

## VENTILATORY ASSISTANCE (MECHANICAL)

Many patients on ventilators are now being transferred from the intensive care unit (ICU) to medical-surgical units with problems including (1) neuromuscular deficits, such as quadriplegia with phrenic nerve injury or high C-spine injuries, Guillain-Barré syndrome, and amyotrophic lateral sclerosis (ALS); (2) COPD with respiratory muscle atrophy and malnutrition (inability to wean); and (3) restrictive conditions of chest or lungs, such as kyphoscoliosis and interstitial fibrosis.

The expectation is that the majority of patients will be weaned before discharge. That is the focus of this plan of care. However, some patients are either unsuccessful at weaning or are not candidates for weaning. For those patients, portions of this plan of care would need to be modified for the discharge care setting, that is, an extended care facility or home.

### Types of Ventilators

Volume-cycled ventilators are the primary choice for long-term ventilation of patients whose permanent changes in lung compliance and resistance require increased pressure to provide adequate ventilation (e.g., COPD).

Pressure-cycled ventilators are desirable for patients with relatively normal lung compliance who cannot initiate or sustain respiration because of muscular/phrenic nerve involvement (e.g., quadriplegics).

### CARE SETTING

Patients on ventilators may be cared for in any setting; however, weaning is usually attempted/accomplished in the acute, subacute, or rehabilitation setting.

### RELATED CONCERNS

Cardiac surgery: postoperative care

Chronic obstructive pulmonary disease (COPD) and asthma

Hemothorax/pneumothorax

Spinal cord injury (acute rehabilitative phase)

Total nutritional support: parenteral/enteral feeding

Psychosocial aspects of care

### Patient Assessment Database

Gathered data depend on the underlying pathophysiology and/or reason for ventilatory support. Refer to the appropriate plan of care.

<b>Discharge plan considerations:</b>	<b>DRG projected mean length of inpatient stay: 9.5 days (or more)</b> If ventilator-dependent, may require changes in physical layout of home, acquisition of equipment/supplies, provision of a backup power source, instruction of SO/caregivers, provision for continuation of plan of care, assistance with transportation, and coordination of resources/support systems <b>Refer to section at end of plan for postdischarge considerations.</b>
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### DIAGNOSTIC STUDIES

**Pulmonary function studies:** Determine the ability of the lungs to exchange oxygen and carbon dioxide, and include but are not limited to the following:

*Vital capacity (VC):* Is reduced in restrictive chest or lung conditions; normal or increased in COPD; normal to decreased in neuromuscular diseases (Guillain-Barré syndrome); and decreased in conditions limiting thoracic movement (kyphoscoliosis).

*Forced vital capacity (FVC):* Measured by spirometry, is reduced in restrictive conditions and in asthma, and is normal to reduced in COPD.

*Tidal volume ( $V_T$ ):* May be decreased in both restrictive and obstructive processes.

*Negative inspiratory force (NIF):* Can be substituted for vital capacity to help determine whether patient can initiate a breath.

*Minute ventilation ( $V_E$ ):* Measures volume of air inhaled and exhaled in 1 min of normal breathing. This reflects muscle endurance and is a major determinant of work of breathing.

*Inspiratory pressure ( $P_{i_{max}}$ ):* Measures respiratory muscle strength (less than -20 cm H<sub>2</sub>O is considered insufficient for weaning).

*Forced expiratory volume (FEV):* Usually decreased in COPD.

*Flow-volume (F-V) loops:* Abnormal loops are indicative of large and small airway obstructive disease and restrictive diseases, when far advanced.

**ABGs:** Assesses status of oxygenation, ventilation, and acid-base balance.

**Chest x-ray:** Monitors resolution/progression of underlying condition (e.g., adult respiratory distress syndrome [ARDS]) or complications (e.g., atelectasis, pneumonia).

**Nutritional assessment:** Done to identify nutritional and electrolyte imbalances that might interfere with successful weaning.

## NURSING PRIORITIES

1. Promote adequate ventilation and oxygenation.
2. Prevent complications.
3. Provide emotional support for patient/SO.
4. Provide information about disease process/prognosis and treatment needs.

## DISCHARGE GOALS

1. Respiratory function maximized/adequate to meet individual needs.
2. Complications prevented/minimized.
3. Effective means of communication established.
4. Disease process/prognosis and therapeutic regimen understood (including home ventilatory support if indicated).
5. Plan in place to meet needs after discharge.

### **NURSING DIAGNOSIS: Breathing Pattern, ineffective/Spontaneous Ventilation, impaired**

#### **May be related to**

Respiratory center depression

Respiratory muscle weakness/paralysis

Noncompliant lung tissue (decreased lung expansion)

Alteration of patient's usual O<sub>2</sub>/CO<sub>2</sub> ratio

#### **Possibly evidenced by**

Changes in rate and depth of respirations

Dyspnea/increased work of breathing, use of accessory muscles

Reduced VC/total lung volume

Tachypnea/bradypnea or cessation of respirations when off the ventilator

Cyanosis

Decreased PO<sub>2</sub> and SaO<sub>2</sub>; increased PCO<sub>2</sub>

Increased restlessness, apprehension, and metabolic rate

#### **DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:**

##### **Respiratory Status: Ventilation (NOC)**

Reestablish/maintain effective respiratory pattern via ventilator with absence of retractions/use of accessory muscles, cyanosis, or other signs of hypoxia; ABGs/oxygen saturation within acceptable range.

