Respiratory Therapy is an allied health field involved in the assessment and treatment of breathing disorders including chronic lung problems, such as asthma, bronchitis, emphysema, and chronic obstructive pulmonary disease (COPD), and the respiratory components of acute multisystemic conditions such as heart attacks and stroke. Respiratory Therapists (RT), also known as Respiratory Care Practitioners (RCP) are specialists in airway management, mechanical ventilation, and acid-base balance.

Respiratory Therapists are commonly found in intensive-care units, emergency rooms, critical care transport teams and operating room environments, as well as other areas of a hospital setting. Respiratory Therapists treat virtually every patient population, and often the most critically ill patients in the hospital. They may work in sleep diagnostic facilities, cardiac catheterization labs, cardiac stress testing labs, and pulmonary function testing labs. Respiratory Therapists are also a critical part of the code team and perform CPR. Particularly, establishing a patent airway. The Respiratory Therapist’s duties include delivery of oxygen via all types of oxygen delivery devices, administration of aerosolized drugs, Endotracheal Intubation (emergent and elective) suctioning, management of life support, weaning of ventilation or life support, insertion of arterial lines, management of tracheostomies, drawing and interpretation of arterial blood gas samples. Advanced skills include intravenous, chest tube and central line insertions as well as performing bronchoscopy procedures. Some Respiratory Therapists go on to work as cardiovascular perfusionists or anesthesia assistants.

http://en.wikipedia.org/wiki/Respiratory_therapy

Nasal Cannula

The nasal cannula (NC) is a device used to deliver supplemental oxygen or airflow to a patient or person in need of respiratory help. This device consists of a plastic tube which fits behind the ears, and a set of two prongs which are placed in the nostrils. Oxygen flows from these prongs. The nasal cannula is connected to an oxygen tank, a portable oxygen generator, or a wall connection in a hospital via a flowmeter. The nasal cannula carries 1–6 litres of oxygen per minute. There are also infant or neonatal nasal cannulas which carry less than one litre per minute; these also have smaller prongs. The oxygen fraction provided to the patient ranges roughly from 24% to 35%, or the cannula may merely supply humidified air.

A nasal cannula is generally used wherever small amounts of supplemental oxygen are required, without rigid control of respiration, such as in oxygen therapy. Most cannulas can only provide oxygen at low flow rates—up to 6 litres per minute (L/min)—delivering an oxygen concentration of 28–44%. Rates above 6 L/min can result in discomfort to the patient, drying of the nasal passages, and possibly nose bleeds (epistaxis).
The nasal cannula is often used in elderly patients or patients who can benefit from oxygen therapy but do not require it to self-respirate. These patients do not need oxygen to the degree of wearing a non-rebreather mask. It is especially useful in those patients where vasoconstriction could negatively impact their condition, such as those suffering from strokes. It may also be used by pilots and passengers in small, unpressurized aircraft that do not exceed certain altitudes. The cannula provides extra oxygen to compensate for the lower oxygen content available for breathing at the low ambient air pressures of high altitude, preventing hypoxia. Special aviation cannula systems are manufactured for this purpose. [http://en.wikipedia.org/wiki/Nasal_cannula](http://en.wikipedia.org/wiki/Nasal_cannula)

**Venti-Mask or Venturi Mask**

The venturi mask, also known as an air-entrainment mask, is a medical device to deliver a known oxygen concentration to patients on controlled oxygen therapy. Venturi masks are considered high-flow oxygen therapy devices. This is because venturi masks are able to provide total inspiratory flow at a specified FIO2 to patients therapy. The kits usually include multiple jets in order to set the desired FIO2 which are usually color coded. The color of the device reflects the delivered oxygen concentration, for example: blue = 24%; yellow = 28%; white = 31%; green = 35%; pink = 40%; orange = 50%. The color however varies with different brands and the user must check the instructions to determine the correct color for the desired FIO2. (In the UK, the colours and respective delivery concentrations are; Blue 24%, White 28%, Yellow 35%, Red 40%, Green 60%). Other brands of masks have a rotating attachment that controls the air entrainment window, affecting the concentration of oxygen. This system is often used with air-entrainment nebulizers to provide humidification and oxygen therapy. [http://en.wikipedia.org/wiki/Venturi_mask](http://en.wikipedia.org/wiki/Venturi_mask)

