EE254

Budget Impact of Telemonitoring (TM)-Enabled Care of Obstructive Sleep Apnea-Hypopnea Syndrome (OSAH) in the UK

Authors: Deger M[1], Yusuf Ibrahim S[2], Sagoo G[3], Wintrip T[3], Velickovic V[4]

1 ResMed Science Center, Munchen, Germany, 2 ResMed Science Center, Kista, Sweden, 3 ResMed Science Center, Didcot, UK, 4 BioMath Models Limited, London, UK

BACKGROUND AND RATIONALE

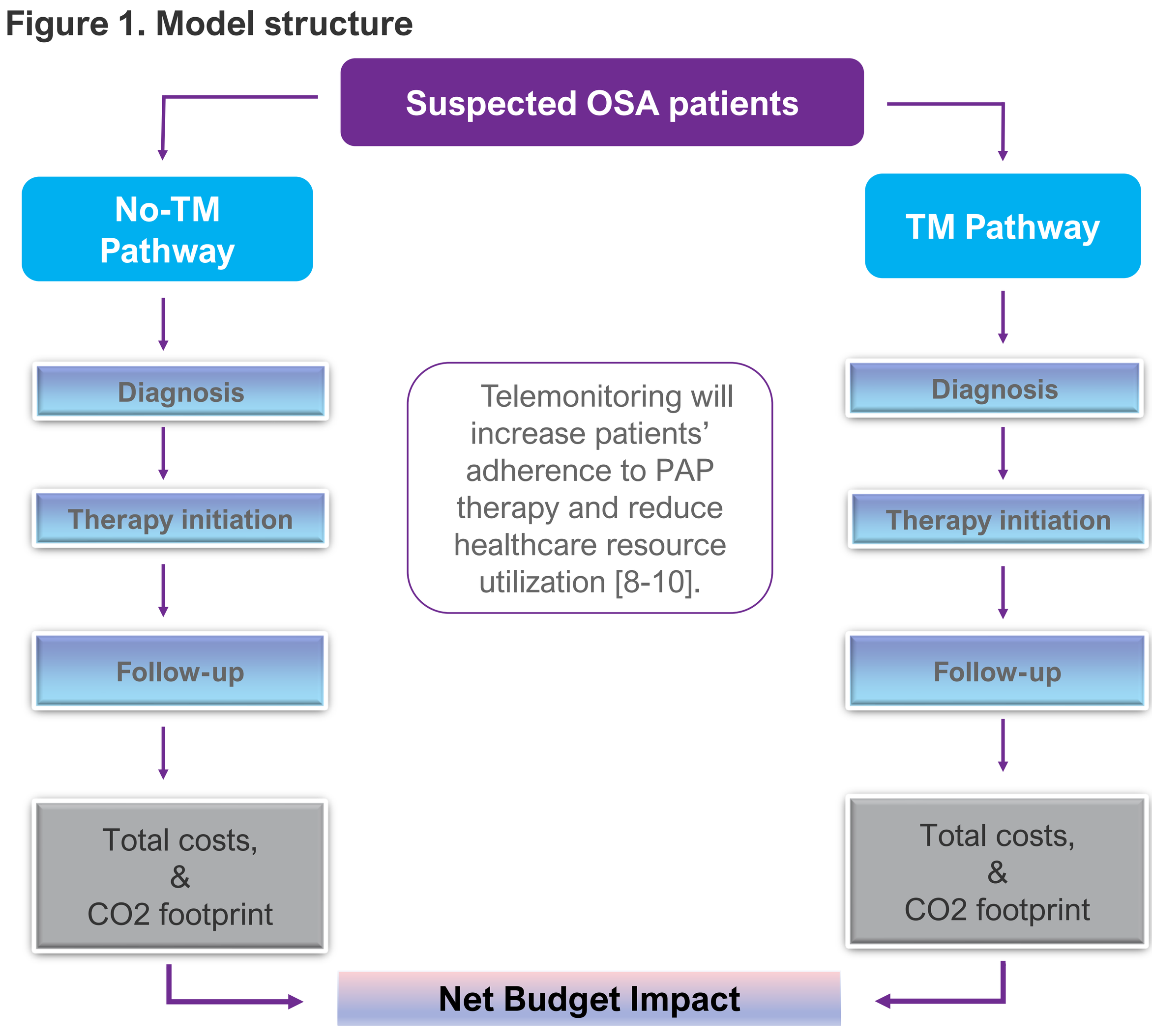
Obstructive sleep apnea hypopnea syndrome (OSAH) is a prevalent chronic condition that significantly develops adverse health outcomes [1]. In recent years, due to the COVID-19 pandemic, the introduction of digital health technologies has expanded the telemonitoring (TM) and management options for OSAH patients [2]. The utilization of TM for continuous positive airway pressure (CPAP) therapy for OSAH improves patient adherence [3] and enables the tracking of treatment progression and the identification of acute events [4]. The National Institute for Health and Care Excellence (NICE) OSAH guideline (2021) recommends TM for up to 12 months and tailoring follow-up to patients via face-to-face, video, or phone consultation with TM data [5]. NICE guidelines highlight the importance of TM at follow-up, but TM can also be used in diagnostic and therapy initiation stages. Even though the COVID-19 pandemic has led to increased utilization of TM, further research is required to fully understand the extent of this adoption and the associated cost implications. TM also has the potential to reduce unnecessary hospital visits and therefore reduce the carbon dioxide (CO2) emission which could contribute to National Health Institute's (NHS) 2040 net zero emission target.

