RESPIRATORY HOME CARE: AN OVERVIEW

by

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RESPIRATORY HOME CARE: AN OVERVIEW

BEHAVIORAL OBJECTIVES

UPON COMPLETION OF THE READING MATERIAL, THE PRACTITIONER WILL BE ABLE TO:

1. State the goals of respiratory home care.
2. Explain the role of government programs in home care.
3. Perform patient assessment and documentation according to guidelines.
4. Summarize the methods and goals of patient and family education.
5. Compare the different types of oxygen therapy typically used in the home.
6. Classify the respiratory medications frequently used by home care pulmonary patients.
7. Describe the various airway care and clearance therapies.
8. List important screening factors prior to utilizing mechanical ventilation in the home.
9. Identify the patient assessment skills and equipment assessment skills that the patient’s family/caregiver must be able to perform for a home care ventilator patient.
10. Summarize the basic guidelines for cleaning and disinfecting home care equipment.

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This course is for reference and education only. Every effort is made to ensure that the clinical principles, procedures and practices are based on current knowledge and state of the art information from acknowledged authorities, text and journals. This information is not intended as a substitution for diagnosis or treatment given in consultation with a qualified health care professional.
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INTRODUCTION

The elderly population in the United States is growing quickly, and this increased mean age parallels with a growing need for health care services. Health care in the hospital setting is sometimes required for effective treatment of an illness. After the acute phase is brought under control, health care in an alternative setting is usually more cost efficient, and may be more desirable to the patient and their family. The alternative care settings include subacute care, skilled nursing facilities, outpatient rehabilitation centers, and home care. This course concentrates on the home care setting for the delivery of respiratory care services. A broad overview of the general concepts of in-home respiratory care is included, along with brief descriptions of the many respiratory services available in the home care setting.

It is assumed the participants of this course have some medical knowledge and experience in health care. The target audience is respiratory therapists, and nurses who provide care for pulmonary patients.

GOALS OF RESPIRATORY HOME CARE

Respiratory care services are frequently needed outside of the acute care hospital setting. The patients who require specialized respiratory services are often newly discharged from the hospital after an acute illness. Good discharge planning is essential to ensure these patients receive the care they need post-hospitalization. Effective discharge planning guides the multidisciplinary team in implementing and continuing a high quality plan of care in the home. A team effort between many disciplines is essential in the patient’s recovery process. The multidisciplinary team includes, but is not limited to: The physician, nurse, respiratory therapist, physical therapist, occupational therapist, dietitian, social worker, pharmacist, pharmacy technician, and the home care company. Some or all of these clinical professionals may participate in each patient’s plan of care, depending on the medical condition of the patient.

Home care is often a desirable first choice for post-acute care if the patients are able to care for themselves, or they have family members and/or caregivers to assist them. Respiratory home care services are provided for patients with many types of disorders including:

- Chronic obstructive pulmonary disease (COPD), emphysema, bronchitis, bronchiectasis, cystic fibrosis
- Asthma
- Restrictive pulmonary disorders
- Neuromuscular disorders
- Carcinoma of the lungs
- Sleep apnea
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- Infants at risk for sudden infant death syndrome (SIDS)

The main goal of home care is to provide high quality healthcare services to patients in their home setting. Other goals include:

- Provide comprehensive education to the patient and their family about the disease process, and methods of minimizing symptoms
- Provide a self-management plan of care for each patient
- Provide the patient with the knowledge and tools they need to improve their physical health and emotional and well-being
- Promote the patient’s self-sufficiency
- Minimize the patient’s dependence on institutional care
- Ensure cost-effective health care.

GOVERNMENTAL LAWS AND REGULATIONS

The majority of reimbursement for patients receiving home care is through Medicare or Medicaid. Since these are government programs, the government plays a major role in setting standards. The Medicare Provider Certification Program ensures that hospitals, skilled nursing facilities (SNF’s), and home care agencies meet certain health, safety, and quality requirements. These requirements, called conditions of participation, emphasize quality indicators and outcome measures that are designed to improve the quality of care given to patients. Periodic on-site inspections are performed to ensure compliance with the laws, regulations, and standards of care.

The federal government works in partnership with state survey agencies (including the state health department or state licensing authority for healthcare facilities). State agencies often set additional regulations that govern the licensing of home healthcare and post-acute providers.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) gives voluntary accreditation of postacute care providers. JCAHO develops standards of care for subacute care providers and home health agencies. Periodic on-site inspections are performed to ensure compliance with standards, and for renewal of accreditation.

PATIENT ASSESSMENT GUIDELINES AND DOCUMENTATION

Home care patients can come from hospitals, nursing homes, or through a direct referral from a physician (after an office visit indicates the need for health care services). The first step includes screening the patient and their home to assure they are candidates for home care services. The complexity of the screening process depends on the severity of the
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medical condition. For patients being discharged from a hospital or a nursing home to home care, the screening process is performed as a part of the discharge planning.

Screening a respiratory home care patient includes an overall evaluation with documentation of the following:

- The patient’s medical condition which indicates a need for respiratory therapy services
- The patient’s overall condition and therapeutic needs
- The patient’s ability to provide self-care
- The availability of family or caregiver support
- The type and complexity of home care equipment needed
- The ability of the patient and/or caregivers to learn and perform the therapeutic regimen of care, as well as the ability to operate, troubleshoot, and clean the equipment
- An assessment of the overall home environment for safety: including an evaluation of possible changes in the home that may be needed to make it satisfactory for safe and efficient home health care.

