HTNA

HYPERBARIC TECHNICIANS AND NURSES ASSOCIATION

30th Annual Scientific Meeting of Diving and Hyperbaric Medicine

7th - 9th September 2022

nipaluna, Hobart

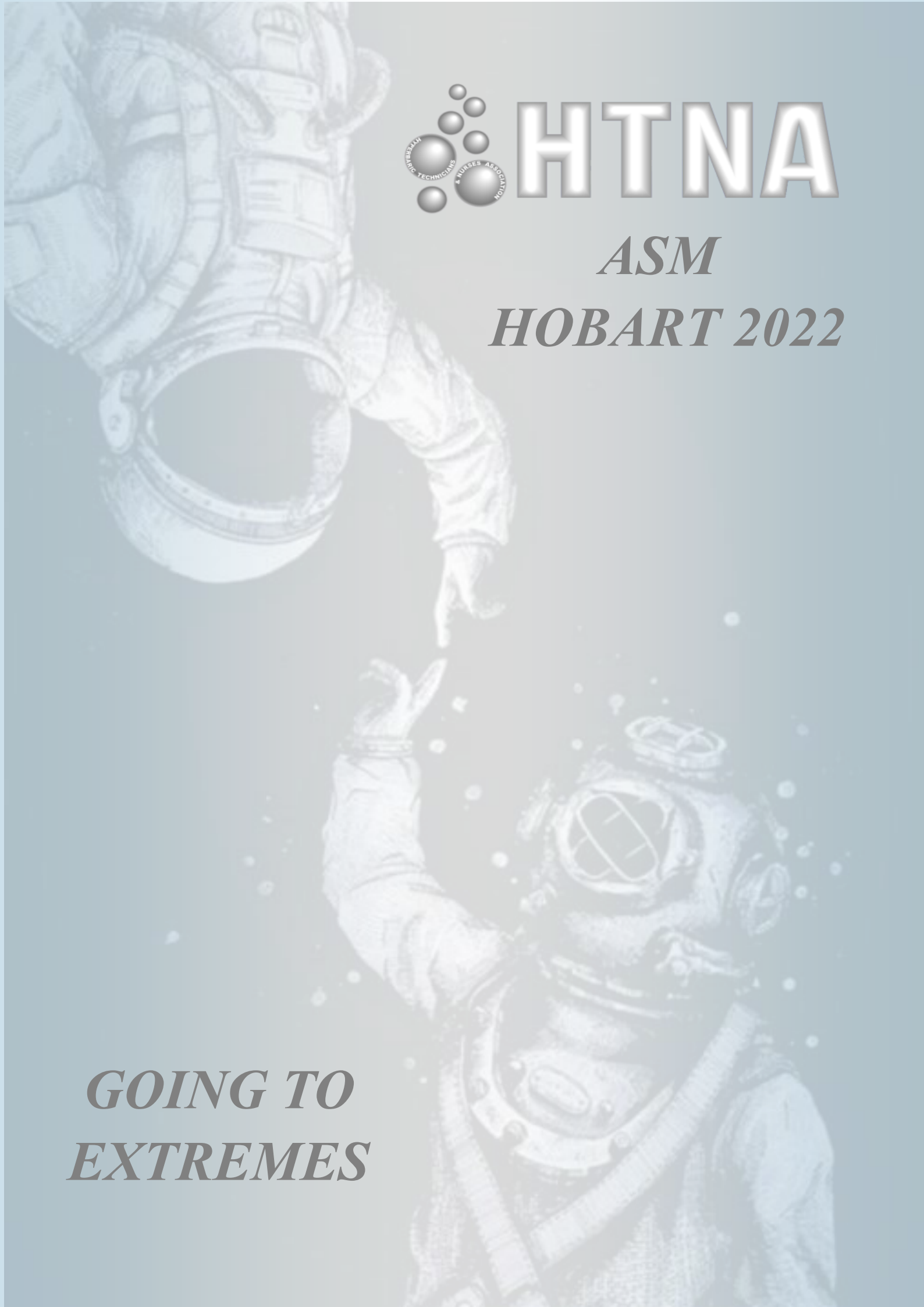
GOING TO EXTREMES

HOSTED BY:

DEPARTMENT OF DIVING AND HYPERBARIC MEDICINE

ROYAL HOBART HOSPITAL

RHH
ROYAL HOBART HOSPITAL



HTNA

ASM HOBART 2022

GOING TO EXTREMES

Welcome

Welcome to the fabulous city of Hobart, home to Australia's newest hyper (and hypo!) baric chamber.

The organising committee of the 30th Hyperbaric Technicians and Nurses Association annual meeting would like to take this opportunity to acknowledge and pay respect to the traditional custodians of this land Lutruwita (Tasmania). We pay respect to the Elders past, present and emerging. We acknowledge the muwinia and palawa peoples, of the South East nation as Tasmanian Aboriginal people who are the continuing caretakers of the land our hospital now stands on and all country in Lutruwita (Tasmania).

This year's conference theme is Going to Extremes. We will have you imagining what it would be like to find yourself alone 300 feet below the sea, or how it would feel navigating a dark flooded cave system, uncertain as to the state of well being of those you have been sent to rescue, as well as looking up to the stars by exploring the challenges of human spaceflight. This conference will have something for everyone.

Our social calendar is also Extreme. Take your pick from sipping cocktails with new and old colleagues, find out who dun it? at the gangster themed murder mystery evening or dance the night away at the formal gala dinner. Join us for all three!

We extend sincere appreciation to the sponsors who support this conference and the HTNA. We encourage you to meet with our sponsors by visiting the trade area during the conference. Discover new products, and information by networking with trade colleagues throughout the conference.

Your HTNA committee is available to answer questions - so please enjoy our 30th Annual Scientific Meeting.

A final note on COVID safety — we kindly ask that you do not attend if you have any signs or symptoms of respiratory illness, and encourage the use of masks.

General information

Venue

This year marks the 30th Hyperbaric Technicians and Nurses Association annual scientific meeting. The ASM will be hosted at the luxurious Henry Jones Art Hotel. Standing on Hobart's waterfront, a row of historic warehouses dating from the 1820s and the former IXL jam factory have been transformed into an enthralling first class hotel showcasing the work of Tasmania's finest visual artists.

On the Hobart historic waterfront, with views to kunanyi / Mt Wellington, the Henry Jones Art Hotel is walking distance to our harbour, Salamanca Market, fabulous restaurants and bars and the Department of Diving and Hyperbaric Medicine at the Royal Hobart Hospital.

Registration Desk

Located at the entrance to the Jones and Co Conference room on the first floor. Please register your attendance each day. Each FULL registration is eligible for one conference gift bag.

Name Tags

Please wear your name tag to each conference session. We will have spare tags if you forget.

Audio Visual

Audio visual assistance is provided by *Scene Change*. All presentations should be provided on a USB and given to the *Scene Change* consultant, or Shane Dennis (HTNA Sec) as early as possible on the day.

Trade Displays

Please support our trade partners during conference breaks. Add to your network of contacts and grab a business card from them.

Royal Hobart Hospital Hyperbaric Facility Tour—K Block

A tour of the Department of Hyperbaric Medicine will be on Saturday 10th September 10am to midday. Further details will be provided at the conference.

General information

Catering

Morning / afternoon tea and lunch are provided by The Henry Jones Art Hotel. All food and refreshments will be served within the hotel complex.

Parking

Public car parks available nearby The Henry Jones Art Hotel:

- 41 Evans St
- Dunn Place car park
- Market Place car park

Please obey all parking signs. Hobart City Council carparking inspectors regularly patrol the parking zones of Hobart. Most carparks and metered spaces operate on the Easypark app.

Health and Emergencies

In an emergency - please call **000**

The Royal Hobart Hospital (RHH) Emergency Department is located two city blocks away from the Henry Jones Hotel with access from Liverpool St. RHH switch ph 03 6166 8308

The Hobart Private Hospital Emergency entrance is located on the same block as RHH with the entrance on Argyle St, and may also be able to assist with less acute emergencies. HPH switch ph 03 6214 3000

After hours GP assistance may be obtained by calling 1300CALLTHEDR (1300 640 471).

COVID/Acute Respiratory Illness Plan:

Please reconsider your attendance if you have any signs or symptoms of an acute respiratory illness. Although density limits and mask mandates have now been lifted in Tasmania, the HTNA organising committee would appreciate conference delegates wear a mask during the lecture sessions. Presenters will be excused from wearing a mask under current restrictions.

Things to do in Hobart

Hobart Convict Penitentiary Ghost Tour

https://nationaltrusttas.rezdy.com/256698/hobart-convict-penitentiary-ghost-tour

Come tour the Hobart Convict Penitentiary after dark and hear the stories of those that experienced heaven and hell in the chapel and the solitary cells beneath, those that were sentenced for their crimes in the courtrooms, the lives that were ended at the gallows, and the spirits that remain haunting every wall.

From $35 - Need to be fully vaccinated. Book online.

Red Decker Double Decker Bus Tours

https://reddecker.com.au

Join the official sightseeing tour of Hobart. Choose from 20 different stops, hop on– hop off or choose the 90 min city loop tour.

From $35 - Buy tickets online.

Pennicott Wilderness Journeys

https://www.pennicottjourneys.com.au

Australian tourism legend Robert Pennicott and his team of passionate local staff have been sharing Tasmania's scenery, wildlife and produce since 1999. Winner of multiple Australian Tourism Awards.

All HTNA guests will receive 15% discount off their standard tour rates during your stay.

To receive the discount, attendees can simply book directly with the reservations team by phone +61 3 6234 4270, or email info@pennicottjourneys.com.au and mention they are delegates of the hyperbaric technicians and nurses association conference.

Mona

https://www.mona.net.au

Museum, eat, drink or all three. Check the website for opening times and admission details, currently only open Friday to Monday. Bookings are essential and MUST be made online $35 adult for non Tasmanians.

Conference Venue

THE HENRY JONES ART HOTEL

The Jones & Co. Room

1st floor

Once the commercial hub of H. Jones & Co, an industrial empire with interests across five continents, the room retains its ambience and connection to a past era. Original timber work is a feature of this generous space.

Organising Committee

Shane Dennis, HTNA Secretary

Contact: 0448 862 269 (available 24 hrs during the conference)

Email: www.conference@htna.com.au

Karl Price, HTNA President

Justin Callard, HTNA Treasurer

Bebe Brown, ANUM DDHM Hobart

Stuart Bumford, DDHM Technician

Jacob Roberts, DDHM Nurse

Kylie Shelverton, DDHM Nurse

The HTNA Executive would like to extend a big THANK YOU to the organising committee for all their hard work in making the 30th HTNA Annual Scientific Meeting an 'EXTREME' success.

HTNA Facility Representatives

Jason Pepper, Royal Hobart Hospital
Hobart, Tasmania

Hayley Perfect, Prince of Wales Hospital
Sydney, New South Wales

Troy Pudney, Royal Adelaide Hospital
Adelaide, South Australia

Richard Turk, Townsville University Hospital
Townsville, Queensland

Danielle Pollock, Royal Darwin Hospital
Darwin, Northern Territory

Liz Williams, Fiona Stanley Hospital
Perth, Western Australia

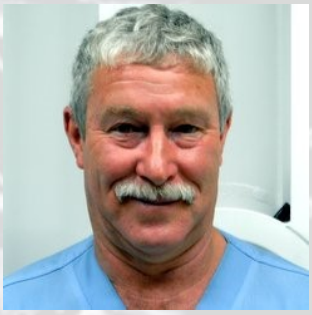
HTNA Facility Representatives

Natalie McGregor, The Alfred Hospital, Melbourne, Victoria

Kyla Martin, Wesley Hyperbaric, Brisbane, Queensland

Basil Murphy, Waitemata District Health, Auckland

Warren Harper, Christchurch Hospital, Christchurch



Andrew Melnyczenko
Mayo Clinic Minnesota

Keynote Speaker

Dr Richard Harris, SC OAM

In June 2018, a few days after a boy's football team went missing in Thailand's fourth longest cave system, Dr Richard Harris, an anaesthetist from Adelaide, applied his rare combination of cave-diving and critical care skills in the resulting rescue mission.

