

# Saving Face with Non-Invasive Ventilation (NIV)



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# Learning Outcome

- Describe how to minimize skin breakdown and pressure points, prevent skin breakdown, and assess skin during NIV.

# NIV is the standard of care

“It is no exaggeration to say that NIV has revolutionized the treatment of acute respiratory failure.”<sup>1</sup>



<sup>1</sup> Scott K. Epstein, MD. *Respiratory Care*, January 2009 Vol 54 No 1.

# NIV advantages over invasive ventilation



## Application

- Avoid Intubation
  - Patient discomfort
  - Upper airway trauma
- Ventilator Acquired Pneumonia (VAP)<sup>9</sup>
  - Intubation is associated with GI bleeding
  - Less chance of barotrauma
- Decreases work of breathing
  - Improves alveolar ventilation
  - Improves gas exchange
  - Counterbalances intrinsic PEEP
- Improves patient-ventilator synchrony

\*Respiratory Care, Feb 2009 54(2):198-211)

<sup>9</sup>Respiratory Care, July 2005; 50(7):924-931.

# NIV advantages over invasive ventilation



## Oral patency

- Preserves efficiency of cough and secretion clearance
- Allows speech, enabling the patient to communicate
- Preserves ability to swallow
- Reduces need for NG tube

# Centers for Medicare & Medicaid Services

CMS classified Stage III and IV pressure ulcers as a preventable Hospital Acquired Condition (HAC).<sup>2</sup>

These are no longer reimbursed by current insurance guidelines.<sup>1</sup>



<sup>1</sup> Scott K. Epstein, MD. *Respiratory Care*, January 2009 Vol 54 No 1.

<sup>2</sup> Gregoretti et al. Evaluation of patient skin breakdown and comfort with a new face mask for non-invasive ventilation: a multi-center study. *Inten Care Med* 2002; 28:278-284.

# How are pressure ulcers impacting your facility?

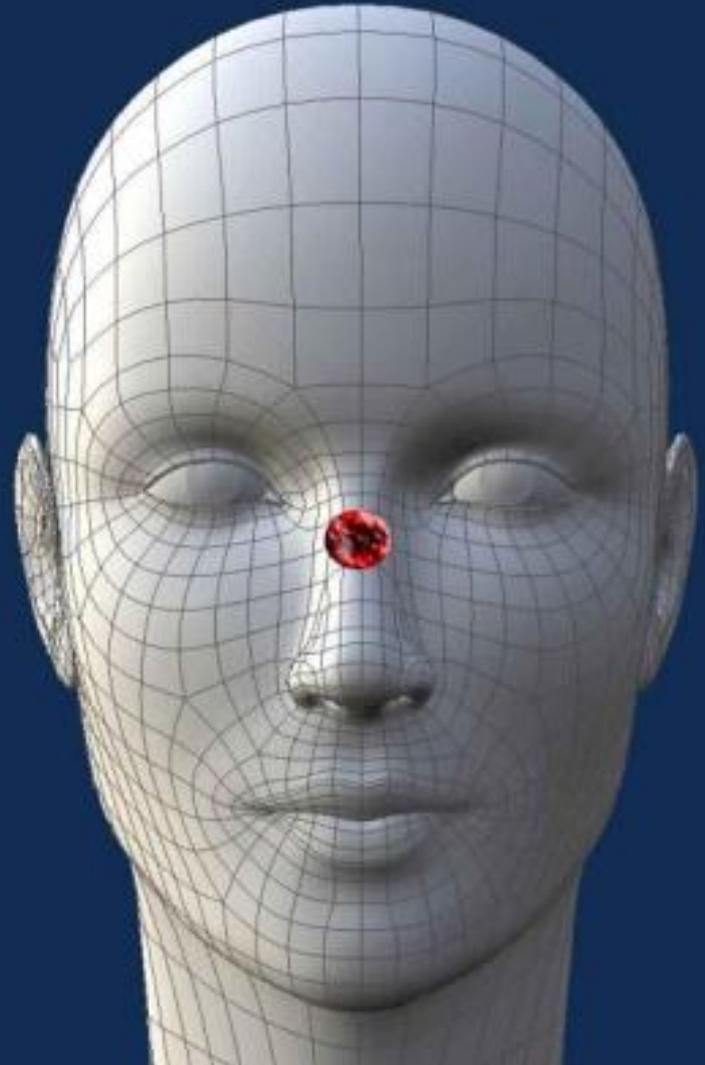
- Difficult to manage
- Costly
- A cause for litigation

Requires a multidisciplinary approach, from administration to the bedside clinician



# What is a pressure ulcer?

A localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear.



# Polling question

What CMS classified pressure ulcers are no longer reimbursed by current insurance guideline?