The post-acute care settings require very extensive patient assessment and documentation. All documentation should be very detail oriented, comprehensive, and comply with all documentation guidelines set forth by the employer, Medicare, Medicaid, and/or the insurance company.

There are four key components in the assessment and documentation process. These are screening, treatment planning, continuous assessment, and discharge.

1. **Screening** - With a physician’s order, a nurse and/or respiratory therapist can screen patients for home respiratory care. The screening process begins with a chart review of all pertinent information. Important forms to review include: the history and physical exam, respiratory diagnosis, onset and severity of symptoms, x-rays, pulmonary function test results, arterial blood gases, prior respiratory status, current medications, and other ancillary service progress notes. Physical assessment includes breath sounds, respiratory rate and pattern, heart rate, cough, sputum production, signs of dyspnea, and pulse oximetry. Also evaluate the patient’s level of consciousness, ability to understand and follow commands, and the availability of a caregiver if one is necessary. If the screening indicates a need for in-home respiratory services, the nurse or therapist can make recommendations to the physician.

2. **Treatment planning** - With a physician’s order for home care, a plan of care is designed for
the patient. The treatment planning includes a detailed list of medications, therapies, and equipment. Also, a plan and time schedule for training and educating the patient and family members. The short and long-term goals and rehabilitation potential are addressed, and a schedule for follow-up visits is arranged.

3. **Ongoing patient assessment** - The patient’s progress must be monitored continuously. This is documented in progress notes and summaries including:

- Patient assessment (objective and subjective) to include:
  - Any change in the patient’s respiratory or medical status
  - Breath sounds, respiratory rate
  - Heart rate, blood pressure
  - Body temperature, skin color changes, fluid retention
  - Mental status changes
  - When indicated: Pulmonary function assessment via bedside spirometry, peak flow meter, or ventilator parameters.

- Patient’s understanding and compliance with the treatment plan

- Any need for additional patient/family education

- Address any problems or concerns of the patient and family

- Equipment assessment (operation, cleanliness, adequate supplies)

- When indicated: Laboratory blood values including arterial blood gases

- Results of any new tests

- A monthly summary report consistent with the care plan. This should identify progress toward stated short term and long-term goals. The summary report should also identify any progress the patient has made in independent activities of daily living (ADL’s). Note the contribution of respiratory therapy and other ancillary services toward improved ADL’s.

- Recommendations to change, increase, or decrease respiratory therapy

- Copies of the progress notes and summaries should be delivered to the patient’s physician, and the home care company, to become part of the patient’s medical record.

4. **Discharge summary** - When a patient has reached their maximum potential, attained their set goals, or has a physician order to discontinue respiratory services, a discharge summary should be completed. The discharge summary should summarize the entire course of respiratory therapy services, and specify whether or not the goals were met.
DIFFERENCES BETWEEN HOSPITAL AND HOME CARE

The home care clinician will experience many differences between the traditional acute care hospital setting and the home environment for the delivery of healthcare services. Many clinicians make the transition from acute care, or nursing homes to home care, and others enter the field of home care directly. All experience in acute care or other healthcare will be valuable assets in home care. Some differences between acute care and home care include:

• Ability to work independently; a must in home care.

• Availability of supervision; usually just a phone call away in home care, but one must be able to work without direct supervision when out in the field delivering medical care.

• Additional personnel to assist with emergency situations; calling 911 may be the first option in home care.

• Availability of resources; not as readily available in home care. This includes equipment, supplies, medications, laboratory results and x-rays. However, with good planning, one can have all of the necessary respiratory supplies in the delivery vehicle. As for laboratories and x-rays, the patient receiving home care should be stable enough not to need these services quite as frequently.

• Different work schedules, including on-call. Many enjoy the Monday through Friday 8-5 schedule in home care, since it coincides with family time. However, one may have to be on call on weekends and holidays.

• Extensive documentation. Home care documentation is often more detailed and comprehensive than in the hospital.

• More comprehensive assessment skills. In the profession of home care, the clinician can better prepare themselves for the job by learning to assess the whole person and situation. This may involve educating oneself a bit beyond what is usually required by one's own profession. This includes research, self education, regular classes or continuing education courses on such topics as nutrition, rehabilitation therapy, fire preparedness and prevention, and domestic violence to name a few.

• Professional-patient interaction; home care clinicians are often more familiar with their patients and the families than in the hospital.

PATIENT AND FAMILY EDUCATION AND TRAINING

It is very helpful if the patient and their family/caregiver is willing and motivated to receive medical care in the home care environment. The support of the family/caregiver is crucial if the patient cannot perform activities of daily living or provide total care for himself/herself. Even if the patient is self-care, it helps to have the support of the family. Everyone involved in
the patient’s care must be motivated, willing, and able to learn and perform all the many tasks that will be required of them. This includes both mental and physical ability and willingness. The family/caregiver may be accepting what may be an enormous endeavor as well as an emotional and physically draining responsibility.

Training and education for home care patients, family/caregiver is very thorough, comprehensive and detailed since they often do not have a professional clinician residing in the home. Education and training may be provided by many methods including instruction booklets, educational videos, interactive education with the professional clinicians, and most importantly, the hands-on training.