Participate in efforts to wean (as appropriate) within individual ability.

##### **CAREGIVER WILL:**

Demonstrate behaviors necessary to maintain patient's respiratory function.

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Mechanical Ventilation (NIC)</b></p> <p><b>Independent</b></p> <p>Investigate etiology of respiratory failure.</p> <p>Observe overall breathing pattern. Note respiratory rate, distinguishing between spontaneous respirations and ventilator breaths.</p> <p>Auscultate chest periodically, noting presence/absence and equality of breath sounds, adventitious breath sounds, and symmetry of chest movement.</p> <p>Count patient's respirations for one full minute and compare with desired/ventilator set rate.</p> <p>Verify that patient's respirations are in phase with the ventilator.</p> <p>Elevate head of bed or place in orthopedic chair if possible.</p> <p>Place in prone position when tolerated.</p> <p>Inflate tracheal/ET cuff properly using minimal leak/occlusive technique. Check cuff inflation every 4–8 hr and whenever cuff is deflated/reinflated.</p> <p>Check tubing for obstruction, e.g., kinking or accumulation of water. Drain tubing as indicated, avoiding draining toward patient or back into the reservoir.</p>	<p>Understanding the underlying cause of patient's particular ventilatory problem is essential to the care of patient, e.g., decisions about future patient capabilities/ventilation needs and most appropriate type of ventilatory support.</p> <p>Patients on ventilators can experience hyperventilation/hypoventilation, or dyspnea/"air hunger," and attempt to correct deficiency by overbreathing.</p> <p>Provides information regarding airflow through the tracheobronchial tree and the presence/absence of fluid, mucus obstruction. <i>Note:</i> Frequent crackles or rhonchi that do not clear with coughing/suctioning may indicate developing complications (atelectasis, pneumonia, acute bronchospasm, pulmonary edema). Changes in chest symmetry may indicate improper placement of the ET, development of barotrauma.</p> <p>Respirations vary, depending on problem requiring ventilatory assistance, e.g., patient may be totally ventilator-dependent, or be able to take breath(s) on own between ventilator-delivered breaths. Rapid patient respirations can produce respiratory alkalosis and/or prevent desired volume from being delivered by ventilator. Slow patient respirations/ hypoventilation increases PaCO<sub>2</sub> levels and may cause acidosis.</p> <p>Adjustments may be required in tidal volume, respiratory rate, and/or dead space of the ventilator, or patient may need sedation to synchronize respirations and reduce work of breathing/energy expenditure.</p> <p>Elevation of patient's head or getting out of bed while still on the ventilator is both physically and psychologically beneficial.</p> <p>Prone position relaxes abdominal muscles, improving diaphragmatic excursion, increasing PaO<sub>2</sub>.</p> <p>The cuff must be properly inflated to ensure adequate ventilation/delivery of desired tidal volume. <i>Note:</i> In long-term patients, the cuff may be deflated most of the time or a noncuffed tracheostomy tube used.</p> <p>Kinks in tubing prevent adequate volume delivery and increase airway pressure. Water prevents proper gas distribution and predisposes to bacterial growth.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Mechanical Ventilation (NIC)</b></p> <p><b>Independent</b></p> <p>Check ventilator alarms for proper functioning. Do not turn off alarms, even for suctioning. Remove from ventilator and ventilate manually if source of ventilator alarm cannot be quickly identified and rectified. Ascertain that alarms can be heard in the nurses' station.</p> <p>Keep resuscitation bag at bedside and ventilate manually whenever indicated.</p> <p>Assist patient in "taking control" of breathing if weaning is attempted/ ventilatory support is interrupted during procedure/activity.</p> <p><b>Collaborative</b></p> <p>Assess ventilator settings routinely and readjust as indicated:</p> <p>Note operating mode of ventilation, i.e., continuous mandatory ventilation (CMV), assist control (ACV), intermittent mandatory (IMV), pressure support (PSV), inverse ratio (IRV);</p> <p>Observe oxygen concentration percentage (FIO<sub>2</sub>); verify that oxygen line is in proper outlet/tank; monitor in-line oxygen analyzer or perform periodic oxygen analysis;</p> <p>Observe end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) values.</p>	<p>Ventilators have a series of visual and audible alarms, e.g., oxygen, low/high pressure, inspiratory:expiratory (I:E) ratio. Turning off/failure to reset alarms places patient at risk for unobserved ventilator failure or respiratory distress/arrest.</p> <p>Provides/restores adequate ventilation when patient or equipment problems require patient to be temporarily removed from the ventilator.</p> <p>Coaching patient to take slower, deeper breaths, practice abdominal/pursed-lip breathing, assume position of comfort, and use relaxation techniques can be helpful in maximizing respiratory function.</p> <p>Controls/settings are adjusted according to patient's primary disease and results of diagnostic testing to maintain parameters within appropriate limits.</p> <p>Patient's respiratory requirements, presence or absence of an underlying disease process, and the extent to which patient can participate in ventilatory effort determine parameters of each setting. PSV, a relatively new mode, has advantages for patients who are on long-term ventilation because it allows patient to strengthen pulmonary musculature without compromising oxygenation and ventilation during the weaning process. Research suggests that intermittent trials of unassisted breathing work faster (for weaning) than methods involving partial ventilatory support.</p> <p>FIO<sub>2</sub> is adjusted (21%–100%) to maintain an acceptable oxygen percentage and saturation (e.g., 90%) for patient's condition. Because machine dials are not always accurate, an oxygen analyzer may be used to ascertain whether patient is receiving the desired concentration of oxygen. <i>Note:</i> FIO<sub>2</sub> of 0.6 or below reduces risk of absorption atelectasis and surfactant inactivation.</p> <p>Measures the amount of exhaled CO<sub>2</sub> with each breath and is displayed graphically to spot CO<sub>2</sub> exchange problems early before they show up on ABGs. Values are affected by matching of ventilation in lung with perfusion of pulmonary capillaries.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Mechanical Ventilation (NIC)</b></p> <p><b>Collaborative</b></p> <p>Assess <math>V_E</math> (respiratory rate and <math>V_T</math>);</p> <p>Assess <math>V_T</math> (10–15 mL/kg). Verify proper function of spirometer, bellows, or computer readout of delivered volume. Note alterations from desired volume delivery;</p> <p>Note airway pressure;</p> <p>Monitor I:E ratio;</p> <p>Check sigh rate intervals (usually 1½ to 2 times <math>V_T</math>);</p> <p>Note inspired humidity and temperature. Use heat moisture exchanger (HME) as indicated.</p>	<p>Respiratory rate of 10–15/min may be appropriate except for patient with COPD and <math>CO_2</math> retention. In these patients, <math>V_E</math> should be adjusted to achieve patient's baseline <math>PaCO_2</math>, not necessarily a “normal” <math>PaCO_2</math>.</p> <p>Monitors amount of air inspired and expired. Changes may indicate alteration in lung compliance or leakage through machine/around tube cuff (if used). <i>Note:</i> Smaller tidal volume may be required in patients with decreased lung compliance (e.g., ARDS).</p> <p>Airway pressure should remain relatively constant. Increased pressure alarm reading reflects (1) increased airway resistance as may occur with bronchospasm; (2) retained secretions; and/or (3) decreased lung compliance as may occur with obstruction of the ET, development of atelectasis, ARDS, pulmonary edema, worsening COPD, or pneumothorax. Low airway pressure alarms may be triggered by pathophysiological conditions causing hypoventilation, e.g., disconnection from ventilator, low ET cuff pressure, ET displaced above the vocal cords, patient “overbreathing” or out of phase with the ventilator.</p> <p>Expiratory phase is usually twice the length of the inspiratory rate, but may be longer to compensate for air-trapping to improve gas exchange in the COPD patient.</p> <p>Sighing promotes maximal ventilation of alveoli to prevent/reduce atelectasis and enhances movement of secretions.</p> <p>Usual warming and humidifying function of nasopharynx is bypassed with intubation. Dehydration can dry up normal pulmonary fluids, cause secretions to thicken, and increase risk of infection. Temperature should be maintained at about body temperature to reduce risk of damage to cilia and hyperthermia reactions. The introduction of a heated wire circuit to the traditional system significantly reduces the problem of “rainout” (condensation in the tubing).</p>

