UNDERSTANDING OXYGEN THERAPY

A Patient Guide to Long-Term Supplemental Oxygen

Provided to you courtesy of

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PREFACE TO ORIGINAL VERSION - 1995

The National Association for Medical Direction of Respiratory Care (NAMDRC) is pleased to provide this informational booklet for physicians and other healthcare providers to use in the education of patients who require long-term oxygen therapy. Patient understanding of the therapeutic benefits of oxygen therapy is important to improve compliance and to encourage appropriate use of this vitally important treatment modality. The booklet is designed to supplement the usual information provided when oxygen therapy is initiated. The content is intended to expand our patients' knowledge and appreciation of the many therapeutic options that are now available, allowing them to be as active as possible in their homes and communities.

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DISCLAIMER: The information contained in this booklet is general in nature and should not be regarded as medical advice. The best source of medical advice that meets your specific needs is your physician or other healthcare professional.

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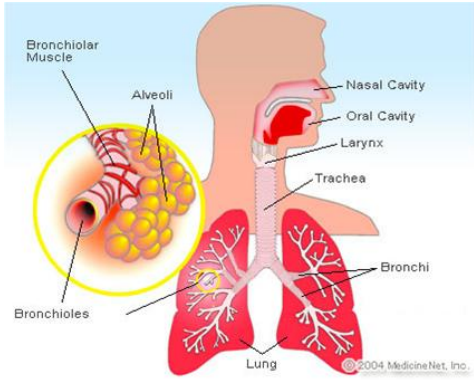
Your doctor has told you that you need oxygen but . . . . What does that mean? **Let's take a closer look at oxygen.**

What is oxygen?

Oxygen (O_2) is an odorless, colorless and tasteless gas that is all around us. Humans and animals alike require oxygen for survival. The air we breathe contains approximately 21% oxygen. The remainder is primarily nitrogen with a handful of other gases in small concentrations.

Our bodies are designed to use oxygen from the air to supply our bodies with the fuel we need to perform daily tasks. Several organs help in getting oxygen to the cells where our bodies use it. The right and left lungs occupy most of the space within the rib cage. The rib cage protects vital organs including the lungs and the heart, which sits between the lungs. The trachea connects the nose, mouth and throat to the lungs and conducts the inhaled and exhaled air from the nose and mouth down to the smaller airways of the lungs. The largest muscle of respiration, the diaphragm, divides the abdomen from the lungs. The diaphragm is domed shape when at rest in normal lungs. When inhalation occurs, it contracts and pulls downward and, in combination with the contraction of the chest muscles, allows the chest cavity to expand. When the diaphragm relaxes, air is passively exhaled from the chest cavity.

When we take a deep breath in, our lungs fill with atmospheric air containing oxygen. The air moves through our nose and mouth, down the trachea, into the large conducting airways, the bronchi, then into the smaller airways and finally into the tiny air sacs called alveoli (al-VEE-o-lye) where respiration takes place. Surrounding the alveoli are microscopic blood vessels called capillaries. The oxygen passes from the alveoli into the capillaries, and enters the bloodstream where the oxygen attaches to red blood cells.



This oxygen rich blood is pumped by the heart throughout the rest of the body via arteries. All cells throughout the body pick up the oxygen carried by the bloodstream to use as fuel. When the oxygen-rich blood reaches the cells, it combines with other nutrients to produce energy. Oxygen becomes fuel for life!

As with any energy production, there is a waste product. Carbon dioxide (CO_2) is the primary waste product that results from energy production in the body. Carbon dioxide is generated when the cell uses oxygen. CO_2 is eliminated from the cell, passed into the bloodstream and is carried back to the heart by veins. The heart then pumps this unoxygenated blood through the capillaries within the lungs and CO_2 is exchanged in the alveoli as oxygen is picked up. During exhalation, CO_2 escapes into the atmosphere through

our mouth and nose. During periods of greater energy requirements, as with running, we breathe larger amounts of air, thus inhaling more O_2 and exhaling more CO_2.

Why is oxygen prescribed?

Your doctor has assessed your overall health and lung function using specific test results such as spirometry, as well as tests such as blood gases or pulse oximetry to determine if your lungs need help getting more oxygen into your blood and to your body. Oxygen is not just a gas, it is a medicine. Supplemental oxygen is prescribed by your doctor, and just like other medications you may take, is under your doctor's direction. Your doctor can identify the specific reasons why you need supplemental oxygen and the clinical expectations with the use of supplemental oxygen.

Many patients require supplemental oxygen continuously; others only require it intermittently or only during the night. The specific time when supplemental oxygen is necessary for you is dependent upon pulmonary function tests (PFTs) performed by your doctor and the level of your day-to-day activities. How much supplemental oxygen you need during rest, sleep, or activities such as walking is determined by these tests. Any form of increased activity, such as exercising, naturally requires more oxygen to fuel your body to meet the increased energy needs, just like a marathon runner. If your blood oxygen level falls below the normal range during rest, sleep, or activity, then supplemental oxygen may be prescribed for you. Your doctor will order specific tests to determine when and how much supplemental oxygen you need.

