Choosing the Right Oxygen System for Your Patient

By
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DeVilbiss Healthcare

Disclaimer

Appendix 3 Declaration of Vested Interest Form

Name of presenter: David Henry RRT
Name of employer: DeVilbiss Healthcare Inc

Definition: A presenter may have an interest in or affiliation with an organization, which does not prevent fair or fair from making a presentation. However, the audience must be informed of this relationship before the presentation of the activity. For this purpose, the apparent conflict of interest is defined as being significant and having an interest in a product to be discussed directly or indirectly during the presentation, being an employee of an industry that makes a product to be discussed or being an employee of a company that makes a product directly or indirectly to study the product that will be discussed in the presentation.

I recognize that I must follow all guidelines and criteria regarding vested interest.

[ ] No, I have no real or perceived conflicts of interest that relate to this presentation.

[ X ] Yes, I have the following real or perceived conflicts of interest that relate to this presentation:

Describe real or perceived conflicts of interest that relate to this presentation

I am an employee of DeVilbiss Healthcare and we manufacture respiratory home care equipment.

My presentations are not product specific but relate to the principles involved in best utilizing certain technologies in the home environment.

Leading Causes of Death and Relation to Tobacco Use

Question #1

Who has the highest incidence of COPD in the US population?

a. Men
b. Women
c. Teenagers
d. All the above
COPD Age Adjusted Deaths by Year and Gender

COPD Prevalence By Geography

COPD Prevalence By Race/Ethnicity/Poverty

Question #2

Who has the highest death rates and hospitalizations related to prevalence of COPD?

a. Men
b. Women
c. Teenagers
d. None of the above
**COPD Prevalence Hospitalizations and Death Rates**

Figure 3: Hospitalization and death rates for COPD among adults aged 18 and over, United States, 1999-2007.

**Diagnosis of COPD Gold Standards**

- **SYMPTOMS**
  - Shortness of breath
  - Chronic cough
  - Sputum

- **EXPOSURE TO RISK FACTORS**
  - Tobacco
  - Occupation
  - Indoor/outdoor pollution

**SPIROMETRY:** Required to establish diagnosis.

**Assessment of COPD**

Assess symptoms:

- Use the COPD Assessment Test (CAT)
- or
- mMRC Breathlessness scale

**CAT COPD Assessment Test**
**Modified MRC (mMRC) Questionnaire**

Please tick in the box that applies to you (one box only):

- Grade 0: I only get breathless with strenuous exercise.
- Grade 1: I get short of breath when hurrying or walking up a slight hill.
- Grade 2: I walk slower than people of the same age because of breathlessness, or I have to stop for breath when walking on my own pace on the level.
- Grade 3: I stop for breath after walking about 100 meters or after a few minutes on the level.
- Grade 4: I am too breathless to leave the house or I am breathless when dressing or undressing.

**Classification of Severity of Airflow Limitation in COPD**

In patients with FEV₁/FVC < 0.70:

<table>
<thead>
<tr>
<th>GOLD 1: Mild</th>
<th>FEV₁ ≥ 80% predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOLD 2: Moderate</td>
<td>50% ≤ FEV₁ &lt; 80% predicted</td>
</tr>
<tr>
<td>GOLD 3: Severe</td>
<td>30% ≤ FEV₁ &lt; 50% predicted</td>
</tr>
<tr>
<td>GOLD 4: Very Severe</td>
<td>FEV₁ &lt; 30% predicted</td>
</tr>
</tbody>
</table>

*Based on Post-Bronchodilator FEV₁

**Therapeutic Options: COPD Medications**

- Beta₂-agonists
  - Short-acting beta₂-agonists
  - Long-acting beta₂-agonists
- Anticholinergic
  - Short-acting anticholinergic
  - Long-acting anticholinergic
- Combination short-acting beta₂-agonists + anticholinergic in one inhaler
- Methylxanthines
- Inhaled corticosteroids
- Combination long-acting beta₂-agonists + corticosteroids in one inhaler
- Systemic corticosteroids
- Phosphodiesterase-4 inhibitors

**Question #3**

According to the GOLD standards, what stage of COPD are patients indicated to have oxygen therapy?

