Pressure Injuries in Invasive And Noninvasive Ventilation

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CLINICAL EDUCATOR
LVHN
ALLENTOWN PENNA

Special thanks to the beside RNs/RRTs

Conflict of Interest

I have no real or perceived conflict of interest that relates to this presentation. Any use of brand names is not in any way meant to be an endorsement of a specific product, but to merely illustrate a point of emphasis.

Learning Objectives

- Describe the frequency of pressure injuries during invasive and non-invasive ventilation
- Define the different classifications of pressure injuries
- Review clinical management strategies in preventing and reducing the incidence of pressure injuries

What is a Pressure Injury

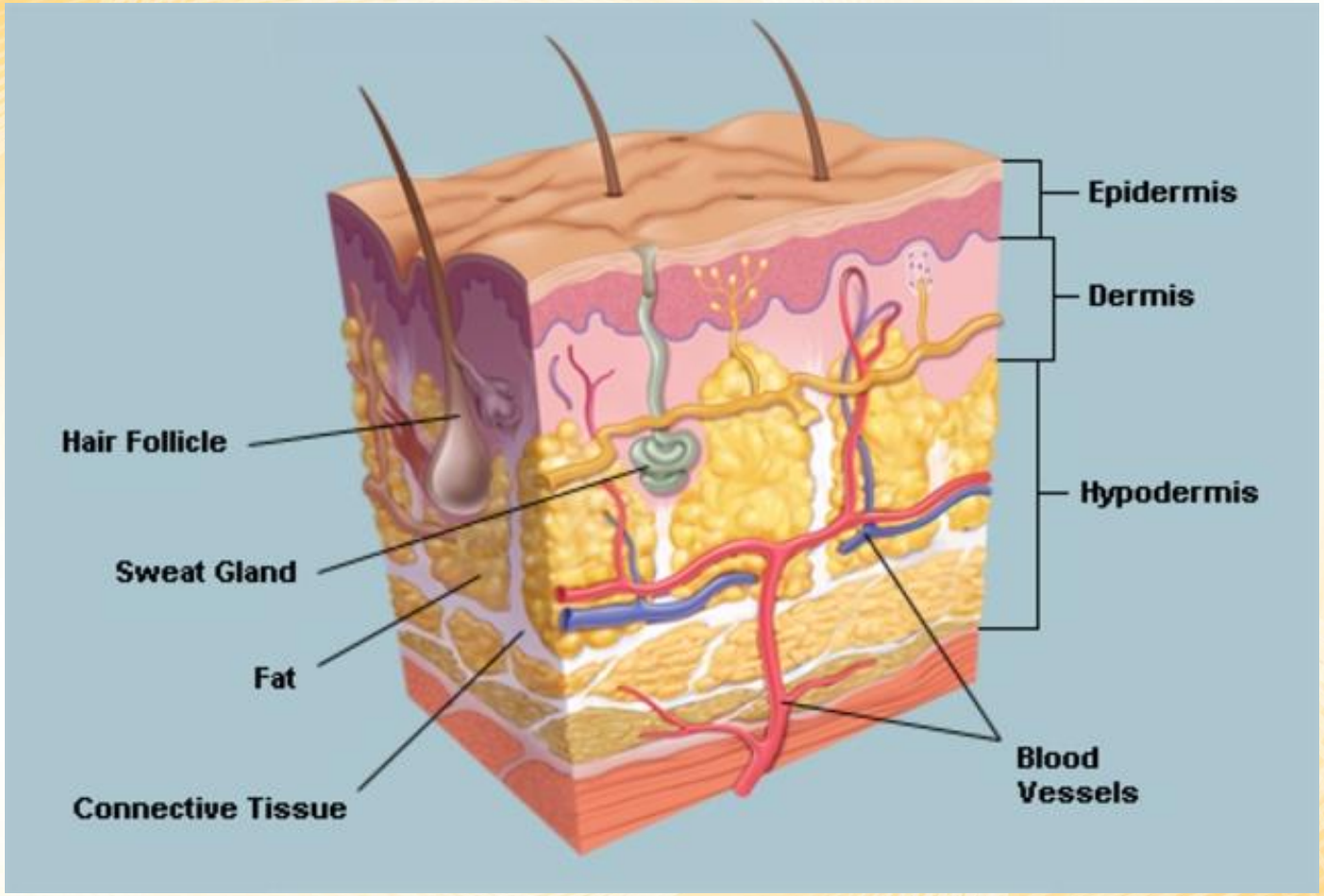
- A **pressure injury** is localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. The injury can present as intact skin or an open ulcer. Depending on it's level it can be painful or not.

- *www.npuap.org*

Stages of Pressure Injuries

A Closer Look At The National Pressure Ulcer Advisory Panel Classification System	
Staging	Description
1	Non-blanchable erythema/purple hue of skin, changes in temperature and sensation
2	Partial-thickness skin loss (i.e. blister or shallow crater)
3	Full-thickness skin loss involving necrosis of subcutaneous tissue
4	Full-thickness skin loss with extensive necrosis to tendon, muscle, bone, or joint
Unstageable	Ulcer with eschar. Wound base cannot be assessed.
DTI	Purple non-blanchable area of intact skin that demarcates between 24-48 hours due to deep tissue destruction

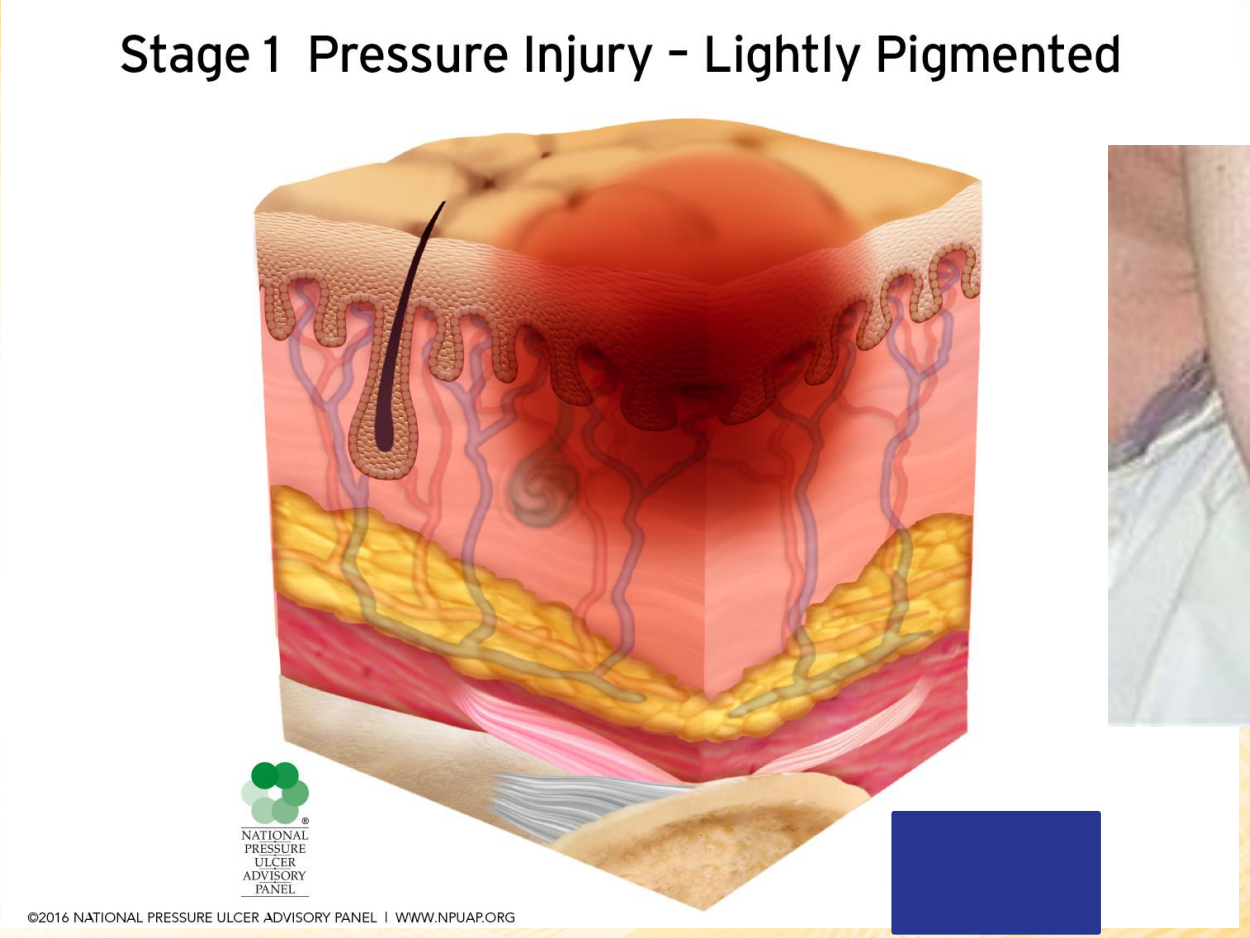
Layers of Skin



Stage 1

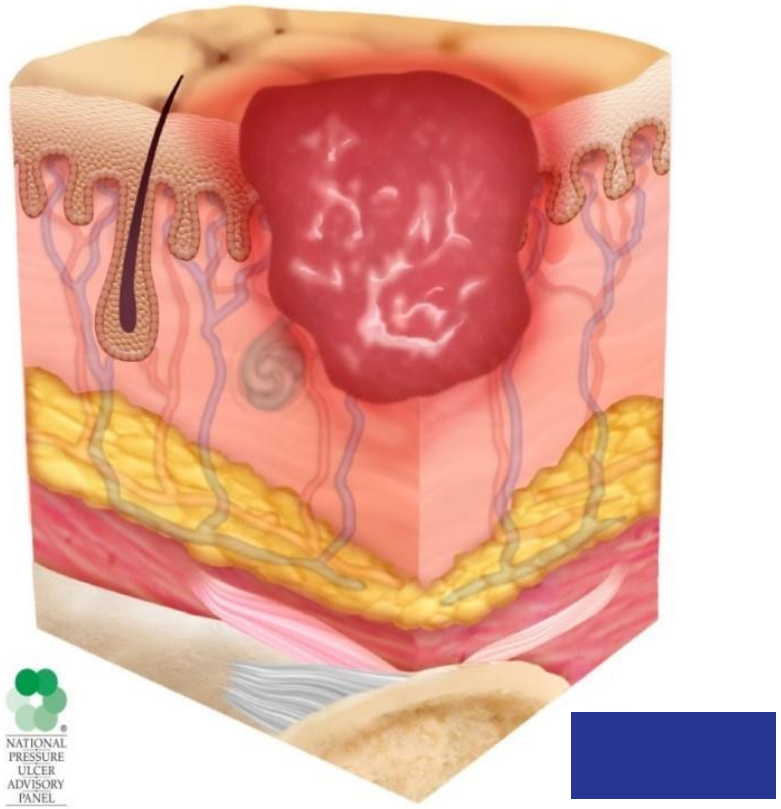
No loss of skin or fluid acclamation

Non-blanchable erythema changes in sensation and temperature Effects epidermis and slightly the dermis



