inogen

PORTABLE OXYGEN CONCENTRATORS

Clinical Evidence Summary



Table of Contents

Patient Use Patterns of Portable Oxygen Concentrators **5**

Health and Economic Impact of Different Long-Term Oxygen Therapeutic Strategies in Patients with Chronic Respiratory Failure **6**

Long Term Domiciliary Oxygen Therapy in Chronic Hypoxic Cor Pulmonale Complicating Chronic Bronchitis and Emphysema **8**

Oxygen Supplementation and Cognitive Function in Long-COVID **9**

Oxygen Supplementation in Ambulatory Patients with Heart Failure **10**

THIS PAGE INTENTIONALLY LEFT BLANK

Patient Use Patterns of Portable Oxygen Concentrators

Glezer et al. Patient use patterns of portable oxygen concentrators. Pulmonary Therapy 2024;10(1):123-132.



Study Design

A retrospective analysis was conducted to assess portable oxygen concentrator (POC) usage among patients who used an Inogen One G5 POC in the United States.

This study aimed to:

- describe the patterns of use of POCS,
- analyze their compatibility to the prescribed oxygen therapy settings, and
- demonstrate the contribution of POC usage to get a standardized long-term oxygen therapy (LTOT).

Data from Inogen One G5 POCs was analyzed; data was obtained directly from devices returned for service or at the end of rental period, from data streamed via the mobile application, and from customer support/reimbursement eligibility assessments.

42% POC users are mobile 42% of the time when using battery power.

Results

The average POC daily usage was 4.29 hours.

- Slightly higher use on weekends.
- Over half of the patients used their POC at night.
- Most patients used their POC in multiple sessions during the day.

STUDY HIGHLIGHTS

- Data collected from this study showed that **patients frequently take advantage of POC portability**, being mobile almost 42% of the time when using battery power.
- Patients used their POCs when mobile and at rest.
- The battery and car charger may be indicative of patient mobility, displaying a higher BPM than while powered by a wall outlet.
- In addition to being ambulatory with their POCs, some patients adjusted their flow rate settings when switching between a mobile or non-mobile status.

Read the full study
https://link.springer.com/article/10.1007/s41030-024-00252-4

Health and Economic Impact of Different Long-Term Oxygen Therapeutic Strategies in Patients with Chronic Respiratory Failure

A French Nationwide Health Claims Database 2 (SNDS) Study.
Stanislav Glezer, Gregoire Mercler, Jean-Marc Coursler, Nicoleta Petrica, Marla Pini, Abhijith Pg

Pulmonary Therapy, 2024. doi: 10.1007/s41030-024-00259-x



Objective

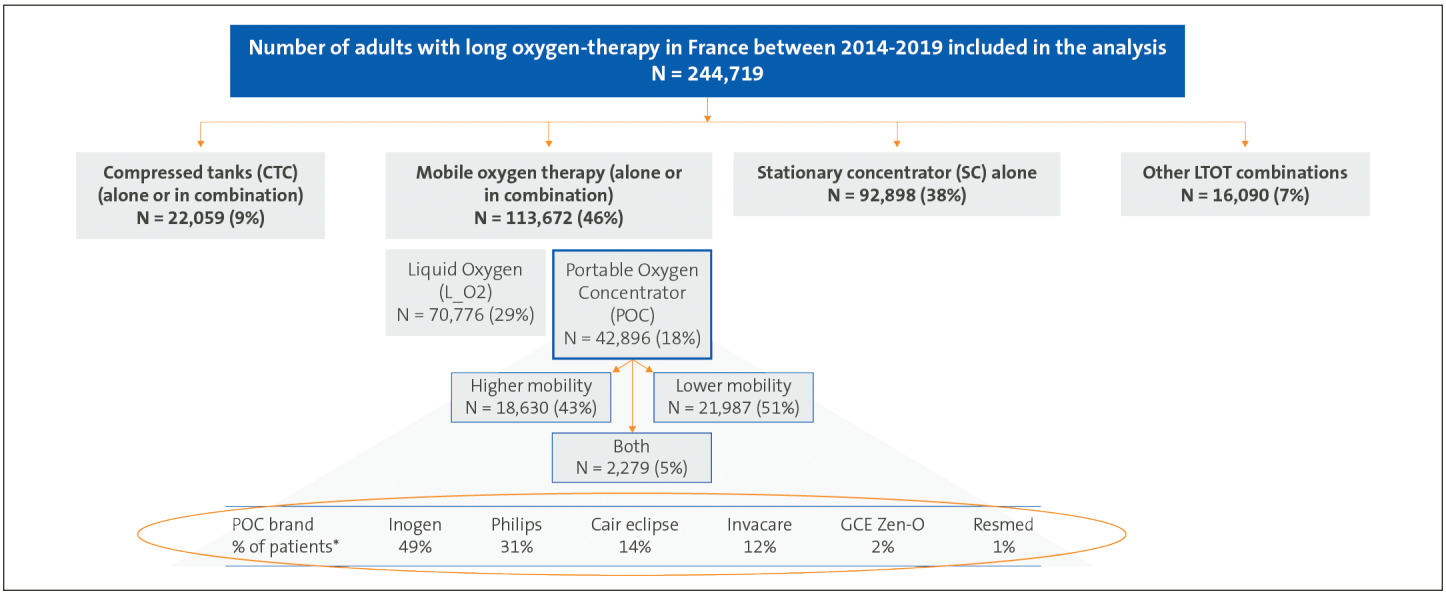
The primary objective of this study was to evaluate the health impact of Long-Term Oxygen Therapy (LTOT) according to the different oxygen-delivery strategies in patients treated for CRF due to COPD or other causes. The secondary objective was to estimate and compare cost-effectiveness of POCs based on the different level of autonomy.

