SEVA-CrashCourse

Standardized Education for Ventilatory Assistance

Robert L. Chatburn, MHHS, RRT-NPS, FAARC

Research Manager – Respiratory Institute

Cleveland Clinic

Professor – Department of Medicine

Lerner College of Medicine of Case Western Reserve University

Conflict of Interest

Royalties

- Jones & Bartlett Learning
- Elsevier

Patents

- U.S. Patent 8,550,077

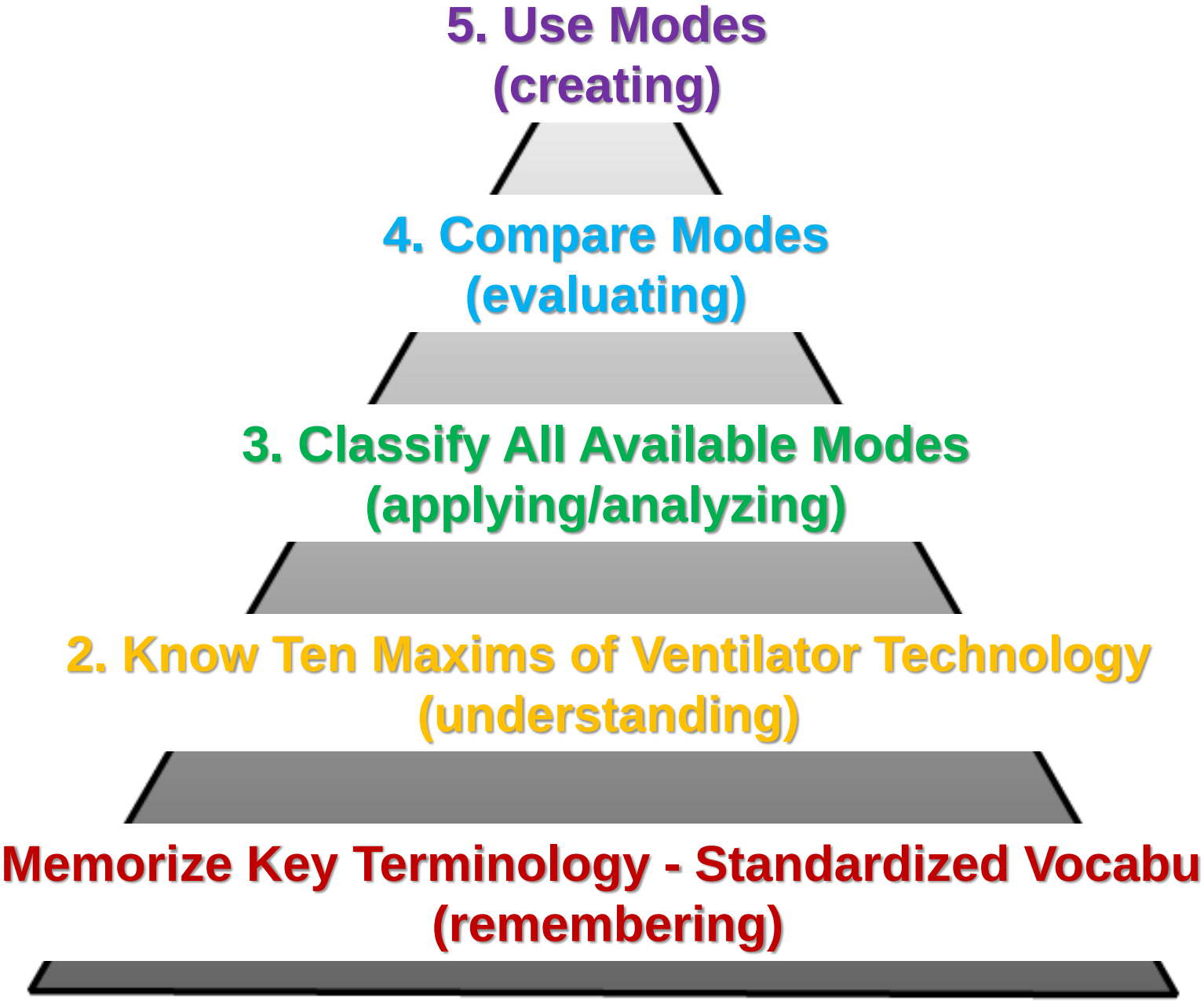
Consulting Agreements

- Ingmar Medical Inc
- University of Cincinnati
- Ventis Medical Inc
-

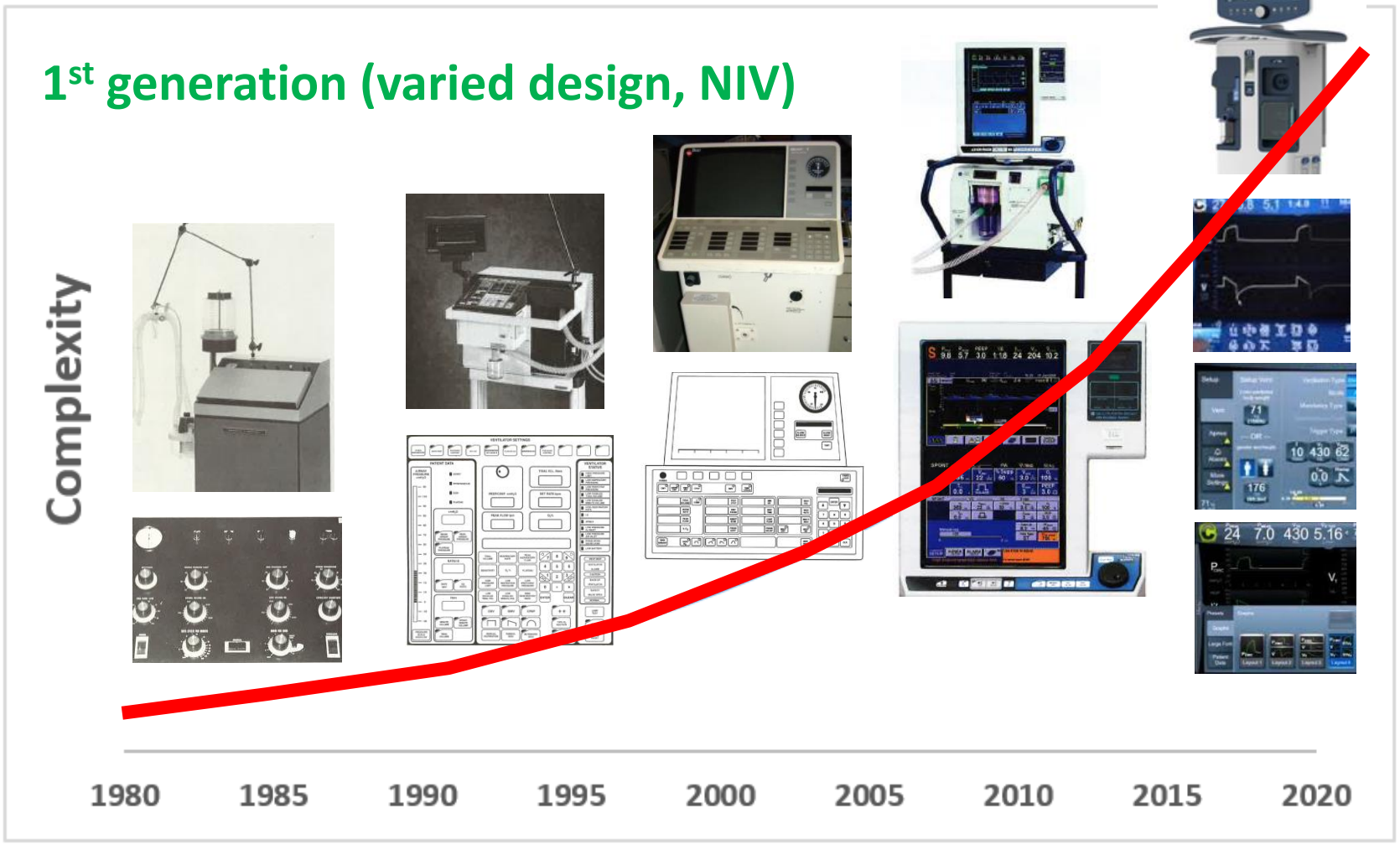
Outline

- **The motivation for learning about mechanical ventilation**
- **The equation of motion (**simplified**)**
- **Taxonomy (**simplified**)**
  - what a TAG is and why we need it
- **Choosing a mode of ventilation based clinical goals**
- **Basic ventilator waveform interpretation**
- **Outline of patient ventilator interactions**

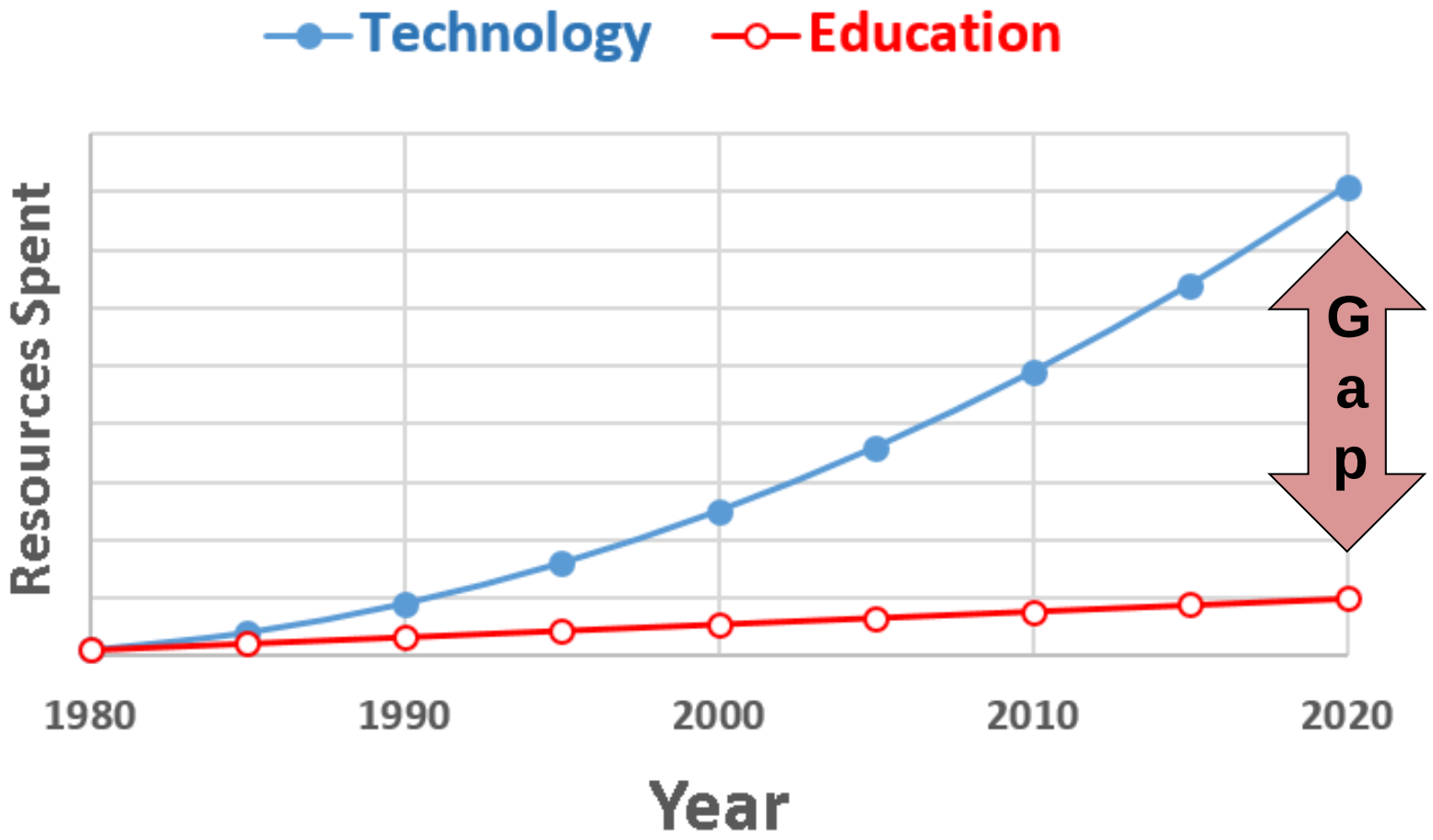
Overview of SEVA program


5. Use Modes
(creating)
4. Compare Modes
(evaluating)
3. Classify All Available Modes
(applying/analyzing)
2. Know Ten Maxims of Ventilator Technology
(understanding)
1. Memorize Key Terminology - Standardized Vocabulary
(remembering)