**Non-rebreather Mask**

A non-rebreather mask, or NRB, is a device used in medical emergencies that require oxygen therapy. An NRB requires that the patient can breathe unassisted, but unlike low flow nasal cannula, the NRB allows for the delivery of higher concentrations of oxygen. The non-rebreather mask covers both the nose and mouth of the patient and attaches with the use of an elastic cord around the patient's head. The NRB has an attached reservoir bag, typically 1.5 liters, that connects to an external oxygen tank. Before an NRB is placed on the patient, the reservoir bag is inflated to greater than two-thirds full of oxygen, at a rate of 15 liters per minute (lpm)\[1\]. Approximately \(\frac{1}{3}\) of the air from the reservoir is depleted as the patient inhales, and it is then replaced by the flow from the O2 supply. If the bag becomes completely deflated, the patient will no longer have a source of air to breathe.
Exhaled air is directed through a **one-way valve** in the mask, which prevents the inhalation of room air and the re-inhalation of exhaled air. The valve, along with a sufficient seal around the patient's nose and mouth, allows for the administration of high concentrations of oxygen, 60–90% O₂. Strictly, "non-rebreather" masks are "partial-rebreather" (PRB) masks; ideally, a non-rebreather mask would not permit air from the surrounding environment to be inhaled. However, since not all of the exhaled air is completely removed by the one-way valve and the seal created by the mask is imperfect, intake of some exhaled and outside air is unavoidable. 

http://en.wikipedia.org/wiki/Non-rebreather

**Nebulizer**

In **medicine**, a **nebulizer**[1] (spelled **nebuliser** in British English)[2] is a device used to administer medication in the form of a mist inhaled into the lungs. A Jet nebulizer attached to a compressor. Nebulizers are commonly used for treatment of cystic fibrosis, asthma, COPD and other respiratory diseases. Nebulizers use oxygen, compressed air or ultrasonic power to break up medical solutions/suspensions into small aerosol droplets that can be directly inhaled from the mouthpiece of the device. The definition of an aerosol is a "mixture of gas and liquid particles," and the best example of a natural occurring aerosol is "mist" (being formed when small vaporized water particles mixed with hot ambient air are cooled down and condense into a fine cloud of visible airborne water droplets). When using a nebulizer for **inhalation therapy** with medicine to be administered directly to the lungs, it is important to note that inhaled aerosol droplets can only penetrate into the narrow branches of the lower airways if they have a small diameter of 1-5 micrometers. Otherwise they are only absorbed by the mouth cavity, where the effect is low.[3] Unfortunately not all of the nebulizers currently available succeed in delivering the aerosols in small enough droplets to achieve an acceptable efficiency for the medicine to reach the lungs. 

http://en.wikipedia.org/wiki/Nebulizer

**Disposable Resuscitator: Ambu Bag**

A **bag valve mask** (also known as a **BVM** or **Ambu bag**) is a hand-held device used to provide **positive pressure ventilation** to a patient who is not breathing or who is breathing inadequately. The device is a normal part of **resuscitation** kit for trained professionals, such as ambulance crew. The BVM is frequently used in **hospitals**, and is an essential part of a **crash cart**. The device is used extensively in the operating room to ventilate an anaesthetised patient in the minutes before a **mechanical ventilator** is attached. The device is self-filling with air, although additional oxygen (O₂) can be added. Use of the BVM to ventilate a patient is frequently called "**bagging**" the patient.[1] Bagging is regularly necessary in **medical emergencies** when the patient's breathing is insufficient (**respiratory failure**) or has ceased...
completely (respiratory arrest). The BVM resuscitator is used in order to manually provide mechanical ventilation in preference to mouth-to-mouth resuscitation (either direct or through an adjunct such as a pocket mask).
http://en.wikipedia.org/wiki/Ambu_bag

