

WCHM

WOUND CARE AND HYPERBARIC MEDICINE

VOLUME 9, ISSUE 3 — FALL 2018

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EDITORIAL STAFF

Best Publishing Company
Jaclyn Mackey, Publisher
jmackey@bestpub.com

MAGAZINE PRODUCTION

Lorraine Fico-White
lorraine@bestpub.com

Lorie DeWorken
info@bestpub.com

ADVERTISING/SPONSORSHIPS

info@bestpub.com

LETTERS

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Introduction to the Role of Hyperbaric Safety Director

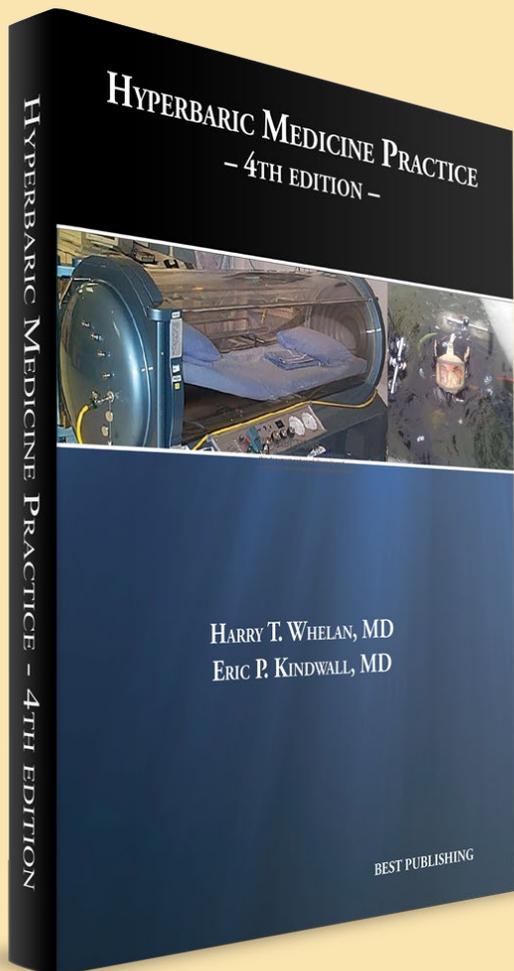
This 2-day program benefits those new to the hyperbaric safety director position by orienting them to the responsibilities as defined by the NFPA, UHMS, and other organizations.

In addition, the course is a great review for current hyperbaric safety directors and seasoned technicians by providing updates to NFPA code and industry standards.

The NBDHMT has approved the program for 16 Category-A CEUs, the Florida Board of Nursing has approved 16 CNE hours and 16 CE hours are approved by the Florida Board of Respiratory Therapy.



The long-awaited, **COMPLETELY REVISED AND UPDATED** edition of Dr. Harry Whelan and Dr. Eric Kindwall's keystone textbook in hyperbaric medicine is now available.



HYPERBARIC MEDICINE PRACTICE

4TH EDITION

by Dr. Harry Whelan and Dr. Eric Kindwall

Harry T. Whelan, MD, lead editor, collected some of the most renowned practitioners in hyperbaric medicine to create this revised and updated 4th edition, which adds new information of interest to all in the field of diving and clinical hyperbaric medicine.

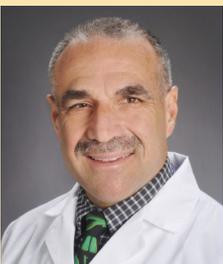
New contributors have written or revised most chapters, but many authors have returned to update their chapters. New chapters cover areas recently approved for hyperbaric oxygen treatment, such as idiopathic sudden sensorineural hearing loss and central retinal vein occlusion. There are also chapters about

submarine rescue and problems that pertain to technical and rebreather diving.

This book will be an essential addition to the library of physicians, nurses, CHTs, CHRNs, and allied health professionals who practice clinical hyperbaric medicine and those involved with the treatment of injured divers.

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Dr. Whelan, a Milwaukee native, is professor of neurology, pediatrics and hyperbaric medicine at the Medical College of Wisconsin. He is also a captain and a diving medical officer (DMO) in the U.S. Navy and a consultant to the Navy Experimental Diving Unit (NEDU). He recently served as commanding officer of Marine Air Control Group 48 Medical and undersea medical officer for Deep Submergence Unit, which is the Navy's submarine rescue team and its deep-sea research component.



NOTE FROM THE EDITOR

Each quarter, the Baromedical Nurses Association (BNA) reaches new heights and achievements. This fall issue of *WCHM* contains 2 articles, with an emphasis on the recent release of the updated *2018 Guidelines of Nursing Care for the Patient Receiving Hyperbaric Oxygen Therapy*.

Jolene Cormier, BSN, RN, EMT-P, CHRN, CHT offers her analysis of risk management as defined by ISO 14971.

Darren Mazza returns with insights on the “hows” and “whys” of providing emotional support for patients undergoing treatment in a hyperbaric chamber.

Dr. Michael Strauss provides 2 articles in this issue. The first describes the only wound scoring system – the Long Beach Wound Scores (LBWS) – that has both reliability and validation data in a peer-reviewed journal (*Wounds: A compendium of clinical research and practice*).

The second article is Part 3 of 3, closing out his discussion of diving with disabilities, an excerpt from the revised

edition of *Diving Science*, due for publication in 2019 by Best Publishing Company.

In a press release as follow-up to previous news, Smith and Nephew announces the first and only Medtech innovation briefing (MIB) published by the UK's National Institute for Health and Care Excellence (NICE) on a Negative Pressure Wound Therapy (NPWT) device for preventing surgical site complications (SSCs).

If you've ever wanted to get an article you authored published to an audience of thousands of wound care and hyperbaric medicine practitioners, now is the time to make it happen. Please submit your articles to info@bestpub.com or call 561.776.6066. We also invite you to join our elite group of *WCHM* advertisers and reach your target audience.

Lorraine Fico-White
Managing Editor, *WCHM* Magazine

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Baromedical Nurses Association (BNA) Updates

Information compiled by Laura Josefsen, RN, ACHRN from the BNA Website: hyperbaricnurses.org

Annette Gwilliam, president, continues to lead the Baromedical Nurses Association (BNA) to new heights and excitement. Kevin Kraft, vice president, is active in many projects of the board. Robin Ortega, as the administrative assistant and treasurer, also oversees the website hyperbaricnurses.org. This website provides an extensive amount of information, including membership, education (free CEUs for members, nominal fee for nonmembers), newsletters, BNACB updates, nursing guidelines, safety, certification, and contact information for all board members.

We are excited to have additional new members on the board for BNA and Baromedical Nursing Associate Certification Board (BNACB) that began July 1, 2018. They are bringing in new ideas and look at our practice with new eyes. How exciting!

The current board members are:

Annette Gwilliam	President
Kevin Kraft	Vice President
Laura Josefsen	Secretary
Robin Ortega	Administrative Assistant/Treasurer
Jolene Cormier	Senior Director at Large
Dana Winn	Junior Director at Large

Anthony Johnston	Publication Chair
Connie Hutson	Research Chair/Past President
Deb Critz	Nominations Chair
Eric Hexdall	Education Chair
John Duffy	Membership Chair
Monica Skarban	Bylaws Chair
Terry Beard	Safety Chair
Tina Ziemba	Awards Chair

Dave Beavers	BNACB Chair
Deb Gonzales	BNACB Committee
Angela Savage	BNACB Committee

Bradley Walker
Gus Gustavson

UHMS Associates Nurse Representative
UHMS Past Nurse Representative

Janet Bello

BNA Online Forum Monitor

We invite you to be involved on the BNA board by looking at the committees to find the one that's for you. The committees provide mentoring and your ideas are encouraged. YOU can make a difference in hyperbaric nursing practice. For example, one area of focus at this time is research. The research committee under the direction of Connie Hutson along with Gus Gustavson is continuing to develop the nursing research process and ideas for evidence-based research in our practice.

The Publications Committee is new starting this year under the direction of Anthony Johnston and is responsible for reviewing and managing articles/papers published by the BNA. The online forum under the direction of Janet Bello is for nursing clinical questions that you may be wondering about. Deb Critz is the Nominations Chair. Please contact her if you are interested in running for a position on the board.

Board positions are for two years, with the Director at Large (DAL) positions being one year. Currently serving are Jolene Cormier and Dana Winn. The DAL positions are a great way to get experience on the board! Mentoring by current board members is provided. We are always excited when new people join!

The Education Committee under the direction of Eric Hexdall reviews the presentations and follows up with getting the CEUs for each presentation. John Duffy oversees the Membership Committee and works on ideas to increase membership. Monica Skarban monitors and keeps the bylaws current, Terry Beard provides safety mentoring and education on the website, and Tina Ziemba searches for qualified candidates for the awards, including the following:

- Diane Norkool Award for excellence in hyperbaric nursing research, clinical practice and leadership,

and

- the new (2nd year) Circle of Excellence Award to honor a nominee who is not a member of the BNA but exemplifies extraordinary mentoring and/or professional support to promote the mission and vision of hyperbaric nursing, including but not limited to research, education or safety.

The BNACB members Dave Beavers, Angela Savage, and Deb Gonzales provide updates, regulations and guidelines for certification and recertification. There are three positions on this board, each for a 6-year commitment rotating various roles every two years. This is a very exciting board and works closely with Dick Clarke at the National Board of Diving and Hyperbaric Medical Technology (NBDHMT).

The UHMS nursing representatives (Bradley Walker and Gus Gustavson) provide updates from the UHMS Board of Directors.

This is the perfect time to become a member and to be active on the committees. We invite you to join the committee that is a perfect fit for you! ■

About the Author

LAURA JOSEFSEN, RN, ACHRN, has been involved in hyperbaric nursing since 1982. A founding member of the Baromedical Nurses Association (BNA) in 1985, she served as BNA president from 1996 to 1998 and as a board member in several positions throughout the years. She served on the Undersea and Hyperbaric Medical Society (UHMS) Associates Council for six years, with two of those years as Nurse Representative on the UHMS Board of Directors. She is a member of the UHMS Accreditation Team as a nurse surveyor, served for many years as an executive board member of the National Board of Diving and Hyperbaric Medical Technology and is a previous chairman of the BNA Certification Board. She is a member of the UHMS Associates, former member of Divers Alert Network, and former member of the Hyperbaric Technologists and Nurses Association (HTNA) of Australia. She has numerous publications and is an internationally recognized speaker in the field of hyperbaric medicine. Her passions are quality improvement and education to promote hyperbaric nursing, safety, and optimal standards of care and practice for patients and the community.