The medical goal of oxygen therapy is to maintain adequate blood oxygen levels under all conditions, every minute of the day. The amount of oxygen you need and the setting you should use for your stationary and portable delivery systems is determined when you are at rest as well as during your usual activities of daily living. If blood oxygen levels are found to be below the normal range at rest, continuous oxygen delivery (24-hours a day) is the single most important factor that can prolong your life. By reaching this goal, your body will not suffer the negative consequences of intermittent or chronic low blood oxygen levels.

Research shows that oxygen is the only drug that can prolong life in patients with chronic bronchitis and emphysema, often called COPD (chronic obstructive pulmonary disease). In fact, oxygen not only prolongs life, but also improves the quality of life and can benefit patients with chronic low oxygen levels due to a variety of diseases.

How is my oxygen level measured?

Two tests are recognized for determination of oxygen levels: arterial blood gas and pulse oximetry.

Arterial blood gas or "ABG" is one type of oxygen test that uses a sample of blood taken directly from an artery, often at the wrist, but can be taken from other arteries. This test provides your doctor with information about how well your lungs are using the oxygen, eliminating CO_2 and the acid/base balance of your blood.

A pulse oximeter is a device used to perform another type of oxygen test to help determine your oxygen level. This device uses a probe placed on your finger and measures your oxygen saturation (S_pO_2) level. S_pO_2 is a measurement of the percent of red blood cells saturated with oxygen molecules. An oximeter reading is quick and painless, but cannot provide data on CO_2 balance or other parameters in your blood that an ABG provides.

Oximeters are used to obtain saturation levels at rest, during sleep, or while walking or performing more intense activities or during exercise. Measurement of oxygen saturation with pulse oximetry is becoming as common as taking a blood pressure or temperature measurement. Pulse oximeters have become so small and easy to use that many patients have their own oximeter at home to measure oxygen saturation, just as some patients have a home blood pressure cuff to monitor their blood pressure. Oximeters, for home use, are not usually covered by Medicare or other health insurance companies. Your doctor should give you direction as to whether or not a home oximeter would be advisable for you.

Remember that high altitude lowers oxygen levels because the air is less dense. This is true whether you are driving, flying, or walking. Your doctor should take altitude into consideration when evaluating your oxygen tests and to compare your results to the normal oxygen range for individuals in your area.

What is a normal oxygen level?

For a normal healthy individual at sea level, oxygen saturation is usually considered normal if it is above 90%, however your doctor will determine what should be a normal level for you with supplemental oxygen dependent upon your unique medical condition and characteristics. Typically, if your oxygen saturation is below 88% without oxygen then supplemental long term oxygen therapy (LTOT) will be prescribed.

How much oxygen is enough?

The flow rates your doctor will prescribe are based on test results obtained with an ABG or pulse oximetry. Once your doctor has determined that you need supplemental oxygen, a written prescription will be provided, just as with any other medication. The oxygen prescription should indicate when you should use the oxygen and state the flow rate (or setting) you should use on your stationary and portable oxygen delivery systems for walking, sleeping and during rest, if appropriate. Oxygen can be prescribed at different times with different settings. For instance, you may only need to use your oxygen during exercise/activities of daily living or you may need to use your oxygen continuously with different flow rates (or settings – the numbers on the machine) for rest and for exercise. Oxygen flow rates are usually expressed as liters per minute (L/min or lpm) such as 2 lpm. Each oxygen device is different and may deliver a different flow rate even if it is on the same number setting. Two (2) on one device is not necessarily the same as two (2) on another device (stationary or portable). And a setting of two does not necessarily indicate flow rate! Also, if you have a system that gives oxygen flow intermittently during your breath, you will be told what settings to use.

What is the purpose of an oxygen prescription?

The oxygen prescription is often written prior to discharge from the hospital or following a visit to your doctor's office. It is part of the documentation necessary to begin the process of setting up oxygen in your home with a homecare provider. The prescription should contain information necessary for Medicare and insurance coverage. The physician will complete an additional required form that will direct the homecare provider to deliver specific oxygen services and equipment to your home to meet your oxygen requirements as prescribed.

In addition to the duration of use and oxygen flow, the prescription completed by the physician should define the delivery device (nasal cannula, mask, transtracheal catheter, etc.) and oxygen source (concentrator, liquid, compressed oxygen tanks, etc). Oxygen may initially be prescribed for a defined period, but it is not uncommon for oxygen to be prescribed "life-long" because of the established benefits.

Finally, the oxygen prescription serves as documentation to support medical guidelines for home oxygen therapy, a requirement for Medicare and other insurers. Certain qualifications must be met for Medicare and most private insurance policies in order for the insurer to cover home oxygen therapy as a paid benefit.

