

ORIGINAL ARTICLE

A CROSS-SECTIONAL STUDY OF MEDICAL PRACTITIONERS' KNOWLEDGE AND ATTITUDES ON HYPERBARIC OXYGEN THERAPY FOR CHRONIC WOUNDS IN KELANTAN, MALAYSIA

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ABSTRACT

This study assesses the knowledge and attitude of medical practitioners toward hyperbaric oxygen therapy (HBOT) in the treatment of chronic wounds. HBOT has been increasingly recognised as an adjunctive treatment for chronic, non-healing wounds, yet its adoption in clinical practice remains limited. A cross-sectional study was conducted involving 197 medical practitioners from various clinical departments in a tertiary hospital. A validated self-administered questionnaire was used to assess their knowledge and attitude toward HBOT. Descriptive statistics were used to summarise the data, and logistic regression analyses were performed to identify significant predictors. The results showed that 70.6% of respondents demonstrated good knowledge of HBOT, while 65.0% exhibited a positive attitude toward its use in chronic wound management. The only significant predictor of good knowledge was the duration of medical practice. A positive attitude was strongly associated with three things: seeing a higher volume of wound care patients each month, having prior experience referring patients for HBOT, and having more years in practice. Additionally, practitioners with good knowledge were 6.62 times more likely to have a positive attitude toward HBOT. Although most practitioners were knowledgeable and supportive, gaps remain in practical experience, particularly regarding cost-effectiveness and accessibility. These findings underscore the need for structured continuing medical education, postgraduate training, and clearer referral pathways to enhance the integration of HBOT into chronic wound management.

Keywords: Knowledge, Attitude, Chronic wound, Hyperbaric oxygen therapy, Medical practitioners

INTRODUCTION

Chronic wounds are defined as wounds that fail to progress in an orderly and timely manner to restore the anatomic and functional integrity of the injured site.¹ They impair an individual's ability to perform daily activities and cause significant psychosocial distress and financial burden.² The most common etiologies are venous, arterial, and diabetic foot ulcers.³ Management typically requires a multimodal approach, including local wound care, optimal glycemic control, revascularization of ischemic limbs, infection treatment, and pressure off-loading. Despite these strategies, chronic wounds often remain resistant to treatment and heal slowly.³

In Malaysia, diabetes mellitus is highly prevalent, with national surveys reporting rates of up to 17.5% among adults.⁴ According to the National Diabetes Registry (2013-2019), approximately 1.2% to 1.3% of patients with diabetes develop diabetic foot ulcers, while 0.6% to 0.7% undergo amputations.⁵ Globally, the lifetime risk of diabetic patients developing a foot ulcer is estimated to be around 15%, which underlines the seriousness of this complication.⁶ The financial

burden is also substantial. A recent economic analysis in Malaysia estimated the annual cost of managing diabetic foot ulcers per patient to be MYR5,981 in public healthcare settings and MYR8,581 in private settings.⁷ Older inpatient data also suggested costs of approximately RM190 per patient per acute episode for diabetic foot infection, excluding long-term follow-up and rehabilitation expenses.⁸ These figures highlight the need for effective adjunctive therapies to reduce chronic wound morbidity, prevent amputations, and relieve the economic strain on the healthcare system.

HBOT was introduced in Malaysia in 1996 when the Institute of Underwater and Hyperbaric Medicine at Armed Forces Hospital Lumut began operating the country's first hospital-based hyperbaric chamber. Initially, it was for decompression sickness, arterial gas embolism, and barotrauma.⁹ Since then, its application has expanded to conditions such as diabetic foot ulcers, chronic osteomyelitis, and carbon monoxide poisoning. HBOT is defined as a treatment where a patient breathes 100% oxygen intermittently while inside a pressurized chamber, typically at 2.0-2.5

atmospheres absolute (ATA), exceeding normal sea-level pressure.¹⁰

Evidence supports HBOT as an adjunct in chronic wound management. For example, Salama et al. (2017) reported that adding HBOT to conventional care significantly reduced ulcer size and complete healing in non-ischemic diabetic foot ulcers, with benefits persisting up to eight weeks post-treatment.¹¹ In 2021, a study demonstrated that HBOT reduced the need for amputations and accelerated healing in wound that persisted for more than 18 months.¹² Locally, Nik Ab Rahman NH et al. (2019) conducted a randomized controlled trial in Malaysia, demonstrating significantly greater wound size reduction in diabetic foot ulcers treated with HBOT compared to conventional wound care alone.¹³

