The Australian and New Zealand Hyperbaric Medicine Group (ANZHMG)

&

The Hyperbaric Technicians and Nurses Association (HTNA)

COVID-19 Guidelines

Published by the South Pacific Underwater Medicine Society (SPUMS),
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SPUMS requests that you attribute this publication (and any material sourced from it) using the following citation: Australian and New Zealand Hyperbaric Medicine Group and the Hyperbaric Technicians and Nurses Association (2020), *ANZHMG/HTNA COVID-19 Guidelines*. Melbourne: SPUMS.

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The Australian and New Zealand Hyperbaric Medicine Group (ANZHMG) and Hyperbaric Technicians and Nurses Association (HTNA) *COVID-19 Guidelines* have been developed to assist hyperbaric clinicians prepare and plan for the maintenance of hyperbaric services during a pandemic, and provide a safe working environment for staff and patients. Considerable effort has been made to ensure the information contained within the recommendations is correct at the time of publication. Information provided has been sourced from the best available evidence and expert opinion. Further iterations of these guidelines will be published as new information comes to hand. The Societies accept no responsibility for any inaccuracies, information perceived as misleading, or the success or failure of any of the recommendations detailed in this document. Neither the South Pacific Underwater Medicine Society (of which ANZHMG is a standing committee) nor the Hyperbaric Technicians and Nurses Association are liable for the accuracy or completeness of the information in this document. The information in this document cannot replace professional advice.

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1. PREAMBLE

COVID-19 is an emerging respiratory infection caused by the SARS-CoV-2 virus, a novel coronavirus related to the pathogens responsible for the SARS (2002) and MERS (2012) outbreaks earlier this century. First identified in Wuhan, capital of Hubei province, China, in December 2019, the disease was declared a pandemic by the World Health Organization (WHO) on 11th March 2020. COVID-19 had infected over 250,000 people in 173 countries and resulted in over 10,000 deaths internationally at the time of commencing writing these guidelines (20th March 2020). By the time the document was complete (27th March 2020), more than half a million confirmed infections were known and the death toll was over 24,000. Mortality from this virus is currently estimated at up to 5% overall, and significantly higher in elderly or comorbid populations. Australia and New Zealand have been relatively spared the effects of this disease so far, but case numbers are now increasing exponentially in our region. Public health measures that would previously have been considered draconian are being implemented globally in an attempt to 'flatten the curve' of disease progression and prevent health services from being overwhelmed. All healthcare workers have a responsibility to examine their work practices and take timely and decisive action to limit the spread of this pathogen in their environment.

The current major challenge centres around preparing our hospitals and staff for the expected surge in caseload, which may be complicated by supply chain issues and workforce challenges. The hyperbaric community strongly supports all robust public health measures to reduce community transmission. The benefits of flattening the pandemic curve are supported by high quality evidence and are essential to minimise load, especially on limited intensive care (ICU) capacity, for all patients – not just those with COVID-19; as well as to maintain the health, wellbeing, and sustainability of the frontline healthcare workforce.

The Australian and New Zealand Hyperbaric Medicine Group (ANZHMG) is a standing committee of the South Pacific Underwater Medicine Society (SPUMS), representing medical practitioners working in accredited hyperbaric facilities around Australasia. The Hyperbaric Technicians and Nurses Association (HTNA) is the professional society representing non-medical healthcare professionals active in this field. The Collaborative Hyperbaric Medicine And Extreme Environment Research Associations (CHYMAERA) Network is a recent global initiative linking research groups with related interests. Together, these organisations reflect the diversity of opinion within the hyperbaric community and oversee all aspects of professional practice (clinical care, national standards, quality assurance, industrial representation, training, education and research).

Hyperbaric oxygen therapy (HBOT) is the standard-of-care for bubble-related diving emergencies (e.g. decompression sickness, arterial gas embolism) and a useful adjunct in certain life-, limb- or sense-threatening non-diving-related medical conditions (e.g. necrotising fasciitis, gas gangrene, central retinal artery occlusion). Hyperbaric facilities in our region provide an essential 24/7 nationwide emergency service for such conditions.

The bulk of most hyperbaric units' routine workload however is comprised of non-emergency treatments for chronic conditions (e.g. diabetic ulcers, radiation tissue injuries). Patients in this population are commonly elderly, or immunocompromised by either their underlying disease process or the treatment for it. As such, this patient cohort is particularly vulnerable to the SARS-CoV-2 virus responsible for the current COVID-19 illness.

The hyperbaric chamber poses unique technical challenges for its safe and effective operation under pandemic conditions. Patients breathe oxygen or other therapeutic gas mixtures through re-usable circuits in a closed environment for several hours at a time over the course of days or weeks – in many cases (e.g. in a multiplace chamber) in close proximity to other patients and staff. Effective 'physical distancing' is extremely difficult within the multiplace chamber. Reducing patient numbers in multiplace chambers assists with physical distancing but nursing staff must still regularly be in close proximity to patients' airways during donning and doffing of oxygen hoods or BIBS circuits. Comprehensive decontamination of the chambers is hampered by the technical complexity of the internal environment and, furthermore, many currently recommended environmental cleaning products are not certified safe for use in a high-pressure oxygen environment (e.g. flammability risk, etching acrylic windows, degrading seals).

With a vulnerable patient population and a clinical environment that is potentially conducive to virus propagation, every hyperbaric facility has a duty of care to review its current practices and take the requisite steps to mitigate any risks identified in its local operating environment. This document is intended to assist that process. No two facilities are the same, and institution-specific considerations must be taken into account when applying any of the recommendations included here.

These guidelines are intended as a 'living document', to be revised in an iterative process incorporating local and international knowledge as this disease progresses through the community. The most up-to-date document and all previous iterations may be found on the SPUMS website: https://www.spums.org.au; and the HTNA website: https://www.htna.com.au.

2. GENERAL CONSIDERATIONS

The ANZHMG and HTNA **strongly support** State, National and International efforts to reduce the spread of pandemic illness through effective public health measures (e.g. physical distancing, cough etiquette, hand hygiene, self-isolation, quarantine). This approach is supported by high quality evidence and significantly mitigates disease impact on our finite health services. Such measures will have the greatest positive impact on the health and well-being of our communities.

Within our own specific field of expertise, we **strongly recommend** that the medical directors of all hyperbaric facilities, in consultation with senior members of their technical and nursing staff, urgently develop facility-specific pandemic plans. All such plans should align with jurisdictional health department requirements. Plans should include a thorough risk assessment and lead to the development of a clear and proportionate risk mitigation strategy for their department.

Despite the primary pathophysiological effect of COVID-19 being severe hypoxia, hyperbaric oxygen therapy has **no role** in the management of this disease. The heterogeneous changes in the lung parenchyma consequent upon development of the acute respiratory distress syndrome (ARDS) increase the risk of pulmonary barotrauma due to gas trapping under hyperbaric conditions. Furthermore, the use of pressurised oxygen delivery systems (e.g. oxygen hoods, ventilator circuits) increases the risk of aerosol generation, environmental contamination and patient-to-patient or patient-to-staff spread of the virus within the confined chamber environment when the system is breached for any reason (whether accidental or therapeutic).