**NURSING DIAGNOSIS: Airway Clearance, ineffective**

**May be related to**

Foreign body (artificial airway) in the trachea  
Inability to cough/ineffective cough

**Possibly evidenced by**

Changes in rate or depth of respiration  
Cyanosis  
Abnormal breath sounds  
Anxiety/restlessness

**DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:**

**Respiratory Status: Airway Patency (NOC)**

Maintain patent airway with breath sounds clear.  
Be free of aspiration.

**CAREGIVER WILL:**

Identify potential complications and initiate appropriate actions.

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Artificial Airway Management (NIC)</b></p> <p><b>Independent</b></p> <p>Assess airway patency.</p> <p>Evaluate chest movement and auscultate for bilateral breath sounds.</p> <p>Monitor ET placement. Note lip line marking and compare with desired placement. Secure tube carefully with tape or tube holder. Obtain assistance when retaping or repositioning tube.</p> <p>Note excessive coughing, increased dyspnea (using a 0–10 scale), high-pressure alarm sounding on ventilator, visible secretions in endotracheal/tracheostomy tube, increased rhonchi.</p>	<p>Obstruction may be caused by accumulation of secretions, mucous plugs, hemorrhage, bronchospasm, and/or problems with the position of tracheostomy/ET.</p> <p>Symmetrical chest movement with breath sounds throughout lung fields indicates proper tube placement/unobstructed airflow. Lower airway obstruction (e.g., pneumonia/atelectasis) produces changes in breath sounds such as rhonchi, wheezing.</p> <p>The ET may slip into the right main-stem bronchus, thereby obstructing airflow to the left lung and putting patient at risk for a tension pneumothorax.</p> <p>The intubated patient often has an ineffective cough reflex, or patient may have neuromuscular or neurosensory impairment, altering ability to cough. These patients are dependent on alternative means such as suctioning to remove secretions. <i>Note:</i> Research supports use of a dyspnea rating scale (like those used to measure pain) to more accurately quantify and measure changes in dyspnea as experienced by patient.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Artificial Airway Management (NIC)</b></p> <p><b>Independent</b></p> <p>Suction as needed when patient is coughing or experiencing respiratory distress, limiting duration of suction to 15 sec or less. Choose appropriate suction catheter. Hyperventilate before and after each catheter pass, using 100% oxygen if appropriate (using vent rather than Ambu bag, which has an increased risk of barotrauma). Suction continuously or intermittently during withdrawal.</p> <p>Use inline catheter suction when available.</p> <p>Instruct patient in coughing techniques during suctioning, e.g., splinting, timing of breathing, and “quad cough” as indicated.</p> <p>Reposition/turn periodically.</p> <p>Encourage/provide fluids within individual capability.</p>	<p>Suctioning should not be routine, and duration should be limited to reduce hazard of hypoxia. Suction catheter diameter should be less than 50% of the internal diameter of the endotracheal/tracheostomy tube for prevention of hypoxia. Hyperoxygenation with ventilator sigh on 100% oxygen may be desired to reduce atelectasis and to reduce accidental hypoxia. <i>Note:</i> Instilling normal saline (NS) is no longer recommended, because research reveals that the fluid pools at the distal end of the endotracheal/tracheal tube, impairing oxygenation and increasing bronchospasm and the risk of infection.</p> <p>Reduces risk of infection for healthcare workers and helps maintain oxygen saturation and PEEP, when used.</p> <p>Enhances effectiveness of cough effort and secretion clearing.</p> <p>Promotes drainage of secretions and ventilation to all lung segments, reducing risk of atelectasis.</p> <p>Helps liquefy secretions, enhancing expectoration.</p>
<p><b>Collaborative</b></p> <p>Provide chest physiotherapy as indicated, e.g., postural drainage, percussion.</p> <p>Administer IV and aerosol bronchodilators as indicated, e.g., aminophylline, metaproterenol sulfate (Alupent), isoetharine hydrochloride (Bronkosol).</p> <p>Assist with fiberoptic bronchoscopy, if indicated.</p>	<p>Promotes ventilation of all lung segments and aids drainage of secretions.</p> <p>Promotes ventilation and removal of secretions by relaxation of smooth muscle/bronchospasm.</p> <p>May be performed to remove secretions/mucous plugs.</p>

