

Impact of Focused Education on Internal Medicine Resident Knowledge and Likelihood to Refer to Undersea and Hyperbaric Medicine

Jeremy Kessler MD¹; Saira Khan MD¹; Brett Leiknes MD¹; Jessica J. F. Kram, MPH²; James Adefisoye, MS²; Laurie Gesell MD¹

¹Department of Undersea and Hyperbaric Medicine, Advocate Aurora Health, Aurora St. Luke's Medical Center; ²AAH Academic Affairs, Aurora UW Medical Group, Advocate Aurora Health, Aurora Sinai Medical Center; ³Center for Urban Population Health, Milwaukee, WI

PROBLEM:

- Hyperbaric medicine is an emerging subspecialty that is gaining recognition within the medical field. A common problem we encounter regularly is referring providers' inexperience about the field.

BACKGROUND:

- Growth and integration of Undersea and Hyperbaric Medicine (UHM) into other specialties continues to be challenging, as referring clinicians lack knowledge about UHM and hyperbaric oxygen therapy (HBOT).
- These clinicians who provide primary clinical care could benefit from routinely partnering with UHM clinicians, as we regularly share mutual patients in hopes of improving provider's confidence level when referring to our department.

OBJECTIVES:

- The objective of this study was to educate our physician peers about Hyperbaric Oxygen Therapy (HBOT).

METHODS:

- A quasi-experimental study was conducted to assess knowledge gained during a virtual didactic lecture about hyperbaric medicine/indications.
- The lecture consisted of hyperbaric physiology, the approved indications for hyperbaric medicine, as well as referral criteria to the UHM department.
- A questionnaire (**Figure 1**) was administered to each IM resident pre- and post-lecture to see if knowledge was gained and referral comfort level improved.
- Responses for categorical variables are presented as percentages.
- A T-test was used to compare comfort level with referring to UHM and summary was presented as a mean with standard deviation on a bar graph.
- P < 0.05 were considered statistically significant.

RESULTS:

- Overall, 42 residents were asked to participate; 26 and 20 completed the pre- and post-survey, respectively.
- Following the lecture, mean comfort level (1 [unsure] – 10 [confident]) with UHM referrals significantly increased (5.0 pre- vs. 8.0 post-survey; $p < .0001$; **Figure 2**).
- Knowledge regarding the physiology and indications of hyperbaric medicine clearly increased in all questions when comparing pre- and post-lecture surveys; **Figure 3**.