As with any medication, it is very important that you use the oxygen exactly as prescribed. The goal is to maintain normal oxygen levels 24-hours a day. Be sure that you understand your prescription and the delivery options available to help you enjoy life with oxygen therapy. Ask your doctor for clarification, if necessary. Remember, it is important to realize that you cannot reliably determine *when* you need oxygen or *how much* you need based on symptoms, such as shortness of breath. Furthermore, how much supplemental oxygen your body needs may change over time. Your doctor should periodically check your oxygen saturation to make sure you are receiving the proper amount.

Oxygen Providers

Most providers are firms that have long histories as medical suppliers in your community or surrounding area. Their basic role is to provide the medical hardware that doctors prescribe for their patients, including wheelchairs, stair lifts, crutches, hospital beds, and bedpans. Of all they provide, portable oxygen equipment is the most challenging for them. Their delivery specialists, customer service personnel, and service technicians must have a basic understanding of oxygen therapy. They should have on staff a respiratory therapist (RT) or other health care professional who understands how to meet a patient's requirements with oxygen.

Like your physician, your oxygen provider must be an approved provider of medical services. Your provider must be approved by your primary insurer, whether it be Medicare or your insurance company.

As dedicated as each oxygen provider may be, you will find subtle differences that may help you choose the one who meets your individual requirements.

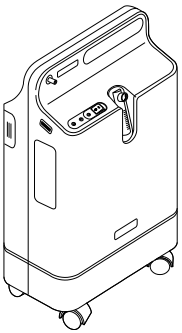
Some things to consider before you select a provider include asking questions such as:

- How long have you been in business in this town?
- Do you provide both liquid and compressed portable oxygen systems?
- How do you select a system (liquid vs. compressed and continuous flow vs. pulsating flow) for a patient?
- How often do you deliver oxygen to a home?
- How quickly do you respond to emergency calls—on weekdays and weekends?
- How quickly do you replace defective equipment?
- Do you arrange for oxygen services when I travel?
- How many branches does your company have and where are they located?

Provider Accreditation

Probably the most important question to ask your proposed provider is about accreditation. An accredited company is one that is responsible to its patients, employees, stockholders, and community. Accredited companies will display their "Certification of Accreditation" prominently. The certificate will be issued by the Joint Commission of Accredited Health Organizations (JCAHO) or one of several other accreditation agencies.

Types of Oxygen Therapy



Long-term oxygen therapy (LTOT) is usually given to patients requiring over a minimum of 15 hours a day, including overnight due to severely limited airflow or oxygen saturation 92% or below when breathing air.

Ambulatory oxygen therapy is offered to people already on LTOT who want to use oxygen outside the home, following an assessment by a specialist. The benefits of ambulatory therapy include:

- It can improve exercise tolerance and breathlessness but there is no evidence of benefit from oxygen before or after exercise in most patients with chronic obstructive pulmonary disease (COPD).
- It may allow increased daily oxygen use and/or better compliance.

Short-burst oxygen therapy refers to the intermittent use of supplemental oxygen at home for 10-20 minutes at a time to relieve dyspnea. It is usually provided from cylinders. It is often prescribed for patients who do not meet the criteria for LTOT but who remain breathless after minimal exertion despite other therapy. Consider short-burst oxygen therapy (from cylinders) only for episodes of severe breathlessness not relieved by other treatments and continue only if breathlessness improves.

How is oxygen supplied and oxygen therapy delivered?

Oxygen therapy may help you function better and be more active. Oxygen is supplied in a metal cylinder or other container. It flows through a tube and is delivered to your lungs in one of the following ways:

- Through a nasal cannula, which consists of two small plastic tubes or prongs that are placed in both nostrils.
- Through a face mask, which fits over your nose and mouth.
- Through a small tube inserted into your windpipe through the front of your neck. Your doctor will use a needle or small incision (cut) to place the tube. Oxygen delivered this way is called transtracheal oxygen therapy.

Oxygen therapy can be done in a hospital, another medical setting, or at home. If you need oxygen therapy for a chronic (ongoing) disease or condition, you might receive home oxygen therapy.

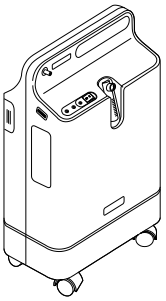
How is oxygen stored in my home?

There are different options for home oxygen therapy. It is important for you to be aware of the choices that are available. It is also important that you work with your doctor to determine which oxygen system best meets your clinical needs and fits your lifestyle.

Home oxygen is generally delivered by “stationary” and “portable” sources. Stationary sources are rather large and heavy and are placed in one area in your home. A long hose attached to your oxygen source allows for activity within a given distance (up to about 50 ft).