<p><b>NURSING DIAGNOSIS: Communication, impaired verbal</b></p> <p><b>May be related to</b></p> <p>Physical barrier, e.g., endotracheal/tracheostomy tube</p> <p>Neuromuscular weakness/paralysis</p> <p><b>Possibly evidenced by</b></p> <p>Inability to speak</p> <p><b>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:</b></p> <p><b>Communication: Expressive Ability (NOC)</b></p> <p>Establish method of communication in which needs can be understood.</p>
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ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Communication Enhancement: Speech Deficit (NIC)</b></p> <p><b>Independent</b></p> <p>Assess patient's ability to communicate by alternative means.</p> <p>Establish means of communication, e.g., maintain eye contact; ask yes/no questions; provide magic slate, paper/pencil, picture/alphabet board; use sign language as appropriate; validate meaning of attempted communications.</p> <p>Consider form of communication when placing IV.</p> <p>Place call light/bell within reach, making certain patient is alert and physically capable of using it. Answer call light/bell immediately. Anticipate needs. Tell patient that nurse is immediately available should assistance be required.</p> <p>Place note at central call station informing staff that patient is unable to speak.</p> <p>Encourage family/SO to talk with patient, providing information about family and daily happenings.</p>	<p>Reasons for long-term ventilatory support are various; patient may be alert and be adept at writing (e.g., chronic COPD with inability to be weaned) or may be lethargic, comatose, or paralyzed. Method of communicating with patient is therefore highly individualized. <i>Note:</i> The inability to talk while intubated is a primary cause of feelings of fear.</p> <p>Eye contact assures patient of interest in communicating; if patient is able to move head, blink eyes, or is comfortable with simple gestures, a great deal can be done with yes/no questions. Pointing to letter boards or writing is often tiring to patients, who can then become frustrated with the effort needed to attempt conversations. Use of picture boards that express a concept or routine needs may simplify communication. Family members/other caregivers may be able to assist/interpret needs.</p> <p>IV positioned in hand/wrist may limit ability to write or sign.</p> <p>Ventilator-dependent patient may be better able to relax, feel safe (not abandoned), and breathe with the ventilator knowing that nurse is vigilant and needs will be met.</p> <p>Alerts all staff members to respond to patient at the bedside instead of over the intercom.</p> <p>SO may feel self-conscious in one-sided conversation, but knowledge that he or she is assisting patient to regain/maintain contact with reality and enabling patient to feel part of family unit can reduce feelings of awkwardness.</p>
<p><b>Collaborative</b></p> <p>Evaluate need for/appropriateness of talking tracheostomy tube.</p>	<p>Patients with adequate cognitive/muscular skills may have the ability to manipulate talking tracheostomy tube.</p>

**NURSING DIAGNOSIS: Fear/Anxiety [specify level]**

**May be related to**

Situational crises; threat to self-concept  
Threat of death/dependency on mechanical support  
Change in health/socioeconomic status/role functioning  
Interpersonal transmission/contagion

**Possibly evidenced by**

Increased muscle/facial tension  
Insomnia; restlessness  
Hypervigilance  
Feelings of inadequacy  
Fearfulness, uncertainty, apprehension  
Focus on self/negative self-talk  
Expressed concern regarding changes in life events

**DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:**

**Fear Control/Anxiety Control (NOC)**

Verbalize/communicate awareness of feelings and healthy ways to deal with them.  
Demonstrate problem-solving skills/behaviors to cope with current situation.  
Report anxiety/fear is reduced to manageable level.  
Appear relaxed and sleeping/resting appropriately.