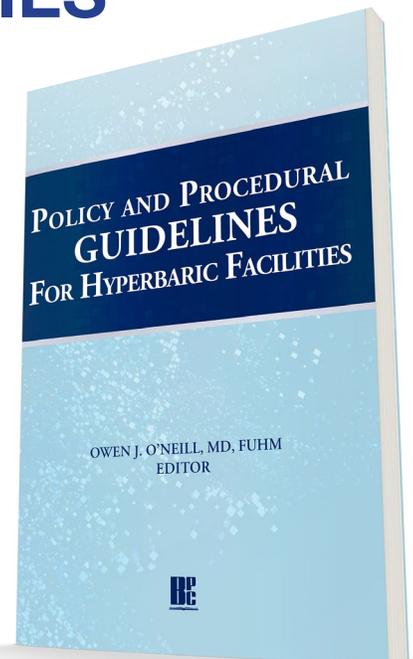


POLICY AND PROCEDURAL GUIDELINES FOR HYPERBARIC FACILITIES

Provides needed resource and reference guidelines for new and established hyperbaric facilities, serving as a reference for the development of new hyperbaric policies as well as customizing and enhancing current policies and procedures already in place.

Policy and Procedural Guidelines for Hyperbaric Facilities addresses issues of safety and practice for both the multiplace and monoplace environments. Utilizing regulatory guidelines and standards of practice as its foundation, this book covers governance, administration, emergency procedures, patient care, hyperbaric chamber maintenance, treatment protocols and quality improvement, among other topics. The appendices include sample forms for both Class A multiplace and Class B monoplace chambers.

The guidelines provided in this document will benefit the diverse group of physicians, nurses, technicians, and allied health-care personnel in the hyperbaric field as they customize their unit-specific policies and procedures.



Endorsement from Baromedical Nurses Association (BNA)

The Baromedical Nurses Association endorses **Policy and Procedural Guidelines for Hyperbaric Facilities** as guidelines to enable hyperbaric facilities to develop and/or endorse their unit-specific policies.

The Baromedical Nurses Association (established in 1985) provides a forum for hyperbaric nursing that encompasses quality, safety, teamwork, mentoring, research, education, and nursing guidelines of standards of care for the patient receiving hyperbaric oxygen therapy.

Baromedical Nurses Association (BNA) Announces Release of Updated Guidelines

Information provided by Jolene Cormier and Dana Winn,
Director at Large representatives in the BNA.

The Baromedical Nurses Association (BNA) announces the release of the updated 2018 Guidelines of Nursing Care for the Patient Receiving Hyperbaric Oxygen Therapy. Find it at:

<http://hyperbaricnurses.org/nursing-guidelines/>

It was formerly called the *Nursing Standards of Care*, first published in 2007. Baromedical nursing's origins began in 1950s Europe, quickly moving outward.

In addition to a new title, many things inside the book have changed. One of the most exciting developments is the increased focus on offering up-to-date evidence-based guidelines. In 2001 the Institute of Medicine recommended a stronger focus on evidence-based practice in its report, "Crossing the Quality Chasm"¹. This was reiterated in the 2003 report, "Health Professions Education"².

In light of these recommendations, the BNA has established a formal process to ensure ongoing review and revision of these guidelines.

"The BNA supports nursing research and closing the research-practice gap," notes Jolene Cormier, who helped draft the revised guidelines, "and we have always strived to use evidence to support our guidelines."

As in the previous release of the document, a detailed and updated reference section is provided.

The BNA has enhanced the guidelines to include the nursing management of potential problems related to the hyperbaric patient's medical condition(s). New guidelines for conditions related to hyperbaric therapy include the potential for vision changes and for unstable blood glucose levels related to hyperbaric oxygen therapy. The guidelines continue to take a whole-person view and address potential problems that are not strictly related to the hyperbaric chamber environment. These include imbalanced nutrition/lower

than body requirements, anxiety, pain, physical mobility, and coping. This holistic approach to the care of the patient receiving hyperbaric therapy exemplifies the BNA focus on integrating evidence-based practice with the art of nursing and person-centered care. It also encourages compliance with CMS requirements about caring for patients with foot ulcers complicated by diabetes by requiring optimized vascular status, glucose control, nutrition status, appropriate offloading, comprehensive wound care and resolving infection.

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1. Institute of Medicine. Crossing the quality chasm: A new health system for the 21st century. 2001. Retrieved from: http://nationalacademies.org/hmd/reports/2001/crossing-the-quality-chasm-a-new-health-system-for-the-21st-century.aspx?_
2. Health professions education: A bridge to quality. 2--3/ Retrieved from: <https://www.nap.edu/read/10681/chapter/1>

About the BNA

The BNA was established in June 1985 to provide registered nurses practicing in hyperbaric medicine a formal organization within which they can develop a network and provide professional support. This organization has grown and expanded outside the boundaries of the United States. Today, the BNA has members in Canada, Europe, Asia, South and Central America, and the South Pacific. The BNA remains dedicated to offering educational opportunities, supporting nursing research efforts, representing the BNA to other national organizations in committees and board participation, having a public voice in general and specialty issues impacting nursing, and providing networking and information exchange opportunities. ■

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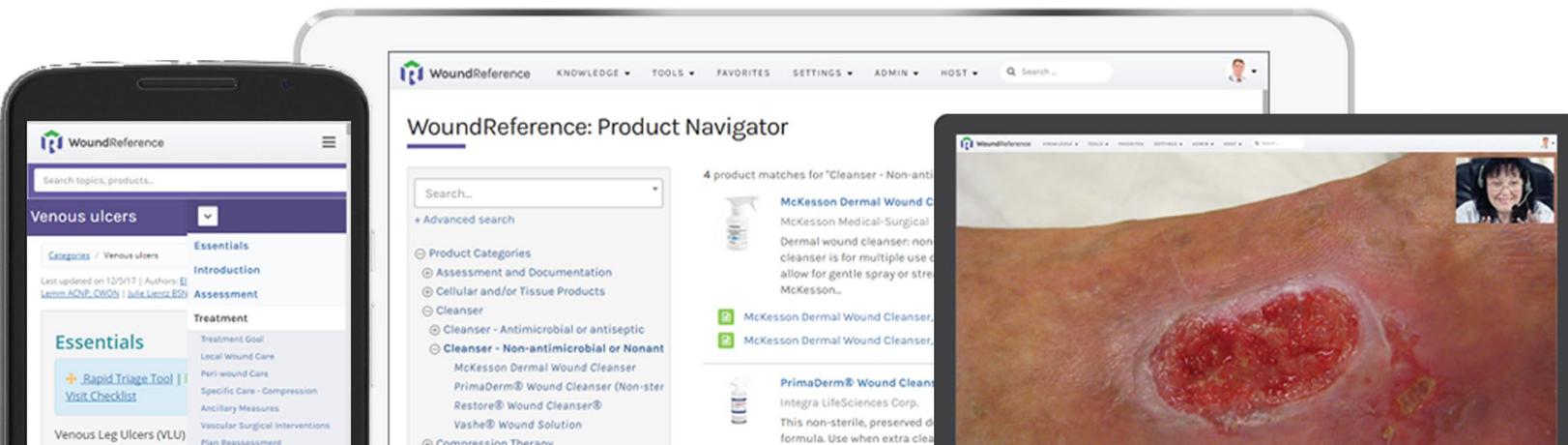
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Risk Management Analysis

Jolene E. Cormier, BSN, RN, EMT-P, CHRN, CHT • joleneecormier@gmail.com

Risk Management is defined by ISO 14971 as “the systematic application of management policies, procedures, and practices to the tasks of analyzing, evaluating and controlling risk” (Schmidt). The purpose of risk management is to identify risks, take steps to mitigate them, and evaluate whether the actions had the intended outcome. ISO 14971 (Schmidt) lists three steps to the risk management process:

1. **Risk analysis** – identifying hazards associated with a device, a procedure, or activity.
2. **Risk evaluation** – assess the probability of the hazard occurring and the severity or impact of the consequence. Probability and severity can be scored using a low-medium-high determination. A sample matrix can be found in the *NFPA 99 Handbook* (2015, p.74).
3. **Risk control** – methods for mitigating the risk which can include redesigning a system or process, staff training or protective measures

Redesigning a process or system (inherent safety) is considered the most effective for controlling risk, while a focus on training is considered the least. Some risks can be eliminated (adding an item to the *No Go* list prevents risks associated with that item); however, often risks cannot be completely eliminated. As stated by Schmidt, “safety means the freedom from unacceptable risk.”

There are two risk analysis methods, retrospective and prospective, based on whether the process is being completed proactively or reactively. If an incident has already occurred a retrospective risk analysis is used to evaluate the cause or causes of the error and try to prevent reoccurrence. A prospective risk analysis attempts to identify possible risks and tries to reduce or eliminate them before an occurrence. In a perfect world all risk analysis would be proactive: In reality both techniques are

subject to biases that can affect quality or accuracy. Bias constitutes a “pre-conceived preference or inclination that has the potential to affect the impartiality of evaluations or decisions” and can result in risks being overlooked or prematurely dismissed (Peacos). Different forms of bias that can affect risk management include: 1) team assembly (individuals with a similar mindset or not including someone who is not affected by the outcome); 2) not considering risks from supporting systems; 3) resistance to change. A hospital system’s internal resources (risk management, environment of care, safety, and infection control) can qualify as team members not affected by the outcome and of a different mindset. Risk analysis expert Paul Baybutt recommends having a devil’s advocate on the assessment team to combat the effects of cognitive biases, someone willing to challenge your views to help determine their validity.

Prospective risk management techniques are often used when evaluating or modifying equipment for the hyperbaric environment; however, this process can be applied throughout the hyperbaric department. It is important to have a systematic method for completing any risk assessment so none of the items or steps that may be required are missed or forgotten. These items/steps may include: identifying the hazard, the probability and severity matrix used, infection control, fire risk, consulting external or internal resources, relevant information/literature review, training and documentation of the process.

Before I lose anyone, the key word is *may*; not all of these items will be necessary, depending on what is being considered or assessed, and the time commitment depends on the project and the key players (or resources) that need to be involved. An expertise in risk analysis is not necessary; literature reviews, consulting resources, and assembling a diverse team can help ensure everything addressed. Documentation may not need to be extensive

but having a record trail is important, as it can serve as a template for future assessments and provide justification for the end result.

