Trends in Medicare Costs of Hyperbaric Oxygen Therapy, 2013 through 2022

Introduction

Authors have criticized high costs of hyperbaric oxygen therapy (HBOT), particularly for wound healing indications that require dozens of treatments, such as diabetic foot ulcers (DFUs) and delayed radiation injuries.¹⁻⁵ Reviews of cost analyses have concluded there is limited/uncertain evidence that HBOT is cost-effective, although it sometimes may be less costly.^{3,4} However, the actual treatment costs of HBOT and the protocols for different indications have not been reported

We recently analyzed HBOT utilization and physician volume data from the Hyperbaric Oxygen Therapy Registry (HBOTR) hosted by the US Wound Registry (USWR) to understand trends in physician supervision for 2013-2022.⁶ The total annual number of treatments increased from 19,400 in 2013 to 31,389 in 2021 and decreased to 25,916 in 2022. The mean number of treatments/patient hovered around 25-28 sessions each year.⁶ In this secondary analysis of HBOTR data, we estimate the Medicare costs of HBOT based on standard treatment protocols and the annual mean number of treatments per patient reported by the registry.

Methods

From 2013-2022, the HBOTR collected electronic health record data for 262,055 HBOT sessions for all payers from 53 centers in 34 states.⁶ The mean number of treatments/patient/year was the total number of treatments/physician divided by the total number of patients. We analyzed the annual Medicare costs of HBOT/patient based on the annual mean number of treatments and a standard series of 40 treatments used in the prior authorization model.²

Medicare costs were defined as the physician fees plus the facility fees for HBOT. Current Procedural Terminology[®] (CPT) Code 99183 determined the physician fee.⁷ We multiplied the physician charge/treatment by the mean number of treatments/patient and per 40 treatments. More than 90% of HBOT is done in hospital outpatient departments;⁸ thus, we used the hospital Outpatient Prospective System (OPPS) fees to determine the fee for a single 30-minute segment of HBOT.⁹ Facility fees for HBOT were historically reimbursed by Healthcare Common Procedure Coding System code C1300, which was replaced with G0277 in 2015 to correspond to the CPT code 99183.^{10,11} Therefore, C1300 was used for 2013 and 2014, and G0277 was used for 2015-2022. The unadjusted national fee schedule was used for this charge, because the geographic index is too variable. While physician reimbursement via CPT code 99183 is only billable once per HBOT session, outpatient facilities typically bill 4 segments of 30-minute increments (120 minutes) per session.^{12,13} Therefore, the OPPS fee was quadrupled and multiplied by the mean number of treatments/patient and by 40 treatments/ patient. We adjusted 2013-2021 costs to 2022 inflation using the 2017-based Medicare Economic Index.^{14,15} The 2022-adjusted physician and facility charges were summed to obtain the total charge of HBOT/patient based on the mean number of treatments/year and the 40-treatment series.

Next, we calculated the 2022 cost to Medicare of standard treatment protocols for HBOT indications that are treated in the outpatient setting only (for which OPPS fee would apply), based on the number of treatments/indication reported by the Undersea and Hyperbaric Medical Society and by clinical studies and private payers (Table 2).^{2,16-21} The number of treatments/indication was multiplied by the cost of a single treatment session. If the typical number of treatments varied, the maximum usual number of treatments was used, as well as the maximum number that may be required beyond the usual number of treatments, except for DFUs and delayed radiation injuries, which usually receive 30-40 treatments, although up to 60 may be medically necessary.^{2,16-21}

Figure 1. Total annual treatment costs per patient of hyperbaric oxygen therapy.



