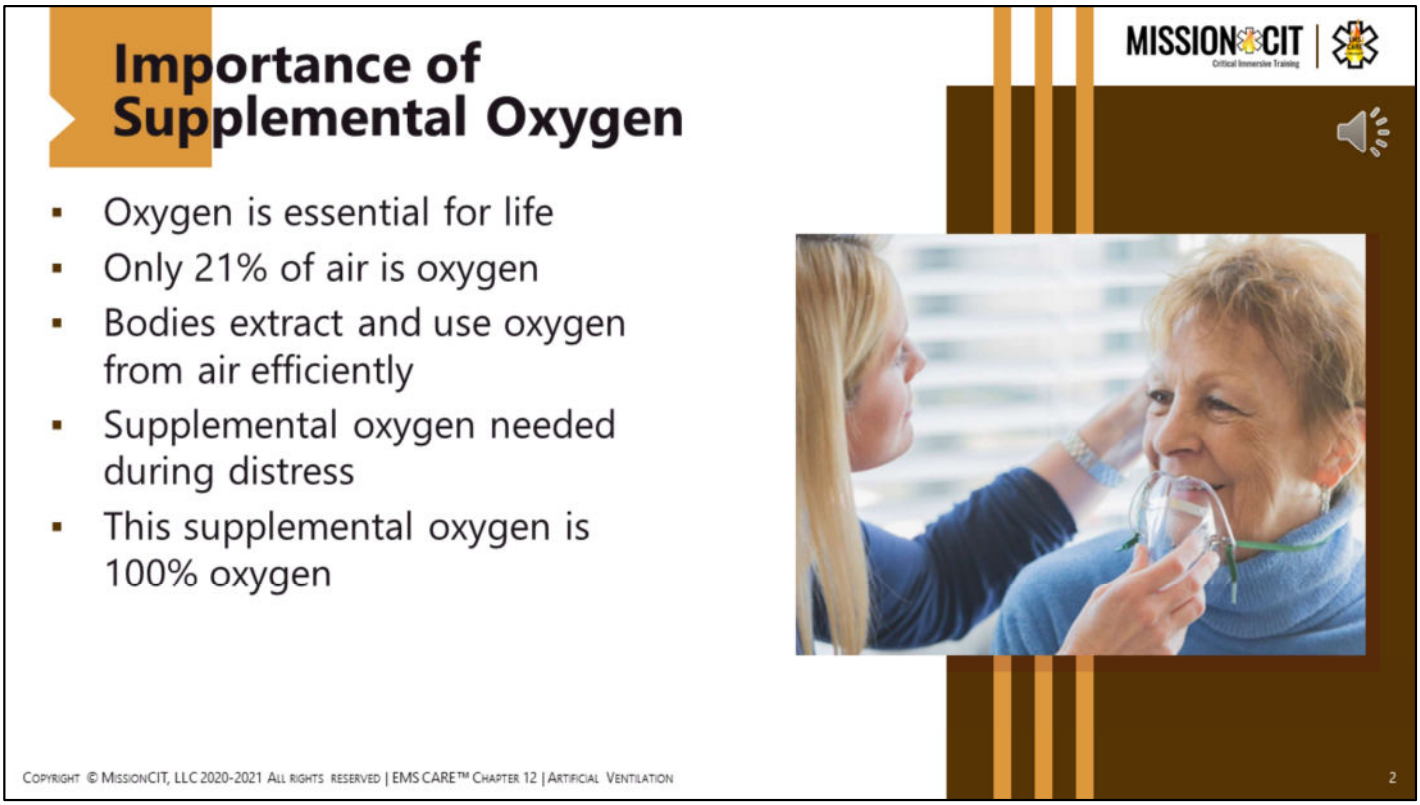


Hello there! Welcome to the oxygen therapy lesson and first off, let’s talk about the importance of oxygen as a drug.