One must evaluate the patient/family/caregiver for the ability to comprehend education, training, and instructions on all of the in-home medical supplies and equipment. Prior to bringing equipment into the home, they must complete all required training and education. They must be able to demonstrate competence and proficiency at performing all the required tasks, and be able to properly operate, maintain, troubleshoot, and clean the equipment. For each medication, they must learn the indications, contraindications, administration technique and schedule, side effects, onset of action, duration of action, and proper storage procedures. This can be a simple matter of learning how to administer one medication, or it can be a very complex and lengthy training session including in-home dialysis equipment and in-home mechanical ventilation. Does the patient/family/caregiver have the ability and motivation to learn these procedures, and perform them with competence?

The patient and/or caregiver must have a rescue plan of action for problematic situations. They must have a phone numbers on hand for the physician and the home care team. There should be a nurse and a respiratory therapist “on call” at all times to answer questions, and address problems immediately, as well as travel to the patient’s home if necessary. The patient and/or caregiver must also be able to recognize when to call 911 for immediate emergency medical care.

EVALUATING AND PREPARING THE HOME ENVIRONMENT

A comprehensive evaluation of the patient’s home environment includes:

- Accessibility in and out of the home, between rooms, and into the bathroom
- The overall set-up of each room for optimal efficiency of care
- Doorway width and height for accessibility
- Stairways that the patient may not be able to utilize
- Carpets that may hamper wheelchair mobility
- The space available for equipment
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- Grounded electrical outlets, and ample electrical service
- Adequate heating, cooling, ventilation, and humidity
- Basic safety standards must be met. The home should be free of fire, health, and safety hazards.

Minor or major adjustments and remodeling may be necessary prior to the patient returning home. This may involve moving furniture, changing rooms, moving a bedroom downstairs, enlarging doorways, adding ramps, upgrading electrical service, or major remodeling. The overall home environment must be clean, safe and conducive to efficient home care. The patient/family must also have the financial resources to make the home acceptable for a home care patient.

RESPIRATORY HOME CARE MODALITIES

OXYGEN THERAPY

A prescription for oxygen must be based on documented hypoxemia, by either arterial blood gases or oximetry. The approximate qualifying values on room air, with the patient at rest, are a PaO₂ of 55 or less, or a saturation less than 88%. If they do not qualify at rest, they may qualify during ambulation, exercise, or while asleep. Once the need for oxygen therapy is established, the physician must write a prescription for home oxygen that includes:

- Flow rate: In liters per minute and/or the concentration
- Frequency of use: The order will depend on the patients’ need for oxygen, based on pulse oximetry, ABG, or other test results. The goal is to minimize episodes of desaturation and dyspnea. The order may state oxygen to be used: Continuous, or in the number of hours per day, or only during sleep, or only with activity (like walking).
- Duration of need
- Diagnosis: Severe primary lung disease, plus any hypoxia-related conditions or symptoms that may improve with oxygen
- Laboratory evidence of hypoxemia: Arterial blood gas results, or pulse oximetry results
- Any additional medical documentation showing there are no acceptable alternatives to home oxygen therapy.

There is usually a schedule of repeat pulse oximetry or arterial blood gases to determine if there
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is a continued need for long-term oxygen therapy.

Home oxygen can be supplied via the following methods:

1. **Oxygen Concentrator** - This is an electrically powered device that works by separating and extracting the oxygen from the nitrogen in the room air via a molecular sieve. A concentrator is a low-pressure system at 15 psi and cannot power mechanical ventilators or other high-pressure devices. The maximum flow-rate a concentrator can output effectively is about 10 liters/minute. Medical equipment manufacturers are continuously upgrading their equipment, and the available flow-rate continues to increase with the advanced technology. If higher flows are needed, 2 concentrators may be linked via tubing to run together.

Most concentrators are compact for home use, and they are electrically powered. The concentrator is on wheels for portability. The patient or caregiver can roll the concentrator from one room to another in the home. Concentrators have filters that must be cleaned or changed on a regular schedule. Humidity is often added for patients on continuous oxygen.

Oxygen concentrators are the most cost-effective means of delivering oxygen when continual low-flow oxygen is needed. The cost to the insurance company is usually a one-time expense of the concentrator itself, with minimal other expenses. The cost to the patient is also minimal. The electric bill will probably increase about 1% to 5% with the concentrator running 24 hours per day. If the patient is able to leave the home, they will need a portable oxygen system to take with them such as a liquid system, or gas in small cylinders. A back-up supply of oxygen will also be necessary for use during an electrical outage, or malfunction of the concentrator. The local power company should be notified of any home with a patient on oxygen or life support.

Patients using a concentrator are usually using a nasal cannula, or a low-flow venturi mask. There are also oxygen conserving devices (OCD’s) that are popular in home care. These can be attached directly to an oxygen tank and run on batteries, or pneumatically. The goal of the OCD’s in home care is to conserve oxygen, while maintaining adequate saturation. There are several types of OCD’s. Some systems allow oxygen to flow during inhalation only, thereby not wasting oxygen during exhalation. Demand-flow systems reduce the wasted oxygen by releasing the oxygen during the first part of the inspiratory cycle only. Demand-flow systems have proven effective in some cases, but during exercise, patients sometimes showed decreased saturation. Patient’s response and pulse oximetry values are evaluated and documented to determine if a patient qualifies for an oxygen conserving device. They must maintain a certain oxygen saturation while on the OCD. The qualifying values and procedures may vary, but typically while using an OCD, they should not have a drop in saturation of 5% or more, and they should have good tolerance (i.e. not dyspneic, not tachypneic, and not tachycardic). If the saturation falls with the oxygen conserving device active, the patient should not use the conserving device, but they can be tested again at a future time.