Internationally, HBOT has been increasingly integrated into chronic wound care pathways, particularly in Europe, the United States, and parts of Asia. In the U.S., HBOT is included in Medicare reimbursement policies for selected diabetic foot ulcers, reflecting both recognition of its efficacy and the need for appropriate patient selection.¹⁴ In the United Kingdom, NICE guidelines acknowledge HBOT as a potential adjunct for non-healing ulcers, although its adoption remains limited due to cost-effectiveness concerns.¹⁵ Surveys among physicians in China and Europe have revealed variability in awareness, referral patterns, and attitudes toward HBOT, often influenced by chamber availability, institutional protocols, and postgraduate training exposure.¹⁶ These international experiences underline the importance of physician knowledge and institutional support in shaping HBOT utilization.

Furthermore, given the substantial investment required to establish and maintain HBOT facilities, it is critical to assess whether medical practitioners possess adequate knowledge and hold positive attitudes toward this therapy. Currently, we lack sufficient data on the perspectives of Malaysian physicians, which is a critical gap that prevents effective decisions regarding resource allocation, training, and expanding medical services.

Therefore, this study aimed to evaluate the knowledge and attitudes of medical practitioners toward the use of HBOT in chronic wound treatment. The results are anticipated to lead to focused educational programs, such as Continuing Medical Education (CME), the integration of these initiatives into postgraduate curricula, and the development of structured referral pathways. Policy-level efforts, including expanding HBOT services in tertiary centres and formulating local clinical guidelines, may further support the appropriate utilization of this therapy, ultimately improving chronic wound outcomes and reducing healthcare costs.

METHODS

A cross-sectional study was conducted at a tertiary teaching hospital on the northeast coast of Peninsular Malaysia from May 2023 to January 2025. **A convenience sampling approach was used**, and an English-language questionnaire was administered to assess the knowledge and attitudes of medical practitioners toward the use of HBOT for chronic wound treatment.

The target sample size was determined based on the study objectives and the number of eligible medical practitioners available within the selected departments during the study period. Eligible participants were recruited during scheduled CME sessions and through online questionnaire distribution.

Participants and Sampling

The sampling frame consisted of eligible medical practitioners working in the departments of emergency medicine, surgery, internal medicine, family medicine, orthopaedics, nuclear medicine, radiotherapy, oncology, and oral and maxillofacial surgery. The list of eligible participants was obtained from the respective departmental administrative offices. Practitioners undergoing specialized training in hyperbaric oxygen therapy and those who returned incomplete questionnaires were excluded.

Recruitment was conducted during scheduled CME sessions and through online distribution of the questionnaire. Conducting the study during CME minimized disruption to hospital services as most attendees were not on clinical duty. All eligible participants were invited to participate voluntarily in the study.

Attendees who declined were allowed to remain in the session without completing the survey. Those who consented received a standardized five-minute briefing on the study objectives and procedures, followed by written informed consent and distribution of the self-administered questionnaire.

Instrument

The questionnaire was adapted from Guo et al. (2005)¹⁶ and comprised three sections: sociodemographic data, four knowledge items on HBOT, and five attitude items toward HBOT. All items used a 5-point Likert scale and demonstrated high internal consistency (Cronbach's alpha = 0.92).

Composite scores were dichotomized into two levels for both knowledge and attitude. Good knowledge was defined as "some or more knowledge," corresponding to scores between 11 and 20, while poor knowledge was defined as "none or little knowledge", corresponding to scores between 4 and 10. Similarly, a positive

attitude was defined as a total score in the "agree" range of 18 to 25, whereas a negative attitude was defined as a total score in the "disagree" range of 5 to 17.¹⁶

Ethical Considerations

The Institutional Review Board of USM (Jawatankuasa Etika Penyelidikan Manusia (JEPeM)) approved this study (approval number USM/JEPeM/KK/23050396). Informed consent was obtained electronically from all participants before completing the questionnaire.

