

	Policies and Procedures Title: OXYGEN ADMINISTRATION ID Number: 1115
Authorization [X] Former SKtnHR Nursing Practice Committee	Source: Nursing, Respiratory Therapy, Physiotherapy Date Revised: May 2018 Date of Previous Revision: March 2015 Date Effective: May 1999 Scope: Former SktnHR and Affiliates

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DEFINITIONS:

Arterial Blood Gas (ABG): a requisitioned lab test that analyzes arterial blood for oxygen (O₂), carbon dioxide (CO₂), bicarbonate (HCO₃) content, and pH to reflect the effectiveness of lung function and gas exchange.

Client: a term used to refer to a client, patient or resident.

FiO₂: the concentration of oxygen in the gas actually being inspired into the lungs and written as a fraction of 1 (i.e. 40% oxygen = 0.40 FiO₂).

Health Care Professional: for the purpose of this policy, Health Care Professional (HCP) will be used to refer to Registered Nurse (RN), Graduate Nurse (GN), Registered Psychiatric Nurse (RPN), Nurse Practitioner (RN(NP)), Licensed Practical Nurse (LPN), Graduate Licensed Practical Nurse (GLPN), Physician, Registered Respiratory Therapist (RRT), Anaesthesia Assistants, Paramedics, and nursing/respiratory/paramedic students.

Hypoxemia: a deficiency of oxygen in arterial blood, generally less than 80mmHg.

Hypoxia: insufficient oxygen available to meet the metabolic needs of tissues and cells.

Lpm: flow rate in litres per minute.

Medical Air: consists of about 21% oxygen, 79% nitrogen (inert) and a small amount of other gases.

Most Responsible Health Practitioner (MRHP): means the Health Practitioner who has the responsibility and accountability for the specific treatment/procedure(s) provided and prescribed to a patient and who is authorized by Saskatchewan Health Authority – former Saskatoon Health Region (SKtnHR) to perform the duties required to fulfill the delivery of such a treatment/procedure(s) within the scope of their practice.

SpO₂: the measurement of functional saturation of oxyhemoglobin. This measurement is obtained non-invasively by pulse oximetry.

1. PURPOSE

1.1 To safely administer oxygen to treat and prevent the symptoms of hypoxia.

2. POLICY

2.1 Initiation of Oxygen

2.1.1 A practitioner's order is required to initiate oxygen therapy, except in an emergency situation.

2.1.2 A practitioner's order should include:

- O₂ flow rate or FiO₂, and, a titration of the oxygen flow rate in order to achieve an acceptable range of SpO₂ values, i.e. 88-92%. In most cases, pulse oximetry is the preferred method of measuring blood oxygen values.

2.1.3 In an emergency situation when a practitioner's order cannot be immediately obtained, oxygen may be temporarily initiated by a healthcare provider in the presence of any acute situation in which hypoxemia is suspected.

2.1.4 A practitioner is to be contacted as soon as possible after initiation of oxygen therapy in emergency situations for verification and documentation of the necessity for oxygen therapy and to obtain any further orders.

2.1.5 In Home Care, the private home oxygen company contracted by the client will be responsible for the initiation, monitoring, management, and discontinuing of oxygen in their home. In Long Term Care the private home oxygen company contracted by the client will be responsible for the initiation, monitoring, management & discontinuing of oxygen in the home, in collaboration with the nursing team.

Note: *Nursing concerns based on assessment of a client's respiratory status, including oxygen saturation, will be directed to the home oxygen company, and if needed the client's practitioner, for follow up.*

2.1.6 Respiratory Therapy Services, if available, is to be consulted when any of the following devices are required: (see Appendix A)

- a large volume nebulizer with FiO₂ greater than 0.5
- a non-rebreathing mask
- a high flow, high FiO₂ nebulizer (i.e. MistyOx[®])
- a heated, humidified, high flow oxygen device (i.e. Optiflow[®])

2.1.7 Oxygen therapy should be administered continuously unless the need has been shown to be associated with specific situations requiring intermittent use only (i.e. exercise or sleep).

2.1.8 Oxygen delivered by nasal cannula at a rate of less than 4 Lpm will not be routinely humidified for adult clients. All oxygen administered by nasal cannula, to pediatric clients, should be humidified. (See Appendix A).

- 2.1.9 Most portable oxygen cylinders have a full oxygen capacity of 2000 psi; if the pressure gauge reads 500 psi or less, or if the pressure bar graph (if equipped) reads less than $\frac{1}{4}$, the tank is considered empty and must be replaced.

