Risk of near-sightedness, Maturing or ripening cataracts, Temporary improvement in far-sightedness, Numb Fingers, Serious Otitis, Fatigue, Decompression Illness, Gas Embolism.

I have been given an opportunity to obtain further information and to ask questions about HBOT, and I understand that I can ask questions or stop treatment at any time.

I consent to_____ collecting and keeping information about my health for making sure that I receive appropriate care and treatment, and for associated administrative tasks. I understand that my health information will be securely stored and that I am entitled to request access to and correction of my health information. I agree to provide all information about me voluntarily.

I am aware that the practice of medicine and surgery is not an exact science and that I have been made no guarantees as to the results of hyperbaric oxygen therapy.

My signature below constitutes my acknowledgement (1) that I have read and agreed to the foregoing, (2) that HBOT has been satisfactorily explained to me and that I have all the information I desire, and (3) that I hereby give my authorization and consent to the use of HBOT on myself.

Name of patient: _____ Signature of Patient: _____

And/or Authorized Representative: _____

*I confirm that I am the authorized representative legally entitled to sign this Consent for Hyperbaric Oxygen Treatment on behalf of_____ I have read and understood the Patient Orientation Handbook and this Consent and I confirm the matters contained in this Consent and I consent to the treatment of*_____

*Representative Name:*_____

Witness signature: _____ Date: _____

Witness Name: _____ _____ Time: _____

APPENDIX 9: RECOMMENDATIONS FOR CLEANING AND PREVENTION OF CROSS-INFECTION IN MEDICAL HYPERBARIC TREATMENT FACILITIES.

The prevention of cross-infection in the HBOT facilities requires a comprehensive program that extends far beyond the cleaning of hyperbaric chambers. The components of such a program should include:

1. Documented adherence to infection control policies of the health facility.
2. Surveillance and testing for antibiotic resistant bacteria and by routinely sending patient swabs for culture and sensitivity tests.
3. Hand hygiene requirements before and after HBOT
    a. Patients
    b. Staff
4. Cleaning of washrooms and change rooms immediately after use by patients known to have antibiotic-resistant organisms and before other patients use these areas.
5. Immediate cleaning and disinfection of obvious gross soiling of areas or equipment.
6. Policies and procedures to help prevent gross contamination and soiling such as:
    a. Appropriate management of ostomies, bladder catheters and patient drains.
    b. Avoid treatment of patients during episodes of nausea, vomiting or diarrhea when practical.
    c. Use of diapers, garments and drapes to reduce contamination of hyperbaric facilities.
7. Adoption of policies requiring universal infectious precautions.
8. Policies to eliminate or reduce physical contact between patients.

9. Cleaning and disinfection of blood pressure cuffs and other equipment that comes into contact with patients.
10. Appropriate treatment and cleaning of wounds.
11. Periodic education of hyperbaric staff and patients about infection control.
12. Safe disposal of potentially infectious materials and fluids.
13. Appropriate use of gloves, gowns and other PPE.
14. Cleaning and disinfection of BIBS masks and head tents before reuse by another patient.
15. Policies to ensure single-patient-use supplies such as oxygen masks are used only for one patient.
16. Ensuring that any garments or bedding that is reused is stored and labelled separately for individual patients.
17. Changing and laundering of linens and bedding.
18. Segregation and isolation of patients.
    a. Where practical do not treat patients with resistant organisms in a multiplace chamber with other patients or ensure adequate separation between patients.
19. Liaison with infectious disease specialists and participation in health facility infection prevention programs.
20. Scheduling of patients with known infectious potential at the end of the day or before a planned complete cleaning and disinfection of the hyperbaric chambers.
21. Monoplace chambers cleaning:
    a. Must comply with the manufacturer's instructions
    b. Use only approved cleaning agents (see below)

c. Surface disinfection of rails of stretchers between every case

d. Brief cleaning (< 5 minutes) after every patient

e. Comprehensive cleaning (30 minutes) at the end of each day and after all cases of resistant organisms or obvious contamination or soiling.

22. Multiplace chambers

a. Cleaning procedures vary according to the design of the chamber such as:

   I. Rounded chambers with removable floor board

   II. Rectangular chambers with flat non-removable floors

b. Disassembly or removal some of chamber components may be required for thorough cleaning and disinfection although this may also increase the risk of infections

c. Comprehensive cleaning and disinfection is required at least weekly, after treatment of contaminated patients and in the event of gross or obvious soiling or contamination.

d. Use only approved cleaning agents and ensure removal of these or dissipation of any odours prior to pressurizing the chamber again.

APPENDIX 10: CRITERIA FOR SELECTION OF CLEANING AGENTS

In selecting suitable cleaning and disinfecting agents, the following criteria should be considered:

1. Effectiveness against the expected spectrum of bacteria, viruses, fungi and other micro-organisms
2. Compatibility with chamber occupants (safe for human use)
3. Compatibility with chamber materials (non-corrosive & non-degrading)
4. Fire safety in terms of volatile compounds (no flammable vapours)
5. Residue to be harmless/non-toxic and non-flammable
6. Acceptable odour
7. Application requirements (ease of use)
8. Availability and price

The most common constituent of suitable hyperbaric cleaning and disinfecting agents is a quaternary ammonium compound, which is non-corrosive, suitable for use with plastics, acrylic materials, rubber and metals.