- a. Stage 1
- b. Stage 2
- c. Stage 3
- d. Stage 4
Oxygen Therapy: The long-term administration of oxygen (>15 hours per day) to patients with chronic respiratory failure has been shown to increase survival in patients with severe, resting hypoxemia.

Question #4

The NOTT and COT studies showed the longest survival rates with patients in what group?

a. Continuous Oxygen: Low Walk
b. Continuous Oxygen: High Walk
c. Nocturnal Oxygen: Low Walk
d. Nocturnal Oxygen: High Walk

NOTT Study


- Landmark study by NHLBI - Multicenter
- 203 patients randomized
  - Continuous oxygen therapy (24 hrs/day)
  - Nocturnal oxygen therapy (12 hrs/day)
- 19.3 months average follow-up
- All centers mortality – NOT > COT
  - RR 1.94 (95% CI, p=0.01)
- Hospitalization – Tended to Less often, fewer days in COT group

Long Term Oxygen Trial (LTOT)

NOTT and COT Study
Survival Rates on Oxygen Therapy

- Those patients that walk more than 3950 feet a day (High Walk COT) and are on oxygen (mean 17.7 hours a day, median 19.4 hours a day) have the longest survival probability
**Clinical Practice Guidelines (CPG’s)**

- **AARC Guidelines**
  - **Indications:** Documented hypoxemia.
    - $\text{PaO}_2 \leq 55$ mm Hg
    - $\text{SaO}_2 \leq 88\%
  - **Conditions of rest, ambulation, sleep, or exercise**
    - $\text{PaO}_2$ 56-59 mm Hg or $\text{SaO}_2$ $\leq 89\%$ with specific clinical condition:
      - Cor pulmonale
      - Congestive Heart Failure
      - Erythrocythemia with Hct $> 56$.

**LTOT Hospital Days Comparison**

- Additionally, the lowest length of stay in admissions per year was witnessed in the same patients. *NOT* = nocturnal oxygen therapy.
- *COT* = continuous oxygen therapy.

**Clinical Practice Guidelines (CPG’s)**

- **CPG – O$_2$ Therapy in the Home or Alternate Site Health Care Facility –**
  - **2007 Revision and Update**
  - **CPG’s for COPD**
    - American Thoracic Society – European Respiratory Society (ATS-ERS)
    - Global Initiative for Obstructive Lung Disease (GOLD)
    - National Institute for Health and Clinical Excellence (NICE) British
Clinical Practice Guidelines (CPG’s)

- AARC Guidelines
  - Frequency
    - "O₂ therapy use in COPD for the treatment of chronic hypoxemia should be administered continuously (i.e. 24 hours per day) unless the need has been shown to be associated only with specific situations (e.g. exercise and sleep)

"Oxygen Therapy in the Home or Alternate Site Health Care Facility – 2007 Revision and Update" Respiratory Care, August 2007 Vol 52 No 1 pg 1066.

Clinical Practice Guidelines (CPG’s)

- Long Term Oxygen Therapy
  - “Short burst” O₂ therapy
    - GOLD and NICE don’t support this technology.
    - NICE concerned with “uncontrolled O₂ therapy” issue with respiratory drive depression.
    - Indication: “Correctable desaturation during exercise.”
    - Only ordered by specialist (NICE)

"Review and Comparison of COPD Practice Guidelines" Pierson D, Respiratory Care 2006, Vol 51 No 3 pg 282

Evolution in Oxygen

Stationary

- Concentrator

Portable

- Light Portable Cylinders & Conservers
- Self-fill
- Portable Concentrators

1980 - Present

History of DeVilbiss Oxygen Concentrators

- Early DeVilbiss 955 Concentrator
- DeVilbiss 515A Concentrator
- DeVilbiss iGo POC
Oxygen Therapy in the US Today

• Stationary Oxygen
  – Concentrator - 1,368,300 beneficiaries
  – Allowed charges - $2.3 Billion

• Portable Oxygen
  – Compressed gas - 625,871
  – Liquid portable - 82,623
  – Portable concentrators – 14,024