To illustrate how quickly and easily some risk assessments can be completed and documented, following are two examples of completed prospective risk analyses that resulted in a change in practice and/or policy.

PROSPECTIVE RISK ANALYSIS FOR ALCOHOL FOAM IN THE HYPERBARIC ROOM

Problem: Alcohol foam was automatically installed outside and inside the hyperbaric chamber room due to hospital policy. There were case reports of fires due to ignition of alcohol gel/foam, with increased fire risk in a hyperbaric environment. However, alcohol foams reduce the spread of health-care associated infections.

Probability: *Low.* Few cases have been reported, and alcohol evaporates quickly. Ignition sources are kept out of the monoplace chamber, and patient grounding is checked before each treatment.

Severity: **1.** Fire in the monoplace chamber – high due to mortality rate; all previous incidences have proven fatal. **2.** Spread of hospital-acquired infections – low due to the presence of an effective alternate. A sink with soap is located in the hyperbaric room.

Internal Resources: Infection control manager and environment of care (EOC) safety officer. An email was sent to the internal resources identified with copies of the case report found. Responses were sent by the end of the day, and engineering removed the alcohol foam. The change was discussed among the hyperbaric team.

PROSPECTIVE RISK ANALYSIS FOR DEFIBRILLATION IMMEDIATELY OUTSIDE A MONOPLACE CHAMBER

Problem: The risk of fire due to arcing during defibrillation immediately outside a monoplace environment. The patient and associated linens are oxygen-enriched after they are removed from a monoplace chamber, which is pressurized with 100% oxygen

Probability: *Low.* Fires have been reported during defibrillation in an oxygen-enriched atmosphere (OEA) when oxygen is flowing directly across the patient's chest, and when paddles are used for defibrillation. Our facility has an AED, which uses pads. Also, cold oxygen is heavier than air and will fall to the floor within 30 seconds. Patient covering and scrub top/gown will need to be removed, resulting further in oxygen dissipation from around patient.

Severity: **1.** *Fire – high.* Fire can result in patient death and staff death or injury. **2.** *Patient death due to cardiac arrest and delayed defibrillation – high.* Immediate early defibrillation and chest compressions are shown to improve survival for patients in cardiac arrest.

Clinic Conclusion: As long as adhesive pads are used, not paddles, it is unnecessary to move the stretcher away from the chamber for defibrillation. The risk of death due to delayed defibrillation is greater than the risk of fire due to arcing in these circumstances. As long as pads are used with AED it is unnecessary to delay defibrillation in patients who have had an apparent cardiac arrest inside the monoplace chamber once they are removed from the chamber.

Internal Resources: Clinic medical director, policy committee to review changes. After being approved by the hyperbaric team and medical director, the new policy was presented to the policy committee, education provided to staff and safety drills updated to reflect the change in procedure.

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Special thanks to devil's advocate Jane Ahlstrom, CHT.

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About the Author

JOLENE E. CORMIER, BSN, RN, EMT-P, CHRN, CHT is senior director at large with the BNA and a volunteer on the UHMS safety committee. The views expressed in this article are her own and not the formal opinion of either of these organizations. She can be reached at joleneecormier@gmail.com.

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Address: 631 US Highway 1, Suite 307 in North Palm Beach, FL
or train at your facility

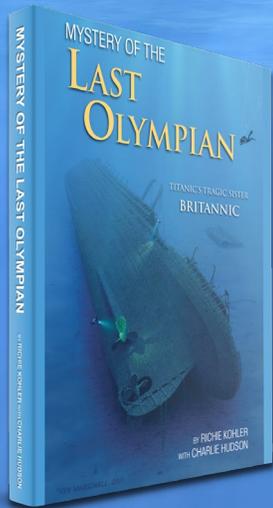
Contact: Jaelyn Mackey, jmackey@bestpub.com

or 561-776-6066 ext. 4

or visit www.WoundEducationPartners.com



Meet the Course Director: Phillip Groff is a professional educator, former US Marine, and law enforcement officer with over 20 years of experience in the training and operational communities. Beginning as a United States Marine assigned to the Fleet Anti-Terrorism Security Teams (FAST), Phill later served on one of the largest SWAT teams in Pennsylvania as an Entry Team Leader and Training Coordinator. Having participated in hundreds of tactical operations, he gained invaluable experience in a number of critical incident skills. As training coordinator, Phill managed all aspects of the team's training development, sustainment training and authored the team's Basic SWAT School curriculum. Currently, you will find Phill teaching active shooter response trainings across the U.S. through Wound Care Education Partners, Vigr Training LLC, and Keystone School Safety Solutions.



MYSTERY OF THE LAST OLYMPIAN: *Titanic's Tragic Sister Britannic*

by Richie Kohler with Charlie Hudson

For 100 years the mystery surrounding the sinking of *Titanic's* tragic sister *Britannic* was a riddle waiting to be solved. This book gives you a firsthand account as Richie Kohler takes readers on the intriguing journey from the rise of the magnificent Olympians to the ship's fateful sinking in 1916. He then moves forward in time through multiple expeditions, beginning with the great Jacques Cousteau, who located the wreck of the ocean liner in 1975. Each successive team of divers who risked their lives uncovered new clues, but it was not until 2009 that Kohler and his dive partner definitively pinpointed the secret that had eluded everyone before then.

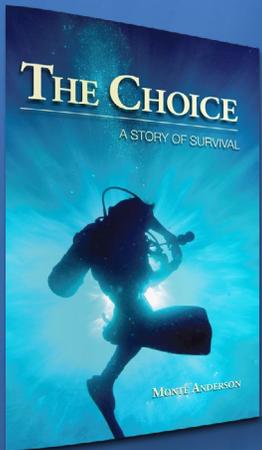
Join Kohler, host of the History Channel's *Deep Sea Detectives* and featured in the bestselling book *Shadow Divers*, as he solves the *Mystery of the Last Olympian*.



"In Richie Kohler's new book, the same drive for adventure that captivated my father comes alive as Kohler rediscovers the mysteries surrounding the ship's fateful demise. Their journey spans across past and present, honoring the legacy of an unsinkable ship and the determination of those who risked, or even lost, their lives in the search to uncover its secrets."

~ Jean-Michel Cousteau, explorer, environmentalist, educator, and producer

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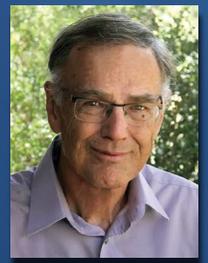
THE CHOICE: *A Story of Survival*

by Monte Anderson

As three friends drove across the Navajo Reservation in northern Arizona after backcountry skiing in Colorado, they talked about their lives. Then one said, "I really shouldn't be alive today."

David Scalia's astounding story occurred in 1982, when a scuba equipment failure caused a devastating accident, but he had a scrapbook documenting everything that happened. He suffered incalculable damage to his body for more than 12 grueling hours. Days later, he was given a profound choice — to live or to die. Almost unbelievable, this is his true story — and it involves some friends and colleagues you may know, including Dr. Gregory Adkisson, Dr. Tom Neuman, and Dr. Paul Phillips.

About the Author: Monte Anderson completed a medical residency at Creighton University and continued his studies with subspecialty training in gastroenterology and hepatology as an army officer at Fort Sam Houston in San Antonio, Texas. After his discharge from the military, most of his career was happily devoted to the Mayo Clinic in Arizona. Feeling that true tales tend to be more compelling than fiction, he has always preferred reading nonfiction, especially since something is always learned in the process. *The Choice: A Story of Survival*, his first effort outside of scientific writing, is nonfiction.



"Dr. Monte Anderson makes his debut in nonmedical writing with *The Choice: A Story of Survival* and does so with a splash. The nonfiction book relates the fascinating story of his friend's 1982 diving accident near a remote island in Mexico. Dr. Anderson's recounting of the details reflects his tremendous investigative ability, as well as the diver's will to survive."

~ Neil B. Hampson, MD, author of *Cherry Red*

Available on Amazon and www.bestpub.com.

Time Machine

by Darren Mazza, CHT

Anyone who's been through some type of medical exam, study, or procedure knows just how much time it involves, especially when you hold a full-time job, have children, or both. As a working adult, every minute seems to be calculated to make room for all of the obligations we are faced with.

I once had to have an MRI which took 45 minutes. Prior to even scheduling the study, I first had to request time off from work, account for travel time, etc. Hyperbaric therapy is quite a bit more involved considering treatments are daily 30 to 50 days straight, totaling 110-120 minutes each, excluding weekends. Ten hours a week plus travel time! The patients I typically treat have other medical appointments such as wound care, infectious disease, and infusion therapy. These types of appointments consume one's day fairly quickly. I recently had a hyperbaric patient who not only had a family which included 2 children, but she also held a full-time job as director overseeing a city-run department. Keep in mind that this patient was also dealing with an extremely painful wound.

The determination and energy it took to maintain her daily obligations would have had to be extraordinary, requiring a lot of emotional support as well. As a CHT, I make it my job to support each patient, especially when they need it the most. I spend a large amount of time with each patient on a daily basis and get to know them on a personal level.

Many other health-care jobs don't allow the time spent with a patient to get to know them. The benefit of time spent with each patient is that I have the ability and can focus on the needs of each patient and can be there for them.

The hyperbaric chamber is like a time machine. The treatments equal approximately 2 hours in which the patient depends either on a good nap or movie. I once had a patient tell me that the chamber is like a time machine, allowing him to look forward to the two-hour break from his day-to-day struggles and obligations. The patient told me he lays there in the chamber and gets lost in mind travel, focusing on the great things in his life that make it worthwhile, giving him the strength to continue the fight! This patient stated he doesn't otherwise have the time or place to escape.

The great thing about hyperbaric therapy is that the healing it promotes seems to go beyond the wound. Some patients utilize their time spent in the chamber as if it were indeed a time machine, allowing them to escape for a while . . .

Take home message: Patients are going through a lot and occasionally need some emotional support. I find that when I share my thoughts of looking at the chamber as a "Time Machine" with a patient who is struggling with their health, time constraints, and other life challenges, they suddenly feel a sense of control again, giving them the strength and drive to continue their fight to heal. ■



About the Author

DARREN MAZZA has been the CHT and safety director at the Center for Wound Healing and Hyperbarics at Swedish Edmonds in Washington since 2008. He began his health-care career working as both an EMT and an emergency room preceptor in Sacramento, California. In 2005, he moved his family to Idaho, where he was department head of the hospital's outpatient wound-care and hyperbaric center. With more than 28 years in health care, he has been able to apply his past to his current role in the hyperbaric industry, making him a more responsible CHT and safety director.

