

# Professional capability within the Australian hyperbaric nursing workforce

## AUTHORS

### Carol Baines

RN, Clinical Nurse,  
Department of Diving and Hyperbaric Medicine, Royal  
Hobart Hospital, GPO Box 1061, Hobart, Tasmania,  
Australia  
carol.baines@dhhs.tas.gov.au

### Pam Sykes

RN, BN  
Clinical Nurse Educator, Practice Development Unit,  
Royal Hobart Hospital, GPO Box 1061, Hobart,  
Tasmania, Australia  
pam.sykes@dhhs.tas.gov.au

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## KEY WORDS

registered nurses, hyperbaric, workforce, emotional intelligence, survey

## ABSTRACT

### Objective

To document and describe a contemporary profile of the Australian hyperbaric nursing workforce.

### Design

A mixed methods research methodology using a web-based survey questionnaire.

### Setting

Members of the Australian Hyperbaric Technicians and Nurses Association.

### Main outcome measures

Overview of the current Australian hyperbaric nursing workforce including demographics, education, clinical experience, employment status and workplace health and safety requirements.

### Results

A majority of the 49 respondents working in the specialty of hyperbaric medicine were female (87.7%) and aged between 45-54 years (42.9%). All have qualifications relevant to hyperbaric, wound management and/or critical care nursing. A mostly part-time and casual workforce (75.5%) participates in an on call roster between one and five times per fortnight (81.6%). Hyperbaric nurses (95.4%) have been recruited from critical and emergency care departments with many continuing to work shifts in these areas. A high level of workplace health and safety compliance includes an annual medical examination (91.8%) and associated hearing test (77.6%). Personal injuries associated with hyperbaric oxygen therapy are low.

### Conclusion

Limited data are available on the characteristics of the hyperbaric nursing workforce in Australia. Results of this survey show the recruitment and retention of female nurses' in the middle of their career ensures a high level of job suitability. Advanced clinical skills coupled with relevant post graduate tertiary qualifications are necessary. A high level of casual workforce employees ensures the mandatory 18 hour break between compression treatments is achievable. The emphasis on workplace health and safety compliance is paramount with few injuries being reported.

## INTRODUCTION

The field of Diving and Hyperbaric Medicine has many idiosyncrasies. It is a unique field of nursing that is physically, emotionally and environmentally challenging. The hyperbaric specialty is growing with an increasing number of medical conditions being accepted as responders to hyperbaric oxygen therapy. Recruiting registered nurses to the hyperbaric environment can present its own difficulties. The hyperbaric nurse must possess all the skills required to care for patients with varying levels of sickness from outpatient to critically ill whilst working independently inside the actual hyperbaric chamber. The physical environment of the hyperbaric facility is highly regulated requiring strict compliance with various treatment tables and is potentially volatile due to the delivery of 100% oxygen in a confined space, consequently, specific technical knowledge and skills are mandatory. In addition, nurses must demonstrate an advanced level of emotional intelligence that alludes to an outward serene demeanour whilst knowing they are solely responsible for facilitating patient care for the two or more hours the chamber is compressed (Gray 2008).

Hyperbaric Medicine is not a new specialty but it is a field of nursing that is not well known. There are fifteen Departments of Diving and Hyperbaric Medicine (hyperbaric facilities) in Australia: eight in major public hospitals in each State and the Northern Territory, five in private facilities and two in military facilities (Frawley et al 2013). A hyperbaric facility often has one large multi-place chamber and several mono-place chambers. They usually operate during office hours but provide an 'on call' service to their catchment area. This design of service delivery is echoed around Australia and documented by Uzun et al (2011) as being an appropriate format.

Several professional groups work harmoniously in a hyperbaric facility: doctors, registered nurses (RNs) and technicians. All members are key to providing safe hyperbaric oxygen therapy (HBOT) that is supported and underpinned by the following regulatory authorities; Australian/New Zealand Standard™ Occupational diving operations Part 2: scientific diving AS/NZS 2299.2:2002 and Australian Standard™ Work in compressed air and hyperbaric facilities Part 2: Hyperbaric oxygen facilities AS 4774.2-2002.