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Anxiety Reduction (NIC)</b></p> <p><b>Independent</b></p> <p>Identify patient’s perception of threat represented by situation. Determine current respiratory status/adequacy of ventilation.</p> <p>Observe/monitor physical responses, e.g., restlessness, changes in vital signs, repetitive movements. Note congruency of verbal/nonverbal communication.</p> <p>Encourage patient/SO to acknowledge and express fears.</p> <p>Acknowledge the anxiety and fear of the situation. Avoid meaningless reassurance that everything will be all right.</p> <p>Identify/review with patient/SO the safety precautions being taken, e.g., backup power and oxygen supplies, emergency equipment at hand for suction. Discuss/review the meanings of alarm system.</p>	<p>Defines scope of individual problem, separate from physiological causes, and influences choice of interventions.</p> <p>Useful in evaluating extent/degree of concerns, especially when compared with “verbal” comments.</p> <p>Provides opportunity for dealing with concerns, clarifies reality of fears, and reduces anxiety to a more manageable level.</p> <p>Validates the reality of the situation without minimizing the emotional impact. Provides opportunity for patient/SO to accept and begin to deal with what has happened, reducing anxiety.</p> <p>Provides reassurance to help allay unnecessary anxiety, reduce concerns of the unknown, and preplan for response in emergency situation.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Anxiety Reduction (NIC)</b></p> <p><b>Independent</b></p> <p>Note reactions of SO. Provide opportunity for discussion of personal feelings/concerns and future expectations.</p> <p>Identify previous coping strengths of patient/SO and current areas of control/ability.</p> <p>Demonstrate/encourage use of relaxation techniques, e.g., focused breathing, guided imagery, progressive relaxation. Provide music therapy, biofeedback as appropriate.</p> <p>Provide/encourage sedentary diversional activities within individual capabilities, e.g., handicrafts, writing, television.</p> <p><b>Collaborative</b></p> <p>Refer to support groups and therapy as needed.</p>	<p>Family members have individual responses to what is happening, and their anxiety may be communicated to patient, intensifying these emotions.</p> <p>Focuses attention on own capabilities, increasing sense of control.</p> <p>Provides active management of situation to reduce feelings of helplessness.</p> <p>Although handicapped by dependence on ventilator, activities that are normal/desired by the individual should be encouraged to enhance quality of life.</p> <p>May be necessary to provide additional assistance if patient/SO are not managing anxiety or when patient is “identified with the machine.”</p>

<p><b>NURSING DIAGNOSIS: Oral Mucous Membrane, impaired</b></p> <p><b>Risk factors may include</b></p> <ul style="list-style-type: none"> <li>Inability to swallow oral fluids</li> <li>Presence of tube in mouth</li> <li>Lack of or decreased salivation</li> <li>Ineffective oral hygiene</li> </ul> <p><b>Possibly evidenced by</b></p> <p>[Not applicable; presence of signs and symptoms establishes an <i>actual</i> diagnosis.]</p> <p><b>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:</b></p> <p><b>Tissue Integrity: Skin and Mucous Membrane (NOC)</b></p> <p>Report/demonstrate a decrease in symptoms.</p> <p><b>CAREGIVER WILL:</b></p> <p>Identify specific interventions to promote healthy oral mucosa as appropriate.</p>
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ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Oral Health Maintenance (NIC)</b></p> <p><b>Independent</b></p> <p>Routinely inspect oral cavity, teeth, gums for sores, lesions, bleeding.</p> <p>Administer mouth care routinely and as needed, especially in patient with an oral intubation tube, e.g., cleanse mouth with water, saline, or preferred mouthwash. Brush teeth with soft toothbrush, Waterpik, or moistened swab.</p> <p>Change position of ET/airway on a regular/prn schedule as appropriate.</p> <p>Apply lip balm; administer oral lubricant solution.</p>	<p>Early identification of problems provides opportunity for appropriate intervention/preventive measures.</p> <p>Prevents drying/ulceration of mucous membrane and reduces medium for bacterial growth. Promotes comfort.</p> <p>Reduces risk of lip and oral mucous membrane ulceration.</p> <p>Maintains moisture, prevents drying.</p>