Growth in Ventilator Complexity



Growing Knowledge Gap

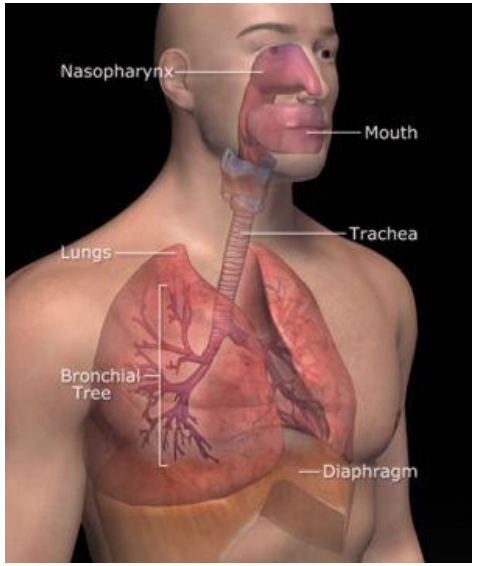


Negative effects on

- patient safety
- health care cost
- clinician confidence

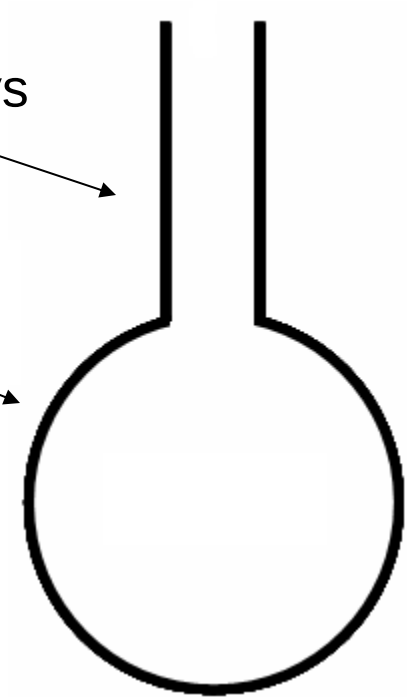
The Equation of Motion

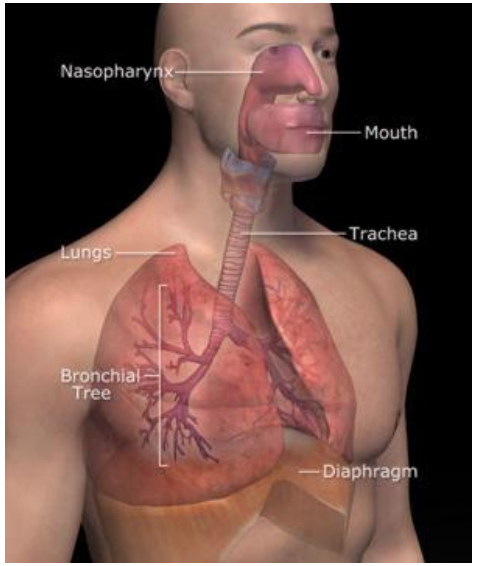
Basic Model of
Patient-Ventilator Interaction

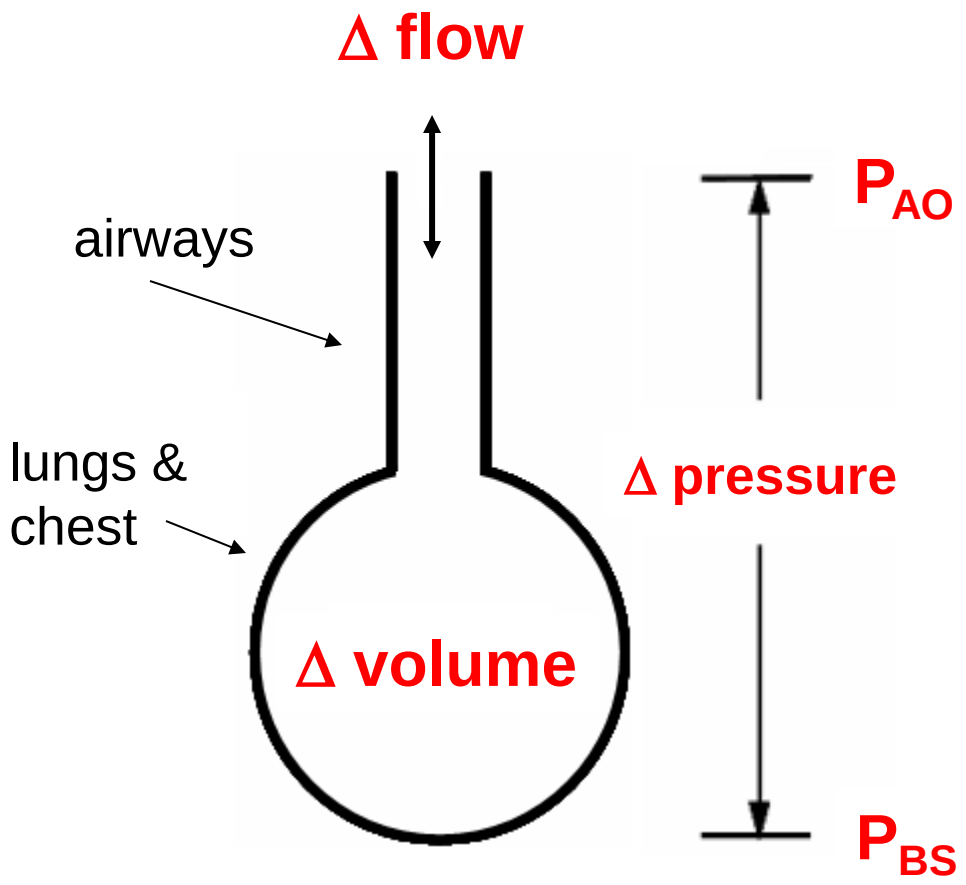


airways

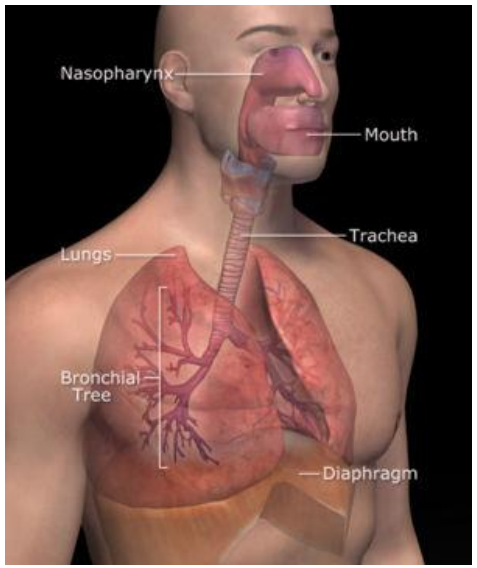
lungs & chest

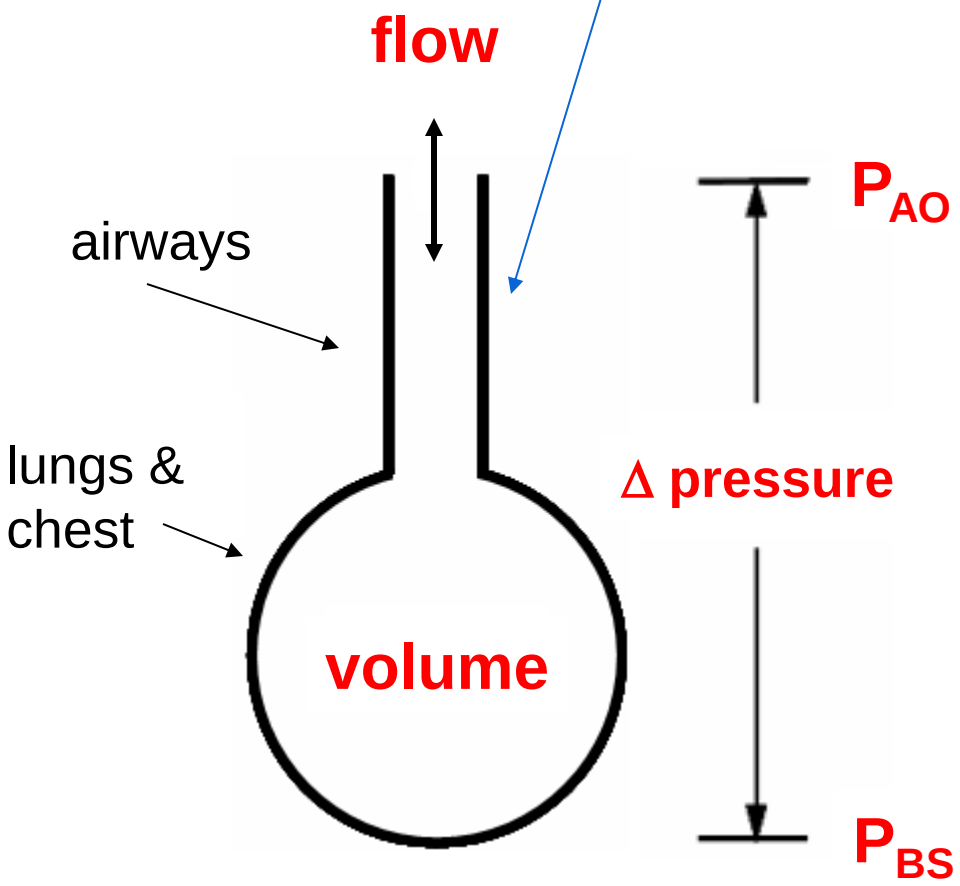



Nasopharynx
Mouth
Trachea
Lungs
Bronchial Tree
Diaphragm


Δ flow
airways
lungs & chest
Δ volume
P_{AO}
Δ pressure
P_{BS}

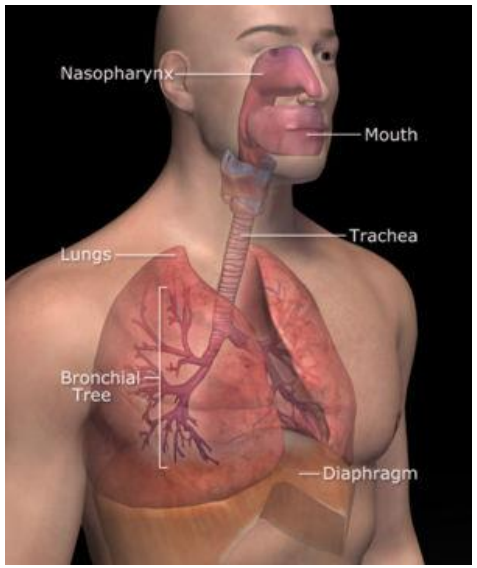
resistance = Δpressure / Δflow





resistance = Δpressure / Δflow

flow



airways

lungs & chest

P_{AO}

Δ pressure

volume

P_{BS}

elastance = Δpressure / Δvolume

compliance = Δvolume / Δpressure

The Equation of Motion

$$P_{action} = P_{reaction}$$

$$P_{inspiration} = P_{elastance} + P_{resistance}$$

elastic load resistive load

The Equation of Motion

$$P_{inspiration} = P_{elastance} + P_{resistance}$$

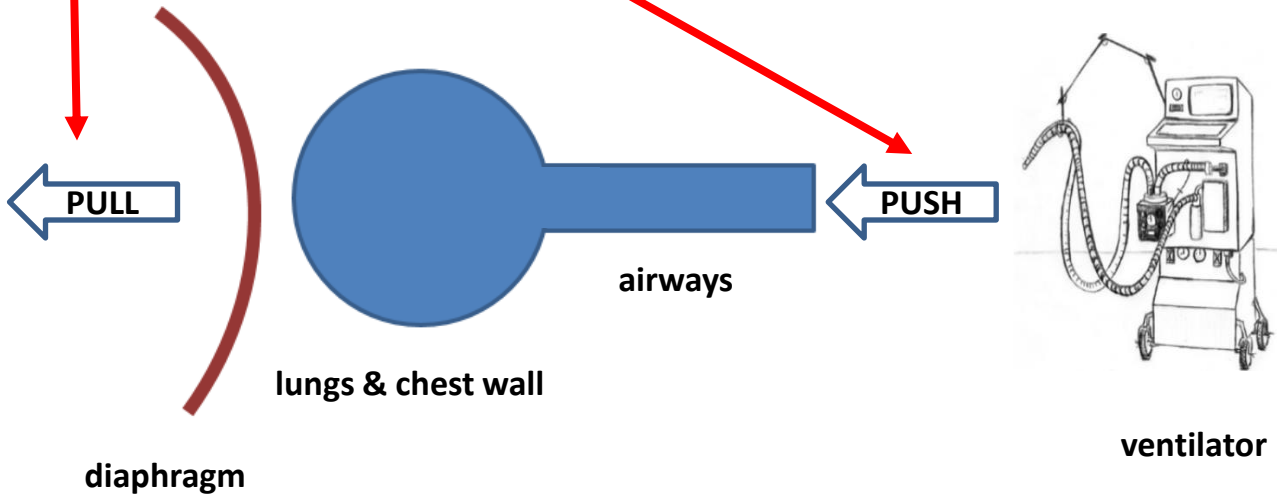
elastic load resistive load

$$= E \times V + R \times \dot{V}$$

elastance (constant) resistance (constant)

Equation of Motion

$$P_{mus} + P_{vent} = E \times V + R \times \dot{V}$$



Taxonomy of Modes

Classification System

Taxonomy for modes of ventilation

Common Mode Names 2022

AC PCV
Adaptive Flow
Adaptive Support Ventilation
Airway Pressure Release Ventilation
APV SIMV
Pressure Control
Pressure Regulated Volume Control
Pressure Support
Proportional Assist Ventilation
SIMV

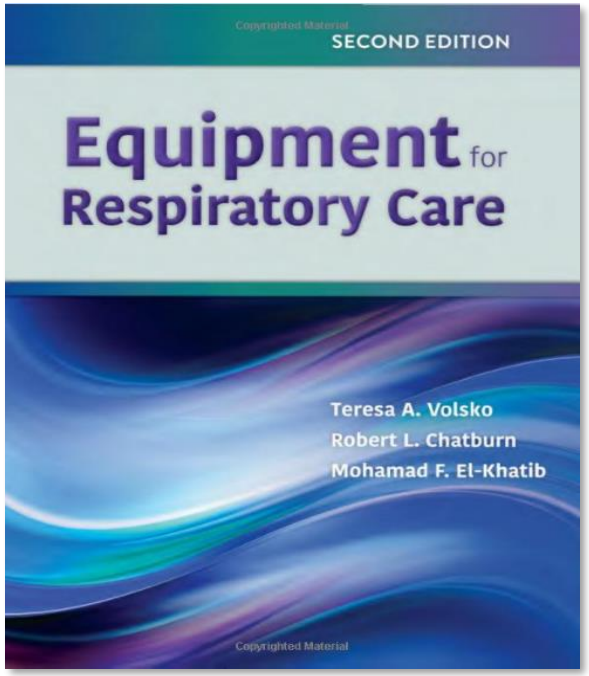
495 unique mode names

75 modes named on a single vent

74 unique modes by taxonomy

55 different ventilators

CPAP
DuoPAP
Flow Adaptive Volume Control
Mandatory Minute Ventilation
PC-A/C
PCV+
Volume Assured Pressure Support
Volume Augment
Volume Control
Volume Support
VV+SIMV



Why Use a Mode Taxonomy?