WOUND CARE CERTIFICATION STUDY GUIDE

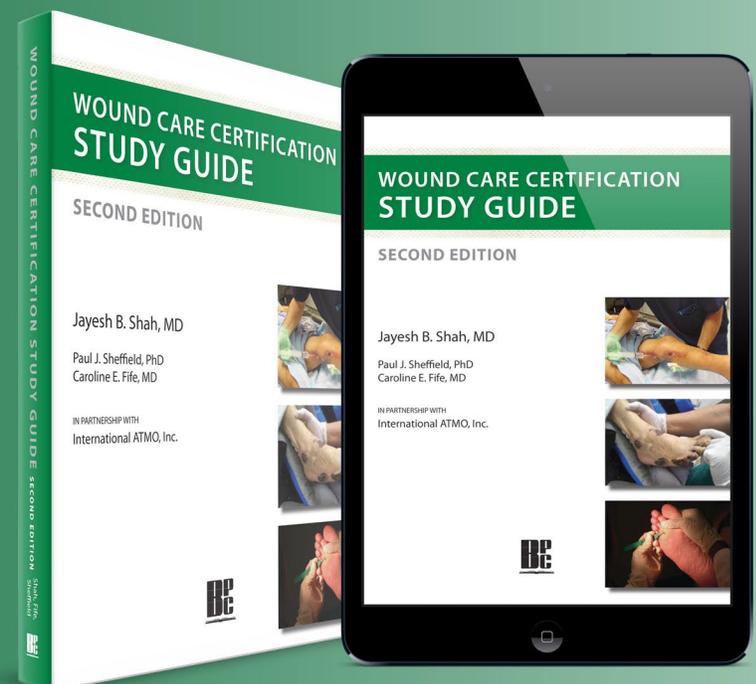
SECOND EDITION

DR. JAYESH SHAH, in partnership with **DR. PAUL SHEFFIELD** of International ATMO and **DR. CAROLINE FIFE** of Intellicure, has created the perfect tool for anyone studying to take a wound certification exam — AAWM, APWCA, CWCN, NAWC, and more.

Now in its second edition, the *Wound Care Certification Study Guide* is fully updated with the latest clinical practices and regulatory and reimbursement information. Drs. Shah, Sheffield, and Fife, along with numerous contributing authors who are considered experts in the field of wound care, have collaborated to create the best possible study resource for these important examinations. The content focuses on key information that wound care certifying agencies consider important in their examinations, with self-assessment questions at the conclusion of each chapter to help participants identify areas of comprehension and concepts that require further study.

This all-inclusive study guide includes:

- Thirty-three informative chapters that review the core principles candidates need to know to obtain wound care certification
- New chapter on hyperbaric oxygen therapy by Yvette Hall, Patricia Rios, and Jay Shah
- Added section on PQRS and quality reporting by Dr. Caroline Fife
- A full-length post-course exam complete with answers and explanations
- Comprehension questions with detailed answers at the end of each chapter
- More than 200 color photos, tables, and diagrams
- Clinical pathways with best practice recommendations for the practitioner
- New chapter on hyperbaric oxygen therapy and added section on PQRS and quality reporting
- Guidance on how to choose the certification



“It was my pleasure to review the second edition of the Wound Care Certification Guide. I found the chapters to be well written and organized, building upon the science of wound healing while including practical clinical applications and sample questions. This text should be useful to all wound care professionals, including the novice and expert alike. It will certainly be an important adjunct for anyone preparing for board examinations.”

— Robert J. Snyder, DPM, MSc, CWS; Professor and Director of Clinical Research, Barry University SPM; Past President, Association for the Advancement of Wound Care; Past President, American Board of Wound Management

“The manuscript is the result of a monumental amount of work. I congratulate all involved.”

— Terry Treadwell, MD, FACS; Medical Director, Institute for Advanced Wound Care



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UHMS Member Wound Scoring System Is Receiving Coverage

by Michael B. Strauss, MD (MStrauss@memorialcare.org)

Long Beach Memorial Medical Center, Hyperbaric Medical Program, Long Beach, California U.S.

Dear Editor:

Our paper “Clinical applications and validation of an innovative wound score” was recently published in the journal *Wounds: A compendium of clinical research and practice* (Wounds 2018; 30(6):154-159; Epub 2018 March 21). To the best of our knowledge this article describes the only wound scoring system – the Long Beach Wound Scores (LBWS) – that has both reliability and validation data in a peer-reviewed journal.

We feel our LBWS has the potential for wound scoring that the Apgar score has for neonatology. With its implementation, wound management becomes obvious. For example, the “healthy” category (LBWS 7-1/2 to 10 points) dictates simple, inexpensive dressing agents be used (possibly biologics if epithelialization is not observed within four to six weeks). For the “problem” wound category (LBWS 3-1/2 to 7 points), the primary problem(s) such as deformity, deep infection, and/or ischemia-hypoxia need to be addressed.

The obvious niche for hyperbaric oxygen treatment is the “problem” wound with ischemia-hypoxia [1]. The “end-stage” wound (LBWS 0 to 3 points) justifies amputation, if revascularization is not possible or it is insufficient to improve the LBWS to the “problem” category.

For research purposes, especially for effectiveness of wound dressing agents, the LBWS is ideal for comparing “like for like” wounds, i.e. Comparative Effectiveness Research (CER), since objective criteria are used to grade from (2 to 0 points) each of the five assessments. They are:

- 1) appearance (of the wound including base and adjacent skin);
- 2) size (including recesses and/or undermining);
- 3) depth (to wound base or end of tract);

4) infection; and

5) perfusion.

Finally, the LBWS is a useful tool for establishing Minimally Clinically Important Improvement (MCII), since objective scoring criteria can be used with a simplified scoring system (as we used in our paper).

- *Healed Wounds* were scored 2 points;
- *Improved Wounds* scored 1-1/2 points (e.g., smaller size, shallower depth, simplified wound care, elimination of pain, clearing of sepsis and/or resumption of mobility);
- *No Improvement* wounds scored 1 point;
- *Worsening Wounds* scored 1/2 point; and
- *Major Amputation* and/or *Death* scored 0 points.

I respectfully recommend that whenever the Wagner scoring system is done to grade a diabetic foot ulcer, a concomitant

About the Author

MICHAEL STRAUSS, M.D., an orthopaedic surgeon, is the retired medical director of the Hyperbaric Medicine Program at Long Beach Memorial Medical Center in Long Beach, California. He continues to be clinically active in the program and focuses his orthopaedic surgical practice on evaluation, management and prevention of challenging wounds. Dr. Strauss is a clinical professor of orthopaedic surgery at the University of California, Irvine, and the orthopaedic consultant for the Prevention-Amputation Veterans Everywhere (PAVE) Problem Wound Clinic at the VA Medical Center in Long Beach. He is well known to readers of *WCHM* from his multiple articles related to wounds and diving medicine published in previous editions of the journal. In addition, he has authored two highly acclaimed texts, *Diving Science* and *MasterMinding Wounds*. Dr. Strauss is actively studying the reliability and validity of the innovative, user-friendly Long Beach Wound Score, for which he already has authored a number of publications.

LBWS be added and the categories described above be used to guide treatment.

In addition to the paper itself, a short descriptive article can be found in Pressure, the open-access member newsletter of the UHMS at: <https://www.uhms.org/publications/pressure/2018-pressure/third-quarter-pressure-2018.html> ■

The Long Beach Wound Score and the Algorithmic Approach to Wound Evaluation & Management

Introduction

The **LBWS** is a effective tool for the evaluation & management of wounds. With peer reviewed reliability & validation (*Wounds*, 2016; 28(6):206-213 and *Wounds*, 2018; 30(6):154-159), it provides objectivity to wound management & should be used in conjunction with the Wagner Score whenever dealing with diabetic foot ulcers as well as other wound conditions.

The **LBWS** utilizes objective criteria (Analogous to Apgar scoring system to assess the viability of newborns) to categorize wounds into 3 types: *Healthy*, *Problem* and *End-stage*. Each category has its own logical management.

A sub-category, the *Transitional* wound, uses information from equally objectively derived patient **Wellness & Goal Scores** to makes decisions about salvage versus amputation for the wounds in an overlapping zone between *Problem* & *End-stage*.

The **LBWS** provides objectivity for **Comparative Effectiveness Research (CER)** of wound care treatment interventions and for establishing **Minimally Clinically Important Improvement/Difference (MCI/D)** of wounds

Finally, the **LBWS** defines the "niche" for hyperbaric oxygen as well as other interventions such as surgery, antibiotics, debridements, biologics, and amputations.

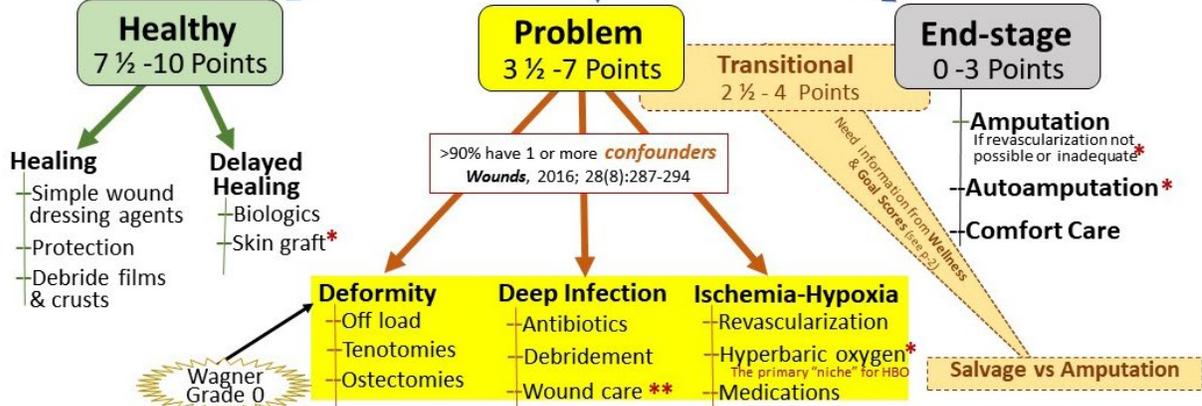
The LBWS summates the grades for 5 assessments