Stage 2

Effects dermis and is often very painful

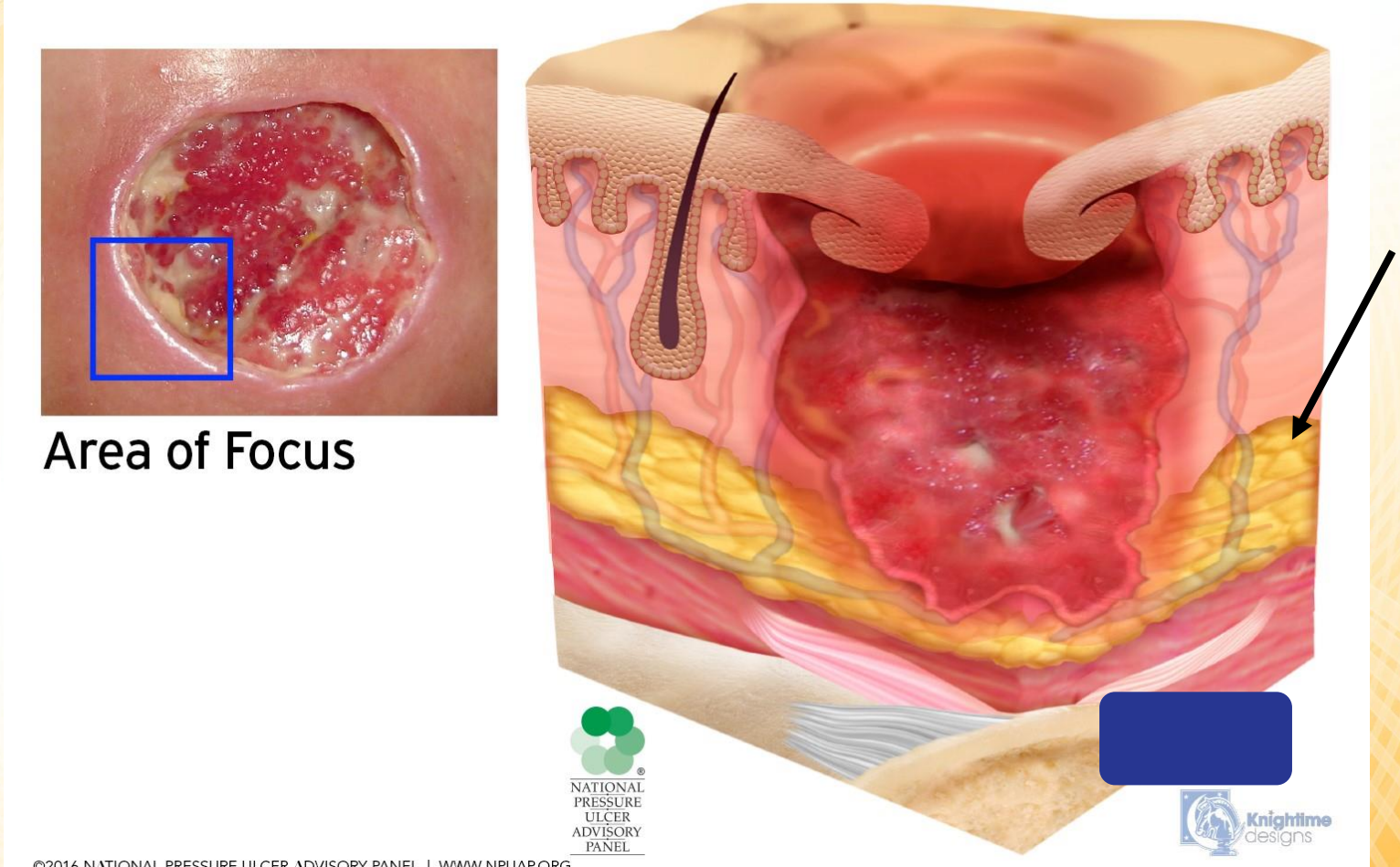


Partial thickness skin loss-blister shallow crater

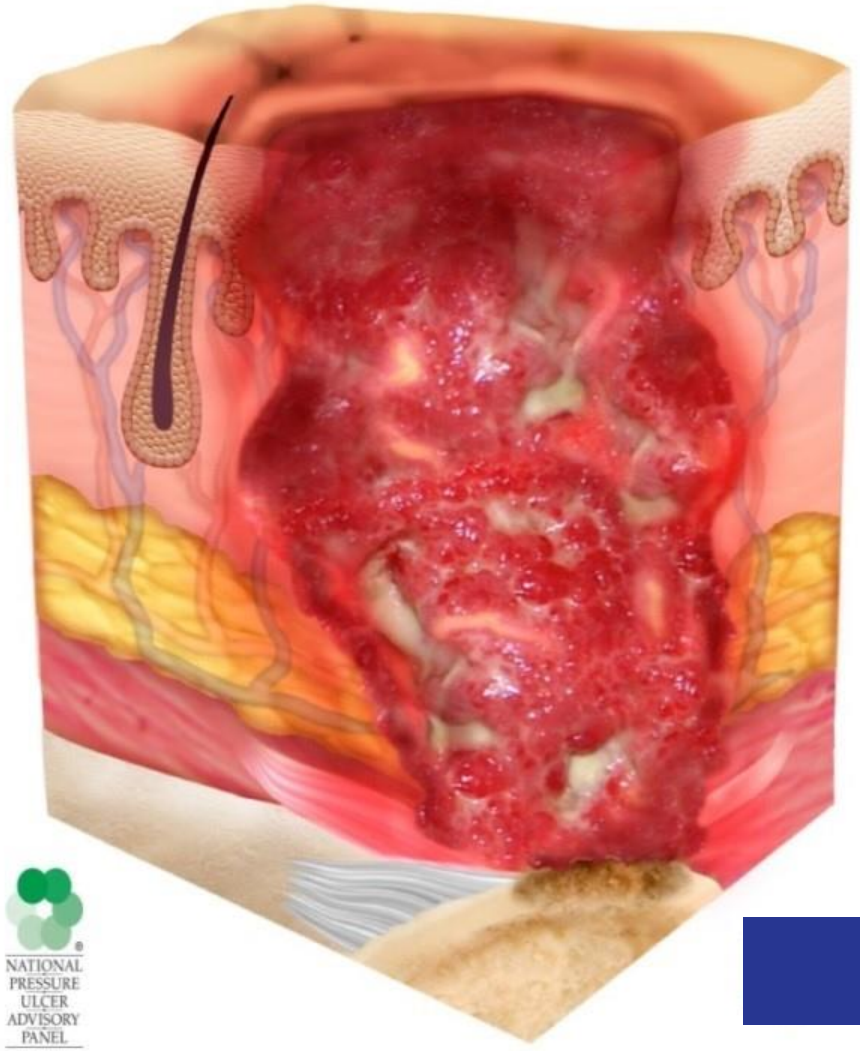
Stage 3

Full thickness skin loss
Involving necrosis

Marked by loss of tissue
Increased fluid
Very painful

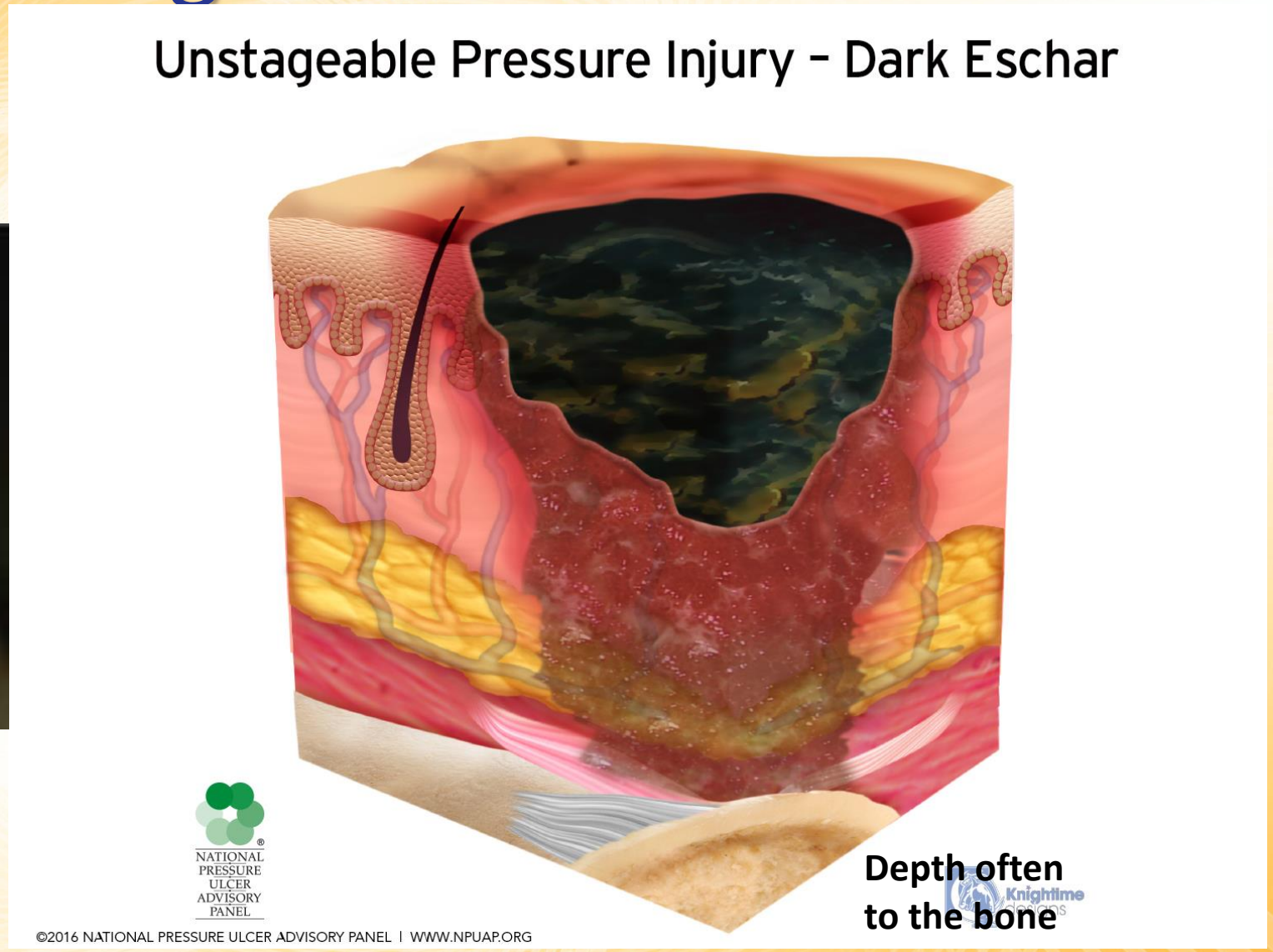


Full thickness skin loss with extensive necrosis to tendon, muscle or bone. Necrosis of skin



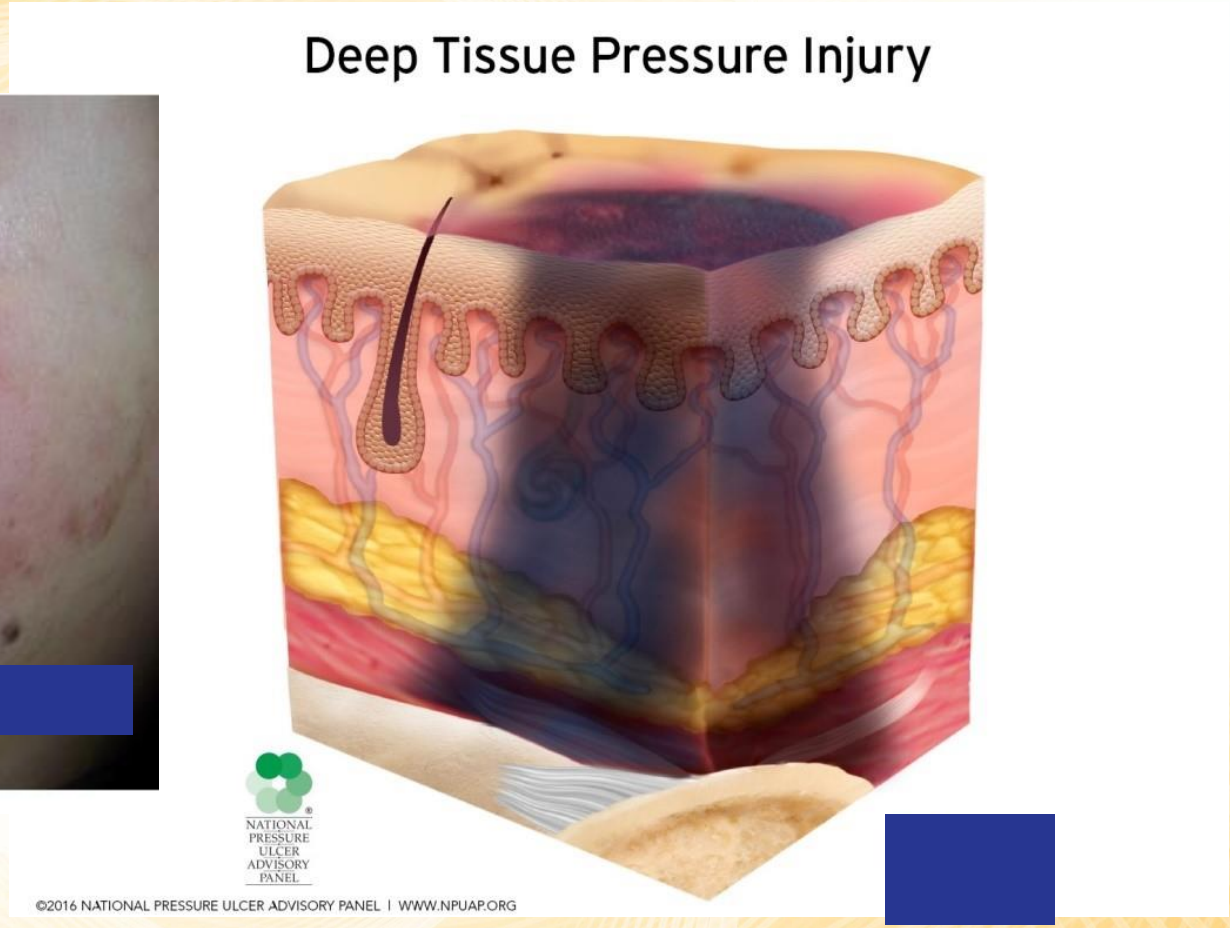
Unstageable

Can't see the depth of injury unless the dead tissue is removed



Depth often to the bone

Deep Tissue Injury



Within 24-48 total skin destruction:☹

Magnitude of the Problem

- Pressure injury incidence rates vary considerably by clinical setting — ranging from 0.4 to 38 percent in acute care, from 2.2 to 23.9 percent in long term care, and from 0 to 17 percent in home care.
- Hospital-acquired pressure injuries result in significant patient harm, including pain, expensive treatments, increased length of institutional stay and, in some patients, premature mortality.
- It is estimated each year more than 2.5 million patients in U.S. acute-care facilities suffer from pressure ulcer/injuries and 60,000 die from their complications.
- The cost of treating a single full-thickness pressure ulcer/injury can be as high as $70,000, and total costs for treatment of pressure ulcer/injuries in the United States is estimated at $11 billion annually.