**A**

Stage 1

**B**

Stage 2

**C**

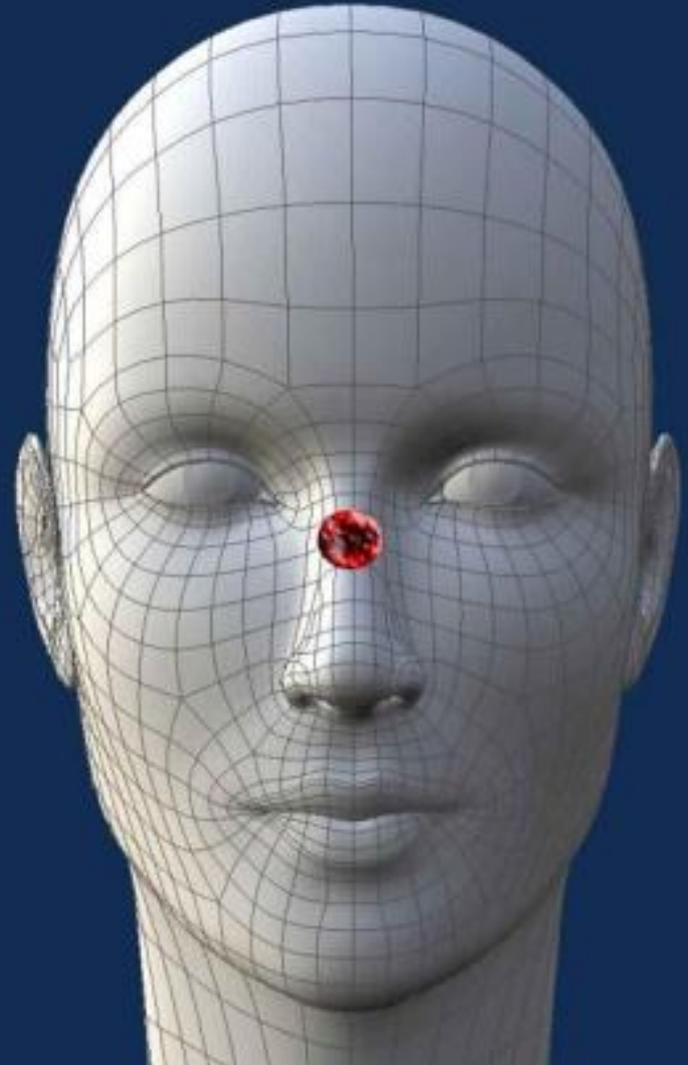
Stage 3

**D**

Stage 3 & 4

# Incidence of skin breakdown

- Skin breakdown “... even after only a few hours of ventilation, is a frequent complication, ranging from 2-23%”.<sup>1</sup>
- “In one study, where patients were continuously ventilated with a face mask for more than 48 hours, this percentage reached 70%”.<sup>2</sup>

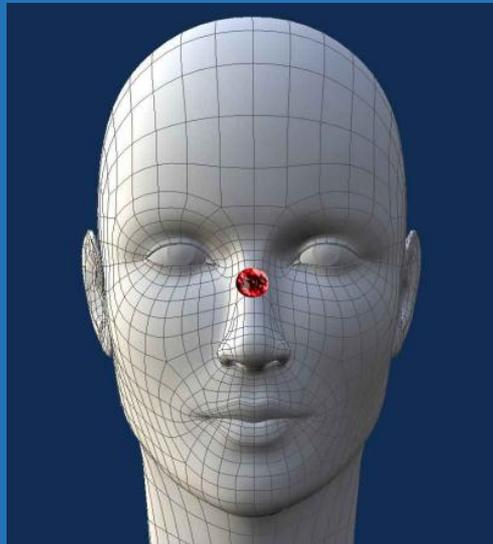


<sup>1</sup> Scott K. Epstein, MD. *Respiratory Care*, January 2009 Vol 54 No 1.

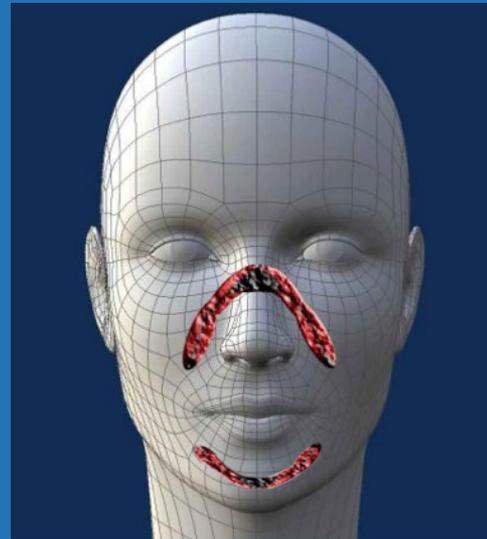
<sup>2</sup> Gregoretti et al. Evaluation of patient skin breakdown and comfort with a new face mask for non-invasive ventilation: a multi-center study. *Inten Care Med* 2002; 28:278-284.

# Incidence of skin breakdown

- Localized areas of tissue necrosis
- Develop when soft tissue is compressed between a bony prominence surface for an extended period of time



Most common on  
bridge of nose<sup>1</sup>



Extreme cases involve  
surrounding areas, like over the  
nose and on the chin

<sup>1</sup> Scott K. Epstein, MD. *Respiratory Care*, January 2009 Vol 54 No 1.