Assessment Grade	2 Points	1 Point <small>Use ½ points if mixed or intermediate between two grades</small>	0 Points
Appearance <small>Wound base</small>	Red	White/Yellow <small>Fibrous membrane/Exudate/Biofilm</small>	Black Wagner Grade 4,5*
Size <small>Including recesses</small>	< Patient's Thumb Print Area	Thumb Print-to-Fist Area	> Fist Area
Depth <small>Base/tract depth</small>	Skin Cover { Subcutaneous tissue = 1 ½ points }	Muscle/Tendon/Bursa	Bone/Joint
Infection	Colonized/Contaminated	Localized sepsis* <small>Maceration/Cellulitis/Tenosynovitis/Deep Abscess/Osteomyelitis/Etc.</small>	Systemic Sepsis
Perfusion	Palpable Pulses <small>Pink/Warm/Cap Refill <2 seconds</small>	Doppler Pulses <small>Dusky/Cool/Cap Refill 2-5 seconds</small>	Imperceptible Pulses <small>Cyanotic/Cold/Cap Refill >5 seconds</small>

Wagner Grade 3*

Management Algorithm Using the LBWS

Wounds



* Possible roles for hyperbaric oxygen

** Use HBO based on juxta-wound transcutaneous O₂ measurements

Decision Making for the Transitional Wound

Requires Consideration of Wellness & Goal Scores



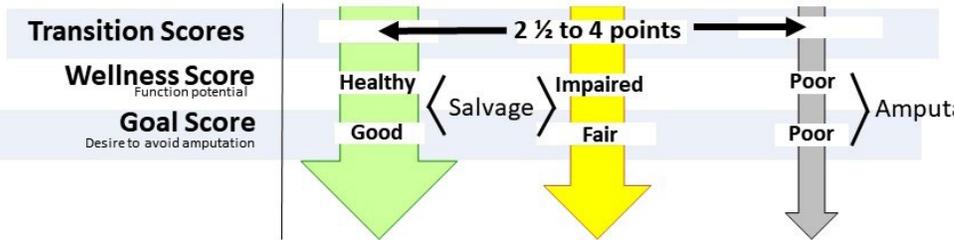
Wellness Score Healthy = 7½ -10, Impaired = 3½-7; Decompensated = 0-3)

Assessments	Grades	2	1	0
		Use ½ points if mixed or intermediate between two grades		
Activities		Full	Some	None
Mobility		Community	Household	None
			<small>Subtract ½ point if mobility aids required</small>	
Comorbidities <small>Except neurological</small>		Full	Impaired	Decompensated
Inhibitors <small>Smoking / steroids / immunosuppressors</small>		None	Past	Current
Neuro Deficits		Insignificant	Impairment	Incapacitating

Goal Score Good = 7½ -10, Fair = 3½-7; Poor = 0-3)

Comprehension	Full	Some	None
Motivation	"	"	"
Compliance	"	"	"
Support <small>Subtract ½ point if institutional</small>	"	"	"
Insight	"	"	"

Interpretations



COMMENTS

- Wagner Grades:** Analogues with LBWS **Wagner Grade 0** = deformity confounder in problem wound type; **Wagner Grades 1 & 2** = healthy wound type; **Wagner Grade 3** = localized sepsis grade in infection assessment; **Wagner Grade 4 & 5** = black grade on wound appearance
- Niches for HBO: Primary:** Problem wound type with **ischemia-hypoxia cofounder** (when revascularization not feasible or not effective); **Other indications:** **a) localized sepsis** in infection assessment (with improvement not occurring after 30 days of conventional management); **b) deep infection** cofounder with >200 mmHg juxta-wound transcutaneous oxygen measurement with HBO; **c) Wagner Grade 4, 5** diabetic foot ulcers; **d) facilitating auto amputation** of the end-stage wound type
- CER:** Objectivity and ability to compare "like for like" wounds became possible by studying the effectiveness of interventions on similar wound types (i.e. healthy, problem, or end-stage + transitional) and/or similar LBWSs
- Outcome Measures** for Reliability and Validation to quantify **MCII/R:** A five permutation scale was used as follows: **Healed** = 2 points; **Improved** (smaller wound size, decrease wound care needs, resumption of activities, absence of pain, and/or elimination of exudate and odor) = 1 ½ points; **No Change** = 1 point; **Worsening** = ½ point; and **Death/Major Amputation** = 0 points.

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CHERRY RED

by Neil B. Hampson, MD

In this mystery thriller, a series of unusual carbon monoxide poisonings hits Seattle, and former college roommates Dr. Bradley Franklin and police detective Robert Heimbigner team up in an effort to solve the mystery. As the investigation develops, they suspect foul play. Can the old friends uncover the connection between the seemingly unrelated events before more lives are lost?

"In *Cherry Red*, Dr. Neil Hampson crafts a fascinating murder mystery set in the city famous for coffee, grunge, and innovation. Hampson's recognized expertise in carbon monoxide poisoning is apparent as he takes the reader through scenarios only he could imagine."

— Michael Bennett, MB BS, MD, Conjoint Professor, University of New South Wales, Sydney, Australia, Department of Diving and Hyperbaric Medicine



About the Author:

Dr. Neil Hampson, a Seattle native, is a retired pulmonary, critical care, and hyperbaric medicine physician. He has an international reputation in hyperbaric medicine, specifically in the area of carbon monoxide poisoning. During his clinical career, he treated more than 1,000 patients with carbon monoxide poisoning and published numerous papers in medical journals about the condition.

Hyperbaric Oxygen Therapy Indications Thirteenth Edition



Every hyperbaric practicing physician should have this on his or her bookshelf and every hyperbaric unit should have a copy at the chamber. I consider this publication the “Merck Manual” for hyperbaric medicine. Word for word, it is the most valuable reference on hyperbaric medicine available.

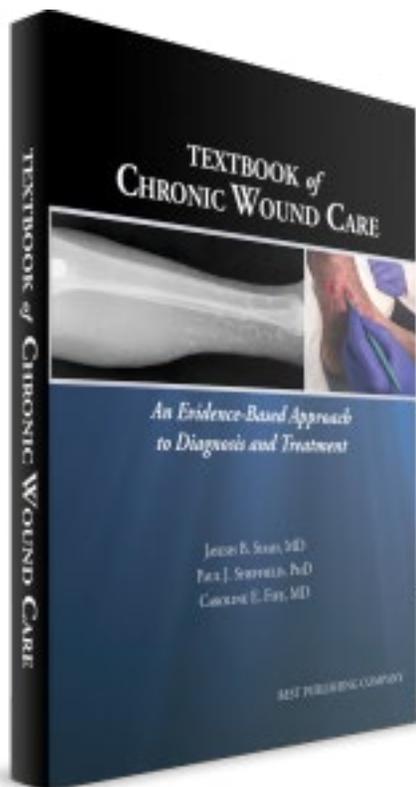
- John J. Feldmeier, D.O., FACRO, FUHM and President of the UHMS



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TEXTBOOK of CHRONIC WOUND CARE

*An Evidence-Based Approach
for Diagnosis and Treatment*

by Jayesh B. Shah, MD,
Paul J. Sheffield, PhD,
and Caroline E. Fife, MD

Available on Amazon and BestPub.com

About the Book

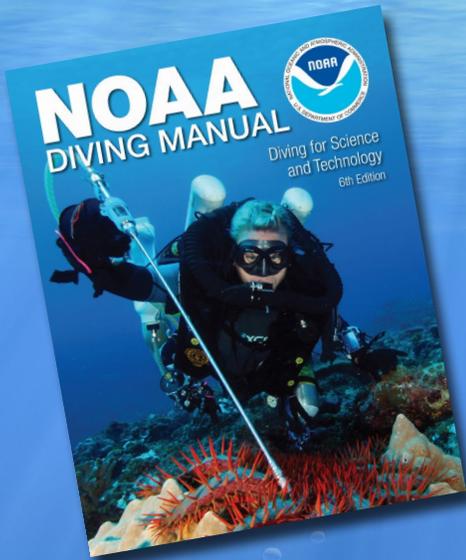
This textbook is a companion reference book for the *Wound Care Certification Study Guide, 2nd Edition*.

This book belongs in the library of every practitioner who treats chronic wound care patients. It proves to be a valuable text for medical students and all health-care professionals - doctors, podiatrists, physician assistants, nurse practitioners, nurses, physical and occupational therapists - in various settings. It provides thorough understanding of the evidence-based multidisciplinary approach for caring for patients with different kinds of wounds.

This textbook provides the best diagnostic and management information for chronic wound care in conjunction with evidence-based clinical pathways illustrated by case studies and more than 350 pictures in addition to up-to-date information for the challenging chronic wound care problems in an easy-to-understand format.

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- Chapters are written by more than 50 well-respected leaders in the specialty of wound care.
- Balanced evidence-based multidisciplinary approach to chronic wound care
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- Excellent resource for preparation of wound care certification exams with 250 questions and answers
- Chapters specifically focused on wound care in different care settings
- Chapter on telehealth and wound care addressing the future of chronic wound care
- Deep understanding of value-based care in wound care in the United States
- Chapter on healthcare payment reform and the wound care practitioner
- Separate sections on approach to wound care in various countries globally



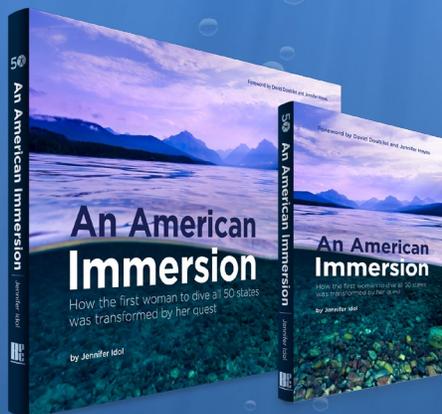
NOAA DIVING MANUAL



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This 800-page sixth edition of the *NOAA Diving Manual* builds on earlier editions, combining new developments in equipment and cutting-edge methods and procedures to provide a reference text that is useful for not only scientists but also all divers.

