London Health Sciences Centre

Home Noninvasive Positive Pressure Ventilation Manual

For: _____
Patient Name

Respiratory Community Care Services
Critical Care Program
London Health Sciences Centre
London, Ontario

Developed May 2011
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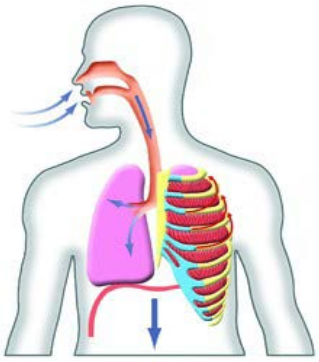
1. Background

In the mid 1980s doctors began using intermittent positive pressure ventilation through face masks to augment breathing in patients with chronic lung failure, particularly during sleep. By using noninvasive positive pressure ventilation (NIPPV) the patient's normal breathing pattern is augmented, thus improving oxygen and carbon dioxide levels in the blood, reducing work of breathing and allowing the breathing muscles to rest. This also allows more restful sleep and helps to gradually reset the respiratory centres of the brain to be more sensitive to carbon dioxide.

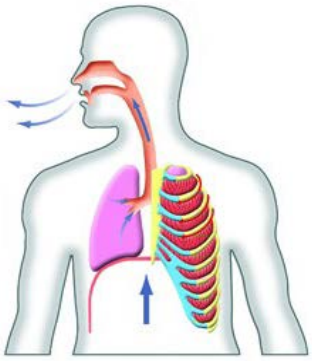
2. Introduction

The process of inhaling and exhaling is known as ventilation (breathing). The purpose of breathing is to allow oxygen (O_2) to come into the body (inspiration) and to allow carbon dioxide (CO_2) to be removed from the body (expiration). As the body uses oxygen it produces carbon dioxide as a waste product.

The primary muscle of breathing in is the diaphragm, a large muscle situated below the lungs.



When the diaphragm contracts during breath in, it moves downward and opens up the lungs, causing air to flow into the lungs.



When the diaphragm relaxes, it moves upwards and air flows back out of the lungs.

If the diaphragm becomes weakened it impairs the ability to take a deep breath. Other muscles involved in breathing are termed the "accessory muscles" and include the neck, chest, abdominal and back muscles. These muscles are used in breathing under times of need such as intense exercise or when the diaphragm is weak. These muscles end up doing some of the work of breathing to help keep oxygen and carbon dioxide levels normal. Use of accessory muscles may first become noticeable when lying down, especially when the diaphragm is weak. However, during deep sleep, the accessory muscles "turn off" and the only muscle working is the diaphragm.

Breathing is less stable when you are sleeping. Breathing muscles have the tendency to relax, and the body exerts less effort to breathe. Less breathing reduces fresh air in the lungs and carbon dioxide levels in your body rise, which in turn will stimulate you to awaken. Although you may be unaware of these constant interruptions of your sleep, they prevent you from having restful, productive sleep. This lack of deep, restful sleep will cause chronic fatigue, excessive daytime sleepiness, and morning headaches all of which will put extra stress on your heart and other major organs.

Noninvasive positive pressure breathing modes are designed to provide inspiratory (breath in) and expiratory (breath out) positive airway pressures. NIPPV only augments breathing --- it is **not** meant to be a life support mode! Anyone on NIPPV must be able to sustain their own spontaneous

breathing. NIPPV can help you by decreasing the work of breathing, improving carbon dioxide removal, promoting improved oxygenation and opening and maintaining the stability of the airways.

The NIPPV reduces your work of breathing and allows your respiratory muscles to rest. These rested muscles are then capable of keeping up with the daily requirements for breathing. NIPPV can be utilized whenever you are resting to augment your breathing pattern and remove some of the work of breathing during this time.

NIPPV is a support mode designed to provide two levels of pressure IPAP (**I**nspiratory **P**ositive **A**irway **P**ressure) and EPAP (**E**xpiratory **P**ositive **A**irway **P**ressure). One pressure is applied during inhalation and a lower pressure is applied during exhalation. Each pressure has a specific role to play in this therapy. The EPAP is the lower pressure and it keeps the lungs slightly distended making it easier for the next breath to come into the lungs. The IPAP is the higher pressure and augments your breath to give you a larger breath. On breathing in, airflow is maintained to meet the IPAP level; on breathing out airflow is maintained to the meet the lower EPAP level. The difference between the two levels is the amount of support you receive with each breath. There will be a backup respiratory rate, which ensures a minimum number of breaths are provided each minute; however, you are in control of the rate and size of each breath as long as your respiratory rate exceeds the back up rate.

3. **Assistive Devices Program (ADP) ⟹ Ventilator Equipment Pool (VEP)**

The Assistive Devices Program (ADP) through the Ontario Ministry of Health & Long Term care funds the Ventilator Equipment Pool (VEP). The VEP is located in Kingston and associated with Kingston General Hospital.

