Home oxygen therapy: From Therapy to Fad.

Professor Alan J Crockett  PSM
"We are all Oxy-Philes. That is, we literally love oxygen."

Dr Petty, 2004
Hypoxia is a reduction of oxygen supply to a tissue below physiological levels despite adequate perfusion of the tissue by blood.

Anaemic Hypoxic is that due to reduction of the oxygen-carrying capacity of the blood owing to decreased total haemoglobin or altered haemoglobin constituents.

Histologic hypoxia is that due to impaired use of oxygen by tissues.

Hypoxic hypoxia is that due to insufficient oxygen reaching the blood.

Shunt/perfusion hypoxia is that due to failure to transport sufficient oxygen because of inadequate blood flow.
• History
• Facts
  – Evidence
  – Guidelines
  – Survival data
  – Quality of life
• Fads and fallacies
• Problems
“My reader will not wonder, that, after having aftertained the superia goodnefs of dephlogifticated air by mice living in it, and the other tefts above mentioned, I fhould have the curiofity to tafte it myself. I have gratified that curiofity, by breathing it, drawing it through a glafs-syphon, and by this means, I reduced a large jar full of it to the ftandard of common air. The feeding of it to my lungs was not fenfibly different from that of common air; but I fancied that my breaft felt peculiarly light and eafy for fome time afterwards. Who can tell but that, in time, this pure air may become a fafhionable article in luxury. Hitherto only two mice and myself have had the privilege of breathing it.”

New discoveries in pneumatics. 1801
Oxygen in therapeutics. A treatise explaining the apparatus, the material and the processes used in the preparation of oxygen and other gases with which it may be combined; also, its administration and effects, illustrated by clinical experience of the author and others, C.E. Ehinger, Chicago: W.A. Chatterton & Co., 1887
PRICE OF OFFICE TREATMENT “The fee for this Treatment is $30.00 per month, payable in advance. This calls for thirty treatments, whether in as many consecutive days or otherwise.”

COMPOUND OXYGEN - ITS ORIGIN AND DEVELOPMENT, by Drs. Starkey and Palen, 1888.

Drs. Starkey and Palen, Reception Parlour 1888
COMPOUND OXYGEN - ITS ORIGIN AND DEVELOPMENT, by Drs. Starkey and Palen, 1888.
"Partial anoxia means not a mere slowing down of life, but progressive and perhaps irreparable damage to living structure."

Haldane JS. BMJ 1919; 65-71
“Intermittent oxygen therapy is like bringing a drowning man to the surface of the water - occasionally”
Alvan L Barach

- 1922. Was the first to systematically use oxygen in hospital for the treatment of lobar pneumonia.
- Modified the first oxygen tent and developed the first portable oxygen devices.

Barach AL. JAMA 1922; 79: 693-699
Alvan Barach
First to conceive of ambulatory oxygen therapy

Barach AL. The therapeutic use of oxygen. JAMA 1922; 79:693-99
Alvan Barach 1920’s

FIG. 1. THE LATE ALVAN BARACH MODELING A SMALL HIGH-PRESSURE OXYGEN CYLINDER CAPABLE OF BEING TRANSFILLED FROM A LARGER COMPRESSED GAS CYLINDER (FROM REFERENCE 4.)
Emphasized the rational, physiological basis for oxygen therapy

- Indication for home oxygen is anoxia
- Home oxygen therapy should not be ceased if it fails to relieve dyspnoea
Hazards from oxygen inhalation

– Elimination of nitrogen
– Depression of respiration
– Depression of circulation
– Depression of cerebral cortical function
– Oxygen toxicity

Comroe JH, Dripps RD. The Physiological Basis for Oxygen Therapy. Charles C Thomas Publisher, Toronto 1950
Portable oxygen apparatus

Cotes JE, Gilson JC. Lancet 1956; 1:822-26
Thomas Petty

– 1967 evaluated the effects of long-term oxygen in reversing pulmonary hypertension and secondary polycythaemia.

– 1970 studied survival of patients receiving oxygen for cor pulmonale and/or heart failure.