Potential Cost Savings

- Through the work of the AHA Hospital Engagement Network, from 2011 to 2014, more than 1,400 hospitals worked to prevent and reduce pressure injuries. Twenty-four of 31 states participating reduced total pressure ulcer/injury harm by more than 40 percent.
- Under this initiative, hospitals prevented 4,655 pressure injuries and saved an estimated $188,537,500.

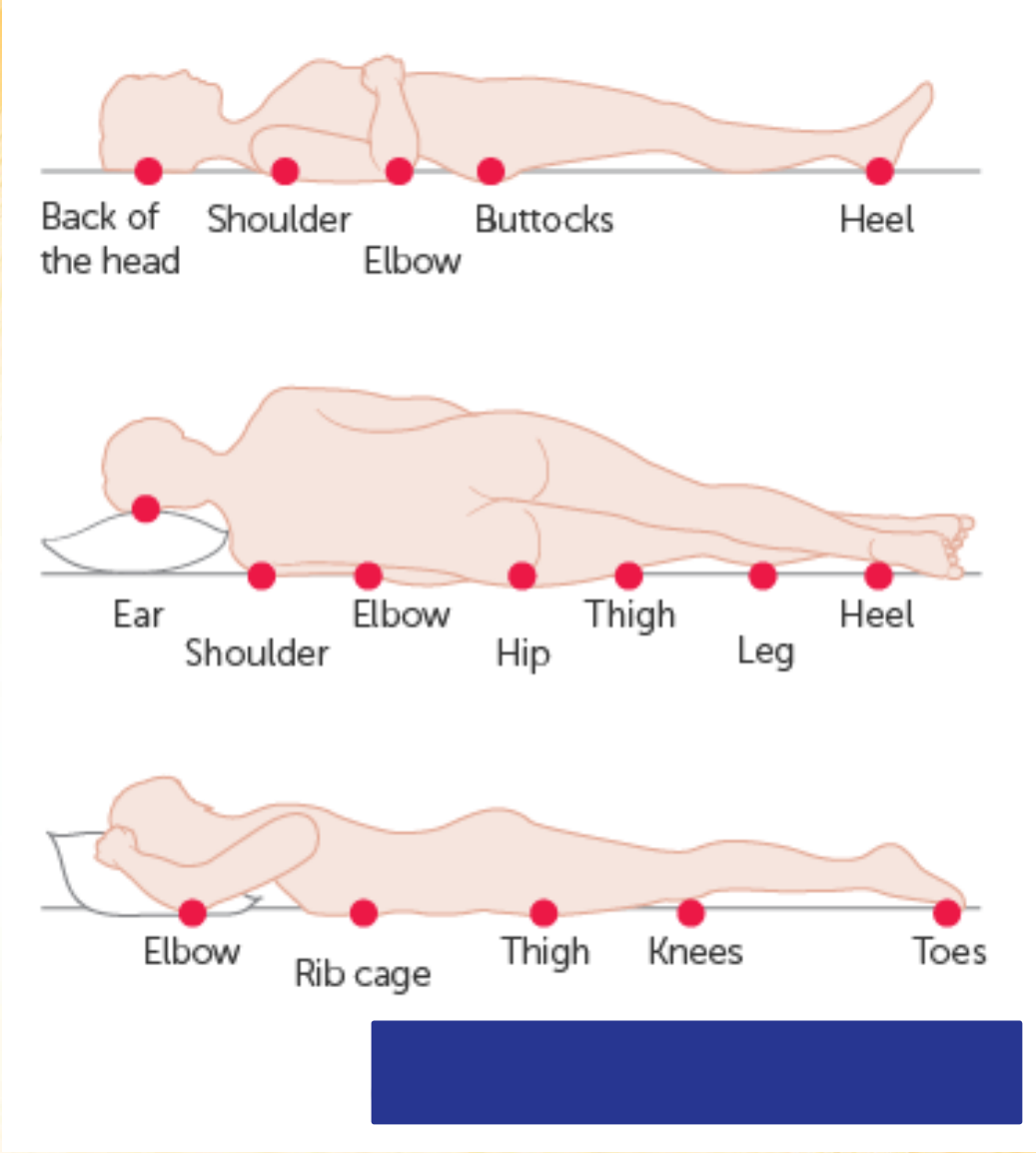
Physical Cost of Pressure Injuries

- Skin mutilation
- Pain/Impaired mobility
- Prolonged hospital duration
- Depression and anxiety

Risk Factors For Developing a Pressure Injury

- Advanced age>65 yrs. old
- Immobility
- Incontinence
- Inadequate nutrition and hydration
- Neuro-sensory deficiency
- Device-related skin pressure
- Multiple comorbidities
  - Diabetes, Obesity, PAD
- Circulatory abnormalities

Areas Prone to Pressure Injuries



Make It Happen

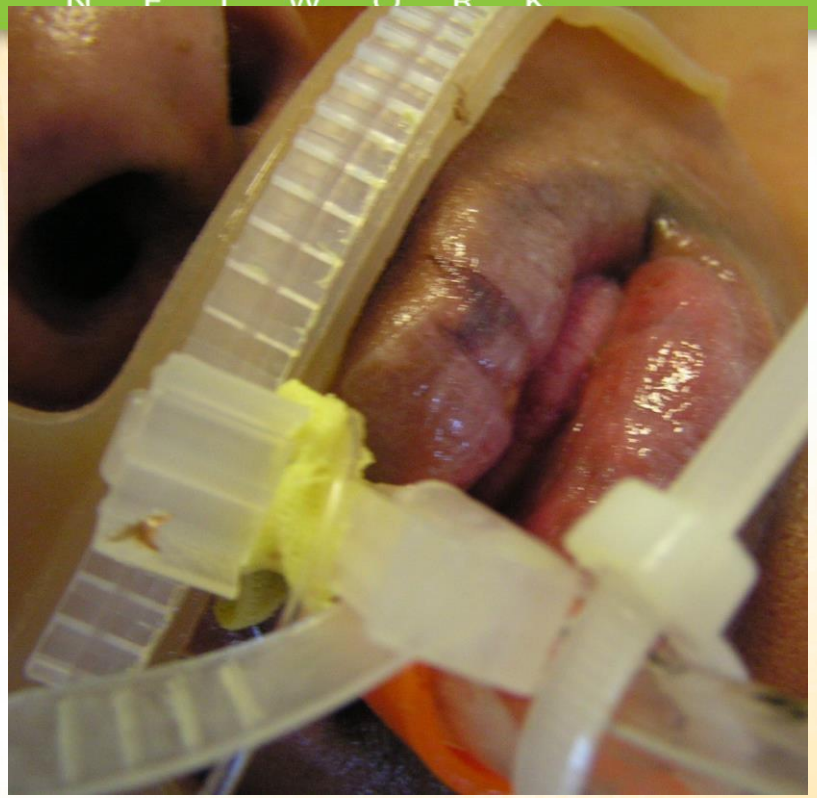
Medical devices have been identified as an extrinsic risk factor for development of pressure injuries, with as many as 30% to 70% of medical device-related pressure injuries resulting from respiratory equipment.

Common Respiratory Care Devices Associated With Pressure Injuries

- Endotracheal tubes
- NIV masks
- SpO2 sensors
- Oxygen delivery devices
  - Cannula
  - Pendant
  - High flow oxygen

Nasal Cannula

Oral endotracheal tube



BIPAP

Questions?

How Can We Reduce Pressure Injuries???

No Easy Task!!!

ons?

Steps to Reduce Lip Injuries Associated with Endotracheal Tubes

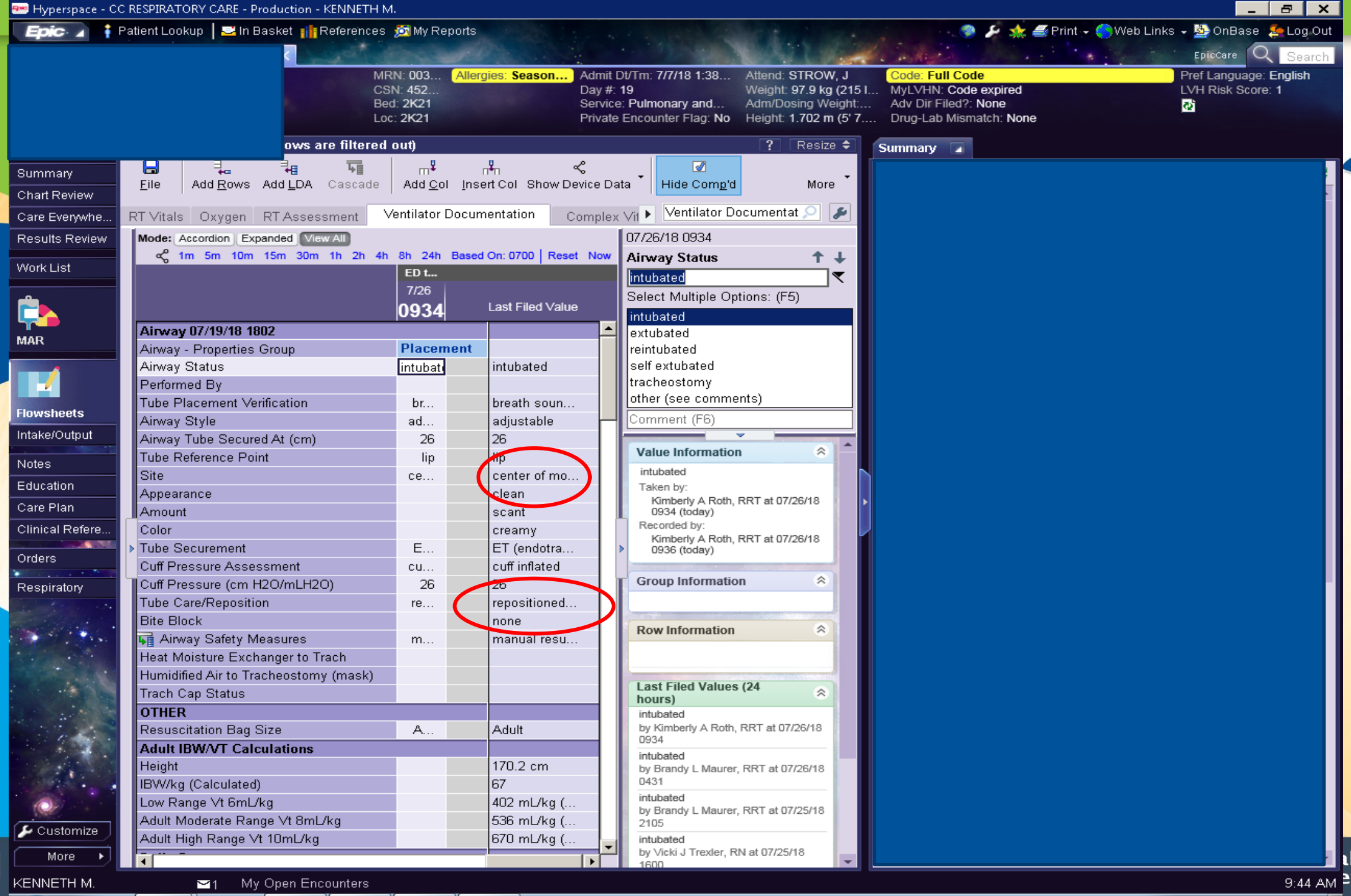
- Use appropriate securing device and correctly secure
- Change endotracheal position every four hours
- Change securing device when indicated or soiled
- Early ventilator liberation

Different Endotracheal Holders

Documentation of Endotracheal Management

- Inspect and assess endotracheal position and lip pressure
- Rotate endotracheal tube every 4 hrs. with documentation
- Notify wound team of any potential pressure injuries


Extubation/Liberation Rt
Intubation/Trach
Intubate_Trach
Tracheostomy
Trac
Trach Size
TrachealSize
8
8
ETT size
EndoTubeSize
ETT Position
Date ET Moved
DateETMoved
ETT pos@lip
ETT pos@Teeth
Cuff Pressure
Cont Suction Pressure
Evaclum Patent
Evac Interventions
ETT Taped/Retaped+
ANCHOR FAST
AnchorFastPosition
VENT MGMT
LogbkReviewed+
Circuit Changed
Wet or Dry
Right
Left
Center
Position to be documented Q4 hours by the Respiratory Therapist.


