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Oxygen Concentrators versus Standard Tank Oxygen for Patients Requiring Oxygen Supplementation: Clinical and Cost-Effectiveness

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About CADTH: CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.

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Research Questions

1. What is the comparative clinical effectiveness of oxygen supplied via concentrators (oxygen 93) versus oxygen supplied by standard tank storage (oxygen 99) for patients requiring oxygen supplementation?
2. What is the cost-effectiveness of oxygen supplied via concentrators (oxygen 93) versus oxygen supplied by standard tank storage (oxygen 99) for patients requiring oxygen supplementation?

Key Findings

No evidence was identified regarding the comparative clinical effectiveness or cost-effectiveness of oxygen supplied via concentrators (oxygen 93) versus oxygen supplied by standard tank storage (oxygen 99) for patients requiring oxygen supplementation.

Methods

Literature Search Methods

A limited literature search was conducted by an information specialist on key resources including Medline via OVID, the Cochrane Library, the University of York Centre for Reviews and Dissemination (CRD) databases, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were oxygen concentrators, tank or general storage. No filters were applied to limit the retrieval by study type. The search was also limited to English language documents published between January 1, 2010 and November 26, 2020. Internet links are provided where available.

Selection Criteria

One reviewer screened literature search results (titles and abstracts) and selected publications according to the inclusion criteria presented in Table 1. Full texts of study publications were not reviewed.

Table 1: Selection Criteria

Population	Patients (all ages) requiring oxygen gas supplementation (e.g., patients undergoing anesthesia, patients with respiratory distress)
Intervention	USP oxygen 93; oxygen concentrators (may be written as: central oxygen concentrator supply, oxygen concentrator-based supply system, Oxygen 93 manufactured using oxygen concentrators, Oxygen93)
Comparator	USP oxygen 99; standard large storage of oxygen via tanks
Outcomes	Q1: Clinical effectiveness (e.g., patient SpO2, FiO2, clinical interventions required for patient stabilization, morbidity, mortality) Q2: Cost-effectiveness (e.g., quality adjusted life years, incremental cost effectiveness ratios)
Study Designs	Health technology assessments, systematic reviews, randomized controlled trials, non-randomized studies, economic evaluations

FiO2 = fraction of inspired oxygen; SpO2 = oxygen saturation; USP = United States Pharmacopeia.

Results

No health technology assessments, systematic reviews, randomized controlled trials, or non-randomized studies were identified regarding the comparative clinical effectiveness of oxygen supplied via concentrators (oxygen 93) versus oxygen supplied by standard tank storage (oxygen 99) for patients requiring oxygen supplementation. Furthermore, no economic evaluations were identified regarding the cost-effectiveness of oxygen supplied via concentrators (oxygen 93) versus oxygen supplied by standard tank storage (oxygen 99) for patients requiring oxygen supplementation.

References of potential interest that did not meet the inclusion criteria are provided in the appendix.

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

No literature identified.

Randomized Controlled Trials

No literature identified.

Non-Randomized Studies

No literature identified.

Economic Evaluations

No literature identified.

Appendix — Further Information

Randomized Controlled Trials

Alternative Intervention – Portable Oxygen Concentrators

1. Moretta P, Molino A, Martucci M, et al. Subject preferences and psychological implications of portable oxygen concentrator versus compressed oxygen cylinder in chronic lung disease. *Respir Care*. 2020 Jul 28.
PubMed: PM32723859

2. Khor YH, McDonald CF, Hazard A, et al. Portable oxygen concentrators versus oxygen cylinder during walking in interstitial lung disease: a randomized crossover trial. *Respirology*. 2017 Nov;22(8):1598-1603.
PubMed: PM28544460

Non-Randomized Studies

Unclear or No Comparator

3. Duke T, Pulsan F, Panauwe D, et al. Solar-powered oxygen, quality improvement and child pneumonia deaths: a large-scale effectiveness study. *Arch Dis Child*. 2020 Oct 16.
PubMed: PM33067311