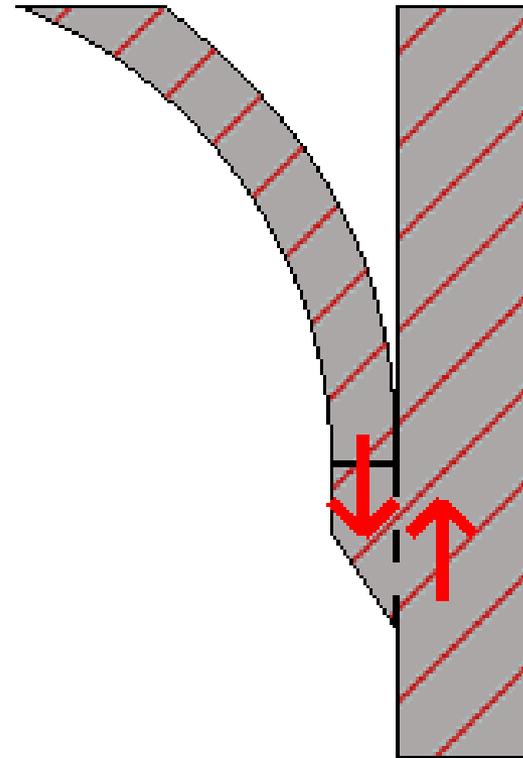
# What causes a pressure ulcer?

The primary causes are<sup>3</sup>:

- Shearing forces:
  - Cause stretching, kinking, and tearing in the subcutaneous tissues
  - Lead to deeper tissue necrosis
- Excessive compressive pressure (CP)
  - CP should be < diastolic BP
  - CP should be < capillary BP (32-45 mmHg)

Risk increases with<sup>3</sup>:

- Duration of pressure exposure
- Pressure over bony prominences

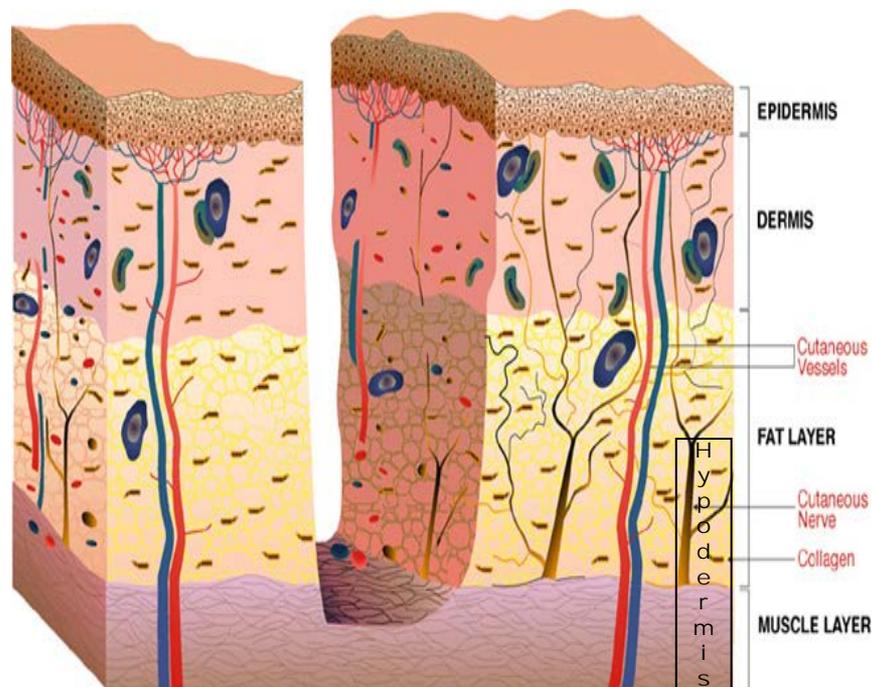


Shearing forces

<sup>3</sup>DeFloor, T. The risk of pressure sores: a conceptual scheme; *Jour of Clin Nursing* 1999;8:206-216.

# Skin anatomy and physiology<sup>4</sup>

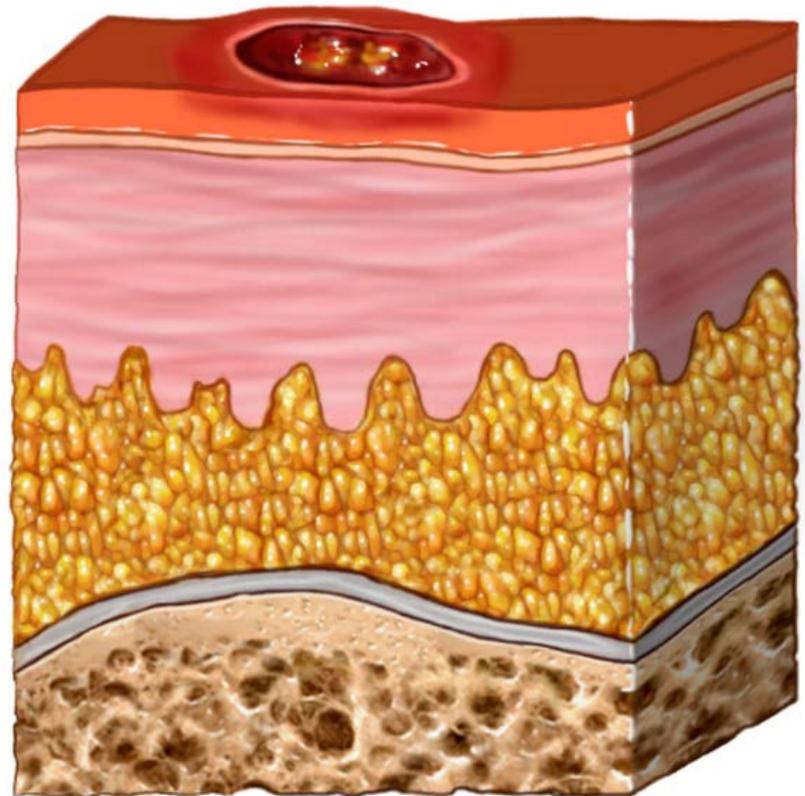
- Epidermis
  - The outer layer of skin sheds every 21 days.
- Dermis
  - The middle layer of skin contains nerve endings, blood vessels, oil glands, and sweat glands.
  - Collagen and elastin
- Hypodermis
  - The subcutaneous layer of skin; fat and connective tissue that houses larger blood vessels and nerves