Hyperspace - CC RESPIRATORY CARE - Production - KENNETH M.
Epic
Patient Lookup
In Basket
References
My Reports
Print
Web Links
OnBase
Log Out
EpicCare
Search
MRN: 003...
CSN: 452...
Bed: 2K21
Loc: 2K21
Allergies: Season...
Admit Dt/Tm: 7/7/18 1:38...
Day #: 19
Service: Pulmonary and...
Private Encounter Flag: No
Attend: STROW, J
Weight: 97.9 kg (215 l...
Adm/Dosing Weight:...
Height: 1.702 m (5' 7....
Code: Full Code
MyLVHN: Code expired
Adv Dir Filed?: None
Drug-Lab Mismatch: None
Pref Language: English
LVH Risk Score: 1
ows are filtered out)
Resize
Summary
Chart Review
Care Everywhe...
Results Review
Work List
MAR
Flowsheets
Intake/Output
Notes
Education
Care Plan
Clinical Refere...
Orders
Respiratory
Customize
More
File
Add Rows
Add LDA
Cascade
Add Col
Insert Col
Show Device Data
Hide Comp'd
More
RT Vitals
Oxygen
RT Assessment
Ventilator Documentation
Complex Vi
Ventilator Documentat
Mode: Accordion Expanded View All
1m 5m 10m 15m 30m 1h 2h 4h 8h 24h Based On: 0700 Reset Now
ED t...
7/26
0934
Last Filed Value
Airway 07/19/18 1802
Airway - Properties Group
Placement
Airway Status
intubat
intubated
Performed By
Tube Placement Verification
br...
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Airway Style
ad...
adjustable
Airway Tube Secured At (cm)
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Appearance
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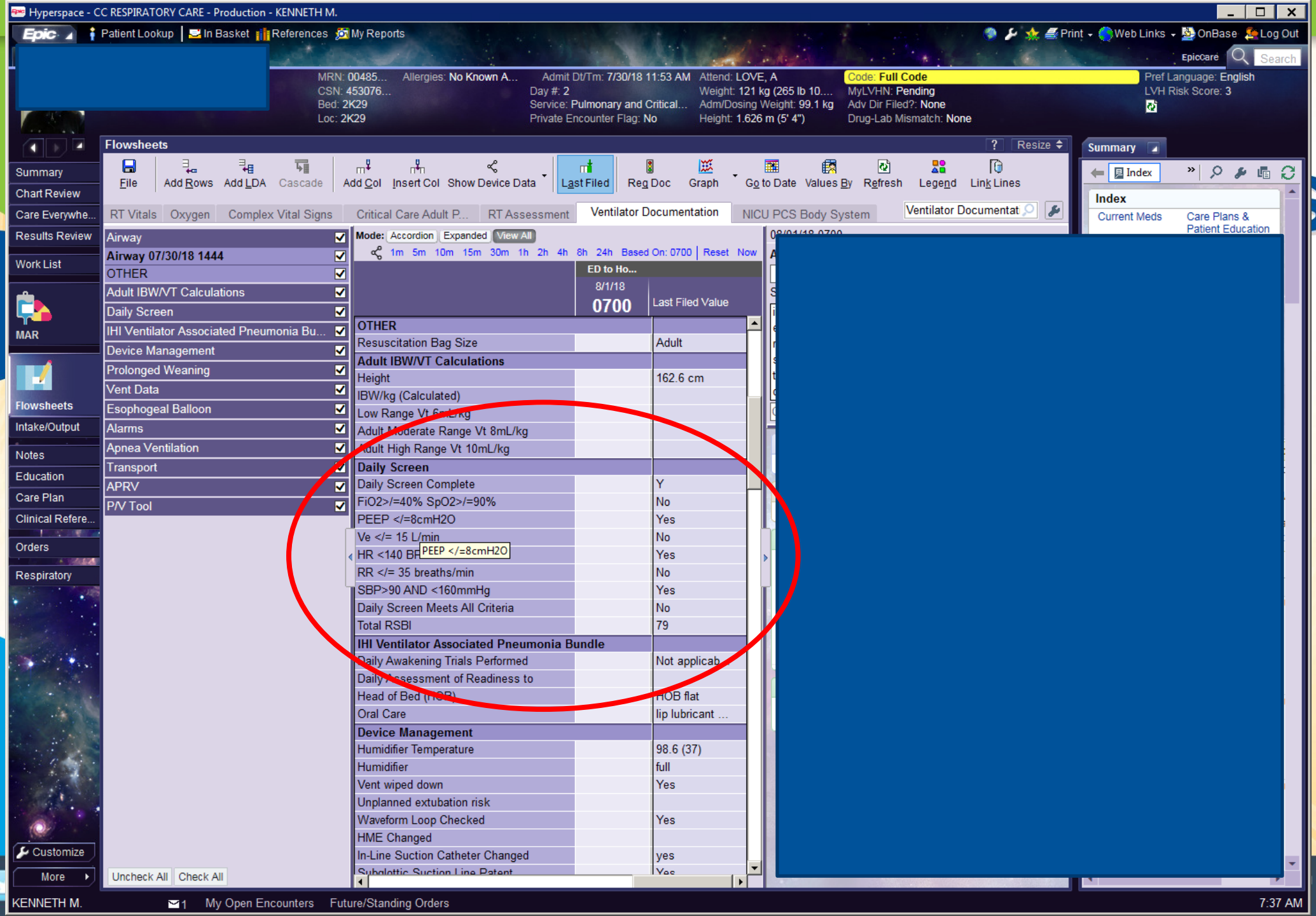
Amount
scant
Color
creamy
Tube Securement
E...
ET (endotra...
Cuff Pressure Assessment
cu...
cuff inflated
Cuff Pressure (cm H2O/mLH2O)
26
26
Tube Care/Reposition
re...
repositioned...
Bite Block
none
Airway Safety Measures
m...
manual resu...
Heat Moisture Exchanger to Trach
Humidified Air to Tracheostomy (mask)
Trach Cap Status
OTHER
Resuscitation Bag Size
A...
Adult
Adult IBW/VT Calculations
Height
170.2 cm
IBW/kg (Calculated)
67
Low Range Vt 6mL/kg
402 mL/kg (...
Adult Moderate Range Vt 8mL/kg
536 mL/kg (...
Adult High Range Vt 10mL/kg
670 mL/kg (...
07/26/18 0934
Airway Status
intubated
Select Multiple Options: (F5)
intubated
extubated
reintubated
self extubated
tracheostomy
other (see comments)
Comment (F6)
Value Information
intubated
Taken by:
Kimberly A Roth, RRT at 07/26/18 0934 (today)
Recorded by:
Kimberly A Roth, RRT at 07/26/18 0936 (today)
Group Information
Row Information
Last Filed Values (24 hours)
intubated
by Kimberly A Roth, RRT at 07/26/18 0934
intubated
by Brandy L Maurer, RRT at 07/26/18 0431
intubated
by Brandy L Maurer, RRT at 07/25/18 2105
intubated
by Vicki J Trexler, RN at 07/25/18 1600
Summary
KENNETH M.
1
My Open Encounters
9:44 AM

Early Ventilatory Liberation

- Daily sedation holiday
- Daily assessment for weaning
- Daily spontaneous breathing trials


Hyperspace - CC RESPIRATORY CARE - Production - KENNETH M.
Patient Lookup
In Basket
References
My Reports
Print
Web Links
OnBase
Log Out
Search
MRN: 00485...
CSN: 453076...
Bed: 2K29
Loc: 2K29
Allergies: No Known A...
Admit Dt/Tm: 7/30/18 11:53 AM
Day #: 2
Service: Pulmonary and Critical...
Private Encounter Flag: No
Attend: LOVE, A
Weight: 121 kg (265 lb 10....
Adm/Dosing Weight: 99.1 kg
Height: 1.626 m (5' 4")
Code: Full Code
MyLVHN: Pending
Adv Dir Filed?: None
Drug-Lab Mismatch: None
Pref Language: English
LVH Risk Score: 3
Flowsheets
Resize
Summary
Chart Review
Care Everywhe...
Results Review
Work List
MAR
Flowsheets
Intake/Output
Notes
Education
Care Plan
Clinical Refere...
Orders
Respiratory
Customize
More
File
Add Rows
Add LDA
Cascade
Add Col
Insert Col
Show Device Data
Last Filed
Reg Doc
Graph
Go to Date
Values By
Refresh
Legend
Link Lines
RT Vitals
Oxygen
Complex Vital Signs
Critical Care Adult P...
RT Assessment
Ventilator Documentation
NICU PCS Body System
Ventilator Documentat
Airway
Airway 07/30/18 1444
OTHER
Adult IBW/VT Calculations
Daily Screen
IHI Ventilator Associated Pneumonia Bu...
Device Management
Prolonged Weaning
Vent Data
Esophogeal Balloon
Alarms
Apnea Ventilation
Transport
APRV
P/V Tool
Uncheck All
Check All
Mode: Accordion Expanded View All
1m 5m 10m 15m 30m 1h 2h 4h 8h 24h Based On: 0700 Reset Now
ED to Ho...
8/1/18
0700
Last Filed Value
OTHER
Resuscitation Bag Size
Adult
Adult IBW/VT Calculations
Height
162.6 cm
IBW/kg (Calculated)
Low Range Vt 6mL/kg
Adult Moderate Range Vt 8mL/kg
Adult High Range Vt 10mL/kg
Daily Screen
Daily Screen Complete
Y
FiO2>/=40% SpO2>/=90%
No
PEEP </=8cmH2O
Yes
Ve </= 15 L/min
No
HR <140 BP
PEEP </=8cmH2O
Yes
RR </= 35 breaths/min
No
SBP>90 AND <160mmHg
Yes
Daily Screen Meets All Criteria
No
Total RSBI
79
IHI Ventilator Associated Pneumonia Bundle
Daily Awakening Trials Performed
Not applicab
Daily Assessment of Readiness to
Head of Bed (HOB)
HOB flat
Oral Care
lip lubricant ...
Device Management
Humidifier Temperature
98.6 (37)
Humidifier
full
Vent wiped down
Yes
Unplanned extubation risk
Waveform Loop Checked
Yes
HME Changed
In-Line Suction Catheter Changed
yes
Subglottic Suction Line Patent
Yes
Summary
Index
Current Meds
Care Plans & Patient Education
KENNETH M.
1
My Open Encounters
Future/Standing Orders
7:37 AM

Reducing Pressure Injuries During Non-invasive Ventilation Application in the ICU: A Success Story

What Was the Current Status Of NIV Application at LVHN

- Increase in facial pressure injuries associated with NIV application:
- Why???
  - Lack of a systematic and consistent clinical management of NIV
  - Lack of well designed plan to manage the chronic or refractory NIV patient
  - Lack of clearly defined clinical end-points germane to NIV management
  - Lack of NIV application education