Established relationships in the international cave rescue community, allowed site British experts to specifically request his expertise to assist with the extraction of the boys and their coach.

In 2018 the Association of Anaesthetists of Great Britain and Ireland, awarded 'Harry' the Pask Award (his most cherished award!), in recognition of his bravery during the cave rescue of the Wild Boar football team. The Edgar Pask citation is given to those who've rendered distinguished service, either with gallantry in the performance of their clinical duties, in a single meritorious act, or consistently and faithfully over a long period.

Whilst he still practices medicine, life is very different now for Harry as he pursues his interest in documentary film making.

Keynote Speaker

Mr Chris Lemons

Chris has been a commercial diver for over 14 years, and currently specialises in deep sea saturation diving, operating almost exclusively in the oil and gas industry.

This highly specialised form of diving involves living in the claustrophobic confines of a decompression chamber for up to 28 days at a time, commuting daily to the sea bed in a diving bell, and working at depths of up to 900 feet for 6 hours at a time.

In September of 2012, a freak failure of the dynamic positioning system of the vessel he was working under, resulted in the umbilical which provides him with breathing gas, light and heat being severed completely. He was left on the seabed, in complete darkness 300 feet below the surface, with only the 5 minutes of breathing gas he carried in the emergency tanks on his back, and no way to protect himself from the freezing temperatures. Chris was resigned to ending his days alone in the dark water knowing every breath was potentially his last. It took his heroic rescuers over 40 minutes to come back and fetch him, and his miraculous survival story has baffled experts ever since.

His extraordinary story was subsequently immortalised in the hit Netflix/BBC documentary 'Last Breath,' Chris continues to dive to this day. Chris was born in Edinburgh, raised in Cambridge, and now lives in the Scottish Highlands with his wife and daughter.

Additional Speakers

(In presentation order)

A/Prof David Cooper

Dr Alicia Tucker

Mr Andrew Melnyczenko

Prof David Smart, AM

Joanna Smart

Heather Morrison, RN

Tom Workman

Dr Elizabeth Elliott

Megan Perry, RN

Dr Susannah Sherlock

Jenny Yuen, RN & Theo Tsouras, Technician

Adele Templeton, RN & Theo Tsouras, Technician

Dr Ian Gawthrope & Dr Neil Banham

Prof Michael Bennett, AM

Derelle Young, RN

Dr Juan Carlos Ascencio-Lane

Dr Darren Meehan

Military Medical Soh Kian Keon, RSN

CMDR Douglas Falconer, RAN

LCDR David Hughes, RAN

CMDR Douglas Falconer, RAN & POMED Kiah Chapple

Conference and Corporate Sponsors

The Hyperbaric Technicians and Nurses Association (HTNA) and the organising committee of the 30th Annual Scientific Meeting on Diving and Hyperbaric Medicine would like to thank the following sponsors for their generous support.

Diamond Members

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HTNA

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Affiliate Members

https://www.spums.org.au

PROGRAM - TUESDAY 6TH SEPTEMBER 2022

Pre-Conference Workshops

HOSTED BY:

DEPARTMENT OF DIVING & HYPERBARIC MEDICINE

ROYAL HOBART HOSPITAL

1. Workshop for Hyperbaric Technicians

Time: 1300—1700hrs

Detail: Technical—Hobart's new hyperbaric/hypobaric multi-place chamber

Topics:
A) Challenges of dual capability—Hyper and Hypo
B) Understanding static control measures
C) Selection of hyperbaric compatible IV pumps and syringe drivers
D) Risk mitigation measures implementation of hypobaric capability
E) Breathing gas delivery systems

2. Research Workshop

Time: 1300 – 1700hrs

Detail: An opportunity for research-oriented individuals to present proposals, discuss problems, and generally brainstorm.

Discussion Topics:

A) Data collaboration
- HTNA statistics
- ADSF
- Hotspur

B) Dive tables

C) Diabetic ulcers

D) ISSNHL

DAY 1 PROGRAM - WEDNESDAY 7TH SEPTEMBER 2022

HENRY JONES ART HOTEL

0800 – 0900 **Conference registration** – Jones & Co. level one

0900 – 1000 **HTNA - Annual General Meeting** – The Packing Room

0900 – 1000 **ANZHMG - Annual General Meeting** – The Art Installation Suite

1000 – 1030 **MORNING TEA**

1000 – 11-30 **Conference registration** – continued
Annual General Meetings – continued

1130 – 1230 **LUNCH**

1230 – 1300 **Session Chair – HTNA President - Karl Price**
Opening address
Welcome to country - Conference commencement

1300 – 1340 **A/Prof David Cooper**
The PEGASUS EnviroLab – Space medicine research in Tasmania

1340 – 1350 Questions

1350 – 1420 **Dr Alicia Tucker**
The right stuff

1420 – 1430 Questions

1430 – 1455 **Mr Andrew Melnyczenko (pre recorded presentation)**
Hypobaric safety

1455 – 1500 Questions

DAY 1 PROGRAM - WEDNESDAY 7TH SEPTEMBER 2022

1500 – 1530 **AFTERNOON TEA**

1530 – 1600 **Prof David Smart, AM**

A reflection on four decades of diving and hyperbaric medicine

1600 – 1605 Questions

1605 – 1650 **Joanna Smart**

Innovation in a future ocean – A global perspective on marine sustainability issues

1650—1700 Questions

DAY ONE CONFERENCE CLOSE

18:30 – 20:30 **Mölnlycke® Welcome cocktail party – The IXL Atrium**

Mölnlycke® Welcome Cocktail Party

Wednesday 7th September 2022

Time: 1830 - 2030hrs

The Henry Jones Art Hotel—The IXL Atrium

The Hyperbaric Technicians and Nurses Association are very grateful to Mölnlycke® for their support in sponsoring the HTNA 30th Annual Conference Cocktail Party.

DAY 2 PROGRAM - THURSDAY 8TH SEPTEMBER 2022

HENRY JONES ART HOTEL

0800 – 0850 **Conference Registration** – Jones & Co. level one

0850 – 0905 **Heather Morrison, RN**

Just a spoonful of sugar

0905—0910 Questions

0910—0955 **Tom Workman**

Low pressure portable hyperbaric chambers:
The pandora's box of hyperbaric oxygen therapy

0955—1000 Questions

1000—1015 **Dr Elizabeth Elliott**

Capturing data—diving death data

1015—1020 Questions

1020– 1050 **MORNING TEA**

1050 – 1110 **Megan Perry, RN**

POWH DDHM—Transitioning to electronic medical records

1110—1115 Questions

1115—1145 **Dr Susannah Sherlock**

Long COVID—Is there a case for HBOT?

1145—1150 Questions

1150 – 1300 **LUNCH**

DAY 2 PROGRAM - THURSDAY 8TH SEPTEMBER 2022

1300—1330 **Jenny Yuen, RN & Theo Tsouras—Engineer/Technician**

Hyperbaric oxygen therapy for critically ill patient in the monoplace

1330—1335 Questions

1335—1405 **Adele Templeton, RN & Theo Tsouras—Engineer/Technician**

Ventricular assist device in HMU. A case report

1405—1410 Questions

1410—1440 **Dr Ian Gawthrope and Dr Neil Banham**

A prospective single-blind randomised clinical trial comparing two treatment tables for the initial management of mild decompression sickness

1440—1445 Questions

1445—1515 **AFTERNOON TEA**

1515—1530 **Prof Michael Bennett, AM**

Diving and hyperbaric medicine—Past, present and future

1530 – 1535 Questions

1535 – 1550 **Derelle Young, RN**

A new hyperbaric nursing model

1550—1555 Questions

1600—1645 **Dr Richard Harris, SC OAM - Keynote Speaker**

Anaesthetics in the dark

1645—1700 Question

DAY TWO CONFERENCE CLOSE

1830—2030 **ConvaTec Murder Mystery Event—The Waterline Eatery**

ConvaTec

MURDER MYSTERY

SPONSORED BY ConvaTec

Thursday 8th September 2022

Time: 1830 - 2030hrs

Waterline Lounge Bar & Eatery—Brooke St Pier

Theme: Tracy Gang 1920s

Dress: 1920s Gangsters, Flapper Girls, Godfathers, F.B.I and Hitmen.

Aiden Abet the leader of the Tracy Gang developed a scam that netted him $1m. However, once his victims caught on he became a hunted man. The $1m was hidden in the Tracy Speakeasy and when it strangely reappears it leads to murder! Unravel the mystery of the dead man walking, the letters from William Shakespeare and the literary weekend.

The Hyperbaric Technicians and Nurses Association are very grateful to ConvaTec for their support and encouragement in sponsoring the HTNA 30th Annual Conference Murder Mystery Party.

DAY 3 PROGRAM - FRIDAY 9TH SEPTEMBER 2022

HENRY JONES ART HOTEL

0800 – 0900	**Conference registration** – Jones & Co. level one
0900—0935	**Dr Juan-Carlos Ascencio-Lane** *Davey Jones' locker: Uncovering diving deaths*
0935—0940	Questions
0940—1000	**Dr Darren Meehan** *Technical assessment of hookah surface supply diving equipment during diving fatality investigation*
1000—1005	Questions
1005– 1030	**MORNING TEA**
1030 – 1045	**Military Medical Expert Soh Kian Keong** *Maintaining hyperbaric chamber operator currency in the Republic of Singapore Navy (RSN)*
1045—1050	Questions
1050 – 1105	**CMDR Douglas Falconer** *Immersion pulmonary oedema in surface swimmers*
1105—1110	Questions
1110—1130	**LCDR David Hughes** *Royal Australian Navy Safety Authority*
1130—1135	Questions
1135—1200	**CMDR Douglas Falconer & POMED Kiah Chapple** *Royal Australian Navy—Hypercapnia in rebreather diving*
1200—1205	Questions
1205 – 1300	**LUNCH**

DAY 3 PROGRAM - FRIDAY 9TH SEPTEMBER 2022

1300—1340 **Dr Richard Harris, SC OAM - Keynote Speaker**

Hydrogen deep bounce diving—are we ready for the next step?

1340—1350 Questions

1350—1420 **AFTERNOON TEA**

1420—1530 **Chris Lemons - Keynote Speaker**

Last Breath

1530—1600 Questions

1600—1630 **Karl Price—HTNA President**

Closing Address

DAY THREE CONFERENCE CLOSE

1900—2300 **Gala Dinner—The Hobart Function Centre, Elizabeth St Pier**

HTNA ASM GALA DINNER

Friday 9th September 2022

Time: 1900 - 2300hrs

Dress: Smart Casual

Hobart
FUNCTION & CONFERENCE CENTRE

1 Elizabeth St Pier, Hobart

HTNA LIFE MEMBERS

The HTNA recognise the following life members:

Bob Ramsay (Vale Bob—September 2019)

Sharon Keetley

John Kershler

Barrie Gibbons

Dave King

HTNA AWARDS

HTNA SCHOLARSHIP

Awarded to one hyperbaric technician and one hyperbaric nurse

Prize: Full HTNA ASM ticket including all social events

Winner: Heather Morrison, RN of Royal Hobart Hospital

EARLY BIRD ABSTRACT AWARD

Awarded to an abstract submitted by the 29th June 2022

Prizes: Pennicott Wilderness journey or a Blackmans Bay Distillery voucher

Winners: Derelle Young RN, of Townsville University Hospital

Megan Perry, RN of Prince of Wales Hospital

SPUMS BOOK AWARD

Awarded to the best medical presentation

Presented by Neil Banham, SPUMS President at the HTNA conference gala dinner

ADSF BOOK PRIZE

Awarded to the best diving related presentation by a technician or nurse

Presented by John Lippman, ASDF Director at the HTNA conference gala dinner

GIFTS / AWARDS

Presented by the HTNA President at the end of the HTNA Conference

BOB RAMSAY AWARD

Formerly the Wee Man Award presented for outstanding achievements by a HTNA member within the past 36 months

Prize: Diving Trophy

Presented at the HTNA Conference gala dinner

The Bob Ramsay Award

"For outstanding achievement in the field of Diving or Hyperbaric Medicine by an HTNA Member" (Previously known as the Wee Diver Award)

The Award is to recognise exceptional contribution that advances the field of diving or hyperbaric medicine in any area including clinical, research, education, safety or technical/equipment by a HTNA Member. The HTNA is delighted to acknowledge the long term support of our old friend Bob Ramsay and have renamed this award in his honour.