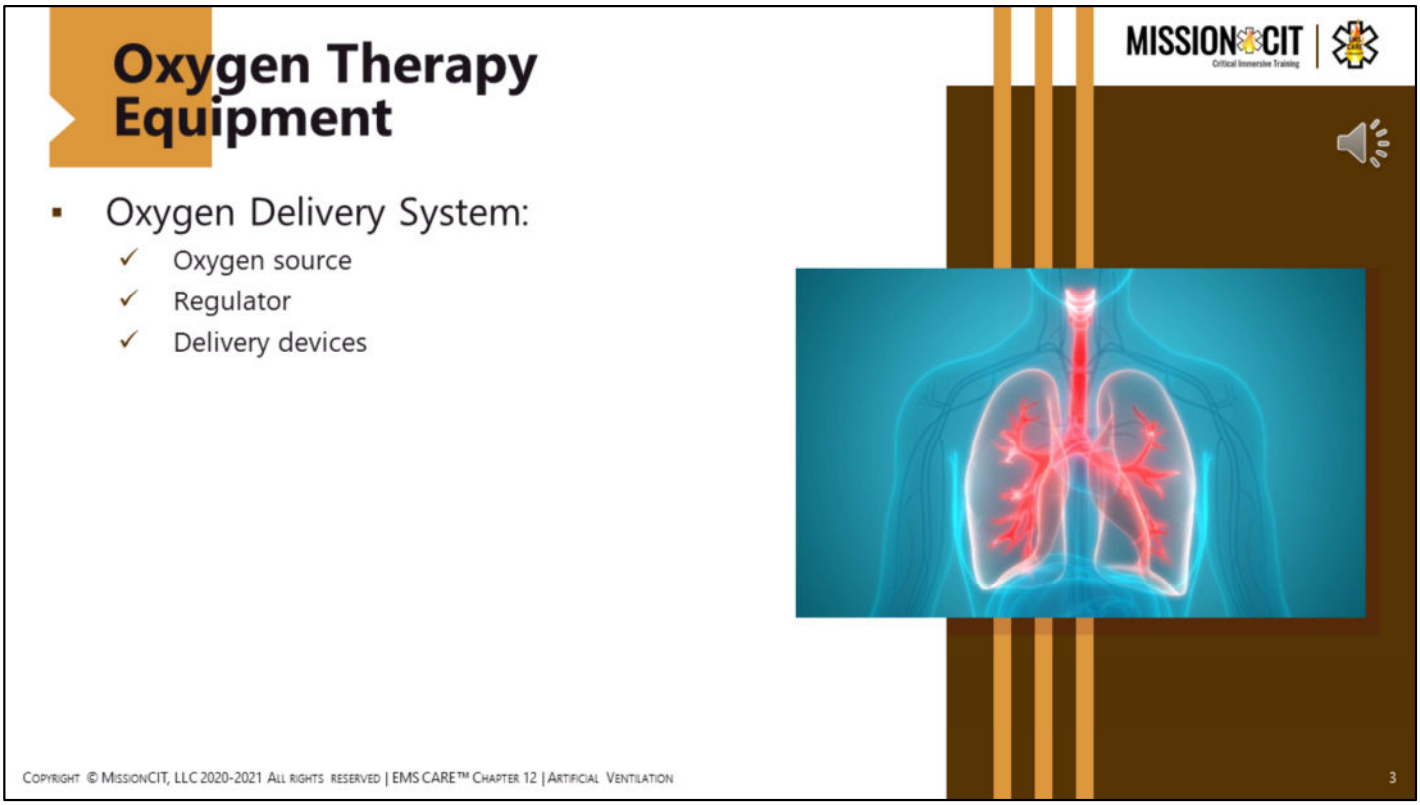
We all know that oxygen is essential for our survival and we get it from the air. But do you know that the air we breathe contains only 21% oxygen? Well, that may be enough during our normal functioning as our lungs are designed to extract oxygen from the air we breathe and send it to the cells and tissues.

But when a person is going through respiratory distress, he or she may not be able to breathe in the required amounts of air, so there's a possibility that enough oxygen may not be available for the body. In turn, this leads to dangerous conditions like cyanosis.

In such situations, oxygen has to be given as a drug and for this, the supplemental oxygen has to be 100% oxygen.

There are three major issues with supplemental oxygen:

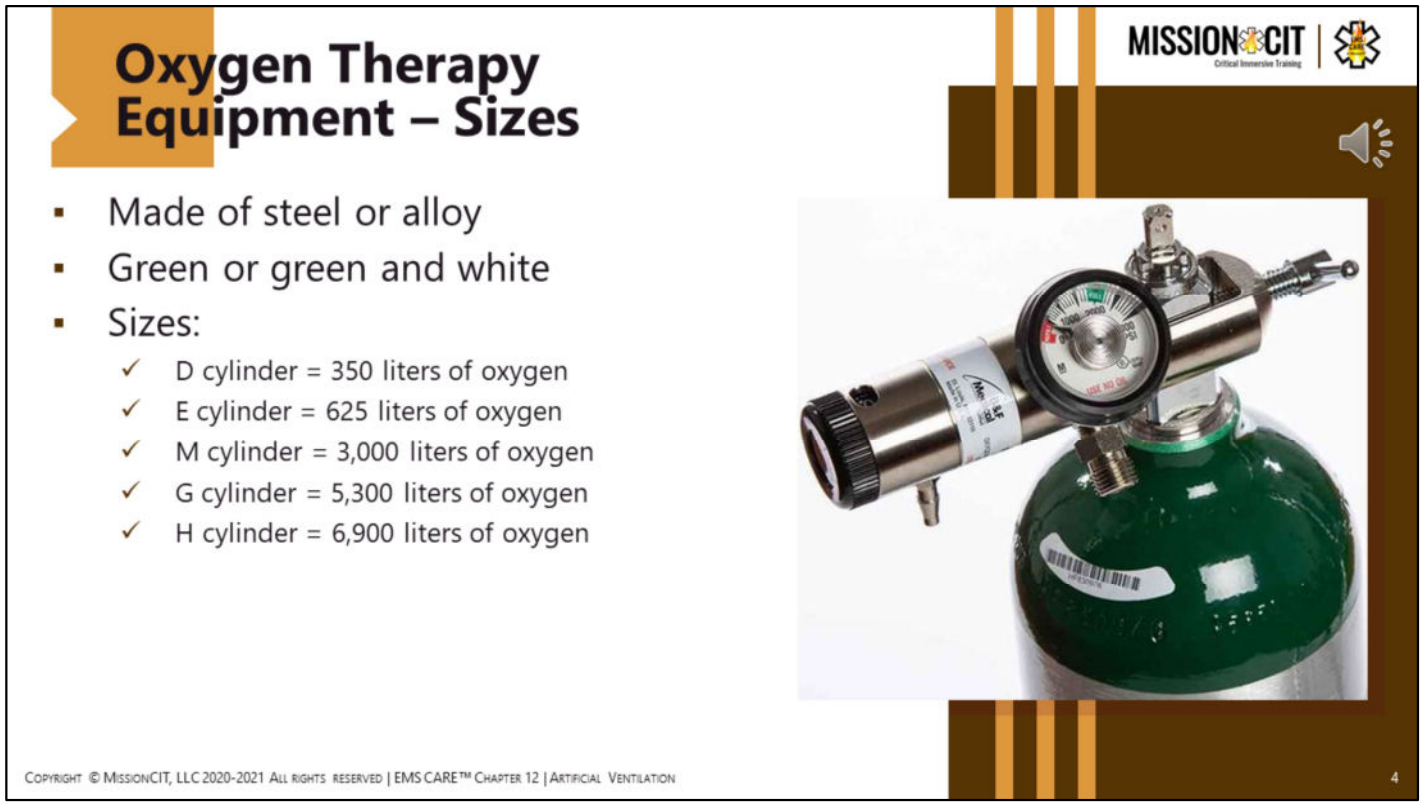
- Oxygen is a drug – It is possible to give too much or too little of it
- Oxygen can cause harm – It can cause damage to heart attack and stroke patients
- Oxygen administration is based on evaluation – Oxygen should be prescribed to achieve a target saturation of 94-98% for most acutely ill patients or 88-92% for those at risk of hypercapnic respiratory failure