<sup>4</sup> National Pressure Ulcer Advisory Panel (NPUAP) [www.npuap.org](http://www.npuap.org).

# Pressure ulcer - Stage 1

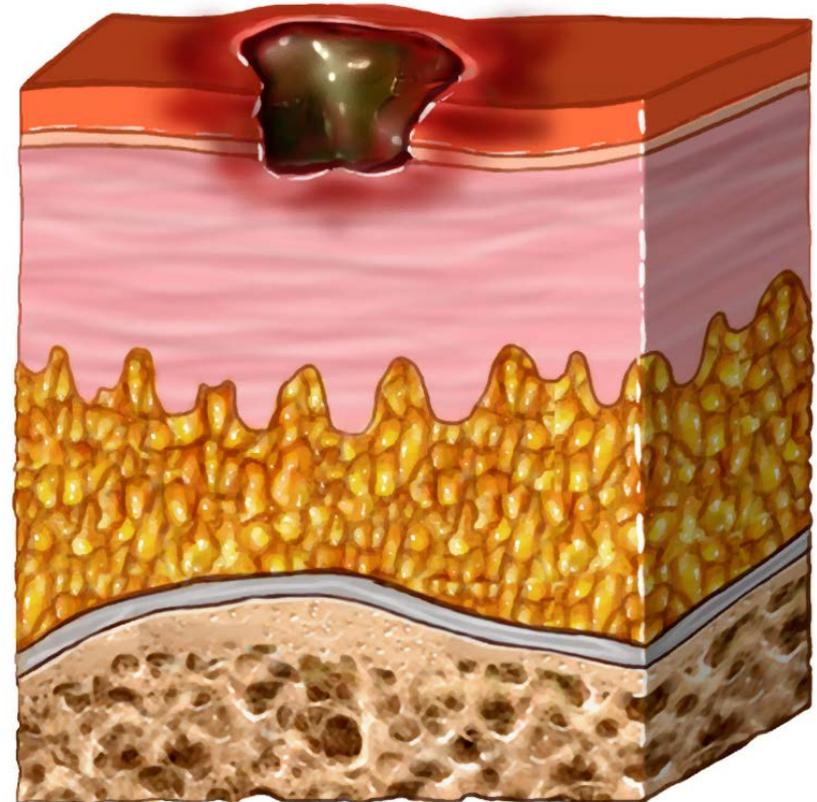
- Intact skin with non-blanchable redness
- A change in the skin temperature (warm or coolness)
- Tissue consistency has a firm or boggy feel
- Possible patient sensation pain or itching



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# Pressure ulcer - Stage 2

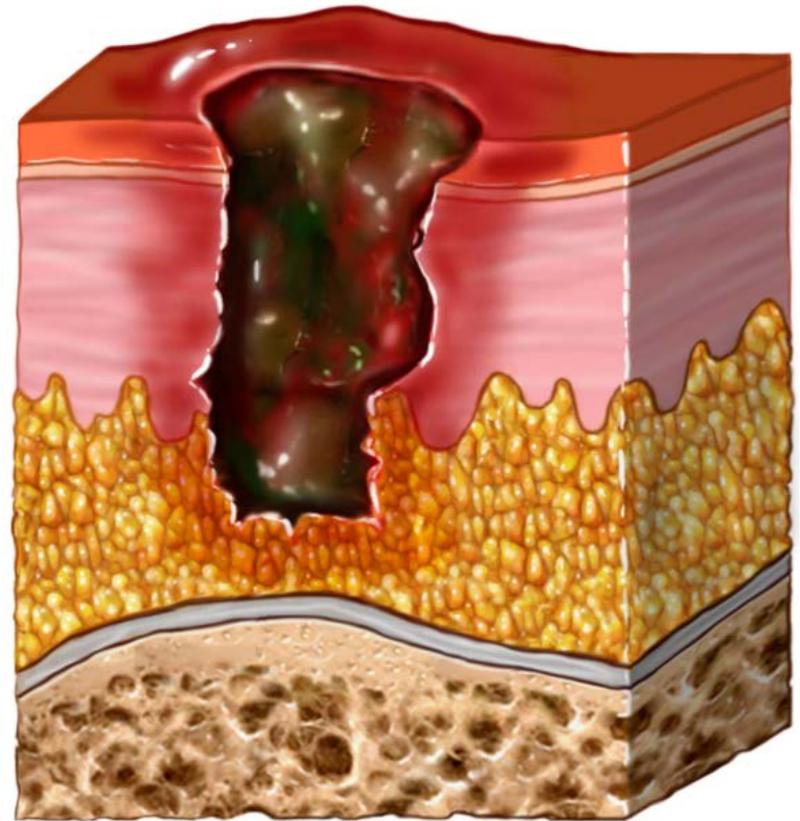
- Partial thickness loss of skin involving epidermis and/or dermis
- Presents as a intact or open serum filled blister or shallow crater