There are also reservoir systems that allow the patient to use a slightly lower oxygen flowrate, and still maintain the same saturation. The reservoirs are usually available as a type of nasal cannula, like the oxymizer or pendant. How much lower one can turn the flow rate depends on
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the type of oxygen conserving device being used, and on patient tolerance. May patients have been able to tolerate a decrease of ½ to 1 liter/minute.

One disadvantage of the oxygen concentrator is that the percentage of oxygen delivered is slightly less than 100%, and the percentage can decrease with increased flow rates. The newer oxygen concentrators can deliver nearly 100%, while the older concentrators may deliver below 95%. Technological advances continue to improve the delivered oxygen percentage. The delivered percentage of oxygen should be checked at regular intervals. If the unit is delivering less oxygen percentage than normal, there may be a need to replace the pellet canisters, or replace the device and send it for repair.

Maintenance includes checking the percentage of delivered oxygen, ensuring the alarms are working properly, and ensuring that the unit is clean and operating effectively. The unit should be cleaned once per week using a damp cloth. If there are filters present, the filters should be removed, cleaned in soap and water, then in vinegar and water, left to air-dry, then replaced. Filters are cleaned on a regular schedule, typically monthly.

2. Liquid Oxygen - One cubic foot of liquid oxygen equals 860 cubic feet of gas, so liquid oxygen systems can store large quantities of oxygen in small spaces. The liquid oxygen systems are very small and portable, and are most useful for an active patient. Liquid oxygen is typically used for a patient who needs oxygen only during exertion such as walking, and for the patient who frequently leaves the home. The small portable unit can be filled from a reservoir to provide up to 8 hours of oxygen at 2 L/min. These reservoirs can contain 100 pounds of liquid oxygen, and have a gauge to show the amount of oxygen remaining. A 100 Lb liquid tank that is full will provide approximately 12 days of continuous oxygen at 2 L/min. If it is only used 4 hours per day at 2 L/min, it would last for 48 days.

The patient or caregiver must be thoroughly trained in the proper procedure for filling the portable tanks from the reservoir. There is a hazard of severe burns from the extremely low temperature of the liquid oxygen. The home care company can refill the reservoir so the patient always has a supply.

Liquid oxygen is a low-pressure system at approximately 15 psi and cannot power a ventilator or other high-pressure devices. The liquid system is more expensive, and most insurance companies will opt for a concentrator if the patient needs continuous flow oxygen. Liquid oxygen systems lose some O₂ through the venting built into the systems. The liquid system can also be used as backup for the concentrator, and the portability of liquid oxygen is a good second source of oxygen for active patients. They can use the concentrator when at home for the least expensive method of continuous flow oxygen, and use the liquid oxygen when they leave the home.

3. Compressed gas oxygen cylinders - The gas oxygen cylinders are high-pressure systems and work at 50 psi. A pressure-reducing valve with a flowmeter is used to adjust the flow to the prescribed level. The flow is adjustable from 0.25 to 15 L/min.
Large H or K cylinders can remain stationary in the home as a backup for the concentrator during power failures. The small E cylinders can be pulled along with a wheeled carrier. There are also small portable tanks the patient can carry in a case. The empty oxygen canisters will need to be replaced by the home care company.

The gas cylinders are best for the small-volume user. Disadvantages of the gas cylinders are the high-pressure safety hazard, large and heavy cylinders, and frequent replacement tanks need to be delivered.

To calculate the duration of flow available, the formula is:

\[
\text{Duration of flow (minutes)} = \left( \text{Gauge pressure} \times \text{Cylinder factor} \right) \div \text{Flow L/min}
\]

The factor for the E cylinder is 0.28, the factor for the H cylinder is 3.14.

Example: Figure the duration of flow for an E cylinder (factor = 0.28) with 2000 psi remaining, if used at 2 L/min.

\[
\text{Duration} = \left( 2000 \times 0.28 \right) \div 2
\]

\[
\text{Duration} = 280 \text{ minutes} \div 60 \text{ minutes} = 4.7 \text{ hours.}
\]

MEDICATIONS

The medications given in the home care setting include many of the same medications given in the hospital. The respiratory medications include bronchodilators, anti-inflammatory medications, xanthenes, and leukotriene inhibitors. These are given via nebulizer, IPPB, metered dose inhaler (MDI), dry powder inhaler (DPI), and/or oral pills, tablets and syrup.
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The most frequently used medications are listed here by classification:

**Beta\(_2\) specific fast-acting bronchodilators** with a duration of 4 to 8 hours. These are given via nebulizer, MDI, DPI, tablets or syrup depending on availability of the drug in differing delivery devices:

- Albuterol (Proventil\(^\text{®}\), Ventolin\(^\text{®}\))
- Bitolterol (Tornalate\(^\text{®}\)),
- Levalbuterol (Xopenex\(^\text{®}\)),
- Pirbuterol (Maxair\(^\text{®}\))

Also note:

- Salmeterol (Serevent\(^\text{®}\)) and Formoterol (Foradil\(^\text{®}\)) are also beta\(_2\) specific bronchodilators, but are slow to act (approximately 20 minutes to onset), and the duration is approximately 12 hours.

**Anticholinergic bronchodilators:**

- Ipratropium bromide (Atrovent\(^\text{®}\)) given via nebulizer or MDI. (Duration of action is 5-8 hours; onset of action is approximately 20 minutes).
- Tiotropium bromide (Spiriva\(^\text{®}\)) given via MDI. (Duration of action is 24 hours, so it is given once per day; onset of action is approximately 20 minutes).