2.2 Monitoring of Oxygen Therapy

- 2.2.1 Clients requiring a FiO_2 of greater than 50% must have continuous pulse oximetry and be monitored in either an Emergency department, ICU or ward observation unit. (Exception – palliative or end of life clients receiving oxygen for comfort measures).
- 2.2.2 SpO_2 will be measured on all clients, in acute care, requiring oxygen:
- Upon initiation
 - When the oxygen flow rate or concentration is changed
 - With a change in respiratory status
 - With vital signs
- 2.2.3 SpO_2 will be measured on home care and long term care clients, as required, based on client assessment or if required for specific disease management (i.e. respiratory disease).

2.3 Discontinuation of Oxygen

- 2.3.1 A practitioner's order is required to discontinue oxygen therapy.

Note: *Criteria for discontinuation of oxygen may include:*

- *the client has stable vital signs*
- *the original disease process has resolved or greatly improved*
- *the client is able to maintain SpO_2 values within or above their target range on room air for 24 hours.*

2.4 Infection Control

- 2.4.1 All oxygen tubing (standard and large bore), humidifiers, large volume nebulizers (including MistyOx®), aerosol masks, and standard cannulas used to deliver oxygen are for single client use only.
- For all clients in acute care and long term care, change these items weekly and when visibly soiled. Document when equipment is due to be changed in care plan or label equipment with date to be changed. Heated, high flow oxygen system (i.e. Optiflow®) wire circuit and humidifier chamber are not required to be changed regularly. However, the interface of these systems should be replaced weekly.
 - For home care clients, change items only when visibly soiled.
- 2.4.2 Aerosol generating oxygen delivery devices (i.e. large volume nebulizers, high flow/high FiO_2 nebulizers, and heated, humidified high flow devices using a mask or tracheostomy interface), should not be used on clients who are known or suspected to be infected Severe Acute Respiratory Syndrome (SARS), emerging respiratory syndromes that have not been clearly identified, or a microorganism transmitted by the airborne route (i.e. tuberculosis,

chicken pox, measles). If no alternative methods of oxygen delivery can be used other than aerosol generating oxygen delivery devices for those clients, they must be treated under Airborne Precautions in a negative pressure room.

Note: For clients on airborne and/or droplet precautions, aerosolized liquids and related equipment present a particular infection control hazard. Aerosols can pose a risk of transmission of infection to others. Standard bubble humidifiers or heated humidifiers (i.e. Optiflow® with nasal cannula interface), do not produce aerosols.

2.4.3 When refilling humidifier bottles, any remaining water will be discarded and the bottle filled with **distilled** water (See Note below). Bottles will not be “topped-up”.

Note: In acute care, sterile water must be used. In home care and long term care, distilled water may be used.

2.5 Safe Handling of Oxygen/Equipment

2.5.1 **Oxygen vigorously supports combustion.** Oxygen therapy equipment must not be used in the presence of open flame. No smoking is allowed in the vicinity of oxygen therapy equipment. No heat source within 1.5 metres of oxygen delivery system. Avoid use of items that create a spark (i.e. Electric razors) with a nasal cannula in place.

2.5.2 Oils and petroleum products are not to be used around the client’s face.

2.5.3 Oxygen cylinders are to be secured in a cylinder cart or bracket at all times.

2.5.4 Do not use humidity on portable oxygen cylinders during patient transport.

2.5.5 Oxygen must not be allowed to flow into the circuit of a BiPAP or CPAP unit that is not turned on. Ensure that the oxygen flow is turned off **prior** to turning off the BiPAP/CPAP unit.

Note: The oxygen could flow back into the unit’s electrical components causing a fire hazard when unit is turned back on.

3. PROCEDURE

3.1 Assess clinical status of client, client history and check the practitioner’s order for oxygen.

Note: In clients with a history of COPD and CO₂ retention, consult with the practitioner prior to initiating oxygen therapy to determine the need for ABGs or ABG results, except in emergency situations.

3.2 Explain the procedure to the client as appropriate.

3.3 Apply a pulse oximeter and obtain a baseline SpO₂ while client is at rest.

Note: In an emergency situation, initiate oxygen therapy even if no SpO₂ available.