  >75% prescribed portable system


Home Oxygen Choices

Inside the Home

Outside the Home

Travel

“Pulse Dose” Devices

• What type of devices use “Pulse Dose” technology
  • Oxygen Conservers on free standing cylinders
  • Oxygen Conservers on Oxygen Filling Cylinders
    • iFill
    • Ultrafill
    • HomeFill
  • Portable Concentrators (POC’s)

Oxygen Conserving Technology “The Balance”
Pulse Dose Technology Used on Portables:

Technologies
• Continuous Flow
• Demand Flow
• Constant Minute Volume
• Constant Pulse Volume

Major Question?
• What happens when the respiratory rate increases?
OR
• What are the effects of RATE RESPONSIVENESS?

Oxygen Conserving Devices (OCD)

Likely to be a part of any system that:
• Generates low amounts of oxygen
• Expensive to operate
“Conserves” oxygen
• O₂ dosed in pulses
• Timed to inspiration
Systems differ
• Timing of pulse
• Length of pulse
• Dose of oxygen

Continuous Flow Oxygen

Flow Diagram @ 2 lpm, 20 bpm
- 20 bpm = 3 seconds per breath
- I:E = 1:2. Inspiration = 1 second
- 2 lpm O₂ Flow = 2000ml/60 second 33.3 ml/sec
- 38 ml useful O₂ / 89 ml total O₂ = 39% effective use

Continuous Flow Oxygen

Flow Diagram @ 2 lpm, 30 bpm
- 30 bpm = 2 sec/breath
- I:E = 1:2. Inspiration = 2/3 sec
- 33.3 ml/sec O₂ flow x 2/3 sec = 22 ml
- 26 ml useful O₂ / 67 ml = 38% effective use

Test data provided by: Valley Inspired Products, Burnsville, MN
**Demand Flow Oxygen Conserver**

Flow Diagram @ 2 lpm, 20 bpm

- 20 bpm = 3 seconds per breath
- I:E = 1:2; inspiration = 1 second
- 2 lpm O₂ Flow x 1 second = 33 ml/second
- 24 ml useful O₂ / 46 ml total O₂ = 52% effective use

**Demand Flow Oxygen Conserver**

Flow Diagram @ 2 lpm, 30 bpm

- 30 bpm = 2 seconds per breath
- I:E = 1:2; inspiration = 2/3 second
- 2 lpm O₂ Flow x 2/3 second = 22 ml/second
- 18 ml useful O₂ / 35 ml total O₂ = 52% effective use

**Constant Minute Volume Conservers**

Flow Diagram @ 2 lpm, 20 bpm

- 20 bpm = 3 seconds per breath
- I:E = 1:2; inspiration = 1 second
- 11 lpm O₂ Flow (or 183ml/sec)x .18 second = 32 ml/second
- 18 ml useful O₂ / 32 ml total O₂ = 100% effective use

**Constant Minute Volume Conservers**

Flow Diagram @ 2 lpm, 30 bpm

- 30 bpm = 2 seconds per breath
- I:E = 1:2; inspiration = 2/3 second
- 9 lpm O₂ Flow x .15 second = 22 ml/second
- 22 ml useful O₂ / 22 ml total O₂ = 100% effective use
Inhale
Exhale

Flow Diagram @ 2 setting, 20 bpm
20 bpm = 3 sec/breath
@ I:E = 1:2, inspiration = 1 sec
if 10 lpm O₂ flow x .2 sec = 33 ml
33 ml useful O₂ / 33 ml total O₂ = 100% effective use

Flow Diagram @ 2 setting, 30 bpm
30 bpm = 2 sec/breath
@ I:E = 1:2, inspiration = 2/3 sec
if 10 lpm O₂ flow x .2 sec = 33 ml
33 ml useful O₂ / 33 ml = 100% effective use