Notwithstanding the current health-system focus on COVID-19 and the lack of relevance of HBOT to this particular condition, other medical emergencies will continue to present for care at a similar rate to usual. Preservation of routine healthcare provision for non-COVID-19 patients may prove challenging as the virus becomes more widespread within our community. Hyperbaric facilities should consider a staged reduction in elective (non-emergency) services as the pandemic progresses – both to reduce the opportunity for virus spread amongst patients and staff, and to free-up clinical personnel for re-deployment outside the hyperbaric unit. Current projections are that pandemic conditions will last for several months and that a second wave of infections may occur in 2021. We **recommend** that hyperbaric facilities focus on preserving emergency services for as long as possible, acknowledging that gaps in service provision may be inevitable.

A tiered response, based on the impact of the pandemic on the capacity of the hyperbaric facility to meet daily operational requirements, should be adopted. Specific thresholds at which the hyperbaric facility will transition between one tier and the next should be clearly pre-defined at each institution (Table 1). These thresholds should take into account facility-specific issues such as baseline staffing levels, casemix, model of care, resourcing, logistics, staff illness susceptibility (e.g. age, co-morbidities) and the probable direct and indirect burden of acute viral disease on essential personnel (e.g. parents of school-age children). Departmental priorities are to:

- Protect their staff,
- Protect their patients,
- Maintain emergency services,
- Support the wider hospital system.

Finally, it must be recognised that a sizable proportion of medical and nursing workforce in the hyperbaric facility will be either current or former practitioners in one of the acute care disciplines that is now closer to the 'front line' of the pandemic (e.g. Intensive Care Unit (ICU), Emergency Department (ED)). Hyperbaric facilities should prepare themselves for the re-deployment of staff members to areas of greater need. Similarly, equipment (e.g. monitors, ventilators, oxygen hoods) and other resources (e.g. drugs) may need to be diverted to the pandemic response. Ultimately, in a situation where the healthcare system is overwhelmed, the priority will be to provide the greatest good to the greatest number.

Table 1. Example of a tiered response. We **recommend** that facility-specific activation thresholds and responses should be developed at each hyperbaric unit.

Tier	Threshold	Activity	Response
Phase 0	No pandemic	All hyperbaric functions	- business as usual
Phase 1	Pandemic declared Isolated cases in local region only No evidence of community spread	Elective treatments Emergency treatments Elective assessments Emergency assessments PPE Patient screening Staff screening Existing cleaning protocols Inventory resources and staff skills	- optional deferment - new patients not commenced - continue - new patients commenced as usual - continue - continue - refresher course for all staff - P2/N95 mask fit-testing for all staff - daily - daily - reviewed - for maintenance of hyperbaric services - for redeployment purposes
Phase 2	Pandemic active locally Community spread confirmed	Elective treatments Emergency treatments Elective assessments Emergency assessments PPE Patient screening Staff screening Enhanced cleaning protocols	- mandatory deferment - continue - continue - continue - staff usage audited and confirmed appropriate - buddy system implemented - daily - daily - implemented
Phase 3	Pandemic active locally Health system under strain ***OR*** Hyperbaric patient tests positive for COVID-19	Elective treatments Emergency treatments Elective assessments Emergency assessments PPE Patient screening Staff screening Enhanced cleaning protocols	- mandatory deferment - graded reduction - deferred - continue as usual - ongoing audit of use - buddy system maintained - daily - daily - implementation audited - full terminal clean of facility daily
Phase 4	Health system overwhelmed	All hyperbaric functions	- hyperbaric facility closed* - all resources redeployed

*may remain available for emergency re-activation to support essential industry

3. MEASURES TO REDUCE VIRUS SPREAD

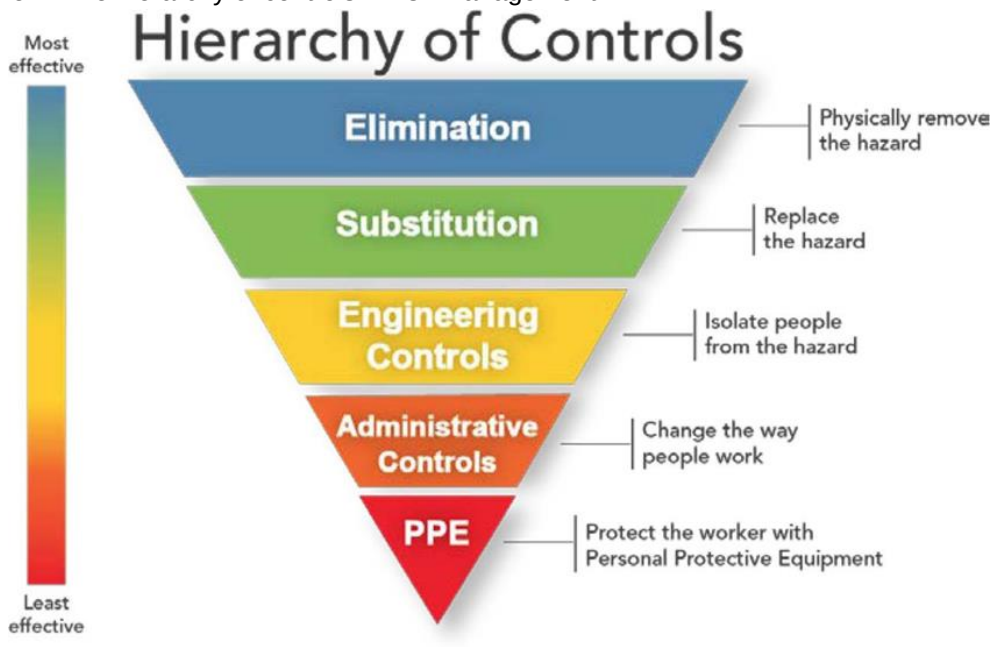
The following measures should be considered to reduce the potential for virus spread within the hyperbaric environment.

3.1 Infection Control in the Hyperbaric Unit

Safety of staff is paramount to protect the individual healthcare worker and to ensure a viable workforce for the duration of the pandemic. In Australia the national infection control standards are AS/NZS1715 (2009) and the National Health and Medical Research Council's *Australian Guidelines for the Prevention and Control of Infection in Healthcare*.

Controlling exposure to COVID-19 is the fundamental method of protecting health care workers. This can be represented by a hierarchy of controls (Figure 1). Elimination and Substitution are the most effective control strategies but may not be available to individual facilities in the current situation. Engineering controls are designed to remove the hazard at the source, before it comes in contact with the worker. Administrative controls and Personal Protection Equipment (PPE) are frequently used with existing processes where hazards are not particularly well controlled. A comprehensive discussion of each level within this hierarchy is beyond the scope of this paper, but we **recommend** that every hyperbaric unit considers how each element of the hierarchy can be applied to their facility.

Figure 1. The hierarchy of controls in risk management



3.2 Patients

We **recommend** that appropriate signage be placed in the hyperbaric waiting area advising of the symptoms of COVID-19 and instructing patients **not** to attend the hyperbaric unit if they develop any of these symptoms. Signs should instruct patients to contact the jurisdictional COVID-19 hotline, institutional COVID-19 Clinic, or personal General Practitioner (by telephone) for further advice. We **recommend** that patients also be requested to notify the hyperbaric unit (by telephone) of their symptoms at the same time, to facilitate contact tracing and appropriate follow-up.