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The 6th edition of the *Commercial Diver Training Manual* is an almost total rewrite. Where previous editions were designed to be utilized in conjunction either the *NOAA Diving Manual* or the *U.S. Navy Diving Manual*, the 6th edition has been written as a stand-alone work that covers history, physics, physiology, diving medicine, and first aid in addition to diving techniques, diving equipment, and working underwater. Updates in the 6th edition include the following:

- comprehensive rewrite that can be used as stand-alone reference
- extensive index
- easy-to-read formatting
- new color photos, tables, and figures
- colorful book cover

Available on Amazon and BestPub.com

Press Release from Smith & Nephew:

UK's NICE publishes a Medtech innovation briefing on PICO™ for the prophylactic use in surgically closed incisions to reduce surgical site complications

June 29, 2018

As follow-up to previous news, Smith and Nephew would like to announce the first and only Medtech innovation briefing (MIB) published by the UK's National Institute for Health and Care Excellence (NICE) on a Negative Pressure Wound Therapy (NPWT) device for preventing surgical site complications (SSCs). Below is the official press release.

Smith & Nephew (LSE: SN, NYSE: SNN), the global medical technology business, announces that the UK's National Institute for Health and Care Excellence (NICE) has issued a Medtech innovation briefing (MIB) on the use of PICO Single-Use Negative Pressure Wound Therapy (sNPWT).

The MIB reports the prophylactic use of PICO as a potentially more effective alternative to standard surgical

dressings in the prevention of surgical site complications (SSCs). This is the first and only MIB published by NICE on an NPWT device for preventing SSCs.

Complications from surgical incisions are a significant economic and human burden, costing an approximate £1 billion¹ to the NHS each year and contributing to significant morbidity and mortality in the UK and globally. A recent World Union of Wound Healing Societies consensus guidelines reports that up to 60% of surgical site infections (SSIs) are preventable².

The prophylactic use of the PICO system is proven to be effective in reducing SSCs, including SSIs and dehiscence (wound rupturing) of the surgical incision, in patients at elevated risk of SSCs⁷.

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The PICO dressing has a proprietary AIRLOCK™ technology that uniformly and consistently delivers NPWT across a surgical incision and the surrounding zone of injury generated naturally by the incision itself⁴. This proprietary feature is designed to help reduce the risk of wound complications by reducing post-operative fluid, swelling and associated tension around a closed surgical incision compared with standard dressings^{5,6}. The combination of these actions helps reduce the risk of surgical wound dehiscence⁷ and SSI⁷, the 2 most common SSCs.

Evidence shows how the prophylactic use of PICO resulted in fewer complications and in earlier discharge from hospitals, reducing length of stay, on average by more than 8 days, in closed laparotomy wounds after abdominal surgery⁸, which has the potential to release bed days for the NHS. In patients undergoing primary hip and knee arthroplasties, it was estimated that care with PICO enabled cost savings of more than £7,000 per high-risk patient (BMI ≥35 or ASA ≥3) compared with care with standard dressings⁹.

Read more about NICE's finding here: <http://www.smith-nephew.com/PICOMIB>

Ms. Pauline Whitehouse, Consultant General and Colorectal Surgeon, Worthing Hospital, said, "Following the introduction of PICO into our Trust for moderate- to high-risk incisions, we quickly noticed a significant reduction in superficial surgical site infections. We have now introduced PICO across the Trust and are seeing similar reductions in infective complications for other specialities."

MIBs are objective information on device and diagnostic technologies to aid local decision-making by clinicians, managers and procurement professionals. They are NICE advice, designed to support NHS and social care commissioners and staff who are considering using new medical devices, and other medical or diagnostic technologies. The briefing will help avoid the need for organisations to produce similar information locally, saving staff time and resources. MIBs are commissioned by NHS England and produced in support of the NHS 5-Year

Forward View, specifically as one of a number of steps that will accelerate innovation in new treatments and diagnostics.

As part of the MIB, NICE conducted a thorough review of the published and peer-reviewed data from a variety of meta-analyses and randomised controlled trials (RCTs). The effectiveness of PICO in reducing SSCs has been examined in 10 RCTs and multiple observational studies. A recently published 1,839 patient meta-analysis demonstrated the efficacy of PICO, used prophylactically, significantly reducing SSIs by 58% in closed surgical incisions compared with standard care^{5***}.

PICO is suitable for use in both hospital and community settings, and is approved for a number of indications, including surgically closed incision sites.

"NICE MIBs are a great resource for NHS organisations and are often a reference used by healthcare systems beyond the UK. Today we are delighted to see the NICE MIB support for the prophylactic use of PICO as an effective alternative for clinicians who look

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to reduce their rates of surgical site complications. This will provide them with the confidence to use PICO for their at-risk patients and procedures, in support of their efforts to achieve better economic and clinical outcomes,” said Paolo Di Vincenzo, Smith & Nephew’s SVP of Advanced Wound Management. “With PICO, we are keeping Smith & Nephew at the forefront of delivering pioneering solutions that continue to improve current standards of care, by reducing the burden and delivering better clinical and economic outcomes. PICO has shown significant clinical results in reducing life-threatening infections on closed surgical incisions, which has contributed significantly to improved patient outcomes, in a cost-effective portable solution.”

Media: www.smith-nephew.com/picomib/

About Smith & Nephew

Smith & Nephew is a global medical technology business dedicated to helping healthcare professionals improve people’s lives. With leadership positions in Orthopaedic Reconstruction, Advanced Wound Management, Sports Medicine and Trauma & Extremities, Smith & Nephew has around 15,000 employees and a presence in more than 100 countries. Annual sales in 2017 were almost \$4.8 billion. Smith & Nephew is a member of the FTSE100 (LSE:SN, NYSE:SNN).

For more information about Smith & Nephew, please visit our website www.smith-nephew.com, follow @SmithNephewplc on Twitter or visit [SmithNephewplc](https://www.facebook.com/SmithNephewplc) on Facebook.com.

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This document may contain forward-looking statements that may or may not prove accurate. For example, statements regarding expected revenue growth and trading margins, market trends and our

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* 50-patient study; length of stay reduced: PICO 6.1 days; control group 14.7 days; $p < 0.019$

** Calculations based on a 220-patient RCT

*** Meta-analysis included 10 RCT and 6 observational studies. Reduction in SSI (16 studies) included 1,839 patients (2,154 incisions); PICO 5.2%; control group 12.5%; $p < 0.0001$. Mean reduction in hospital length of stay (8 studies included): 0.47 days; $p < 0.0001$

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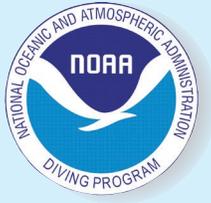
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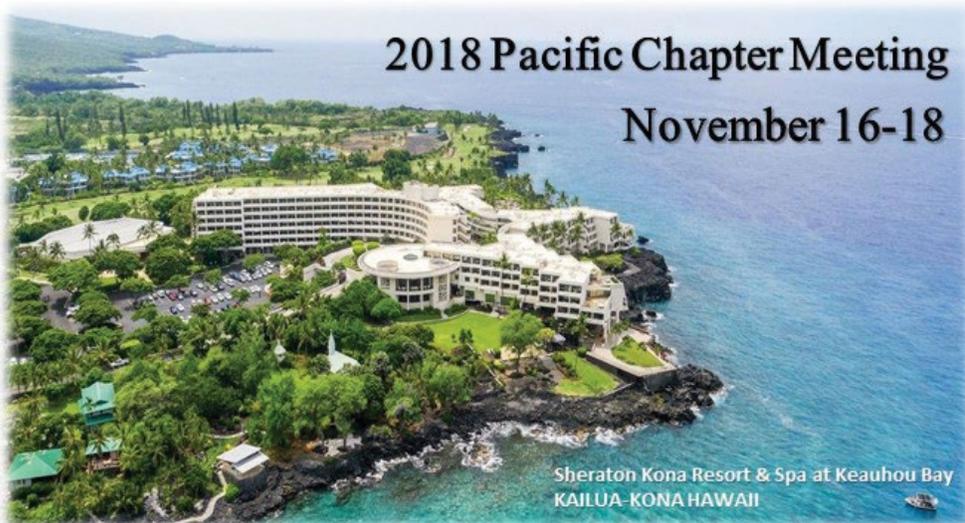
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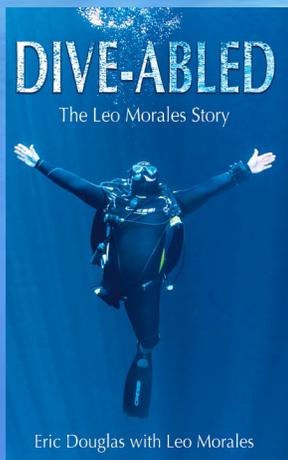


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DIVE-ABLED: THE LEO MORALES STORY

by Eric Douglas with Leo Morales

If you ask Leo Morales, nothing is impossible if you set your mind to it. And he should know. After he lost his right leg to cancer, Leo struggled with life. But he decided his disability would not define him. When friends suggested scuba diving as part of his physical therapy, he was hooked. He quickly progressed from diver to dive instructor and technical diver. Leo has set two world records as a disabled diver, one for depth and one for distance underwater, and tirelessly travels to share his message that disabilities are only in the mind.

DEEP INTO DECO REVISED AND UPDATED

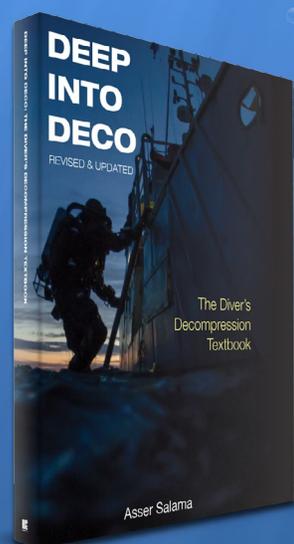
by Asser Salama

This second edition of *Deep Into Deco* has been fully updated to reflect the latest research outcomes. Chapter summaries have been added to give a quick overview of each chapter. A new section on nitrogen and helium kinetics has been added as well as a second appendix for calculating the acceleration in post-diving no-fly time associated with breathing surface oxygen.

Deep Into Deco is a comprehensive and well-written reference text that covers various topics of decompression theory. It portrays the latest developments and controversial issues in technical diving in a way that is straightforward, easy to read, understandable and free from technical jargon.

With a writing style that is a mix of strict no-nonsense reporting along with interesting storytelling, *Deep Into Deco* includes interviews with accomplished divers, industry professionals, researchers and software developers.

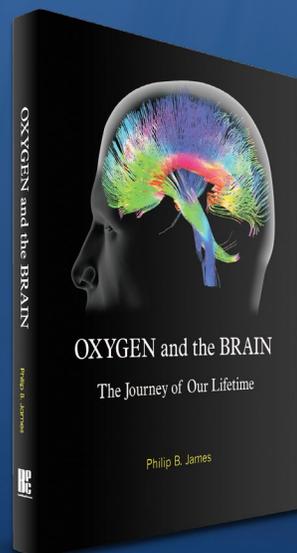
This book is a must read for any diver who wants to understand decompression theory, how it evolved, what it accomplished and where the latest research is headed.