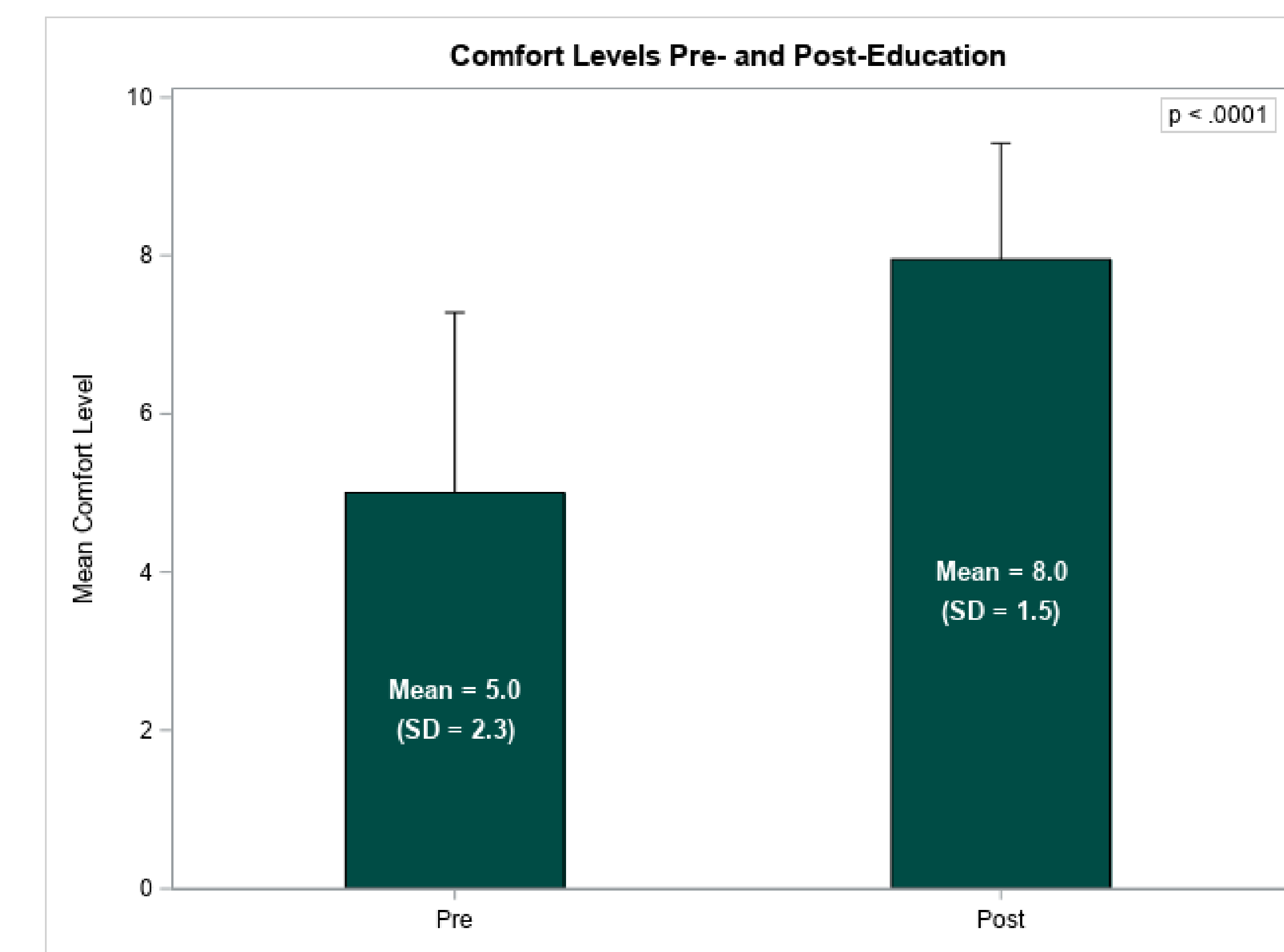


Figure 2. Comfort Levels Pre- and Post-Education.