Countermeasures

- Assessment of different NIV masks
- Development of interdisciplinary team to review the NIV process
- Enhance RRT/RN NIV mask application education
- Development of a multidisciplinary practice guideline algorithm approach to NIV clinical management
- Utilize an alternating mask strategy
- Evaluate enhanced skin barriers

Formed a Multi-disciplinary team to address the incidence of pressure injuries

This is how they reacted when I told them what our project Was:

Focused On Lean Ideology

Development of Interdisciplinary Team

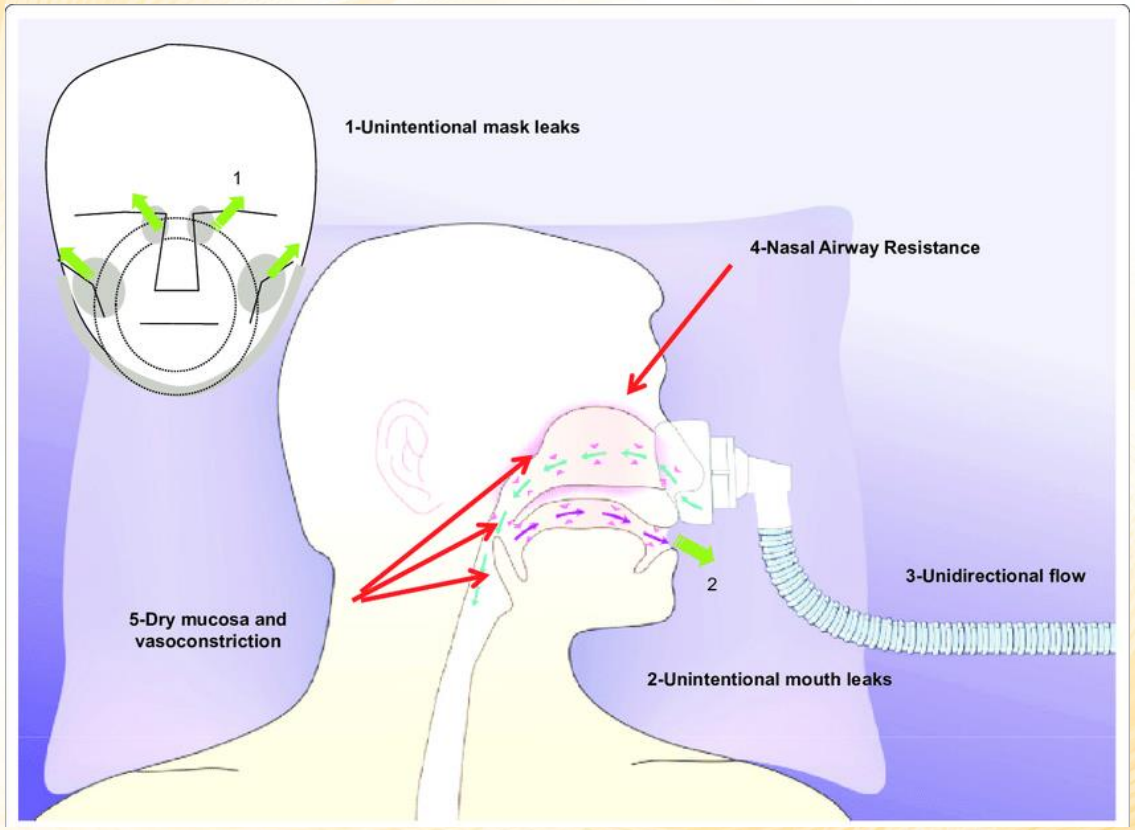
- Team Members:
  - RRTs
  - RNs
  - Wound Team
  - Physician/Providers

Assessment of Different NIV Masks

- All RNs/RRTs educated
- Trialed in one critical care unit at a time

Importance Correct Mask Sizing

Stressed that a Mask Leak is OK!!!

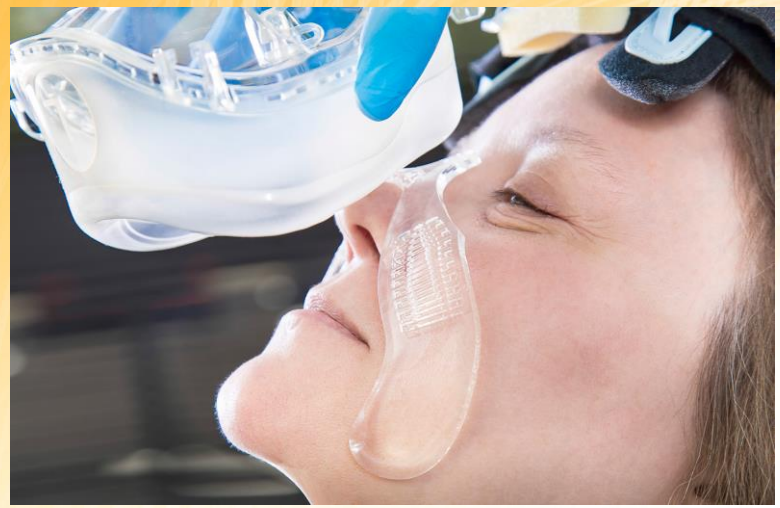


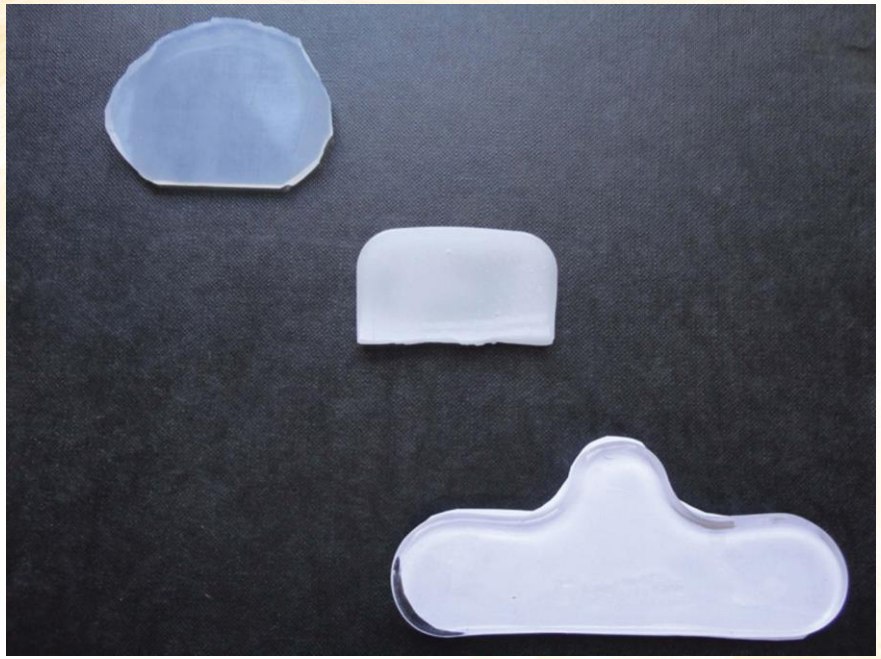
Goal>10%<30% leak

Utilization of An Alternating Mask Strategy

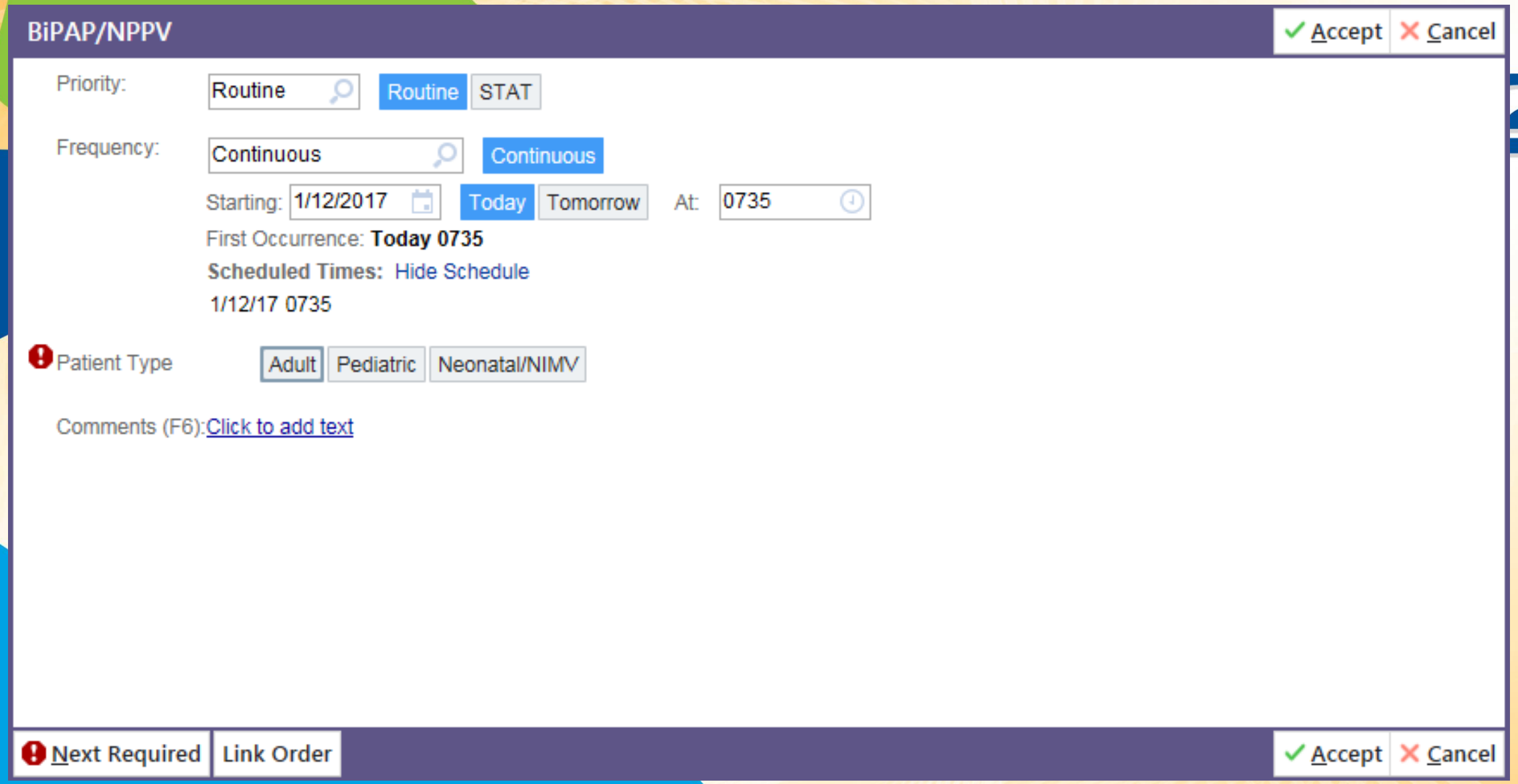
Alternating mask Q4-6hrs. To reduce same stress points