The primary aim of this analysis was to examine the economic impact associated with the increased telemonitored-enabled care pathway encompassing diagnosis, therapy initiation, and follow-up stages from the perspective of the NHS. The secondary aim of this study was to evaluate the impact of telemonitored-enabled OSAH care in reduction of CO2 emissions.

METHODS

An MS Excel model was developed to assess the cost and CO2 impact of OSA treatment at three stages: diagnostic, therapy initiation, and follow-up. TM vs. no-TM was compared from the NHS perspective (Figure 1). TM was defined as clinician facing app, patient facing app, and video/tele conferencing.

Figure 1. Model structure



In the TM arm, 90% use was assumed as not all patients would be eligible depending on their access to technology. 650 new and 4.000 existing OSAH patients were included in the calculations to be representative of a mid-size sleep clinic in England with 4 healthcare professionals (HCP). 10% drop-out rate and 15% growth-rate for new setups were estimated. Costs included in the model were as follows: PAP device, consumables, TM platform (source: NICE breakdown costs), HCP wages (source: PSSR book), and healthcare resource utilization (HCRU) (source: NHS reference prices) (Table 1). The model calculated cost and CO2 impact for 1- and 5-years time horizons. For the CO2 impact travel to point of care is factored at diagnosis and therapy initiation stage. CO2 impact of shipping diagnostic tool is also factored per parcel.

Table 1. Cost inputs for resource utilization and carbon footprint

Input Variable	Value
Respiratory sleep study	£377,00 [6]
Hospitalisation visits	£3.898,42 [6]
Inpatient observation visits	£72,00 [6]
Emergency department visits	£119,00 [6]
APAP AirSense 10 AutoSet	£384,00 ResMed
Mask	£75,00 ResMed
Humidifier (HumidAir) + Accessories	£41,50 ResMed
AirView (Annual)	£45,00 ResMed
Average cost per working hour: nurse	£12,00 [6]
Average cost per working hour: hospital-based doctor	£72,20 [6]
Average cost per TM consultation	£14,23 [6]
Cost per kg of CO2 emission	£0,0025 [7]

TM pathway assumptions:

1) diagnostic delivery, return, and PAP machine delivery were done by post
2) for new patients, 1 visit was factored for adherent patients and 2 for non-adherent patients for follow-up; 40% of existing patients were on patient-initiated follow-up protocol (PIFUP) and the follow-up method was video or phone consultation with TM data for the 90% and 10% face-to-face.
3) higher adherence to PAP therapy and lower HCRU was assumed per the literature [8-10]. The base case scenario assumed an 16% improvement in patient adherence to CPAP therapy when telemonitored by a healthcare provider [8,9].
4) 8.3% inpatient visits reduction due to the increase in PAP usage, a 4.9% reduction in the annual incidence of outpatient visits, and a 10.6% reduction in the annual incidence of emergency department visits [10].