<p><b>NURSING DIAGNOSIS: Nutrition: imbalanced, less than body requirements</b></p> <p><b>May be related to</b></p> <p>Altered ability to ingest and properly digest food Increased metabolic demands</p> <p><b>Possibly evidenced by</b></p> <p>Weight loss; poor muscle tone Aversion to eating; reported altered taste sensation Sore, inflamed buccal cavity Absence of/hyperactive bowel sounds</p> <p><b>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:</b></p> <p><b>Nutritional Status (NOC)</b></p> <p>Indicate understanding of individual dietary needs. Demonstrate progressive weight gain toward goal with normalization of laboratory values.</p>
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ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Nutrition Therapy (NIC)</b></p> <p><b>Independent</b></p> <p>Evaluate ability to eat.</p> <p>Observe/monitor for generalized muscle wasting, loss of subcutaneous fat.</p> <p>Weigh as indicated.</p> <p>Document oral intake if/when resumed. Offer foods that patient enjoys.</p> <p>Provide small frequent feedings of soft/easily digested foods if able to swallow.</p> <p>Encourage/administer fluid intake of at least 2500 mL/day within cardiac tolerance.</p> <p>Assess GI function: Presence/quality of bowel sounds; note changes in abdominal girth, nausea/vomiting. Observe/document changes in bowel movements, e.g., diarrhea/constipation. Test all stools for occult blood.</p>	<p>Patients with a tracheostomy tube may be able to eat, but patients with ETs must be tube fed or parenterally nourished.</p> <p>These symptoms are indicative of depletion of muscle energy and can reduce respiratory muscle function.</p> <p>Significant and recent weight loss (7%–10% body weight) and poor nutritional intake provide clues regarding catabolism, muscle glycogen stores, and ventilatory drive sensitivity.</p> <p>Appetite is usually poor and intake of essential nutrients may be reduced. Offering favorite foods can enhance oral intake.</p> <p>Prevents excessive fatigue, enhances intake, and reduces risk of gastric distress.</p> <p>Prevents dehydration that can be exacerbated by increased insensible losses (e.g., ventilator/intubation) and reduces risk of constipation.</p> <p>A functioning GI system is essential for the proper utilization of enteral feedings. Mechanically ventilated patients are at risk of developing abdominal distension (trapped air or ileus) and gastric bleeding (stress ulcers).</p>
<p><b>Collaborative</b></p> <p>Adjust diet to meet respiratory needs as indicated.</p> <p>Administer tube feeding/hyperalimentation as needed. (Refer to CP: Total Nutritional Support: Parenteral/Enteral Feeding.)</p> <p>Monitor laboratory studies as indicated, e.g., prealbumin, serum transferrin, BUN/creatinine (Cr), glucose.</p>	<p>High intake of carbohydrates, protein, and calories may be desired/needed during ventilation to improve respiratory muscle function. Carbohydrates may be reduced and fat somewhat increased just before weaning attempts to prevent excessive CO<sub>2</sub> production and reduced respiratory drive.</p> <p>Provides adequate nutrients to meet individual needs when oral intake is insufficient/not appropriate.</p> <p>Provides information about adequacy of nutritional support/need for change.</p>

**NURSING DIAGNOSIS: Infection, risk for**

**Risk factors may include**

Inadequate primary defenses (traumatized lung tissue, decreased ciliary action, stasis of body fluids)  
Inadequate secondary defenses (immunosuppression)  
Chronic disease, malnutrition  
Invasive procedure (intubation)

**Possibly evidenced by**

[Not applicable; presence of signs and symptoms establishes an *actual* diagnosis.]

**DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT/CAREGIVER WILL:**

**Knowledge: Infection Control (NOC)**

Indicate understanding of individual risk factors.  
Identify interventions to prevent/reduce risk of infection.  
Demonstrate techniques to promote safe environment.

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Infection Protection (NIC)</b></p> <p><b>Independent</b></p> <p>Note risk factors for occurrence of infection.</p> <p>Observe color/odor/characteristics of sputum. Note drainage around tracheostomy tube.</p> <p>Reduce nosocomial risk factors via proper handwashing by all caregivers, maintaining sterile suction techniques, reducing the number of times the ventilator tubes are open, and providing clean nebulizer/tubing changes.</p> <p>Encourage deep breathing, coughing, and frequent position changes.</p> <p>Auscultate breath sounds.</p> <p>Monitor/screen visitors. Avoid contact with persons with URI.</p>	<p>Intubation, prolonged mechanical ventilation, trauma, general debilitation, malnutrition, age, and invasive procedures are factors that potentiate patient's risk of acquiring infection and prolonging recovery. Awareness of individual risk factors provides opportunity to limit effects and help prevent ventilator-associated pneumonia (VAP).</p> <p>Yellow/green, purulent odorous sputum is indicative of infection; thick, tenacious sputum suggests dehydration.</p> <p>These factors may be the simplest but are the most important keys to prevention of hospital-acquired infection. <i>Note:</i> Centers for Disease Control and Prevention (CDC) guidelines recommend changing tubing no more often than every 48 hr. Research indicates that less frequent tubing changes (every 5–7 days) may even be acceptable.</p> <p>Maximizes lung expansion and mobilization of secretions to prevent/reduce atelectasis and accumulation of sticky, thick secretions.</p> <p>Presence of rhonchi/wheezes suggests retained secretions requiring expectoration/suctioning.</p> <p>Individual is already compromised and is at increased risk for development of infections.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Infection Protection (NIC)</b></p> <p><b>Independent</b></p> <p>Instruct patient/SO in proper secretion disposal, e.g., tissues, soiled tracheostomy dressings.</p> <p>Provide respiratory isolation when indicated.</p> <p>Maintain adequate hydration and nutrition. Encourage fluids to 2500 mL/day within cardiac tolerance.</p> <p>Measure pH of gastric secretions, and monitor use of antacid medications as indicated.</p> <p>Encourage self-care/activities to limit of tolerance. Assist with graded exercise program.</p> <p><b>Collaborative</b></p> <p>Obtain sputum cultures as indicated.</p> <p>Administer antimicrobials as indicated.</p>	<p>Reduces transmission of fluid-borne organisms.</p> <p>Depending on specific diagnosis, patient may require protection from others or must prevent transmission of infection to others (e.g., tuberculosis).</p> <p>Helps improve general resistance to disease and reduces risk of infection from static secretions.</p> <p>Maintaining acid level of stomach around 7.2 pH may help reduce risk of nosocomial infection and stress ulcers.</p> <p>Improves general well-being and muscle strength and may stimulate immune system recovery.</p> <p>May be needed to identify pathogens and appropriate antimicrobials.</p> <p>If infection does occur, one or more agents may be used, depending on identified pathogen(s).</p>