4. Fashanu C, Mekonnen T, Amedu J, et al. Improved oxygen systems at hospitals in three Nigerian states: an implementation research study. *Pediatr Pulmonol*. 2020 Jun;55(Suppl 1):S65-S77.
PubMed: PM32130796

5. Cisse FA, Damien C, Bah AK, et al. Minimal setting stroke unit in a Sub-Saharan African public hospital. *Front Neurol*. 2019 Aug;10:856.
PubMed: PM31447769

6. Gray AZ, Morpeth M, Duke T, et al. Improved oxygen systems in district hospitals in Lao PDR: a prospective field trial of the impact on outcomes for childhood pneumonia and equipment sustainability. *BMJ Paediatr Open*. 2017 Aug;1(1):e000083.
PubMed: PM29637121

Alternative Intervention – Portable Oxygen Concentrators

7. Su CL, Lee CN, Chen HC, Feng LP, Lin HW, Chiang LL. Comparison of domiciliary oxygen using liquid oxygen and concentrator in northern Taiwan. *J Formos Med Assoc*. 2014 Jan;113(1):23-32.
PubMed: PM24445009

Alternative Outcome – Costs

8. Bradley BD, Light JD, Ebonyi AO, et al. Implementation and 8-year follow-up of an uninterrupted oxygen supply system in a hospital in The Gambia. *Int J Tuberc Lung Dis*. 2016 Aug;20(8):1130-1134.
PubMed: PM27393551

9. Munhoz AS, Adde FV, Nakaie CM, Doria Filho U, Silva Filho LV, Rodrigues JC. Long-term home oxygen therapy in children and adolescents: analysis of clinical use and costs of a home care program. *J Pediatr (Rio J)*. 2011 Jan-Feb;87(1):13-18. PubMed: PM21180778

10. Duke T, Peel D, Wandi F, Subhi R, Sa'avu M, Matai S. Oxygen supplies for hospitals in Papua New Guinea: a comparison of the feasibility and cost-effectiveness of methods for different settings. *P N G Med J*. 2010 Sep-Dec;53(3-4):126-138. PubMed: PM23163183

Review Articles

11. Hardavella G, Karampinis I, Frille A, Sreter K, Rousalova I. Oxygen devices and delivery systems. *Breathe*. 2019 Sep;15(3):e108-e116. PubMed: PM31777573

12. Papali A, Adhikari NKJ, Diaz JV, et al. Infrastructure and organization of adult intensive care units in resource-limited settings. In: Sepsis management in resource-limited settings [Internet]. Cham (CH): *Springer*. 2019;Chapter 3:31-68. PubMed: PM32091695

13. Duke T, Graham SM, Cherian MN, et al. Oxygen is an essential medicine: a call for international action. *Int J Tuberc Lung Dis*. 2010 Nov;14(11):1362-1368. PubMed: PM20937173

Additional References

14. Allen M. Oxygen on site. Third Ed. Rock Hill (SC): BeaconMedæs; 2017 Jan: https://mgpho.org/resources/SiteUploads/20190213/oxygen%20on%20site%20booklet%20v3.pdf?token=cb250a2a1f7b4b3c6f40f69d47048dca Accessed 2020 Dec 02.
See: Concentrators and the Pharmacopoeias (p.9)

15. Zehrung D, Keith B, Mazia G, et al. Proposal to include an additional listing of oxygen for management of hypoxemia on the WHO Model List of Essential Medicines and List of Essential Medicines for Children. Seattle (WA): PATH; 2016 Nov: https://www.who.int/selection_medicines/committees/expert/21/applications/s1_oxygen_ind.pdf?ua=1 Accessed 2020 Dec 02.
See: Annex VI - Comparison of oxygen cylinders and concentrators as the basis for oxygen systems

16. Prien T, Meineke I, Zuchner K, et al. Oxygen 93: a new option for European hospitals. *Br J Anaesth*. 2014 Nov;113(5):886-7. PubMed: PM25326481