First prototype of the membrane-type oxygen concentrator 1973
Continuous oxygen therapy (at least 15 hours/day)

- $\text{PaO}_2 \leq 55 \text{ mmHg at rest, awake, breathing air}$
- $\text{PaO}_2 \ 56–59 \text{ mmHg at rest, awake, breathing air if:}$
  - Polycythaemia (haematocrit $> 0.55$)
  - Clinical or electrocardiographic evidence of pulmonary hypertension and/or
  - Episodes of right heart failure

McDonald CF, Crockett AJ, Young IH. MJA 2005; 183(9): 474
Intermittent oxygen therapy

- **COPD**
  - Use in patients not fulfilling criteria for continuous oxygen therapy is controversial
  - Treatment of exercise-induced hypoxaemia may improve quality of life in patients with significant exercise induced desaturation
  - Evidence of short-term benefit should be demonstrated before this therapy is recommended.

- **Acute asthma**
- **Significant hypoxaemia during air travel**
- **Intractable dyspnoea**

McDonald CF, Crockett AJ, Young IH. MJA 2005; 183(9): 474
Nocturnal oxygen therapy

- May be indicated for demonstrated oxygen desaturation during sleep to \( \text{SpO}_2 \leq 88\% \) (\( \text{PaO}_2 < 55 \text{ mmHg} \)) for more than a third of the night or in the presence of hypoxia-related sequelae

McDonald CF, Crockett AJ, Young IH. MJA 2005; 183(9): 474
• Assess: Evaluate for correct oxygen flow rate at rest and during exercise
• Know the patient and their goals
• Know the options
• Choose oxygen devices that will allow the patient to achieve their goals
• Reinforce education and need for compliance.
• Adequate provision of home care – Respiratory nurse
• Appropriate selection of equipment

Petty TL Guide to Prescribing Home Oxygen
National Lung Health Education Program
National Lung Health Education Program 2002-2005
• Stressed the importance of using evidence from randomised controlled trials (RCT's)

• 1980s Led to the establishment of an international collaboration: The Cochrane Collaboration
NOTT and MRC survival curves
**Comparison: 01 Continuous oxygen therapy versus nocturnal oxygen therapy**

**Outcome: 01 Mortality**

<table>
<thead>
<tr>
<th>Study</th>
<th>Continuous n/N</th>
<th>Nocturnal n/N</th>
<th>Peto OR (95%CI Fixed)</th>
<th>Weight %</th>
<th>Peto OR (95%CI Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 at 12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOTT 1980</td>
<td>12 / 101</td>
<td>21 / 102</td>
<td></td>
<td>100.0</td>
<td>0.53 [0.25, 1.11]</td>
</tr>
<tr>
<td>Subtotal(95%CI)</td>
<td>12 / 101</td>
<td>21 / 102</td>
<td></td>
<td>100.0</td>
<td>0.53 [0.25, 1.11]</td>
</tr>
<tr>
<td>Chi-square 0.00 (df=0) P: 1.00 Z=-1.68 P: 0.09</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| 02 at 24 months |                |               |                       |          |                       |
| NOTT 1980     | 23 / 101       | 41 / 102      |                       | 100.0    | 0.45 [0.25, 0.81]     |
| Subtotal(95%CI) | 23 / 101       | 41 / 102      |                       | 100.0    | 0.45 [0.25, 0.81]     |
| Chi-square 0.00 (df=0) P: 1.00 Z=-2.66 P: 0.008 |               |               |                       |          |                       |

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Nocturnal oxygen versus room air for mild to moderate hypoxaemia


Survival probability on home oxygen: studies versus South Australian COPD patients 1977-2002

- NOTT O₂ 12 hr (n = 102)
- NOTT O₂ 24 hr (n = 101)
- MRC O₂ 15 hr (n = 42)
- MRC control (n = 45)
- Robert et al (n = 50)
- Multicenter study (n = 259)

SA males
SA females

Months
Relative survival probability of South Australian and French COPD patients on long-term oxygen therapy 1977-2002

Cranston JM, Nguyen AM, Crockett AJ. Respirology, 2004; 9, 237-242
South Australian home oxygen patients survival probability by diagnosis 1977-2002
Survival probability COPD females age <70 years by mean hours of concentrator usage 1991-2002

p<0.05 Log rank test
Survival probability COPD males age <70 years by mean hours of concentrator usage 1991-2002

- hrs ≥19, n=28
- hrs <19, n=40
Survival probability on home oxygen by BMI (kg/m²) COPD patients 1995-2004

BMI >35, n=17
BMI 27-35, n=84
BMI 23-26, n=117
BMI ≤22, n=108

p<0.001 Log rank test
• Eaton 2005
• Prospective, RCT (12 week cross-over)
• Intervention - ambulatory oxygen
• N=50
• Significant improvements in all CRQ and HAD domains

Health related quality of life. COPD patients on LTOT
Mean change in CRQ score from baseline to 3, 6, 12, 18 and 24 months of LTOT.
1991-2002 LTOT

[Bar chart showing mean change from baseline for Fatigue, Emotion, and Mastery in Males and Females at 3, 6, 12, 18, and 24 months.]