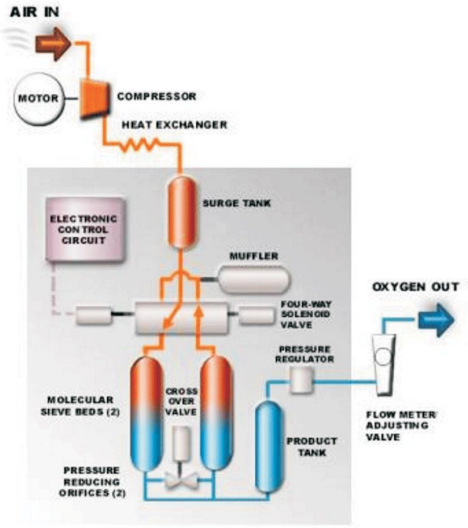
A portable oxygen source is smaller and lighter than the stationary source and may be provided in addition to the stationary source. Even though the duration of oxygen use is limited due to size and storage capacity, the portable source allows for greater ambulation and activity both within and outside the home. There are a number of stationary and portable source alternatives that may be considered.

Oxygen Concentrators



An oxygen concentrator is a machine that draws air from the room through an electrically powered compressor. “Sieve beds” within the machine separate out nitrogen molecules and decrease the amount of nitrogen in the gas you inhale, thereby ‘concentrating’ the purity of oxygen to 90% or greater. A typical concentrator may deliver oxygen flows of 0.5 to 5 L/min, while some models may generate up to 10 L/min. Regulation of the flow is by a flow meter on the front/top of the unit. Stationary concentrators are heavy with an average weight of 40+ pounds and may look like a small piece of furniture. Your homecare provider will assist you in determining the best place for your concentrator. The concentrator should be placed in a well-ventilated area.

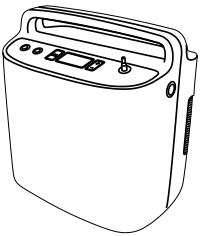
Concentrators plug into a standard electrical wall outlet and operate off normal household electricity. Medicare or insurance companies do not reimburse for the electricity used by concentrators in the home and electrical consumption may vary between models and households.



Routine maintenance should be performed periodically on concentrators. Some of this maintenance is done by your homecare provider while other maintenance is done by you. Depending on the model of your concentrator, maintenance may involve cleaning the filters weekly and changing them on a scheduled basis. Your homecare provider may test for purity and flow rate accuracy and check the machine's operating pressure on a routine schedule. Homecare providers often exchange concentrators on a regular basis so that the periodic maintenance can be performed off site.

If using a concentrator, a backup system is recommended in the event of a mechanical failure or an electrical power outage. When a concentrator is the stationary source of oxygen in the home, compressed oxygen cylinders may serve as the portable supply system.

Portable Oxygen Concentrators (POC)



Portable oxygen concentrators operate in much the same way as stationary oxygen concentrators described in the previous section. However, as the name implies, they are portable, weighing from about 3.5 to 20 pounds (weight is typically associated with total oxygen production and oxygen delivery method) and operate on rechargeable batteries. These units typically have a power adaptor for use during travel in your automobile or wherever a DC outlet is available. Some of these POCs have been approved by the Department of Transportation (DOT) and the FAA for use on-board aircraft. You should check with your specific airline on its regulations regarding use of POCs, specifically your model, on-board while in-flight.

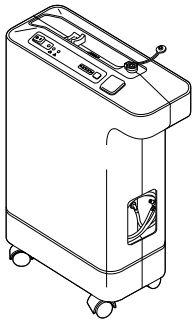
As of May 2009 all carriers with flights accommodating 60 passengers or more arriving and/or departing in the US are required to permit FAA approved POCs on-board and in-flight. Cruise ship, train and bus travel with POCs should be checked out with the specific carrier when booking. More information on traveling with POCs can be found on the NHOPA website (www.homeoxygen.org).

Compressed Oxygen Cylinders/Tanks

The oldest method of storing oxygen is to compress the gas under high pressure, typically 2200 psi (pounds per square inch) when full, and store it inside cylinders or tanks. The cylinders are often green or have a green top, the universal color for oxygen. Large cylinders were initially used as the stationary source in the home but smaller and lighter compressed gas cylinders are now available and are used primarily as portable sources. Older portable cylinders may be difficult to use because they are constructed of heavy steel. Newer lightweight materials, such as aluminum, and smaller cylinders allow for easier portability. Cylinders are sized on an alphabetical system with a large stationary backup cylinder referenced as an H tank, and a standard cylinder referenced as an 'E cylinder or tank'. Smaller cylinders are D, B, A, or M series.

Whether used in the home or with activity outside the home, an oxygen cylinder usually requires attachment of a device for pressure regulation and gas delivery for proper function and oxygen administration. Based upon ambulatory needs the homecare provider periodically delivers a supply of portable oxygen cylinders and patients easily learn to detach the regulator/flow meter device from a near empty cylinder and attach it to a full cylinder. Caution should be used when storing and handling oxygen cylinders due to the high storage pressures. Cylinders should be clearly labeled for content and properly secured in a stand or cart, at all times, to prevent them from tipping over.