No-TM pathway assumptions:

1) diagnostic delivery, return, and PAP machine delivery required patient's travel to point of care
2) for new patients, 3 visits/annum for follow-up was assumed; 60% of existing patients on PIFUP. Follow-up method was 100% face-to-face

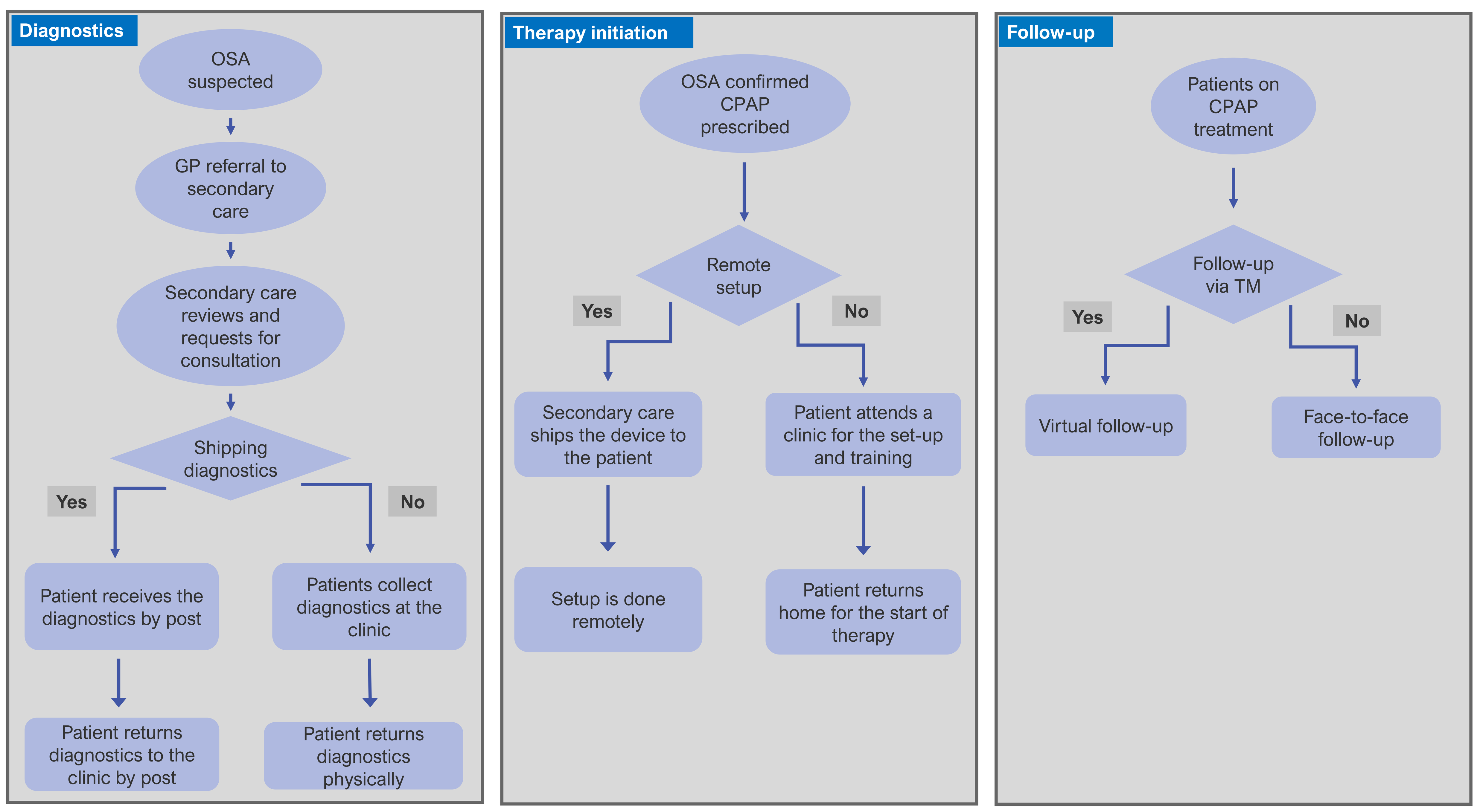
METHODS CONTINUED

Table 2. Input variables for calculating the impact on healthcare utilization due to TM and improvement in patient adherence to CPAP therapy

Input Variable	Value
Improved patient adherence to CPAP therapy when monitored remotely by a healthcare provider	16.0% [8,9]
Reduction in inpatient hospitalisation visits	8.3% [10]
Reduction in the incidence of inpatient observation visits	4.9%[10]
Reduction in emergency department visits	10.6%[10]

The OSAH patient pathways were carried out through expert opinions from the sleep clinics (Figure 2).

Figure 2. OSAH pathways



RESULTS

The cost impact of diagnostics, therapy initiation, and follow-up stages were -£43.945, -£82.363, and £149.863 for 1 year, respectively, with negative values indicating cost savings. The total budget impact was £23.554. The budget impact analysis also showed 258 days savings in healthcare providers' time and 103 tonnes of avoided CO2 emissions when switching to the telemonitoring care pathway of OSA (Table 3) and (Figure 2). Five years impact results are reported in Table 4 and Figure 4.