Every oxygen delivery system comprises of three components and they are:

- Oxygen source
- Regulator, and
- Delivery devices

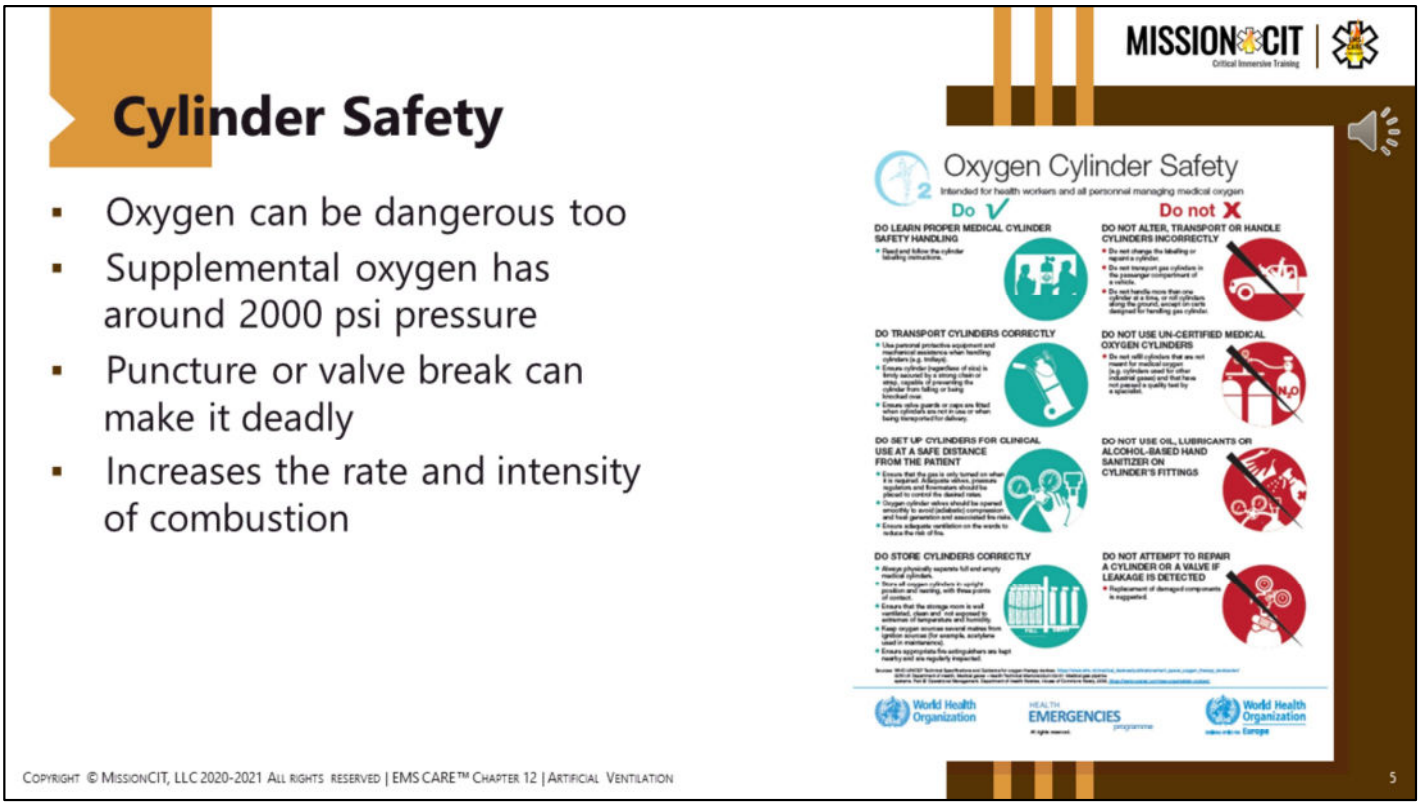
As the names suggest, the oxygen source component is responsible for holding the oxygen, the regulator gives you the option to turn it on or off and helps you determine the required rate of flow, while the delivery device component is responsible for delivering the oxygen to the patient. Oxygen equipment in the field must be safe, lightweight, portable, and dependable. Other devices like BVM and pocket masks can be used to force oxygen into the patient's lungs.



The most widely used oxygen delivery equipment is the oxygen cylinder. Cylinders are seamless steel or alloy canisters filled with oxygen under pressure. They are green or green and white. Depending on the needs, these cylinders come in various sizes and are identified by letters.

For example:

- D cylinder holds 350 liters of oxygen
- E cylinder holds 625 liters of oxygen
- M cylinder holds 3,000 liters of oxygen
- G cylinder holds 5,300 liters of oxygen, while
- The H cylinder holds 6,900 liters of oxygen respectively



Oxygen is vital for life. But at the same time, do you know that it can also be dangerous?

Generally speaking, supplemental oxygen cylinders may be under 2000 psi. If this tank is punctured or if the valve breaks off, the supply tank and valve can become deadly projectiles.

Why?