- **Same need as for generic drug names in pharmacology**
  - Improve communication
  - Better use of technology
  - Improves patient care and safety
- **Taxonomy is essential for establishing accurate records**
  - Epic now uses mode taxonomy at Cleveland Clinic
  - At least one other hospital has adopted it

Standardizing electronic health record ventilation data

“Equivalent” headache medicines

Generic Names

HAMILTON G5 or C6	TAG
(S)CMV	VC-CMVs
Adaptive Support Ventilation	PC-IMV(3)oi,oi
Adaptive Support Ventilation + Tube Comp	PC-IMV(3)oir,oir
Airway Pressure Release Ventilation	PC-IMV(1)s,s
APRV + Tube Comp	PC-IMV(1)sr,sr
APVcmv (or (S)CMV+) + Tube Comp	PC-CMVar
APVcmv (or (S)CMV+)	PC-CMVa
APVsimv (or SIMV+)	PC-IMV(1)a,s
APVsimv (or SIMV+) + Tube Comp	PC-IMV(1)ar,sr
Duo Positive Airway Pressure	PC-IMV(1)s,s
Duo Positive Airway Pressure + Tube Comp	PC-IMV(1)sr,sr
INTELLiVENT ASV	PC-IMV(3)oi,oi
Nasal CPAP/Pressure Support	PC-IMV(2)s,s
Noninvasive Ventilation	PC-CSVs
Noninvasive Ventilation Spontaneous/Timed	PC-IMV(2)s,s
PCV +	PC-CMVs
P-CMV + Tube Comp	PC-CMVsr
P-SIMV	PC-IMV(1)s,s
P-SIMV + Tube Comp	PC-IMV(1)sr,sr
SIMV	VC-IMV(1)s,s
Spontaneous	PC-CSVs
Spontaneous + Tube Comp	PC-CSVsr
Volume Support	PC-CSVa
Volume Support + Tube Comp	PC-CSVar

GETINGE SERVO	TAG
Automode (Press Cont to Press Suppt)	PC-IMV(2)s,s
Automode (PRVC to Vol Supp)	PC-IMV(2)a,a
Automode (VC + Flow Adapt to Vol Sup)	VC-IMV(2)d,da
Automode (VC + sqr/ramp to Vol Sup)	VC-IMV(2)s,a
Bi-Vent	PC-IMV(1)s,s
Neurally Adjusted Ventilatory Assist	PC-IMV(2)s,rs
Noninvasive CPAP	PC-CSVs
Noninvasive Pressure Control	PC-CMVs
Noninvasive Pressure Support	PC-CSVs
Pressure Control	PC-CMVs
Pressure Regulated Volume Control	PC-CMVa
Pressure Support	PC-CSVs
SIMV (Pressure Control)	PC-IMV(1)s,s
SIMV (Volume Control + Flow Adapt)	VC-IMV(4)d,ds
SIMV (VC + ramp or square flow)	VC-IMV(1)s,s
SIMV Press Reg Vol Cont	PC-IMV(1)a,s
Spontaneous/CPAP	PC-CSVs
Volume Control (+ square or ramp flow)	VC-CMVs
Volume Control + Flow Adaptation	VC-IMV(4)d,d
Volume Support	PC-CSVa

Key Words

- **Taxonomy**
  - A classification system
  - Identifies generic modes (similar to generic vs brand names for drugs)
- **TAG**
  - Abbreviation for mode: Control Variable, Breath Sequence, Targeting Scheme
- **Breath Control Variable**
  - What is pre-set (either pressure or volume/flow)
- **Breath Sequence**
  - Pattern of mandatory vs spontaneous breaths

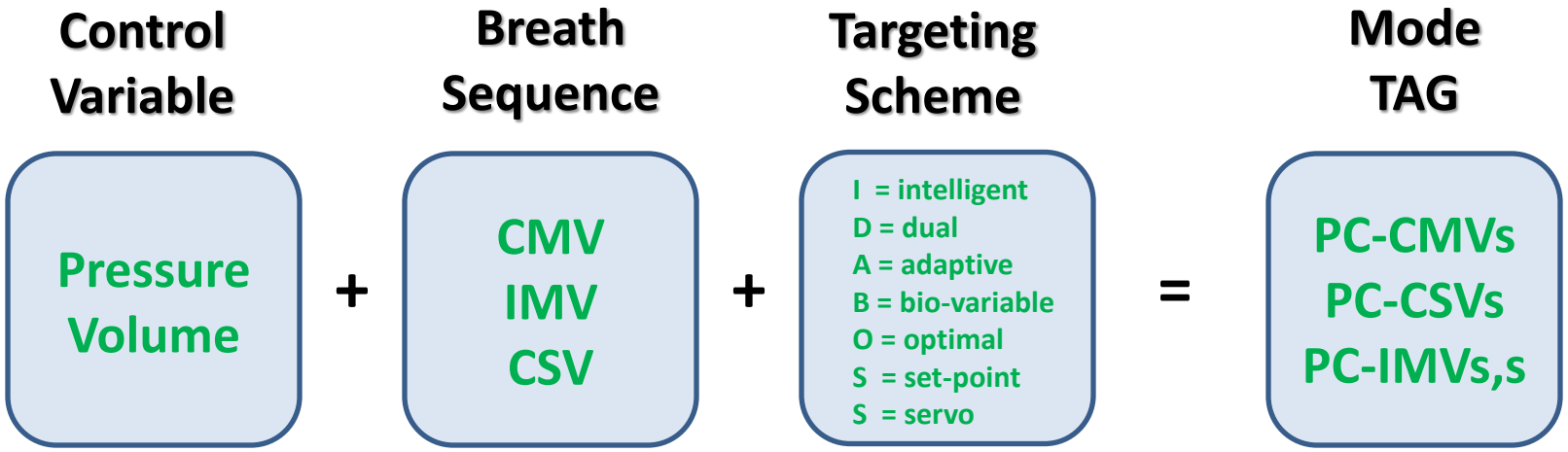
Key Words

- **Trigger (event)**
  - To start inspiration
    - Initiated by patient or machine
- **Cycle (event)**
  - Top end inspiration
    - Initiated by patient or machine
- **Spontaneous Breath**
  - Inspiration is both patient triggered (started) and patient cycled (ended)
- **Mandatory Breath**
  - A breath for which inspiration is either machine triggered, or machine cycled (or both)

Key Words

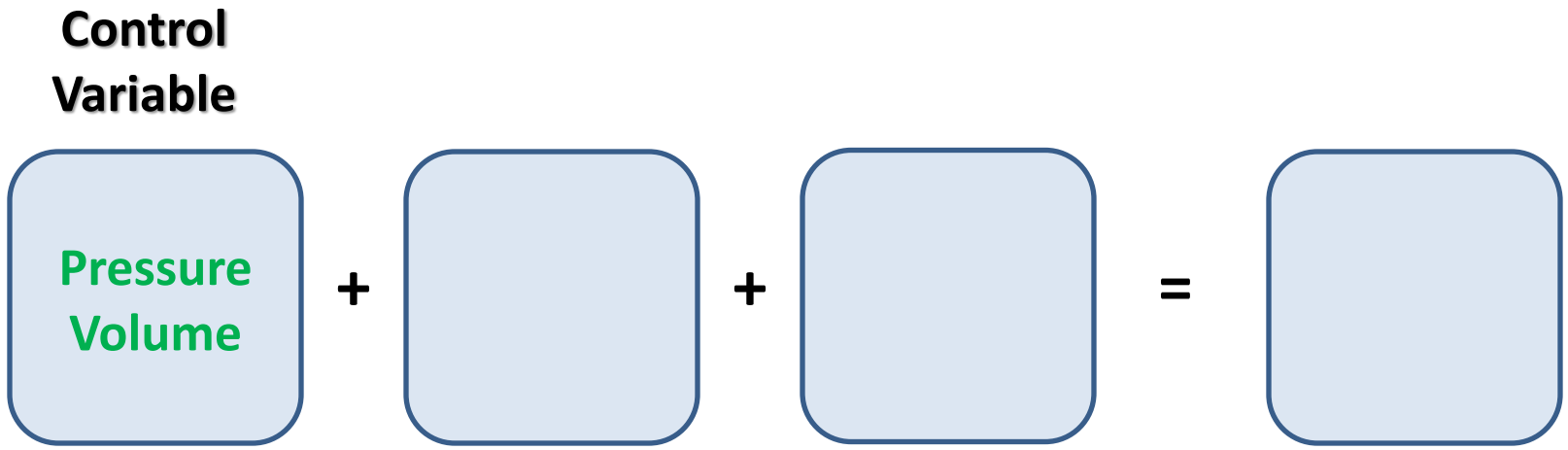
- **Target**
  - A parameter set by you or automatically by the ventilator (eg, inspiratory pressure, tidal volume, flow, minute ventilation, SpO_2 $ETCO_2$ etc) that is a goal of the ventilator's targeting scheme
- **Targeting scheme**
  - Software that manages the control variable and breath sequence

The Components of a Mode of Ventilation



All modes have these 3 components

The Components of a Mode of Ventilation



Pressure Control Modes

$$\boxed{P_{vent}}_{\text{pressure control}} = E \times V + R \times \dot{V}$$

- **Preset values**
  - Inspiratory pressure target
    - Constant inspiratory pressure, or
    - Inspiratory pressure is proportional to inspiratory effort
  - Inspiratory time

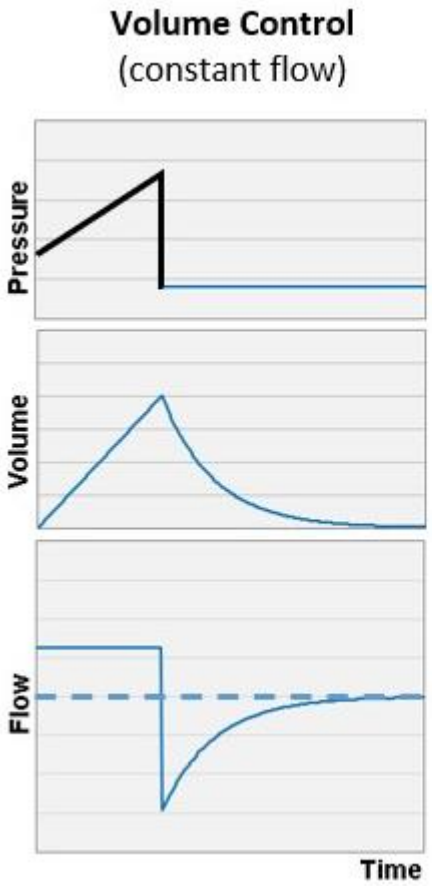
Volume Control Modes

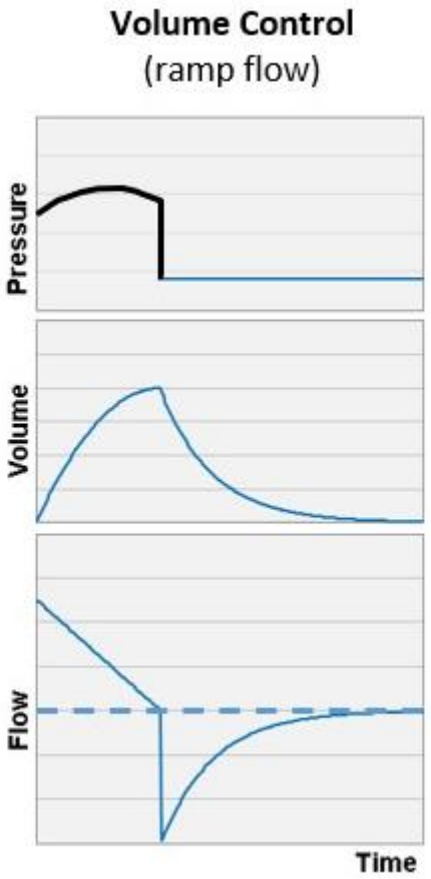
$$P_{vent} = \boxed{E \times V + R \times \dot{V}}$$