Year

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ble 1. Medicare reimbursement cost data per patient (USD) for hyperbaric oxygen therapy (HBOT).											
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
an no. of txts/patient	25	25	27	27	26	26	25	27	28	27	
an 2017-based MEI	0.928	0.945	0.962	0.980	1.000	1.024	1,048	1.072	1.105	1.161	
tpatient facility fees ee/segment ^a ee/ 4 segments 1ean cost/patient ^b ost/patient/40 txts. ^b	\$107.75 \$431.00 \$13,480.36 \$21,568.58	\$110.93 \$443.72 \$13,628.54 \$21,805.67	\$109.29 \$437.16 \$14,244.96 \$21,103.65	\$107.71 \$430.84 \$13,781.16 \$20,416.54	\$110.19 \$440.76 \$13,304.78 \$20,468.89	\$114.16 \$456.64 \$13,461.07 \$20,709.34	\$114.40 \$457.60 \$12,673.51 \$20,277.62	\$115.04 \$460.16 \$13,455.82 \$19,934.54	\$119.28 \$477.12 \$14,036.40 \$20,051.99	\$121.80 \$487.20 \$13,154.40 \$19,488.00	
/sician fees ee/txt. 1ean cost/patient ^b ost/patient/40 txts. ^b	\$119.76 \$3,745.73 \$5,993.16	\$123.59 \$3,795.98 \$6,073.57	\$113.19 \$3,688.32 \$5,464.18	\$112.07 \$3,584.75 \$5,310.75	\$112.69 \$3,401.66 \$5,233.32	\$113.04 \$3,332.25 \$5,126.54	\$112.44 \$3,114.09 \$4,982.55	\$114.04 \$3,334.71 \$4,940.31	\$109.91 \$3,233.44 \$4,619.20	\$108.66 \$2,933.82 \$4,346.40	

MEI = Medicare Economic Index; txts. = treatments; ^aHealthcare Common Procedure Coding System reimbursement code C1300 was used for 2013 and 2014 and was replaced by G0277 in 2015; each charge is for one 30-minute segment of HBOT; ^badjusted for 2022 inflation using annual mean of quarterly 2023-based MEIs¹⁵

Results

Table 1 and Figure 1 summarize the Medicare reimbursement cost data and annual costs per patient based on the mean number of HBOT treatments/patient and 40 treatments/patient. Generally, all costs per patient decreased from 2013 through 2022, while the mean number of treatments/patient varied minimally. The facility cost/patient/40 treatments decreased by 10.7% in 2022 (Table 1). The physician cost/patient/40 treatments decreased by -37.8%. The total cost/patient/40 treatments decreased by 15.6% from \$27,561.74 to \$23,834.40. Table 3 and Figure 1 summarize the estimated cost ranges of standard treatment protocols per patient for outpatient HBOT indications for 2022. The lowest costs were for crush injury, compartment syndrome, and other acute traumatic ischemias (\$2,383.44-\$8,342.04/patient) The highest cost range was for DFUs and delayed radiation injuries (\$17,875.80-\$23,834.40 for 30 to 40 treatments, but could cost as much as \$35,751.60 for 60 treatments).

Table 2. Recommended no. of treatments (txts.) of hyperbaric oxygen indications treated in the outpatient setting.

lication ^a	Usual No. of Txts. ^b	Maximum No
ush injury/compartment syndrome/other acute traumatic ischemias ¹⁹⁻²¹	4	14
ntral retinal artery occlusion ¹⁹⁻²¹	4	20
abetic foot ulcers ^{c,16,17,19-21}	30-40	60
racranial abscess ¹⁹⁻²¹	21	42
crotizing soft tissue infections ¹⁹⁻²¹	30	30
fractory osteomyelitis ¹⁹⁻²¹	20	40
layed radiation injury (soft tissue and bony necrosis) ^{2,18-21}	30-40	60
mpromised grafts and flaps ¹⁹⁻²¹	20	20
opathic sudden sensorineural hearing loss ¹⁹⁻²¹	10	20

^asevere anemia is excluded, because its txt. regimen is variable and not well-defined;^{19-21 b}maximum no. of usual no. of txts. required; ^crepresents the indication for problem wounds, because it is the most commonly used indication

Figure 2. Estimated Medicare cost ranges of outpatient indications of hyperbaric oxygen per patient in 2022.