**Xanthine drugs:**

- Theophylline (Theo-Dur\(^\text{®}\), Theovent\(^\text{®}\), Slo Bid\(^\text{®}\)) given via pill
- Aminophylline given intravenously

**Anti-Inflammatory Medications:**

- Corticosteroids given via MDI or DPI:
  - Beclomethasone (Beclovent\(^\text{®}\), Vanceril\(^\text{®}\), QVAR\(^\text{®}\))
  - Budesonide (Pulmicort\(^\text{®}\))
  - Fluticasone (Flovent\(^\text{®}\))
  - Flunisolide (Aerobid\(^\text{®}\))
  - Triamcinolone (Azmacort\(^\text{®}\))

- Systemic Corticosteroids given via pill, IM, or IV:
  - Hydrocortisone, prednisone, and methylprednisolone

- Nonsteroidal anti-inflammatory agents given via MDI or nebulizer:
  - Cromolyn sodium (Intal\(^\text{®}\))
  - Nedocromil sodium (Tilade\(^\text{®}\))
Leukotriene inhibitors given via pill:
  Zileuton (Zyflo®)
  Zafirlukast (Accolate®)
  Montelukast (Singulair®)

Mucolytic:
  Acetylcysteine (Mucomyst®) given via nebulizer mixed with a beta₂ drug.

Note: There are also combination inhalers like Advair®, which contains both Serevent® and Flovent®.

The patient and/or caregiver must be trained in the proper administration and dosage of medications on a schedule ordered by the physician. Comprehensive education should be given about each medication, along with indications, contraindications, and side effects.

The National Institute of Health has established guidelines for the pharmacological management, control, and prevention of asthma. These guidelines can also useful for COPD patients. This agency is an excellent source of education and they can be contacted at (301) 951-3260, or online at www.nhlbi.nih.gov.

The following is a stepwise approach used for management of asthma and COPD based on the severity of symptoms. The patient’s response to the treatments should be reviewed every 1 to 6 months. If the patient is managing their symptoms with sustained control for at least 3 months, a gradual stepwise reduction in treatment may be indicated. If the patient is unable to manage their symptoms, as evidenced by using the fast-acting beta₂ bronchodilator every day, then a step up in treatment may be necessary.

MANAGEMENT OF ASTHMA AND COPD

Severity of Symptoms:

Step 1. Mild Intermittent
Symptoms occur less than once per week, nocturnal symptoms occur less than twice per month, asymptomatic between exacerbations.

Fast Relief:
  Fast-acting beta₂ bronchodilator as needed for symptoms.

Long-term Control:
  No daily medications needed.
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Step 2. **Mild Persistent**
Symptoms occur two or more times per week, nocturnal symptoms occur three or more times per month.

*Fast Relief:*
- Fast-acting \( \beta_2 \) bronchodilator as needed for symptoms.

*Long-term Control:*
- Inhaled anti-inflammatory medications in low doses:
  - Corticosteroid, cromolyn or nedocromil,
  - Oral sustained-release theophylline to serum concentration of 5 to 15 mcg/mL,
  - A leukotriene inhibitor.

Step 3. **Moderate Persistent**
Symptoms occur daily, nocturnal symptoms occur two or more times per week.

*Fast Relief:*
- Fast-acting \( \beta_2 \) bronchodilator as needed for symptoms.

*Long-term Control:*
- Inhaled anti-inflammatory corticosteroid medication in medium dose,
  - Inhaled corticosteroid in low to medium dose,
  - A long-acting bronchodilator (especially for nocturnal symptoms), either a long-acting \( \beta_2 \)agonist, or sustained release theophylline.

Step 4. **Severe Persistent**
Continuous symptoms, frequent nocturnal symptoms, severity of symptoms limit activities of daily living.

*Fast Relief:*
- Fast-acting \( \beta_2 \) bronchodilator as needed for symptoms.

*Long-term Control:*
- Inhaled anti-inflammatory corticosteroid in high dose,
  - A long-acting bronchodilator; either a long acting \( \beta_2 \) drug, or sustained-release theophylline,
  - Oral corticosteroid tablets or syrup.

**PULMONARY HYGIENE**

Pulmonary hygiene is important in optimizing respiratory status. This includes many therapies such as medications, deep breathing, coughing, suctioning, and chest physical therapy (CPT). Also, the Acapella PAP® and Flutter® chest vibration devices, when
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indicated.8,9.

PEP Device. Compliments of: DHD® Healthcare

Flutter Valve
Flutter Valve

Patients with tracheostomies require daily stoma care, tracheal tube care and tracheal suctioning when necessary. Sterile technique and proper hand washing are important to prevent infections. Portable suction units are available for in-home use. Tracheal care and stoma care includes cleaning the stoma site, tracheal tube, and inner cannula with hydrogen peroxide and sterile water. (Some inner cannulas are disposable, and should be replaced with a new one).