We **recommend** that additional signage regarding hand hygiene, cough etiquette and similar precautions be installed in the patient waiting room, together with additional hand-sanitizer for patient use pre- and post-hyperbaric therapy.

We **recommend** that steps be taken to facilitate physical distancing and discourage patients and families from congregating unnecessarily (e.g. every second chair in the patient waiting area to be removed).

We **recommend** that patient amenities be reviewed as potential sources of virus transmission and steps taken to mitigate this risk (e.g. water-coolers, vending machines, TV remotes and similar be removed from the patient waiting area to prevent public access).

We **strongly recommend** that all hyperbaric patients are screened daily for potential COVID-19 infection prior to treatment (**questionnaire and temperature check**). Patient screening should align with the latest national recommendations for COVID-19 case definition and should include clinical symptoms, plus contact and travel history. Each day's questionnaire and temperature record should be filed in the patient's notes. Patients deemed at risk should be isolated and tested for COVID- 19.

We **recommend** that consideration be given to staggering the start times for elective treatments (e.g. in monoplace chambers) at half-hour intervals to limit patient-patient interaction.

We **recommend** limiting in-chamber cross-contamination opportunities in multiplace chambers by staggering patient air-breaks or changing oxygen/air delivery techniques (e.g. switching the gas externally, where possible, to limit the need to remove the hood/mask from the patient).

We **recommend** that units develop specific plans for a graded reduction in hyperbaric services as the disease progresses through our societies. This will conserve scarce resources and further facilitate physical distancing for the

remaining patients. Such plans should include consideration of:

3.2.1 Deferment or Cancellation of Elective Hyperbaric Treatments

This will vary between sites, and may be performed in a staged manner, with initial deferment of minor or marginal elective cases, escalating to deferment of all non-emergency treatments. We **recommend** that decisions regarding deferment be undertaken primarily by the hyperbaric team, but include appropriate consultation with the referring team (e.g. maxillofacial surgeons regarding timing of surgery), other healthcare providers who may need to take over elements of the patients' care (e.g. community nursing for dressings), and the patients themselves. Appropriate processes need to be established to minimise any detriment associated with deferment of treatment and to ensure timely recommencement when appropriate.

A graded reduction in hyperbaric services might follow the pattern described below:

1. Existing elective hyperbaric patients are offered the opportunity to defer the remainder of their current course of treatment, without prejudice, until such time as the trajectory of the pandemic and its effects within the local community become apparent. New elective hyperbaric patients do not commence treatment.
2. Mandatory deferment of existing elective hyperbaric patients by the facility. Emergency hyperbaric assessments and treatments proceed as usual.
3. Graded reduction in emergency hyperbaric services. New emergency patients are assessed as usual but HBOT is only offered following a thorough risk-benefit analysis that includes consideration of all relevant factors (e.g. current pandemic burden on healthcare system, likelihood of benefit to patient, availability and efficacy of alternative treatment modalities, etc).
4. Closure of hyperbaric services. Staff and equipment redeployed in support of hospital-wide priorities. The capability to treat serious diving emergencies from essential industries (e.g. food production, oil and gas industry) should be preserved in all but the most extreme circumstances (e.g. complete collapse of health system).

3.2.2 Reserving HBOT for Patients Requiring Emergency Intervention

We **recommend** deferring provision of non-emergency HBOT to conserve resources, prevent unnecessary patient contact with a potentially virus-prone healthcare system, and optimise physical distancing precautions amongst those who must attend for hyperbaric treatment.

We **recommend** that, where alternative treatment strategies of similar efficacy are available, HBOT **not** be used. HBOT should be reserved for conditions for

which no effective alternatives exist. This may necessitate regular re-evaluation of institutional policies in light of changing resource availability (e.g. intermittent outpatient hyperbaric oxygen therapy *vs* protracted inpatient normobaric oxygen therapy for moderate-severe carbon monoxide poisoning).

3.2.3 Proactive Consideration of Treatment Goals

We **recommend** that, for all patients, the indications for HBOT and relevant temporal factors (e.g. timing of planned surgery) should be reviewed immediately – and the ability to defer treatment without detriment to the patient (if applicable) should be clearly documented in the patient notes and correspondence to the referring practitioner.

There should be early consideration of treatment goals to avoid hyperbaric admissions in patients who can be deferred or appropriately managed elsewhere. We **recommend** that all in-patients have documented goals-of-care or equivalent completed upon hospital admission.

3.2.4 Testing for COVID-19 in the Hyperbaric Unit

COVID-19 has presented with mild, moderate or severe respiratory illness – and can present atypically (e.g. abdominal symptoms, diarrhoea). Severe illness can include pneumonia, ARDS, sepsis and septic shock.

We **recommend** local case definitions be referred to when assessing the need to test for COVID-19 amongst hyperbaric patients or staff, although **a high index of suspicion for COVID-19 disease should be maintained at all times**.

If possible, testing should be made available via local hospital pathology services to expedite results. Exclusion of COVID-19 as a diagnosis should occur in consultation with jurisdictional guidelines.

3.3 Staff

We **strongly recommend** that staff members be screened daily (questionnaire and temperature check) prior to shift commencement. The results should be logged in a departmental register.

We **recommend** that staff members who have had unprotected contact with a known *or suspected* coronavirus case should not attend work at the hyperbaric unit. They should follow jurisdictional guidelines and plan to self-isolate for 14 days post-exposure. They should contact the appropriate COVID-19 hotline for further advice.

We **suggest** that staff members who have had contact with known or

suspected coronavirus cases in the course of their duties elsewhere in the hospital whilst wearing appropriate PPE (e.g. ED and ICU staff working in the hot-zone) are able to attend work at the hyperbaric unit, but should observe standard social distancing guidelines and hygiene procedures.

- A sizable proportion of the hyperbaric medical and nursing workforce are employed by their hyperbaric unit on a part-time basis, with the majority of their employment in other departments (e.g. ED, ICU). In these other roles, it is expected that these staff members will routinely be in close proximity to COVID-19 patients. Although current PPE recommendations are expected to provide adequate protection against virus transmission in these environments, the potential for unrecognised breaches does exist.
- To minimise the risk of onwards transmission under these circumstances, **consideration** may be given to having direct hyperbaric patient care preferentially undertaken by full-time hyperbaric staff, where available. Under these circumstances staff who work in ED or ICU should, where possible, be allocated to essential non-clinical roles and may be supported to work remotely or from home (if applicable).
- The rostered clinical specialist must, however, always be within 3 minutes of the hyperbaric chamber to support the junior medical staff when patients are under pressure, in accordance with AS/NZS 4774.2 (2019).
- This measure is intended to reduce the risk of asymptomatic staff-to-staff or staff-to-patient transmission as disease prevalence increases in the community.

All staff should observe physical distancing guidelines between themselves and with the patients insofar as this is consistent with service provision. Outside the chamber, standard hospital guidelines regarding PPE use should be observed.

3.3.1 Personal Protection Equipment (PPE)

We **recommend** that all hyperbaric facilities should keep a record of staff training in PPE compliance and competency; only staff who have been trained in PPE usage should be exposed to patients or environments where COVID-19 contact is possible.