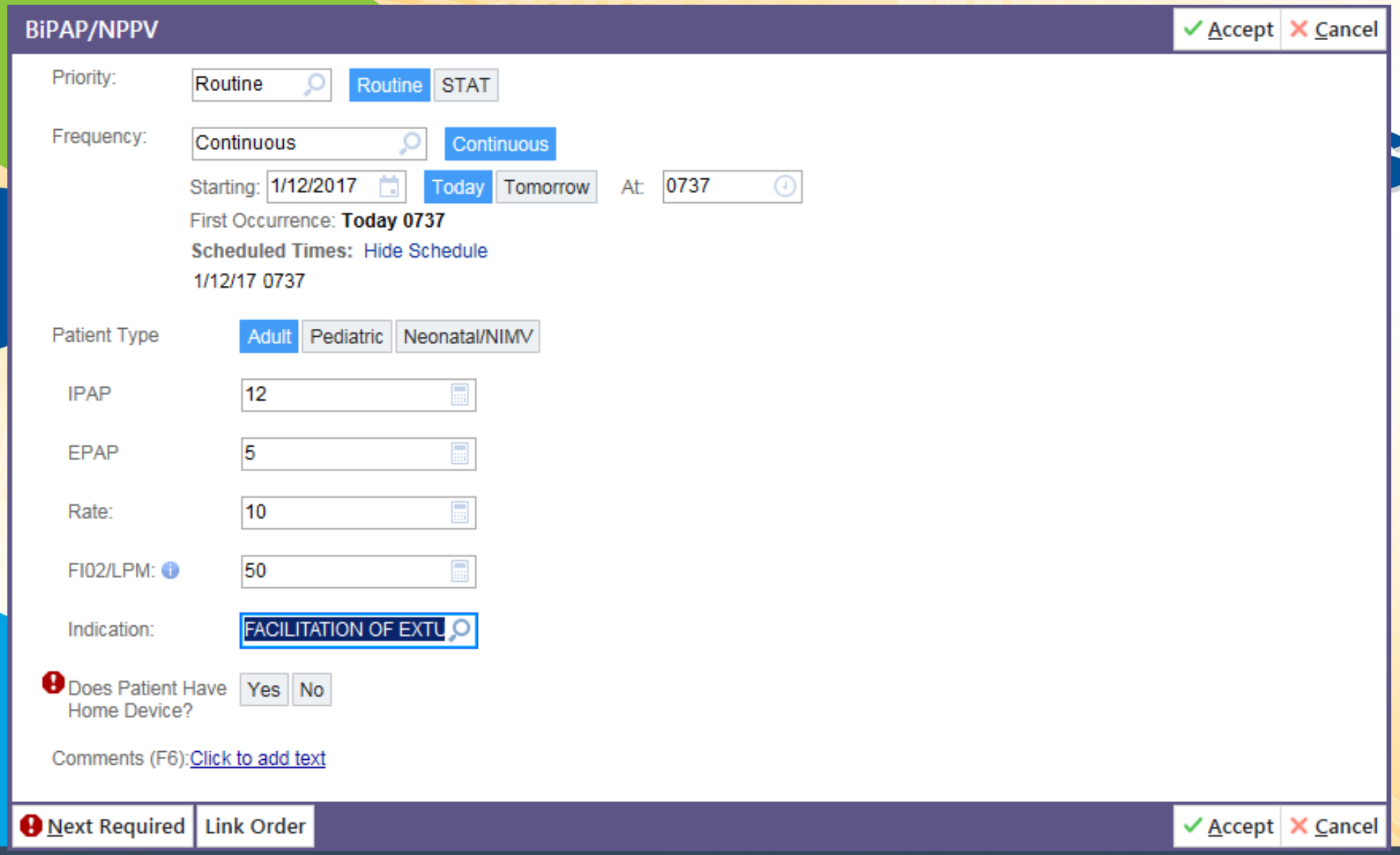
Assessment of Different Skin Barriers



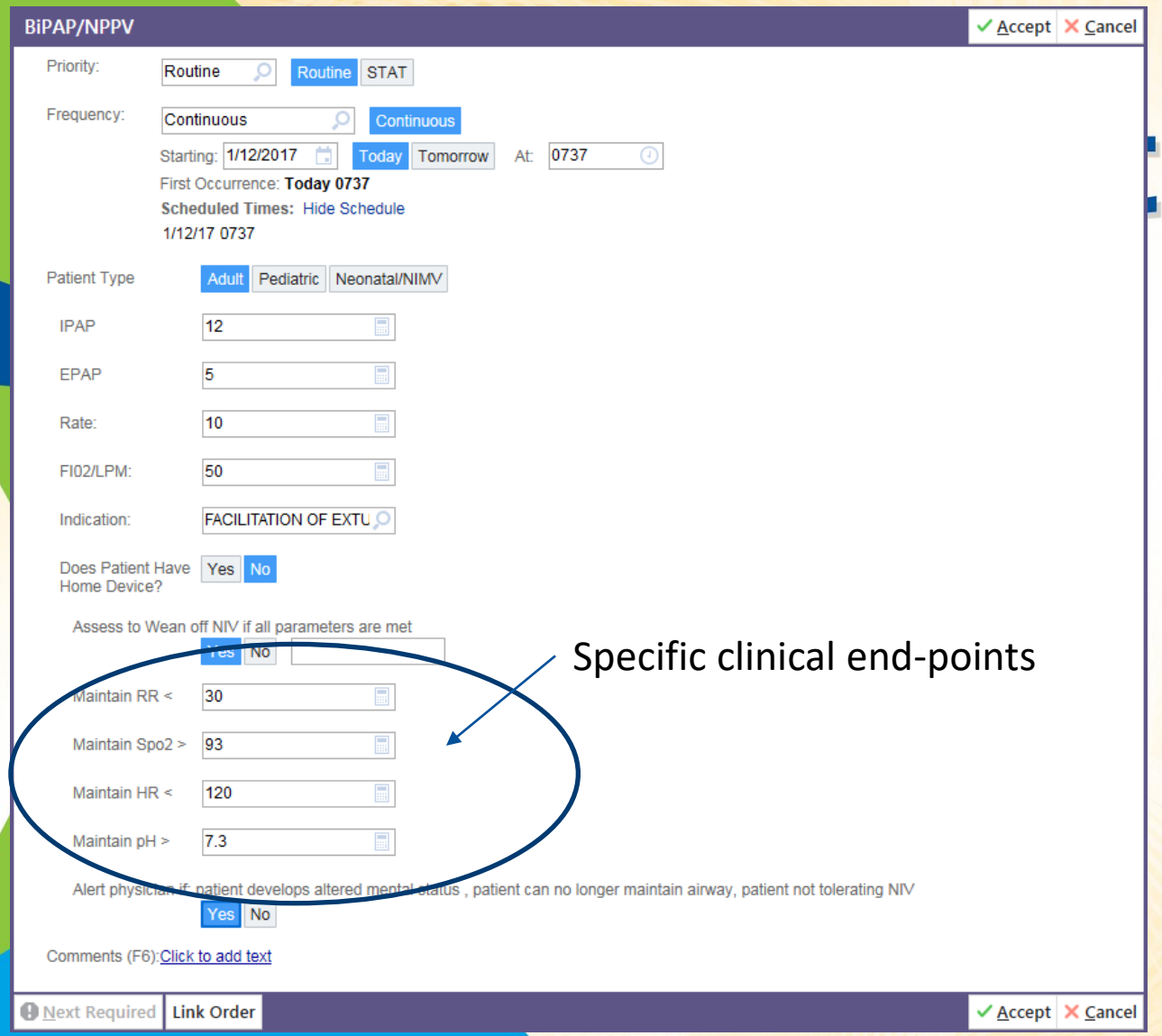


Creation of Specific NIV Order To Include Clinical Endpoints

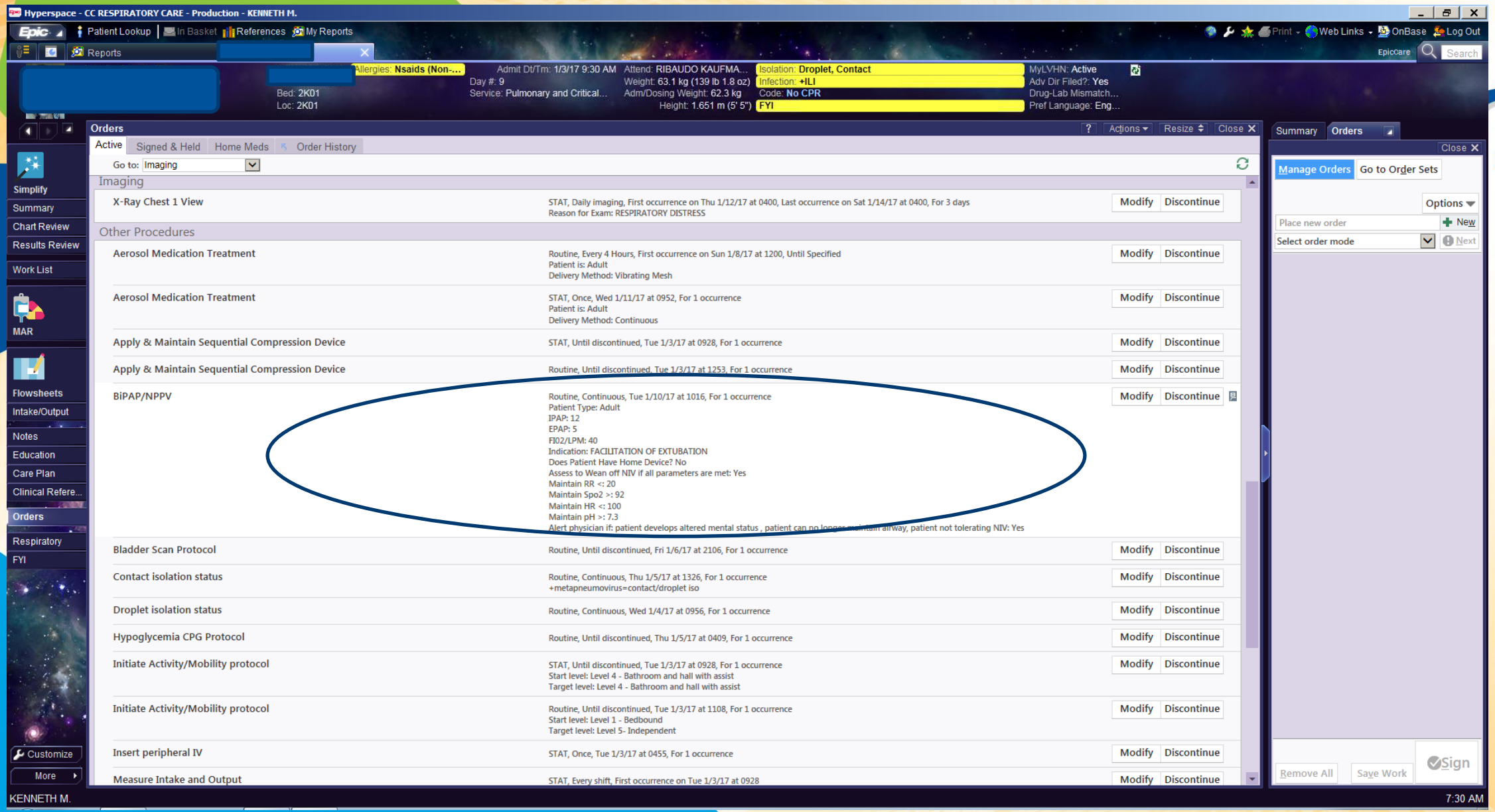

BiPAP/NPPV
Accept
Cancel
Priority:
Routine
Routine
STAT
Frequency:
Continuous
Continuous
Starting:
1/12/2017
Today
Tomorrow
At:
0735
First Occurrence: Today 0735
Scheduled Times: Hide Schedule
1/12/17 0735
Patient Type
Adult
Pediatric
Neonatal/NIMV
Comments (F6):Click to add text
Next Required
Link Order
Accept
Cancel


BiPAP/NPPV
Accept
Cancel
Priority:
Routine
Routine
STAT
Frequency:
Continuous
Continuous
Starting:
1/12/2017
Today
Tomorrow
At:
0737
First Occurrence: Today 0737
Scheduled Times: Hide Schedule
1/12/17 0737
Patient Type
Adult
Pediatric
Neonatal/NIMV
IPAP
12
EPAP
5
Rate:
10
FI02/LPM:
50
Indication:
FACILITATION OF EXTU
Does Patient Have Home Device?
Yes
No
Comments (F6):Click to add text
Next Required
Link Order
Accept
Cancel

tions?