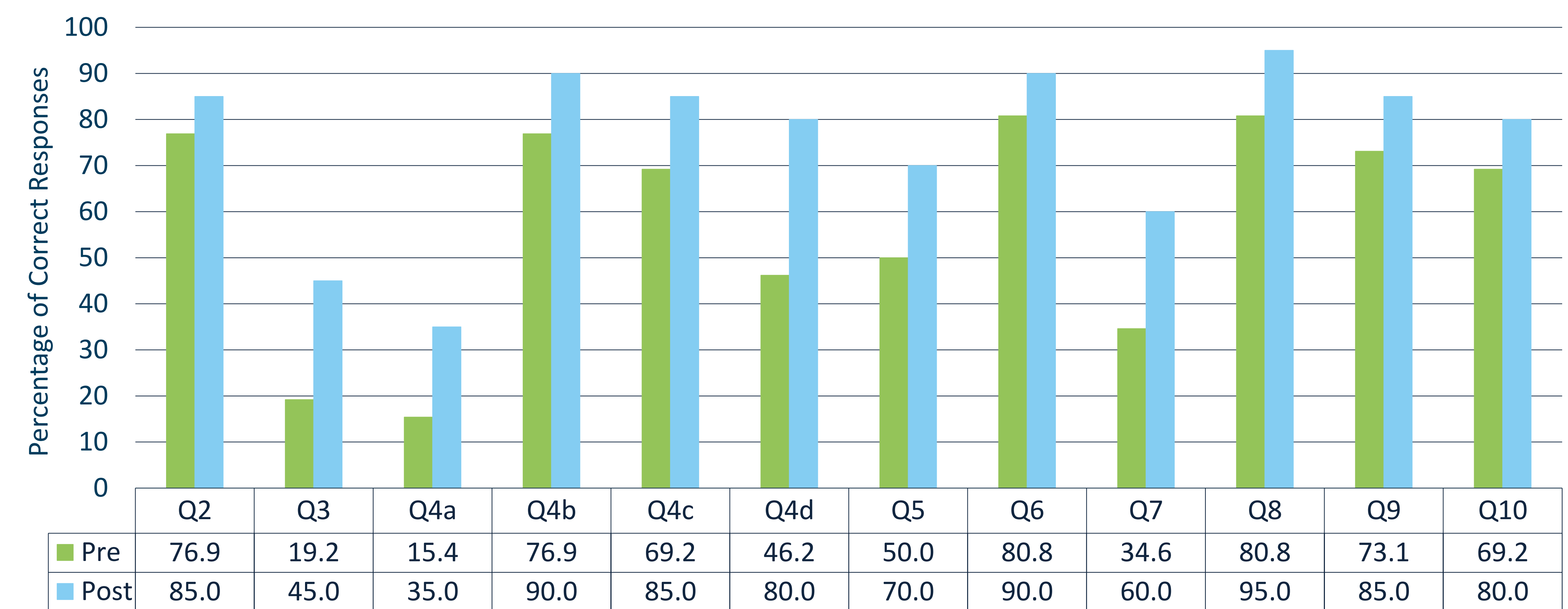


Figure 3. Pre- and Post- Didactic Survey Results.

CONCLUSIONS:

- Our educational session resulted in short term knowledge gain and improved comfort levels with referrals among Internal Medicine residents. Collectively as a study group, knowledge base regarding the physiology and indications of hyperbaric medicine clearly increased in all questions when comparing pre and post surveys.
- Unfortunately, the study design did not allow a paired analysis to calculate individual knowledge gain. Results from the study may not necessarily be generalizable outside of our study location.
- A follow up study in 3 months to assess retained knowledge and durability could be of value. This survey has identified knowledge gaps that could be from underrepresentation during medical education. Closing this gap may be as simple as improving exposure with periodic educational discussions about hyperbaric medicine.