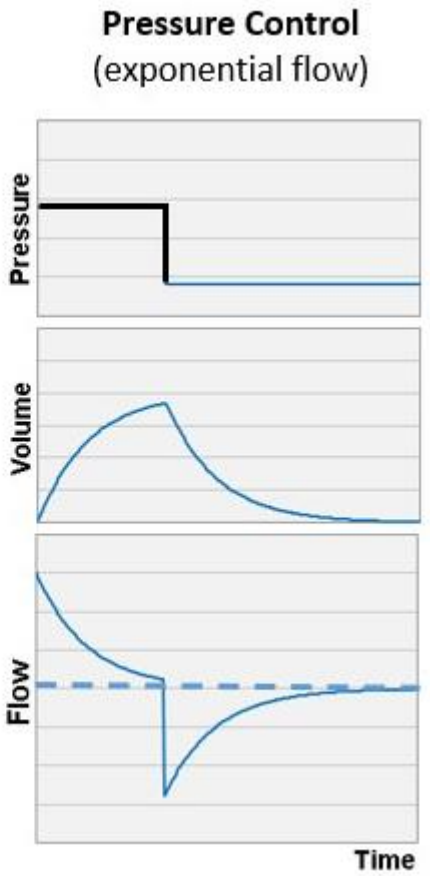
volume control

- **Preset values**
  - Inspiratory volume (tidal volume)
  - Inspiratory flow (peak and waveform)

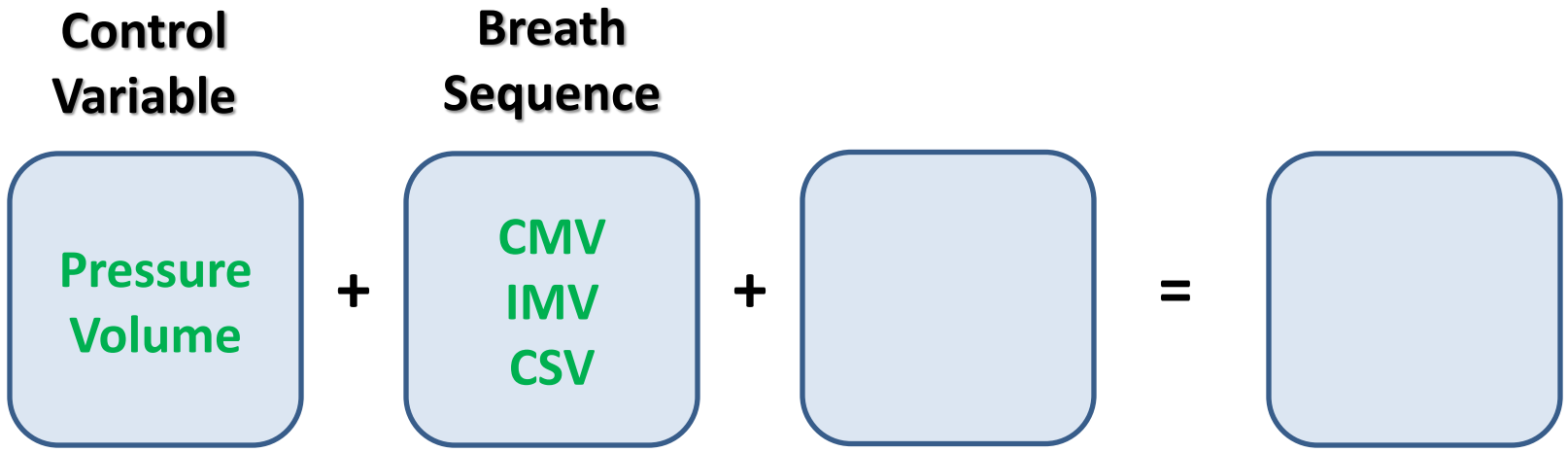
Ideal Waveforms







What is a Mode of Ventilation?



Key Idea – 4 Kinds of IMV

IMV(1): mandatory rate delivered independent of patient action

IMV(2): mandatory breaths suppressed if spontaneous breath rate higher that set mandatory breath rate

IMV(3): mandatory breaths suppressed if spontaneous minute ventilation higher than set mandatory minute ventilation

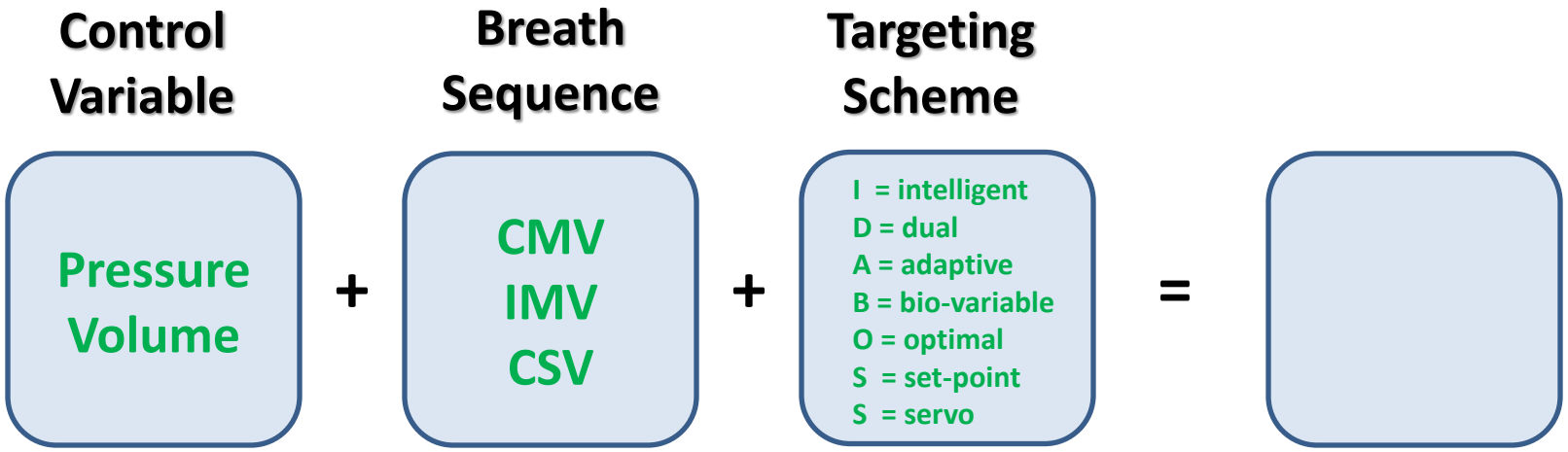
IMV(4): individual mandatory breaths suppressed if inspiratory effort high enough

Evolution of IMV

Five Basic Ventilatory Patterns

Control Variable	Breath Sequence	Symbol
Volume	Continuous Mandatory Ventilation	VC-CMV
	Intermittent Mandatory Ventilation	VC-IMV
Pressure	Continuous Mandatory Ventilation	PC-CMV
	Intermittent Mandatory Ventilation	PC-IMV
	Continuous Spontaneous Ventilation	PC-CSV

What is a Mode of Ventilation?



Targeting Schemes (abbreviations)

1. **Set-point** (s)
   - All targets are operator pre-set

     Example: Volume Assist/Control
2. **Dual** (d)
   - Ventilator switches between VC and PC

     Example: "flow adaptation" (Servo-U)
3. **Servo** (r)
   - Inspiratory pressure proportional to effort

     Example: NAVA (Servo-U) or PAV+ (PB980)
4. **Adaptive** (a)
   - Ventilator adjusts inspiratory pressure to achieve the preset tidal volume as compliance and resistance change

     Example: Pressure Regulated Volume Control (Servo-U)

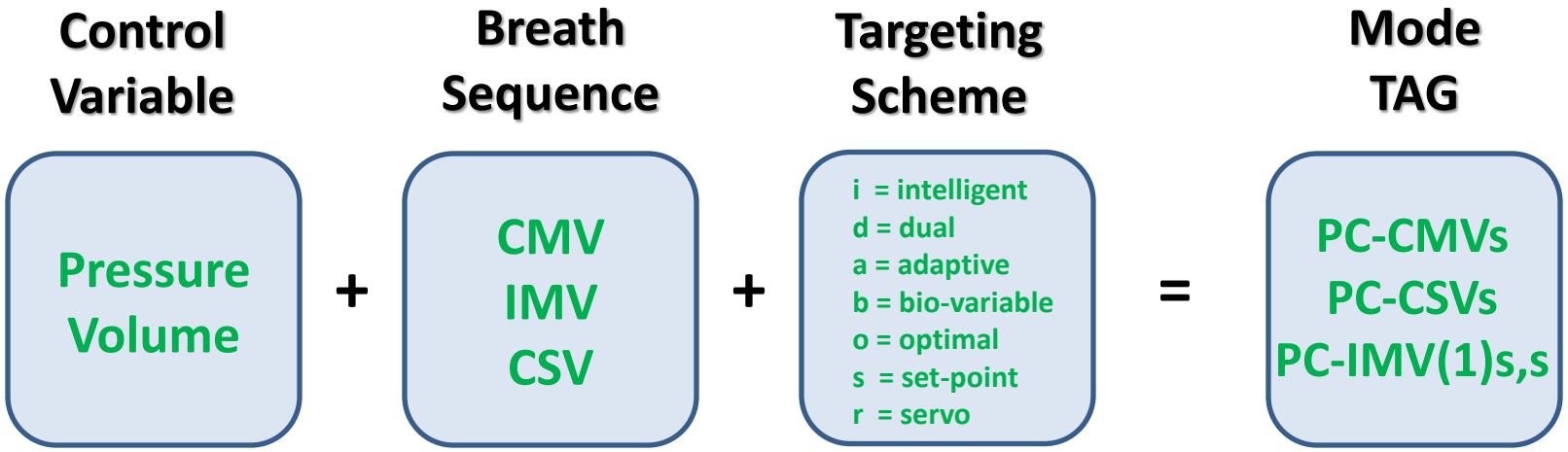
Targeting Schemes (abbreviations)

5. **Optimal** (o)
   - Ventilator adjusts target to maximize or minimize some desired parameter

     Example: Adaptive Support Ventilation (Hamilton C6)
6. **Intelligent** (i)
   - Ventilator adjusts target using artificial intelligence tools

     Example: SmartCare (Dräger V500) or IntelliVent (Hamilton C6)