You will be asked to sign two ADP forms:

i. One ADP form will be used to request a NIPPV device from the VEP. Equipment from the VEP is provided free-of-charge to you on a loan basis for as long as it is required. Once you no longer need the unit, it should be returned to the VEP. The VEP was developed in order to provide a cost-effective way of allowing patients to return home with respiratory equipment to assist with their breathing. The VEP is responsible for all maintenance and troubleshooting of the equipment.

ii. The second ADP form you will take to your respiratory homecare vendor for the purchase of masks, headgear, filters, and tubing. ADP will help cover 75% of the costs of these supplies up to a maximum. This form is valid for 3 years and after that time a new ADP form will be filled out. You may purchase a maximum of three masks in the three-year claim period. For example, you may choose to purchase two masks up front and then purchase the third mask in year two or three. Often having a spare mask is a good idea although purchasing all three at once is discouraged in case you experience weight loss and these masks no longer fit. You may find it helpful to use more than one kind of mask. For example, you may wear one mask at night and a different one if you need to wear your NIPPV during the day. Finding a mask that fits you well is one of the most important steps in getting used to the therapy.

4. **Equipment**

- NIPPV device and humidifier (ResMed VPAP)

- Reusable breathing circuit

- Mask fitted with headgear

5. **NIPPV Therapy**

The NIPPV device requires that you wear a mask over your nose and mouth. This mask has to be tight fitting on your face and is held in place by headgear attached to the mask. The headgear goes around the back of your head and can be adjusted to make the mask more comfortable. There are many different styles of masks available with new masks coming out frequently. If the mask or headgear that you are wearing is not comfortable ask your healthcare provider about other options. Finding a mask that fits you well is one of the most important steps in NIPPV comfort.

A blower in the unit gently pushes a prescribed amount of air through the mask and into your lungs. The air delivered causes an increased pressure in your airways and down into your lungs as you breathe in. When you begin to breathe out the pressure will drop to a lower prescribed pressure. This will prevent areas of your lungs from collapsing during sleep. The delivery of these two separate pressures makes it easier to breathe out than using a constant pressure level.

The NIPPV device also uses a humidification system. Literature today shows positive pressure devices used in conjunction with heated humidifiers provide better patient comfort and compliance. The air being gently pushed into your lungs is dry and the body cannot, with its normal humidification system, keep up with the flow of air; therefore, an external humidification system is added. This will help to reduce dryness in your nose, mouth, and throat.

Things to remember about the humidifier:

- You will be shown how to assemble and disassemble the humidifier for cleaning.
- Fill the humidifier only to the fill line with **distilled** water. Do not overfill the chamber; as overfilling will cause water to be blown into the tubing or the machine.
- Never place any medications into the chamber.
- Always remember to turn your unit off when you are refilling the chamber.

There are currently many different types of NIPPV devices on the market. They basically all work the same way.

All units contain the following:

a. <u>On/Off switch</u> – this will be used to turn the device on and off.

b. <u>Air outlet port</u> – at this outlet one end of the tubing will be connected, the other end will be connected to the mask.

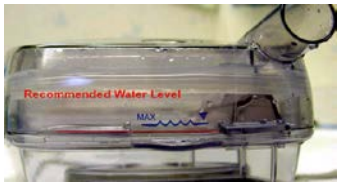
c. <u>Air inlet filters</u> – they are located on the back of most devices, where the external air enters the device. It is important nothing is blocking this air inlet. There are filters needed on this air inlet to prevent any environmental particles such as dust and dirt from entering the device. They will need to be changed and cleaned periodically; the frequency will vary depending on the environment the device is used in.

New filters can be purchased from your respiratory supply company (where your mask is purchased).

6. **Setup**

Place the NIPPV device and humidifier on a flat, sturdy surface near an area where you will be sleeping. Make sure that the inlet filter is free from obstructions (clothes, drapes, ect.). Do **not** place the unit on a carpet or pad; this may prevent the flow of air needed to cool the unit down. Keep the unit away from heaters and/or air conditioners (your machine may draw that air in which can affect the operation of the unit).

Plug the NIPPV device and humidifier directly into a grounded outlet.



Fill the humidifier chamber to the marked line with **distilled** water. Place the one end of the long tubing on the outlet of the humidifier and on the other end attach the mask with headgear.

Connect all straps from the headgear to the mask. All masks require an exhalation port (may be a small connector added to the mask or it may be incorporated directly into the mask), this port will allow for your exhaled air to escape from the mask. This port must not be obstructed in any way. Make sure the mask has a snug fit, not so tight that it causes irritations but tight enough so that you have minimal leaks. Each strap should be adjusted so that it will form a secure fit (try not to tighten one strap more then another). Pressure from the straps should be distributed evenly. The NIPPV device will compensate for small leaks; however, you should not have air blowing in your eyes.