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# Pressure ulcer - Stage 3

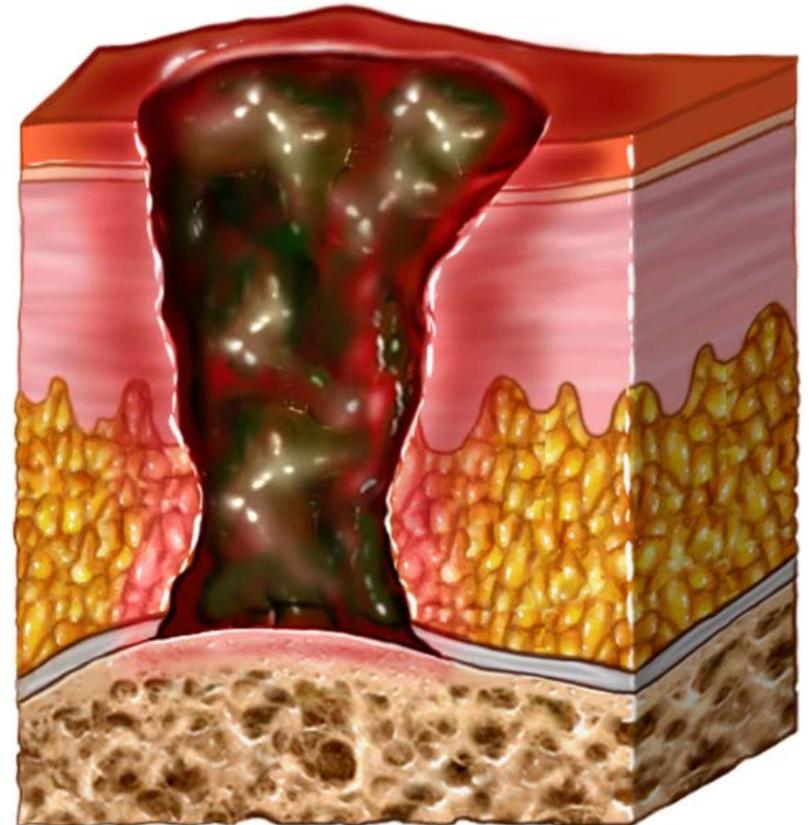
- Full thickness tissue loss involving damage to or necrosis of subcutaneous tissue
- May extend down to, but not through, underlying fascia
- Presents as a deep crater which may include undermining or tunneling



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# Pressure ulcer - Stage 4

- Full thickness tissue loss with extensive destruction
- Exposed bone, muscle or tendon
- Some slough or eschar may be present



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# Pressure ulcer - Stage 4

What are the signs of a Stage 1 pressure sore?

**A**

Exposed bone

**B**

Intact skin with  
non-blanchable  
redness

**C**

Full thickness  
tissue loss  
involving damage  
to or necrosis of  
subcutaneous  
tissue

**D**

All of the above

<sup>4</sup> National Pressure Ulcer Advisory Panel (NPUAP) [www.npuap.org](http://www.npuap.org).

# Mask rotation practices



By rotating mask designs, the pressure points are redistributed to help reduce the potential for skin breakdown.

# Risk factors for hospital-acquired pressure ulcers<sup>5</sup> (HAPU)

- Age
- Trauma from friction and shearing forces
- Poor nutrition
- Low blood pressure (low perfusion)
- Extended use of NIV



<sup>5</sup> NPUAP-EPUAP-Prevention and treatment of Pressure Ulcers: Quick reference guide. Oct.16, 2014

# Considerations for mask selection

## Did you know?

Up to 50% of NIV failures are related to the mask.<sup>6</sup>



<sup>6</sup>Nava et al. Interfaces and humidification for noninvasive ventilation; Respir Care 2009; 54:71-82.

# Clinical considerations

Clinicians remove and reposition masks many times per day for:<sup>7</sup>

- Oral care
- Medication administration
- Hydration
- Therapy break



<sup>7</sup>Hilbert et al. Noninvasive ventilation for acute respiratory failure. Quite low time consumption for nurses Eur Respir J 2000; 16:710-716.

# Mask design considerations<sup>8</sup>

- Estimated length of use
- Compatibility with NIV device
- Mask safety features
  - Quick release clips
  - Anti-asphyxia valves
- Facial features
  - Skin condition
  - Facial abnormalities
- Elbow / Ventilator compatibility
  - EE
  - SE



<sup>8</sup>Nava, S., et al. Interfaces and Humidification for Noninvasive Mechanical Ventilation. Resp. Care. Jan 2009. Vol 54-1

# Patient considerations<sup>9</sup>

- Mouth breather
- Claustrophobic
- Level of consciousness
- Cooperation
- Facial structure
- Elbow style
- Size matters



<sup>9</sup>Nava, S., Hill, N., Non-invasive ventilation in acute respiratory failure. Lancet 2009;374-250-59.