The Components of a Mode of Ventilation



Choosing the Right Mode

Goals of Mechanical Ventilation

Rational framework for selecting modes

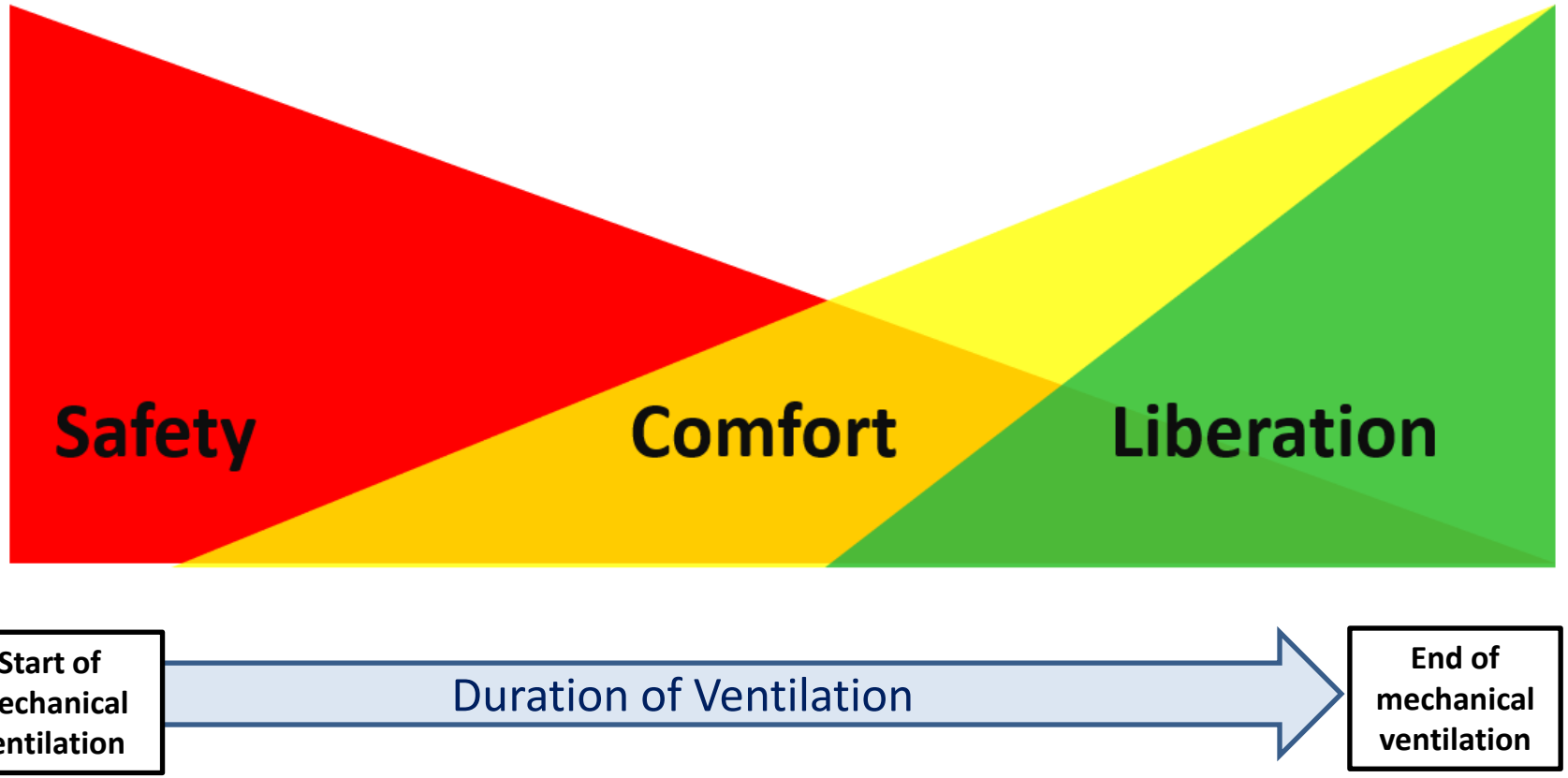
AIM Before You ACT

What is your Goal?

- **There are only 3 basic goals of mechanical ventilation:**
  - **Safety**
    - ensure adequate gas exchange
    - minimize risk lung injury
  - **Comfort**
    - maximize patient-ventilator synchrony
    - minimize work shifting (balance work of breathing)
  - **Liberation**
    - minimize duration of ventilation
    - minimize risk of adverse events

Safety, Comfort *or* Liberation

There can be only one…



Technical Capabilities that Serve the Goal

- **Safety**
  - **Ventilation**
    1. Tidal volume targeted
    2. Breath rate targeted
  - **Oxygenation**
    3. Automatic FiO_2 and PEEP targets
  - **Lung Protection**
    4. Automatic safety rules (including automatic rate and V_T targets)

Technical Capabilities that Serve the Goal

- **Comfort**
  - **Synchrony**
    1. All breaths may be spontaneous
  - **Appropriate assistance level**
    2. Inspiratory pressure proportional to effort

Technical Capabilities that Serve the Goal

- **Liberation**
    1. Ventilator initiated reduction of support
    2. Automatic Spontaneous Breathing Trial

Which Mode to Choose – PB 840/980

Medtronic PB 840 or PB 980	TAG	Safety				Com.		Lib.	
SIMV Volume Control Plus	PC-IMV(1)a,*s*	A	B						
A/C Volume Control Plus	PC-CMVa	A	B						
SIMV Volume Control	VC-IMV(1)s,*s*	A	B						
A/C Volume Control	VC-CMVs	A	B						
Spont Volume Support	PC-CSVa	A				E			
SPONT Proportional Assist	PC-CSVr					E	F		
SPONT Tube Compensation	PC-CSVr					E	F		
Bilevel + Pressure Support	PC-IMV(1)s,*s*		B						
SIMV Pressure Control	PC-IMV(1)s,*s*		B						
A/C Pressure Control	PC-CMVs		B						
SPONT Pressure Support	PC-CSVs					E			

Which Mode to Choose - Servo

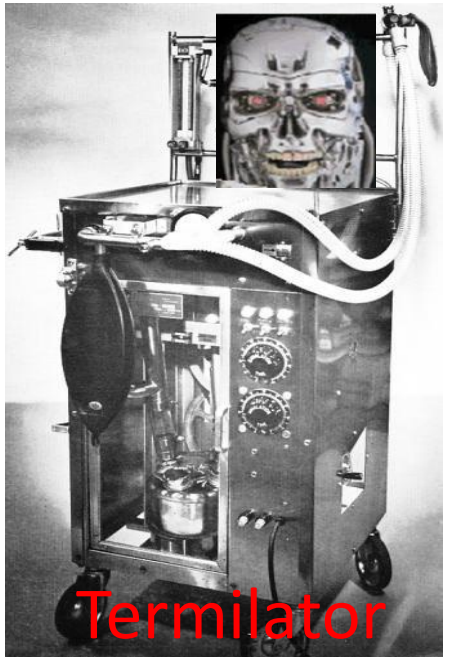
Getinge Servo-I or Servo-U	TAG	Safety				Com.		Lib.	
Automode (PRVC to VS)	PC-IMV(2)a,a	A	B			E			
Automode (VC-Flow Adapt to VS)	VC-IMV(2)d,da	A	B			E			
Automode (VC-Square/Ramp to VS)	VC-IMV(2)s,a	A	B			E			
SIMV Pressure Regulated Volume Control	PC-IMV(1)a,s	A	B						
SIMV (VC-Flow Adapt)	VC-IMV(4)d,ds	A	B						
Volume Control (Flow Adapt)	VC-IMV(4)d,d	A	B						
Pressure Regulated Volume Control	PC-CMVa	A	B						
SIMV (VC-Square/Ramp)	VC-IMV(1)s,s	A	B						
Volume Control (Square/Ramp flow)	VC-CMVs	A	B						
Automode (PC to PS)	PC-IMV(2)s,s		B			E			
Volume Support	PC-CSVa	A				E			
Neurally Adjusted Ventilatory Assist	PC-CSVr					E	F		
Bi-Vent	PC-IMV(1)s,s		B						
SIMV (Pressure Control)	PC-IMV(1)s,s		B						
Pressure Control	PC-CMVs		B						
Pressure Support/CPAP	PC-CSVs					E			

Which Mode to Choose – C6

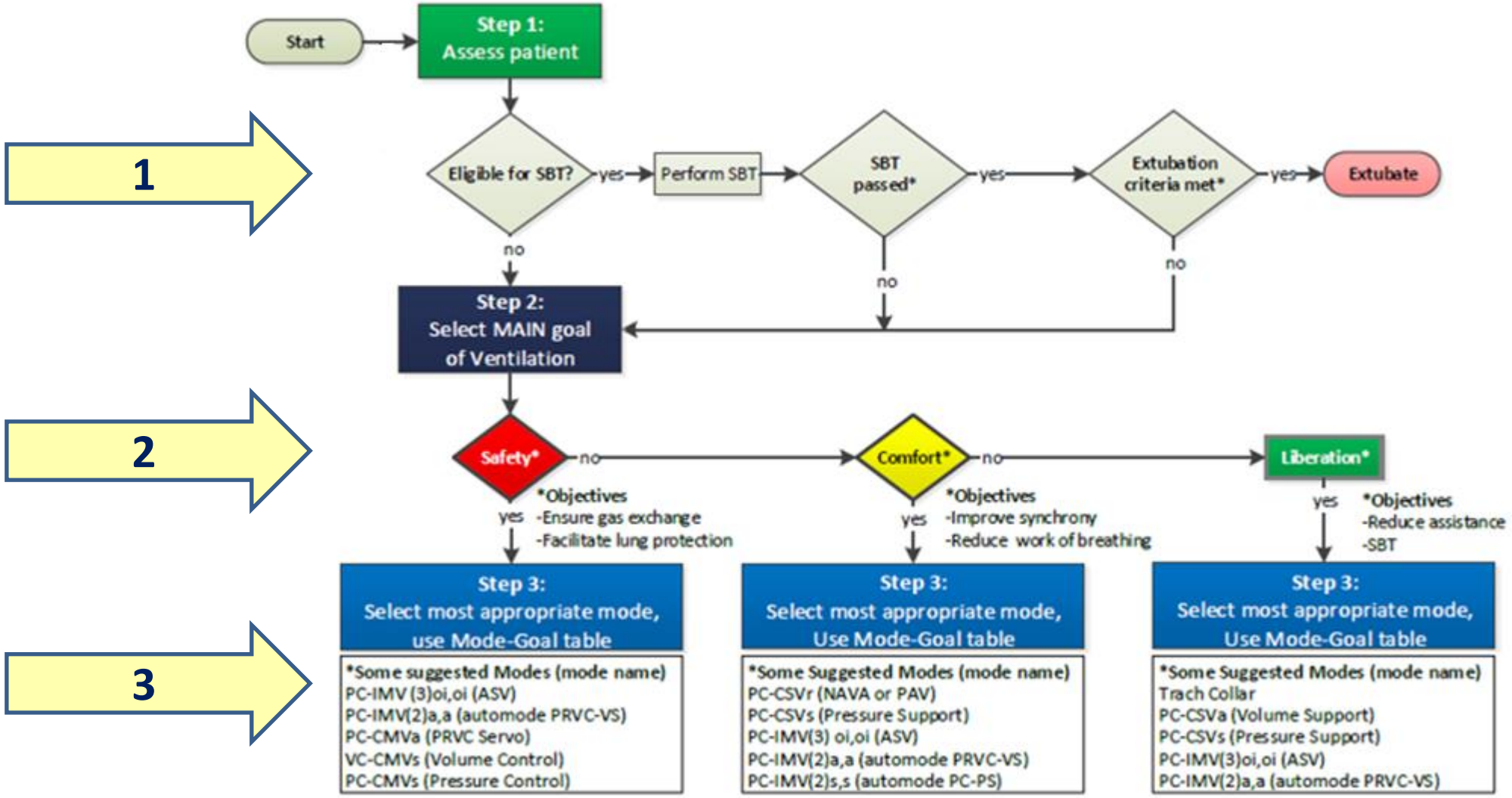
Hamilton C6	TAG	Safety				Com.		Lib.	
INTELLiVENT Adaptive Support Ventilation	PC-IMV(3)oi,oi	A	B	C	D	E		G	H
Adaptive Support Ventilation	PC-IMV(3)oi,oi	A	B		D	E			
APVsimv	PC-IMV(1)a,s	A	B						
APVcmv	PC-CMVa	A	B						
SIMV	VC-IMV(1)s,s	A	B						
(S)CMV	VC-CMVs	A	B						
P-SIMV with Psync	PC-IMV(2)s,s		B			E			
Duo Positive Airway Pressure	PC-IMV(1)s,s		B						
P-SIMV	PC-IMV(1)s,s		B						
Airway Pressure Release Ventilation	PC-IMV(1)s,s		B						
PCV +	PC-CMVs		B						
SPONT	PC-CSVs					E			