Introduction

Long-term oxygen therapy (LTOT) is reported to improve survival in patients with chronic respiratory failure. We aimed to describe effectiveness, burden, and cost of illness of patients treated with portable oxygen concentrators (POC) compared to other LTOT options.

Methods

This retrospective comparative analysis included adult patients with chronic respiratory insufficiency and failure (CRF) upon a first delivery of LTOT between 2014 and 2019 and followed until December 2020, based on the French national healthcare database SNDS. Patients using POC, alone or in combination, were compared with patients using stationary concentrators alone (aSC), or compressed tanks (CTC) or liquid oxygen (LO2), matched based on age, gender, comorbidities, and stationary concentrator use.



Study Results

Among 244,719 LTOT patients (mean age 75 ± 12, 48% women) included, 38% used stationary concentrators, 46% mobile oxygen in the form of liquid oxygen (29%) and POC (18%), whereas 9% used compressed tanks. The risk of death over the 72-month follow-up was estimated 13%, 15%, 12% lower for patients in the POC group compared to stationary concentrators, compressed tanks, and liquid oxygen, respectively. In the POC group yearly mean total costs per patient were 5% higher and 4% lower compared to stationary concentrators and compressed tank groups, respectively, and comparable in the liquid oxygen group. The Incremental Cost-Effectiveness Ratio (ICER) of POC was €8,895, €6 288, and €13,152 per year of life gained compared to stationary concentrators, compressed tanks, and liquid oxygen, respectively.

STUDY HIGHLIGHTS

- First of its kind and largest study with an observed population of 244,719; possibly the first large study (n>150) evaluating the cost effectiveness of POC, used either alone or in combination, compared to other oxygen-delivery solutions.
- **Better survival and lower mortality were associated with the POC and HM groups.**
  - POC (alone or in combination) was better than other modalities (stationary concentrator, tank, liquid).
  - HM group (higher mobility/POC device battery run time greater than 5 hours, i.e., Inogen device) better than LM group (lower mobility/POC device battery run time less than 5 hours, i.e., non-Inogen device).
- **Healthcare costs were lower or comparable for the POC group compared to other modalities**; costs for the HM group were lower than the LM group; only applicable to Europe.
- **POCs, used alone or in combination, were cost-effective compared to stationary concentrator, tank, and liquid oxygen**; only applicable to Europe, based on the incremental cost-effectiveness ratio (ICER).

Considerations

- This was a retrospective observational study of the SNDS claims database, not a prospective clinical trial.
- This was an analysis of the French healthcare system; cost results do not apply to other countries.
- The analysis included a very large number of patients.
- The POC group was POC in combination with other modalities, not just POC alone.
- In the paper, “treated” = POC-equipped patients and “control group” = other modalities; groups are named by the index/first LTOT prescription and, with the exception of stationary concentrators, includes the modality alone and/or in combination with others (stationary concentrator is the only group that received only stationary concentrators).
- Propensity score matching was utilized to adjust for other factors (age, gender and comorbidities); this normalized baseline characteristics.
- Differentiation of the HM/Higher mobility and LM/Lower mobility groups was determined by POC device battery run time, i.e., HM = higher mobility/autonomy POC and LM = lower mobility/autonomy POC.
- **Of note, in the HM/Higher mobility group only Inogen devices were detected in the SNDS database**, as they were the ones approved for reimbursement within France during the study period.
- Cost data are only applicable to the French healthcare system and market.
- The effects seen were NOT a result of only POCs or only Inogen POCs.