Standard delivery of hyperbaric oxygen therapy (HBOT) in Australian hospital-based facilities involves breathing 100% oxygen at 243 kPa (2.4 Ata) for periods of usually 120 minutes for each treatment session (Smart and Bennett 2010). It is usual for patients suffering with chronic conditions, such as a diabetic leg ulcer, to be prescribed 40 or more treatments of hyperbaric oxygen. The actual delivery of hyperbaric oxygen is most commonly administered via a 'hood' system (figure 1) with patients seated in a multi-place chamber. This is a shared experience for patients (Cooper et al 2009) (figure 2) attended to by a RN or 'inside attendant'.

**Figure 1: Amron™ Hood System**



**Figure 2: Multi-place Chamber Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital 2012**



Hyperbaric oxygen medicine is historically associated with the treatment of the diving ‘bends’. A comprehensive list of medical and surgical conditions that also benefit from HBOT has been established by the Australian and New Zealand Hyperbaric Medicine Group (ANZHMG 2012) (table 1).

**Table 1: Accepted indications for hyperbaric therapy**

<b>BROAD INDICATION</b>	<b>SPECIFIC INDICATION</b>
Bubble Injury	Decompression illness Arterial gas embolism (Diving/ Iatrogenic/ Misadventure)
Acute Ischaemic Conditions	Compromised flaps/grafts Crush injury/Compartment syndrome Reperfusion injuries Sudden sensorineural hearing loss Avascular necrosis
Infective Conditions	Clostridial myonecrosis Necrotizing fasciitis non clostridial Myonecrosis necrotizing cellulitis Malignant otitis externa Refractory mycoses Refractory osteomyelitis Intracranial abscess
Radiation Tissue Injury	Osteoradionecrosis Established Prophylactic Soft tissue radiation injury Established Prophylactic
Problem Wounds	Chronic ischaemic problem wounds Diabetic: ulcers/gangrene/post-surgical Non -diabetic problem wounds: Pyoderma gangrenosum Refractory venous ulcers Post-surgical problem wounds
Toxic Gas Poisoning	Carbon monoxide poisoning (Mod/Severe) Carbon monoxide poisoning delayed sequelae
Ocular Ischaemic Pathology	Cystoid macular oedema Retinal artery / vein occlusion
Miscellaneous	Thermal burns Bells palsy Frostbite
Adjuvant to Radiotherapy	As adjunct to radiotherapy in treatment of solid tumours

Review of various position statements from a number of facilities show the RN employed in a hyperbaric facility has a multifaceted role that includes:

- acting as an ‘inside attendant’ that involves being pressurised at the same time as patients during their treatment inside the multi-place chamber to a treatment depth;
- compliance with the usual nursing paradigm in terms of initial patient assessment, patient education, collaboration with other medical personnel, planning of treatment and goals of care and scheduling follow-up care (most facilities have a large outpatient component);

- delivering a diverse range of direct patient care such as wound management, medication administration, airway management etc;
- easing patient anxiety about the decompression treatment and preparing patients for lengthy periods in a closed chamber;
- driving programs associated with patient education and health promotion;
- educating peers; and
- participating in research.

Many facilities employ a small number of RNs as permanent staff and a significant number of casual staff. This is a deliberate decision to promote compliance with workplace health and safety requirements. Once an RN has completed their role as an inside attendant (typically being pressurised to 14 metres of sea water for 100 minutes) for any given day, it is a requirement of the Defence and Civilian Institute of Environmental Medicine (DCIEM) decompression tables that the nurse cannot be compressed again within 18 hours (Cooper et al 2009).

Workplace Health and Safety are mainstays of practice in all hyperbaric facilities. The routine of each clinical day is regulated to accommodate AS 4774.2 and AS/NZS 2299.2 plus the National Fire Protection Association (NFPA) fire code (NFPA 2012). It is these comprehensive documents that inform the workplace and ensure best practice for both the patient and the RN. There remain, however, numerous work-related risks associated with hyperbaric nursing. Some nurses can experience varying physical side effects from continual exposure to highly pressurised environments. Cooper et al (2009 p71) write specifically of decompression illness (DCI), or 'the bends', as a potential injury following an episode of being an inside attendant and make comment that 'it is not acceptable to expose staff members, potentially thousands of times in a career to health risks'. It is this level of insight that informs the specialties understanding of risk mitigation, however, these types of injuries are rare, with Cooper et al (2009) reporting zero cases in 6,062 attendant exposures.