Data Analysis

Data were analysed using IBM SPSS Statistics version 26. Categorical variables were summarized as frequencies and percentages, while continuous variables were reported as mean $\pm$ standard deviation (SD). Associations were assessed using chi-square or Fisher's exact tests for categorical variables, and independent-sample t-tests for continuous variables.

Predictors of good knowledge and positive attitude toward HBOT in chronic wound management were identified using simple and multiple logistic regressions, with variables showing $p < 0.20$ in univariable analyses entered into multivariable models. The relationship between knowledge and attitude scores was examined using Pearson's correlation, while the association between dichotomized categories of good knowledge and positive attitude was analysed using logistic regression. A p -value < 0.05 was considered statistically significant.

Normality of continuous data was assessed through combined inspection of histograms, Q-Q plots, and the coefficient of variation. Linearity in the logit for continuous variables was evaluated using the Box-Tidwell test, where each variable was multiplied by its natural logarithm. The original and transformed terms were entered into the regression model. A p -value > 0.05 indicated linearity.

Multicollinearity was examined using the variance inflation factor (VIF). Age and years of practice had VIF values less than 5, indicating low multicollinearity. Although some studies adopted a cut-off of below 10, this study applied a stricter threshold of <5 .

RESULTS

Of the 200 questionnaires distributed, 198 were returned, yielding a response rate of 99%. However, only 197 were included in the final analysis because one response was incomplete. The study population consisted of 197 participants, with 53.8% female ($n = 106$) and 46.2% male ($n = 91$), and a mean age of 33.8 ± 3.2 years. Most were emergency medicine specialists (59.4%), saw more than 5 wound care patients/month (51.8%), and had never

encountered HBOT requests (92.9%) or made referrals (89.3%). Knowledge scores averaged $12.59 \pm 4.17/20$ (70.6% good knowledge), while attitude scores were $18.31 \pm 3.36/25$ (65.0% good attitude). Table 1 summarizes the demographics, specialty distribution, and key variables.

The second part of the questionnaire evaluated participants' attitudes toward HBOT in chronic wound treatment. Most respondents agreed that HBOT is effective (74.6%), safe (66.5%), reduces the risk of amputation (60.4%), and shortens the healing time (66.0%). However, only 39.1% agreed that HBOT is cost-saving, with 42.6% remaining neutral on this item. Neutral responses for other items ranged from 20% to 35%, while disagreement ranged from 4.1% to 18.3%. Mean scores across the five attitude items ranged from 3.26 to 3.90, reflecting generally positive attitudes toward HBOT. Table 2 summarises the attitude section.

Factors Associated with Knowledge and Attitude

Seven variables were assessed to determine their association with knowledge and attitude towards HBOT, namely gender, age, duration of medical practice, number of wound care patients per month, specialty, patient requests for HBOT, and prior referrals (Table 3). Of these, only the duration of medical practice was significantly associated with knowledge (8.49 ± 3.38 vs 7.00 ± 3.18 years, $p = 0.0046$). Age and number of wound care patients showed borderline significance ($p = 0.0870$ and $p = 0.0592$, respectively), while other factors were not significantly associated ($p = 0.2689$ - 1.0000). For attitude, significant associations were found with duration of medical practice ($p = 0.0443$), frequency of wound care patients ($p = 0.0444$), and previous HBOT referrals ($p = 0.0351$). Other variables, including gender, age, specialty, and patient requests, showed no significant associations ($p = 0.1702$ - 0.7740).

Predictors of Good Knowledge

All variables associated with knowledge and attitude at $p < 0.20$ were included in simple and multiple logistic regressions. The variables used to assess knowledge included the participants' age, duration of medical practice, and their monthly volume of wound care patients. Of the three variables, duration of medical practice emerged as a significant predictor of good knowledge (Table 4). Each additional year in medical practice was associated with a 1.16 times increase in odds of having good knowledge (95% CI, 1.05-1.29; $p = 0.0052$). After adjusting for age and number of wound care patients per month, duration of medical practice remained a significant predictor of good knowledge on multiple logistic regression. Each additional year in medical practice was associated with a 1.21 times increase in odds of having good knowledge (95% CI = 1.03-1.41, $p = 0.0187$).