The award takes the form of the affectionately named Wee Diver (possibly a comment on the fine figure of the man who conceived the award) and lists each recipient on its base. Each winner also receives a $100 book Dymocks voucher and a plaque to keep.

History (from Bob)

The recipient is selected by the HTNA executive and is presented at the conference dinner of the HTNA Annual Scientific Meeting.

The award was suspended in 2012 when the original corporate support was withdrawn.

In 2018 the HTNA revived the award under the new title, and the inaugural recipient was Derelle Young from Townsville. The criteria, nomination and selection process remains as before. The HTNA committee will make the decision from the nominations received from HTNA Members.

The new award will retain the previous recipients (2007-2019). Their contribution to the HTNA must endure – as was intended – despite the name change.

The Wee Man is wearing a Draeger DM 40 helmet circa 1915. It shows the rebreather configuration. Not much is known of how the set was dived, but it is well recorded in an old movie. In 1916, the Williamson brothers from the USA made an underwater movie of 20,000 Leagues under the Sea (https://www.youtube.com/watch?v=vPttwFF407A). They submerged a camera inside a tube with a glass viewing chamber at the base. This was deployed from a barge, and indeed was possibly the first truly underwater film. The scenes from the movie show several rebreather sets being used. It was not filmed on the surface, which is clear if you see the movie, and there were no bubbles.

Congratulations to all past and future recipients of the 'Wee Diver Award'

Bob Ramsay Bio

Prior to retirement Bob worked in Europe, Australia, NZ, Asia and Pacific in the diving and hyperbaric industry. Bob had been involved with diving and hyperbaric medicine for about 50 years. Bob started diving in 1966, then worked as a mixed gas diver in the North Sea. Both bounce diving to 180 msw and saturation diving in 75-120 msw range.

Moving to Australia (1978), Bob continued commercial diving, and also became a PADI OWSI.

Bob achieved several firsts in his career, among them the first ever diver to bring British oil direct into the UK (Argyll Field, 5 July 1974). A retail dive store / marine business Bob was involved with became the first ever PADI 5 Star Facility outside USA / Canada.

South Australia's first purpose built recompression chamber (1979) was designed and commissioned by Bob. This chamber supported commercial diving operations, and emergency diver therapy for the Royal Adelaide Hospital.

Refilling scuba tanks after a busy day's diving was an industry problem. The solution, a fully automatic computer controlled compressor to, set and forget. In 1980 was designed by Bob and was selling modified HP compressors with all these features, leading the World by several years.

In 1988 Bob moved to the RAH as a Hyperbaric Technician, ending his 20 plus year commercial diving career. Bo teamed with John Lippmann to start DAN in the Asian Region. Bob became a founding Board Member and served in that capacity for about 8 years.

Bob joined Hyperbaric Health in 2000 as Director of Operations and Hyperbaric Design. Hyperbaric Health went on to build the world's largest network of hyperbaric chambers. With this network, many divers' future health and lives were saved.

Since the first SA chamber, built in 1979, Bob's tally of systems is now well over 40. Special pride of place among these designs was the 1994 rectangular Royal Adelaide system. The RAH concept, while originating with Bob, involved the whole HMU and its overall design. Fink Engineering has taken that concept and improved it out of sight from that humble beginning, now accepted as a preferred option worldwide.

Bob consulted for the project with James Cameron and the "Deep Sea Challenger" project (2011-12). This submersible was designed to revisit Marianas Trench, the deepest part of the ocean. Bob consulted for the life support system and fire prevention measures for this project with the Cameron Team based in Sydney.

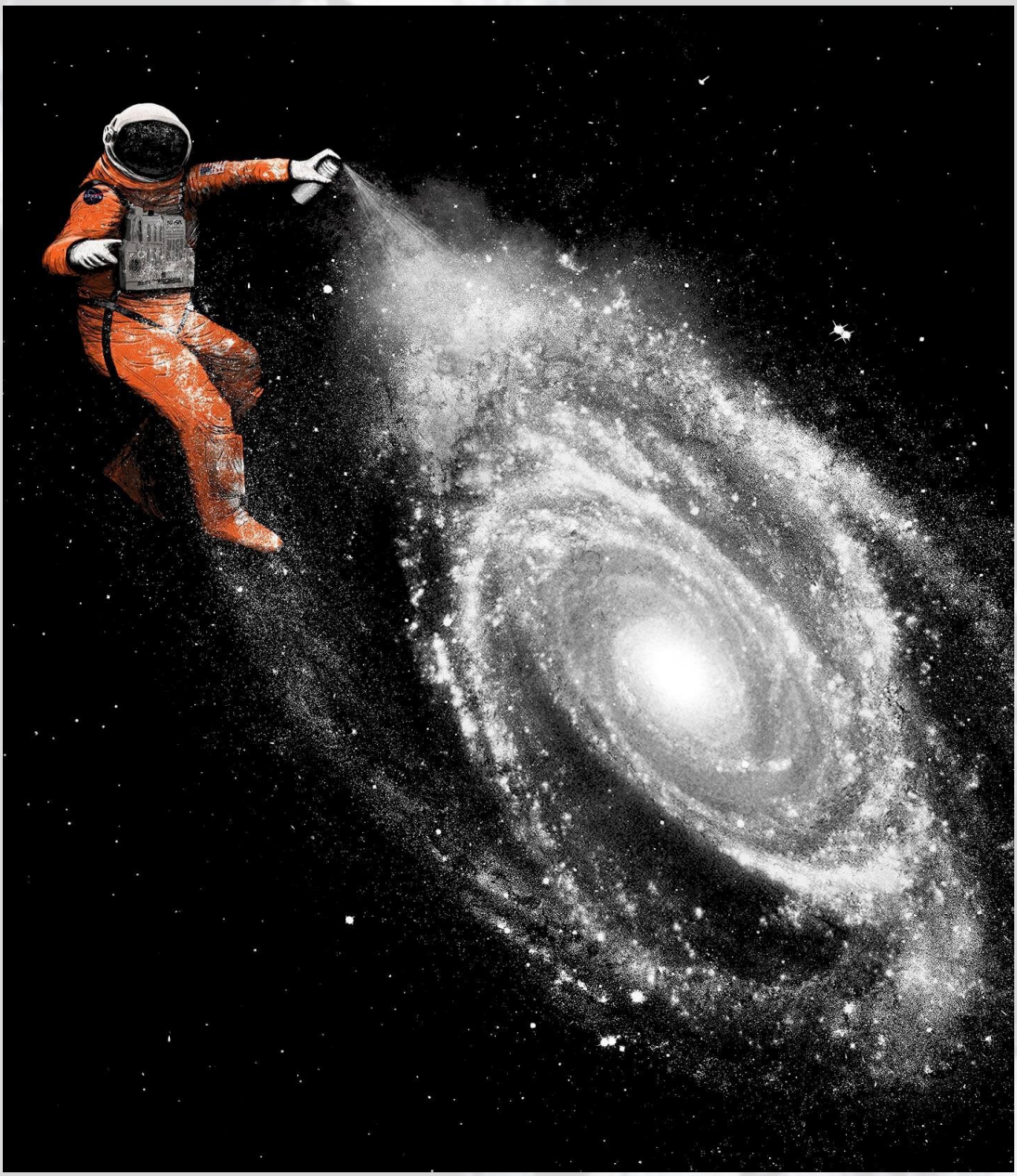
Bob has served on many honorary positions; and presented at over 50 International Scientific Meetings, and published over 60 papers and articles on HBO, chambers and diving history. Authored or contributing author of 9 published books, Bob is also a Founding Member of the Hyperbaric Technicians and Nurses Association (HTNA) and the Asian Hyperbaric and Diving Medical Association (AHDMA).

Recognition for work in diver safety. Bob has received awards from DAN, Australian Dive Travel Association. Inducted into the DEMA Hall of Fame in 2000, The HDS USA ER Cross Award for his research of diving history.

ABSTRACTS

Day 1

WEDNESDAY 7TH SEPTEMBER 2022



HTNA

Fink Engineering

27 Years of Rectangular Hyperbaric Chamber Innovation










THE PEGASUS ENVIROLAB – SPACE MEDICINE RESEARCH IN TASMANIA

A/Prof David Cooper

Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital, Tasmania

Humans have always been explorers. Our species has colonized all but the most inhospitable corners of our home planet and, since the advent of space travel, has extended this exploratory drive to the surface of other celestial bodies and the interplanetary vacuum of space. From our earliest ancestors migrating out of Africa to our current forays off-planet, the human drive to explore alien environments has resulted in our exposure to extremes of temperature, pressure, oxygenation, radiation, diurnal variation, isolation and a multitude of other environmental stressors that have tested our physiological and psychological adaptability to its very limits. Experience gained in the course of these endeavours has driven the development of diagnostic and therapeutic modalities for a wide range of medical conditions – from the therapeutic hypothermia used in cardiothoracic surgery to hyperbaric oxygen therapy for late radiation tissue injury. Many techniques developed as a consequence of our exploratory urge, such as cardiac telemetry, are now ubiquitous in mainstream medical practice.

The PEGASUS EnviroLab is the medical research division of the Department of Diving, Hyperbaric & Aerospace Medicine at the Royal Hobart Hospital in Tasmania, Australia. PEGASUS (the Physiology of Extreme Geographic, Aviation, Space & Under-Sea Environments Laboratory) is dedicated to furthering our understanding of the human physiological response to extreme environments, and translating the lessons learned at the edge of the human survivability envelope to mainstream medical practice.

Staffed by clinicians from a range of acute care disciplines, the PEGASUS EnviroLab is based in the newly refurbished department at the Royal Hobart Hospital, and now includes a state-of-the-art triple-lock, dual purpose hypo-/hyper-baric chamber which is unique in the Southern Hemisphere and one of only a small handful of comparable facilities worldwide. The chamber can operate across a range of pressures from 6 atmospheres absolute (equivalent to 50 metres below sea level) to 0.01 atmospheres absolute (equivalent to 100,000 feet altitude above mean sea level on Earth – or the surface pressure of Hellas Planitia on Mars) and provide a range of atmospheric gas mixtures. In addition to these primary capabilities, additional chamber-compatible resources are being developed to simulate microgravity (head-down bed-rest and limited neutral buoyancy capabilities) and provide a range of thermal and circadian environments in-chamber. PEGASUS is thus ideally positioned to expand our knowledge of human responses to extreme environmental challenges, and translate those gains into practical advances in the care of the broader population.

Presenters e-mail: david.cooper@ths.tas.gov.au

Duration: 40 minutes

Question Time: 10 minutes

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HADDENHAM

THE RIGHT STUFF

Dr Alicia Tucker

Department of Diving & Hyperbaric Medicine, Royal Hobart Hospital, Tasmania

Abstract:

Within the diving and hyperbaric industry, we are all familiar with how this extreme environment can affect us physically, physiologically and psychologically. These, and individual factors, we take in to account when we undertake 'Fitness to Dive' medicals. The spaceflight environment presents its own challenges to the human body. In this presentation, Dr Alicia Tucker will introduce you to the Challenges of Human Spaceflight and see if you possess 'The Right Stuff' and also share with you her own experience with the current European Space Agency Astronaut selection process.