Ventilator

A medical ventilator can be defined as any machine designed to mechanically move breathable air into and out of the lungs, to provide the mechanism of breathing for a patient who is physically unable to breathe, or breathing insufficiently. See also mechanical ventilation. Ventilators are chiefly used in intensive care medicine, home care, and emergency medicine (as standalone units) and in anesthesia (as a component of an anesthesia machine).

In its simplest form, a modern positive pressure ventilator consists of a compressible air reservoir or turbine, air and oxygen supplies, a set of valves and tubes, and a disposable or reusable "patient circuit". The air reservoir is pneumatically compressed several times a minute to deliver room-air, or in most cases, an air/oxygen mixture to the patient. If a turbine is used, the turbine pushes air through the ventilator, with a flow valve adjusting pressure to meet patient-specific parameters. When overpressure is released, the patient will exhale passively due to the lungs' elasticity, the exhaled air being released usually through a one-way valve within the patient circuit called the patient manifold. The oxygen content of the inspired gas can be set from 21 percent (ambient air) to 100 percent (pure oxygen). Pressure and flow characteristics can be set mechanically or electronically. Ventilators may also be equipped with monitoring and alarm systems for patient-related parameters (e.g. pressure, volume, and flow) and ventilator function (e.g. air leakage, power failure, mechanical failure), backup batteries, oxygen tanks, and remote control. The pneumatic system is nowadays often replaced by a computer-controlled turbopump.

Modern ventilators are electronically controlled by a small embedded system to allow exact adaptation of pressure and flow characteristics to an individual patient's needs. Fine-tuned ventilator settings also serve to make ventilation more tolerable and comfortable for the patient. In Germany, Canada, and the United States, respiratory therapists are responsible for tuning these settings while biomedical technologists are responsible for the maintenance.

The patient circuit usually consists of a set of three durable, yet lightweight plastic tubes, separated by function (e.g. inhaled air, patient pressure, exhaled air). Determined by the type of ventilation needed, the patient-end of the circuit may be either noninvasive or invasive. Noninvasive methods, which are adequate for patients who require a ventilator only while sleeping and resting, mainly employ a nasal mask. Invasive methods require intubation, which for long-term ventilator dependence will normally be a tracheotomy cannula, as this is much more comfortable and practical for long-term care than is larynx or nasal intubation.

http://en.wikipedia.org/wiki/Ventilator
Tracheotomy

Among the oldest described surgical procedures, tracheotomy (also referred to as pharyngotomy, laryngotomy, and tracheostomy) consists of making an incision on the anterior aspect of the neck and opening a direct airway through an incision in the trachea. The resulting stoma can serve independently as an airflow or as a site for a tracheostomy tube to be inserted; this tube allows a person to breathe without the use of his or her nose or mouth. Both surgical and percutaneous techniques are widely used in current surgical practice.

In the acute setting, indications for tracheotomy include such conditions as severe facial trauma, head and neck cancers, large congenital tumors of the head and neck (e.g., branchial cleft cyst), and acute angioedema and inflammation of the head and neck. In the context of failed orotracheal or nasotracheal intubation, either tracheotomy or cricothyrotomy may be performed. In the chronic setting, indications for tracheotomy include the need for long-term mechanical ventilation and tracheal toilet (e.g. comatose patients, or extensive surgery involving the head and neck). In extreme cases, the procedure may be indicated as a treatment for severe Obstructive Sleep Apnea seen in patients intolerant of Continuous Positive Airway Pressure (CPAP) therapy.