Hyperbaric nurses are in high demand; this is a growing field that provides challenging work and cutting edge technology that can be very rewarding. Current minimum employment requirements include registration as a nurse with the Australian Health Practitioner Regulation Agency (AHPRA), at least two years' work experience and completion of Part 1 of a recognised hyperbaric training course. Neither medical nor nursing professions have routinely embraced student undergraduate placements in Australian hyperbaric facilities.

Recruitment and retention of RNs is a national issue (AHWAC 2004). Future planning strategies may be needed to ensure a sustainable workforce. In order to better understand the career pathway for a RN working in this small specialty, a survey of the current incumbents was undertaken. Hyperbaric nurses working in Australian Diving and Hyperbaric facilities in August 2013 were invited by email to complete an online, anonymous survey titled, 'Who we are and where do we come from?'

## **METHODS**

### **Questionnaire**

A mixed methods research methodology using a 16-point web based survey (Survey Monkey™) questionnaire (including space for free text comments) was distributed to participants via the Hyperbaric Technicians and Nurses Association (HTNA) membership email listing in August 2013. The questions related to five major headings including demographics, education, professional experience, employment status and workplace health and safety. A small onsite pilot was undertaken in the workplace of the researcher and refinements made based on evaluation of the data and feedback. An information sheet explained the purpose and aims of the survey. Participation was voluntary and all information was de-identified.

## Participants

All members of the HTNA were invited to participate in the survey. This targeted sample reflects nurses who are currently working in a Department of Diving and Hyperbaric Medicine Unit (private and/or public facility) across Australia.

## Data Collection and analysis

All data was collected and analysed via the web-based Survey Monkey™ program. Responses to each question were tallied and graphed. Qualitative data, where relevant, was tabulated and themed for researcher interpretation and analysis.

## FINDINGS

A total of 68 surveys were issued with 49 (72.1%) completed within the allocated time-frame of two weeks. Four facilities were represented by the 49 respondents.

### Demographics / Professional experience

The majority of respondents were:

- female (43/49, or 87.7%);
- aged between 45-54 years (21/49, or 42.9%);
- employed in the field of diving and hyperbaric medicine for between 2 and 10 years (38/49, or 77.6%); and
- holding other clinical positions within the hospital(47/49, or 95.9%).

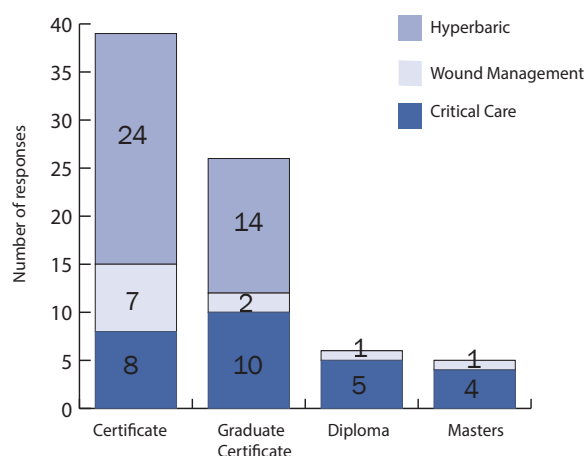
Respondents (29/49, or 59.2%) predominately expressed an ongoing intent to remain in the specialty for a further five years or more. All of those surveyed indicated they had been recruited to hyperbaric from an acute care environment, either surgical, medical, intensive care or emergency.

### Post Graduate Education

Graph 1 shows respondents had a significant number of formal post graduate tertiary qualifications. A free text section in the survey allowed the respondents to write about post graduate education and training. Data offered showed a commitment by the respondents to remain up-to-date with current best nursing/medical practice.

**Graph 1: Tertiary qualifications**

Have you completed tertiary qualifications in any of these areas?



Fifty eight point seven percent (27/49 or 58.7%), of respondents reported their involvement/assistance with research studies within their facility and a further 16.3% (8/49) had undertaken independent research themselves.

### Employment status

Three quarters (37/49 or 75.5%) of those who responded were permanently employed in a part time (less than 37.5 hours per week) or casual (no contracted hours per week) capacity. On-call commitment varied with 18.4% (9/49) doing no on-call duties, and the remaining 81.6% (40/49) committed to between one and five on-call sessions per fortnight (see graph 2). For

most nurses 'on-call' was recorded as being a non-contractual commitment based on a 'volunteer' system. Three facilities expressed 'on-call' as a mandatory component of employment and as such it is written into the position description.