<p><b>NURSING DIAGNOSIS: Ventilatory Weaning Response, risk for dysfunctional</b></p> <p><b>Risk factors may include</b></p> <ul style="list-style-type: none"> <li>Sleep disturbance</li> <li>Limited/insufficient energy stores</li> <li>Pain or discomfort</li> <li>Adverse environment (e.g., inadequate monitoring/support)</li> <li>Patient-perceived inability to wean; decreased motivation</li> <li>History of extended weaning</li> </ul> <p><b>Possibly evidenced by</b></p> <p>[Not applicable; presence of signs and symptoms establishes an <i>actual</i> diagnosis.]</p> <p><b>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:</b></p> <p><b>Respiratory Status: Ventilation (NOC)</b></p> <ul style="list-style-type: none"> <li>Actively participate in the weaning process.</li> <li>Reestablish independent respiration with ABGs within acceptable range and free of signs of respiratory failure.</li> <li>Demonstrate increased tolerance for activity/participate in self-care within level of ability.</li> </ul>
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ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Mechanical Ventilatory Weaning (NIC)</b></p> <p><b>Independent</b></p> <p>Assess physical factors involved in weaning, e.g.:</p> <ul style="list-style-type: none"> <li>Stable heart rate/rhythm, BP, and clear breath sounds;</li> <li>Fever;</li> <li>Nutritional status and muscle strength;</li> <li>Respiratory volumes.</li> </ul> <p>Determine psychological readiness.</p> <p>Explain weaning techniques, e.g., T-piece, spontaneous intermittent maximal ventilation (SIMV), continuous positive airway pressure (CPAP), or NIPPV. Discuss individual plan and expectations.</p> <p>Provide undisturbed rest/sleep periods. Avoid stressful procedures/situations or nonessential activities.</p> <p>Evaluate/document patient's progress. Note restlessness; changes in BP, heart rate, respiratory rate; use of accessory muscles; disorganized breathing with ventilator; increased concentration on breathing (mild dysfunction); patient's concerns about possible machine malfunction; inability to cooperate/respond to coaching; color changes.</p>	<p>The heart has to work harder to meet increased energy needs associated with weaning. Physician may defer weaning if tachycardia, pulmonary crackles, and/or hypertension are present.</p> <p>Increase of 1°F (0.6°C) in body temperature raises metabolic rate and oxygen demands by 7%.</p> <p>Weaning is hard work. Patient not only must be able to withstand the stress of weaning but also must have the stamina to breathe spontaneously for extended periods.</p> <p>Predictors of readiness to wean include (NIP) <math>\leq</math>-220, (PEP) <math>\leq</math>+120, (STV) <math>&gt;</math>5 mL/kg, (MC) <math>&gt;</math>10–15 mL/kg, (MV) <math>\leq</math>10 L/min.</p> <p>Weaning provokes anxiety for patient regarding concerns about ability to breathe on own and long-term need of ventilator.</p> <p>Assists patient to prepare for weaning process, helps limit fear of unknown, promotes cooperation, and enhances likelihood of a successful outcome. <i>Note:</i> Pressure support ventilation unloads respiratory muscles, allowing patient to “set” rate and volume and decelerating flow pattern because breath can be shaped to simulate a more normal respiratory pattern with higher gas flow on inspiration then tapering off. This increases patient comfort and is especially beneficial for patients at high risk for DVWR.</p> <p>Maximizes energy for weaning process; limits fatigue and oxygen consumption. <i>Note:</i> It takes approximately 12–14 hr of respiratory rest to rejuvenate tired respiratory muscles. For patients on assist/control, raising the rate to 20 breaths/min can also provide respiratory rest.</p> <p>Indicators that patient may require slower weaning/opportunity to stabilize or may need to stop program. <i>Note:</i> Moving from pressure/volume (e.g., assist/control) ventilator to T-piece may precipitate a “flash” form of heart failure requiring prompt intervention.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Mechanical Ventilatory Weaning (NIC)</b></p> <p><b>Independent</b></p> <p>Recognize/provide encouragement for patient's efforts.</p> <p>Monitor response to activity.</p> <p><b>Collaborative</b></p> <p>Consult with dietitian, nutritional support team for adjustments in composition of diet.</p> <p>Monitor CBC, serum albumin and prealbumin, transferrin, total iron-binding capacity, and electrolytes (especially potassium, calcium, and phosphorus).</p> <p>Review chest x-ray and ABGs.</p>	<p>Positive feedback provides reassurance and support for continuation of weaning process.</p> <p>Excessive oxygen consumption/demand increases the possibility of failure.</p> <p>Reduction of carbohydrates/fats may be required to prevent excessive production of CO<sub>2</sub>, which could alter respiratory drive.</p> <p>Verifies that nutrition is adequate to meet energy requirements for weaning.</p> <p>Chest x-rays should show clear lungs or marked improvement in pulmonary congestion or infiltrates. ABGs should document satisfactory oxygenation on an FIO<sub>2</sub> of 40% or less.</p>