# Choosing the right mask for your patient

- Mask types
- Headgear selection
- Soft, self-sealing cushions
- Anti-asphyxia features



# Initial assessment

**BRADEN SCALE – For Predicting Pressure Sore Risk**

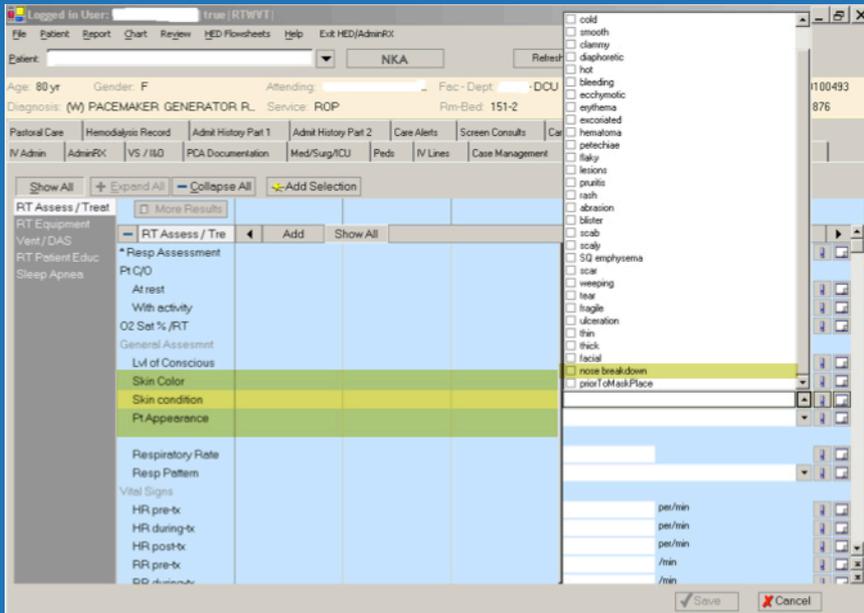
| SEVERE RISK: Total score ≤ 9  |  | MODERATE RISK: Total score 13-14 |        | HIGH RISK: Total score 10-12 |        | MILD RISK: Total score 15-18 |                           | DATE OF ASSESS → |   |   |   |  |
|---|--|----------------------------------|--------|------------------------------|--------|------------------------------|---------------------------|------------------|---|---|---|--|
| RISK FACTOR   | SCORE/DESCRIPTION  |                                  |        |                              |        |                              |                           | 1                | 2 | 3 | 4 |  |
| <b>Sensory perception</b><br>ability to respond meaningfully to pressure-related discomfort   | <b>1. NO IMPAIRMENT</b> – Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.   |                                  |        |                              |        |                              |                           | ✓                |   |   |   |  |
|   | <b>4. RARELY MOIST</b> – Skin is usually dry. linen only requires changing at routine intervals.   |                                  |        |                              |        |                              |                           |                  | ✓ |   |   |  |
|   | <b>4. WALKS FREQUENTLY</b> – walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.  |                                  |        |                              |        |                              |                           | ✓                |   |   |   |  |
| <b>MOBILITY</b><br>Ability to change and control body position  | <b>1. COMPLETELY IMMOBILE</b> – Does not make even slight changes in body or extremity position without assistance.  |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
|   | <b>2. VERY LIMITED</b> – Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.   |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
|   | <b>3. SLIGHTLY LIMITED</b> – Makes frequent though slight changes in body or extremity position independently.   |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
|   | <b>4. NO LIMITATIONS</b> – Makes major and frequent changes in position without assistance.  |                                  |        |                              |        |                              |                           | ✓                |   |   |   |  |
| <b>NUTRITION</b><br>Usual food intake pattern<br><br><sup>NPO</sup> : Nothing by mouth.<br><sup>IV</sup> : Intravenously.<br><sup>TPN</sup> : Total parenteral nutrition. | <b>1. VERY POOR</b> – Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement.      |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
|   | <b>2. PROBABLY INADEQUATE</b> – Rarely eats a complete meal and generally eats only about 1/3 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
|   | <b>3. ADEQUATE</b> – Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally refuses a meal, but will usually take a supplement if offered.                                      |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
|   | <b>4. EXCELLENT</b> – Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.                             |                                  |        |                              |        |                              |                           | ✓                |   |   |   |  |
| <b>Friction and shear</b>   | <b>1. NO APPARENT PROBLEM</b> – Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.  |                                  |        |                              |        |                              |                           | ✓                |   |   |   |  |
|   | or agitation leads to almost constant friction. time but occasionally slides down.   |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
| <b>TOTAL SCORE</b>  | Total score of 12 or less represents HIGH RISK   |                                  |        |                              |        |                              |                           |                  |   |   |   |  |
| ASSESS  | DATE   | EVALUATOR SIGNATURE/TITLE        |        |                              | ASSESS | DATE                         | EVALUATOR SIGNATURE/TITLE |                  |   |   |   |  |
| 1   | / /  |                                  |        |                              | 3      | / /                          |                           |                  |   |   |   |  |
| 2   | / /  |                                  |        |                              | 4      | / /                          |                           |                  |   |   |   |  |
| NAME-Last   |  | First                            | Middle | Attending Physician          |        | Record No.                   |                           | Room/Bed         |   |   |   |  |