Working inside the chamber as an attendant for a medical treatment is colloquially referred to as being 'compressed'. Respondents stated they were compressed 4 out of a maximum 10 opportunities as afforded by their roster. One respondent commented that 'I was compressed as often as permitted by the Australian Standard 4774.2'

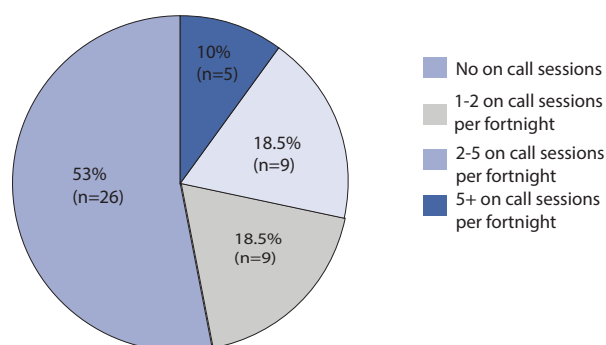
Fifty percent (24/48 or 50%) received a financial remuneration, or allowance, following an episode of 'being compressed'. This financial sum was of varying amounts and was not consistent across workplaces. The allowance is titled either "in chamber compression allowance" or more colloquially "risk money". One respondent did not answer this question.

### Workplace Health & Safety

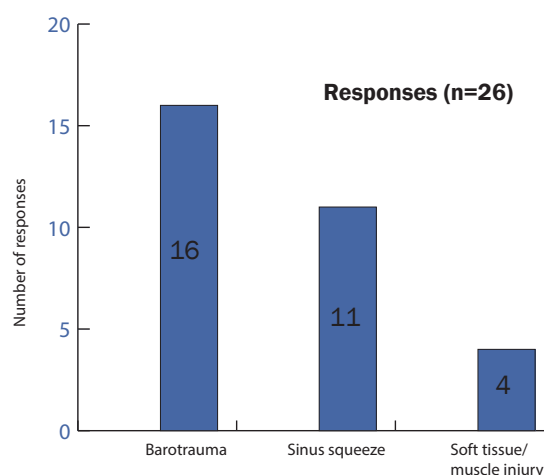
Respondents were asked if they had ever experienced an injury whilst working in the chamber. The results are shown in graph 3.

**Graph 2: Participation in on call sessions**

**Do you participate in an on call roster in your facility?  
Responses (n=49)**



**Graph 3: Injuries experienced while working in the hyperbaric chamber**



Ninety one point eight percent (45/49 or 91.8%) of respondents undergo an annual medical examination as per recommendations from AS 4774.2. Of these, 84.4% (38/45) reported also having a formal audiology assessment. 'Formal' was considered to be an assessment conducted off site, at a separate time to the medical examination and usually performed in an approved sound proof booth. Five respondents (5/49 or 10.2%) self-reported having a decompression injury following a hyperbaric exposure.

## DISCUSSION

Findings from this survey show that the current cohort of RNs employed in the specialty of Diving and Hyperbaric Medicine in Australia are predominantly female, aged 45-54, with broad clinical experience and educated to a high academic standard. This demographic compares well to a similar size group (n=32) of RNs working in the largest Hyperbaric Medicine Department in the United States of America (USA) based at Duke University Hospital. The average age reported at this facility was 38 years and the average years of service between 3.5 and 20 years (Kevin Kraft, NUM Duke University Hospital, email, 20.08.13). The Australian data demonstrates female nurses in the middle of their career are the typical group for recruitment and consequently retention in this unique field. It may also speak to the proposition forwarded by Freshwater and Stickley (2004 p93) that



'every nursing intervention is affected by the master aptitude of emotional intelligence'. Working as the only healthcare provider inside a multi-place hyperbaric chamber during a treatment calls for outward serenity and calm – any panic could be contagious for all of the patients in the chamber.