Which Mode to Choose - Generic

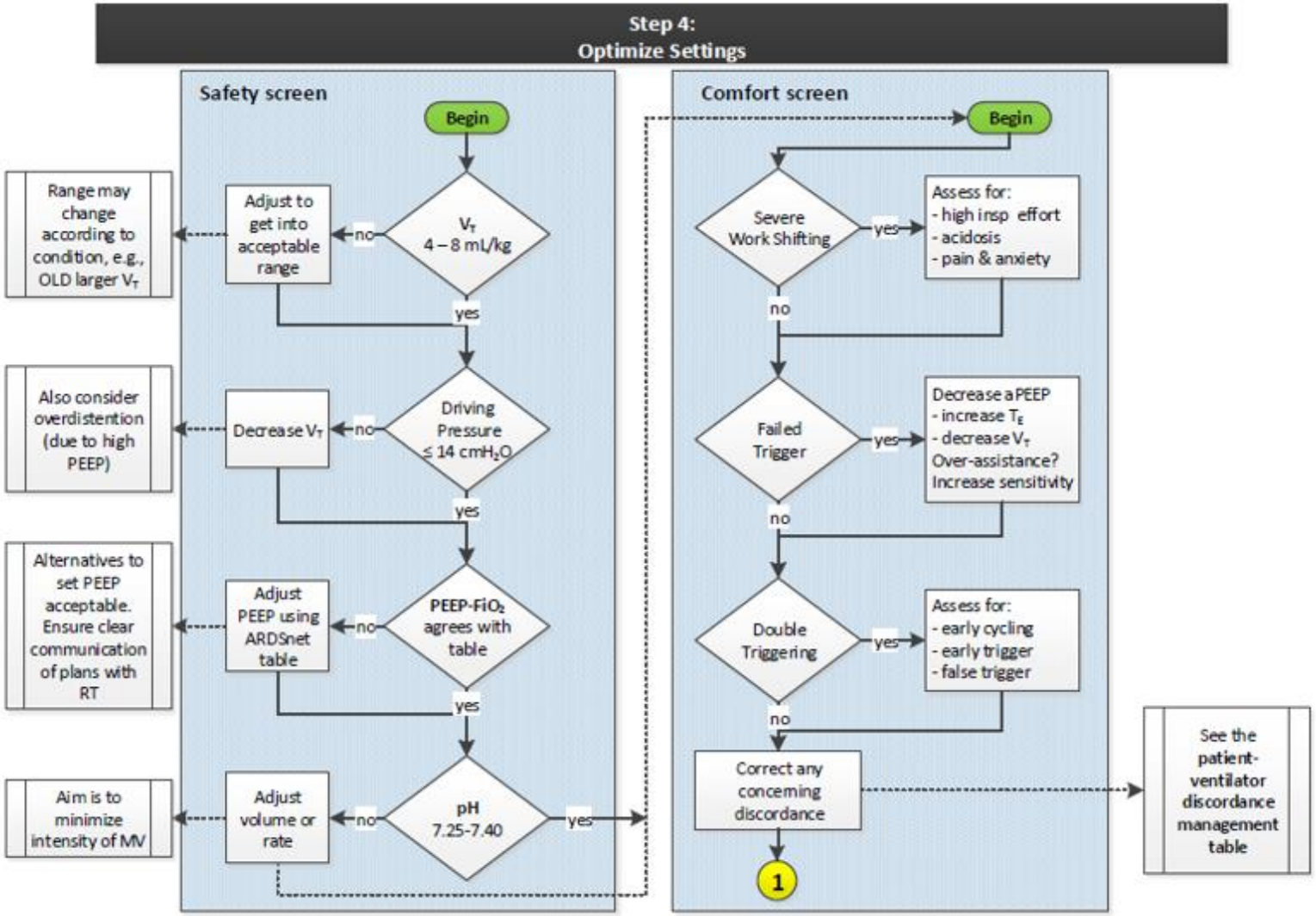
		TAG	Safety				Com.		Lib.		TOTAL SCORE
C6	INTELLiVENT Adaptive Support Ventilation	PC-IMV(3)oi,oi	A	B	C	D	E		G	H	7
C6	Adaptive Support Ventilation	PC-IMV(3)oi,oi	A	B	C	D	E				5
Servo	Automode (PRVC to VS)	PC-IMV(2)a,a	A	B			E				3
Servo	Automode (VC-FlowAdapt to VS)	VC-IMV(2)d,da	A	B			E				3
Servo	Automode (VC-Square/Ramp to VS)	VC-IMV(2)s,a	A	B			E				3
C6	APVsimv	PC-IMV(1)a,s	A	B							2
C6	APVcmv	PC-CMVa	A	B							2
C6	SIMV	VC-IMV(1)s,s	A	B							2
C6	(S)CMV	VC-CMVs	A	B							2
Servo	SIMV (VC-FlowAdapt)	VC-IMV(4)d,ds	A	B							2
Servo	Volume Control (FlowAdapt)	VC-IMV(4)d,d	A	B							2
C6	P-SIMV with Psync	PC-IMV(2)s,s		B			E				2
PB980	Spont Volume Support	PC-CSVa	A				E				2
PB980	SPONT Proportional Assist	PC-CSVr					E	F			2
C6	Duo Positive Airway Pressure	PC-IMV(1)s,s		B							1
C6	PCV +	PC-CMVs		B							1
C6	SPONT	PC-CSVs					E				1



Which Mode to Choose - Flowchart



Mode Settings Adjustment



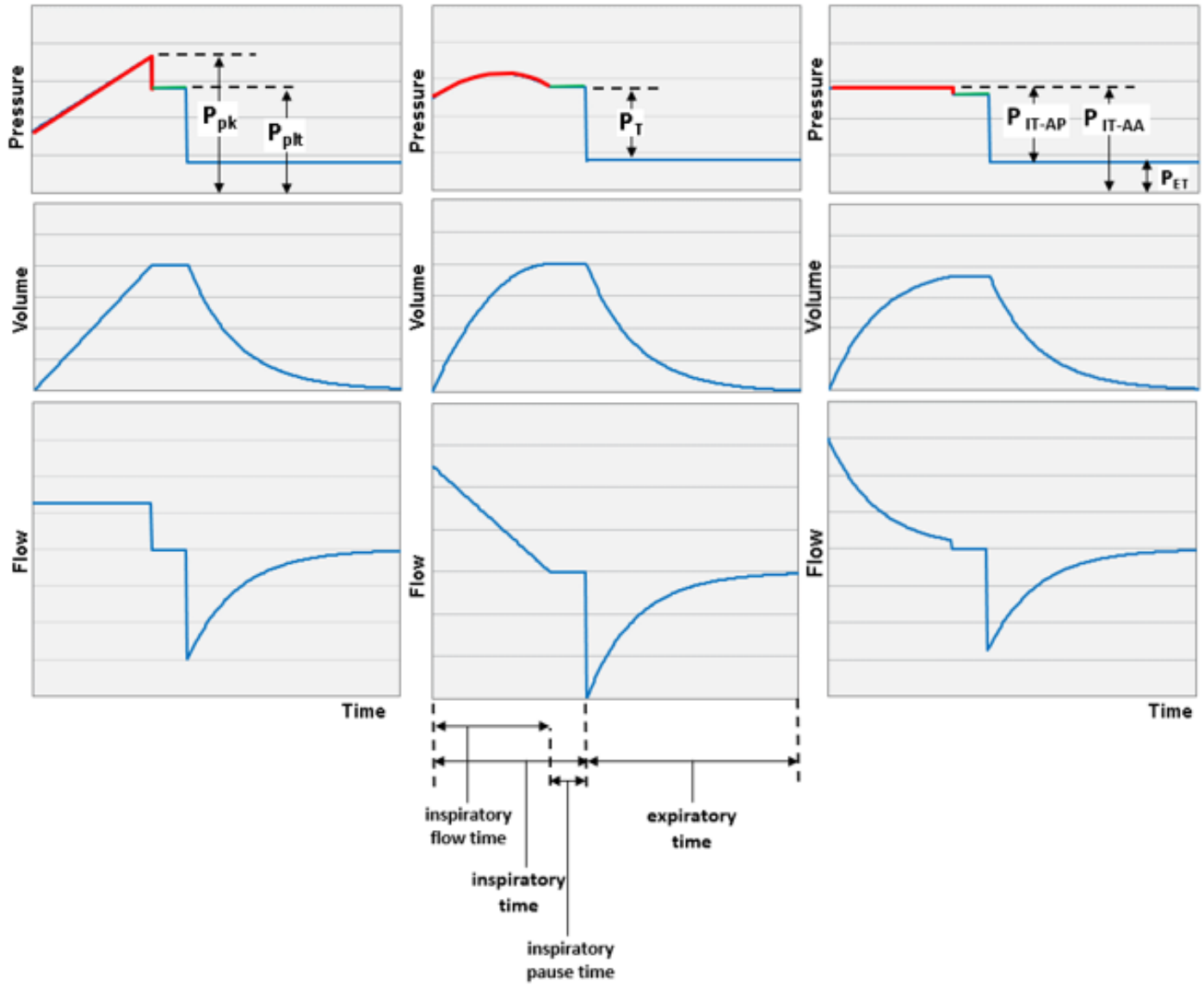
Waveform Analysis

Know the Lingo

Taxonomy for patient-ventilator interactions and method for reading waveform

P_{IT-AP} = inspiratory pressure target above PEEP
P_{IT-AA} = inspiratory pressure target above atmospheric pressure
P_{ET} = expiratory pressure target (PEEP)
P_{pk} = peak airway pressure
P_{plt} = plateau pressure
P_T = tidal pressure (aka, driving pressure)

inflation pressure
pause pressure
inspiratory pressure
expiratory pressure
airway pressure



Key Terms

- **total-PEEP**
  - Static end-expiratory pressure above atmospheric pressure
    - during expiratory hold maneuver
- **auto-PEEP or intrinsic PEEP**
  - Static end-expiratory pressure above set PEEP
    - during expiratory hold maneuver
- **Plateau Pressure**
  - Static end-inspiratory pressure above atmospheric pressure
    - during inspiratory hold maneuver
- **Tidal Pressure or Driving Pressure (**$E \times V_T$**)**
  - Static end-inspiratory pressure above total PEEP
    - during inspiratory hold maneuver

Key Terms

- **Work Shifting**
  - ***Any P_{mus} > 0 results in some work shifting***
    - work by vent is shifted to patient
  - ***If P_{vent} > 0 then work shifting may be acceptable***
    - P_{aw} > PEEP
  - ***If P_{vent} < 0 (VC modes) work shifting is inappropriate***
    - P_{aw} < PEEP
    - This is also called flow starvation
    - No mode or setting can fix this
    - May need to sedate and paralyze

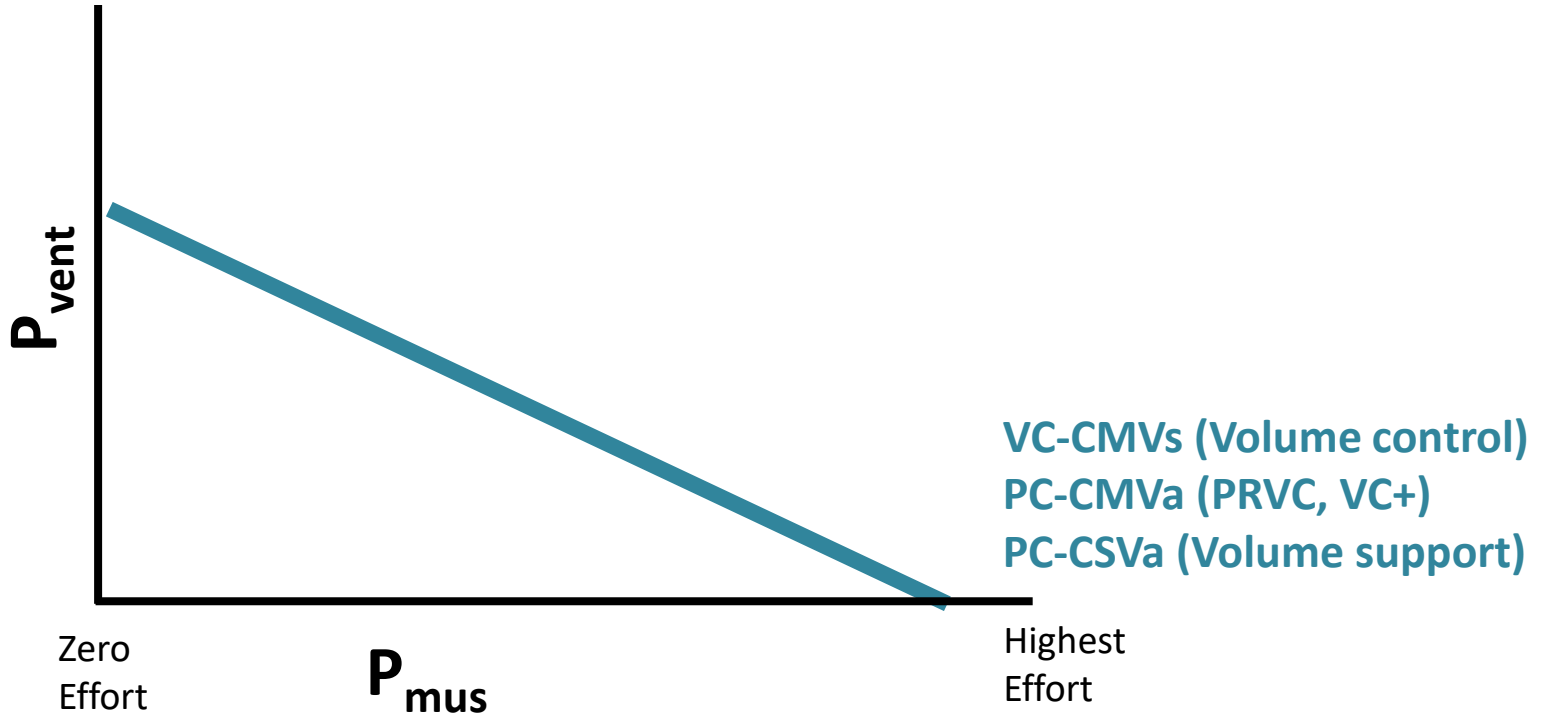
Key Terms

- **Patient-Ventilator Synchrony Monitoring**
  - P_{mus} is the reference signal
  - P_{mus} surrogates
    - esophageal pressure, P_{es}
    - diaphragmatic electromyogram, Edi