Contact email: alicia.tucker@ths.tas.gov.au

Duration: 30 minutes

Question Time: 10 minutes

Wesley Hyperbaric

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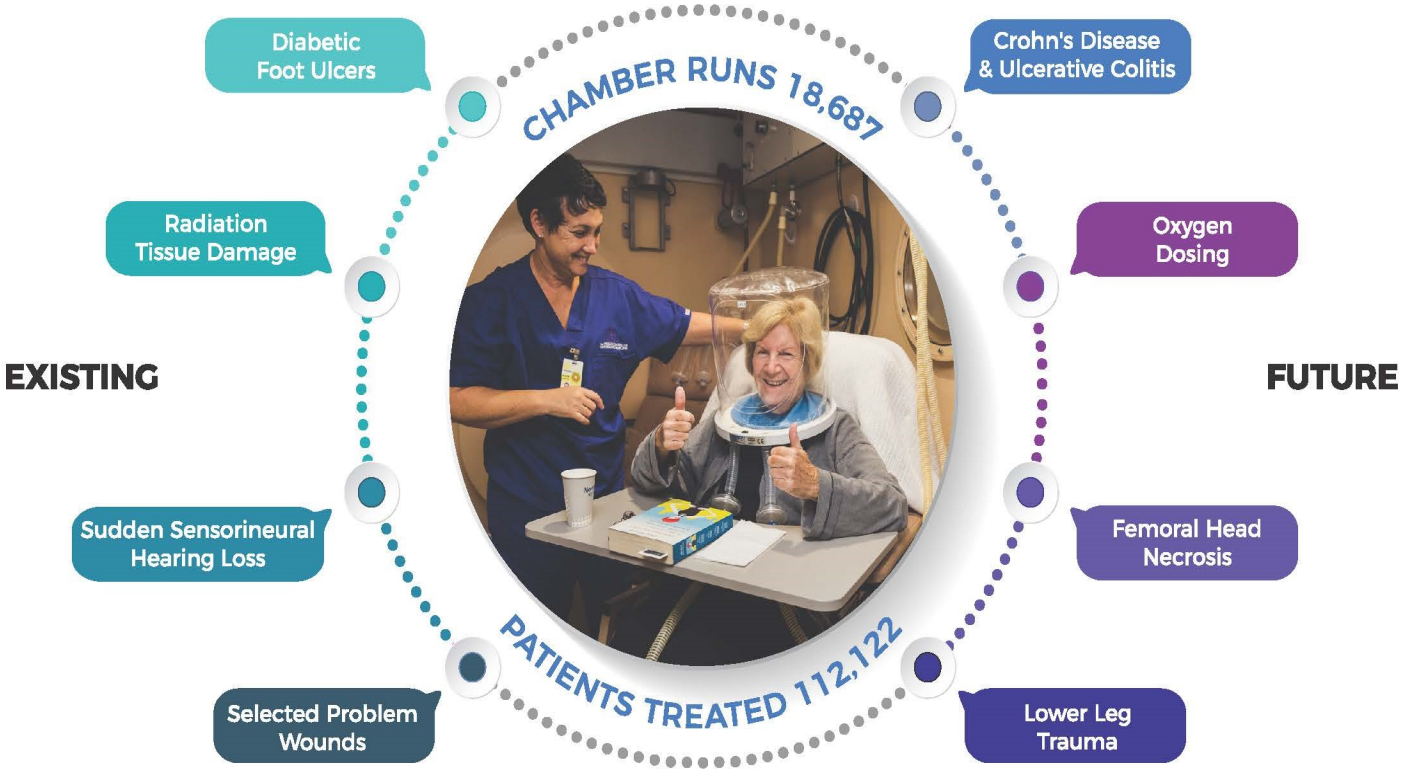

LOOKING FORWARD TO THE NEXT 22 YEARS OF QUALITY PATIENT CARE AND MEDICAL RESEARCH

HYPOBARIC SAFETY

Andrew Melnyczenko

Pre recorded presentation

Mayo Clinic Minnesota, USA

Abstract:

Topic to be confirmed

Contact email: melnyczenko.andrew@mayo.edu

Duration: 30 minutes

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A REFLECTION ON FOUR DECADES OF DIVING AND HYPERBARIC MEDICINE

Clinical Professor David Smart, AM

Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital, Tasmania

Introduction: The author has practiced emergency medicine, diving and hyperbaric medicine in Australia since the 1980's and had the privilege of pioneering two previously non-existent medical specialties. This presentation is an opportunity to reflect on achievements, compare past and present and to document successful career and life survival strategies including planning for and actioning retirement.

Authors brief resume: Tasmanian born, David has logged over 2500 hours underwater since scuba training in 1981. He graduated in Medicine nearly 4 decades ago and has always been active in Diving and Hyperbaric medicine since his intern year, helping to create a career path in the discipline. His career spans operation of all 4 hyperbaric chambers at the Royal Hobart Hospital (RHH). He completed his Dip DHM in 1987 and FACEM in emergency medicine in 1991. After time in SA and WA, he returned to Hobart, was Director of Emergency Medicine at RHH 1994 - 1998, Calvary health care emergency 1996-2014 as well as working in the "new" RHH hyperbaric facility. In 1998, he became Medical Co-director of Diving and Hyperbaric Medicine at RHH. In 2004 he was awarded fellowship with the International Federation of Emergency Medicine for services to emergency medicine. He completed his Medical Doctorate with UTAS in 2005 studying carbon monoxide poisoning. David has had numerous roles in diving medicine including medical consultant to various professional diving industry organizations; Chair of the ANZCA Exam Committee in Diving and Hyperbaric Medicine; including being a DHM examiner with ANZCA since 2003, Chair of the ANZHMG; SPUMS Education Officer and President; SPUMS Australian Standards representative for occupational diving. He also actively teaches at all of Australia's short courses in Diving and Hyperbaric Medicine. He has published over 150 peer reviewed papers and abstracts, and received multiple national and international awards, and contributed to the development of both emergency medicine and diving medicine in Australia and Fiji. In 2019 he was awarded Member of the Order of Australia (AM) for his services to diving and hyperbaric medicine and professional organizations. He has been particularly active in his work with occupational divers, contributing to health assessment and monitoring, standards, risk management and occupational diving research. His research interests include: hyperbaric facility and equipment safety, diving safety in occupational diving, investigation of diving deaths including hookah diving safety, inner ear barotrauma, HBOT for lower limb trauma and oxygen delivery systems. He absolutely detests useless bureaucracy that does not add value to healthcare outcomes.

Conclusion: Royal Hobart Hospital has the newest hyperbaric facility in Australia. Commissioned in 2019, the triple lock rectangular chamber is the only one in the southern hemisphere which also has altitude capability, opening up many opportunities for altitude, space and Antarctic research.

Contact email: dsmart@iinet.net.au

Duration: 30 minutes Question Time: 5 minutes

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INNOVATION IN A FUTURE OCEAN – A GLOBAL PERSPECTIVE ON MARINE SUSTAINABILITY ISSUES

Ms Joanna N Smart—Rolex Scholarship Recipient 2019

Introduction
It's no secret that our oceans are facing an unprecedented number of challenges. In the setting of climate change, human overpopulation, overfishing, pollution and exploitation, the preservation of marine natural values can feel like fighting an uphill battle. Whilst the future of the oceans may look bleak, innovation and technology are playing an important role in restoring ocean habitat and protecting the environment from anthropogenic pressures.

Aim
To present the author's experience as the 2019 Rolex and Our World Underwater Scholarship Society Australasian Scholar, investigating innovative solutions to restoring ocean habitat in the setting of challenges resulting from climate change and multiple anthropogenic pressures.

Methods and Results
The scholarship provided an opportunity to visit many countries and witness sustainable solutions to global anthropogenic pressures on the ocean. The presentation will demonstrate a selection of the observed technological innovations. From world-first underwater vegetable gardens in Italy, to seaweed farming in the remote Faroe Islands and the repurposing of oil rigs in California, individuals and companies all over the globe are striving to not only look after the marine environment, but also support ocean-dependent communities.

Conclusions
By exploring examples of the most cutting-edge ocean innovation, we learn that we can all be ocean advocates in our own way. Different perspectives, skill sets and experiences can combine to generate the most unique solutions to solving our ocean's problems. The future of the oceans could be brighter than we think.

Contact Email: joanna.smart96@gmail.com

Duration: 45 minutes

Question Time: 10 minutes

ABSTRACTS

DAY 2

THURSDAY 8TH SEPTEMBER 2022

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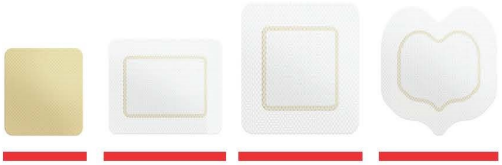

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References: 1. Münter KC, Meaume S, Augustin M, Senet P, Kérihuel J.C. The reality of routine practice: a pooled data analysis on chronic wounds treated with TLC-NOSF wound dressings. J Wound Care. 2017 Feb; 26 (Sup2): S4-S15. Erratum in: J Wound Care. 2017 Mar 2; 26(3): 153. I **2.** Edmonds M, Lázaro-Martínez JL, Alfayate-García JM, Martini J, Petit JM, Rayman G, Lobmann R, Uccioli L, Sauvadet A, Bohbot S, Kerihuel JC, Piaggesi A. Sucrose octasulfate dressing versus control dressing in patients with neuroischaemic diabetic foot ulcers (Explorer): an international, multicentre, double-blind, randomised, controlled trial. Lancet Diabetes Endocrinol. 2018 Mar;6(3):186-196.*

JUST A SPOON FULL OF SUGAR

Heather Morrison, RN

Department of Diving & Hyperbaric Medicine Unit, Royal Hobart Hospital, Tasmania

Abstract:

Studies have shown that all patients undergoing hyperbaric oxygen treatments (HBOT) experience a reduction in blood glucose levels compared to pre-hyperbaric oxygen treatment levels. This expected physiological reaction may result in a range of challenges for both the patients and hyperbaric facility, including hypoglycaemic events, increased risk of oxygen toxicity seizure as well as leading to potential treatment cancellations and schedule changes. Reduction in blood glucose levels is more pronounced in patients with diabetes.

Heather has been a hyperbaric nurse attendant at the Royal Hobart Hospital, for nearly 15 years. In 2020, Heather was unexpectedly diagnosed with Type 1, insulin dependent, diabetes mellitis as a rare complication of successful immunotherapy with Nivolumab for metastatic melanoma.