Table 1: Descriptive statistics of the participants

Variables	<i>n</i>	%	Mean	SD
Gender				
Female	106	53.8		
Male	91	46.2		
Age (years)			33.76	3.21
Duration of medical practice (years)			8.05	3.38
Wound care patients per month				
≤5 patients	95	48.2		
>5 patients	102	51.8		
Specialty				
Emergency medicine	117	59.4		
Family medicine	29	14.7		
General surgery	19	9.6		
Oral maxillofacial surgery	5	2.5		
Orthopaedics	9	4.6		
Internal medicine	11	5.6		
Nuclear medicine, radiotherapy & oncology	7	3.6		
Voluntary patient request of HBOT				
No	183	92.9		
Yes	14	7.1		
Previous HBOT referral				
No	176	89.3		
Yes	21	10.7		
Total knowledge score			12.59	4.17
Levels of knowledge				
Poor knowledge	58	29.4		
Good knowledge	139	70.6		
Total attitude score			18.31	3.36
Attitude				
Poor attitude	69	35.0		
Good attitude	128	65.0		

Table 2: Attitude towards chronic wound treatment using HBOT among medical practitioners in HUSM

Item	Mean score ± SD	Strongly disagree or disagree	Neither agree nor disagree	Strongly agree or agree
(Q5) HBOT is an effective adjunctive treatment for chronic ischemic non-healing wounds.	3.90 ± 0.83	8 (4.1)	42 (21.3)	147 (74.6)
(Q6) HBOT is a cost-saving adjunctive treatment for chronic ischemic non-healing wounds.	3.26 ± 0.95	36 (18.3)	84 (42.6)	77 (39.1)
(Q7) HBOT is a safe treatment for chronic ischemic non-healing wounds.	3.77 ± 0.87	10 (5.1)	56 (28.4)	131 (66.5)
(Q8) HBOT decreases the chance of lower extremity amputation.	3.69 ± 0.79	9 (4.6)	69 (35.0)	119 (60.4)
(Q9) HBOT reduces the healing time for chronic ischaemic non-healing wounds.	3.69 ± 0.92	20 (10.2)	47 (23.9)	130 (66.0)

The variables used to assess attitude were age, duration of medical practice, number of wound care patients per month, and previous HBOT referral. The simple logistic regression identified three variables as significant predictors of a positive attitude. Every additional year in medical practice was associated with 1.10 times increased odds of having a good attitude (95% CI=1.00-1.21, $p=0.0465$). Medical practitioners who saw more than five wound care patients per month were 1.83 times more likely to have a good attitude

than those who saw five or fewer wound care patients per month (95% CI=1.01-3.31, $p=0.0454$). Meanwhile, medical practitioners with a history of previous HBOT referrals were 3.60 times more likely to have a positive attitude than those who had never made HBOT referrals (95% CI=1.02-12.69, $p=0.0463$). However, none of the three variables remained significant predictors of a good attitude on multiple logistic regression (all $p>0.05$).

Table 3: Factors associated with knowledge and attitude of medical practitioners in chronic wound treatment using HBOT in HUSM

Variables	Knowledge		p-value	Attitude		p-value
	Good	Poor		Good	Poor	
Gender, n (%)^a						
Female	76 (71.7)	30 (28.3)	0.7048	65 (61.3)	41 (38.7)	0.2459
Male	63 (69.2)	28 (30.8)		63 (69.2)	28 (30.8)	
Age (years)^b	34.01 ± 3.31	33.16 ± 2.89	0.0870	33.99 ± 3.37	33.33 ± 2.87	0.1702
Duration of medical practice (years)^b	8.49 ± 3.38	7.00 ± 3.18	0.0046*	8.41 ± 3.56	7.39 ± 2.93	0.0443*
Wound care patients per month, n (%)^a						
≤5 patients	61 (64.2)	34 (35.8)	0.0592	55 (57.9)	40 (42.1)	0.0444*
>5 patients	78 (76.5)	24 (23.5)		73 (71.6)	29 (28.4)	
Specialty, n (%)						
Other specialties	57 (71.3)	23 (28.7)	0.8602	55 (68.8)	25 (31.3)	0.3584
Emergency medicine	82 (70.1)	35 (29.9)		73 (62.4)	44 (37.6)	
Voluntary patient request of HBOT, n (%)^c						
No	129 (70.5)	54 (29.5)	1.0000	118 (64.5)	65 (35.5)	0.7740
Yes	10 (71.4)	4 (28.6)		10 (71.4)	4 (28.6)	
Previous HBOT referral, n (%)^a						
No	122 (69.3)	54 (30.7)	0.2689	110 (62.5)	66 (37.5)	0.0351*
Yes	17 (81.0)	4 (19.0)		18 (85.7)	3 (14.3)	