- All patients should be assessed for skin integrity upon admission
- Assessment of risk factors for HAPU should also be determined on admission and prior to NIV initiation
- Assess the patient using the Braden scale
- Relative risk should determine monitoring frequency and prevention strategy

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# Assessment and documentation



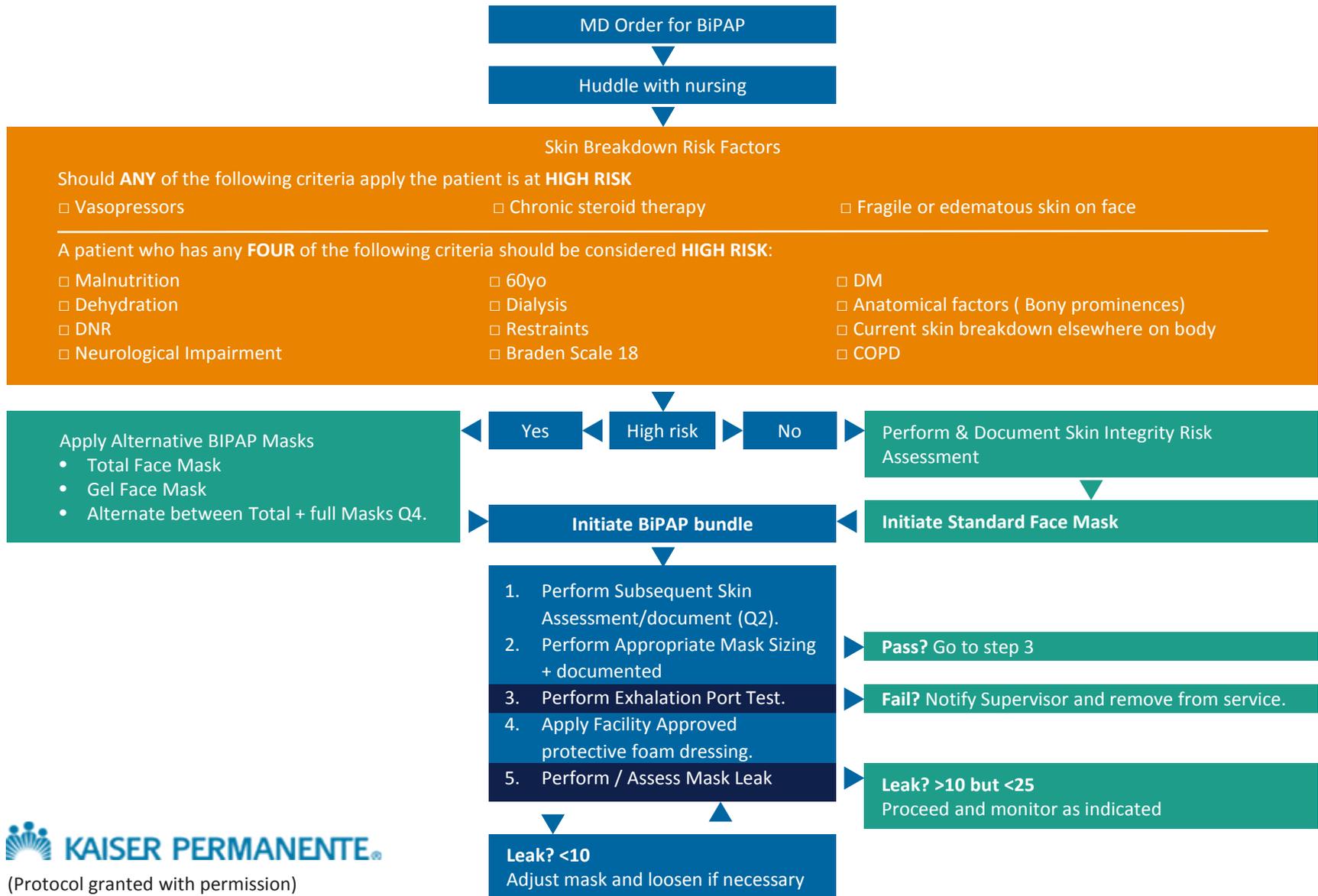
- **Complete** a risk assessment before starting NIV
- **Assess** all potential areas for redness that could be impacted by respiratory devices
- **Assess** redness or open wounds; report findings to the primary registered nurse
- **Document** a wound or red area on the respiratory flow sheet or the treatment plan
- **Document** “off-loading” and/or implementation of protective devices and procedures

# Polling question

Is your hospital using some type of skin assessment protocol?



# Patient assessment



# Patient assessment

## Skin Integrity Risk Assessment

1. Check for redness, tearing, discoloration, breakdown, etc.
  - a. If present notify RN/Wound care.
2. Document Findings and Individual notified.

## Subsequent Skin Assessments

1. Remove or lift protective foam dressing.
2. Check for redness, tearing, discoloration, breakdown, etc.
  - a. If present notify RN/Wound care.
3. Document findings and individual notified.