Variations of Volume with Same Setting of OCD

<table>
<thead>
<tr>
<th>Unit</th>
<th>Volume per breath</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helios</td>
<td>17 ml/breath</td>
</tr>
<tr>
<td>Airsep ImPulse (A)</td>
<td>19 ml/breath</td>
</tr>
<tr>
<td>Chad 411</td>
<td>20 ml/breath</td>
</tr>
<tr>
<td>Chad Cypress</td>
<td>26 ml/breath</td>
</tr>
<tr>
<td>Precision Medical Easy Pulse 5</td>
<td>27 ml/breath</td>
</tr>
<tr>
<td>DeVilbiss PD4000, Western OPC-830, Victor</td>
<td>28 ml/breath</td>
</tr>
<tr>
<td>DeVilbiss PD1000, CFO, Salter, Airsep Impulse (B)</td>
<td>33 ml/breath</td>
</tr>
</tbody>
</table>

*At a “2” setting, 20 breaths/minute

Test data provided by Valley Inspired Products, Burnsville, MN

Home Oxygen Choices
Portable Oxygen Concentrator Systems

POC used as:
• Stationary
• Ambulatory
• Travel
  • Air travel

Performance characteristics vary by design and device

Portable Oxygen Concentrators

• Two “modes” of delivery (Dual Purpose POC’s)
  • Pulse Dose
  • Continuous Flow

• Not all Portable concentrators can deliver continuous flow (Travel POC’s)

• Most patients “ok” with pulse dose except:
  • Higher flow
  • Irregular respiratory patterns
  • Some nocturnal use patients

Performance Trade Offs

Portable Concentrator Design Considerations:
• Size
• Weight
• Noise
• Oxygen production & output
• Energy consumption/power duration
• Power supply

POC Comparisons

Oxygen Dose Per Setting
15, 20, 25, 30 BPM

Test data provided by: Valley Inspired Products, Burnsville, MN
Oxygen and Air Travel:

- SFAR 106 (Special Federal Air Regulation) Ruling allows patients to use POCs during flight
  - Effective August 11, 2005
- Numerous airlines have approved the use of portable concentrators onboard (must still check with carrier)
- Several devices currently approved for use in flight

Question #5

What factors have led to improvement in ambulatory oxygen delivery to our patients?

a. Sieve bed materials.
b. Compressor technology.
c. Battery technology.
d. All of the above.

Oxygen Concentrator Components

Improvements in Concentrators

Continued improvement/advancement of:

- Sieve bed materials
- Compressor technology
- Cycle times
- Battery technology
- Something totally new???
Oxygen Reimbursement Scenarios

Traditional Delivery Model

<table>
<thead>
<tr>
<th>Item</th>
<th>HCPCS</th>
<th>Description</th>
<th>Price</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrator</td>
<td>E1390</td>
<td>36 month capped rental 306DS-Ai Go with Battery and Rolling Carry Case</td>
<td>$2,217.81</td>
<td>$90.00</td>
</tr>
<tr>
<td>Portable Concentrator</td>
<td>E1392</td>
<td>36 month capped rental 306DS-Ai Go with Battery and Rolling Carry Case</td>
<td>$0.00</td>
<td>$44.06</td>
</tr>
</tbody>
</table>

iFill (O2 Filling System)

Non-Delivery Model

<table>
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iGo (POC)

Non-Delivery Model

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Summary of DeVilbiss Oxygen Profitability Models

Traditional Oxygen Delivery Models:
- iFill (O2 Filling System)
- iFill (O2 Filling System with electronic OCD)
- iFill (O2 Filling System with pneumatic OCD)
- iFill (O2 Filling System with CF Regulator)

Choosing the Right Oxygen System by Patient Profiles

Question #6

Mid Stage COPD patient with:
- pH – 7.36
- PCO2 – 47
- PO2 – 46

Which oxygen system could be used with this patient?
- a. 5 L Stationary Concentrator
- b. O2 Filling System with electronic OCD
- c. O2 Filling System with pneumatic OCD
- d. All of the above are acceptable
### Choosing the Right Oxygen System by Liter Flow