http://en.wikipedia.org/wiki/Tracheotomy

Positive Airway Pressure

Positive airway pressure (PAP) is a method of respiratory ventilation used primarily in the treatment of sleep apnea, for which it was first developed. PAP ventilation is also commonly used for those who are critically ill in hospital with respiratory failure, and in newborn infants (neonates). In these patients, PAP ventilation can prevent the need for tracheal intubation, or allow earlier extubation. Sometimes patients with neuromuscular diseases use this variety of ventilation as well. CPAP is an acronym for "continuous positive airway pressure", which was developed by Dr. George Gregory and colleagues in the neonatal intensive care unit at the University of California, San Francisco. [1] A variation of the PAP system was developed by Professor Colin Sullivan at Royal Prince Alfred Hospital in Sydney, Australia, in 1981.[2]

The main indications for positive airway pressure are congestive heart failure and chronic obstructive pulmonary disease. There is some evidence of benefit for those with hypoxia and community acquired pneumonia.[1]

PAP ventilation is often used for patients who have acute type 1 or 2 respiratory failure. Usually PAP ventilation will be reserved for the subset of patients for whom oxygen delivered via a face mask is deemed insufficient or deleterious to health (see CO₂ retention). Usually, patients on PAP ventilation will be closely monitored in an intensive care unit, high dependency unit, coronary care unit or specialist respiratory unit.

The most common conditions for which PAP ventilation is used in hospital are congestive cardiac failure and acute exacerbation of obstructive airway disease, most notably exacerbations
of COPD and asthma. It is not used in cases where the airway may be compromised, or consciousness is impaired. CPAP is also used to assist premature babies with breathing in the NICU setting.

The mask required to deliver CPAP must have an effective seal, and be held on very securely. The "nasal pillow" mask maintains its seal by being inserted slightly into the nostrils and being held in place by various straps around the head. Some full-face masks "float" on the face like a hover-craft, with thin, soft, flexible "curtains" ensuring less skin abrasion, and the possibility of coughing and yawning. Some people may find wearing a CPAP mask uncomfortable or constricting. Breathing out against the positive pressure resistance (the expiratory positive airway pressure component, or EPAP) may also feel unpleasant to some patients. These factors lead to inability to continue treatment due to patient intolerance in about 20% of cases where it is initiated. Some machines have C-Flex pressure relief technology that makes sleep therapy more comfortable by reducing pressure at the beginning of exhalation and returning to therapeutic pressure just before inhalation. The level of pressure relief varies based on the patient’s expiratory flow and which of the three C-Flex settings has been selected, making breathing out against the pressure less difficult. Those who suffer an anxiety disorder or claustrophobia are more likely to be unable to tolerate PAP treatment. Sometimes medication will be given to assist with the anxiety caused by PAP ventilation.

Unlike PAP used at home to splint the tongue and pharynx, PAP is used in hospital to improve the ability of the lungs to exchange oxygen and carbon dioxide, and to decrease the work of breathing (the energy expended moving air into and out of the alveoli). This is because:

- During inspiration, the inspiratory positive airway pressure, or IPAP, forces air into the lungs—thus less work is required from the respiratory muscles.
- The bronchioles and alveoli are prevented from collapsing at the end of expiration. If these small airways and alveoli are allowed to collapse, significant pressures are required to re-expand them. This is because of the Young–Laplace equation (which explains why the hardest part of blowing up a balloon is the first breath).
- Entire regions of the lung that would otherwise be collapsed are forced and held open. This process is called recruitment. Usually these collapsed regions of lung will have some blood flow (although reduced). Because these areas of lung are not being ventilated, the blood passing through these areas is not able to efficiently exchange oxygen and carbon dioxide. This is called ventilation–perfusion (or V/Q) mismatch. The recruitment reduces ventilation–perfusion mismatch.
- The amount of air remaining in the lungs at the end of a breath is greater (this is called the functional residual capacity). The chest and lungs are therefore more expanded. From this more expanded resting position, less work is required to inspire. This is due to the non-linear compliance–volume curve of the lung.

http://en.wikipedia.org/wiki/Bipap