We **strongly recommend** the use of a buddy system when PPE is used. The buddies should observe the donning procedure, check PPE integrity prior to any potential COVID-19 exposure, watch for any potential breaches of PPE during COVID-19 patient/environment contact, and guide the doffing procedure. Formal PPE donning/doffing **checklists are to be encouraged** – both to ensure a standardised approach even under adverse conditions (e.g. extreme fatigue) and to make it easier for all staff to call out breaches even

when a significant perceived difference in seniority exists between buddies.

We **recommend** that each observed breach in PPE usage is recorded in the incident management system as an occupational health and safety risk. An assessment of the breach is to be made and an infection control assessment to be performed as to whether the breach warrants a period of self- isolation. The ANZHMG and HTNA recognise that breaches will occur despite best efforts and no blame should be apportioned to the individuals involved.

We **recommend** that any nosocomial healthcare worker COVID-19 infection is entered into the local incident management system as a sentinel event and should be managed in accordance with established guidelines.

3.3.1.1 Training in PPE

We **recommend** that all hyperbaric unit personnel (medical, nursing, technical, cleaning and ward assistants) receive training in infection control and personal protection equipment. We **recommend** that all personnel receive individual P2/N95 mask fit checking. We **suggest** P2/N95 fit testing, if available, recognising that the evidence for fit testing effectiveness is limited and that the variation and supply of P2/N95 mask types will make any recommendation on fit testing difficult to implement from a practical perspective.

3.3.1.2 Application of PPE

We **strongly recommend** the institution of a buddy system to supervise all donning and doffing of PPE (see above). The buddy should be appropriately trained in PPE and the use of formal donning/doffing checklists is encouraged.

Specific recommendations for airborne precautions should follow national infection control recommendations; including fit checked P2/N95 mask, goggles, long-sleeved impervious gown and gloves. In addition, the following can be **considered**:

- Hair cover for aerosol-generating procedures or when working in a physically constrained and potentially contaminated environment (e.g. cleaning a monoplace chamber).
- Shoes that are impermeable to liquids. Recurrent use of shoe covers is **not recommended** as repeated removal is likely to increase the risk of staff contamination.

3.3.2 Staff Care and Wellbeing

A focus on the care and protection of individual healthcare workers is essential for staff well-being, to ensure a safe and sustainable workforce, and to maintain high quality clinical care. It should be recognised that hyperbaric staff redeployed to acute care areas, working outside their usual scope of

practice or recent experience, and with an increased workload, will likely have heightened anxiety and stress levels both at work and at home.

We **recommend** that hyperbaric units **consider** the following:

- sourcing hospital scrubs for staff to wear at work. If scrubs are provided, staff should get changed at work at the beginning and end of every shift and whenever they leave the hospital buildings (e.g. for lunch). Scrubs are not a fashion statement.
- requesting individual staff members to bring in a separate pair of clean enclosed-toe footwear solely for use at work. Recurrent use of shoe covers is **not recommended** as repeated removal is likely to increase the risk of staff contamination.
- where possible, showering facilities should be made available at the end of every shift and in the event of a PPE breach.

3.3.3 Staff Illness

Staff who are ill should follow national guidelines in regard to self-isolation and testing for COVID-19. We **recommend** prioritising the testing for COVID-19 in healthcare workers to minimise the time away from the workforce.

3.3.4 Post-Exposure Management

In event of an exposure, risk categorization of the staff member should be done in accordance with national guidelines. Based on risk of exposure the appropriate further management should be commenced immediately, including quarantine period.

For either staff illness or post-exposure management we **recommend** the provision of adequate psychosocial support for the staff member during quarantine or for the duration of their illness. On return to work refresher infection control and prevention training should be offered to the staff member.

3.3.5 Staff Information and Education

Communication within departments, hospitals and the wider healthcare community will be vital to ensuring maintenance of hyperbaric staff safety and quality care.

We **recommend** that hospitals and hyperbaric units utilise secure and approved platforms such as institutional email and messaging applications to inform staff of any changes in policy, workflow or other relevant information.

We **recommend cancelling** face-to-face meetings wherever possible. For meetings with operational, clinical or education value we **recommend** that secure video-conferencing applications are provided and utilised.

We **recommend** the use of interdisciplinary small group simulation to practice and improve clinical processes and staff training in PPE.

3.4 Chamber and Associated Facilities

Aerosol and fomite transmission of COVID-19 are a serious concern. The SARS-CoV-2 virus has been shown to remain viable in aerosols for at least three hours and up to three days on some common hospital surfaces (copper = up to 4 hours, cardboard = up to 24 hours, plastic and stainless steel = up to 72 hours). We **recommend** that all hyperbaric units review their facility's cleaning protocols with these data in mind.

Choice of cleaning product should be carefully considered. Many cleaning agents currently recommended for hyperbaric use have not been tested for efficacy against this virus. A regularly updated list of disinfectants that can be used against SARS-CoV-2 ("List N") is maintained by the United States' Environmental Protection Agency (EPA) and may be accessed at the following web address: www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2. We **recommend** that the latest version of the EPA document is referred to and cross-referenced against manufacturers' product information regarding hyperbaric compatibility when making decisions concerning choice of cleaning products. NB: Products are often marketed under different brand names in different parts of the world, however if they display the same EPA registration number they are the same product.

Many different chamber configurations are in use around our region. Some hyperbaric units operate more than one type of chamber (Figure 2). Cleaning protocols therefore vary from facility to facility.

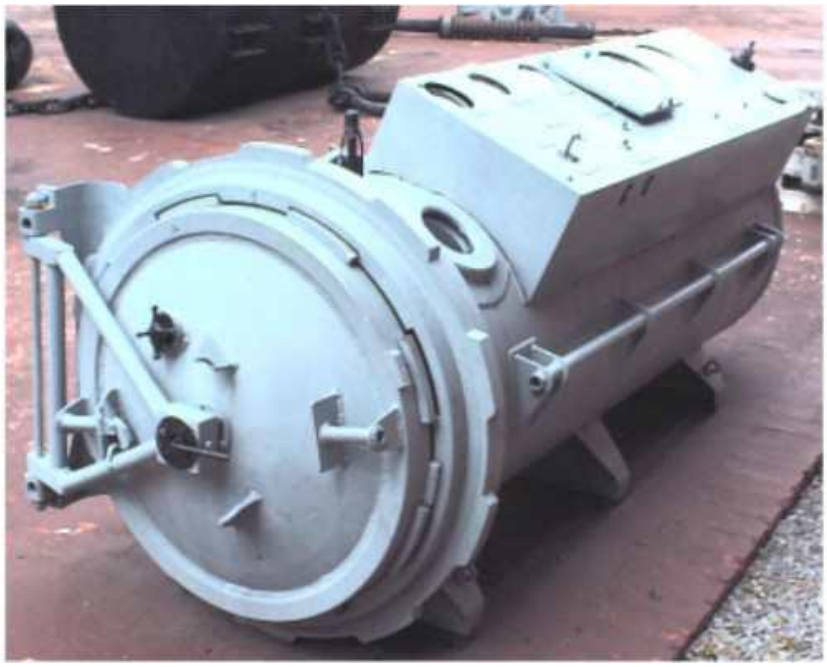
Figure 2. Australian hyperbaric unit operating two multiplace chambers and three monoplace chambers of two different models.