3.4 Obtain the correct oxygen delivery device and humidifier bottle, if required (See Appendix A & B).

- 3.5 If a humidifier bottle is indicated, fill it with sterile water and ensure all connections are tight and not cross-threaded (See Appendix C).
- Note:** *In client's home and long term care homes, the use of distilled or de-ionized water is acceptable*
- 3.6 Connect the device to the oxygen source and set the oxygen flow rate appropriate for the specific oxygen delivery device, as prescribed (See Appendix A).
- Note:** *Ensure the oxygen tubing is connected to an **oxygen flow meter sourced from an oxygen outlet** (See Appendix D).*
- Note:** *If medical air is being used for nebulization from the medical air outlet, the flow meter will be clearly marked as medical air (See Appendix D).*
- 3.7 Apply the device to the client.
- 3.8 Continue to monitor SpO₂ until client's oxygen saturation has stabilized within target range. Within 2-5 minutes, blood oxygen levels should equilibrate with alveolar oxygen and the oximeter reading will begin to stabilize.
- 3.9 If a SpO₂ target is ordered, continue to adjust oxygen flow rate or FiO₂ allowing a 2-5 minute stabilization period between adjustments until desired SpO₂ is achieved. Consider the oxygen device's flow limitations when adjusting flow rate. See Appendix A for flow limitations. Use the minimum amount of oxygen necessary to achieve target saturation. Continue to monitor SpO₂ until oxygen saturation is within target range.
- Note:** *In an emergency situation, do not wait 2-5 minutes between oxygen flow rate adjustments to achieve SpO₂ target.*
- 3.10 Continue to monitor the client's vital signs and watch closely for somnolence or confusion and apnea if the client has a history of COPD or if CO₂ retention is suspected.
- 3.11 Discontinue oxygen therapy when the client's oxygen saturation can be maintained in, or above, the target range without the use of supplemental oxygen. Ensure a practitioner's order is obtained.
- 3.12 Document on health record:
- Date, time of initiation of oxygen
 - Client assessment
 - O₂ flow rate or FiO₂ setting and delivery device(s)
 - SpO₂ changes
 - Client's response
 - Client/caregiver education
 - Weaning/discontinuation of oxygen and client response

4. RELATED POLICIES

Acute Care Pediatrics unit specific High Flow Oxygen Policy

Infection Prevention and Control Policy & Procedure # 30-20: Airborne Precautions

Infection Prevention and Control Policy & Procedure # 30-30: Droplet Precautions

NICU unit specific Standards of Care

Saskatchewan Health Authority Policy # 7311-60-024: Application of Non-Invasive Ventilation for Acute Respiratory Failure

5. REFERENCES

Centers for Disease Control and Prevention (2003). Guidelines for Preventing Health-Care -Associated Pneumonia

Centers for Disease Control and Prevention (2018). Prevention strategies for seasonal influenza in healthcare settings: Guidelines and Recommendations.

College of Respiratory Therapists of Ontario (2013). Oxygen Therapy: Clinical Best Practice Guidelines.

Fisher & Paykel product information insert – Optiflow Nasal Cannula rev 2010-05

Moga C, Chojecki D., (2016). Oxygen therapy in acute care settings. Edmonton (AB): Institute of Health Economics.

PALS Provider Manual (2016). American Heart Association, pg 207.

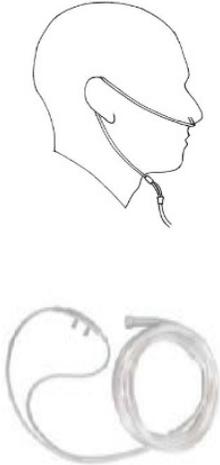
Perry, A., Potter, P. & Ostendorf, W. (2018) Clinical Nursing Skills & Techniques – 9th Edition. St. Louis, MO: Elsevier - Mosby. 627-638.

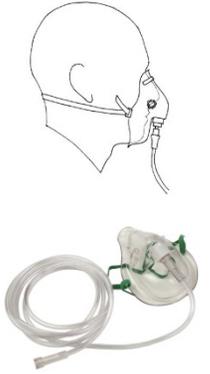
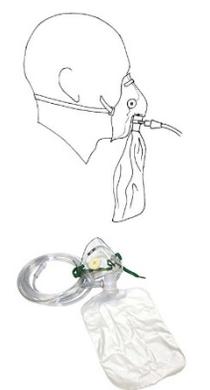
Oxygen Administration Devices

Appendix A

See Perry, A., Potter, P. & Ostendorf, W. (2018) *Clinical Nursing Skills & Techniques* – 9th Edition page 627-638.