Though oxygen by itself is not combustible, it greatly increases the rate and intensity of combustion. Of course, oxygen and oil don't mix well either.

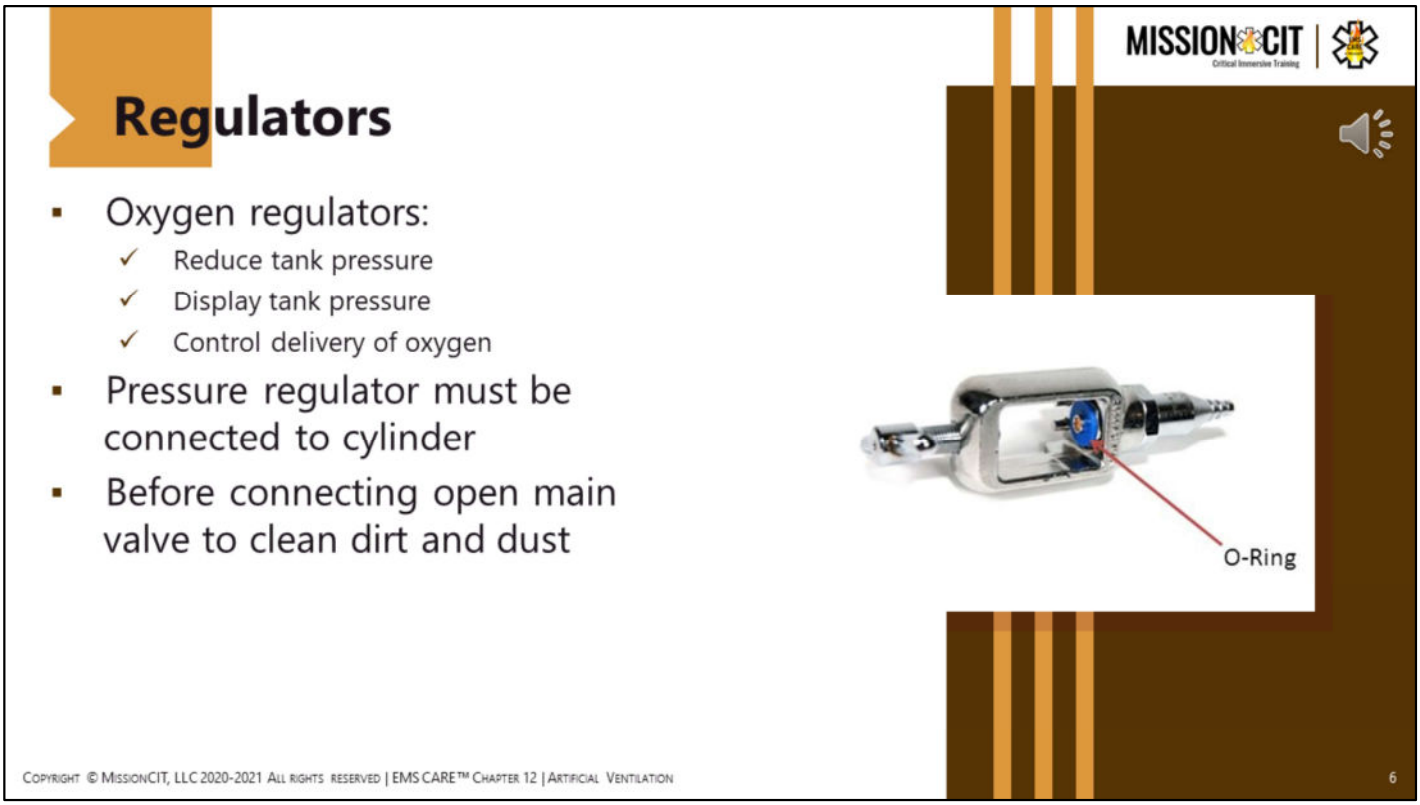
Since oxygen can be hazardous, so you must take a lot of precautions while using them.

In general,

- Never allow smoking.
- Never use around open flames or sparks.
- Never use grease or oil.
- Never put tape on a cylinder.
- Never store near high heat or in a closed vehicle parked in the sun.
- Keep portable cylinders lying flat.

- Use pressure gauges and regulators.
- Ensure O-Ring is in good condition.
- Valves/connections must be tightened by hand only.
- Open and close all valves slowly.
- Store in a cool, ventilated room.
- Have cylinders hydrostatically tested.