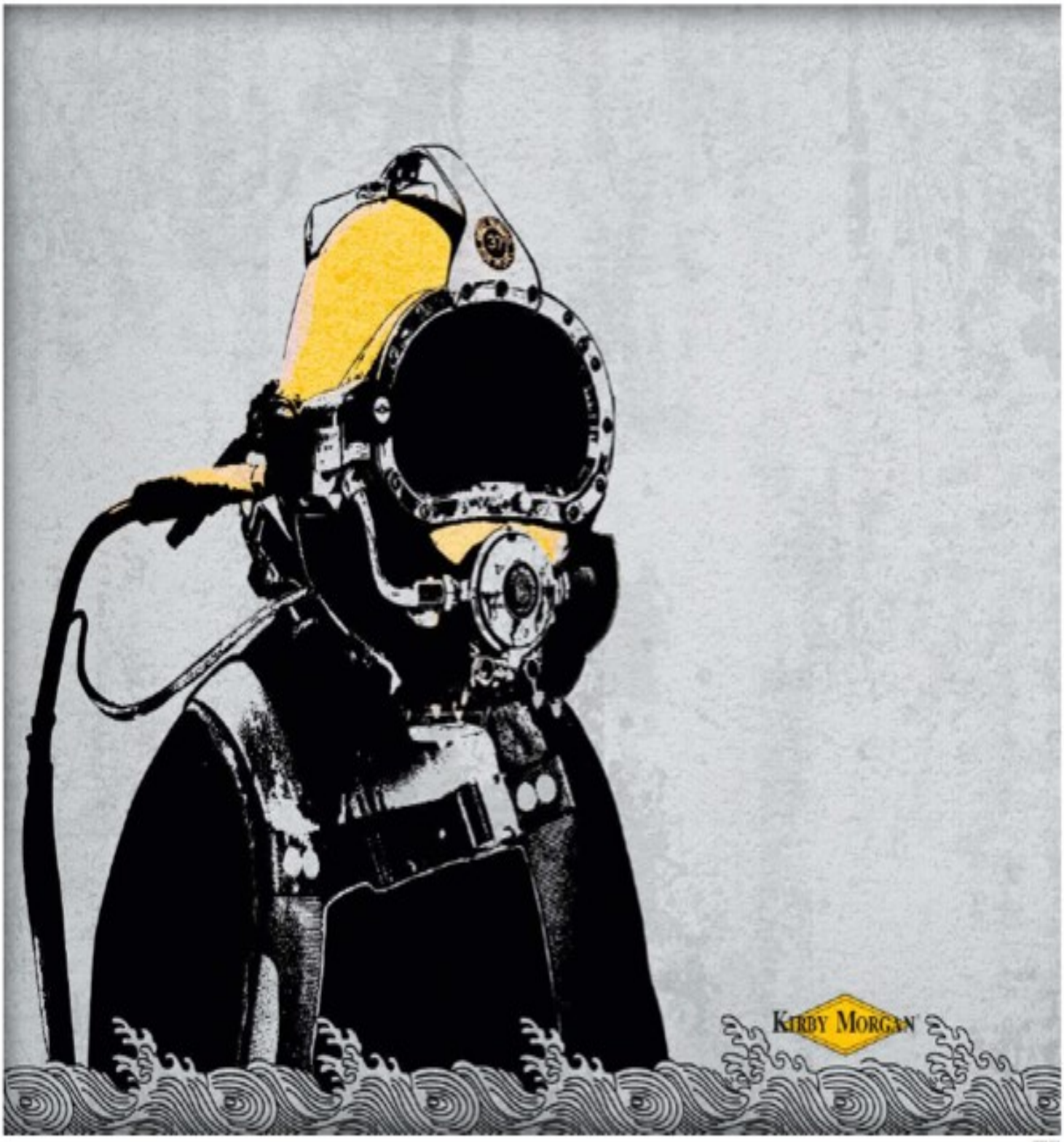
The Australian/New Zealand Standards for Occupational Diving Operations (AS/NZS 2299.1 2015) excludes occupational divers from medical clearance if they have diabetes requiring medication or insulin. The Australian/New Zealand Standards for Work in Compressed Air and Hyperbaric Oxygen Facilities (AS/NZS 4774.2 2019) dictate caution and individual assessments of attendants with a diagnosis of diabetes due to the known physiological effects of the hyperbaric environment.

During this session, Heather will share her unique story of the challenges of managing a new diagnosis of insulin dependent diabetes as a seasoned hyperbaric nurse attendant. Heather will also provide an overview of the medical management plan that has been evolved to allow her to return to normal duties, and her experience using a continuous glucose monitor within the chamber environment.

Contact email: heather.morrison@ths.tas.gov.au

Duration: 15 minutes

Question Time: 5 minutes



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LOW PRESSURE PORTABLE HYPERBARIC CHAMBERS: THE PANDORA'S BOX OF HYPERBARIC OXYGEN THERAPY

Mr Tom Workman, BS, MS, CAsP, CHT-Admin, FAsMA, FUHM

Director of Quality Assurance & Regulatory Affairs for the UHMS (retired)

Abstract:

On August 8, 2000, the US Food and Drug Administration (FDA) cleared the first of eight low-pressure, portable fabric hyperbaric oxygen therapy (HBOT) chambers. Since then, these types of hyperbaric chambers have become endemic.

Since September 2021, it has been discovered that there are hundreds, if not thousands, of low-pressure, portable fabric hyperbaric chambers that are being illegally exported to the US from at least seven countries. These chambers have not been cleared for use in the U.S. by the FDA and none meet hyperbaric-specific safety codes. There are at least 10 US companies who are known to be contributing to this illegal activity by distributing them.

In light of the above, who are the customers for these illegal, portable chambers? The manufacturers and U.S. distributors are targeting chiropractors, naturopathic doctors, functional medicine physicians, wellness centres, spas and lay people. Neither the facilities nor the manufacturers mention the fact that these low pressure chambers cannot achieve a therapeutic dose of oxygen for any of the recognised hyperbaric indications. This misleading omission may lead patients to believe that they are receiving a medical treatment when in fact, they are not.

It is important to note that the FDA specifically prohibits the use of oxygen cylinders or oxygen concentrators with these low-pressure, portable fabric hyperbaric chambers. Despite this, virtually every one of these chambers are being sold with oxygen concentrators. If this situation exists in the U.S., I am confident that the same might be the case in Australia.

Contact email:

Duration: 45 minutes

Question Time: 5 minutes


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DIVING DEATHS IN TASMANIA: A STATEWIDE APPROACH

Dr Elizabeth Elliott

Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital, Tasmania

Abstract:

Diving deaths in Tasmania are an uncommon event, however a recent escalation in cases prompted a review of the engagement of essential prehospital and hospital services.

Our aim was to provide an optimal outcome regarding the retrieval of diving gear and the deceased body to capture timely information that could impact on the post-mortem process.

A working group was derived voluntarily with the Coroner's Associate, marine and rescue police service, radio dispatch service, Tasmanian ambulance service, retrieval medical service, forensic pathology, and hyperbaric and diving medicine.

By defining the roles and responsibilities that each working group provides in the event of a diving related death, we have been able to develop and clarify specific policies and procedures for each group to ensure improved collection and preservation of information. The policies and procedures have been adapted to correspond to site specific resources outside of Hobart in the event that components of the diving related death has delayed delivery to the Royal Hobart Hospital.

A special thanks goes to Dr Chris Lawrence, Karl Price, Sergeant Bernard Peters and Officer Scott Williams for their time, enthusiasm, and expertise.

Presenters Email: drlizzie@gmail.com

Duration: 15 minutes

Question Time: 5 minutes


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POWH DEPARTMENT OF DIVING AND HYPERBARIC UNIT'S JOURNEY TRANSITIONING TO ELECTRONIC MEDICAL RECORDS.

Megan Perry, RN

Department of Diving and Hyperbaric Medicine, Prince of Wales Hospital, NSW

Abstract:

With the transition of NSW Health to electronic medical records (eMR), the Department of Diving and Hyperbaric Medicine at POWH decided to also start transitioning to eMR. What followed was a 4-year journey developing eMR systems/forms to meet the unique needs of the hyperbaric unit. The process included defining exactly what we needed from the new system, developing electronic versions of existing paper forms, several rounds of feedback and amendment of those new electric forms and finding suitable hyperbaric-compatible computer hardware for use inside the chamber, before going live with the new systems. The evaluation cycle of our on-line forms continues.

Contact email: Megan.Perry1@health.nsw.gov.au

Duration: 20 minutes

Question Time: 5 minutes

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LONG COVID: IS THERE A CASE FOR HBOT?

Dr Susannah Sherlock

Wesley Hyperbaric, Brisbane, Queensland

Abstract:

This is a review of current literature in long covid including definitions proposed mechanisms and potential therapies. It includes current research efforts utilising HBOT.

Contact email: Susannah.sherlock@health.qld.gov.au

Duration: 30 minutes

Question Time: 10 minutes

HYPERBARIC OXYGEN THERAPY FOR THE CRITICALLY ILL PATIENT IN THE MONOPLACE

Jenny Yuen and Theo Tsouras

The Alfred Health, Melbourne, Victoria, Australia

Introduction:

In 2021, the Alfred Hospital's hyperbaric multiplace chamber approached its twentieth year in service, necessitating an 8 week shutdown for major maintenance works. As the state service for Hyperbaric therapy, uninterrupted treatment capability for critically unwell patients was provided by technical modification of a monoplace chamber.

Objectives of Report:

Planning and implementing all engineered changes were led by our biomedical engineers and engaged members across our multidisciplinary team. New guidelines were developed with considerations for changes in equipment, patient assessment, workflow, and patient care.

Description of Subject:

Major outcomes covered installation and validation of equipment to Australian standards, including; medical power, medical gas, patient monitoring, suction, true ETCO2, pressure bag inflator, infusions via penetrators and invasive ventilation capability. Staff training initially focused on the use of each piece of equipment and was followed by walkthroughs using developed checklists. Simulation training was the next step, culminating in a multidisciplinary deteriorating patient scenario.

Statements and Conclusion:

All patients received successful treatment during the period of refurbishment, comprising four critically unwell patients over twelve treatments. We have since maintained monoplace capability for critical care treatments to support multiplace maintenance. Using the monoplace chamber to treat critically unwell patients remains a proven and safe way to continue to provide a state service for hyperbaric therapy during periods of multiplace chamber unavailability

Contact email: J.Yuen@alfred.org.au

T.Tsouras@alfred.org.au

Duration: 30 minutes

Question Time: 5 minutes

VENTRICULAR ASSIST DEVICE IN HYPERBARIC – A CASE REPORT

Adele Templeton and Theo Tsouras

Alfred Health, Melbourne, Victoria, Australia

Introduction:

Alfred Health Hyperbaric Service received a referral for a female patient with refractory haemorrhagic cystitis which was consistent with late radiation side effects. The patient also had inserted a Abbott Heartmate III Left Ventricular Assist Device (LVAD) which to date had not been tested under Hyperbaric conditions. Due to the patient's previous medical history, there were surgical options that had been exhausted, and frequent red blood cell transfusions, exploring the Heartmate III's compatibility for HBOT required serious investigation.

Objectives of Report:

Discuss and elaborate on the patient condition which lead to investigate the Heartmate III's hyperbaric compatibility. Plan, testing and implement the engineering alterations made by engineering team along with Abbott Cardiovascular - Heartmate III manufacturers. New workflows, guidelines were developed to accommodate the changes in patient monitoring and care.

Description of Subject:

The outcome of Heartmate III performance, fire safety and power supply under hyperbaric conditions with oversight form Abbott Cardiovascular. New workflows and emergency processes were developed due to the changes in patient and device care. Staff training was focused on a limited number of staff who are Intensive Care, VAD trained and competent staff.

Statements and Conclusions:

The patient received a course of 38 hyperbaric treatments and had minimal to no further bleeding and has returned home. There were no adverse events or noted performance concerns with the Heartmate III clinically or when data was analysed by Abbott Cardiovascular.

Contact email: A.Templeton@alfred.org.au

T.Tsouras@alfred.org.au

Duration: 30 minutes

Question Time: 5 minutes

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A PROSPECTIVE SINGLE-BLIND RANDOMISED CLINICAL TRIAL COMPARING TWO TREATMENT TABLES FOR THE INITIAL MANAGEMENT OF MILD DECOMPRESSION SICKNESS

Dr Ian Gawthrope

Dr Neil Banham

Department of Hyperbaric Medicine, Fiona Stanley Hospital

Introduction: Limited evidence suggests that shorter recompression schedules may be as efficacious as the US Navy Treatment Table 6 (USN TT6) for treatment of milder presentations of decompression sickness (DCS). This study aimed to determine if divers with mild DCS could be effectively treated with a shorter chamber treatment table.

Methods: All patients presenting to the Fremantle Hospital Hyperbaric Medicine Unit with suspected DCS were assessed for inclusion. Participants with mild DCS were randomly allocated to receive recompression in a monoplace chamber via either a modified USN TT6 (TT6m) or a shorter, custom treatment table (FH01). The primary outcome was the number of treatments required until resolution or no further improvement (plateau).