Table 3. One year budget and CO2 impact

Parameter	No-TM	TM	Budget Impact
CO2	159 tonnes	56 tonnes	-103 tonnes
Diagnostics	£356.555	£312.610	-£43.945
Therapy initiation	£235.482	£153.119	-£82.363
Follow-up	£1.066.845	£1.216.708	£149.863
Total costs	**£2.602.917**	**£2.636.701**	**£23.554**

Figure 3. One year costs

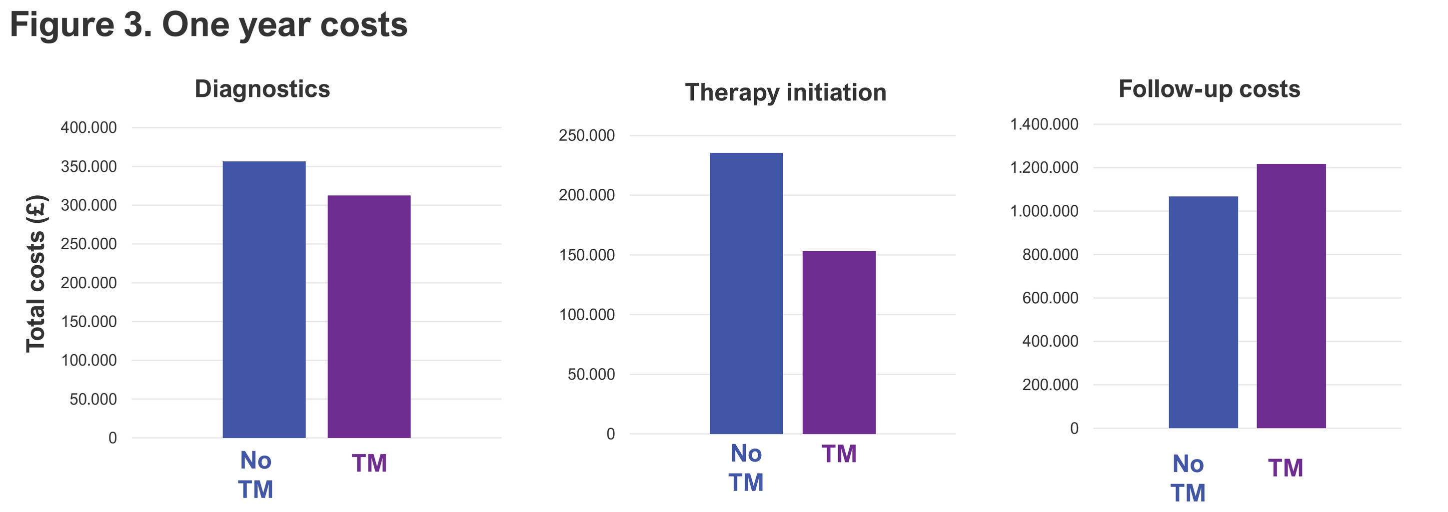
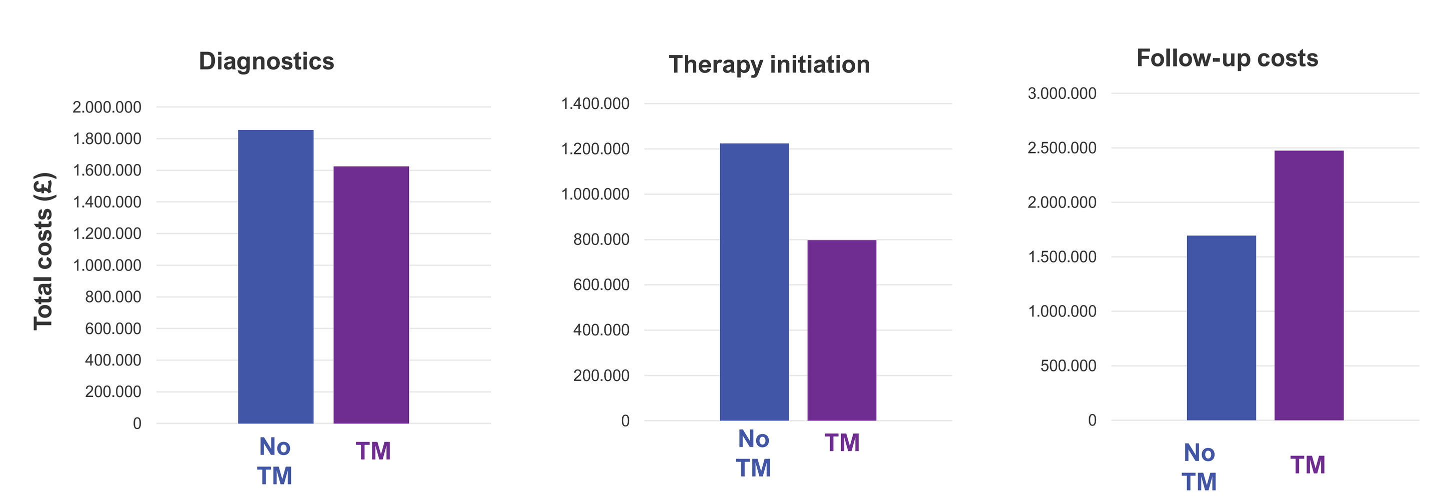


