



**Centre for Clinical Effectiveness**

Enhancing patient outcomes through clinical application of the best available evidence

**EVIDENCE CENTRE**  
**CRITICAL APPRAISAL**  
Series 2003: Therapy

# **Oxygen versus medical air for nebulisers in patients with COPD**

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*Southern Health*

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## **SUMMARY STATEMENT**

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**Publication of materials** – please use the following format when citing this article:

Higgins, S. (2003). Oxygen versus medical air for nebulisers in patients with COPD. (The Centre for Clinical Effectiveness), Available:

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[Accessed:Access date...]

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## REQUEST

Should COPD patients that have a hypoxic respiratory drive or retain CO<sub>2</sub> be given oxygen or medical air to vaporize nebulised therapy?

## REQUESTED BY

**Judith Allat**, ANUM, Ward 44 North, Monash Medical Centre, Clayton.

## METHODOLOGY

### Search Strategy

The Centre for Clinical Effectiveness defines the 'best available evidence' as that research we can identify that is least susceptible to bias. We determine this according to pre-defined National Health and Medical Research Council (NHMRC 2000) criteria (see Appendix 1).

First, we search for systematic reviews, evidence based clinical practice guidelines, health technology assessments and randomised controlled trials. If we identify sound, relevant material of this type, the search stops. Otherwise, our search strategy broadens to include studies that are more prone to bias, less generalisable or have other methodological difficulties. We include case-control and longitudinal cohort studies in our critical appraisal reports. While we cite observational and case series studies, narrative reviews and consensus statements in our reports, we do not critically appraise them. Such studies can produce accurate results but they are generally too prone to bias to allow determination of their validity beyond their immediate setting.

### Details of Evidence Request

Patients (Subjects): Hospitalised patients with COPD who retain CO<sub>2</sub>

Intervention: Nebulised therapy driven with oxygen

Comparisons: Nebulised therapy driven with medical air

Outcomes: CO<sub>2</sub> retention or respiratory drive

### Search terms

(see Appendix 2 for exact search strategy)

Patients (Subjects): COPD, obstructive lung disease, emphysema, chronic bronchitis, type 2 respiratory failure, hypercapnia, carbon dioxide retention

Intervention: Nebuliser, nebulizer, vaporiser, vaporizer, inhalation therapy, oxygen therapy, oxygen

Comparison: -

Outcome: -

## Resources Searched

We searched the following databases and internet websites:

Resource	Issue or Access Date
The Cochrane Library (Online)	Issue 3, 2003
Biological Abstracts	1980 to August 2003
Medline (OVID)	1966 to September week 3, 2003
EBM Reviews (OVID) -	
Cochrane Database of Systematic Reviews	3 <sup>rd</sup> quarter, 2003
Database of Abstracts of Reviews of Effectiveness	3 <sup>rd</sup> quarter, 2003
Cochrane Controlled Trials Register	3 <sup>rd</sup> quarter, 2003
CINAHL (OVID)	1982 to September week 3, 2003
PREMEDLINE (OVID)	September 29, 2003
Australasian Medical Index	Accessed Sept 30, 2003
National Guideline Clearinghouse	Accessed Sept 30, 2003
Scottish Intercollegiate Guideline Network	Accessed Sept 30, 2003

## Refinements, searching & reporting constraints

We included items that were available to us on 31<sup>st</sup> October 2003. The following inclusion and exclusion criteria were applied:

### *Inclusion criteria*

Controlled trials of oxygen compared to medical air to deliver nebulisers in patients with obstructive airways disease

### *Exclusion criteria*

Level IV Evidence (See Appendix 1).

Studies published in a language other than English

Studies conducted in countries markedly different from Australia

Studies presenting data published in another report

## RESULTS

From our sources we identified 3 potentially relevant articles. We obtained the full text of these articles to determine their relevance.

After examination of the 3 articles, the following were excluded as detailed below:

Reason for exclusion	Number
Level IV evidence	2
No comparison with medical air	1
<b>Total</b>	<b>3</b>

No articles remained for appraisal after exclusions.