University of South Australia
Targeting an oxygen saturation below 90% with the use of current oximeters in extremely preterm infants was associated with an increased risk of death.

NEJM, 2013, 30\textsuperscript{th} May.
Fads and Fallacies – The myth of oxygen

“A widespread belief that oxygen can both treat disease and improve health in ways that go far beyond any evidence base.”

Recreational Oxygen

“Oxygen fans tout the benefits of oxygen as reducing stress, increasing energy and alertness, lessening the effects of hangovers, headaches, and sinus problems, and generally relaxing the body.”

FDA Consumer magazine. November-December 2002
The oxygen myth is the foundation of industries that sell:

– oxygen-enriched air in ‘oxygen bars’
– oxygenated water as an invigorating drink
– ‘canned’ oxygen
– antiphlogistic tablets
– sideline oxygen for football players
– hyperbaric chambers for all kinds of illnesses where there is no evidence base

Over 75 different products

- Oxygen bar equipment
- Oxygen bubbler
- Oxygen aroma headsets
- Nasal cannulas (nose hoses)
- Aromas for headsets
- Aromas for bubblers
- Oxygen face lift

- O₂ to go
- O₂ air purifier
- O₂ sauna
- O₂ water maker
- O₂ brain machine
- + many others
Oxygen Bars
"Exciting, New To Australia, Internationally Proven!! "

Welcome to Utopia Oxygen Bars, Australia’s leading supplier of quality oxygen bar equipment producing 92% pure oxygen.

Utopia Oxygen Bars can be set up quickly and easily in a minimum of space. With service and support from Utopia, it’s simple to deliver oxygen to your customers and profits to your business!

We’re known for our customer service and 24-hour support, solid guarantees, and stunning design. We also guarantee to beat any competitors price.

If you’re considering getting into the lucrative oxygen bar business, you’ve come to the right place.

“Flavoured" Oxygen

“Peppermint, bayberry, cranberry, wintergreen. Breath mints? Scented candles? No--they're "flavours" of oxygen offered at your local oxygen bar. Since oxygen bars were introduced in the United States in the late 1990s, the trend has caught on, and customers are coming to bars around the country to sniff oxygen through a plastic hose (cannula) inserted into their nostrils. And many patrons opt for the "flavoured" oxygen produced by pumping oxygen through an aroma en route to the nose.”

FDA Consumer magazine. November-December 2002
O₂ Aromas

Nasal cannula or colour coordinated nose hose

Nose Hoses

Nasal cannula or colour coordinated nose hose: Neon (assorted colours), Blue, Orange, Yellow, Red & Pink.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 to 1000</td>
<td>£0.39 each</td>
</tr>
<tr>
<td>1001 to 5000</td>
<td>£0.35 each</td>
</tr>
<tr>
<td>5000 - 9999</td>
<td>£0.33 each</td>
</tr>
<tr>
<td>10000 +</td>
<td>£0.28 each</td>
</tr>
</tbody>
</table>

COLORFUL NOSE HOSES

All our hoses are now individually wrapped

Price Reduced

NH1: Nose Hoses Neon (100 to 1000)
NH2: Nose Hoses Neon (1001 to 5000)
NH3: Nose Hoses Neon (5001 to 9999)
NH4: Nose Hoses Neon (10000 +)

Our colorful nose hoses come in a variety of colors.
Soft and comfortable.
Pricing can be found at

Place an order

http://www.portalmarket.com/spafacials.html
Oxygenated Water

Claims:
- Extra supply of oxygen to the body for over-all health improvement
- Enhancement of the brain function for clearer thinking and alertness
- More oxygen to the muscle to increase energy and performance
- More oxygen to skin cells for healthier, younger looking skin
- Enhanced metabolism and waste removal
- Enhancement of the body's ability to fight bacteria and viruses
- Better absorption of vitamins, minerals and other nutrients
O₂ Shooters

“AFTER PARTY HERBAL HANGOVER REMEDY”