The following chart describes two classifications of O₂ administration devices, low flow (variable FiO₂) devices and high flow devices for adult and pediatric populations. For neonate specific information, please refer to Appendices A & B and unit standards of care.

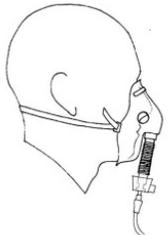
Low Flow Devices:					
<ul style="list-style-type: none"> • Provide variable oxygen concentration (FiO₂) depending on the client's inspiratory demands (rate and depth of breathing). • Have limited ability to deliver a precise oxygen concentration in various respiratory breathing patterns, therefore, the concentration of oxygen cannot be guaranteed. 					
Oxygen Device Client population	Oxygen flow rate & concentration	Indication	Advantages	Disadvantages	Points of Interest
Standard Nasal Cannula <ul style="list-style-type: none"> • Adults • Pediatrics 	<ul style="list-style-type: none"> • O₂ concentration: 24-40% FiO₂ • O₂ Flow rate: 1-6 Lpm • <u>Pediatrics</u>: Limit the upper flow rate to 3-4 Lpm • <u>Neonates</u>: .01 Lpm – 1 Lpm; no more than 2 Lpm (considered high flow) 	<ul style="list-style-type: none"> • For clients who have a relative stable respiratory pattern, require low oxygen percentage, need supplemental oxygen during an operative or diagnostic procedure, or for chronic home care 	<ul style="list-style-type: none"> • Allows client to eat and converse normally • Can reduce anxiety and claustrophobia compared to O₂ masks • Better compliance 	<ul style="list-style-type: none"> • Contraindications: nasal deformity, trauma, surgery, epistaxis, nasal/sinus congestion • Cannot deliver oxygen at higher concentrations • Can dry the nasal mucosa at higher O₂ flow rates 	<ul style="list-style-type: none"> • Ensure patency of both nasal passages (mouth breathing is acceptable as long as nasal passages are clear) • Rates above 4 Lpm should be humidified • Always use a humidifier for pediatrics

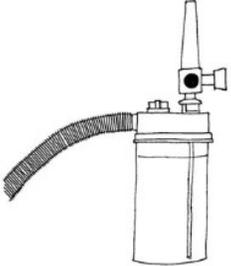
Oxygen Device Client population	Oxygen flow rate & concentration	Indication	Advantages	Disadvantages	Points of Interest
Simple Face Mask <ul style="list-style-type: none"> Adults Pediatrics 	<ul style="list-style-type: none"> O₂ concentration: 35-50% FiO₂ O₂ Flow rate: 5-10 Lpm 	<ul style="list-style-type: none"> Best used for short-term emergencies, operative procedures, or for those clients where a nasal cannula is not appropriate 	<ul style="list-style-type: none"> Provides higher FiO₂ than nasal cannula Contoured to fit over the client's mouth and nose Air mixed with oxygen decreases need for humidification 	<ul style="list-style-type: none"> Contraindicated for clients who retain CO₂ Interferes with speaking and eating Client may feel claustrophobic and anxious Long term use can lead to skin irritation and pressure sores 	<ul style="list-style-type: none"> Flow rate never less than 5 Lpm to avoid rebreathing exhaled CO₂ Humidify if the simple face mask is to be used more than a few hours Not recommended for long term use
Non-Rebreather Mask <ul style="list-style-type: none"> Adults Pediatrics 	<ul style="list-style-type: none"> O₂ concentration: 60-90% FiO₂, depending on mask fit O₂ Flow rate: 10-15 Lpm 	<ul style="list-style-type: none"> Best utilized in acute cardiopulmonary emergencies where a high FiO₂ is necessary such as cardiac arrest, shock, sepsis, pulmonary embolus, etc. 	<ul style="list-style-type: none"> Quick method of supplying a high FiO₂ The reservoir bag provides for extra oxygen when the client breathes faster or deeper Does not dry mucous membranes in the short term 	<ul style="list-style-type: none"> Noisy, interferes with speaking and eating Client may feel claustrophobic and anxious as mask must fit snugly for optimal performance 	<ul style="list-style-type: none"> O₂ flow rate must be set to ensure reservoir bag remains at least two-thirds inflated during inspiration (minimum of 10 Lpm to prevent rebreathing) Short term use only Do not use a humidifier with a reservoir mask

High Flow Devices:

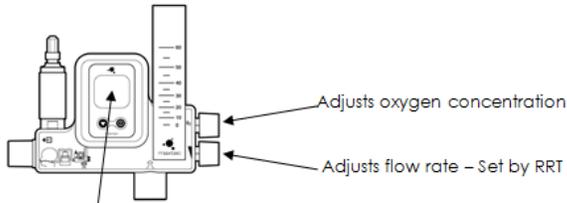
- Provides fixed oxygen concentrations sufficient to meet all of the client’s inspiratory demands, regardless of respiratory rate or depth of breathing
- Oxygen concentration is precise and guaranteed as long as equipment is set up properly and the client’s inspiratory flow rate does not exceed the device’s flow rate

<p>• Interfaces used with high flow devices:</p> <p>Aerosol Mask</p>  <ul style="list-style-type: none"> • Can be used with or without “tusks”. Tusks (short pieces of corrugated blue tubing attached to the side holes of the mask) increase the reservoir size and provides a higher oxygen concentration. 	<p>Trach collar/mask</p>  <ul style="list-style-type: none"> • A tracheostomy mask can be used to supply humidity and oxygen to a client with a tracheostomy. 	<p>Face Tent</p>  <ul style="list-style-type: none"> • Used for clients with facial trauma or oral/nasal surgery, and may be preferred by clients who become claustrophobic with a regular aerosol mask.
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Oxygen Device Client population	Oxygen flow rate & concentration	Indication	Advantages	Disadvantages	Points of Interest
<p>Air-Entrainment Mask (Venti-Mask®)</p> <ul style="list-style-type: none"> • Adults • Pediatrics 	<ul style="list-style-type: none"> • O₂ concentration: 24-50% • O₂ Flow rates: 2-12 Lpm • Look at the side of each coloured valve for specific O₂ concentration and flow rate 	<ul style="list-style-type: none"> • Clients who require a specific FiO₂ that will not fluctuate with changes in breathing pattern • Clients at risk for CO₂ retention (ie. COPD) 	<ul style="list-style-type: none"> • Delivers controlled, constant accurate levels of O₂ using diluter jets • Limited potential to re-breathe expired gases 	<ul style="list-style-type: none"> • Cannot run the O₂ through a humidifier 	<ul style="list-style-type: none"> • Always attach the clear, plastic humidifier cup to prevent the entrainment ports on the valve being blocked • Humidity can be supplied in aerosol form via the entrainment port (must have medical air readily available) – contact RT (if available) if humidity needed

Oxygen Device Client population	Oxygen flow rate & concentration	Indication	Advantages	Disadvantages	Points of Interest
<p>Standard Large Volume Nebulizer</p> <ul style="list-style-type: none"> Adults Pediatrics Infants 	<ul style="list-style-type: none"> O₂ concentration: 35-50% The dial on the neck of the nebulizer indicates the oxygen concentration O₂ Flow rates: 8-12 Lpm 	<ul style="list-style-type: none"> Clients who require a consistent FiO₂ The client with increased respiratory demand and abnormal respiratory pattern who needs predictable and consistent high FIO₂ values 	<ul style="list-style-type: none"> Regardless of the client's respiratory pattern, high-flow systems are expected to deliver predictable, consistent, and measurable high and low FiO₂ values also can control the humidity of the delivered gases 	<ul style="list-style-type: none"> At settings above 50%, the total flow available for the client diminishes to the point that this device can no longer be considered a high flow device (the FiO₂ cannot be guaranteed) Not for use during transport. Produces droplet particles which could be a risk of infection transmission to others 	<ul style="list-style-type: none"> The standard, large volume nebulizer produces an oxygen enriched aerosol that is directed to the client interface (mask, face tent, tracheostomy mask) via large bore corrugated tubing Also known as "cold neb (nebulizer)" The nebulizer attaches directly to the oxygen flow meter
<p>High Flow, High FiO₂ Nebulizer (Misty-Ox®)</p>  <p>Respiratory Therapy Services (if available) must be consulted for access to this device</p>	<ul style="list-style-type: none"> O₂ concentration: 60-96% The dial on the neck of the nebulizer indicates the oxygen concentration Flow rate: "flush" (turn the flow meter to the fullest open position) 	<ul style="list-style-type: none"> Clients with severe hypoxemia requiring FiO₂ greater than 50% (more than the standard large volume nebulizer) 	<ul style="list-style-type: none"> Designed to provide very high total flow output at near 100% oxygen values (the client is less likely to inhale room air around the mask, therefore oxygen is not diluted). 	<ul style="list-style-type: none"> Not for use during transport. 	<ul style="list-style-type: none"> Clients must be monitored very closely, preferably in an ICU or observation unit (see exceptions in policy statement 2.2)