DHD® Tracheostomy Strap
Compliments of DHD® Healthcare

Deep breathing, either independently or with incentive spirometry, is an effective lung expansion therapy. This will aid in preventing pneumonia and increasing alveolar ventilation for patients who breathe shallow due to pain or the inherent shallow respirations of patients confined to a bed or chair.
Cough techniques may be helpful in the clearance of pulmonary secretions. Cough instruction should be provided to help patients generate an effective cough. These techniques can be used and repeated as necessary for chest congestion. Splinting of any operative site, or painful areas may be necessary during coughing or CPT. Techniques include:

- Simple deep breath in, then cough

- Manually assisted cough - The patient takes a deep breath in, (or inspiration can be assisted with a resuscitation bag) then external pressure is applied to the thoracic cage or epigastric region during forced exhalation. This may be contraindicated in many cases such as rib fractures, pregnant women, or abdominal pathologies. Another device available to assist in coughs is the noninvasive cough assist mechanical insufflation-exsufflation (MI-E). One new device on the market is the Respironics CoughAssist™ MI-E. A mask is used to make a good seal, and a gradual application of positive pressure is applied to the airway, followed by a rapid switch to negative pressure. This simulates the natural cough and can help avoid complications of more invasive procedures such as suctioning.

- The huff technique (forced expiration technique) - A period of diaphragmatic breathing is followed by one or two forced expirations without closure of the glottis by huffing during exhalation

- A double cough - The patient is instructed to inhale deeply and cough twice during exhalation
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- A triple cough - The patient is instructed to take in a small breath followed by a small cough, then a second deeper breath followed by a stronger cough, then the third breath is the deepest, followed by the strongest cough possible.

- Chest physical therapy (CPT) - This is an effective therapy for opening airways, mobilizing and clearing secretions, and reversing atelectasis. CPT can be given by several methods. Percussion and vibration using the cupped hand technique, or using an electric or gas-powered vibrator are effective. Proper position of the patient is necessary to treat the affected lobes of the lungs. The frequency varies based on the patient’s response to therapy. Two to four times per day, for 10 minutes each session, is usually effective.

- Flutter/PEP - These are devices that patients may be able to perform independently depending on their medical condition. Flutter and PEP therapy are substitutes for the traditional CPT, having most of the same benefits, and few of the side effects. The flutter valve (Flutter®), and the positive expiratory pressure device (Acapella PEP®) cause oscillatory vibrations in the lungs. These devices improve aeration, prevent and reverse atelectasis, and help mobilize secretions. The patient is instructed to inhale, then slowly blow out all of their air into the mouthpiece of the device. A positive pressure is created and maintained in the lungs throughout exhalation with a vibration that effectively mobilizes secretions. Common therapeutic use is twice to four times daily for five to ten minutes. Frequency is dependent on the type of pulmonary disorder and the patient’s response to therapy.

Acepella® Vibratory Positive Expiratory Pressure System
Compliments of DHD® Healthcare

PULMONARY REHABILITATION

Comprehensive pulmonary rehabilitation can aid in optimizing the pulmonary status of patients, and their ability to perform activities of daily living (ADL’s). Patients with COPD, or any chronic pulmonary disease can benefit greatly through a pulmonary rehabilitation program. The key components of successful pulmonary rehabilitation are education and training. The patient and/or family/caregiver must be well educated on the disease
RESPIRATORY HOME CARE: AN OVERVIEW

process, and the methods and medications used to prevent and alleviate symptoms. They should also be very familiar with each of the medications, and therapies, plus the schedule to follow for effective therapy. Pulmonary rehabilitation can begin in the hospital, nursing home, outpatient rehabilitation center, or the home.

Pulmonary rehabilitation includes the pulmonary hygiene methods mentioned above, and the proper use of medications, with strict adherence to medication schedules. Triggers of exacerbations must be identified and avoided. If the patient smokes, a smoking cessation program is indicated.

The patient must also have a rescue plan of action for exacerbations. They must know exactly which medications to take in which order and when emergency professional medical care is required.

Other components of a successful pulmonary rehabilitation program include a progressive exercise program, and dietary guidelines to maximize nutritional status. The multidisciplinary team approach, inclusive of all these therapies, can best optimize the patient’s overall functional status.

CPAP AND BIPAP THERAPY

Non-invasive ventilatory support using BIPAP or CPAP are commonly utilized for home care patients, when indicated. Many of these patients need CPAP or BIPAP therapy only while they are sleeping. An example is a patient with sleep apnea who needs CPAP each night and for naps. The number of patients with obstructive sleep apnea who need CPAP while sleeping continues to increase in home care. Patients with a chronic neuromuscular disease and hypoventilation may need BIPAP to increase alveolar ventilation, and to allow the patient to rest for a certain number of hours per day. Some patients use BIPAP continuously as in end stage COPD. BIPAP is also used for patients who need CPAP, but are unable to tolerate CPAP alone.

BiPAP Synchrony S7. Compliments of Respironics®

Knightstar 330 BiPAP. Compliments of Puritan Bennett®
Some of the newer CPAP machines include C-Flex, with a slight drop in pressure at the beginning of exhalation, allowing easier exhalation. Newer CPAP machines also have the option of a preset range of automatically adjusting pressure. This is called smart CPAP, auto-CPAP, or auto-PAP. Smart CPAP machines also include a memory storage “smart card” which can record the patient usage and pressures to give the physician a good record of utilization. The new settings are designed to improve patient comfort and tolerance. There are also multiple types of masks and nasal pillows available designed to increase patient comfort.
MECHANICAL VENTILATION

Providing successful ventilator support in a person’s home is a challenging endeavor to the home care team, the patient, the family, and/or the caregivers. Successful transition from hospital to home on a mechanical ventilator involves many factors including:

- A well-coordinated team effort by all professional clinicians involved in the patient’s home care.
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- Feasibility study including consultation between family and multidisciplinary care team.