<table>
<thead>
<tr>
<th>Oxygen Equipment</th>
<th>Stationary Concentrator</th>
<th>In Filling System with Pulse (OCD)</th>
<th>In Filling System with Pneumatic (OCD)</th>
<th>In Filling System with CF Regulator</th>
<th>Portable Concentrator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Profile</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe &amp; End Stage</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>COPD, Minimal Lung Function, Shallow Breathing</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>Mid Stage COPD</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>Early Stage COPD</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
</tbody>
</table>

### Choosing the Right Oxygen System by Lung Function

<table>
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<th>In Filling System with Pulse (OCD)</th>
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<td></td>
</tr>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>COPD, Minimal Lung Function, Shallow Breathing</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Mid Stage COPD</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>Early Stage COPD</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
</tbody>
</table>

### Choosing the Right Oxygen System by Ambulation

<table>
<thead>
<tr>
<th>Oxygen Equipment</th>
<th>Stationary Concentrator</th>
<th>In Filling System with Pulse (OCD)</th>
<th>In Filling System with Pneumatic (OCD)</th>
<th>In Filling System with CF Regulator</th>
<th>Portable Concentrator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Profile</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Ambulation</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>Mild Ambulation (Away from home 1-2 times per week, 6-12 hours at a time &amp; ambulation around the home)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>Moderate Ambulation (Away from home 1-3 times per week, 6-12 hours at a time &amp; ambulation around the home)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
<tr>
<td>High Ambulation (Away from home more than 3 times per week, more than 12 hours a week &amp; ambulation around the home)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>CF or None</td>
</tr>
</tbody>
</table>

### Question #7
What system is preferred if patient is on 2 lpm and patient can handle moderate ambulation within 30 miles of travel.
- a. Stationary Concentrator
- b. Dual Purpose POC
- c. Stationary concentrator PLUS Dual Purpose POC
- d. None of the above
### Question #8

Why are oxygen filling systems with cylinders BEST compared to Dual Purpose Portable Oxygen Concentrators with patients requiring 1, 2, or 3 lpm?

- a. Cylinders with OCD’s allow more mobility than Dual Purpose Portable Oxygen Concentrators.
- b. Cylinders with OCD’s are lighter than Dual Purpose POC’s.
- c. None of the cylinders with OCD’s will last more than 15 minutes.
- d. Both a and b.

### Question #9

Why isn’t a Dual Purpose Concentrator indicated for patients requiring 4-5 lpm oxygen flow?

- a. Too heavy
- b. Too noisy
- c. No Dual purpose concentrator can deliver 4-5 lpm.
- d. Dual purpose concentrator COULD be used for patient requiring 4-5 lpm.
Choosing the Right Oxygen System by Modalities

<table>
<thead>
<tr>
<th>LPM</th>
<th>Stationary Concentrator</th>
<th>Stationary Concentrator with Oxygen Filling Cylinders</th>
<th>Dual Purpose POC</th>
<th>Stationary Concentrator with Dual Purpose POC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Medium</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>High</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>3 or more</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>

Question #10

Patient with “High Ambulation” on 4 lpm and wants to do an overnight trip to see family?

a. Stationary Concentrator
b. Stationary concentrator PLUS oxygen filling cylinders with OCD’s
c. Dual purpose POC
d. None of these systems would be recommended for overnight travel.

Questions to Ask!

• Major question is “What is the best stationary and ambulatory oxygen system for my patient?”
• What system fits into the home care provider’s available choices?
• With changing trends in the reimbursement environment, what choices take care of my patient’s needs and allow the home care provider to stay in business?
• What is my part in keeping the balance of good respiratory care and good business practices within my organization?

Take Home Message!

• Oxygen technology is changing.
• Future improvements dependent upon:
  – Improved battery technology
  – Improved or new oxygen extraction/generation mechanisms
  – Reimbursement changes
• Wide range of technologies available to match patients to their oxygen needs
**Questions?**

- All questions will be fielded through the “chat” on Go To Webinar.
- Please type in your question on the “chat” section at the bottom of the Go To Webinar box.
- We will field questions depending on the time available.

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  - Go to On Demand Webinar section and pick this webinar.
  - Choose “Quiz” and complete the quiz.
  - With passing score, print off your CRCE/CSRT certificate.

---

**And My Thanks to YOU!**