OXYGEN AND THE BRAIN: *The Journey of Our Lifetime*

by Philip B. James, MB, ChB, DIH, PhD, FFOM

Following the human journey from conception to old age, *Oxygen and the Brain* presents evidence amassed over more than a century that can transform the care of patients with birth injury, head trauma, multiple sclerosis, and stroke and can even reverse decline in old age. There is no more necessary and scientific action than to correct a deficiency of oxygen, especially in the brain, and it is simple to give more.



Diving with Disabilities

Part 3 of 3

Lientra Q. Lu, BS, Michael B. Strauss, MD

This third article in the series on diving with disabilities is an excerpt from the extensive revision in progress of Dr. Michael Strauss and Dr. Igor Aksenov's *Diving Science* textbook.

This three-part series is extracted from a chapter in the second edition of *Diving Science* by Michael B. Strauss, MD, et al. which covers special diving types, situations and environments. Part 3 of this series in the current issue of *WCHM* discusses previous medical problems of diving and provides resources for divers with handicaps.

Previous Medical Problems of Diving

Introduction This subject has the potential to generate much discussion. The comment if “bent” (i.e. joint pain only decompression sickness) once, the second “hit” (i.e. episode of decompression sickness) will be at the same site. Data to support this comment is not known to the authors. However, there is physiological justification for decompression sickness (DCS) to target a joint that has been previously traumatized. If the trauma was severe, it is logical that scar tissue, injured muscle and healed fracture sites will have altered perfusion. This will likely influence on and offgassing during the scuba dive and make the site more vulnerable to developing gradients sufficient to cause DCS in the joint.

Residual Disabilities and Bends

Proneness If neurological disabilities remain after an episode of decompression sickness or arterial gas

embolism severe enough to alter gait and/or interfere with higher brain center functions, scuba diving should not be resumed. Often times reasons for the episodes are not obvious and this raises the question, “Is the diver bends prone i.e. experienced DCS without an apparent reason?” A patent foramen ovale (see cardiovascular disabilities section of this chapter) could be considered a bends prone factor. If DCS occurs without apparent reason, disordering events, that is incidents that could have altered the offgassing of nitrogen during the dive, should be sought by a careful review of the dive history.⁶

Conversely, some divers appear bends resistant and do not develop symptoms of DCS even though their dives are extra-ordinary and/or exceed dive tables/dive computer guides. Coagulopathies (abnormalities of blood clotting) have not been established as a cause of DCS or conversely, a reason divers do not get “bent.” However, nitrogen bubbles in contact with endothelial surfaces (the linings of blood vessels) initiate an inflammatory reaction somewhat resembling the reperfusion injury as observed with transient interruption of the blood supply to critical organs. Hence, it is our recommendation that divers who experience decompression sickness

In the 1970s, Chryssanthou proposed that smooth muscle activating factors (SMAFs) were associated with decompression sickness in laboratory animals subjected to pressurizations. He then utilized “anti” SMAFs (somewhat analogous to anti-inflammatory agents), which resolved the bends symptoms. Although the information received attention and sounded enticing at the time, he was unable to obtain funding for further studies and the roles of SMAFs and anti-SMAFs “died a silent death.”¹⁸

pain only symptoms with complete resolution and an apparent deserving event is identified, should not resume scuba diving for a minimum of two weeks after the occurrence. This is the time the nitrogen bubble, endothelium inflammatory reaction would be expected to resolve. A new area of interest concerns microparticles in the blood stream which may provide a nidus for bubble enucleation.¹⁹ However, at this time, changes in ambient pressure coupled with perfusion and gradients provide the best understanding why bubbles occur in decompression sickness.²⁰

Deserved versus Undeserved

Decompression Sickness Another consideration with regard to returning to diving is whether or not the episode of decompression was deserved (for

TABLE 7. Return to Diving after an Episode of Decompression Sickness or Arterial Gas Embolism

	Deserved	Undeserved
No Residuals	Yes (After 2 weeks; educate)	No*
Residuals (Especially neurological)	No (Possible dive with special precautions)	No

*If the bends victim is determined to dive again then the following should occur: 1) cardiology consult (bubble study), 2) neurology consult (brain and spinal cord MR studies), 3) trial of recompression (60 feet for 60 minutes breathing air) and 4) instructions in conservative diving practices (nitrox; depth and time limitations, number of dives per day, etc.)

example the diver exceeded the diving tables) or undeserved (there was no apparent violation of diving practices). If deserved and there are no residuals after hyperbaric oxygen recompression treatment, we feel it is OK to allow the diver to resume scuba diving. However, we advise the diver to wait two weeks before doing such to allow the theoretically injured endothelium from the nitrogen bubble interaction to resolve. If the DCS episode was undeserved, we hesitate to allow the patient to resume scuba diving. With the above considerations, logical advice can be made regarding return to diving or not (Table 7).

Other Considerations Injuries from marine animal encounters such as jellyfish stings and spine puncture injuries impose only temporary restrictions to diving—once the problem is resolved, the patient may return to diving. After nonfatal shark bites, motivated divers have resumed scuba diving just as surfers who experienced similar injuries have done so. The unilateral loss of hearing, especially if associated with a scuba dive, is an absolute contraindication for scuba diving as was previously discussed (see Hearing Impairments under Neuropsychiatric Disorders section). This is because the ears

are such a vulnerable structure to barotrauma associated with changes in ambient pressure. Almost all the other medical problems of diving such as nitrogen narcosis, oxygen toxicity, hypothermia, sunburn, panic and blackouts impose no or only temporary restrictions for diving once the problems are resolved.

Organizations and Agencies Dealing with Divers with Disabilities

In their goals to promote scuba diving to a broader population and demonstrate that everyone can enjoy scuba diving, many diving organizations have established programs to train and certify divers with disabilities such as paraplegia, asthma, diabetes, and epilepsy/seizures. For each type of disability, it is advisable that divers are trained and well informed about the risks in advance for their conditions. Consider the following:

Handicapped Scuba Association (HSA) has started from a research program at the University of California, Irvine in the 1970s using donated equipment from the Professional Association of Diving Instructors (PADI). Adapting curricula from both PADI and the National Association of Underwater Instructors (NAUI), HSA now has their

own certification programs focusing on divers with a wide range of disabilities, including visually impaired, post-traumatic stress disorder, paraplegia, quadriplegia, and those with high-functioning intellectual disabilities.^{21,22} The programs are multileveled and center on the physical challenges disabled divers must overcome under water.

Even though they did not offer suggestions for a training program for divers with asthma, the Undersea and Hyperbaric Medical Society (UHMS) created a guideline on the risks and symptoms of divers with asthma at their 1995 annual scientific meeting.²³ The symposium “Are Asthmatics Fit to Dive?” concluded that divers with a history of asthma are at risk of shortness of breath, panic, arterial gas embolism and drowning. Scuba diving is OK if the asthmatic’s symptoms are intermittent, is asymptomatic at the time of the scuba dive, and does not require medications to remain such. The Divers Alert Network (DAN) reported a small increase in the risk of decompression illness but there were not enough data points to accurately assess it. Another note is that divers with active asthma (requiring medications) may be diving against medical advice but are probably doing such since their symptoms are mild.

Before 1997, people with diabetes were advised against scuba diving due to the risk of becoming hypoglycemic under water. However, with proper training and planning in advance, diabetic divers can avoid this problem. DAN has issued a diving guideline for the diabetic on their website with emphasis on the diver’s physical fitness even under hypoglycemic conditions (in which some people are prone to seizures, lack of coordination, or impaired judgment).²⁴ PADI as well as Scuba Schools International (SSI) also include the education and preparation for people with diabetes in their normal open-water diving certificates.

It is almost uniformly agreed that patients with epilepsy not scuba dive.^{25,26} However, epilepsy has many presentations, and some might not adversely affect the ability to scuba dive safely. In the United Kingdom, the Sport Diving Medical Committee requires people with epilepsy to be seizure-free and off of their medications for at least 5 years before diving. In the United States, scuba diving is considered the same as driving in terms of limitations and they vary from state to state, ranging from 6 months to a year's restriction and 5 years off of their medications according to DAN. Most of the divers also need a "sign-off" from their doctors, who should be familiar with diving medicine as well as the patients' medical conditions.

Conclusions

Certainly, the discussion of every possible disorder that can be considered a disability for scuba diving cannot be included in this chapter. Two thousand plus pages of medical and

surgical textbooks include countless disorders that contraindicate scuba diving. Common sense needs to be used in making recommendations when patients with conditions other than those mentioned in this chapter occur in patients who would like to scuba dive. On one end of the spectrum there are dermatological conditions that temporarily prevent or minimally limited restrictions for scuba diving. In the middle are conditions like celiac disease and Crohn's disease where relative contraindications to scuba diving can usually be mitigated. At the other end of the spectrum are decompensating conditions like liver failure, end-stage kidney disease, critical limb ischemia, advanced cancers and major wounds that are incompatible with scuba diving. This chapter, we believe, includes the 99 percent of disabilities and handicaps that are likely to be encountered in those who want to engage in scuba diving activities.

Myths and Misconceptions about Scuba Diver Disabilities and Handicaps

Myth Handicaps and disabilities are essentially the same thing

Facts Although closely related terms, handicaps usually refer to disorders that limit a particular activity while a disability is more a legal term that the problem prevents usual and customary activities. Disabilities are often rated by percentages determined by how much the patient is incapacitated. The American Disabilities Act (ADA) specifies what accommodations employers as well as new construction must make to accommodate those patients with handicaps. Education, assistive devices and therapy are typical interventions used to mitigate handicaps.

Myth Patients who have had heart attacks should not scuba dive

Fact A heart attack is not an absolute contraindication for scuba diving.

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Considerations of how much heart damage, if any, occurred, whether or not the heart muscle has been revascularized, and the patient's exercise potential determine if the patient has enough cardiac reserve to scuba dive without undue risk. Likewise, low demand scuba dives such as in warm water, with absence of currents, diving off of boats with descending lines, and good visibility should be selected as the diving venues for such divers.