Turn the machine on. Adjust the mask until the leak is minimal; keep in mind that all the straps should be pulled at the same time with the same tension. Position the tubing so it will loop over the top of your bed, chair, or anything which will allow you to rest comfortably while not pulling on your mask or headgear. Take a few deep breaths through your nose and relax.

It may take a little time to get used to wearing the NIPPV device. Ask your healthcare provider for strategies to help you adjust to wearing it. **The risk of not wearing it can worsen your condition so make every effort to become comfortable with NIPPV.** Discuss with your physician different scenarios that may lead to the inability to use the NIPPV device. Ask your physician what is safe? Can I sleep at night without it? What happens if there is a power failure? What if I get a cold or my nose gets congested? What if the equipment fails? What if I am away from home and cannot return to get my device?

7. Complications

The main complications associated with NIPPV include: skin soreness from the mask, dry nose and mouth, runny nose from the high airflows, increased gas from air swallowing and facial flattening from prolonged use of mask. If there are large air leaks from the mask eye irritation may also occur. Careful attention to mask size and fitting, rotation of masks and regular review of the adequacy of the mask will help to prevent skin sores and minimize facial flattening. Adjustment of the pressures, rate of inspiratory airflow and respiratory rates according to clinical need and patient comfort will usually ensure that runny nose and air swallowing are minimized. This also means that these settings need regular review over time by your healthcare professional.

8. Cleaning

If you don't clean your NIPPV system it can lead to many problems. Masks that are not cleaned can lead to sores on your face and may not seal properly. Without regular cleaning the mask not last as long because the oils from your skin can cause the plastic to break down more quickly. Tubing that is not cleaned can gather dust and sometimes even mold. Filters are made for trapping dust but must be cleaned or replaced to prevent the dust from getting into your tubing. Headgear sits against your hair and skin; like any clothing it will last longer if it is washed regularly. The humidification chamber

provides the perfect warm moist place for mold and bacteria to grow. Without cleaning properly you are increasing your risk of infection.

Important! Do NOT use bleach, chlorine, alcohol or antibacterial products.

A. Daily – Mask, Humidifier Chamber

- Wash your hands thoroughly
- Remove headgear from your mask and disconnect mask from tubing
- With mild soap and warm water gently wipe the mask and all parts in contact with your face.
- Be sure to rinse all parts with warm, clean water and allow to air dry.
- Reassemble when dry and reattach headgear and hose
- Top up distilled water in humidifier each night

B. Weekly – Filters, Humidifier Chamber

- Wash your hands thoroughly
- Check all filters to see if they need to be changed
- Humidifier chamber should be emptied weekly and rinsed with soap and water. Be sure to thoroughly rinse with warm water, allow to air dry.

C. Monthly – Tubing, Headgear, Humidifier Chamber

- Wash your hands thoroughly
- Wash tubing and headgear in warm soapy water, do **not** put into washing machine. Do not use heat to dry the headgear, it will shrink the cloth and ruin the Velcro®.
- Disinfect tubing in one part white vinegar and 3-4 parts water. Allow all parts to sit in the solution for approximately 30-45 minutes.
- Thoroughly rinse all parts with warm water and allow to air dry
- Humidifier chamber should be emptied and disinfected in a solution of white vinegar and water. After disinfection, be sure to thoroughly rinse with warm water, allow to air dry.

When you first start using your NIPPV device the cleaning can seem a little overwhelming. Your investment of time is well spent in improving your health.

IMPORTANT: Check the manufacturer's specifications as the instructions and recommendations for cleaning and disinfecting may vary.

9. Frequently Asked Questions

- When should I use my NPPV device?
  You normally use your unit when you sleep but you can use it whenever you are resting to rest the muscles as well.

- How many hours a day should I use the device?
  You should use the device every night and for as many hours as you sleep. It may take as much as 3-6 weeks to become completely comfortable using the device and you may never feel 100% comfortable using the device.

- When will I get my device from Ventilator Equipment Pool (VEP)?
  The Assisted Devices Program (ADP) form will be started today and it normally takes 4-6 weeks to receive equipment from the VEP.

- How will I know when the device is coming from VEP?
  The VEP will call you the day before sending the unit to your house to confirm someone will be home. Purolator sends the device so it will arrive the next business day.

- Will it be the same machine I was tried on?
  The VEP will send whatever device they have available. The VEP will send a Respiratory Therapist to your house within 10 business days to set up the device and do some teaching with you.

- What if I have problems with the VEP device?
  The VEP has a 1-800 # with a Respiratory Therapist on call 24/7. This number will be on a sticker on the top of the equipment for your convenience.