Transfilling Oxygen Cylinder Units



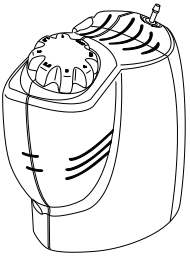
As an alternative to relying on the delivery schedule of the homecare provider for portable cylinders, active patients may benefit from oxygen concentrator transfilling systems that allow them to refill small oxygen cylinders from a specialized stationary unit whenever needed. Typically, the transfilling unit is an oxygen concentrator (discussed previously) that works in conjunction with a specialized compressor system that takes some of the oxygen from the concentrator, pressurizes it, and fills a small cylinder. Concentrator transfilling systems may have the transfilling compressor built into the concentrator or it may be a separate unit that connects to the concentrator. Some concentrator transfill systems allow you to breathe off the concentrator while it is filling the cylinder and other units are designed to only fill the cylinder, requiring you to receive your oxygen from another source, such as a stationary concentrator or a cylinder.

In the past several years, there have been questions regarding the use of oxygen filling systems in healthcare facilities such as long term care facilities and nursing homes. Use of oxygen filling systems is subject to a number of applicable statutes, rules, regulations and standards affecting health and safety, including, without limitation, U.S. Food and Drug Administration (FDA) regulations and individual states' statutes and regulations, the National Fire Protection Association's ("NFPA") Life Safety Code provisions, and Compressed Gas Association ("CGA") requirements relating to medical gases. In many areas, the authority of a federal agency such as the FDA to regulate medical devices supersedes that of a state or local regulatory body. Though we cannot predict or guarantee that any state or local regulatory authority will not call into question the use of oxygen filling systems in nursing homes, personal care homes, or other long-term care facilities, we believe the FDA's authority over medical devices should be determinative in these cases.

Liquid Oxygen

When oxygen is super cooled (-297^{o} F) it becomes a liquid, which provides more compact storage than when oxygen is in a gas form. This frigidly cold liquid oxygen is stored in a thermos-type container. When exposed to room temperatures the liquid oxygen turns back into a gas before it exits the thermos and warms spontaneously before it enters your body. As with the concentrator and compressed gas cylinders, a controller device, often incorporated into the liquid system, adjusts the amount of oxygen delivered to you. Pressure within the liquid oxygen container is typically 15-25 pounds per square inch (psi), which is much less than the pressure of about 2200 psi in a full compressed gas cylinder.

Unlike the concentrator, liquid oxygen does not require electricity, but works off the pressure of the oxygen. Patients learn to refill small portable liquid oxygen units as needed from the large stationary sources. A small portable liquid oxygen unit will last longer than a compressed gas cylinder of a similar size because of the greater capacity to store oxygen in a liquid form. Your homecare provider will periodically come to your home and fill the stationary unit based on your oxygen usage. Most liquid oxygen units must be kept in an upright position however, some of the newer units available will work in any position. Ask your homecare provider about your specific unit and know which type you have. Be aware that liquid oxygen will dissipate or 'vent' over time especially when not in use. This is the result of normal evaporation of liquid oxygen. Consequently, if a full portable unit sits unused overnight, you may find it partially or near empty the next morning.



A relatively new technology can transfill liquid oxygen rather than compressed oxygen and is another portable option to consider.

With either the liquid or compressed gas systems, make sure you check with your homecare provider to determine the length of time *your* supply of oxygen will last based on *your* usage and delivery requirements.

What device allows me to breathe oxygen from the stationary or portable source?

Several devices allow you to receive oxygen from your specific portable or stationary oxygen source.

Nasal Cannula

A nasal cannula is the most common device used to deliver oxygen. This device has been considered the standard oxygen delivery

device for years. Its design is simple, it is easy to learn to use, and it is inexpensive. Cannulas have two plastic prongs that are inserted into the nostrils. The tubing continues across the cheeks and is draped over the ears and under the chin. Oxygen floods the nasal and oral cavities, enriching the air you breathe. Nasal cannula flow rates normally range from 1-6 L/min. Higher oxygen flows may be achieved with specialized nasal cannulas and humidifiers. Intermittent flow devices use nasal cannulas. However, some require special cannula designs, which may be more expensive than the standard design. High oxygen flow cannulas and humidifiers are not intended for use with intermittent flow devices.

Some novel devices exist for nasal cannula devices e.g. a single cannula into a nostril via an opening near the nose piece of a pair of eyeglass frames.

Nasal cannulas should be replaced about once a month as the plastic prongs become rigid and may irritate the nose. Some individuals may develop soreness or discomfort under the nose or over the ears with the device. Hypoallergenic cannulas are available to persons who may have sensitivity to regular plastic. Your homecare provider should supply you with a new cannula on a regular basis. Ask your homecare provider about other cannula options and accessories.