Table 4: Predictors of good knowledge of chronic wound treatment using HBOT among medical practitioners in HUSM

Predictor	Simple regression		p-value	Multiple regression		p-value
	OR	95% CI		OR	95% CI	
Age	1.10	0.99-1.23	0.0885	0.94	0.79-1.11	0.4528
Duration of medical practice	1.16	1.05-1.29	0.0052*	1.21	1.03-1.41	0.0187*
Wound care patients per month						
≤5 patients	1	Ref.	-	1	Ref.	-
>5 patients	1.81	0.97-3.37	0.0606	1.76	0.93-3.33	0.0804

*Significant results when $p < 0.05$.

Correlation between Knowledge and Attitude towards Chronic Wound Treatment Using HBOT

We determined the correlation between knowledge and attitude towards chronic wound treatment with HBOT by analysing both variables in two ways: as continuous scores and as categorical groupings. As a continuous parameter, the total knowledge scores were significantly and positively correlated with the total attitude scores, as determined by Pearson's correlation analysis. The strength of this correlation was fair ($r=0.4360$, $p<0.0001$).

As categorical parameters, the percentage of medical practitioners with good attitudes was larger among those with good knowledge than among those with poor knowledge (77.7% vs 34.5%). Further analysis using simple logistic regression revealed that medical practitioners with good knowledge had 6.62 times higher odds of having a good attitude (95% CI=3.38-12.97, $p<0.0001$).

DISCUSSION

This study showed that a slightly higher proportion of medical practitioners were familiar with the therapeutic mechanism of HBOT in wound healing (46.2%) compared to those who were not (33.0%), indicating a general lack of strong foundational knowledge. This gap may be attributed to the limited coverage of HBOT in undergraduate curricula and insufficient clinical exposure. Expanding continuing medical education and increasing access to HBOT-related resources and clinical guidelines may help improve knowledge and clinical application.

Less than half (43.7%) of the respondents were aware of the safety risks associated with HBOT (such as barotrauma, seizures, and hypoglycemia), with a substantial 34.5% reporting a lack of awareness. Knowledge of contraindications was relatively higher, with over 54% indicating moderate to high familiarity. Guo et al. found that 60% of respondents had adequate

knowledge of HBOT's mechanisms, applications, and risks.¹⁶ Similarly, Darandari et al. reported a relatively high overall knowledge score of 76.2% among physicians.¹⁷ In contrast, Evans et al. found that fewer than 10% of primary care physicians had adequate HBOT knowledge.¹⁸ Magri et al. also highlighted that general practitioners were 11.5 times less likely to answer HBOT-related questions correctly compared to hospital-based physicians.¹⁹ Ozkan further supported this, with 73.7% of respondents lacking sufficient knowledge, but most agreed that HBOT was effective (65.7%) and safe.²⁰

In Malaysia, referral for HBOT remains low, which may reflect limited awareness and restricted access. Currently, HBOT facilities are concentrated in a small number of tertiary hospitals, such as HUSM, and a few in military hospitals. This limited availability contributes to underutilization, as reflected by our finding that 89% of respondents had not referred patients for HBOT in the past year. Additionally, the absence of widely disseminated local guidelines may exacerbate referral hesitancy. International standards, such as those issued by the Undersea and Hyperbaric Medical Society (UHMS) and the European Committee for Hyperbaric Medicine (ECHM), list diabetic foot ulcers, chronic refractory osteomyelitis, and radiation-induced soft tissue injury among the accepted indications for HBOT.^{21,22} Lack of alignment with these internationally recognized criteria may explain the knowledge gaps and uncertainty observed among our respondents.