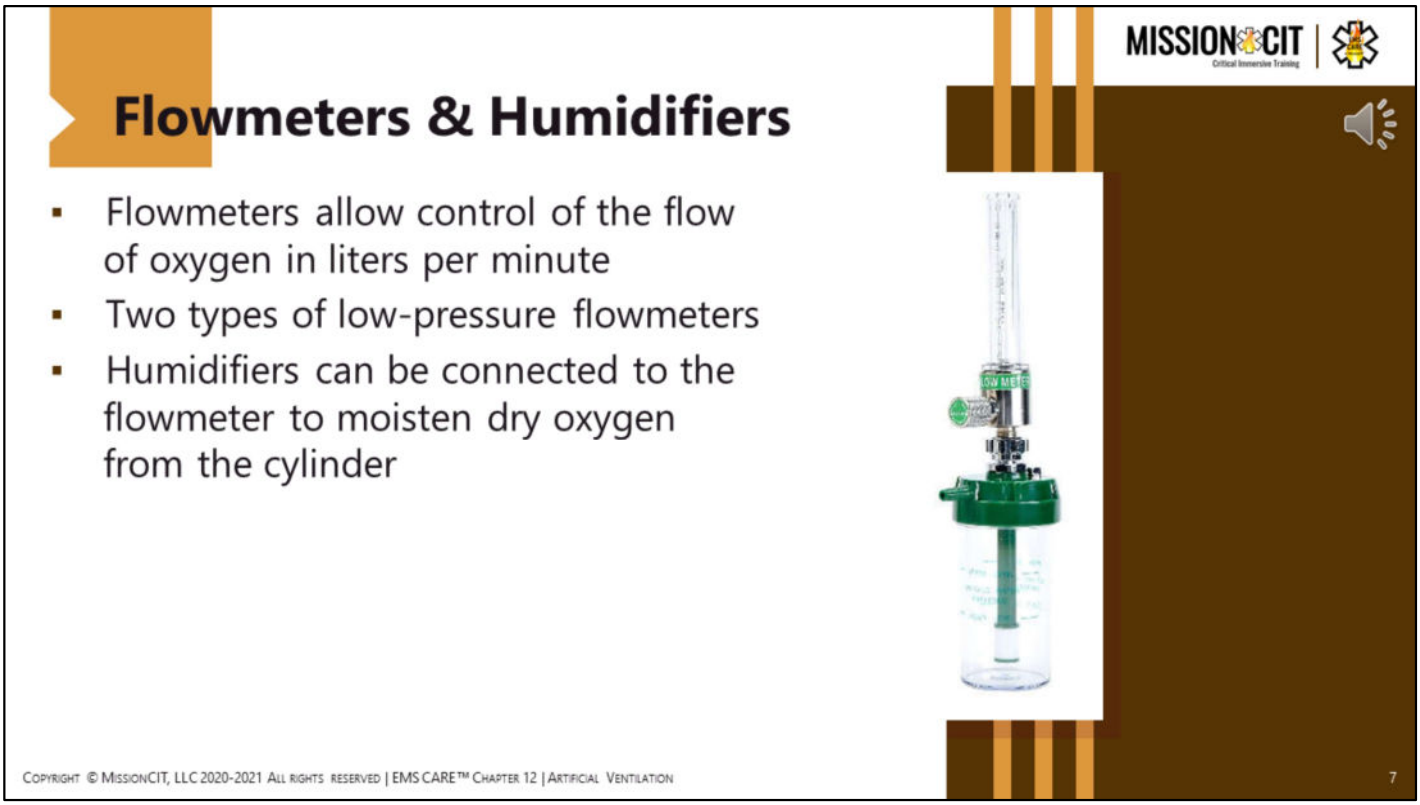
This poster from WHO is intended for health workers and other personnel on the safety and mitigation measures that need to be adhered to when dealing with medical oxygen. Medical oxygen, either in liquid or gas form, is an oxidizing agent that can result in a fire or explosion if not handled properly.



Oxygen regulators are a key part of the oxygen delivery system as it helps you to adjust the optimal flow. Broadly speaking, these regulators have three functions, and they are:

- Reduce tank pressure
- Display tank pressure, and
- Control delivery of oxygen

Note that they come with a pin index system, which is a safety system used to ensure the proper regulator is used for a specific gas. Also, the O-Ring ensures an airtight seal between the regulator and tank valve. A pressure regulator must be connected to a cylinder to provide a safe working pressure of 30 to 70 psi. Before connecting a regulator to a cylinder, open the main valve slightly to clear dirt and dust.



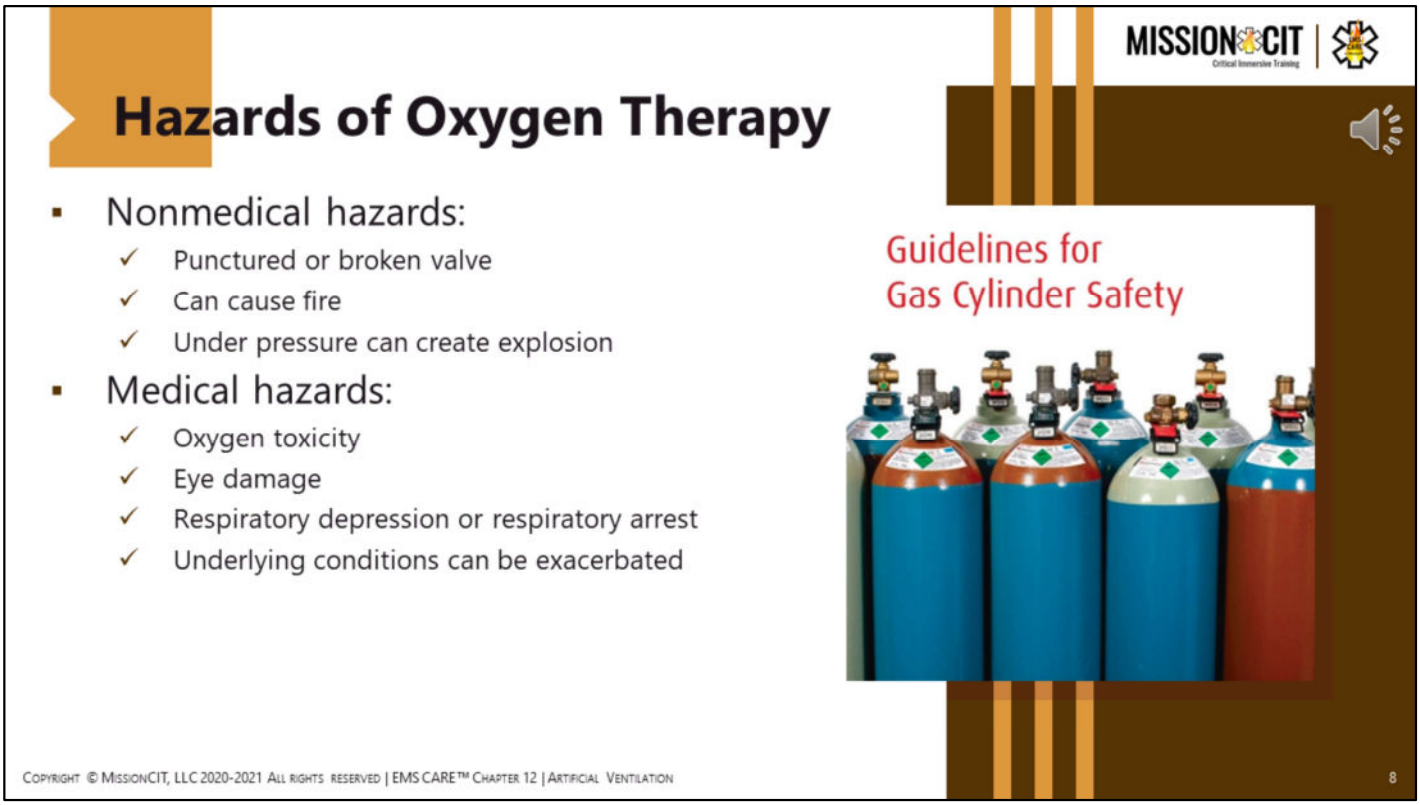
Flowmeters allow control of the flow of oxygen in liters per minute. They are usually permanently attached to pressure regulators on emergency medical equipment.