We **recommend** that units operating more than one chamber type review the cleaning requirements of each chamber and preferentially use the chamber that is easiest to clean ***and*** has the lowest risk of staff contamination during

the cleaning process. As a general rule the following hierarchy can be applied:

1. Older-style metal-hulled cylindrical monoplace chambers (excluding ‘clam-shell’ and similar designs) are the most difficult to clean safely (Figure 3). Access is limited and internal lighting is frequently suboptimal. Small internal dimensions increase the potential for inadvertent back or hair contamination and place the cleaner’s face within one metre of surfaces to be cleaned.

Figure 3. Metal-hulled monoplace chamber



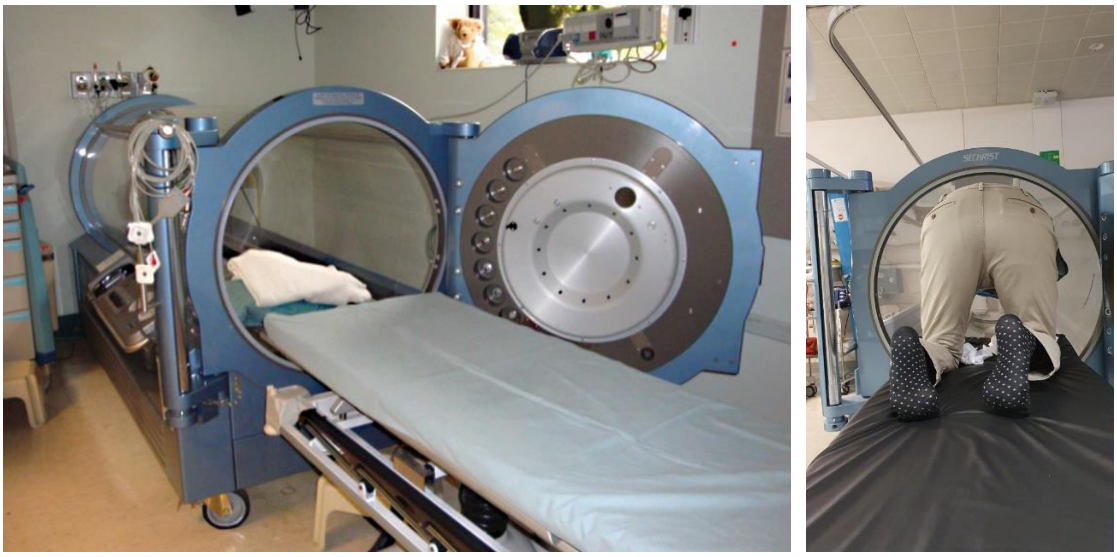
2. Older-style cylindrical multiplace chambers are easier to clean safely than monoplaces because the larger dimensions reduce the potential for inadvertent staff contamination. The complexity of the internal environment however (e.g. exposed piping) makes comprehensive cleaning of all exposed surfaces difficult and the internal dimensions still pose a risk of inadvertent surface contact for the cleaner (Figure 4). The internal dimensions also make physical distancing of patients and staff problematic.

Figure 4. Interior of cylindrical multiplace chamber

3. Modern acrylic monoplace chambers have simple lines that are generally easier to clean internally and have excellent internal lighting by which to look for contamination and observe the progress of cleaning procedures. However, they still may require a staff member to enter their confines during the cleaning process and pose a risk for inadvertent back or hair contamination (Figure 5). Engineering solutions such as extendable poles on cleaning mops should be considered.

Figure 5. Acrylic monoplace chamber; (a) simple lines and good lighting aid cleaning, but (b) accessibility constraints may expose staff to contaminated surfaces during cleaning.

(a) (b)



4. Modern rectangular chambers specifically designed for the medical environment offer the easiest and safest cleaning option. Lighting is usually good, physical space is optimal and internal piping and similar services are contained behind easier-to-clean covers (Figure 6). Physical distancing of patients and staff may be facilitated by removing every second chair.

Figure 6. Rectangular medical hyperbaric chamber

The variety of chamber types in use around our region precludes any definitive statement about which chamber type to use preferentially in the current situation. Each has advantages and disadvantages and a facility-level risk assessment and mitigation strategy should be urgently developed in each unit.

- Where the option exists, because of concerns regarding physical distancing and aerosol generation during oxygen hood removal, we **suggest** that multiplace chambers be reserved for emergency situations where the immediate in-chamber availability of a staff member is deemed essential for clinical care. Nursing staff should wear full *airborne* PPE when attending patients inside the multiplace chamber Respiratory protection may be provided via either a P2/N95 mask (breathing shared chamber atmosphere) or hood/BIBS system (independent gas supply). Owing to the variety of PPE equipment available internationally, we **recommend** that each unit review the material safety data sheets for every item of PPE supplied by the hospital to ensure its hyperbaric compatibility.
- Other facilities may, however, choose to use the multiplace chamber for preference if a safe technique for monoplace cleaning cannot be developed, or supply of the necessary PPE for cleaning activities is restricted due to logistic concerns.

3.4.1 Avoiding environment cross contamination

The following actions are **recommended** to minimise the risk of contamination of staff via equipment:

- Avoid sharing equipment (e.g. BIBS circuits).
- Minimise personal effects in workplace.
- No personal devices (e.g. mobile telephones) in patient care areas.
- Stethoscope use should be minimised, and be appropriately cleaned after each use.

We **recommend** cleaning of clinical and non-clinical areas complies with national and jurisdictional standards for COVID-19, insofar as that is consistent with established hyperbaric safety considerations. It is vital that staff providing cleaning and ancillary services are provided with appropriate training in PPE.

We **recommend** that hyperbaric chambers be thoroughly cleaned by appropriately trained personnel between patients.

- **monoplace chambers** may require personnel to enter the confines of the chamber (depending on system design) during the cleaning process. This places their faces within one metre of potentially contaminated surfaces

whilst performing procedures that may be aerosol generating. The restrictive nature of a monoplace chamber also potentially exposes their backs to contaminated surfaces. Consideration should therefore be given to using full *airborne* PPE (P2/N95 mask, safety goggles or visor, hair-covering, impermeable wrap-around long-sleeved gown, gloves) during the cleaning process.

- **multiplace chambers** are significantly larger and (depending on chamber configuration) make it easier to maintain a more reasonable distance from potentially contaminated surfaces during the cleaning process, with a much lower risk of inadvertent back or hair contamination. Under these conditions it may be appropriate for technical staff to consider using *droplet* PPE only (surgical mask, safety goggles or visor, plastic apron, gloves) during the cleaning process. Hyperbaric units should take into account local considerations (e.g. chamber dimensions, configuration, ease of access, etc) when determining the appropriate PPE for use during cleaning operations.

We **recommend** that all departmental surfaces external to the chambers with which patients come in contact (e.g. door handles, chair arms, patient lockers, bench-tops, etc) should be cleaned twice per day, or between patient sessions if more than two discrete chamber-run sessions are provided per day. Acknowledging that hospital environmental services personnel will be overloaded with cleaning requests from higher priority areas, cleaning may need to be performed by hyperbaric unit staff using *contact* and *droplet* precautions (surgical mask, safety goggles or visor, plastic apron, gloves).