Results: Forty-one DCS cases were included, 21 TT6m and 20 FH01. Two patients allocated to FH01 were moved to TT6m mid-treatment due to failure to significantly improve (as per protocol), and two TT6m required extensions. The median total number of treatments till symptom resolution was 1 (IQR 1−1) for FH01 and 2 (IQR 1−2) for TT6m (P = 0.01). More patients in the FH01 arm (17/20, 85%) showed complete symptom resolution after the initial treatment, versus 8/21 (38%) for TT6m (P = 0.003). Both FH01 and TT6m had similar overall outcomes, with 19/20 and 20/21 respectively asymptomatic at the completion of their final treatment (P = 0.97). In all cases where two-week follow-up contact was made, (n = 14 FH01 and n = 12 TT6m), patients reported maintaining full symptom resolution.

Conclusions: The median total number of treatments till symptom resolution was meaningfully fewer with FH01 and the shorter treatment more frequently resulted in complete symptom resolution after the initial treatment. There were similar patient outcomes at treatment completion, and at follow-up. We conclude that FH01 appears superior to TT6m for the treatment of mild decompression sickness.

Contact email: ian.gawthrope@health.wa.gov.au

neil.banham@health.wa.gov.au

Duration: 30 minutes

Question Time: 5 minutes

DIVING AND HYPERBARIC MEDICINE – PAST, PRESENT AND FUTURE

Prof. Michael Bennett, AM

DDHM, POWH, Randwick, NSW

Abstract:

And now, the end is near, and I must face the final curtain….

Much has changed since 1985 when I first compressed a patient in Peterborough, Cambridgeshire for a necrotising infection. All seemed to go well at the time. When I returned to Australia from the UK in 1990 to work on the Retrieval Service at Prince Henry Hospital (PHH) in Sydney I came in touch with another DHM facility. We brought a lot of divers, carbon monoxide poisonings and necrotising infections home to give them access to HBOT – and I was drawn to the fascinating physiology and physics of it all.

When I got a job as an anaesthetist at PHH in 1992, I asked for some clinical time in the HBU and a career was born. We were not busy in those days working under the steely gaze of our NUM, Sue Sheeran. Three or four patients in the morning, education sessions around the hospital towards lunch, and a game of golf or a session down the beach for some well-earned rest. A lot of my professional time has been spent persuading my colleagues in other branches of medicine that HBO was not all wishful thinking, and the rest arguing with my hyperbaric colleagues that a lot of it was. I hope I persuaded at least one person that an important truth lay in being as sceptical as possible of wild claims and to follow the evidence wherever it led.

Today I am going to tell you a story, based on where I have been, that may help us all prepare for where we will be tomorrow.

Contact email: m.bennett@unsw.edu.au

Duration: 15 minutes

Question Time: 5 minutes

A NEW HYPERBARIC NURSING MODEL

Derelle Young, Nurse Manager

Hyperbaric Medicine Unit, Townsville University Hospital, Queensland.

Abstract:

In Mid 2018 the Townsville Hyperbaric Medicine Unit went from a 7 to a 5 day Service. With no staff rostered to the weekend, we would have 3-4 nurses per shift.

In 2019 the HOPON multicentre trial by Shaw et al was published and we noted a substantial decrease in hyperbaric medicine referrals for ORN. For 6 months we often required only 1 chamber run for elective patients. Taking pre-emptive action, we considered our skillset and developed a concept brief for a nurse led outpatient wound management clinic where we would be working closely with the clinical nurse Consultant (CNC) for wound management. After going through the steps of stakeholder engagement, our concept brief was submitted and approved. In August 2020 we started our clinic on a trial basis for 3, then 6 months. Our clinic has now been running 3 days a week for 2 years.

The greatest challenge has been balancing the workload of the hyperbaric unit and the wound clinic. The skillset for the nurses has expanded due to managing a greater variety and complexity of wounds and working more closely with the specialists, wound CNC, podiatrist, and allied health. Many of our patients fall into a gap in wound care provision and we have improved the health outcomes for many patients. The new nursing model which combines hyperbaric Nursing with wound management has proved to be a cost effective concept which utilises the space, time and skills of the staff whilst bringing in an additional income stream.

Contact email: derelle.young@health.qld.gov.au

Duration: 15 minutes

Question Time: 10 minutes

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1. Bowler PG, et al. Parsons, Wound Medicine 14 (2016) 6–11. 2. Metcalf DG et al. J. Wound Care 2016; Vol25, No3. 3. Metcalf DG, et al. Int Wound J 2017; 14: 203-213. 4. Malone M et al. 2017. JWC; 20-25.

* When compared to AQUACEL® Ag Extra™ dressing and other silver-only competitor dressings: ACTICOAT™ 7 and SILVERCEL™ Non-Adherent dressings.

ANAESTHESIA IN THE DARK

Dr Richard Harris, SC AOM—Keynote Speaker

Abstract:

In 2018 Richard Harris was requested by the Australian government to attend the proposed rescue of 12 young boys and their soccer coach from a flooded cave in northern Thailand. As an anaesthetist with experience in cave diving and remote area medicine, as well as experience in volunteer cave rescue, 'Harry' finally agreed to the use of an unprecedented and very high risk general anaesthetic technique to assist with the boys' extrication. Although the story is now widely known, this presentation will reveal many details of the diving and medical operation.

Contact email: drharry@me.com

Duration: 40 minutes

Question Time: 10 minutes

ABSTRACTS

DAY 3

FRIDAY 9TH SEPTEMBER 2022

DAVEY JONES' LOCKER: UNCOVERING DIVING DEATHS

Dr Juan Carlos Ascencio-Lane

Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital, Tasmania

Abstract:

The study group undertook a twenty year analysis of diving deaths in Tasmania. Through this study, a new format was proposed to analyse diving deaths. This uncovered numerous issues with the dives, even though at times a single caused had been named.

The idea of delving into Davey Jones locker was to find common issues for diving in Tasmania; undertake research to improve diving and its safety within Tasmania and to utilise this analysis not only for deaths but for any accidents that occur in diving.

With thanks to Prof David Smart and Dr John Lippmann

Contact email: juan.ascencio-lane@ths.tas.gov.au

Duration: 35 minutes

Question Time: 5 minutes

TECHNICAL ASSESSMENT OF HOOKAH SURFACE SUPPLY DIVING EQUIPMENT DURING DIVING FATALITY INVESTIGATION

Dr Darren Meehan

Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital, Tasmania

Abstract:

Hookah is a very specific type of surface supply breathing apparatus with some unique risks not associated with scuba or rebreather equipment. It uses multiple technical components that provides compressed air delivery to divers underwater from a remote source. An analysis of technical reports related to hookah diving deaths that occurred in Tasmanian waters between 1995 and 2019 was conducted by the study group with the aim to develop a standard process for methodical evaluation of the hookah apparatus and to guide future best practice.

With thanks to Prof David Smart & Dr John Lippmann

Contact email: darrenjmeehan@gmail.com

Duration: 20 minutes

Question Time: 5 minutes

The Australasian Diving Safety Foundation

The *Australasian Diving Safety Foundation* (ADSF) is an Australian-based Health Promotion Charity. The main object of the Foundation is to "promote the prevention and control of diving-related diseases and illnesses in human beings, including but not limited to decompression illness."

The ADSF supports its objects predominantly by undertaking research, providing education on diving safety, *and offering grants for relevant research and diving safety promotions.*

Funds have been allocated to support up to AUD$150,000 per year for appropriate research projects. In addition, the ADSF offers grants of up to AUD$20,000 to fund safety-related projects within the diving industry. Full details of these grants, as well as applications are available at http://adsf.org.au.

MAINTIANING HYPERBARIC CHAMBER OPERATOR CURRENCY IN THE REPUBLIC OF SINGAPORE NAVY (RSN)

KK Soh, ES Ng, ML Loo, JMW Kwek, DAVID Law

Republic of Singapore Navy

Introduction:

The Republic of Singapore Navy (RSN) doctors and nurses started providing recompression treatment for local fishermen divers who suffered "bends" as well as provided medical support to the fledging Naval Diving Unit in the 1960s. Over the past six decades, the Navy Medical Service (NMS) developed deep expertise in Diving and Hyperbaric medicine and has become a vital national resource supporting compressed workers, divers and submarine rescue round the clock.

Objectives of the report:

The objectives are to share: (1) how RSN hyperbaric chamber operators maintained currency and the (2) perennial challenges faced to fulfil these requirements.

Description of the report:

The RSN nurses and paramedics are trained, to operate the hyperbaric chambers. After completion of the Hyperbaric Medical Technician Course and on-the-job training they are expected to undergo refresher training every three months.

The challenges faced by operators are as follows: (1) Requirement to maintain currency for five different chamber systems, (2) Limited availability of training platforms, (3) Need to juggle between primary job scope and operational requirement and (4) Training the trainers.

Substantiation of opinions or statements:

While some challenges are commonly faced by hyperbaric treatment facilities others are unique to the RSN. To meet the operational demands of the Navy and Singapore, RSN chamber operators continue to explore different solutions to overcome resource limitations.

Conclusion:

While it has been challenging for the RSN hyperbaric chamber operators to maintain the rigorous currency requirements, innovation solutions are potential enablers to overcome these challenges.

Duration: 15 minutes

Question Time: 5 minutes

IMMERSION PULMONARY OEDEMA IN SURFACE SWIMMERS

CMDR Douglas Falconer, RAN

SMA DiveMed, SUMU

HMAS Penguin

Introduction:

The Royal Australian Navy utilises surface swimming for its diver training and assessment.

Since 2016 there have been over 12 cases of swimmers immersion pulmonary oedema (IPO) during different surface swimming trials. A review of the predisposing factors that may lead to swimmers immersion pulmonary oedema was undertaken in an attempt to reduce the risk to divers conducting the activity.

Objectives:

To review the pathophysiology and potential risk factors for swimmers IPO.

A comprehensive medical exam including a full cardiac workup was also completed as part of the case study review.

The review was designed to highlight any predisposing factors that may contribute to a diver suffering from IPO and to see if there was a correlation between IPO induced by surface swimming and IPO caused by scuba diving. If there was to be a correlation, then a fitness to dive assessment would have to be undertaken.

Conclusion:

The risk factors for Swimmers Immersion Pulmonary Oedema was identified and was differentiated from Scuba Divers Immersion Pulmonary Oedema. As such it was deemed that a diver who had sustained Swimmers IPO was still considered fit to dive.

Contact email: douglas.falconer@gmail.com

Duration: 15 minutes

Question Time: 5 minutes

DEFENCE DIVING SAFETY AUTHORITY

LCDR David Hughes, RAN

NDSA, HMAS Waterhen

Introduction:

This presentation will be delivered in the context of general information and oversight and not as a substantial report.

Objective:

The presentation will outline the evolution of the structure, management and oversight of diving safety in the Australian Defence Force from DIVESAFE through to the Defence Diving Safety Authority. This will include the reasons on why the decision was made to establish a single diving safety authority within Defence; including a brief summary on the outcomes of the death of a Royal New Zealand Navy diving trainee in 2019 as this incident was the genesis for change with the Australian Defence Force.

Contact email: david.hughes3@defence.gov.au

Duration: 20 minutes

Question Time: 5 minutes

HYPERCAPNIA IN 100% OXYGEN REBREATHER DIVING

CMDR Douglas Falconer, RAN & POMED Kiah Chapple

HMAS Penguin

Introduction: The Royal Australian Navy Clearance Divers utilise a 100 % Oxygen rebreather system. This system is used for a number of differing military operations and objectives. The oxygen rebreather is rarely used outside of the military environment.

Whist a very effective and efficient system the rebreather has encountered multiple incidents of divers becoming hypercapnic whilst diving the rebreather. These divers suffered a range of signs and symptoms up to and including a loss of consciousness. As such SUMU undertook an investigation into the possible causes to explain these events and provide a diagnosis.

Objectives: The Submarine and Underwater Medicine Unit (SUMU) reviewed the potential causes for a loss of consciousness in the oxygen rebreather diver. These potential causes included system failures, exertional rates, mission profiles and the divers themselves.