All 49 respondents (100%) had completed Part 1 of the graduate certificate of Diving and Hyperbaric Medicine, while only 51% (25/49) had completed Part 2. One nurse commented, 'why do Part 2 just to get a post graduate certificate?' This rationale could account for the lower completion rate. It is a national training and safety requirement in Australia and New Zealand that all RNs working in a compressed gas environment (hyperbaric chamber) must successfully complete a standard training. The curriculum for this training has been influenced by the HTNA and endorsed by the University of Adelaide, South Australia. This is the only certificate level course currently offered in Australia and is available in two parts. Part 1 of the course is a compulsory requirement for employment and is delivered on-site in the local clinical facility by the doctors/nurses/technicians based in that department. The course is customised accordingly to each facility. The hospital/facility must provide a suitable environment for the practical component and competencies to be achieved. The second part (Part 2), which is non-compulsory, is required to successfully complete the post graduate certificate and is delivered as an on-line module from the University of Adelaide, South Australia.

Whilst acknowledging the educational system is slightly different in the USA, Duke University Hospital reported 100% of their registered nurses having an equivalent post graduate certificate. Most recently La Trobe University in Victoria (Australia) has added a diploma level module to its suite of critical care post graduate education.

Registered nurses recruited to the specialty have a minimum of two years post graduate experience. This is a requirement informally agreed upon nationally by all facilities to attract personnel who have established clinical skills and a level of confidence with their primary nursing roles and responsibility. The usual RN role when working in the facility is that of inside attendant. It is essential that they understand and feel confident to practice in this autonomous and very different environment. When the RN is performing their duties as an inside attendant they are required to rely on their individual clinical skills and competence as it can take up to eight minutes for other medical personnel to be compressed and consequently able to assist in any medical or practical emergency. The delivery of a specifically designed and structured hyperbaric course, coupled with pre-existing skill sets results in a blended practitioner who is versatile, autonomous and able to work under pressure physically, emotionally and environmentally.

Student nurses are offered placements in hyperbaric centres in both the United Kingdom (UK) and USA but not currently in Australia. Wilkinson (2006) comments on a number of advantages of having student placements in hyperbaric facilities, such as engaging students to increase their knowledge about the specialty and learning essential nursing skills that are transferable to all environments. The reason for Australian hyperbaric facilities not yet welcoming students to this unique field may be that much of the daily hyperbaric routine is focused around the actual administration of hyperbaric treatment and the students' role would be limited to an observer in this context. An Australian survey by Halcomb et al (2011) on self-reported preparedness of new graduate nurses to work in critical care showed a potential benefit of clinical placements in specialty areas. New graduate nurses who had more than one week clinical placement in critical care reported greater confidence and interest in seeking employment after graduating. This may become an important factor to consider should recruitment of hyperbaric nurses in Australia become a future workforce issue.

There appears to be a self-reported increase in decompression illness (DCI) awareness amongst inside attendants. Respondents were asked 'Have you had or do you know anyone who has had DCI?' Results indicated five RN's (5/49 or 10.20%) responded yes to this question. Latest published evidence from Cooper et al (2009) and Uzun et al (2011) clash with this survey data. Both studies report retrospective analysis from

their facilities of no reported cases of attendant DCI. Cooper et al (2009) and Uzun et al (2011) state that, in their opinion, DCI risk is low when there is compliance with routine treatment tables and when preventive measures are in place. Alternative explanations to account for the self-reported DCI awareness could include breaches of the four hour restriction before undertaking exercise or travelling to >300 metres above sea level. Hyperbaric inside attendant management policies should include post dive restrictions.

Further longitudinal studies are needed and it may be timely to repeat the Australian study completed by Cooper et al (2009) at the 10 year mark to further evaluate safety systems for inside attendants.

## CONCLUSION

Hyperbaric medicine is recognised as a specialist environment for patients and healthcare personnel. It is also, of necessity, a highly regulated environment due to workplace health and safety considerations. Registered nurses are a key member of the hyperbaric workforce team working as inside attendants during a compression treatment in mostly a part-time or casual capacity. This survey demonstrates the recruitment and retention of female nurses in the middle of their career ensures a high level of job fit. They are highly skilled and experienced, with many holding relevant tertiary level qualifications and contributing to the ongoing body of evidence that describes and frames hyperbaric nursing. This survey provides a snapshot and describes a general profile of the Australian hyperbaric nursing workforce that could prove useful for future recruitment or workforce planning.

## LIMITATIONS

This survey is subject to several limitations. Although the response rate of 72.1% was acceptable, not all registered nurses working in the field of Diving and Hyperbaric Medicine in Australia and New Zealand in 2013 completed the survey. The survey was only offered to those registered nurses who were members of the HTNA. Eleven of the fifteen Australian facilities were not represented.

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