We **recommend** that each department keeps a log of daily cleaning activities for both the chambers and all external patient-contact areas. This should include maintaining a record of who did the cleaning for the purposes of contact tracing and appropriate follow-up if required.

In the event that a patient or staff member tests positive to COVID-19, we **recommend** that the entire unit is subject to a full terminal clean under the supervision of a senior technical officer.

The addition of UV light sterilisation, in addition to usual cleaning, for both the multiplace chamber and the wider hyperbaric unit may provide an additional layer of safety and should be **considered** where the requisite equipment exists. We **recommend** covering of potentially UV-sensitive acrylic viewports and monoplace acrylic cylinders if this strategy is implemented.

Where the chamber exhausts into a publicly accessible area there is a risk that droplets aerosolised by the high gas flows in-chambers may be vented into the atmosphere. If this is felt to be a possibility (even if risk screening of

all patients and staff is routine) it may be prudent to **consider** installing HEPA filters on the exhausts.

3.4.2 Personal Protection Equipment

In hyperbaric facilities there is an increased risk of dispersion of aerosolised virus into the healthcare environment due to the performance of potentially aerosol generating procedures (e.g. oxygen hood removal). We therefore **strongly recommend** that *airborne* PPE equipment should be available for use in the hyperbaric facility under appropriate circumstances. Such circumstances may include:

- in-chamber attendants responsible for patients' oxygen hood removal in the multiplace chamber
- hyperbaric technicians entering monoplace chambers to clean them between patients
- any staff dealing with suspected or confirmed COVID-19 patients

We **recommend against** the use of improvised, non-standard PPE, as poorly standardised PPE potentially poses a risk to the user.

3.5 Visitors to the Hyperbaric Unit

We **recommend** that every effort be made to minimise the number of visitors to the hyperbaric facility during the pandemic. This may include formally restricting access to the department, limiting numbers (e.g. single support person only) and/or visitor attendance times (e.g. drop-off and pick-up times only), and instituting changes in waiting areas to facilitate physical distancing and discourage visitors from congregating (e.g. removing every second chair, all reading material and any entertainment facilities). At a minimum, visitors with a temperature or respiratory symptoms should not be allowed to attend a patient.

We **recommend** that communication with families and visitors should include posting visual alerts (e.g. posters) at all departmental entrances and in strategic places (e.g. waiting areas, elevators) advising visitors not to enter the facility when ill.

3.6 Miscellaneous Equipment

Pulmonary function testing (e.g. spirometry) is an essential component in the performance of diving medical examinations. Unfortunately, the risk of aerosol generation during use is moderate to high. We **recommend** that consideration be given to stopping performance of this test for the duration of the pandemic. If the decision is taken to continue pulmonary function testing, then we **recommend** that such use only continue whilst disposable patient-contact elements (e.g. mouthpiece and spirometer head) are still available. The use of

reusable patient-contact elements should be discouraged unless an approved viral filter (e.g. MicroGard II PFT Filter) is available. All patient-contact surfaces of diagnostic equipment should be cleaned between patients with an appropriate viricidal solution in accordance with institutional guidelines and manufacturers' recommendations. **Staff should wear *airborne* PPE when supervising pulmonary function testing**.

4. MAINTAINING CHAMBER OPERATIONS

Due to potential workforce shortages in acute-care areas, it is likely that hyperbaric medical and nursing staff will be called upon to assist in the care of patients elsewhere in the hospital. Many hyperbaric staff will have significant prior experience in acute-care disciplines such as ED and ICU, and may be targeted for redeployment back to these areas during the pandemic. This should only occur with the relevant managerial authorisations, and under the supervision of current critical care staff, utilising a team-based model of care.

The minimum staffing levels consistent with Australian Standards should be maintained within the hyperbaric unit. Staff rostered on non-clinical duties should be encouraged to work remotely or from home, where this is possible, to reduce the potential for disease transmission amongst unit personnel.

A phased reduction in hyperbaric activity (assessments and treatments) should be planned for (see above) until the pandemic trajectory in our community is better understood.

Emergency hyperbaric services should be preserved for as long as possible. **Consideration** should be given to modifying local protocols to support this (e.g. modifying treatment tables to allow selected diving emergencies to be treated in a monoplace chambers in units where this is normally prohibited), if local circumstances allow.

Community initiatives should be implemented to support families of health care workers so that they can continue in the workforce. Initiatives to inform the public of the need to support health care workers to remain available to attend work are **recommended**.

We **recommend** workforce planning should include consideration of pandemic specific requirements, such as additional workload from donning and doffing personal protective equipment (PPE), the need for additional rest days, and the need to allocate staff to key non-clinical duties such as enforcing infection control procedures.

5. MEDICAL EMERGENCIES

5.1 Hyperbaric Unit Preparation

We **recommend** that all hyperbaric units should develop facility-specific plans for the management of clinical deterioration in their patients during this pandemic. This should include a plan for if a patient requires airway support or cardiopulmonary resuscitation (CPR) in the hyperbaric facility.

Any patient undergoing sudden and/or unexpected clinical deterioration should be treated as if they have COVID-19 until proven otherwise. Owing to the high probability of aerosol generation or blood/body-fluid spillage during resuscitation all hyperbaric staff should don full *airborne* PPE before commencing resuscitation. Patients deteriorating whilst in-chamber or immediately following exit are likely to be hyper-oxygenated already, so staff have adequate time to don appropriate PPE and check their buddy. Patients deteriorating elsewhere in the facility have no more time than the general public, but staff safety must take priority. No 'short-cuts' should be taken in the PPE donning process during an emergency.

We **recommend** provision of clear guidelines on personal protective equipment for use during resuscitation in the hyperbaric unit.

We **recommend** that standard hyperbaric-specific resuscitation protocols should be reviewed in advance, to determine their applicability and safety under pandemic conditions.

5.2 MET Call or Code Blue

Where it is necessary for the MET or Code Blue team to attend, we make the following **recommendations**:

- PPE must be available that is equivalent to that used in ICU, therefore airborne precautions including a P2/N95 mask.
- In-chamber resuscitation should be initiated and performed solely by hyperbaric-trained staff.
- Entry to hyperbaric chamber should be limited to hyperbaric staff to minimise the potential for hyperbaric-incompatible 'contraband' (e.g. electronic devices, cosmetics, contaminated PPE) to be introduced to the environment. Non-hyperbaric Resuscitation Team members should be positioned to receive the patient as they are removed from the chamber following decompression.
- The patient should be assessed by the most senior medical staff available to determine appropriate management and disposition.
- CPR is an aerosol-generating procedure and we **strongly recommend** all staff should wear *airborne* PPE including a P2/N95 mask before

commencing chest compressions.

- Bag-mask ventilation is also an aerosol-generating procedure but will seldom be required in-chamber as the patient is usually hyper-oxygenated already. **"Compression-only" CPR is appropriate and preferred in the hyperbaric chamber.** Where bag-mask ventilation is considered, airborne PPE should be donned and checked first. Mouth-to-mouth resuscitation (even with a face-shield) is **never** appropriate.