Key Takeaway Messages

- A 10-year review of national Hyperbaric Oxygen Therapy Registry (HBOTR) data demonstrated that the potential Medicare costs of HBOT are generally decreasing, largely due to a reduction in physician fees.
- In 2022, the estimated Medicare cost of a single session of HBOT was \$595.86, which seemingly refutes previous authors' claims that HBOT is cost-prohibitive based on a single session costing "thousands of dollars".
- In 2022, the HBOT cost to treat diabetic foot ulcers was \$17,875.80-\$23,834.50 per patient for 30-40 treatments, but the mean number of treatments per patient in the HBOTR was approximately 26, implying a potentially lower cost in the real-world population.

Discussion and Conclusion

In this secondary, real-world analysis of 10-year registry data representing, the mean number of treatments was approximately 26, which is considerably less than the standard 40-treatment regimen oft-cited but similar to the mean number of treatments (n = 27) reported in a limb salvage program.²² When considering how much different HBOT indications *should* cost Medicare (Figure 2), the costs are not nearly as high as literature has suggested. A single HBOT treatment does not costs "thousands of dollars",² but only \$595.86 (in 2022), assuming that the facility is billing 4-segments per session.

We estimated that the usual cost to treat a DFU with HBOT ranged from \$17,875.80 to \$23,834.40, which approaches costs from the aforementioned limb salvage program (\$17,000 per DFU) from 2005 through 2013.²² Among 96 patients receiving HBOT, 91.7% were spared amputations. Fifty-three patients who did not receive HBOT had a major lower extremity amputation. The first-year costs of amputation (\$66,300-\$73,000) were considerably higher than the HBOT costs, and nearly half (n = 25) died by the end of follow-up. HBOT for limb salvage was more cost-effective and less costly than an amputation.²²

In our analysis, the Medicare costs/patient for the mean number of treatments in 2022 (\$16,088.22), for a standard up-to-40 treatment course (\$23,834), and for a maximum number of treatments that may be medically necessary for DFUs and delayed radiation injuries (\$35,751.60) were relatively low in comparison with the annual costs of some prescription drugs. For example, a single 90 mg injection of ustekinumab, which is injected every 8 weeks to treat Crohn's disease, cost \$25.497.12 in March 2022; without insurance, its annualized cost was \$30,000-\$70,000.^{23,24} Among 7.3 million patients with digestive diseases covered by private insurance in 2016-2018, the highest annualized drug cost was for Hepatitis C at \$93,432.²⁵

The HBOT per-patient costs have decreased over the past decade, with 40 sessions per patient costing 15.6% ess in 2022 than in 2013 (Figure 1). This savings is mainly attributed to decreased physician costs, with physicians making 37.8% less per patient in 2022 than in 2013, due to the reduced conversion factors used in recent years to calculate physician fees (done so to offset the higher costs of Evaluation and Management office visit codes).²⁶

This study is limited by its retrospective design. It only includes data from 53 facilities in 34 states registered in the HBOTR in a 10-year period. However, the real-world registry data reflect patients covered by private payers (commercial plans), Medicaid, traditional Medicare, and Medicare Advantage. This was a secondary analysis of data related to physician trends, so we do not know the actual diagnoses requiring HBOT in the HBOTR, and the number of treatments was not disaggregated per patient. As such, we cannot determine the actual cost of each indication, which is why hypothetical cost ranges were estimated based on usual treatment protocols (Table 2). Facility fees were based on 4 segments, and some sessions may not have lasted the full 120 minutes.

This real-world analysis demonstrates that the actual cost of HBOT is not nearly as costly as the literature has implied, and the per-patient cost to Medicare is decreasing, mainly due to decreased physician costs. Although HBOT is most frequently used for wound healing indications, which usually require dozens of treatments, registry data show that the average number of treatments/patient is approximately 26, much lower than the standard 40treatment regimen. This cost analysis demonstrates that HBOT can be affordable for Medicare. References

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