Transtracheal Catheter

The transtracheal oxygen (TTO) catheter is a small, flexible tube placed in the trachea to deliver oxygen directly to the lungs for the greatest benefit. Using this method of delivery, one uses about one half the amount of oxygen compared to a nasal cannula because the oxygen is delivered directly to where it is used. Since patients have the catheter in place all the time, oxygen delivery is uninterrupted. This delivery device meets the goal of maintaining adequate oxygen levels virtually 24-hours a day while conserving required oxygen. TTO provides a comfortable alternative to nasal cannula therapy. Because of some physical benefits, TTO is especially intended for active patients. However, due to the oxygen conservation, TTO has been used to achieve adequate oxygen levels in a number of individuals who cannot be adequately oxygenated with standard nasal cannulas and standard continuous flow oxygen delivery systems.

Initial placement of a TTO catheter is a procedure performed by a specialist in a hospital or outpatient facility. Medical professionals instruct patients in the routines of transtracheal catheter care. The outside diameter is about the size of a "cocktail straw." Speech and eating routines are unaffected and the catheter can easily be hidden from view. Generally, cleaning is required once to twice per day, taking about as much time as brushing your teeth. TTO therapy requires maintenance of the catheter and may be associated with medical complications, particularly if instructions for care are not followed. Transtracheal oxygen does require a special hose to connect to the catheter; however, the hose will connect to any type of oxygen system. As described in another section, TTO cannot be used with intermittent flow devices that require a certain nasal cannula design.

Oxygen Mask

Oxygen can be delivered through a plastic oxygen mask. The mask covers the nose and mouth and is held in place by an elastic strap around the head. The use of a mask for oxygen therapy in the home is rare. Practical issues make this device difficult to use on a continuous basis, but it may be rarely selected in certain clinical conditions where very high concentrations of oxygen are necessary and cannot be delivered by a more practical or acceptable means.

Oxygen Conserving Devices

Oxygen conserving devices, as the name implies, are used to conserve oxygen. Intermittent flow devices, transtracheal catheters and certain nasal cannulas described in the section below are oxygen conserving devices. Intermittent flow devices can be electric or pneumatic. Oxygen is not delivered during expiration, thus conserving or saving oxygen. Consequently, these are intermittent flow devices. In addition to the oxygen conserving devices, there are some specially designed nasal cannulas intended for continuous flows of oxygen that use a reservoir system to lower liter flow needs.

If you are placed on a conserving device, you should be evaluated by your doctor to make sure that your oxygen saturations are adequate during all types of activities including rest, walking, exercise, and sleep.

The use of an oxygen-conserving device is a change in the oxygen prescription written by your doctor so your doctor must be notified of any new device that your provider recommends for you.

Electric and Pneumatic Intermittent Flow Devices

Electric or pneumatic conserving devices may also be referred to as a pulse dosing device or demand oxygen delivery device (DODD). The electric and pneumatic conserving devices deliver oxygen when you breathe in, however their operation is different.

Electronic devices typically operate on batteries to control the delivery of oxygen on inspiration and to power safety alarms. Electronic oxygen devices sense the onset of breathing and deliver a pulse or bolus of oxygen, the size of the bolus is based on the setting and the device's design. Electronic devices use a single lumen, or regular, nasal cannula as described previously. Some types of electronic devices may have the ability to switch between continuous flow and pulsed flow.

Pneumatic devices work off pressurized gas, do not require batteries, and are usually incorporated into the source unit. Many modern pneumatic units may use a standard nasal cannula and operate much like the electronic conservers, Some pneumatic conservers require a dual lumen cannula, which use one side of the cannula to sense the inspiration and the other to deliver the oxygen. The beginning of expiration is also sensed shutting 'off' the flow of oxygen. Pneumatic units may have the ability to switch between intermittent/pulse mode and continuous mode.

Utilization of intermittent flow systems can save 50% or more of the flow of oxygen, allowing liquid and compressed gas systems to last longer. With a longer lasting portable system, you will be able to be away from your home for longer periods of time. Your homecare provider can let you know how long your oxygen will last with your specific conserving system. Remember, if you switch from intermittent to continuous flow, the duration your system will last will be reduced. Just as with other oxygen conserving systems, intermittent flow devices may not achieve adequate oxygen in all patients, particularly during exertion or sleep. Your physician should determine that you have adequate oxygen levels using that specific device.

Nasal Cannula Conserving Devices

A nasal cannula with a reservoir stores oxygen in a reservoir chamber within the cannula as oxygen flows from the source. The reservoir chamber is flooded with oxygen during the expiratory phase of each breath, providing access to a greater volume of oxygen during the next inspiratory effort. The reservoir can be an under the nose 'mustache' style or lower in the tubing like a 'pendant' necklace. These nasal cannulas with reservoirs do not work with intermittent flow devices; they simply store oxygen and add it to the continuous flow delivered with the next breath.