5.3 Airway Management in the Hyperbaric Unit

Multiple comprehensive guidelines are under development for airway management during the COVID-19 pandemic at international, national and local levels. In keeping with the ANZICS *COVID-19 Guidelines* upon which this document is based, we **recommend** the following principles for intubation of a proven or suspected patient with COVID-19 in the hyperbaric unit:

- Intubation should preferentially be performed in a negative pressure room (Class N) or if not available – as is generally the case in most hyperbaric facilities – then a single room (Class S) is to be preferred over an open or multi-bed ward area.
- It is vital that *airborne* PPE is used for all staff in attendance including:
    - Fit checked P2/N95 mask
    - Goggles or face shield
    - Long-sleeved, impervious gown
    - Gloves
- The procedure should be performed by the most qualified available staff with the minimum number of healthcare personnel present as are required to undertake a safe intubation.
- Video laryngoscopes should be used preferentially, using video rather than direct vision to guide tube placement.
- In order to minimise aerosol generation staff should consider:
    - Minimising the need for bag-mask ventilation (especially if patient already hyper-oxygenated).
    - Use of a viral filter on the bag-mask circuit.
    - Avoidance of High Flow Nasal Oxygen (HFNO) use to pre-oxygenate patients prior to intubation.
    - Post-intubation, provision of positive pressure ventilation (either by bagging circuit or ventilator) should be initiated only **after** confirming that the endotracheal tube cuff is inflated and **after** ensuring that an appropriate viral filter and waveform capnography device are in place.

6. REDEPLOYMENT AND REPURPOSING ISSUES

6.1 Staff

As mentioned above, the current or former skillsets of many hyperbaric personnel may result in them being re-deployed to other areas of the hospital as the pandemic progresses. The following issues should be considered in this eventuality:

We **recommend** the use of remote online education courses (e.g. BASIC and BASIC for Nurses) for refreshing critical care skills in hyperbaric medical and nursing staff who have been out of the acute-care workforce for any significant period of time, prior to re-deployment.

We **recommend** that hyperbaric staff who are judged to be at higher risk when caring for COVID-19 patients should not be redeployed to a COVID-19 isolation area. This includes staff who are pregnant, have significant chronic respiratory illnesses or are immunocompromised. The international experience is that mortality is higher in older individuals, particularly with comorbidities related to cardiovascular disease, diabetes mellitus, chronic respiratory diseases, hypertension and malignancy. Staff member risk decisions should be made on a case-by-case basis by the unit director with the support of the local occupational health and safety unit. We **recommend** that these staff should be reallocated to other roles and not enter COVID-19 areas.

6.1.1 Medical

We **strongly recommend** medical staff be re-deployed in a manner consistent with their current or former scope of practice (e.g. emergency physicians to ED, intensivists to ICU).

Medical staff from other disciplines, but with critical care training, may be deployed to manage HDU patients in repurposed clinical areas physically separate from the ICU, under the supervision of more experienced ICU staff.

Junior medical staff with little to no ICU or ED training may assist with documentation and non-ICU/ED clinical activities.

Where medical staff are requested to perform duties outside their usual scope of practice due to severe workforce shortages (e.g. anaesthetists taking on an intensivist role), this should be at their discretion and with organisational reassurance regarding indemnity coverage, as well as adequate supervision.

6.1.2 Nursing

We **recommend** that all hyperbaric nursing staff with formal critical care training or experience should be urgently identified. Nursing staff in departments with reduced clinical activity who are familiar with the critical care environment are a valuable asset in situations such as we now face.

We **recommend** that a formal re-orientation program is provided (e.g. a modified BASIC for Nurses course), and these nurses should work under the supervision of an experienced current ICU nurse.

We **recommend**, in addition, that if hyperbaric nurses without critical care experience are to be re-deployed, they be suitably trained for any specialised roles to which they are assigned.

6.1.3 Technical Staff

Hyperbaric technicians are a highly specialised workforce with a varied and diverse skillset. Many come from diving or military backgrounds and may be familiar with the principles and practice of operations in a non-respirable medium or HAZMAT environment. Each hyperbaric facility should ascertain the particular capabilities of their technical staff and identify the skills that may be of greatest value to the hospital in the current situation. Individual units may, however, have very limited numbers of technical staff in their hyperbaric team and this must be taken into account when redeployment options are considered. Hyperbaric technicians are not commonly considered as healthcare providers in the traditional sense and will be something of an unknown quantity to the hospital administrators responsible for redeployment decisions. In this setting they are vulnerable to redeployment into lower-value, higher-risk, or otherwise inappropriate roles. Departmental directors should be prepared to provide guidance to hospital administration regarding the most appropriate redeployment decisions for hyperbaric technical staff. Such roles may include:

- Supervision of staff and visitors donning/doffing of PPE.
- Maintenance, repair and cleaning of equipment (e.g. breathing circuits).
- Logistics – re-supply, storage, inventory.
- Data collection for pandemic research.
- Assistance with technical set-up of oxygen equipment and ventilators.

6.2 Physical Infrastructure

As existing ICUs fill up, other areas of the hospital will need to be repurposed as critical care areas. Recovery rooms, operating theatres, anaesthetic bays and stand-alone high dependency units (e.g. neurosurgical) are the obvious first-line choices under these circumstances.

Hyperbaric chambers are major pieces of capital infrastructure which provide a potentially life-saving service that no other hospital area can provide. As such, hyperbaric units are not an obvious addition to the list of areas suitable for repurposing. The aim should be to keep the hyperbaric facility virus-free for as long as possible in order to maintain emergency hyperbaric services.

A few of the larger hyperbaric units, however, may have dedicated Resuscitation Bays or ICU Receiving Areas which, together with neighbouring wound-care areas, might be able to be repurposed as a small, stand-alone critical care (mixed ICU/HDU) pod. We **recommend** that individual hyperbaric units review their infrastructure with this in mind (ahead of time) to prevent inappropriate decision making by those external to the unit. In the event that a hyperbaric ward area is repurposed in this manner, we **recommend** that it be used for non-Coronavirus patients to minimise the risk of contamination of the chamber. **Consideration** should also be given to complete closure of hyperbaric services if the unit is repurposed in this manner.

The following criteria are the College of Intensive Care Medicine of Australia and New Zealand's (CICM) requirements for a high dependency bed space and should be considered when repurposing an area for the care of critically ill patients:

- Two oxygen outlets
- One air outlet
- Two suction outlets
- Twelve mains electricity outlets
- Appropriate physiological monitoring

6.3 Equipment

Most Australian and New Zealand hyperbaric facilities provide a comprehensive medical service that is equipped and staffed to be capable of providing mechanical ventilation and invasive cardiovascular monitoring within the chamber for the duration of hyperbaric treatment. In Australia this requirement is enshrined in the Commonwealth's *Medicare Benefits Schedule*. As such, hyperbaric facilities maintain equipment that may be of value elsewhere in the hospital under pandemic conditions.

We **recommend** that hyperbaric units should inventory their current stock of equipment (e.g. ventilators, monitors, intravenous infusion pumps, oxygen hoods, circuits), including consumables and disposables, and quantify how much can realistically be re-deployed to other areas whilst still maintaining emergency hyperbaric services. Units should also identify available logistic channels for supply, storage, and procurement of additional equipment.

Much of this equipment will, however, be unfamiliar to non-hyperbaric personnel and appropriate education must be provided to new users.