Table 4. Five year budget and CO2 impact

Parameter	No-TM	TM	Budget Impact
CO2	829 tonnes	289 tonnes	-540 tonnes
Diagnostics	£1.854.088	£1.625.573	-£228.515
Therapy initiation	£1.224.506	£796.219	-£428.287
Follow-up	£1.693.186	£2.472.472	£779.285
Total costs	**£5.629.470**	**£5.751.954**	**£122.483**

Figure 4. Five year costs



CONCLUSIONS

The cost of TM is partially offset by the reduction in HCRU as a result of increase in adherence to CPAP therapy and eliminating unnecessary visits for patients not having problems with their therapy or by resolving the problems remotely. Increasing the use of TM created CO2 reduction as well. For the future CO2 calculations, including production and cloud solutions CO2 impact will enable more robust environmental impact calculations.

ACKNOWLEDGEMENTS

The present study received funding from ResMed. The model utilized in this study was developed and executed by Biomath Models. The authors assumed complete responsibility for all aspects of content and editorial decision-making, actively participated in every stage of poster production, and provided their approval for the final edition.

REFERENCES

1. Benjafield AV, Ayas NT, Eastwood PR, et al. Estimation of the global prevalence and burden of obstructive sleep apnoea: a literature-base Pinnock H, Murphie P, Vogiatzis I, Poberezhets V.
2. Telemedicine and virtual respiratory care in the era of COVID-19. ERJ Open Res. 2022 Jul 25;8(3):00111-2022. doi: 10.1183/23120541.00111-2022. PMID: 35891622; PMCID: PMC9131135. d analysis. The Lancet Respiratory Medicine. 2019;7(8):687-698.'
3. Hu, Y., Su, Y., Hu, S., Ma, J., Zhang, Z., Fang, F., & Guan, J. (2021). Effects of telemedicine interventions in improving continuous positive airway pressure adherence in patients with obstructive sleep apnoea: a meta-analysis of randomised controlled trials. Sleep & breathing = Schlaf & Atmung, 25(4), 1761–1771. https://doi.org/10.1007/s11325-021-02292-5
4. Pépin, J.L., Tamisier, R., Hwang, D., Mereddy, S. and Parthasarathy, S. (2017) Does remote monitoring change OSA management and CPAP adherence?. Respirology, 22: 1508–1517. doi: 10.1111/resp.13183.
5. Obstructive sleep apnoea/hypopnoea syndrome and obesity hypoventilation syndrome in over 16s NICE guideline [NG202]. NICE. https://www.nice.org.uk/guidance/ng202
6. 2021/22 National Cost Collection for the NHS. NHS. https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection/
7. Tennison, I., Roschnik, S., Ashby, B., Boyd, R., Hamilton, I., Oreszczyn, T., Owen, A., Romanello, M., Ruyssevelt, P., Sherman, J. D., Smith, A. Z. P., Steele, K., Watts, N., & Eckelman, M. J. (2021). Health care's response to climate change: a carbon footprint assessment of the NHS in England. The Lancet. Planetary health, 5(2), e84–e92. https://doi.org/10.1016/S2542-5196(20)30271-0
8. PwC. Empowering the sleep apnea patient. How online patient engagement tools improve adherence to treatment. 2016.
9. Malhotra A, Crocker ME, Willes L, Kelly C, Lynch S, Benjafield AV. Patient Engagement Using New Technology to Improve Adherence to Positive Airway Pressure Therapy: A Retrospective Analysis. Chest. 2018;153(4):843-850. doi:10.1016/j.chest.2017.11.005
10. Kirsch DB, Yang H, Maslow AL, Stolzenbach M, McCall A. Association of Positive Airway Pressure Use With Acute Care Utilization and Costs. J Clin Sleep Med. 2019;15(9):1243-1250. doi:10.5664/jcsm.7912