Read the full study
https://link.springer.com/article/10.1007/s41030-024-00259-x

Long Term Domiciliary Oxygen Therapy in Chronic Hypoxic Cor Pulmonale Complicating Chronic Bronchitis and Emphysema

Report of the Medical Research Council Working Party

Lancet. 1981 Mar 28;1(8222):681-6. PMID: 6110912.



Study Design

This trial was planned to determine if oxygen, given for 15 hours in a day, over a three year period, could reduce mortality and improve exercise tolerance and working capacity.

The 87 patients, all under 70 years of age, who took part had chronic bronchitis or emphysema with irreversible airways obstruction, severe arterial hypoxaemia, carbon dioxide retention, and a history of congestive heart failure.

Patients in the treatment group received oxygen for at least 15 h a day, given by nasal prong, at a flow rate of 2 l/min, or at a higher flow rate if this was necessary to achieve a PaO2 > 60 mm Hg.

Results

Supplemental oxygen use improved survival: compared with 40 of the 45 controls, over the three-year period of the trial, 19 of the 42 patients who received oxygen died. In the longer term survivors, it would appear that long term oxygen therapy prevented progression of the fall in PaO_2 and in the rate or rise of pulmonary vascular resistance, without provoking further rise in $PaCO_2$.

STUDY HIGHLIGHTS

- Indicators such as **general improvement in the sense of wellbeing, improved appetite, and general alertness** were frequently found in those patients treated with domiciliary oxygen.
- Patients were not bed bound and many showed **considerable gains in both social and physical mobility**, many insisting that oxygen had made all the different to their lives.
- LTOT decreases mortality among patients who have COPD and severe resting hypoxemia.

Read the full study
https://pubmed.ncbi.nlm.nih.gov/6110912/

Oxygen Supplementation and Cognitive Function in Long-COVID

Christine Gagnon[1], Thomas Vincent[1], Louis Bherer[1], Mathieu Gayda[1], Simon-Olivier Cloutier[1], Anna Nozza[2], Marie-Claude Guertin[2], Patricia Blaise[1], Isabelle Cloutier[2], Alan Kamada[3], Stanislav GlezerID[3], Andre´ Denault[1], Jean-Claude TardifID

1 Montreal Heart Institute, Universite´ de Montre´ al, Montreal, Quebec, Canada,
2 Montreal Health Innovations Coordinating Center (MHICC), Montreal, Quebec, Canada,
3 Inogen, Goleta, California, United States of America



Background

Patients can experience persistent cognitive complaints and deficits in long-COVID. Inflammation and capillary damage may contribute to symptoms by interfering with tissue oxygenation.

Method

This was an exploratory pilot crossover study designed to describe the effects of supplemental oxygen (portable oxygen concentrator, POC) on cognitive performance and peripheral and cerebral oxygen saturation at rest and exercise. A total of 35 patients were recruited for this study, from which 21 (17 female and 4 male participants) were randomized (10 in Sequence 1 and 11 in Sequence 2). In Sequence 1 (POC-Control), 8 participants completed the study, whereas in Sequence 2 (Control-POC), 10 participants completed the study.

Conclusion

An advantage of POC over Control was observed for global cognition, attention, visuospatial/ executive performance and depressive symptoms. Results need to be validated in a larger study. Study limitations include preliminary findings from a small, short-term exploratory study (N=21; two 2-week treatment periods with 1-week washout). Results are descriptive and require confirmation in larger, long-term trials.

Participants' satisfaction using a visual analog scale for Inogen one G4 POC

70% of patients agreed or strongly agreed on accepting its weight and size.

95% of patients agreed or strongly agreed that the device was user friendly and did not require mental effort to use.