Despite the knowledge gap, the overall attitude toward HBOT was positive. Most respondents agreed that HBOT is effective (74.6%), safe (66.5%), reduces amputation risk (60.4%), and accelerates healing in chronic ischemic wounds (66.0%). These results suggest that many medical practitioners recognize the potential benefits of HBOT as an adjunct therapy. However, only 39.1% agreed that HBOT is cost-effective, and many were undecided. This finding aligns with Guo et al., who also reported disagreement regarding the cost-effectiveness of HBOT.¹⁶ Similarly, Evans et al. found insufficient knowledge about HBOT cost-effectiveness among primary care physicians.¹⁸ A Canadian study by Chuck et al. concluded that adjunctive HBOT for diabetic foot ulcers is cost-effective compared to standard care.²³

In our study, the duration of medical practice was significantly associated with better knowledge of HBOT. Each additional year of practice increased the odds of having good knowledge by 1.21 times (95% CI=1.03-1.41, $p=0.0187$). This finding aligns with Evans et al., who reported that physicians with more than 20 years of experience demonstrated better HBOT knowledge, likely due to greater clinical exposure.

In predicting attitude using simple logistic regression, the three significant factors were years of practice, monthly frequency of wound care patients, and prior experience with HBOT referrals. Evans et al. similarly found that referring patients for HBOT was significantly associated with a more favourable attitude.¹⁸ Practitioners managing more wound care cases may be more open to alternative therapies like HBOT due to the limitations of conventional treatments. However, none of the predictors remained significant in multiple regression analysis. Importantly, a strong association was found between knowledge and attitude, where 77.7% of those with good knowledge also had a positive attitude, compared to 34.5% among those with poor knowledge. This suggests that improving knowledge could directly enhance acceptance and utilization of HBOT. Guo et al. also reported a positive correlation between familiarity with HBOT and favourable attitudes toward its use in wound healing.¹⁶

The findings highlight the importance of education and structured exposure. Due to the limited number of HBOT centres in Malaysia, integrating HBOT into postgraduate training (e.g., surgery, family medicine, emergency medicine), providing structured CME modules, and organizing clinical rotations in existing units could help close the current educational gap. Simulation-based training and inter-hospital referral pathways may also strengthen awareness and improve utilization in clinical practice.

A limitation of this study is its single-centre design, which involves medical practitioners in Kelantan, and may restrict its generalizability. Broader studies in various settings, including private hospitals and rural clinics, are needed. Additionally, while several predictors were significant in univariate analysis, none remained significant in the multivariate model, likely due to limited sample size. Future research with larger samples is recommended.

Lastly, the study relied on self-reported knowledge and attitude, without assessing practical competence, which may not reflect actual clinical performance. Theoretical knowledge alone may not translate into clinical competence, and a lack of hands-on experience may impact decision-making and the effective use of HBOT in real-life clinical settings.

CONCLUSION

This study concluded that medical practitioners in HUSM, Kelantan, Malaysia, had good knowledge of chronic wound treatment using HBOT and demonstrated positive attitudes toward its use. Duration of medical practice was the only factor significantly associated with knowledge. In contrast, the duration of practice, number of wound care patients seen per month, and previous

HBOT referrals were significant factors for attitude. Despite the generally positive perceptions, significant knowledge gaps remain, particularly regarding the cost-effectiveness and safety profile of HBOT. Addressing these gaps through structured CME modules, incorporation into postgraduate curricula, and clear referral pathways could improve evidence-based use of HBOT. Policy efforts to expand access to HBOT services in tertiary centres and to establish local clinical guidelines may further support its appropriate utilization in chronic wound management.

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Conflict of interest

The authors declare they have no conflict of interest.