- Appropriate physician’s orders written.

- Discharge plan formulated with input from all clinicians in the home care team, plus family members.

- Extensive education and training provided to the patient and family/caregiver. Education is continued until they are comfortable performing all necessary procedures, operating all equipment, and troubleshooting problems.

- Thorough assessment and preparation of the home environment. The home environment is prepared to provide the most efficient care for the patient. This may involve minor to major changes including changing the furniture layout, rearranging rooms, widening doorways, removing carpeting, adding ramps, or upgrading electrical service.

- Careful selection of equipment and supplies. The equipment and supplies are set up in the home, and the local power company is notified of the home with a patient on life support. Appropriate backup power (battery and/or compressed gas source) is made available for power failures. A secondary ventilator in the home is recommended for any patient who is not breathing spontaneously.

- Extensive and detailed planning with regularly scheduled follow-up visits by the home care team.

Mechanical ventilators used in home care are simplified to make them easier for lay persons to operate them. Ventilators used in the home include the Puritan Bennett LP10® and the Achieva®, among others.

The patient and/or family must be willing and able to complete extensive training prior to bringing a patient on invasive mechanical ventilation home. They must also be willing to accept the emotional and physical demands, as well as accepting responsibility for a family member on life support. The patient must be medically stable, and if the patient is able to communicate by any means, their wishes should be considered. It is helpful if the patient is willing and motivated to make a successful transition to the home care environment.

The patient and caregiver needs to learn how to safely operate, troubleshoot, clean, and maintain the in-home ventilator. Some patients need continuous ventilator support, while others may only require mechanical ventilation at night while sleeping. Those patients who are able to come off the ventilator for periods of time may need an aerosol trach collar, or they may be able to tolerate capping the trach tube and use a nasal cannula during the day. This all depends on the patient’s diagnosis, tolerance, and physician’s orders.
Monitoring of the patient on mechanical ventilation is important. The caregiver is trained to assess the following parameters:

- Any change in the patient’s respiratory or medical status
  - Breath sounds, respiratory rate
  - Heart rate, blood pressure, body temperature, and color changes
  - Mental status changes

- Proper functioning and cleanliness of all equipment

- Ventilator parameters:
  - Tidal volume, set rate, patient’s rate
  - PEEP/CPAP setting, pressure support setting
  - Peak pressures
  - Alarm function
  - Temperature of inspired gases
  - Appropriate humidification of inspired gases

- Indications for tracheal suction and proper sterile technique

A comprehensive assessment of the patient, all equipment, and ventilator parameters should be performed by a credentialed health care professional on a regular schedule. A clinician must also be “on call” at all times to answer questions and address problems that the family/caregiver may have.
The following is a list of equipment and supplies that are kept in the home. This list can give one an idea of the space needed for the main area of clinical care, and extra storage space. Also, this gives an indication of the training that may be required of home care patients, family, or caregivers.

- Ventilator, CPAP, or BIPAP machine
- Ventilator humidifier with thermostat
- Manual resuscitator (bag-valve-mask unit)
- Alarm and monitoring devices
- 12-volt battery & battery charger
- Air compressor
- Oxygen concentrator
- Large & small oxygen tanks
- Apnea monitor
- Suction machine & catheters
- Hospital bed
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- Bedside commode, bedpan, or urinal
- Cleaning and disinfecting supplies
- Intravenous medication equipment and supplies
- Airway appliances
- Tracheal tubes, masks
- Tracheostomy care kits
- Aerosol trach collar supplies
- Gloves, gowns
- Circuits, filters
- HME's
- Sterile distilled water
- Nebulizer kits
- Surge protectors
- Wheelchair
- Bedside table

APNEA MONITORING

Infants who are at risk for sudden infant death syndrome (SIDS) can be placed on apnea monitors while in the hospital. Some of these infants need to continue apnea monitoring after they return home. The monitor can be set up in the home after the family has completed extensive training in the use of the equipment and in neonatal resuscitation.

The apnea monitors detect heart rate and respiratory rate. There are visual and audio alarms that are activated when preset high limits or low limits are reached. One of the most frequent trouble-shooting problems involves poor placement of the electrodes, resulting in poor readings and frequent alarms. Apnea monitoring is usually continued until the infant demonstrates negative pneumocardiograms.
EQUIPMENT CLEANING AND MAINTENANCE

Home care equipment must be cleaned and disinfected daily or weekly according to manufacturers instructions and/or the home care companies policies. Some equipment filters require only monthly cleaning. The patient or caregiver performs most of the cleaning and disinfecting procedures themselves. Some types of equipment require a special cleaning procedure, and that procedure should always be followed. At times, the equipment manufacturer may recommend to use, or not use, a commercial disinfectant solution, alcohol, or peroxide. Some equipment only need a surface cleaning with a lint-free cloth and disinfectant. Much of the home care equipment can be cleaned and disinfected following this procedure:

- Wash hands (proper hand washing is always important)
- Disassemble all equipment
- Rinse equipment with warm water
- Soak equipment in warm soapy water for 30 minutes
- Wash and scrub the equipment with a lint-free cloth or soft brush to remove any debris
- Remove equipment and thoroughly rinse it with water
- Soak equipment in a vinegar and water (1:4) solution for 30 minutes
- Rinse well with water and allow equipment to air dry.