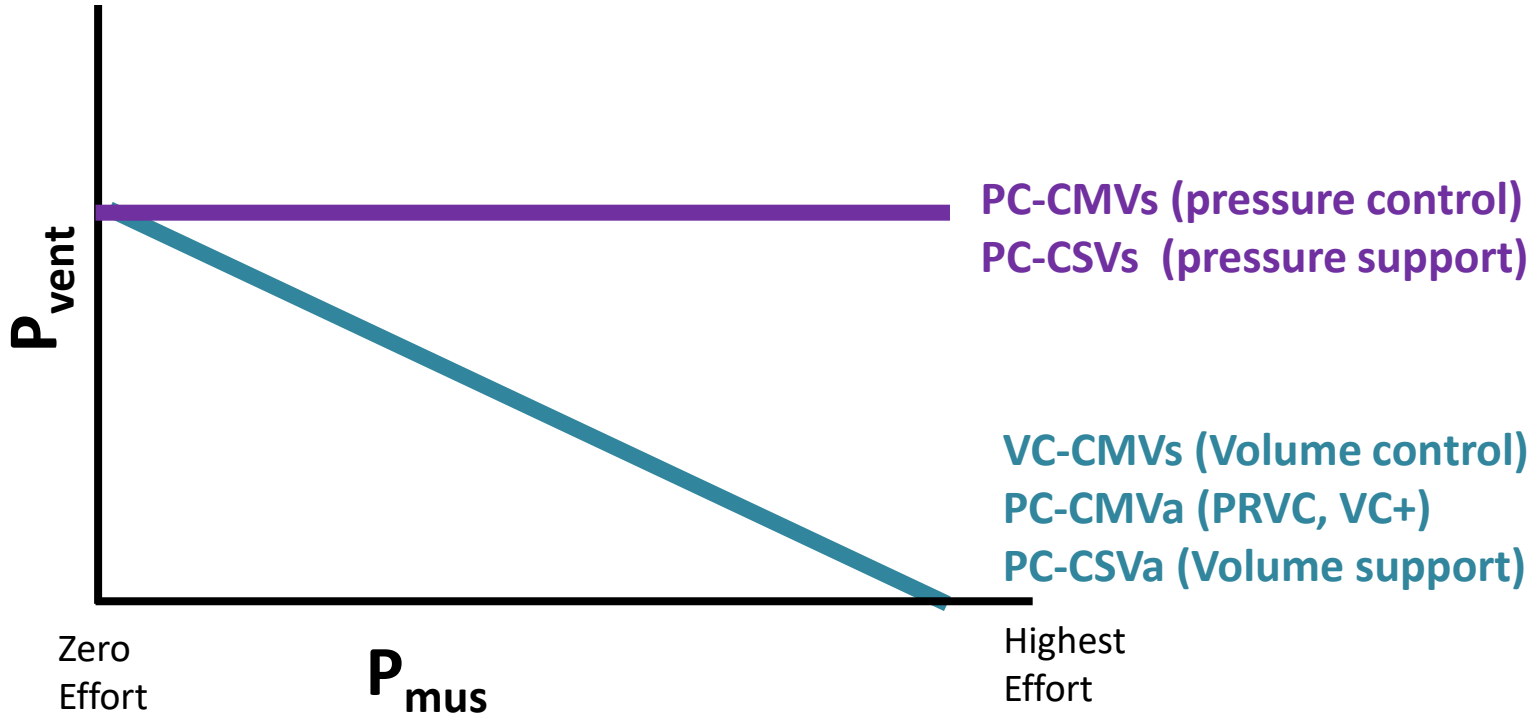
Key Terms

- **Synchrony**
  - P_{vent} and P_{mus} start and end at the same time
  - P_{mus} is the reference signal
- **Asynchrony**
  - Absence of one signal (P_{vent} or P_{mus})
    - Failed trigger: P_{mus} without P_{vent}
    - False trigger: P_{vent} without P_{mus}
- **Dyssynchrony**
  - P_{vent} and P_{mus} start and end at different times
    - Early trigger or cycle: P_{vent} before P_{mus}
    - Late trigger or cycle: P_{vent} after P_{mus}

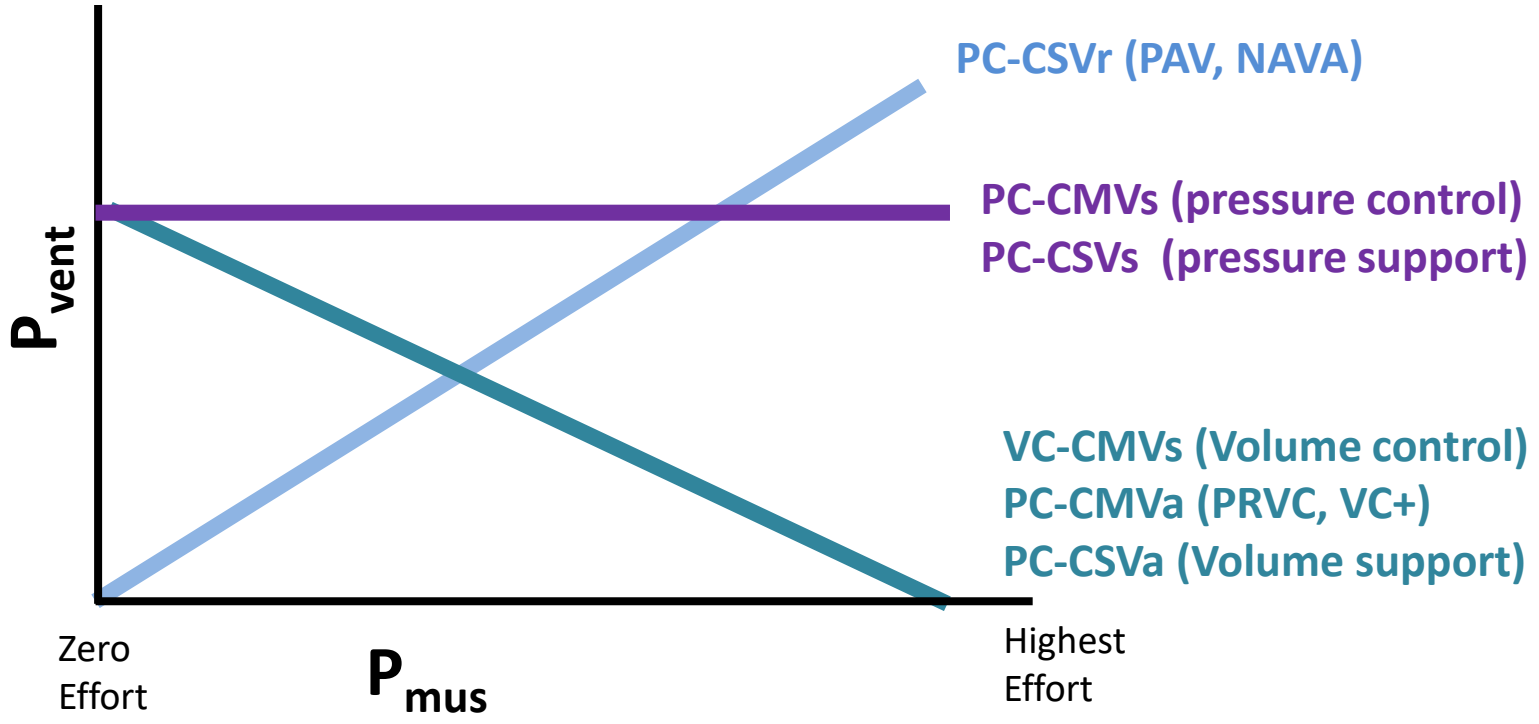
Work Shifting



Work Shifting

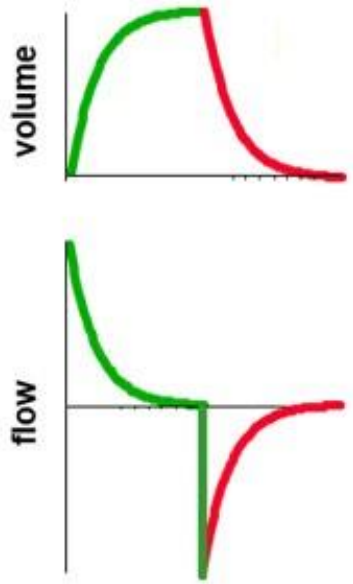


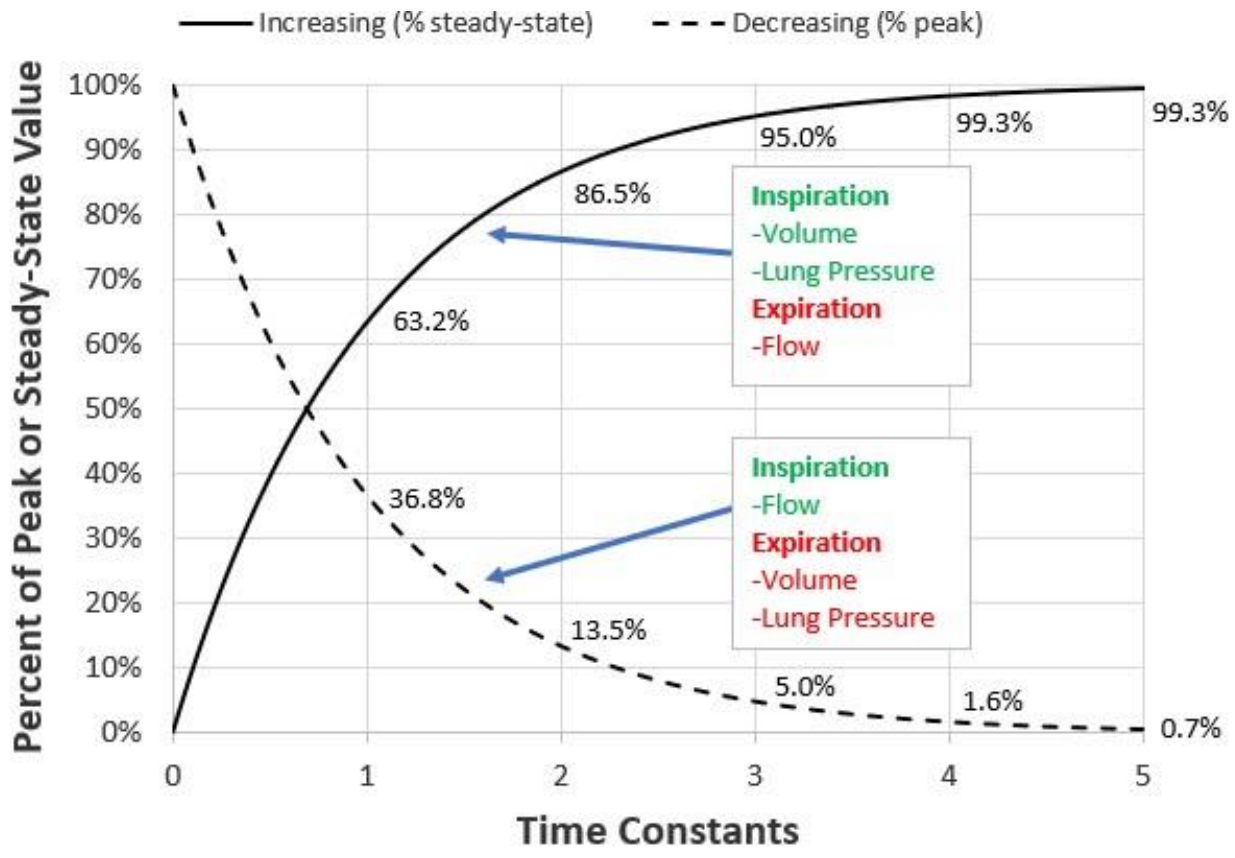
Work Shifting



Time Constant

- **Time Constant = Resistance x Compliance** (units: seconds)
  - time to change 63%