Oxygen Device Client population	Oxygen flow rate & concentration	Indication	Advantages	Disadvantages	Points of Interest
<p>Heated, Humidified, High Flow Oxygen (i.e. Optiflow, Airvo)</p> <ul style="list-style-type: none"> Adults Pediatrics Infants 	<ul style="list-style-type: none"> O₂ concentration: 21-100% O₂ Flow rate: 2-60 Lpm <p>RT (if available) will complete initial set up of oxygen concentration and flow rate settings.</p>	<ul style="list-style-type: none"> Clients with high oxygen needs, high inspiratory flow demands, humidity needs, poor compliance with high flow oxygen delivery via an aerosol mask 	<ul style="list-style-type: none"> It provides very high flow rates of blended gas (up to 100% O₂) to the client. Increased client comfort due to warmed and humidified gas Aids in expectoration and/or airway suctioning in clients with thick, tenacious airway secretions 	<ul style="list-style-type: none"> FiO₂ dependent on client respiratory pattern 	<ul style="list-style-type: none"> Clients must be monitored very closely, preferably in an ED, ICU or observation unit Used in conjunction with a special interfaces (i.e. nasal cannula, tracheostomy or face mask adapters) System consists of an air entraining oxygen and flow rate controller (see below), a special circuit and a heated humidifier



Delivered oxygen concentration displayed here

Respiratory Therapy Services (if available) must be consulted for access to these devices.

- Oxygen can be administered to infants via either low flow or high flow oxygen by nasal cannula. Low-flow regulators are available which typically deliver oxygen at doses between 0.01 Lpm - 1.0 Lpm. Neonates requiring greater than 1.0 Lpm should be assessed carefully and may require high-flow blended oxygen, nasal CPAP or intubation. For further information, please consult respiratory therapy services and the unit specific standards of care regarding these procedures.
- Although nasal cannula is considered a low flow system for adults, infants can receive high flow oxygen therapy via nasal cannula because an infant's inspiratory flow rate is much lower than that of an adult. The flow rate of gas being delivered by the cannula is set at 2 Lpm, which is high enough to provide all of the inspired gas that the infant requires. An air/oxygen blender is used to provide the flow to the cannula at an adjustable concentration, and a known FiO_2 is delivered to the client.

Nasal Cannula for low flow oxygen administration:



Microdial for 0.01 lpm to 0.1 lpm



Precision Medical for 0.1 lpm to 1 lpm

Nasal cannula for Blended Oxygen with heated humidity:



Air/Oxygen Blenders with Humidifiers:



Bird blender



Maxtec blender

T-Piece Resuscitators and Oxygen Delivery

The Neopuff Infant Resuscitator is a flow controlled pressure limited mechanical device. When used in conjunction with a blender, the Neopuff can deliver oxygen concentrations of 21-100% through the ETT or via a mask held loosely to the neonate's face. When the Neopuff is used with a tightly sealed face mask, positive end-expiratory pressure (PEEP) will also be delivered. Occlusion of the T-piece aperture allows for delivery of positive pressure breaths to the apneic infant.

Humidifier Bottles

Appendix C

Oxygen will pick up water vapour if it is bubbled through water in a humidifier bottle. Humidified oxygen does not dry oral/nasal mucosa so is less irritating and theoretically will not cause thickening of secretions. Adults do not usually require a humidifier bottle for flow rates equal to or less than 4 Lpm

Humidifier bottles are sometimes composed of several parts that require connection (humidifier top and water jar) and attachment to a flow meter and O₂ delivery device. To avoid leaks care must be taken to ensure all connections are tight and not cross threaded. A leak will result in less O₂ being delivered to the client.

Pediatrics: pediatric clients receiving oxygen therapy should have a humidifier bottle in-line, except in emergency situations, i.e. manual ventilation.

Do not use a humidifier bottle when using a non-rebreathing mask or air entrainment mask (Venti-Mask®).

Appendix D

Oxygen Flowmeter

vs

Medical Air Flowmeter

(Never use medical air for oxygen administration. It is used for nebulization and ventilation but does not deliver therapeutic doses of oxygen.)