Following the most recent cause of a loss of consciousness in a diver undertaking an open water rebreather dive, the diving profile was recreated in a swimming pool to measure the levels of expired CO_2 using an end tidal CO_2 monitor and oxygen saturations pre, during and at the end of the dive.

The aim was to use the $ETCO_2$ as a surrogate marker of $PaCO_2$ and compare these results to a cohort of divers who undertook similar testing.

Conclusion: The results of the testing showed abnormally high levels of $ETCO_2$ when compared to the cohort and as such provided a likely diagnosis for the loss of consciousness was hypercapnia

Contact email: douglas.falconer@gmail.com

Duration: 30 minutes

Question Time: 5 minutes

HYDROGEN IN DEEP BOUNCE DIVING: ARE WE READY FOR THE NEXT STEP?

Dr Richard Harris, SC OAM—Keynote Speaker

Abstract:

Recreational technical divers continually push the envelope in the name of exploration. It has become almost routine for explorers utilising mixed gas rebreathers to dive beyond 150m depth, and even dives beyond 200m are no longer considered to be the domain of the lunatic fringe! But as free swimming bounce dives proceed deeper, physiology, physics and technology conspire to gradually reduce the margin of safety. A particular concern is the effect of gas density on the ability to perform work and maintain normal ventilation at depth. The need for a less dense gas leaves only one contender on the periodic table; hydrogen.

This talk will discuss the issues surrounding hydrogen as a breathing gas, with an emphasis on recreational deep bounce diving.

Contact email: drharry@me.com

Duration: 40 minutes

Question Time: 10 minutes

LAST BREATH

Mr Chris Lemons - Keynote Speaker

Abstract:

Chris has been a commercial diver for over 14 years, and currently specialises in deep sea Saturation diving, operating almost exclusively in the Oil and Gas Industry. This highly specialised form of diving involves living in the claustrophobic confines of a decompression chamber for up to 28 days at a time, commuting daily to the sea bed in a diving bell, and working at depths of up to 900 feet for 6 hours at a time. In September of 2012, a freak failure of the dynamic positioning system of the vessel he was working under, resulted in the umbilical which provides him with breathing gas, light and heat being severed completely. He was left on the seabed, in complete darkness 300 feet below the surface, with only the 5 minutes of breathing gas he carried in the emergency tanks on his back, and no way to protect himself from the freezing temperatures.

Chris was resigned to ending his days alone in the dark water knowing every breath was potentially his last. It took his heroic rescuers over 40 minutes to come back and fetch him, and his miraculous survival story has baffled experts ever since.

His extraordinary story was subsequently immortalised in the hit Netflix/BBC documentary Last Breath, whilst Chris continues to dive to this day.

Contact email:

Duration: 1 hour 10 minutes

Question Time: 30 minutes

Australian and New Zealand Hyperbaric Treatment Data, 1 July 2020 - 30 June 2021

Diagnosis	Sub Category	Royal Adelaide Hospital	The Alfred Hospital	Royal Hobart Hospital	Prince of Wales Hospital	Royal Brisbane & Women's Hospital	Wesley Centre for Hyperbaric Medicine	The Townsville Hospital	Royal Darwin Hospital	Naval Hospital Auckland	Fiona Stanley Hospital	Christchurch Hospital
Permanent Staff (FTE)	Doctors (FTE)	1.6	1.93	1.61	4.3	1.25	1	0.75	0	1	1.3	1
	Doctors (Actual)	0	5	6	8	3	3	0.75	0	1	0	4
	Registrar/Resident (FTE)	0	1	2	1	1	NIL	1	0	0	2	0
	Reg/ Res (Actual)	0	1	3	1	1	NIL	1	0	0	0	0
	Nurses (FTE)	3	3.71	2.58	5.25	6	3.5	3.7	1	2.6	3.5	2.43
	Nurses (Actual)	3	12	3	4.5	3.5	14	3.7	1	2.6	3	4
	Chamber Supervisors (FTE)	3	3	3.3	2.3	2	1.2	0	0	2	0	1.9
	Chamber Supervisors (Actual)	3	3	3	3	1	2	2.5	0	2	0	3
	Other Technical staff (FTE)	0	0	0	0	0	NIL	0	1	0	3	0
	Other Technical staff (Actual)	0	0	0	0	0	3	0	1	0	0	0
	Secretary/Reception staff (FTE)	1	1	0.5	1	1	1.8	1	0	1	1	0
	Other (FTE)	0	0	1	0	1	NIL	0.6	0	0	0	0
Casual Staff	Doctors	5	0	2	0	4	5	4	9	3	2	1
	Nurses	17	18	22	11	0	12	18	14	5	15	0
	Technicians	2	1	2	2	4	3	0	0	5	4	0
	Other	0	0	1	0	0	0	0	0	0	0	3
Number of own staff trained (last 12 months)	Doctors	0	2	3	2	1	1	2	0	0	4	0
	Nurses	0	1	5	0	6	1	4	10	0	0	0
	Technicians	0	0	0	0	1	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0
Number of Outside staff trained (last 12 months)	Doctors	0	0	0	0	0	0	0	0	0	11	0
	Nurses	0	0	0	0	0	0	0	0	0	0	0
	Technicians	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0
Staff Incidents	DCI	0	0	0	0	0	NIL	0	0	0	0	0
	Barotrauma-Ear-Grade 0-1	0	0	3	0	0	2	1	0	0	1	0
	Grade 2-3	0	1	1	0	0	NIL	0	0	0	0	0
	Grade 4-5	0	0	0	0	0	NIL	0	0	0	0	0
	Sinus	0	0	0	0	0	NIL	0	0	0	0	0
	Dental	0	0	0	0	0	NIL	0	0	0	0	0
	Other	0	0	1	0	0	NIL	0	0	2	0	0
	Total Staff Incidents	0	1	5	0	0	2	1	0	2	1	0
Patient Incidents (Side Effects)	Barotrauma-Ear Grade 0-1	31	22	28	3	18	3	9	1	2	23	1
	Grade 2-3	6	NR	8	4	14	5	9	0	2	12	5
	Grade 4-5	1	NR	0	0	2	NIL	0	0	0	0	5
	Sinus	0	0	1	2	0	1	0	0	0	1	0
	Lung	0	0	0	0	0	NIL	0	0	0	0	0
	Dental	0	0	0	0	0	NIL	0	0	0	0	0
	GIT	0	0	0	0	0	NIL	0	0	0	0	0
	Acute Claustrophobia	2	0	0	3	3	NIL	1	0	0	3	0
	Pulmonary Oxygen Toxicity (POT)	0	0	2	0	0	NIL	0	0	0	0	0
	CNS Oxygen Toxity	0	0	0	0	0	0	0	3	0	0	0
	CNS Seizure 0-10m	0	0	0	0	0	0	0	0	0	0	0
	10-15m	0	0	0	0	0	1	0	0	0	0	0
	15-20m	0	0	0	0	0	0	0	0	0	0	0
	Non-seizure 0-10m	0	0	0	0	0	0	0	0	0	0	0
	10-15m	0	0	0	0	2	0	0	0	0	0	0
	15-20m	0	0	0	0	0	0	0	0	0	0	0
	Eye Sight Changes	11	NR	5	0	29	26	NR	0	0	44	6
	Abort Treatment (other than POT)	0	28	0	0	2	4	9	1	15	9	6
	Hypoglycaemia event	0	9	0	0	2	1	1	1	0	1	0
	Other	3	52	0	6	4	0	0	1	1	3	0
	Total Pt Incidents	54	111	44	18	76	15	29	7	20	96	23

Australian and New Zealand Hyperbaric Treatment Data, 1 July 2020 - 30 June 2021

Diagnosis	Sub Category	Royal Adelaide Hospital	The Alfred Hospital	Royal Hobart Hospital	Prince of Wales Hospital	Royal Brisbane & Women's Hospital	Wesley Centre for Hyperbaric Medicine	The Townsville Hospital	Royal Darwin Hospital	Naval Hospital Auckland	Fiona Stanley Hospital	Christchurch Hospital
Bubble Injury	DCI	3	6	25	11	8	1	10	3	7	20	7
	AGE - Diving	0	2	1	0	0	NIL	0	0	0	3	0
	- Iatrogenic	0	8	0	0	0	NIL	0	0	0	2	0
	Other	0	0	0	0	0	0	0	0	0	0	0
	Total	3	16	26	11	8	1	10	3	7	25	7
Acute Ischaemic Conditions	Compromised Flaps & Grafts	0	1	4	0	3	1	7	0	1	5	0
	Crush Injury	0	0	0	0	0	NIL	0	0	0	0	0
	Compartment Syndromes	0	0	0	0	0	NIL	0	0	0	0	0
	Reperfusion Injuries	0	2	0	0	2	NIL	0	0	0	0	0
	Other	0	0	0	3	5	0	1	0	1	17	0
Infective Conditions	Clostridial Myonecrosis	0	0	0	0	0	NIL	0	0	0	0	0
	Necrotizing Fasciitis	0	19	0	4	0	NIL	3	1	0	14	0
	Fungal	0	0	0	1	0	NIL	0	0	0	3	0
	Malignant Otitis Externa	0	0	0	1	0	NIL	0	0	0	0	0
	Refractory Osteomyelitis	0	1	1	1	1	NL	4	0	0	3	1
	Intracranial Abscess	0	0	0	0	0	NIL	0	0	0	0	0
	Other	0	2	0	1	0	0	0	0	0	1	0
Radiation Tissue Damage	Osteoradionecrosis - Established	13	6	5	11	4	NIL	2	0	2	10	0
	- Prophylactic	29	4	8	19	4	4	2	0	10	12	1
	Soft Tis. Rad'necrosis - Established	19	0	16	109	37	NIL	8	0	3	21	18
	- Prophylactic	3	0	0	0	1	NIL	0	0	1	0	0
	Soft Tissue (Wound in irradiated field)	1	2	0	6	0	9	0	4	1	0	0
	Xerostomia	0	0	0	0	4	NIL	2	0	0	0	0
	Radiation Cystitis	12	23	0	65	25	16	9	1	16	60	10
	Radiation Proctiis	2	4	0	13	12	8	8	0	1	3	8
	Other Radiation Damage	0	0	0	0	0	NIL	0	0	0	0	0
Problem Wounds	Diabetic Ulcers	5	5	13	7	11	2	8	6	1	18	1
	Venous Ulcers	0	0	4	0	2	NIL	0	0	0	0	0
	Vascular Ulcers	2	6	4	0	0	5	10	0	3	0	1
	Decubitus Ulcers	0	0	2	0	0	NIL	0	0	0	0	0
	Frostbite	0	0	1	0	0	NIL	0	0	0	0	0
	Surgical Wounds	2	0	0	2	0	NIL	4	0	1	0	1
	Spider Bite	0	0	0	0	0	NIL	0	0	0	0	0
	Calciphylaxis	3	1	0	0	0	NIL	1	0	0	1	0
	Crohns	0	1	3	9	0	NIL	0	0	0	1	0
	Other	2	1	1	10	0	6	0	0	14	20	4
Gas Poisoning	Carbon Monoxide	0	NR	30	0	2	NIL	1	0	2	3	1
	Other	0	0	0	0	0	NIL	0	0	0	0	0
Ocular Conditions	Retinal Arterial Occlusion	0	1	4	2	2	2	3	0	0	4	8
	Vein Occlusion	0	0	0	0	0	NIL	0	0	0	0	0
	Other	0	0	1	9	1	NIL	1	0	0	0	0
Miscellaneous	Thermal Burns	0	1	0	0	0	NIL	0	0	0	0	0
	Except'nal Blood Loss Anaemia	0	0	0	0	0	NIL	0	0	0	0	0
	↑ Radiosensitivity of Tumours	0	0	0	0	0	NIL	0	0	0	0	0
	Sham / Isobaric e.g. HORTIS	0	0	0	0	0	NIL	0	0	0	0	0
	Sudden Sensorineural Hearing Loss	6	15	5	15	63	13	29	0	0	23	0
	Other	3	2	2	1	0	NIL	0	0	0	5	0
Ventilated Patients	Ventilated Patients	0	23	0	4	0	NIL	3	0	0	2	1
	Ventilated Pt Treatments	0	80	0	6	0	NIL	18	0	0	5	1
Paediatric Patients	0 up to 8 years old	0	1	3	0	0	NIL	0	0	0	0	0
	8 up to 16 years old	0	3	2	1	1	NIL	0	0	0	0	0
'Deep' Treatments	> 3 ATA e.g. Comex 30	0	1	0	0	0	NIL	0	0	0	0	0
Number of Patients Treated	Elective	NR	NR	0	136	51	47	59	13	57	146	27
	Acute	NR	NR	0	44	70	15	37	NR	NR	5	NR
	Emergency	NR	NR	0	36	25	3	17	3	9	47	16
	Total	91	104	130	216	**146**	65	113	16	66	198	43
Number of Patient Treatments	Elective	NR	NR	1606	NA	2054	1550	NR	198	1453	3593	856
	Acute	NR	NR	0	NA	530	208	NR	13	NR	20	NR
	Emergency	NR	NR	44	NA	70	3	39	3	65	183	54
	Total	2270	1655	1645	4706	2634	1761	2338	214	1518	3796	910
Number of Chamber Compressions	Multiplace	721	297	494	781	752	1761	572	154	507	543	456
	Monoplace	0	779	366	1546	0	NIL	0	0	0	1080	0
	Sham/Isobaric Treatments	0	0	0	0	0	NIL	0	0	0	0	0
	Total	721	1076	860	2327	752	1761	572	154	507	1623	456