> **A note of caution: Your doctor should evaluate your saturation level using your specific conserving device to make sure your saturation levels stay in the appropriate range. Even though the devices save oxygen, you will not receive the benefits of supplemental oxygen if you do not maintain adequate oxygen saturation levels. All oxygen conservation systems should be approved and prescribed by your doctor prior to use.**

Other Oxygen Delivery Devices

CPAP or Bi-level Machines

Patients with sleep apnea or other nighttime breathing problems may require the use of a device called a CPAP or Bi-level machine. CPAP (Continuous Positive Airway Pressure) machines provide a constant preset pressure during both inspiration and expiration. Bi-level Positive Airway Pressure machines apply preset inspiratory and expiratory pressures. Both machines use a mask over the nose or mouth and nose to apply positive pressure to the patient's airway during sleep, thereby maintaining an open airway to improve breathing. These home units are usually small and portable and make travel with the device relatively easy. Some patients may require administration of supplemental oxygen in addition to the CPAP or Bi-level machine. A concentrator or stationary liquid oxygen system can deliver oxygen directly into the unit. Your homecare provider will show you how this is set up.

Oxygen Accessories

Humidifier

A major function of the nose is to humidify and heat the air we breathe in. When a nasal cannula directs the flow of dry oxygen into the nostrils, the nasal passage can become inflamed and irritated. As a result, the nose may become less efficient in heating and humidifying the air especially in drier climates. A humidifier can be added to a stationary oxygen system such as a concentrator or liquid oxygen system. Patients on low nasal cannula flows, who do not have problems with mucus, or who live in humid climates may not need a humidifier. However, humidifiers may help to minimize or decrease the effects of breathing the dry gas. Humidifiers are not used with intermittent flow devices. There are now a number of different types of humidifiers designed for different needs. If required, your homecare provider can help select and supply the humidifier that is best for you.

Portable Oxygen Carrying Case

Portable oxygen units can be placed in a variety of carrying cases for easier portability. These can range from backpacks to wheeled carts to side pouches. Your homecare provider can provide you with different options that may come in different styles, colors and specific options to complement your lifestyle and your specific system. Other options are available from a variety of independent sources. A note of caution with carrying cases and portable liquid oxygen devices: the case must be appropriately vented so that the liquid oxygen unit does not freeze up during use. Freezing stops the delivery of your oxygen.

Miscellaneous Accessories

As oxygen therapy becomes a more common way of life for many people, there are new products that make living with oxygen easier. Perhaps there are accessories that might fit your needs and your lifestyle. Ask your homecare provider for information on available accessories.

Safety Considerations

- Oxygen should never be used near an open flame, including candles or a lit cigarette. Oxygen is not flammable, but does support and accelerate burning.

- Do not use electrical equipment such as razors or hair dryers when using your oxygen. The equipment may spark and cause a fire. Battery operated equipment can be used.
- Flammable products such as oil-based face creams, aerosol sprays, rubbing alcohol, and other oil-based products and lubricants should not be used near oxygen.
- Place concentrators and liquid units in well-ventilated areas and keep away from heater vents.

- Do not oil or grease your oxygen equipment.
- Although oxygen delivery systems are durable, they should be handled with care.
- Take precaution to prevent liquid and compressed gas units from tipping over or falling upon hard surfaces. Properly secure compressed gas cylinders at all times, either in a stand or cart, to prevent tipping.
- Clearly label compressed gas cylinders for contents.
- Liquid oxygen, if spilled, may cause frostbite upon contact with skin.
- Vaseline or other petroleum products should not be used in or around the nares. Water-based products such as K-Y jelly can be used for dry nasal passages.
- Make sure that a back up nasal cannula, mask, or transtracheal catheter is available.

Oxygen and Smoking 

The use of home oxygen systems has increased over the past decade. It's important for people to practice fire safe behaviors when oxygen is in use. Oxygen itself does not burn, but a fire needs oxygen to start and to keep burning. When more oxygen is in the air, the fire will burn hotter and faster. Smoking should not be allowed in a home where oxygen is used. Even if oxygen is not being used, it may have saturated the home including clothing, curtains, furniture, or anything in the area.

Your homecare provider should review all necessary precautions and safety information with you. They can also review your doctor's prescription with you and offer you instruction on the proper use of your oxygen system.

Safety Tips

- Never smoke in a home where oxygen is used.
- Post "no smoking" signs in and outside of the home to remind residents and guests not to smoke.

Traveling with Oxygen

Traveling by air, train, bus or boat requires preparation and may include some extra fees. These methods of transportation may require a doctor's prescription as well as clearance by the transportation company's medical staff. Preparation is still necessary, even if you are traveling with your own portable concentrator. The medical staff reviews the prescription and may need verbal or written confirmation from your doctor that you are medically stable to travel. It is handy to carry a few copies of your oxygen prescription on your person when traveling. It is best to check out each transportation company's requirements and guidelines before booking your ticket.

Once you book passage, remind the company that you are traveling with that you are on oxygen and will require oxygen during travel. Keep track of the names of the persons you speak with when making travel arrangements.

Some private businesses and organizations set up cruises and tours specifically designed for persons on supplemental oxygen. They assist you in setting up oxygen for your travel to the cruise ship and destination and take care of setting up the oxygen on the cruise ship or at the destination. If you book with a private organization, make sure that you know the arrangements regarding your oxygen.