There are two types of low-pressure flowmeters:

- Pressure-compensated flowmeters are used for larger cylinders in the ambulance
- Constant flow selector valve can be used with any size cylinder

High-pressure flowmeters may be necessary for oxygen-powered devices or respirators and ventilators.

Humidifiers have been used as an oxygen regulator, though many EMS systems no longer use humidifiers due to infection risk. Humidifiers can be connected to the flowmeter to moisten dry oxygen from the cylinder. If your EMS system uses it, know that humidifiers are an unbreakable container of sterile water and it helps to make oxygen more comfortable for patients to breathe.

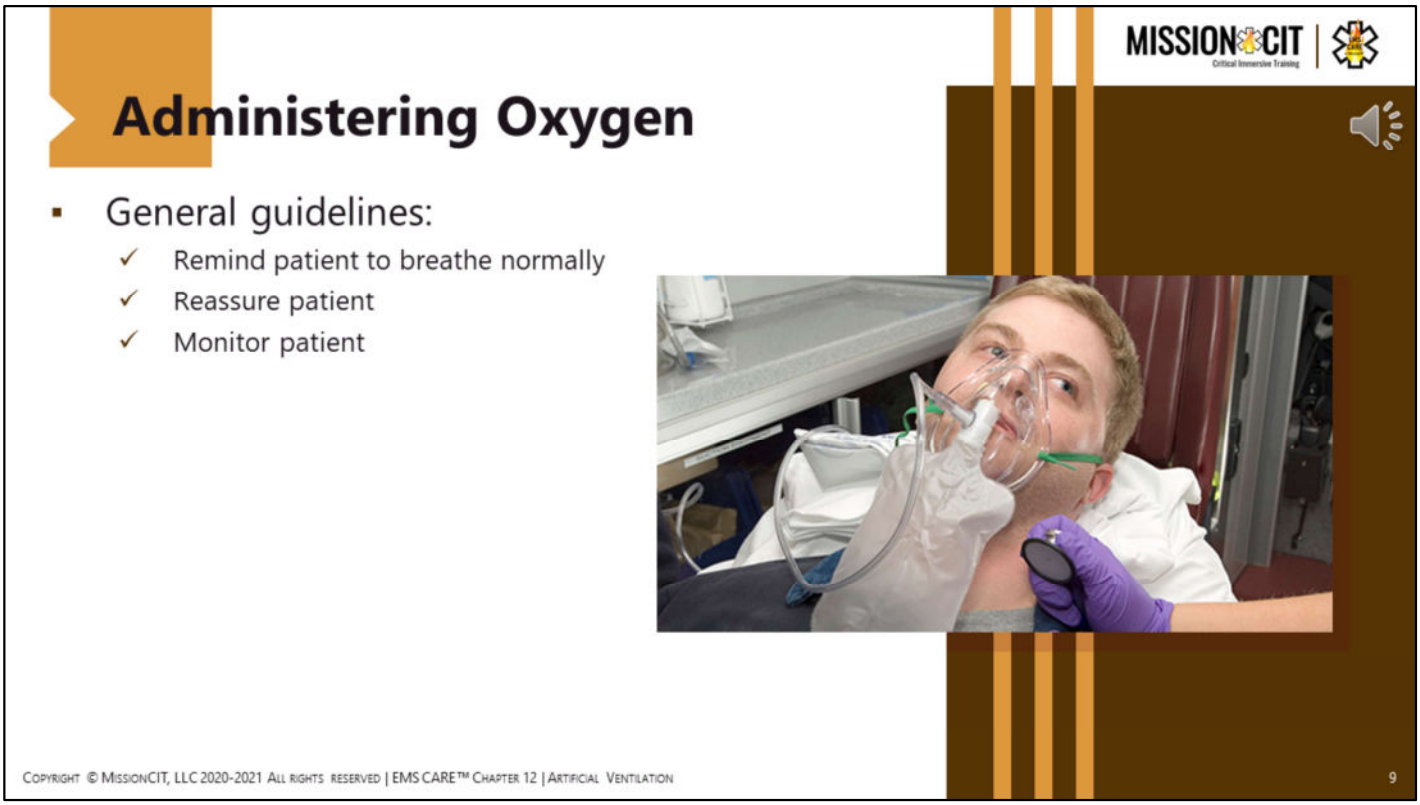


Nonmedical hazards are extremely rare and can be avoided by treating equipment properly:

- If a tank is punctured or a valve breaks off, the supply tank can become a missile
- Oxygen can cause fire to burn more rapidly
- Oxygen under pressure and oil create a severe, explosive reaction

Medical hazards can occur but take time to develop and are rarely seen by EMTs:

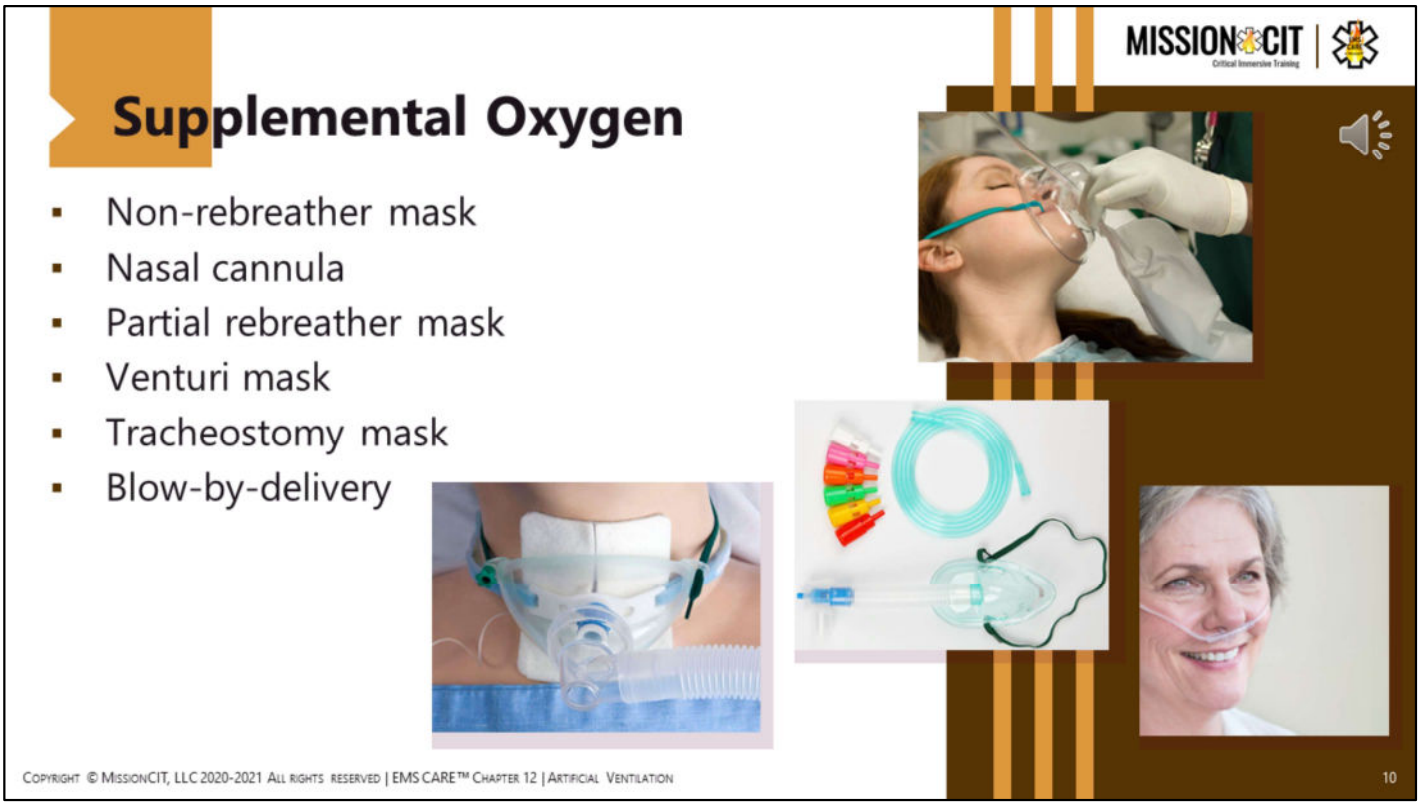
- Oxygen toxicity or air sac collapse occurs when there is an “overload” of oxygen
- Eye damage may occur when premature infants receive oxygen over a long period
- Respiratory depression or respiratory arrest occur when the hypoxic drive is depressed in COPD patients
- Underlying conditions can be exacerbated, as with myocardial infarction or stroke



Various devices are used to administer oxygen. These guidelines apply regardless of which device you use. Let's look at some general guidelines you can follow:

- Remind the patient to breathe as normally as possible
- If a patient is anxious and reluctant to accept the device, provide extra reassurance
- Monitor patient closely

Work with your instructor or follow your instructor's directions to understand how to use specific equipment.



Supplemental oxygen should be used when there is shortness of breath, hypoxia, or low oxygen saturation.

- For mild distress, administer low-concentration oxygen via nasal cannula
- For moderate to severe distress, administer high-concentration oxygen via a non-rebreather mask
- Local protocols may offer additional guidance

A non-rebreather mask is the best way to deliver high concentrations of oxygen to breathing patients. It is a face mask with a one-way valve that acts as a reservoir bag. While using, inflate the bag before placing it on the patient's face and always ensure that there's adequate oxygen flow, typically 12 to 15 liters per minute. It should be used in patients with signs of hypoxia with shortness of breath, chest pain, and altered mental status. You can choose a non-rebreather mask when patients are in moderate to severe distress and need about 80 to 95 percent oxygen. These devices can deliver oxygen at the rate of 10 to 15 liters per minute.

On the other hand, the nasal cannula is used to deliver low concentrations of supplemental oxygen to a breathing patient. Ideally, choose nasal cannula when patients are in mild to moderate distress and need about 25 percent to 45 percent oxygen. These devices can deliver oxygen at the rate of one to six liters per minute. The cannula is the best choice for a patient who refuses to wear an oxygen face mask.