Estimated gross profit at $1.50 per minute

### Oxygen Bar Revenue Stream

<table>
<thead>
<tr>
<th>Number of 10 min Sessions (Daily)</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross profit at $1.50 min</td>
<td>$15.00</td>
<td>$75.00</td>
<td>$150.00</td>
<td>$375</td>
<td>$750</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>Consumables and GST</td>
<td>$2.41</td>
<td>$12.05</td>
<td>$24.10</td>
<td>$60.25</td>
<td>$120.50</td>
<td>$241.00</td>
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<tr>
<td>Net Profit</td>
<td>$12.59</td>
<td>$62.95</td>
<td>$125.90</td>
<td>$314.75</td>
<td>$629.50</td>
<td>$1,259.00</td>
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<tr>
<td>Weekly Net Profit</td>
<td>$88.13</td>
<td>$440.65</td>
<td>$881.30</td>
<td>$2,203.25</td>
<td>$4,406.50</td>
<td>$8,813.00</td>
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<tr>
<td>Annual net profit</td>
<td>$4,582.76</td>
<td>$22,913.8</td>
<td>$45,827.60</td>
<td>$114,569.00</td>
<td>$229,138.00</td>
<td>$458,276.00</td>
</tr>
</tbody>
</table>

"Oxygen To Go"

Claims

- “After all kinds of workouts; swimming, golf, tennis, soccer, track sports, aerobics, mountain climbing, etc.
- When you have to be in places with a lot of dust and smog.
- To revive your tired body after long-distance driving and stressful days of hard work.
- After excessive drinking.
- For those who have difficulty in breathing.
- High Altitude Relief.”

http://www.o2planet.com/02toGo.html
Sideline oxygen

• 1 RCT
  – Effects of 100% oxygen on performance of professional soccer players
    – N=12
    – Randomised, double-blind crossover study
    – Room air or 100% oxygen inhalation, five minutes at rest between
    – 2 bouts of exhaustive exercise
    – Conclusion: no advantage 100% oxygen for short periods after exercise on recovery or on subsequent exercise performance.
    – Subjects unable to identify which gas they received

Recreational oxygen in ‘healthy’ people

- No RCTs support recreational oxygen use in healthy people.
- Oxygen bars may be located in nightclubs or casinos where smoking is common.
- Safety of inhalation of oily substances.
- The sterility of the aerosol generated cannot be guaranteed.
- Concentration of oxygen inhaled?
- Undiagnosed COPD.

FDA Consumer magazine November-December 2002
Therapeutic uses of hyperbaric oxygen

• **Strong scientific evidence**
  
  **Main treatment**
  - Decompression sickness
  - Arterial gas embolism
  - Severe carbon monoxide poisoning or smoke inhalation
  
  **Adjunctive treatment**
  - Prevention and treatment of osteoradionecrosis
  - Improved skin graft and flap healing
  - Clostridial myonecrosis

• **Suggestive scientific evidence**
  
  **Adjunctive treatment**
  - Refractory osteomyelitis
  - Radiation induced injury
  - Acute traumatic ischaemic injury
  - Prolonged failure of wound healing
  - Exceptional anaemia from blood loss

Leach RM et al. *BMJ* 1998;317:1140-1143
• **Fire hazard** (Most common fatal complication)

• **General**
  - Claustrophobia
  - Reversible myopia
  - Fatigue, Headache, Vomiting

• **Barotrauma**
  - Ear damage, Ruptured middle ear
  - Sinus damage
  - Lung damage

• **Oxygen toxicity**
  - Brain: Convulsions, Psychological
  - Lung: Pulmonary oedema, Haemorrhage, Pulmonary toxicity, Respiratory failure (may be irreversible when due to pulmonary fibrosis)

• **Decompression illness**
  - Decompression sickness
  - Pneumothorax
  - Gas emboli
• Smoking

“... a friend came around and she phoned the ambulance. I mean I couldn’t, I couldn’t even have a cigarette it was that bad. I tried and tried to inhale it but it wouldn’t come.”
Smoking and home oxygen
• Oxygen should be regarded as a drug.

• Oxygen should be prescribed for defined indications in which its benefits outweigh its risks.

• Prescriptions should specify the dose, method and duration of delivery and the patient’s response to this therapy is monitored.

• Oxygen supplementation during ambulation.

• Continuous oxygen therapy in patients with moderate hypoxia

• Nocturnal Oxygen for desaturation during sleep.

• Detailed, individualised prescription for LTOT

NO OXYGEN
NEXT
10 MILES