Specific clinical end-points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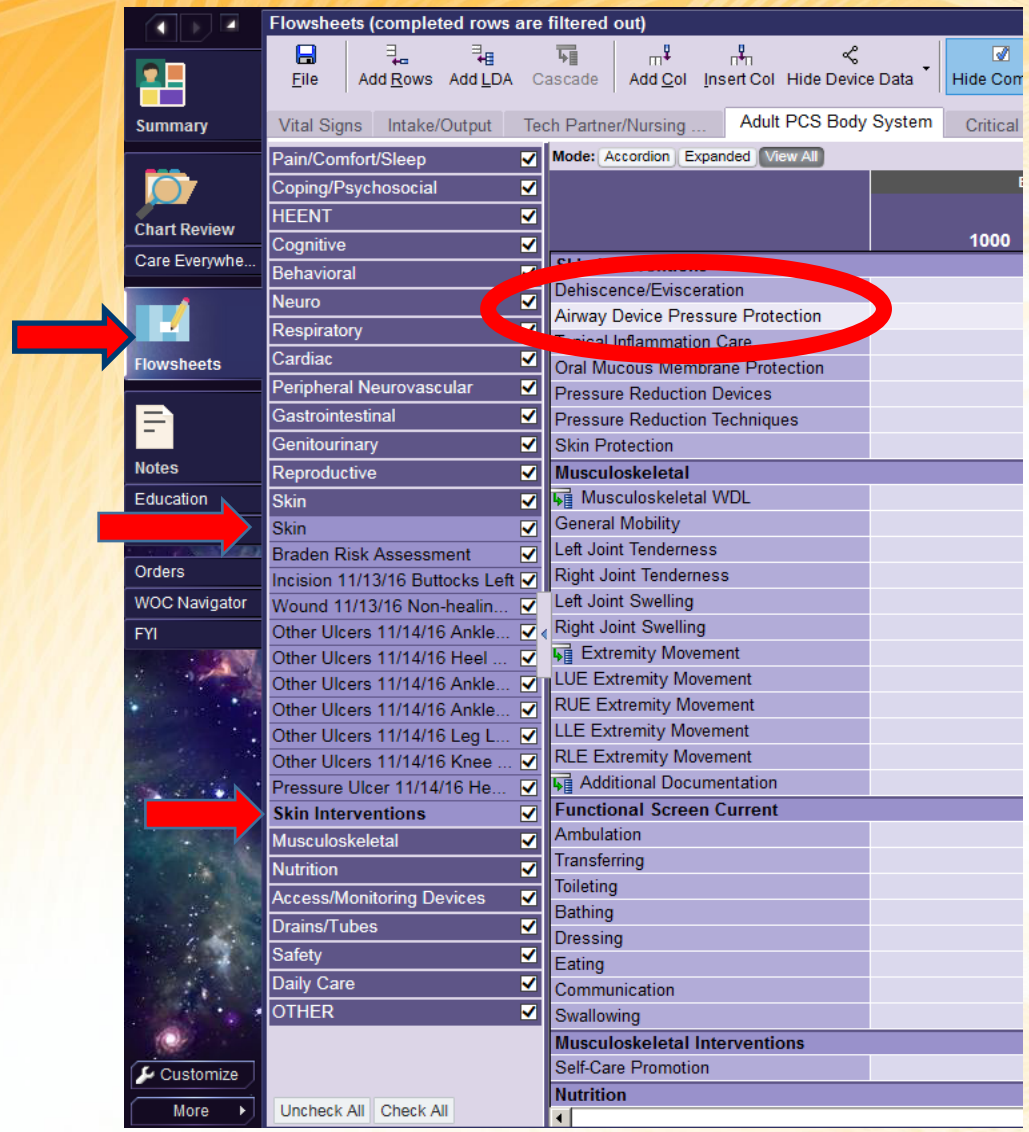
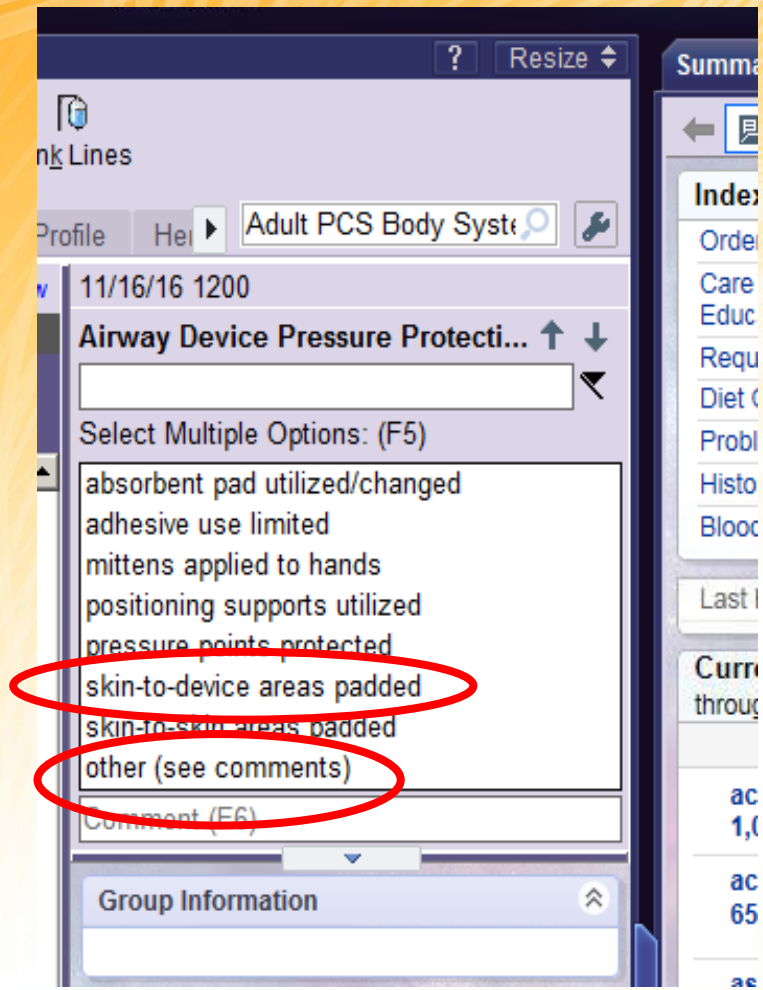
Patient Lookup
In Basket
References
My Reports
Print
Web Links
OnBase
Log Out
Reports
EpicCare
Search
Allergies: Nsaids (Non-...
Admit Dt/Tm: 1/3/17 9:30 AM
Attend: RIBAUDO KAUFMA...
Isolation: Droplet, Contact
MyLVHN: Active
Bed: 2K01
Loc: 2K01
Day #: 9
Service: Pulmonary and Critical...
Weight: 63.1 kg (139 lb 1.8 oz)
Adm/Dosing Weight: 62.3 kg
Height: 1.651 m (5' 5")
Infection: +ILI
Code: No CPR
FYI
Adv Dir Filed?: Yes
Drug-Lab Mismatch...
Pref Language: Eng...
Orders
Actions
Resize
Close
Active
Signed & Held
Home Meds
Order History
Go to: Imaging
Imaging
X-Ray Chest 1 View
STAT, Daily imaging, First occurrence on Thu 1/12/17 at 0400, Last occurrence on Sat 1/14/17 at 0400, For 3 days
Reason for Exam: RESPIRATORY DISTRESS
Modify
Discontinue
Other Procedures
Aerosol Medication Treatment
Routine, Every 4 Hours, First occurrence on Sun 1/8/17 at 1200, Until Specified
Patient is: Adult
Delivery Method: Vibrating Mesh
Aerosol Medication Treatment
STAT, Once, Wed 1/11/17 at 0952, For 1 occurrence
Patient is: Adult
Delivery Method: Continuous
Apply & Maintain Sequential Compression Device
STAT, Until discontinued, Tue 1/3/17 at 0928, For 1 occurrence
Apply & Maintain Sequential Compression Device
Routine, Until discontinued, Tue 1/3/17 at 1253, For 1 occurrence
BiPAP/NPPV
Routine, Continuous, Tue 1/10/17 at 1016, For 1 occurrence
Patient Type: Adult
IPAP: 12
EPAP: 5
FI02/LPM: 40
Indication: FACILITATION OF EXTUBATION
Does Patient Have Home Device? No
Assess to Wean off NIV if all parameters are met: Yes
Maintain RR <: 20
Maintain Spo2 >: 92
Maintain HR <: 100
Maintain pH >: 7.3
Alert physician if: patient develops altered mental status , patient can no longer maintain airway, patient not tolerating NIV: Yes
Bladder Scan Protocol
Routine, Until discontinued, Fri 1/6/17 at 2106, For 1 occurrence
Contact isolation status
Routine, Continuous, Thu 1/5/17 at 1326, For 1 occurrence
+metapneumovirus=contact/droplet iso
Droplet isolation status
Routine, Continuous, Wed 1/4/17 at 0956, For 1 occurrence
Hypoglycemia CPG Protocol
Routine, Until discontinued, Thu 1/5/17 at 0409, For 1 occurrence
Initiate Activity/Mobility protocol
STAT, Until discontinued, Tue 1/3/17 at 0928, For 1 occurrence
Start level: Level 4 - Bathroom and hall with assist
Target level: Level 4 - Bathroom and hall with assist
Initiate Activity/Mobility protocol
Routine, Until discontinued, Tue 1/3/17 at 1108, For 1 occurrence
Start level: Level 1 - Bedbound
Target level: Level 5- Independent
Insert peripheral IV
STAT, Once, Tue 1/3/17 at 0455, For 1 occurrence
Measure Intake and Output
STAT, Every shift, First occurrence on Tue 1/3/17 at 0928
Simplify
Summary
Chart Review
Results Review
Work List
MAR
Flowsheets
Intake/Output
Notes
Education
Care Plan
Clinical Refere...
Orders
Respiratory
FYI
Customize
More
Summary
Orders
Close
Manage Orders
Go to Order Sets
Options
Place new order
New
Select order mode
Next
Remove All
Save Work
Sign
KENNETH M.
7:30 AM

Nursing documentation of skin interventions related to BIPAP/CPAP/NIV masks



- Flowsheets
  - Skin
    - Skin Interventions
      - Airway Device Pressure Protection



Select appropriate interventions:

- Skin to device areas padded

Add a comment specifying skin under mask intact or other assessment findings

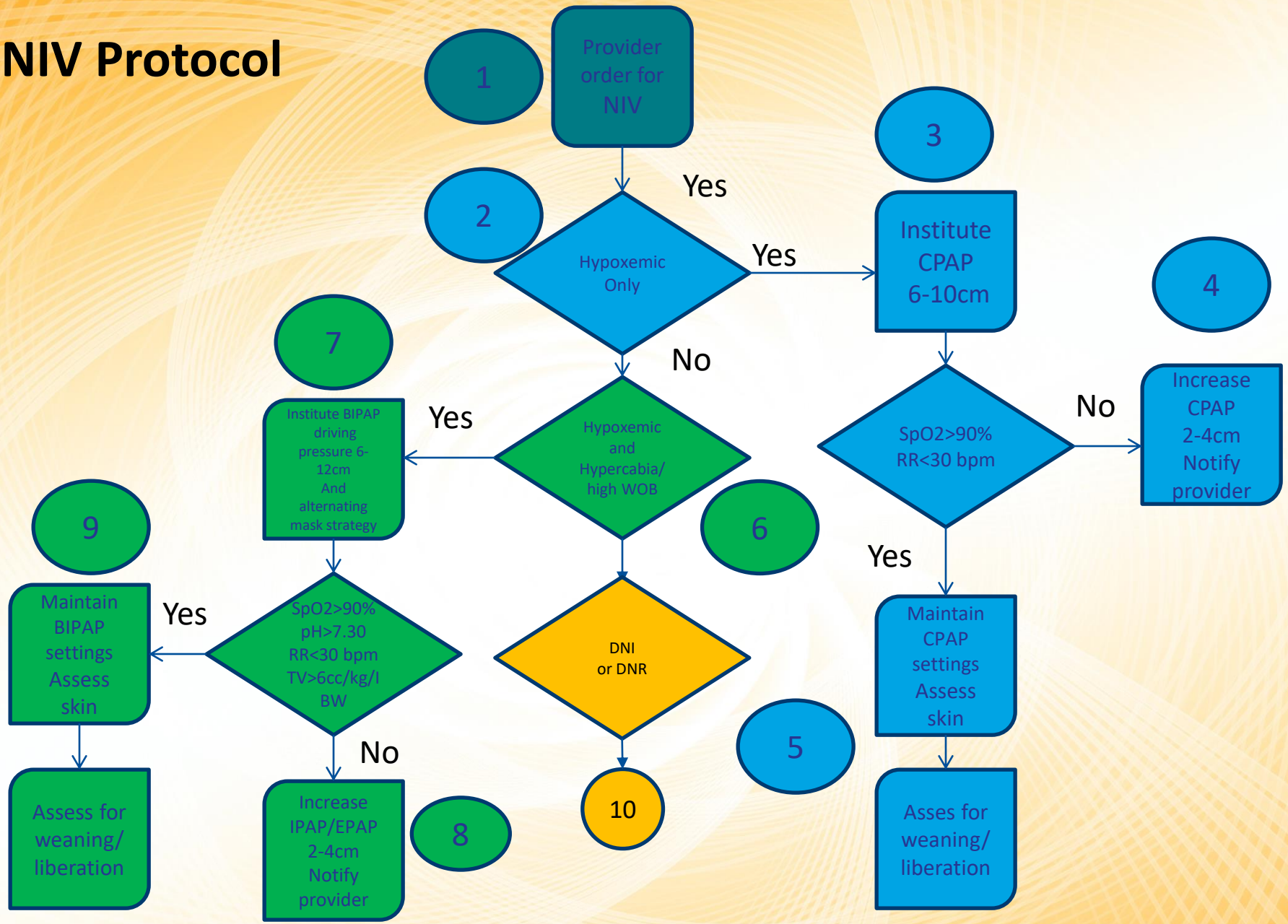
Specify which mask is on the patient at assessment:

- Oral Nasal mask OR full-face mask

Questions?