<p><b>NURSING DIAGNOSIS: Knowledge, deficient [Learning Need] regarding condition, prognosis and therapy, self-care and discharge needs</b></p> <p><b>May be related to</b></p> <p>Lack of exposure/recall</p> <p>Misinterpretation of information; unfamiliarity with information resources</p> <p>Stress of situational crisis</p> <p><b>Possibly evidenced by</b></p> <p>Questions about care, request for information</p> <p>Reluctance to learn new skills</p> <p>Inaccurate follow-through of instructions</p> <p>Development of preventable complications</p> <p><b>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT/SO/CAREGIVER WILL:</b></p> <p><b>Health-Seeking Behavior (NOC)</b></p> <p>Participate in learning process.</p> <p>Exhibit increased interest, shown by verbal/nonverbal cues.</p> <p>Assume responsibility for own learning and begin to look for information and to ask questions.</p> <p><b>Knowledge: Treatment Regimen (NOC)</b></p> <p>Indicate understanding of mechanical ventilation therapy.</p> <p>Demonstrate behaviors/new skills to meet individual needs/prevent complications.</p>
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ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Learning Facilitation (NIC)</b></p> <p><b>Independent</b></p> <p>Determine ability and willingness to learn.</p> <p>Schedule teaching sessions for quiet, nonstressful times when all participants are well rested.</p> <p>Arrange information in logical sequence, progressing from simple to more complex material at learners' pace.</p>	<p>Physical condition may preclude patient involvement in care before and after discharge. SO/caregiver may feel inadequate and afraid of machinery and have reservations about ability to learn or deal with overall situation.</p> <p>Enhances learners' ability to focus on and absorb content provided.</p> <p>Allows learner to build on information learned in previous sessions, is less threatening/overwhelming.</p>
<p><b>Knowledge: Disease Process (NIC)</b></p> <p>Provide material in multiple formats, (e.g., books/pamphlets, audiovisuals, hands-ondemonstrations) and take-home instruction sheets as appropriate.</p> <p>Discuss specific condition requiring ventilatory support, what measures are being tried for weaning, short- and long-term goals of treatment.</p> <p>Encourage patient/SO to evaluate impact of ventilatory dependence on their lifestyle and what changes they are willing or unwilling to make. Problem-solve solutions to issues raised.</p> <p>Promote participation in self-care/diversional activities and socialization as appropriate.</p> <p>Review issues of general well-being: role of nutrition, assistance with feeding/meal preparation, graded exercise/specific restrictions, rest periods alternated with activity.</p> <p>Recommend that SO/caregivers learn CPR.</p> <p>Schedule team conference. Establish in-hospital training for caregivers if patient is to be discharged home on ventilator.</p> <p>Instruct caregiver and patient in handwashing techniques, use of sterile technique for suctioning, tracheostomy/stoma care, and chest physiotherapy.</p>	<p>Uses multiple senses to stimulate learning/ retention of information. Provides resources for review following discharge.</p> <p>Provides knowledge base to aid patient/SO in making informed decisions. Weaning efforts may continue for several weeks (extended period of time). Dependence is evidenced by repeatedly increased Pco<sub>2</sub> and/or decline in PaO<sub>2</sub> during weaning attempts, presence of dyspnea, anxiety, tachycardia, perspiration, cyanosis.</p> <p>Quality of life must be resolved by the ventilator-dependent patient and caregivers who need to understand that home ventilatory support is a 24-hr job that affects everyone.</p> <p>Refocuses attention toward more normal life activities, increases endurance, and helps prevent depersonalization.</p> <p>Enhances recuperation and ensures that individual needs will be met.</p> <p>Provides sense of security about ability to handle emergency situations that might arise until help can be obtained.</p> <p>Team approach is needed to coordinate patient's care and teaching program to meet individual needs.</p> <p>Reduces risk of infection and promotes optimal respiratory function.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p><b>Knowledge: Disease Process (NIC)</b></p> <p><b>Independent</b></p> <p>Provide both demonstration and “hands-on” sessions, as well as written material, about specific type of ventilator to be used, function, and care of equipment.</p> <p>Discuss what/when to report to the healthcare provider, e.g., signs of respiratory distress, infection.</p> <p>Ascertain that all needed equipment is in place and that safety concerns have been addressed, e.g., alternative power source (generator, batteries); backup equipment; patient call/alarm system.</p> <p>Contact community/hospital-based services.</p> <p>Refer to vocational/occupational therapist.</p>	<p>Enhances familiarity, reducing anxiety and promoting confidence in implementation of new tasks/skills.</p> <p>Helps reduce general anxiety while promoting timely/appropriate evaluation and intervention to prevent complications.</p> <p>Preadmission preparations can ease the transfer process. Planning for potential problems increases sense of security for patient/SO.</p> <p>Suppliers of home equipment, physical therapy, care providers, emergency power provider, social services; financial assistance, aid in procuring equipment/personnel, and facilitating transition to home.</p> <p>Some ventilator-dependent patients are able to resume vocations, either while on the ventilator or during the day (while ventilator-dependent at night).</p>

**POTENTIAL CONSIDERATIONS following acute hospitalization (dependent on patient’s age, physical condition/presence of complications, personal resources, and life responsibilities)**

If patient is discharged on ventilator, the patient’s needs/concerns remain the same as noted in this plan of care, in addition to:

Self-Care deficit—decreased strength/endurance, inability to perform ADLs, depression, restrictions imposed by therapeutic intervention.

Family Processes, interrupted—situational crisis.

Caregiver Role Strain, risk for—severity of illness of care receiver, discharge of family member with significant home care needs, presence of situational stressors (economic vulnerability, changes in roles/responsibilities), duration of caregiving required, inexperience in caregiving.