A partial rebreather mask is very similar to a non-rebreather mask:

- It does not have a one-way valve like the non-rebreather mask
- It allows the patient to rebreathe about one-third of the exhaled air
- This is useful to preserve carbon dioxide levels to stimulate breathing
- The partial rebreather mask delivers 40 to 60 percent oxygen at 9–10 liters per minute

A Venturi mask delivers specific concentrations of oxygen by mixing oxygen with inhaled air. It has adjustable "jets" that allow a user to more accurately determine specific oxygen concentration levels. It is most commonly used on COPD patients.

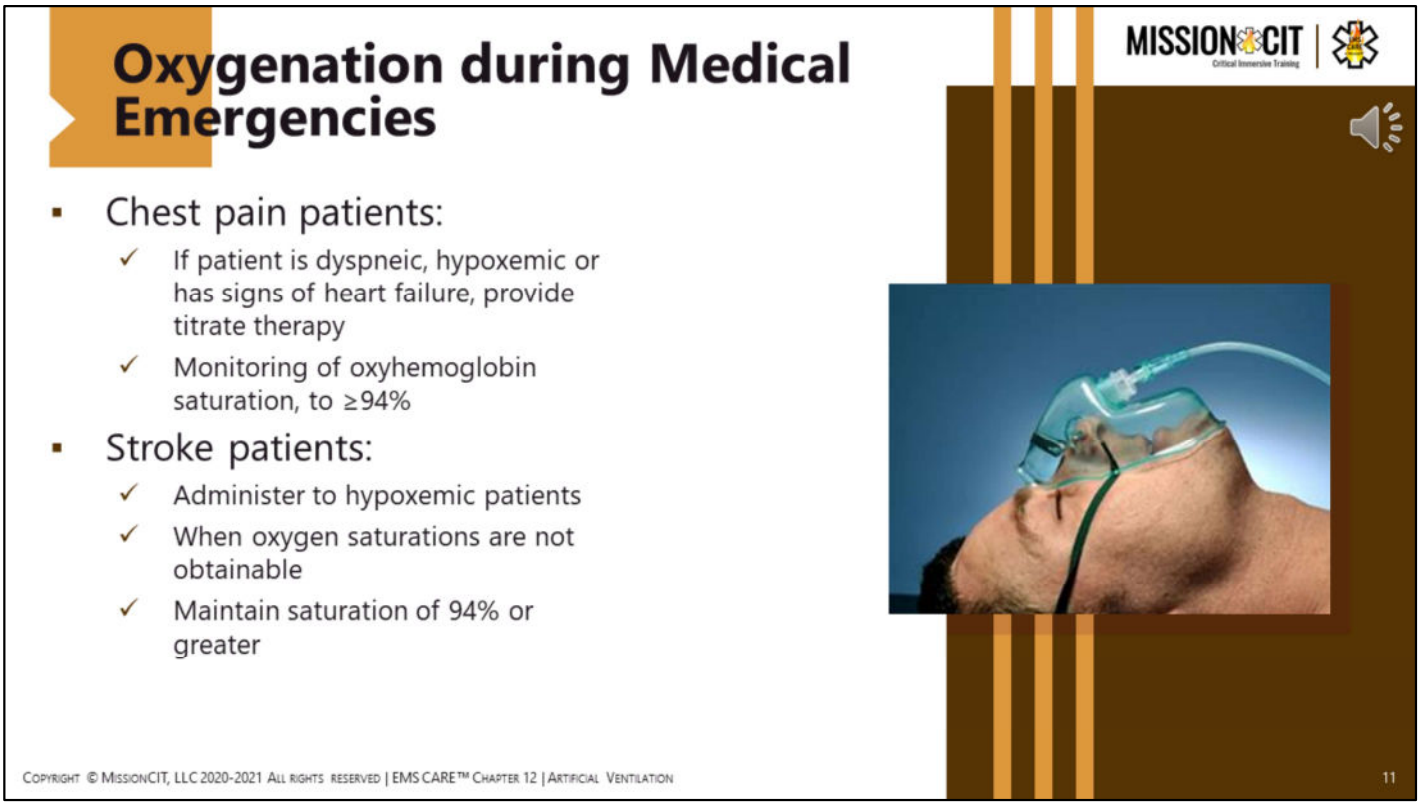
A tracheostomy mask is placed over a stoma or tracheostomy tube to provide supplemental oxygen.

- It is typically a small, cuplike mask that fits over the tracheostomy
- It is connected to 8 to 10 liters per minute of oxygen via supply tubing

High-concentration oxygen should be administered to children in respiratory distress, with inadequate respirations, or in possible shock.

Many times, you'd want to use the blow-by-delivery method for patients who will not tolerate traditional masks or cannula placed on the face. It is especially good for small children.

- Hold tubing or a non-rebreather mask 2 inches from the face
- Oxygen passes over the face and is inhaled



It has been our traditional practice to give high concentrations of oxygen to patients with chest pain and myocardial infarction. Even though recent data suggests it has harmful effects that are mediated primarily by coronary artery vasoconstriction. For this reason, the American Heart Association's emergency cardiac care guidelines have, since 2010, recommended as follows: There is insufficient evidence to support [oxygen's] routine use in uncomplicated ACS. If the patient is dyspneic, hypoxemic or has obvious signs of heart failure, providers should titrate therapy, based on monitoring of oxyhemoglobin saturation, to ≥94%.

Stroke patients should be managed similarly. Administer supplemental oxygen to stroke patients who are hypoxemic or when oxygen saturations are not obtainable; the goal is to maintain a saturation of 94% or greater.

This brings us to the end of this lesson and in the next one, Missah will continue with positive pressure ventilation.