Myth A diabetic who has experienced a hypoglycemic episode should not scuba dive

Fact The more important consideration is the stability of the diabetic's blood sugars. If labile, scuba diving should not be done. However, if stable and the diver is knowledgeable about his/her disease, performs blood glucose testing immediately before and after a scuba dive, carries an emergency supply of a high sugar content item on the dive, and plans the dive to reduce

energy expenditures and stresses, scuba diving without undue risks is possible.

Myth It is unfair not to allow a patient with a history of adult-occurring seizures to scuba dive.

Fact Fairness is not the question! The risks of seizure occurring while on a scuba dive is compounded by the stresses of increased ambient pressures, Valsalva maneuvers to clear the ears, increased oxygen partial pressures as the diver descends, and energy demands to meet emergencies. The history of seizure disorder in contrast to asthma and diabetes is the one relative common condition that essentially all diving authorities consider a contraindication to scuba diving.

Myth The respiratory system and especially the alveoli are the ultimate "fast" tissue with respect to on and offgassing with changes in ambient pressure and correspondingly present

no contraindications for scuba diving
Fact While the first part of the myth is true, respiratory conditions that interfere with the effectiveness of gas exchange in the alveoli such as asthma, emphysema, atelectasis (collapse of lung alveoli), pulmonary fibrosis and lung cancer must be considered before allowing a patient with problems of this type to scuba dive. Some such as asthma prevent relative contraindications while a spontaneous pneumothorax is a temporary (up to 5 years) contraindication. In addition, with explosive decompressions, the offgassing of gas in the alveoli may be overwhelmed with bubble formation in these structures leading to the life and death problem of lung decompression sickness, referred to as the chokes.

Myth Once a diver has experienced decompression sickness without violation of the dive computer or diving tables, he/she should not be allowed to scuba dive again

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Fact Several considerations must be given to this myth. First, are there residual problems such as neurological deficits that persist after the hyperbaric oxygen recompression treatment? Second, can disordering events to offgassing be identified during the ascent phase of the dive? If there are no residuals and disordering events, for example, dehydration, interference with offgassing due to keeping an extremity in the cramped position, or a patent foramen (PFO) identified, scuba diving may be resumed after the diver is educated about the problem, and in the case of the PFO, corrected. ■

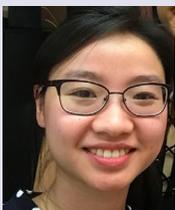
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About the Authors



Michael Strauss, M.D., an orthopaedic surgeon, is the retired medical director of the Hyperbaric Medicine Program at Long Beach Memorial Medical Center in Long Beach, California. He continues to be clinically active in the program and focuses his orthopaedic surgical practice on evaluation, management and prevention of challenging wounds. Dr. Strauss is a clinical professor of orthopaedic surgery at the University of California, Irvine, and the orthopaedic consultant for the Prevention-Amputation Veterans Everywhere (PAVE) Problem Wound Clinic at the VA Medical Center in Long Beach. He is well known to readers of *WCHM* from his multiple articles related to wounds and diving medicine published in previous editions of the journal. In addition, he has authored two highly acclaimed texts, *Diving Science* and *MasterMinding Wounds*. Dr. Strauss is actively studying the reliability and validity of the innovative, user-friendly Long Beach Wound Score, for which he already has authored a number of publications.



LIENTRA LU is a research coordinator at the VA Medical Center in Long Beach, California, under the guidance of Dr. Ian Gordon, a vascular surgeon, and Dr. Michael Strauss. She is also an administrative assistant in the accounting department of the Southern California Institute for Research and Education (SCIRE). She received a bachelor of science degree in chemical biology at the University of California, Berkeley, in 2015 and subsequently has taken medically related courses at the University of California, Los Angeles. Miss Lu is helping with diabetic foot and venous leg ulcer studies at the VA Medical Center while also serving as an assistant in patient care at the PAVE Clinic there. She also works with the American Red Cross in her other interest, disaster preparedness.

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Home page: http://anesthesiology.duke.edu/?page_id=828766

HENNEPIN COUNTY MEDICAL CENTER Minneapolis, Minn.

Contact: Stephen Hendriksen, MD

E-mail: stephen.hendriksen@hcmcd.org

Phone: (612) 873-7420

Home page: www.hcmc.org/education/fellowships/hyperbaric-fellowship/index.htm

KENT HOSPITAL Warwick, R.I.

Contact: Todd May

E-mail: twmay99@gmail.com

Phone: (401) 736-4646

Home page: www.kentri.org/

LOUISIANA STATE UNIVERSITY New Orleans, La.

Contact: Tracy Leigh LeGros, MD, PhD, FACEP, FAAEM, FUHM

E-mail: tlegros1@cox.net

Phone: (504) 366-7638

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E-mail: michael.richards.1@us.af.mil

Phone: (210) 292-3483

Home page: www.bamc.amedd.army.mil/saushec/

SUNY UPSTATE MEDICAL UNIVERSITY Syracuse, N.Y.

Contact: Marvin Heyboer III, MD, FACEP, FUHM

E-mail: heyboerm@upstate.edu

Phone: (315) 464-4363

Home page: www.upstate.edu/emergency/education/fellowships/hyperbaric.php

UNIVERSITY OF CALIFORNIA SAN DIEGO San Diego, Calif.

Contact: Peter Witucki, MD, FACEP

E-mail: pwitucki@ucsd.edu

Phone: (619) 543-6463 or (619) 543-6218

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Contact: Kevin Hardy, MD and Wendy Kelly

E-mail: wherrman@mail.med.upenn.edu

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In commemoration of the 75th anniversary of the attack on Pearl Harbor, Best Publishing Company announces the publication of

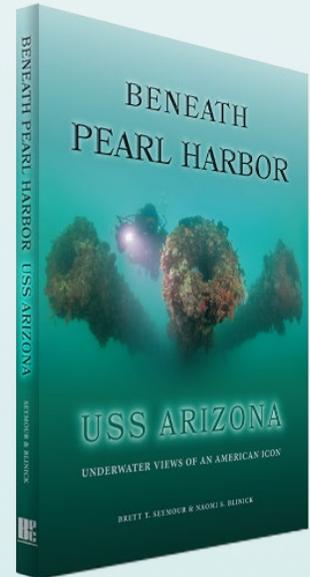
BENEATH PEARL HARBOR: USS ARIZONA UNDERWATER VIEWS OF AN AMERICAN ICON

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Experience *USS Arizona* as never before in this collection of images and essays that bring the fallen World War II battleship to life. Explore the submerged ship, its artifacts and history underwater with individuals who have a tangible and passionate connection to the ship—National Park Service divers.

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—LAUREN BRUNER, *USS Arizona*



Brett Seymour is the Deputy Chief of the U.S. National Park Service's Submerged Resources Center (SRC).

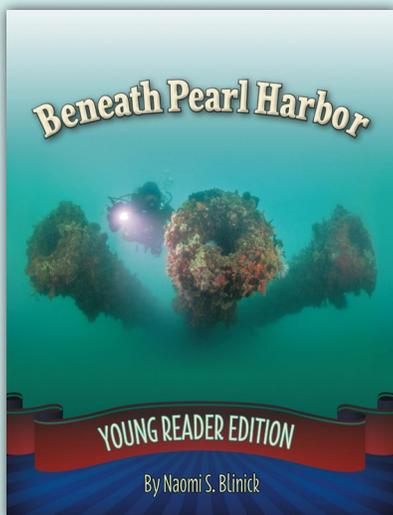


Naomi Blinick is a freelance photographer and marine biologist.

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Have you ever wondered what it looks like under the waters of Pearl Harbor? The *USS Arizona* is the most well-known battleship sunk during the Japanese attack on Pearl Harbor in Hawaii on December 7, 1941. In this book, you can explore the *USS Arizona* alongside National Park Service scuba divers, who use diving as a tool to study and preserve the ship. Learn about one of the most historic shipwrecks of all time through narrative and stunning photographs.



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“It was my dream to visit the *USS Arizona* Memorial, and getting to experience it in person is something I will never forget. This book allows my younger generation to learn about Pearl Harbor without being there. The stories of these brave men and women live on through us by what we learn and share about them.”

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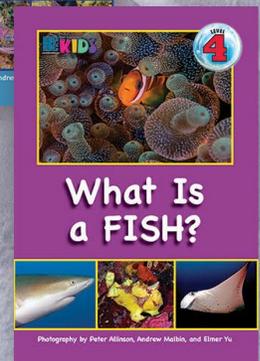
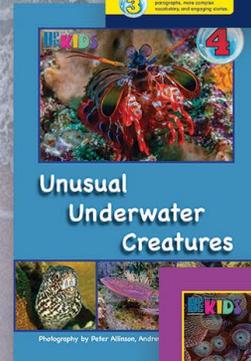
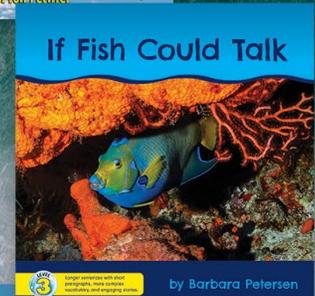
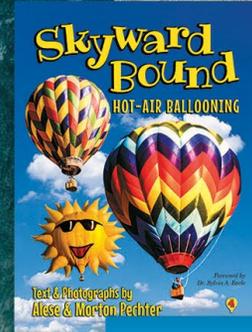
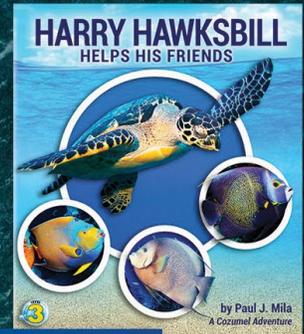
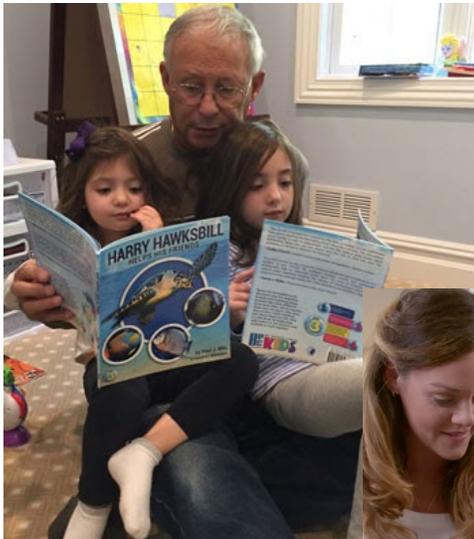
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