REFERENCES

1. Lazarus GS, Cooper DM, Knighton DR, et al. Definitions and guidelines for assessment of wounds and evaluation of healing. *Wound Repair Regen.* 1994;2(3):165-170.
2. Sen CK, Gordillo GM, Roy S, et al. Human skin wounds: a major and snowballing threat to public health and the economy. *Wound Repair Regen.* 2009;17(6):763-771.
3. Frykberg RG, Banks J. Challenges in the treatment of chronic wounds. *Adv Wound Care (New Rochelle).* 2015;4(9):560-582.
4. Institute for Public Health. *National Health and Morbidity Survey 2015*. Ministry of Health Malaysia; 2015.
5. Ministry of Health Malaysia. *National Diabetes Registry Report 2013-2019*. Ministry of Health Malaysia; 2020.
6. Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. *N Engl J Med.* 2017;376(24):2367-2375.
7. Goh Y, Tan JH, Liau SY, et al. Economic burden of diabetic foot ulcer in Malaysia. *Int Wound J.* 2022;19(6):1467-1476.
8. Pendsey S. Understanding diabetic foot. *Int J Diabetes Dev Ctries.* 2010;30(2):75-79.

9. Yusof MY, Kamarudin NA, Abdullah B, et al. History and development of hyperbaric oxygen therapy in Malaysia. *Med J Malaysia.* 2004;59(Suppl F):36-41.
10. Mathieu D. *Handbook on Hyperbaric Medicine*. Springer; 2006.
11. Salama AM, Abdo NM, El-Labban GM, et al. Hyperbaric oxygen therapy for non-ischemic diabetic foot ulcers. *J Wound Care.* 2017;26(12):688-693.
12. Thistlethwaite KR, Roberts H, Ashford R, et al. Long-term outcomes of hyperbaric oxygen therapy in chronic non-healing wounds. *Diabetes Res Clin Pract.* 2021;175:108795.
13. Nik Ab Rahman NH, Ahmad A, Kamarudin NA, et al. Hyperbaric oxygen therapy in diabetic foot ulcer: a randomized controlled trial. *Med J Malaysia.* 2019;74(6):500-506.
14. Thom SR. Hyperbaric oxygen: its mechanisms and efficacy. *Plast Reconstr Surg.* 2011;127(Suppl 1):131S-141S.
15. National Institute for Health and Care Excellence (NICE). *Hyperbaric Oxygen Therapy for Chronic Wounds: Interventional Procedures Guidance*. NICE; 2017.
16. Guo S, Counte MA, Schmitz H, Wu HS. Physician adoption of hyperbaric oxygen therapy in the treatment of chronic wounds. *Ostomy Wound Manage.* 2005;51(10):46-58.
17. Darandari JM, AlDahi SK, Farahat F. Knowledge, attitude and practice of hyperbaric O₂ therapy in the treatment of chronic non-healing wounds among physicians. *ResearchGate*. 2019 [cited 2024 Mar 4]. Available from: <https://www.researchgate.net/publication/336104069>
18. Evans AW, Gill R, Valiulis AO, et al. Hyperbaric oxygen therapy and diabetic foot ulcers: knowledge and attitudes of Canadian primary care physicians. *Can Fam Physician.* 2010;56(6):e237-44.
19. Magri K, Bigeni S, Azzopardi CP, et al. Hyperbaric oxygen therapy awareness within a doctor population. *Undersea Hyperb Med.* 2020;47(1):39-50.
20. Ozkan E, Ozgok Kangal MK, Ozkan R, et al. Knowledge, attitudes, and behaviors of family physicians towards hyperbaric oxygen therapy. *Life Med Sci.* 2024;10. doi:10.54584/lms.2024.53.

21. Undersea & Hyperbaric Medical Society. *Hyperbaric Medicine Indications Manual, 15th Edition*. Best Publishing; 2024.
22. Thom SR, Feldmeier J, Coldwell D, et al. Tenth European Consensus Conference on Hyperbaric Medicine: recommendations for accepted and non-accepted clinical indications and practice of hyperbaric oxygen treatment. *Diving Hyperb Med*. 2017;47(1):24-32.
23. Chuck AW, Hailey D, Jacobs P, et al. Cost-effectiveness and budget impact of adjunctive hyperbaric oxygen therapy for diabetic foot ulcers. *Int J Technol Assess Health Care*. 2008;24(2):178-83.