Based on our searching we are reasonably confident these articles represent the most relevant findings published to date.

The most appropriate study design to answer this question would be a randomised controlled trial of patients with COPD who had evidence of CO<sub>2</sub> retention or a hypoxic respiratory drive, where patients were randomised to receive medical air or oxygen to deliver the nebulisers. Data could be sought for CO<sub>2</sub> levels, respiratory rate and final outcome. Evidence could also be provided by a cohort study of a group of patients with COPD who had nebulisers delivered by medical air, compared to those who had nebulisers delivered with oxygen. Investigators would need to be confident that patients did not differ in important characteristics, however.

The citations of excluded studies are listed below, in order of publication date. The study by Charoenratanakul et al (1995) compared the effects of three different flow rates of oxygen (4, 6 and 8 L/min) in patients with stable COPD. These authors reported that CO<sub>2</sub> levels rose and respiratory rate declined with higher flow rates. Cameron et al (1992) assessed CO<sub>2</sub> levels in 16 patients after an oxygen delivered nebuliser and concluded that no patients deteriorated clinically, despite a 6.7 mmHg rise in CO<sub>2</sub> (which was not statistically significant). Lim & Tan (1985) reported a series of six patients who experienced severe hypercapnia after oxygen delivered nebulisers.

Note that none of these studies were appraised, as their design is generally too prone to bias to allow determination of validity beyond their immediate setting. None of the studies identified provided any comparison of medical air compared to oxygen for the delivery of nebulised therapy.

## REFERENCES

### ARTICLES NOT CRITICALLY APPRAISED

Charoenratanakul S, Borrirukwanit K, Lekuthai S, Satyawiwat W & Dejsomritrutai W (1995). Is driving oxygen flow rate clinically important for nebulizer therapy in patients with COPD? *Journal of the Medical Association of Thailand* 78(12): 670-676.

Cameron P, Coleridge J, Epstein J & Teichtahl H (1992). The safety of oxygen-driven nebulisers in patients with chronic hypoxaemia and hypercapnia. *Emergency Medicine* 4(3): 159-162.

Lim TK & Tan WC (1985). Acute carbon dioxide narcosis during inhalational therapy with oxygen powered nebulizers in patients with chronic airflow limitation. *Annals of the Academy of Medicine, Singapore* 14(3): 439-441.

# APPENDIX 1

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## Levels Of Evidence

Based on "How to use the evidence: assessment and application of scientific evidence" (National Health & Medical Research Council, Canberra, 2000):

Level I		Evidence obtained from a systematic review (or meta-analysis) of all relevant randomised controlled trials.
Level II		Evidence obtained from at least one randomised controlled trial.
Level III	-1	Evidence obtained from pseudo-randomised controlled trials (alternate allocation or some other method).
	-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case control studies or interrupted time series with a control group.
	-3	Evidence obtained from comparative studies with historical control, two or more single-arm studies or interrupted time series without a parallel control group.
Level IV		Evidence obtained from case series, either post-test or pretest/post-test.

## APPENDIX 2

### Search strategy

	Search terms for CINAHL
1	Exp Lung Diseases, Obstructive/ OR COPD.mp
2	Exp Bronchitis/ OR chronic bronchitis.mp
3	Exp EMPHYSEMA/ OR emphysema.mp
4	Type 2 respiratory failure.mp
5	Hyperca\$.mp
6	(carbon dioxide AND (retention OR narcosis).mp
7	OR/ 1-6
8	Exp Administration, Inhalation/ OR exp "Nebulizers and Vaporizers"/
9	Nebuliser\$ OR nebulizer\$.mp
10	Vaporiser\$ OR vaporizer\$.mp
11	OR/ 8-10
12	Exp Oxygen therapy/ OR exp/ oxygen/ OR oxygen.mp
13	11 AND 12
14	7 AND 13

Similar terms, appropriately transformed were used in other databases.