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Permanent Staff (FTE)	Doctors (FTE)	0.6	2.1	1.61	4.3	2	0.6	0.75	0	1	1.3	1
	Doctors (Actual)	1	6	6	8	5	1	0.75	6	1	4	4
	Registrar/Resident (FTE)	0	1	2	1	1	0	1	0	0	2	0
	Reg/ Res (Actual)	0	1	3	1	1	0	1	0	0	0	0
	Nurses (FTE)	3.06	5.34	2.58	5.25	5	1.6	3.87	0	2.6	3.3	2.43
	Nurses (Actual)	3	0	3	4.5	8	2	3.6	0	1.8	2.8	4
	Chamber Supervisors (FTE)	3	1	3.3	2.35	1	1.2	2.5	1	2	4	1.9
	Chamber Supervisors (Actual)	2	1	4	3	5	2	2.5	1	2	3.2	3
	Other Technical staff (FTE)	3	3	0	0	0	0	0	0	0	0	0.3
	Other Technical staff (Actual)	2	3	0	0	1	0	0	0	0	0	0
	Secretary/Reception staff (FTE)	0	1	0.5	1	1	1	1	0	1	1	0
	Other (FTE)	0	1.1	0	0	1	0	0	0	0	0	0.25
Casual Staff	Doctors	5	0	2	1	0	4	3	0	3	2	1
	Nurses	0	15	22	9	4	12	19	10.8	3	12	0
	Technicians	5	0	1	3	3	3	0	2	5	3	0
	Other	17	1	0	0	0	2	0	0	4	0	2
Number of own staff trained (last 12 months)	Doctors	1	0	?	0	0	0	0	0	0	4	0
	Nurses	0	7	7	0	2	0	5	7	2	0	0
	Technicians	0	0	1	0	1	0	0	0	0	0	1
	Other	0	0	0	0	0	0	0	0	1	0	1
Number of Outside staff trained (last 12 months)	Doctors	0	4	0	2	0	2	0	0	0	20	0
	Nurses	0	0	0	3	1	1	0	0	0	0	0
	Technicians	0	1	0	3	0	1	0	0	0	0	0
	Other	0	0	0	0	0	3	0	0	0	0	0
Staff Incidents	DCI	0	0	1	0	0	0	0	0	0	0	0
	Barotrauma-Ear-Grade 0-1	0	0	1	0	1	0	3	0	0	0	0
	Grade 2-3	0	0	0	0	1	0	0	0	0	0	1
	Grade 4-5	0	0	0	0	0	0	0	0	0	0	0
	Sinus	0	0	0	0	0	0	0	0	0	0	0
	Dental	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	1	0	0	0	0	0	5	0	0
	Total Staff Incidents	0	0	1	0	2	0	3	0	5	0	1
Patient Incidents (Side Effects)	Barotrauma-Ear Grade	22	24	24	12	0	4	8	3	6	25	0
	Grade 2-3	11	1	16	0	25	7	4	0	10	9	4
	Grade 4-5	1	0	0	0	0	0	0	0	0	1	0
	Sinus	1	0	1	1	1	1	1	0	1	1	0
	Lung	0	0	0	0	0	0	0	0	0	0	0
	Dental	0	0	0	1	0	0	0	0	0	0	0
	GIT	0	0	0	0	0	0	0	0	0	0	0
	Acute Claustrophobia	5	1	3	0	0	0	3	0	0	8	0
	Pulmonary Oxygen Toxicity (POT	0	0	0	0	4	0	0	0	0	0	0
	CNS Oxygen Toxity	0	3	4	0	8	0	0	0	0	1	0
	CNS Seizure 0-1	0	0	0	0	0	0	0	0	0	0	0
	10-15m	0	2	0	0	1	0	0	0	0	0	0
	15-20m	0	1	0	1	0	0	0	0	0	0	0
	Non-seizure 0-1	0	0	1	0	0	0	0	0	0	0	0
	10-15m	0	0	1	0	7	0	0	0	0	0	0
	15-20m	0	0	0	0	0	0	0	0	0	0	0
	Eye Sight Changes	0	0	8	13	29	10	NR	0	0	NR	3
	Abort Treatment (other than POT	0	9	0	0	0	0	3	0	8	16	7
	Hypoglycaemia event	1	9	0	0	0	0	0	2	0	4	0
	Other	3	1	4	0	0	0	0	1	0	0	0
	Total Pt Incidents	44	51	62	27	67	22	19	6	25	65	14

Australian and New Zealand Hyperbaric Treatment Data, 1 July 2021 - 30 June 2022

Diagnosis	Sub Category	Royal Adelaide Hospital	The Alfred Hospital	Royal Hobart Hospital	Prince of Wales Hospital	Royal Brisbane & Women's Hospital	Wesley Centre for Hyperbaric Medicine	The Townsville Hospital	Royal Darwin Hospital	Health New Zealand Waitemata AK	Fiona Stanley Hospital	Christchurch Hospital
Bubble Injury	DCI	4	9	15	4	9	1	23	2	7	31	4
	AGE - Diving	0	0	0	0	1	0	0	0	0	4	0
	- Iatrogenic	0	2	0	0	0	0	0	0	0	2	0
	Other	0	0	0	0	0	0	0	0	0	0	0
	Total	4	11	15	4		1	23	2	7	37	4
Acute Ischaemic Conditions	Compromised Flaps & Grafts	0	3	7	2	4	1	4	0	1	1	0
	Crush Injury	0	0	0	0	0	0	0	0	0	0	0
	Compartment Syndromes	0	0	0	0	1	0	0	0	0	0	0
	Reperfusion Injuries	0	0	0	0	0	1	0	0	0	0	0
	Other	0	1	0	0	6	0	0	0	1	6	0
Infective Conditions	Clostridial Myonecrosis	0	0	0	0	0	0	0	0	0	0	0
	Necrotizing Fasciitis	0	18	6	7	0	0	2	0	0	6	0
	Fungal	0	1	0	1	0	0	0	0	0	1	0
	Malignant Otitis Externa	0	2	0	0	1	0	0	0	0	0	0
	Refractory Osteomyelitis	0	1	5	0	2	1	2	0	0	0	0
	Intracranial Abscess	0	0	0	0	1	1	1	0	0	0	0
	Other	0	0	0	1		0	0	0	0	0	0
Radiation Tissue Damage	Osteoradionecrosis - Established	8	2	4	11	7	2	3	0	4	13	1
	- Prophylactic	17	2	10	18	4	0	4	0	4	4	1
	Soft Tis. Rad'necrosis - Established	18	2	18	102	44	0	15	0	8	5	16
	- Prophylactic	3	0	0	5	3	0	2	0	0	0	0
	Soft Tissue (Wound in irradiated field)	0	2	0	0	0	10	0	1	4	3	0
	Xerostomia	0	0	0	0	5	2	0	0	0	0	0
	Radiation Cystitis	0	25	7	0	0	13	11	2	9	37	9
	Radiation Proctiis	0	3	3	0	0	12	2	0	1	1	1
	Other Radiation Damage	1	0	9	0	0	0	0	0	0	0	6
Problem Wounds	Diabetic Ulcers	8	6	17	7	12	5	5	4	0	12	0
	Venous Ulcers	0	3	1	4	1	0	0	0	2	0	1
	Vascular Ulcers	0	0	0	0	3	0	4	0	0	0	0
	Decubitus Ulcers	0	0	0	0	0	0	0	0	0	0	0
	Frostbite	0	0	0	0	0	0	0	0	0	0	0
	Surgical Wounds	2	1	0	0	3	2	1	0	3	8	1
	Spider Bite	0	0	0	0	0	0	0	0	0	0	0
	Calciphylaxis	6	0	0	0	1	1	0	0	0	1	0
	Crohns	0	1	1	4	0	0	0	0	0	2	1
	Other	0	10	19	7	4	0	0	0	3	2	1
Gas Poisoning	Carbon Monoxide	2	0	12	0	0	0	0	0	3	14	3
	Other	1	0	0	1	0	0	0	0	0	0	0
Ocular Conditions	Retinal Arterial Occlusion	0	0	5	0	8	1	0	0	0	2	9
	Vein Occlusion	0	0	0	1	0	0	0	0	0	0	0
	Other	0	0	0	6	1	0	0	0	0	0	1
Miscellaneous	Thermal Burns	1	0	0	0	0	0	0	0	0	0	0
	Excepf nal Blood Loss Anaemia	0	0	0	0	0	0	0	0	0	0	0
	h Radiosensitivity of Tumours	0	0	0	0	0	0	0	0	0	0	0
	Sham / Isobaric e.g. HORTIS	0	0	0	0	0	0	0	0	0	0	0
	Sudden Sensorineural Hearing Loss	7	38	10	17	101	37	28	0	3	40	0
Ventilated Patients	Other	0	0	6	1	0	0	0	0	1	2	0
	Ventilated Patients	1	20	9	3	0	0	1	0	0	5	0
Paediatric Patients	Ventilated Pt Treatments	1	80	67	8	0	0	3	0	0	17	0
	0 up to 8 years old	0	0	0	0	1	0	0	0	0	0	0
	8 up to 16 years old	0	3	2	0	3	0	0	0	0	0	0
'Deep' Treatments	> 3 ATA e.g. Comex 30	0	0	0	0	0	0	0	0	0	0	0
Number of Patients Treated	Elective	NR	173	87	146	188	90	0	8	40	129	22
	Acute	NR	38	38	19	0	1	0	0	7	35	0
	Emergency	NR	11	NR	40	22	2	0	2	0	27	17
	Total	77	222	125	205	210	93	104	10	47	191	39
Number of Patient Treatments	Elective	NR	404	2067	NR	NR	2280	0	112	1078	3306	599
	Acute	NR	579	NR	NR	NR	1	0	7	15	28	0
	Emergency	NR	118	25	NR	NR	2	27	2	0	131	39
	Total	1953	1101	2092	4523	2533	2283	1762	121	1093	3465	638
Number of Chamber Compressions	Multiplace	620	434	1690	744	1116	624	570	80	376	577	371
	Monoplace	0	667	402	1542	24	0	0	0	0	1164	0
	Sham/Isobaric Treatments	0	0	0	0	0	0	0	0	0	0	0
	Total	620	1101	2092	2286	1140	624	570	82	376	1741	371

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