- How do I get a more comfortable mask?
  Another ADP form will be started today and you will take it home with you. You should take this form with you to a home respiratory company in your area and the respiratory therapist will fit you with a more comfortable mask. ADP will cover 75% of the cost of this mask.

- Why does it feel hard to breathe out? Will anything make it easier?
  Remember it is normal to feel uncomfortable at first. Since you are breathing out against a pressure it will feel more difficult. Relax and take slow deep breaths.

- My eyes are red and sore in the morning or wake me up because they hurt, what should I do?
  This can be caused by air leaking around the mask and into your eyes. You should solve this problem quickly to avoid further injury to your eyes. Start by reapplying the mask and adjusting the straps on the headgear. If you have an adjustable forehead rest on your mask adjust it until the air is not leaking into your eyes. Make sure not to over tighten your mask. If your mask is pressing hard on the skin by your eyes it can also make your eyes sore.
  If these steps do not solve your problem then try some different masks. You will need to call your respiratory homecare vendor to discuss your options.

- My face is red where the mask touches it, what should I do?
  Try loosening your mask. As long as it is not leaking severely, or leaking into your eyes there isn't a need to have it really tight. In fact over tightening your mask can cause it to leak more. Try a different mask. Not all masks are the same shape so a different one may not irritate your skin or put pressure in the same places. You will need to call your respiratory homecare vendor to discuss your options. Because the mask is pushing against your skin it can cause irritation. Sometimes using a barrier or cushioning the bridge of the nose with a product like moleskin can help. Ask your respiratory homecare vendor about these products.
  It is also possible you are allergic to the mask material or the cleaning agent. Please be certain the soap you are using is not anti-bacterial. Try using a hypoallergenic soap.

- Why is my nose runny when I put on my NIPPV?
  This is a reaction to the airflow of the NIPPV. Start by increasing the setting of your heated humidifier. Moist air should not irritate your nose as much. If this does not work then please book an appointment to see your doctor. It is possible that you will need to use a nasal medication.

- Why is my nose stuffy when I put on my NIPPV?
  The first thing to check is the filter on the back of the NIPPV device. If it is clogged with dust then it is likely dust is being blown through your NIPPV device and into your mask. This not only makes your nose stuffy but is hard on the motor of your device. This can be another reaction to the airflow of your NIPPV device. Adjust your heated humidifier to a higher setting. As long as water is not collecting in your tubing it is OK to turn up the heater. If the stuffy nose lasts more then a week consult your doctor.

- It feels like the machine is puffing the air faster than I am breathing, what should I do?
  Try to relax and see if you can get used to this different way of breathing. If your breathing rate was fast when you first started therapy it may slow down with using NIPPV. You may need some adjustment made to your unit.

- My nose is dry and burning inside, what can I do?
  Use a heated humidifier as dry air can cause this feeling. If you are already using one then adjust it to a higher setting

- My throat is dry when I wake up, what can I do?
  You need to increase the setting on your humidifier because the current setting is not high enough and the blowing air is drying out your throat.

- I turned up my heated humidifier and now get woken up by a popping or thumping sound from my tubing, what can I do?
  This sound is caused by water collecting in the tubing. This can happen because the air around the tubing cools the warm, moist air as it leaves the heated humidifier. Cooler air cannot hold as much moisture so some of the water drops out into your tubing.
  Make sure there is no air blowing on the tubing such as from a fan or open window. This will cool the tubing and cause more water to develop in the hose. You may try to keep the hose under the sheets if possible. You should call the VEP for possible solutions to this problem. Empty the water from the tubing but do not attempt to empty the water back into the humidifier.

There are also hose insulators to decrease the amount of condensation produced in the tubing. These wrap around your tubing and try to keep the air warmer to decrease the amount of condensation.

10. Therapy Reference Sheet

Your Current Prescription

Setup Date: _____

Pressure Setting: IPAP Setting: _____ EPAP Setting _____

Backup Rate: _____

NPPV Model: _____

Mask Type: _____

Mask Size: ☐ small ☐ medium ☐ large ☐ X-large

Humidification System: _____

NPPV is a medically prescribed device that requires proper adjustments by medically trained personnel. If your physician prescribes a change in your pressure settings, please contact a home respiratory company in your area.

This equipment is **NOT A LIFE SUSTAINING DEVICE**. In the event of a life-threatening problem, seek emergency medical assistance immediately.

11. Checklist

Assemble/Disassemble the Humidifier	
Fill the Humidifier	
Turn the Humidifier on/off	
Adjust Humidifier Temperature up/down	
Assemble/Disassemble the Circuit	
Place the unit on Standby	
Turn the unit on/off	
Place the mask on/off	
Adjust the straps on the mask	
Silence any alarms	
Locate the filters and describe cleaning	
Discuss IPAP, EPAP, and Rate	

_____
Patient/Caregiver Signature

_____
Date

_____
RRT Signature