<p>Phase II Pre- and Post-Survey Questions to be distributed through via paper and Survey Monkey:</p> <p>1. What is your comfort level regarding referrals to the Hyperbaric Medicine and Wound Care Department? 1—2—3—4—5—6—7—8—9—10 (1 feeling unsure through 10 feeling confident; circle one)</p> <p>2. When treating a refractory wound, such as a diabetic foot ulcer, which of the following should be completed prior to initiating Hyperbaric Oxygen Therapy:</p> <p>A. Smoking cessation B. Diabetic control with goal of HgbA1c less than 7.4% C. Infection control D. Nutritional assessment E. Optimize vascular flow to the region of the wound F. All of the above G. Choice A, B & C</p> <p>3. Diabetic foot ulcers that stall or deteriorate after optimization of treatment for greater than 30 days are candidates for hyperbaric oxygen therapy if they are categorized as the following severity:</p> <p>A. Wagner grade 1 – Superficial ulceration with no deep penetration of the wound B. Wagner grade 2 – Deep penetration of the wound with involvement or extension into tendon or bone or joint capsule C. Wagner grade 3 – Presence of tendonitis, deep abscesses or osteomyelitis D. All of the above E. None of the above</p> <p>4. Match the best mechanism of hyperbaric oxygen that serves the indication for HBO:</p> <p>(match the correct letter of indication to the mechanism)</p> <p>Causes a gradient to offload gasses: _____</p> <p>Helps promote angiogenesis: _____</p> <p>Prevents the production of clostridial toxin: _____</p> <p>Decreasing ischemia-reperfusion injury: _____</p>	<p>5. Which area of the body is most susceptible to barotrauma during Hyperbaric Oxygen Therapy (HBOT)?</p> <p>A. Ears B. Lungs C. Intestines D. Bladder E. Sinuses</p> <p>6. Which of the following is an absolute contraindication for HBOT:</p> <p>A. Newly diagnosed pulmonary edema/CHF B. Worsening COPD C. Untreated pneumothorax D. Seizure disorder without anticonvulsant management</p> <p>7. HBOT for radiation injury is indicated for the following:</p> <p>A. Radiation cystitis B. Radiation proctitis C. Osteoradionecrosis of the mandible D. Brain radiation necrosis E. All of the above F. A, B, & C</p> <p>8. Choose the <u>two</u> most frequent indications for HBOT:</p> <p>A. Intracranial abscess B. Central Retinal Artery Occlusion (CRAO) C. Diabetic foot ulcers D. Carbon monoxide poisoning E. Clostridium Myonecrosis – Gas Gangrene F. Compromised grafts and flaps G. Crush injury/Skeletal muscle compartment syndrome H. Decompression illness (DCS) I. Soft tissue/osteo radiation necrosis (STRN) J. Idiopathic sudden sensorineural hearing loss (ISSNHL) K. Arterial Gas Embolism (AGE) L. Necrotizing soft tissue infection - (NSTI) M. Chronic refractory osteomyelitis - (CROM) N. Severe anemia O. Thermal burns</p>	<p>9. During a bedside encounter in the CICU you remove a Swan-Ganz catheter from the patient's left chest. The patient immediately develops stroke like symptoms with right facial weakness and left sided hemiparesis.</p> <p>What is the most likely cause and indication for emergent HBOT?</p> <p>A. Intracranial abscess B. Central Retinal Artery Occlusion (CRAO) C. Diabetic foot ulcers D. Carbon monoxide poisoning E. Clostridium Myonecrosis – Gas Gangrene F. Compromised grafts and flaps G. Crush injury/Skeletal muscle compartment syndrome H. Decompression illness (DCS) I. Soft tissue/osteo radiation necrosis (STRN) J. Idiopathic sudden sensorineural hearing loss (ISSNHL) K. Arterial Gas Embolism (AGE) L. Necrotizing soft tissue infection - (NSTI) M. Chronic refractory osteomyelitis - (CROM) N. Severe anemia O. Thermal burns</p> <p>10. A 70-year-old male past medical history of hypertension, current smoker, atrial fibrillation and poorly controlled Diabetes type II presents to clinic with sudden onset loss of vision in his left eye that started an hour prior to arrival. He is diagnosed with central retinal artery occlusion.</p> <p>What is the recommended treatment window to initiate HBOT?</p> <p>A. 1 hour B. 24 hours C. 3 days D. 5 days</p>
--	--	--

Figure 1. Survey Questions.

REFERENCES

- Bove A. *Bove and Davis' Diving Medicine*. 4th ed. Philadelphia, PA: Saunders; 2008.
- Edmonds C, Bennett M, Lippman J, Mitchell S. *Diving and Subaquatic Medicine*. 5th ed. Boca Raton, FL: CRC Press; 2016.
- Moon R. *Hyperbaric Oxygen Therapy Indication*. 14th ed. North Palm Beach, FL: Best Publishing Company; 2019.
- Neuman T, Thom S. *Physiology and Medicine of Hyperbaric Oxygen Therapy*. 1st ed. Philadelphia, PA: Saunders; 2008.
- Whelan H, Kindwall E. *Hyperbaric Medicine Practice*. 4th ed. North Palm Beach, FL: Best Publishing Company; 2017.