Development of a NIV Management Protocol

NIV Protocol



Node 1:

NIV order to be written by provider to include desired SpO2, pH and high respiratory and heart rates in EPIC ordering set or doc. phrase in assessment note.

Mode selection includes: S/T Mode, PCV. CPAP, AVAPS to meet clinical endpoints

Indications include the following inclusion for acute BIPAP/CPAP:

Appropriate diagnosis with potential reversibility

Establish need for ventilatory assistance

Moderate-to-severe respiratory distress and

Tachypnea (respiratory rate >24/min for COPD, >30/min for CHF);
Accessory muscle use or abdominal paradox
Blood gas derangement (pH <7.35, $PaCO_2$ >45 mm Hg, or PaO_2/FiO_2 < 200)

Exclude patients with contraindications to NIV:

Respiratory or cardiac arrest
Medical instability (hypotensive shock, myocardial infarction requiring intervention, uncontrolled ischemia or arrhythmias)
Unable to protect airway
Unable to fit mask
Untreated pneumothorax
Recent upper airway or esophageal surgery
Excessive secretions
Uncooperative or agitated

Clinical parameters are to be assessed within two hours after the implementation NIV-provider should be notified of current clinical parameters

NIV CPG should be activated by RRT

Node 2:

Evidence of hypoxemia without hypercarbia and increased work of breathing.

Node 3:

Institute CPAP mode and placed on CPAP of 6-10cm with FIO2 of 100% and monitor SpO2, working of breathing, heart rate.

Assess skin integrity and utilize appropriate interface and skin barrier in all patients. Consider other medical interventions to improve oxygenation (diuresis, pharmalogical administration, anxiety invention, nebulized bronchodilators).

Assess progress in 2-4 hours

Node 4:

If SpO2 goal not achieved: increase CPAP level by 2-4cm.

Notify provider of above. If evidence of increased work of breathing and/or hybercarbia: **proceed to node 6.**

Node 5:

If SpO2 goal achieved maintain current CPAP/FIO2 levels.

Assess skin and liberation assessment every four hours. **See skin integrity assessment protocol.**** 4-6 hours post stabilization assess for CPAP/FIO2 weaning and liberation.

Consider liberation when CPAP≤5cm and FIO2≤40%

Node 6:

Evidence of hypoxemia and increased work of breathing and/or hypercarbia.

Node 7:

Institute Either PCV or S/T mode and placed on IPAP of 12-16cm to target exhaled tidal volume of 6-8cc/kg/IBW and EPAP 4-8cm with FIO2 of 70% and monitor SpO2, working of breathing, heart rate.

Also assess skin integrity and utilize appropriate interface and skin barrier in all patients.

Consider other medical interventions to improve oxygenation (diuresis, pharmalogical administration, anxiety invention, nebulized bronchodilators).

Node 8:

If SpO2/pH, high respiratory and heart rates goal not achieved: increase IPAP/EPAP level by 2-4cm. Notify provider of above.

If clinical end-points not unable to be achieved with four hours consider intubation or de-escalation discussion

Node 9:

If SpO2/pH, high respiratory and heart rates goal achieved maintain current IPAP/EPAP/FIO2 levels. Assess skin every four hours. **See skin integrity assessment protocol.**** 4-6 hours post stabilization assess for IPAP/EPAP/FIO2 weaning and liberation.

Wean IPAP/EPAP by 1-2cm. Consider liberation when FIO2≤40% and IPAP/EPAP≥ 12/6.

Node 10:

If the administration of NIV is for end-of-life management maintain settings to minimize work of breathing and dyspnea.

***If unable to wean utilize AVAPS Mode and consider palliative management to include no escalation of BIPAP parameters.**

** If patient on NIV for 6 or more hours, begin alternating full-face mask with naso-oral mask every 4 hrs.

Did All This Work Make a Difference??

Results

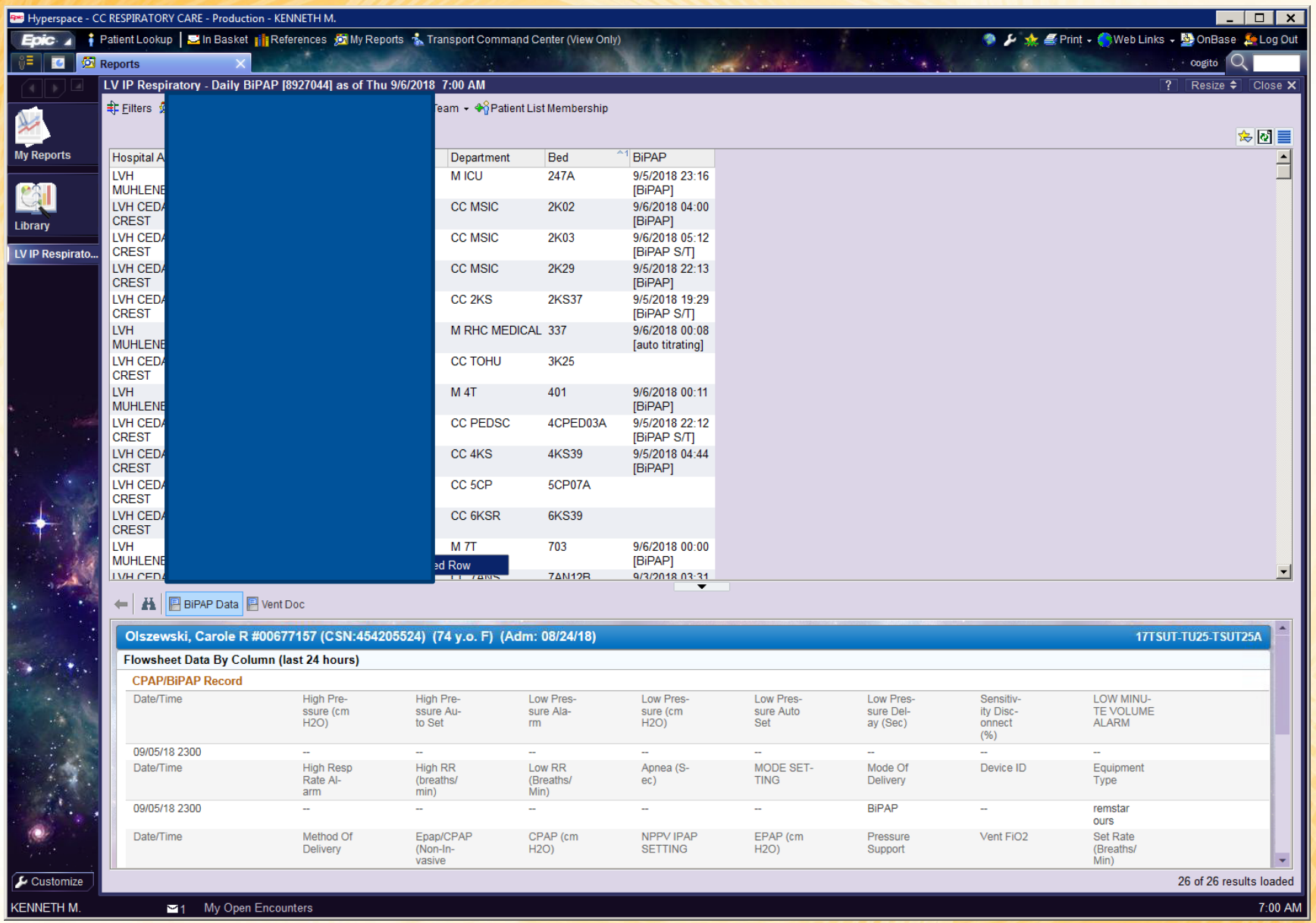
7. Reduce BIPAP Pressure Injuries															
Site	FY'16 Number	GOAL	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	FY'17 Total
LVH-CC	24		2	2	Intervention 1	0	0	0	0	0	0	0	0	0	5
LVH-M	8		1	0	0	0	1	0	0	0	0	0	0	0	2

7. Reduce BIPAP Pressure Ulcers															
Site	FY'17 Number	GOAL	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	FY'18 Total
LVH-CC	4		0	0	0	0	0	0	1	0	0	0	0	0	1
LVH-M	1		0	0	0%	0	0	0	0	0	0	0	0	0	0

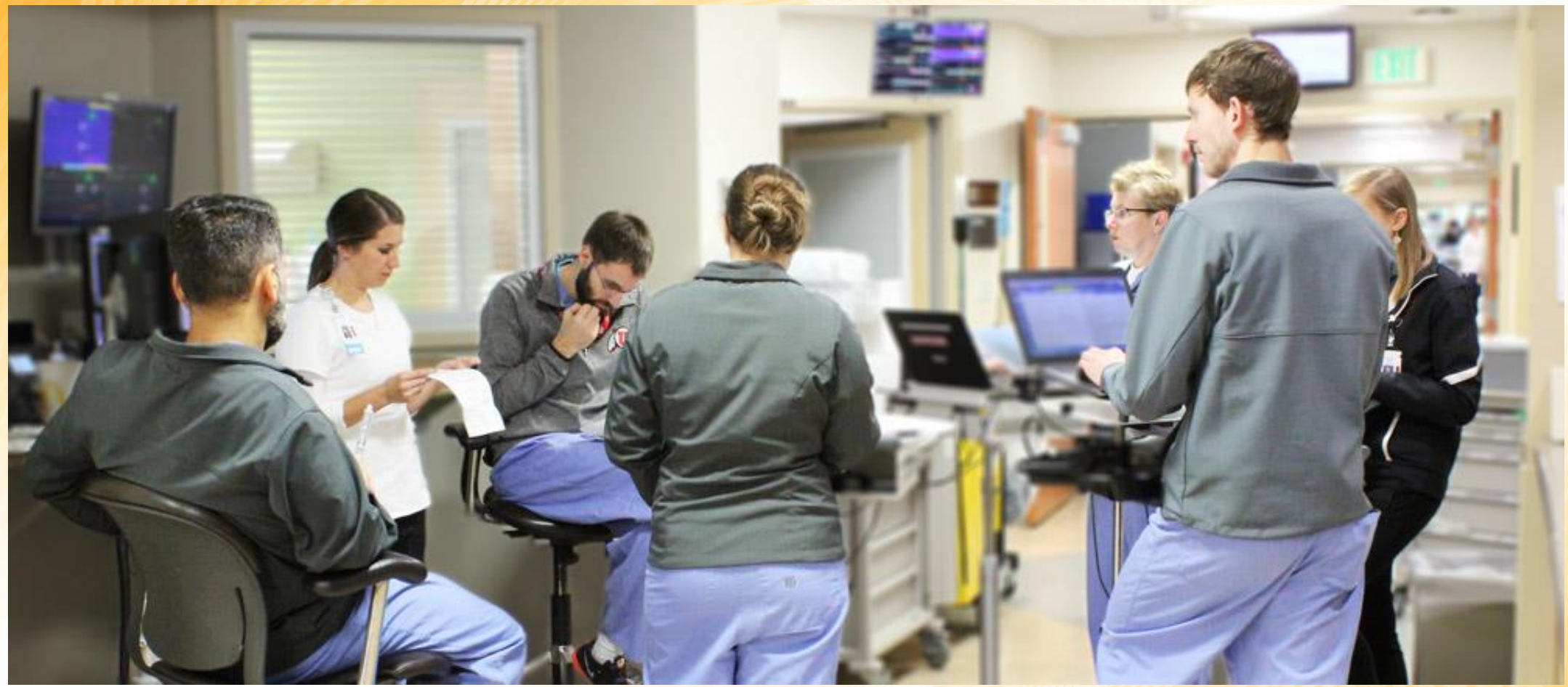
Follow-Up

- Daily NIV rounds
  - NIV patient list from EMR
- Education for new staff
- Continue to seek additional counter measures

Daily NIV rounds



Collaborate Clinical Rounds



EMPOWERMENT OF BEDSIDE STAFF

Conclusion

- Pressure injuries are expensive and cause suffering
- Most pressure injuries are avoidable with proactive care
- All clinicians must be aware of the potential pressure injuries from the devices that they utilize
- Constant vigilance is mandatory to reduce the chance of pressure injuries

Questions

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