90% of patients agreed or strongly agreed that they did not encounter any difficulty with the oxygen delivery using POC

STUDY HIGHLIGHTS

- Overall, the treatment with Inogen one G4 POC seemed to improve performance on cognitive tests that measure global cognition, attention, working memory and executive functions. Interestingly, these cognitive functions have frequently been reported as being impaired in individuals with long- COVID
- Post-hoc analyses were performed for the MoCA by comparing both groups in Period 1. Participants obtained better performances under Inogen G4 POC than Control for the total MoCA score, as well as for the visuospatial/executive and attention subscores.
- Inogen G4 POC appeared to have an advantage over Control on symptoms frequently reported in long-COVID, mental health issues and more specifically, depressive symptoms

Read the full study
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0312735

Oxygen Supplementation in Ambulatory Patients with Heart Failure: A Randomized Proof-Of-Concept Study

Maxime Tremblay-Gravel[1], Anna Nozza[2], Stanislav Glezer[3], Alan Kamada[3], Jacinthe Boulet[1], Marie-Claude Parent[1], Geneviève Giraldeau[1], Normand Racine[1], Anil Nigam[1], Isabelle Cloutier[2], Raynold Pierre[2], Jean-Lucien Rouleau[1], Eileen O'Meara[1], Anique Ducharme[1], and Jean-Claude Tardif [1,2]

1 Montreal Heart Institute, Université de Montréal, 5000 Bélanger Est, Montreal, Quebec, Canada H1T 1C8
2 Montreal Health Innovations Coordinating Center, Montreal Heart Institute, Université de Montréal, 5000 Bélanger Est, Montreal, Quebec, Canada H1T 1C8
3 Inogen Inc., 859 Ward Dr #200, Goleta, CA 93111, USA



Background

The aims of this study were to describe the short-term effects of oxygen therapy on the physiological response and symptoms during ambulation in patients with chronic heart failure (HF).

Methods

In this pilot, cross-over, randomized study, subjects with chronic HF underwent two 6-min walk tests (6MWTs) on the same day. They were randomized to either receive oxygen through a portable oxygen concentrator (POC ON) during the first test and no oxygen (POC OFF) during the second test, or vice versa. Endpoints included (i) peripheral oxygen saturation, (ii) heart rate, and (iii) modified BORG scale. A linear mixed model for repeated measures was used for comparisons. A total of 20 participants were included, aged 70 ± 10 years, with the mean left ventricular ejection fraction 33% ± 10% and N-terminal pro-B-type natriuretic peptide 1115 ± 1625 pg/mL.

Conclusion

Study results suggest that for a same amount of physical activity, supplemental oxygen can improve peripheral oxygen saturation and breathlessness in symptomatic patients with chronic HF. Results are from a small, exploratory, single-day randomized crossover study (N=20) conducted at the Montreal Heart Institute. Findings reflect outcomes measured at 3 and 6 minutes during exercise in patients with heart failure and may not apply to all patients.

Read the full study
https://academic.oup.com/ehjopen/article/5/3/oeaf074/8160590

STUDY HIGHLIGHTS

On Oxygen Saturation

- The oxygen saturation was significantly higher with POC ON compared to POC OFF at baseline (SpO2 +0.8%, 95% CI 0.2% to 1.3%) and during exercise (3 minutes, SpO2 +3.4%, 95% CI 1.8% to 5.0%; 6 minutes, +2.8%, 95% CI 2.2% to 3.3%).
- The difference in oxygen saturation was no longer observed three minutes after exercise (which represents 3 minutes after cessation of supplemental oxygen for the POC ON sequence; SpO2 -0.2%, 95% CI -1.1 to 0.8%).
- Heart rate recovery has also been correlated with peak oxygen consumption and improved cardiovascular outcomes in HF patients.

On Exercise and fatigue

- Perceived exertion and fatigue were similar at baseline, and was significantly lower with POC ON during exercise at 3 minutes (-0.7; 95% CI -1.2 to -0.2), and 6 minutes (-0.75; 95% CI -1.1 to -0.4).
- Decreased perception of exertion and fatigue carried on 3 minutes into recovery, where the Borg scale value was on average -0.5 (95% CI -0.8 to -0.2) points lower when the 6MWT was performed with POC ON.
- The heart rate recovery tended to be better in patients with POC ON compared to POC OFF (15.2 bpm and 7.8 bpm, respectively)

THIS PAGE INTENTIONALLY LEFT BLANK

PM260020 EN_EX_GBL | Rx Only. © 2026 Inogen, Inc. | 859 Ward Drive, Suite 200, Goleta, CA 93111
Inogen® is a trademark of Inogen, Inc. The usage of any Inogen, Inc. trademark is strictly forbidden without the prior consent of Inogen, Inc. All other trademarks are trademarks of their respective owners or holders.

www.inogen.com