The home care company therapist, depending on the type of equipment, performs additional maintenance and calibration of equipment on a regular schedule. This includes a comprehensive evaluation of the proper function and cleanliness of the equipment, along with any additional instruction the patient, family or caregiver may need on proper cleaning and maintenance. Proper cleaning and maintenance at timely intervals can decrease the incidence of infections caused by contaminated equipment, and ensure optimal performance of the equipment.

CONCLUSION

Providing medical care in the home environment is a challenging endeavor to everyone involved. The complexity of care varies from simple MDI’s to complex invasive mechanical ventilation. A professional multidisciplinary team approach is necessary in order to achieve successful medical care in the home care environment. Comprehensive education and training are keys to success. The patient, family, and/or caregivers must be intricately involved in the care plan, and motivated to perform all that will be required of them. This can be an enormous emotional and physical responsibility for them, and it can also be a rewarding experience. A well-oriented team approach can yield excellent results for the patient’s
recovery process and improve their overall quality of life.
SUGGESTED READING AND REFERENCES


RESPIRATORY HOME CARE: AN OVERVIEW

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1. What are the goals of respiratory home care?
   a. Provide high quality healthcare services
   b. Promote the patient’s self-sufficiency
   c. Ensure cost-effective health care
   d. All of the above

2. Assessment and documentation in home care is detailed and comprehensive. Which of the following are typical types of documentation?
   a. Patient screening and treatment planning
   b. Ongoing assessment
   c. Discharge planning and summary
   d. All of the above

3. Which of the following statements is true about the difference between gas and liquid oxygen?
   a. One cubic foot of gas oxygen is the equivalent of 860 cubic feet of liquid oxygen
   b. Liquid oxygen is less costly than gas oxygen
   c. Gas oxygen is less costly than liquid oxygen
   d. The concentrator provides both liquid oxygen and gas oxygen

4. What is the primary goal of patient and family education?
   a. To teach the family how to safely and effectively perform all required therapies, and operate all necessary equipment
   b. To increase the number of home care clinician visits
   c. To teach the family how to change the settings on a mechanical ventilator whenever they feel it is appropriate
   d. All of the above

5. What is the main purpose of governmental regulations?
   a. Ensuring health, safety, and quality of care requirements are met
   b. Ensuring adequate reimbursement to the home care company
   c. To limit the coinsurance payment due by the patient
   d. None of the above
6. Which of the following pulmonary medications are used most frequently by a COPD patient?
   a. Bronchodilators & anti-inflammatory medications
   b. Xanthenes & antipsychotics
   c. Leukotriene inhibitors & sulfonamides
   d. Bronchodilators & topical corticosteroids

7. What are the primary benefits of CPT, PEP therapy and the flutter device?
   a. Splinting of the operative site
   b. To mobilizing and clear secretions, and reverse atelectasis
   c. To mobilize and clear pleural effusions
   d. These therapies are unrelated in primary benefits

8. Which of the following are true regarding smart CPAP machines?
   a. There is an adjustable pressure range
   b. There is a memory storage “smart card” that records pressures and usage
   c. a and b
   d. None of the above

9. Home care equipment should always be cleaned and disinfected using:
   a. Hydrogen peroxide
   b. Cidex
   c. Manufacturer’s instructions and/or employer’s policy
   d. Autoclaving

10. The patient and/or family/caregiver must have the ability to safely and effectively operate all equipment used in the home. This includes:
    a. Ability to assess ventilator parameters for patients on ventilators
    b. Ability to troubleshoot equipment malfunctions
    c. Ability to assess alarm function
    d. All of the above

11. The family/caregiver must be able to perform patient assessments that include:
    a. Respiratory rate, heart rate, and breath sounds
    b. Flow volume loop interpretation
    c. Polysomnography interpretation
    d. Plethysmography interpretation
12. Which of the following are not typically members of the home care multidisciplinary team who will be visiting in the home?

   a. The respiratory therapist
   b. The radiologist
   c. The nurse
   d. The physical therapist

13. Which of the following are changes that are sometimes needed in the home to ensure safe and efficient patient care?

   a. Widen doorways and add ramps for a wheelchair bound patient
   b. Move furniture around in a room to access electrical outlets, and improve access to the patient and equipment
   c. a and b
   d. None of the above

14. Ongoing patient assessment includes:

   a. Any changes in respiratory or mental status
   b. Compliance with the treatment plan
   c. Inspection of equipment function and cleanliness
   d. All of the above

15. Chronic pulmonary disorders, which are commonly treated in the home by a respiratory therapist or nurse do not include:

   a. Acute episode of status asthmaticus
   b. Chronic bronchitis
   c. Emphysema
   d. Cystic fibrosis

16. Which of the following mechanical ventilators would one most likely utilize in the home care setting?

   a. Achieva
   b. Puritan Bennett 7200
   c. Servo I
   d. Servo 900C
17. Which of the following are true of liquid oxygen?
   a. There is a hazard of burns from the extremely low temperature
   b. The patient/caregiver can be taught to refill a portable tank from a reservoir kept in the home
   c. Liquid oxygen is a low-pressure system at 15 psi
   d. All of the above

18. A home care clinician performing a follow-up visit would perform the following:
   a. Evaluation of the equipment
   b. Evaluation of the patient
   c. a and b
   d. None of the above

19. Pulmonary rehabilitation can aid in optimizing pulmonary status and improve the patient’s ability to perform ADL’s.
   a. True
   b. False

20. Apnea monitors are sometimes used in the home for infants at risk for SIDS.
   a. True
   b. False
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