Traveling by car or motor home is limited only by the availability of an oxygen provider outlet nearby when a liquid fill, cylinder exchange or concentrator maintenance is required. Make sure you talk to your oxygen provider before you hit the open road. You should carry extra oxygen prescriptions with you whenever you travel.

Note: **You should carry extra oxygen prescriptions with you whenever you travel.**

Guidance for people with disabilities and who travel is found in the basis of disability in Air travel Final Rule" (see 14 CFR 382) , and FAA advisory circular AC No: 91-21B.

It is recommended that anyone traveling with an assist device call the airline in advance to check on their travel policy. Other items to consider:

1. Obtain a Physician's order/ prescription explaining the need for the device.
2. Advise the patient that they should carry the User Instruction Manual with them or keep it with the device.
3. Instruct the patient to contact the POC device manufacturer if the airline has any specific questions regarding the approval of the device.

Refer the patient to the following link which offers some TSA guidance that helps get the through airline security: http://www.tsa.gov/assets/pdf/special_needs_memo.pdf

Traveling with oxygen is a subject that cannot be adequately covered in a few short paragraphs. For more detailed information on traveling with oxygen go to the NHOPA website at www.homeoxygen.org.

Conclusion

Long-term oxygen therapy is very important to you. Proper use will help you live longer and healthier. The options in oxygen delivery sources, devices, and accessories should be fully understood in order to help you attain the highest quality of life possible while using oxygen. Remember oxygen is a drug, and should be taken as prescribed by your doctor. If you need additional information about oxygen therapy, contact your doctor and your homecare provider.

Terms You Should Know

Alveoli	(al-VEE-o-lye) Tiny air sacs in the lungs.
Bronchi	Large airways.
Bronchioles	Smaller airways leading to alveoli.
Capillaries	Microscopic tubes connecting arteries and veins and providing blood flow to tissues.
Catheter	(kath-a-ter) A small tube inserted into the body.
CGA	Compressed Gas Association
Chronic Obstructive Pulmonary Disease (COPD)	A progressive lung disease characterized by obstruction of the smaller airways often secondary to cigarette smoking.
FAA	Federal Aviation Administration
FDA	U.S. Food and Drug Administration
Long-Term Oxygen Therapy	Well established as the standard form of treatment for patients with low oxygen levels in the blood.
NFPA	National Fire Protection Association
Nasal Cannula	(kan-u-la) The hose that passes over the ears, across the cheeks and into each nostril to deliver supplemental oxygen.
Oximetry	A noninvasive method to determine blood oxygen saturation using a painless light probe placed on the finger or ear lobe.
Pulmonary Function Tests (PFTs)	Breathing tests which measure the volume and flow rates of the air in the lungs.
Trachea	(tray-key-ah) The windpipe. The trachea is a tube in the front of the neck about 4.5 inches long which extends from the voice box (Adam's apple) to the lungs.
Transtracheal	Passing directly into the trachea. A transtracheal catheter passes from the skin of the lower neck, through a tissue passage way and directly into the trachea.

Common Laboratory Blood Tests for Respiratory Diseases:

Arterial Blood Gases (ABG)	Blood sample obtained directly from an artery, commonly from the wrist. Results define P_aO_2, P_aCO_2, saturation, and acid/base measurements. This test is usually obtained to determine accurate data on how efficiently the lungs are working.
P_aO_2	Partial pressure of oxygen in the arteries measured in millimeters of mercury (mmHg). This reading should remain above 55 mmHg. Slight variances due to age and altitude may be acceptable. This test is obtained from arterial blood samples.
P_aCO_2	Partial pressure of carbon dioxide in the arteries measured in millimeters of mercury (mmHg). Normal values (35-45 mmHg) are easily defined in healthy people but can vary in individuals with lung diseases. This test is obtained from arterial blood samples.
pH of Blood	Acid/base measurement with normal values of 7.35-7.45. This test is usually determined from an ABG.
S_aO_2	Saturation of oxygen in the blood. Normal is above 90%. P_aO_2 levels can be estimated from oximetry results, sometimes avoiding an ABG.
S_pO_2	Obtained via pulse oximetry and usually is reflective of the S_aO_2. Normal is above 90%.

Important Phone Numbers

(Write down and keep a copy next to your phone and in your wallet or purse)

Primary Doctor:_____

Homecare Provider: _____

Local Hospital: _____

Local Rescue Service (if not 911): _____

Relative/Friend:_____

Pulmonary Rehab Program: _____

Other Doctors:_____

Pulmonologist (Lung): _____

Cardiologist (Heart):_____

Other:_____

Notes:

_____

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Medication List

(Keep a copy in a convenient location at home and a copy in your purse/wallet)

Oxygen Prescription

Activity	L/Min	Continuous or DODS
Rest	____	_____
Walking or other exertion	____	_____
Sleep	____	_____

Medications

Medication	Dose	How Often Each Day

This publication is based on the pamphlet previously authored by **Patrick M. Mallett, RRT** of Littleton, Colorado.

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