1. Ventilators used inside the hyperbaric chamber must be hyperbaric compatible. They must be capable of functioning across a range of atmospheric pressures (differing gas densities) and not pose an electrical or mechanical hazard (e.g. fire or implosion risk) in an oxygen-enriched high-pressure environment. Because of their relatively infrequent use and the costs/difficulties associated with finding suitable replacements hyperbaric ventilators often remain in service for many years after their contemporaries in the anaesthetic or intensive care unit have been replaced. These older-style, often fully pneumatic, ventilators (e.g. Penlon Nuffield, Draeger Oxylog [original]) are generally less capable than modern ICU ventilators and offer a smaller range of ventilatory options than may be desirable in ARDS. Significant user education will be required to ensure optimal use in these fragile patients. More modern hyperbaric ventilators (e.g. Siaretron 1000 Iper, Maquet Servo-i H) are capable of providing full ICU-grade ventilation but their user interface and particular idiosyncrasies will still be unfamiliar to general ICU staff and education of new users will still need to be provided. Other considerations include the availability of circuits and other disposables for these non-standard ventilators (hyperbaric facilities may hold only a limited supply for their own use) and the ability to install HEPA filters at appropriate points in their circuit.

2. Monitors: many different monitoring systems are in use throughout Australia and New Zealand, some internal to the chamber (e.g. in nitrogen-flushed hyperbaric housings) and others external (e.g. with cabling plumbed through hull penetrators). As with the ventilators, the relatively infrequent use of this equipment and the technical issues related to rendering it hyperbaric-compatible in the first instance often result in monitors being replaced less frequently than in other hospital areas. Connections may not be compatible with current equipment elsewhere in the hospital and the user interface may be unfamiliar to non-hyperbaric staff, requiring a period of familiarisation to use optimally.

3. Oxygen Hoods: High-flow nasal oxygen (HFNO) has been recommended as therapy for hypoxia associated with COVID-19 disease, as long as staff are wearing optimal *airborne* PPE. The risk of airborne transmission to staff is low with well-fitted newer HFNO systems when optimal PPE and other infection control precautions are being used, but negative pressure rooms remain preferable for patients receiving HFNO therapy.

Patients on HFNO however may occasionally need to be transferred around

the hospital (e.g. from ED to the ward, between wards, to CT, etc). Under these circumstances HFNO is not appropriate (difficult to meet required flow-rates of up to 60 l/min, and high risk of environmental contamination) but standard 'transport-friendly' oxygen delivery systems (e.g. non-rebreather masks) may not meet the patient's oxygen requirements. In this situation the oxygen hood systems (e.g. Amron) used in many multiplace chambers may be of benefit in three distinct ways:

1. These systems can reliably provide up to 100% oxygen (without air entrainment), unlike most ward-level oxygen delivery systems. To prevent carbon dioxide retention a minimum flow rate of 30 l/min is recommended and can be provided by connecting two cylinders in parallel through a Y-piece (oxygen-oxygen for 100% O_2, oxygen-air for lower percentages). Short intrahospital transfers (maximum 30 minutes) can be managed with a flow rate of 15 l/min from a single flowmeter without obvious respiratory distress in most patients.

2. Although insertion of a standard PEEP valve on the hood's expiratory port will generally cause the hood to pop off the neck-ring even at its lowest setting (5 cmH_2O), the insertion of a HEPA filter (or even two in series, depending on brand) will cause enough expiratory flow resistance to provide 2-3 cmH_2O of PEEP. This is not usually enough to cause the hood to pop off the neck-ring but is enough to provide useful support in some patients.

3. Finally, the sealed nature of the oxygen hood, with a HEPA filter on the expiratory limb, reduces the risk of environmental contamination by the patient whilst in transit.

Oxygen hoods are re-usable and, with careful maintenance and cleaning, may be used for up to 20 patients This may be an advantage when re-supply issues become a problem. In order to safely re-use such equipment however a rigorous cleaning process is required, whilst simultaneously ensuring staff risk is kept to a minimum. Multiple commercial preparations are available to clean respiratory equipment. We **recommend** that manufacturers' guidelines be strictly followed, and local infection control advice should be sought if uncertainties are identified.

As with any specialised equipment, appropriate training of new users will be essential to ensure patient and staff safety (Figure 7). Particular pitfalls to be highlighted with the oxygen hood include:

- The need to appropriately size and fit the neck seal.
- How to optimise fresh gas in-flow rate so that it matches the patient's minute ventilation. Inadequate flow rates will result in inadequate

oxygen delivery, inadequate carbon dioxide clearance, and the hood 'shrink-wrapping' the patient's head. Overly generous flow rates, on the other hand, will result in the hood popping off the neck-ring and potential aerosol generation as the hood decompresses.

- The fresh gas in-flow must be switched off and the hood squeezed to decompress it via the HEPA filter on the expiratory limb before breaking the seal to remove the hood from the neck-ring (again, to reduce the risk of aerosol generation).
- All staff attending a patient wearing an oxygen hood should wear *airborne* PPE at all times due to the risk of viral transmission in the event of inadvertent depressurisation of the system. This message must be reinforced continuously. The sealed nature of the oxygen hood under normal operating conditions may lead to a false sense of security amongst those unfamiliar with the system's limitations.
- Cleaning requirements may also be unfamiliar to ward staff. Manufacturers' guidelines should be strictly followed, and local infection control advice should be sought if uncertainties are identified.

Figure 7. Amron oxygen hood: (a) components – disassembled, clockwise from top left – neck ring, hood, exhaust [red] and inflow [clear] hoses, two HEPA filters, silicone neck seal; (b) components – assembled; (c) neck seal fitted – note use of two filters in series to provide increased PEEP; (d) hood in place.

(a)

(b)

(c)

(d)

7. OTHER CONSIDERATIONS

7.1 Development of Co-operative Agreements with Other Health Services

Where multiple hyperbaric facilities exist within a single jurisdiction, we **recommend** that agreements be created to facilitate the transfer and care of appropriate patients and to minimise unnecessary transfers.

Approaches should, where possible, include:

- A graded transfer of responsibility for hyperbaric service provision (elective first, then emergency, as appropriate to local conditions) from hospitals with pandemic responsibilities to those without. This will reduce the risk of patient infection from attending for treatment and free up staff and resources at the pandemic hospital.
- Notification of ambulance and retrieval services of the agreement to minimise delays in provision of definitive hyperbaric management (e.g. of diving emergencies), reduce unnecessary resource utilisation and prevent avoidable contact with – and overload of – designated pandemic hospitals.

7.2 Additional Considerations

To ensure a sustainable workforce, we **recommend** the following:

- Streamlining of administrative processes (e.g. electronic health record training) which limit staffing flexibility and upskilling new staff members.

- Accommodation for staff unable to return home.
- Staff reassurance regarding indemnity coverage for operating beyond their normal scope of practice.
- Provision of debriefing and psychological support; staff morale may be adversely affected due to redeployment outside their usual scope of practice, increased workload, anxiety over personal safety and the health of family members.
- That cancellation of pre-arranged annual leave during a pandemic should only be considered if absolutely necessary. Maintaining staff morale is imperative as pandemic conditions may persist for many months.

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