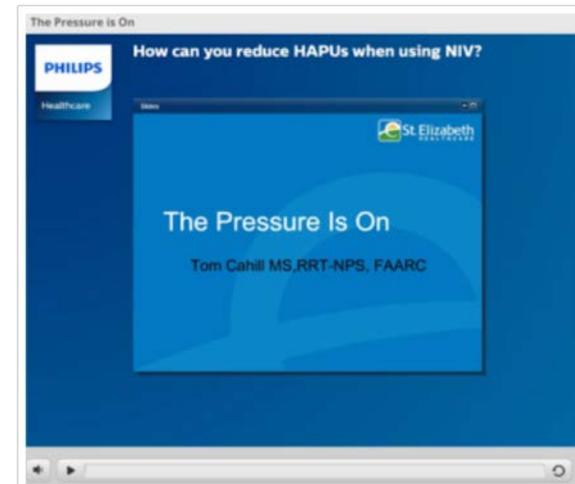


# Best practices



## Saving Face

Strategies to reduce skin breakdown during NIV for patient care



Visit [www.thinkniv.com](http://www.thinkniv.com)

# In literature<sup>8</sup>



Noninvasive ventilation masks are associated with pressure ulcers under the mask

## Sampling

- 5 ICUs (111 ICU beds)
- Recruited 200 patients with NIV orders
  - First 100 patients received Oro-nasal mask
  - Second 100 patients received Full-face mask

## Education

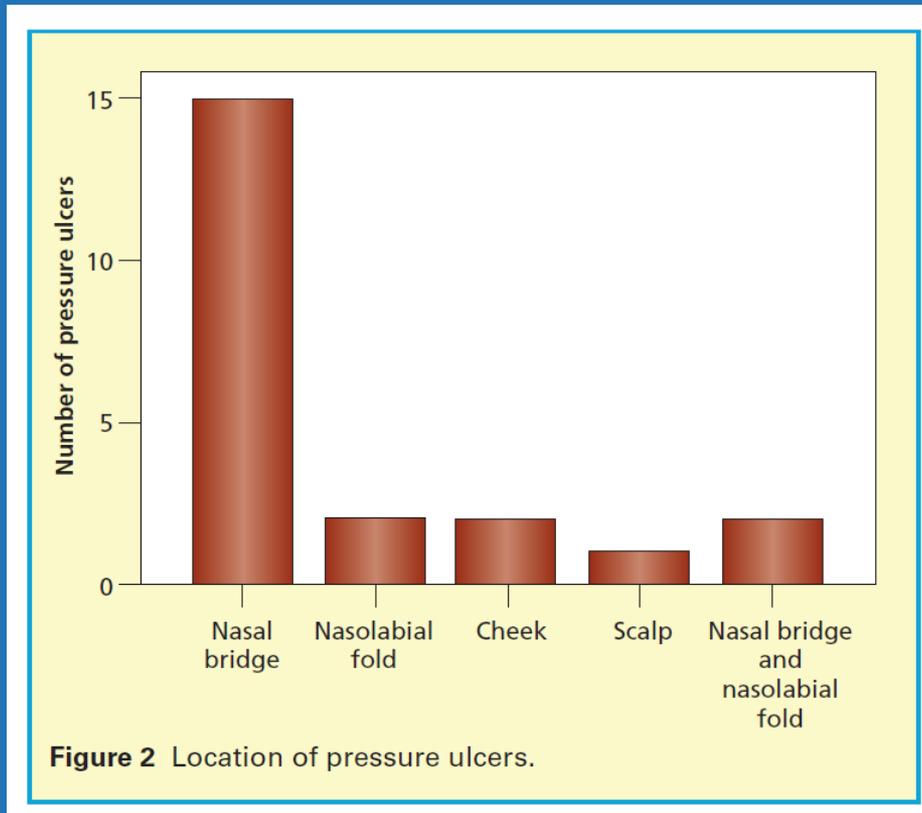
- Therapists and nurses practiced application and proper adjustments of the masks on a mannequin.

## Patient assessed

- Skin integrity
- Comfort level

<sup>8</sup> Schallom, M., Cracchiolo, L., et al. Pressure Ulcer Incidence in Patients Wearing Nasal-Oral Versus Full-Face NIV masks. AJCC, July 2015, Vol.24. No.4.

# In literature<sup>8</sup>



## Results

- 20% of patients in the oro-nasal masks developed a pressure ulcer.
- 2% of patients in the full-face masks developed a pressure ulcer.
- Comfort scores significantly lower in the Full-face mask group.

## Conclusion:

Full-face mask resulted in significantly fewer pressure ulcers and was more comfortable for patients.

<sup>8</sup> Schallom, M., Cracchiolo, L., et al. Pressure Ulcer Incidence in Patients Wearing Nasal-Oral Versus Full-Face NIV masks. AJCC, July 2015, Vol.24. No.4.

# Summary - Helping reduce the potential for pressure ulcers

- Assess the patient.
- Select the proper mask(s) design.
- Mask rotation to redistribute pressure points.
- Manage mask leak (7-25 L/min).
- Perform skin care and early interventions.
- Conduct continuing education.