Basic
Waveform Interpretation
Standardized Procedure

Taxonomy for patient-ventilator interactions and
method for reading waveform

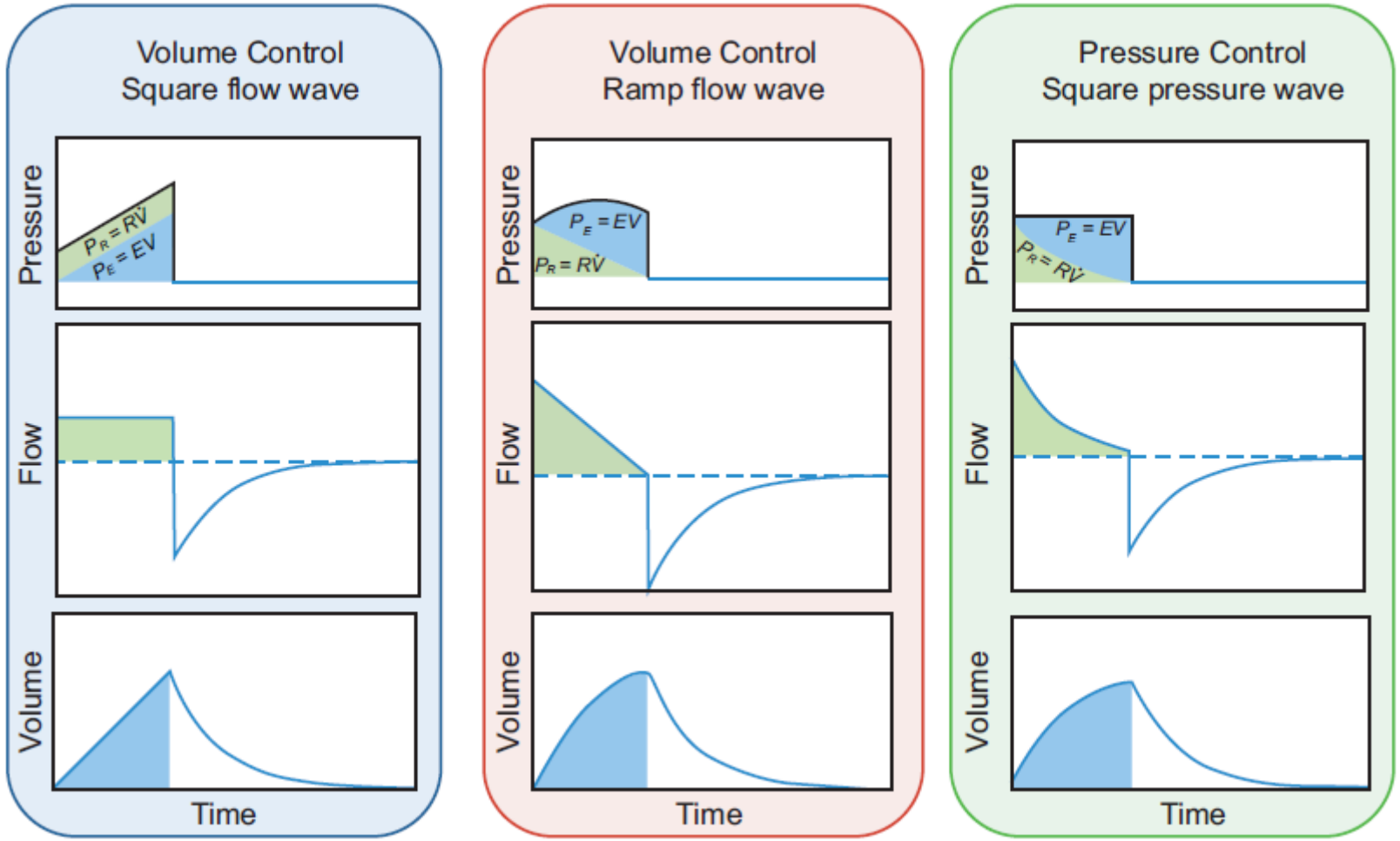
Step 1 – Define the TAG

Standardized Ventilator Waveform Analysis

1. **Define the TAG**

- ☐ PC-CMVs
- ☐ PC-CMVa
- ☐ VC-CMVs
- ☐ VC-CMVd
- ☐ PC-CSVs
- ☐ PC-IMVa,a
- ☐ PC-CSVa
- ☐ PC-CSVr
- ☐ VC-IMVs,s
- ☐ VC-IMVd,d
- ☐ PC-IMVs,s
- ☐ Other_____

Ideal Waveforms



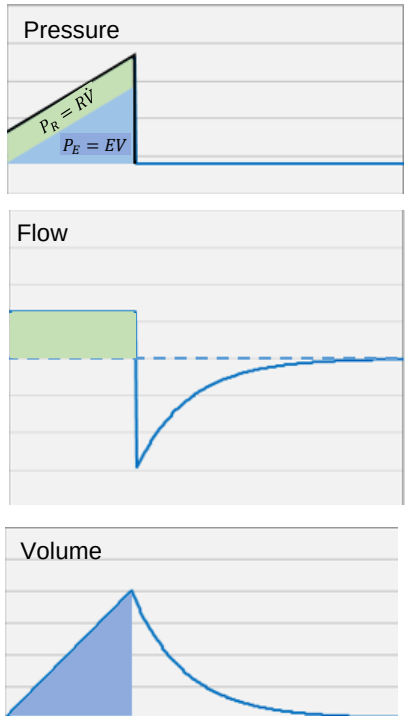
Step 2 – Define the Load

2. Define the load

Inspiration	Expiration
☐ Elastic load	☐ Elastic load
☐ Resistive load	☐ Resistive load
☐ P_{mus}	☐ P_{mus}

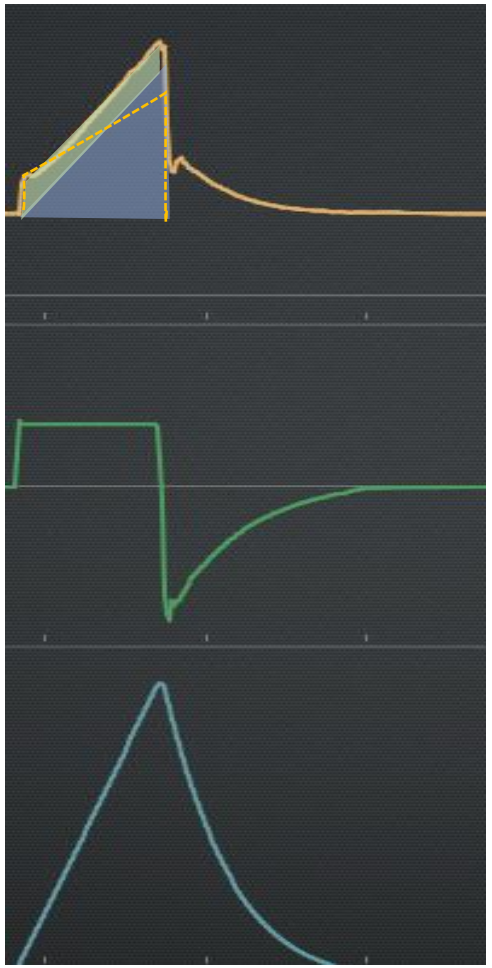
Effects of Increased Loads

Volume Control
Square flow wave

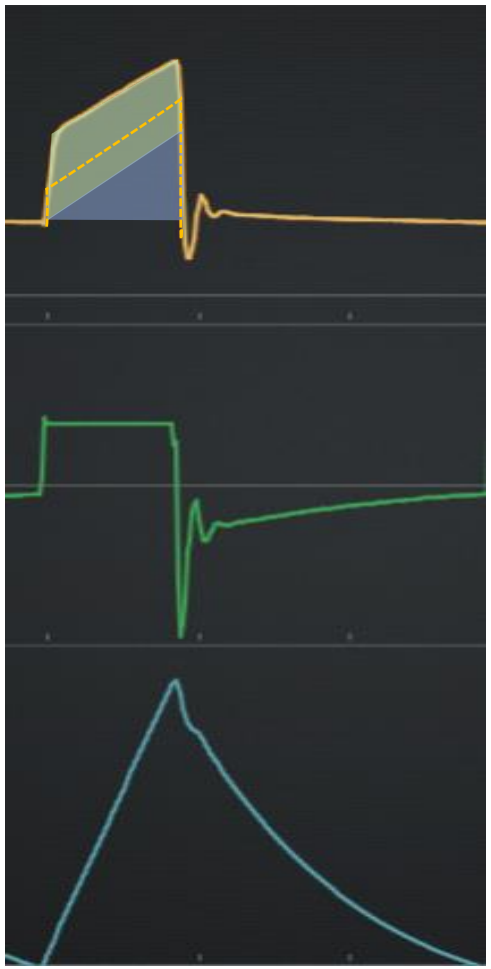


$$P_{vent} = EV + R\dot{V}$$
$$= P_R + P_E$$

Increased Elastic Load

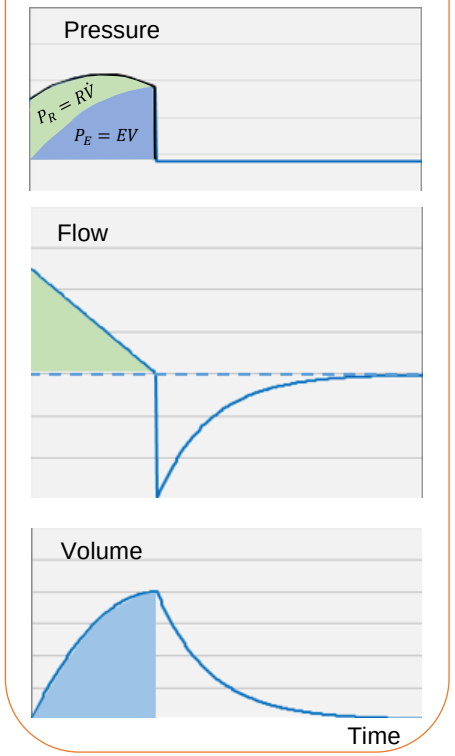


Increased Resistive Load



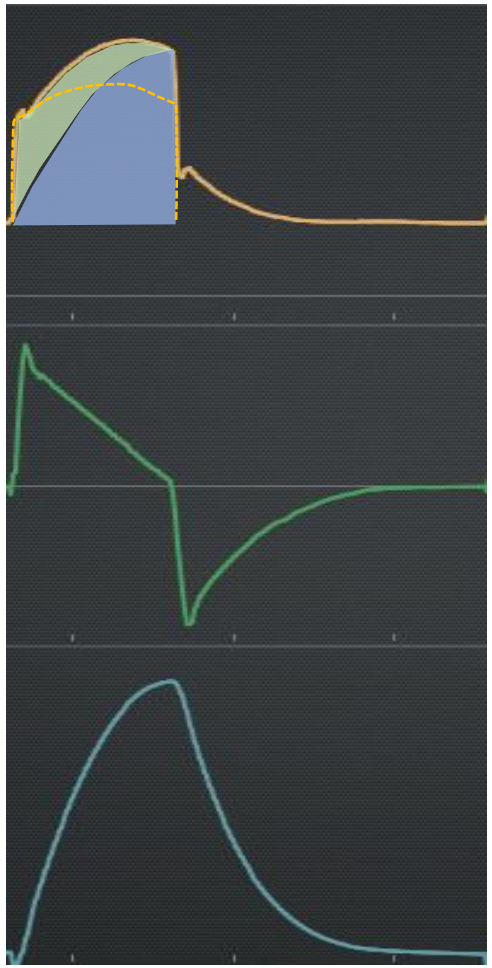
Effects of Increased Loads

Volume Control
Ramp flow wave

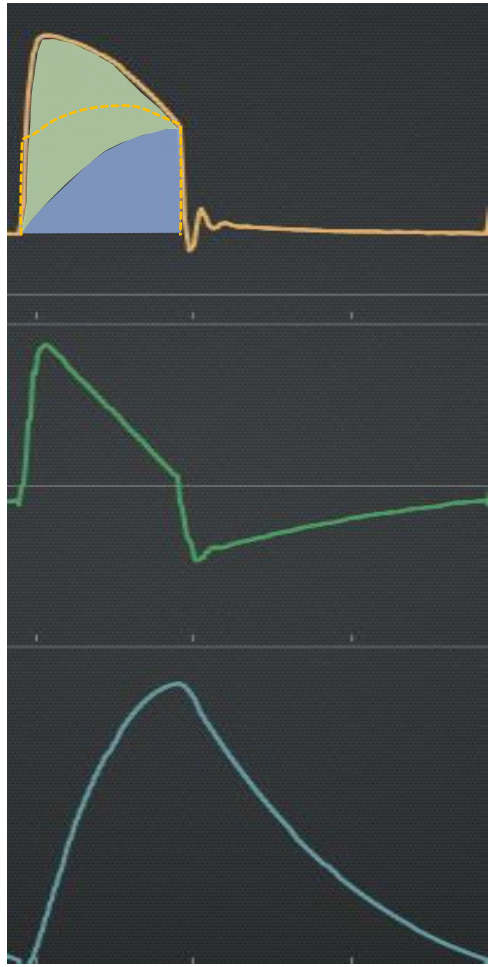


$$P_{vent} = EV + R\dot{V}$$
$$= P_R + P_E$$

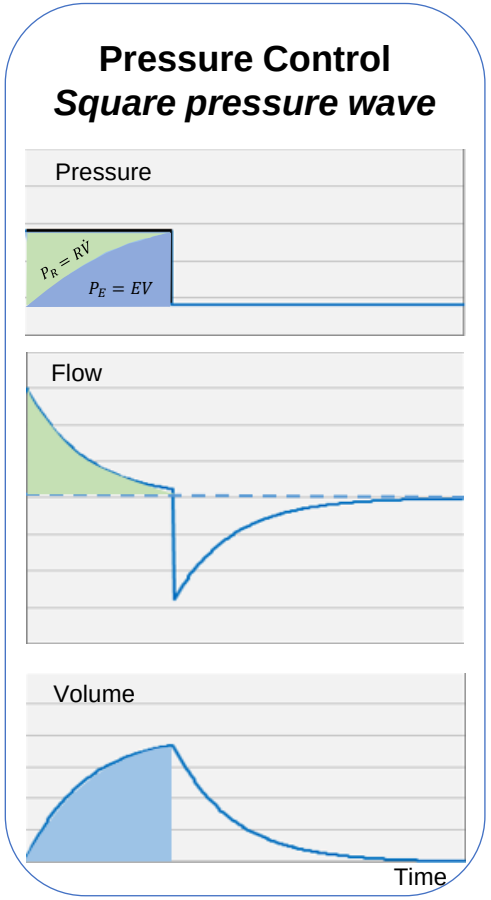
Increased Elastic Load



Increased Resistive Load

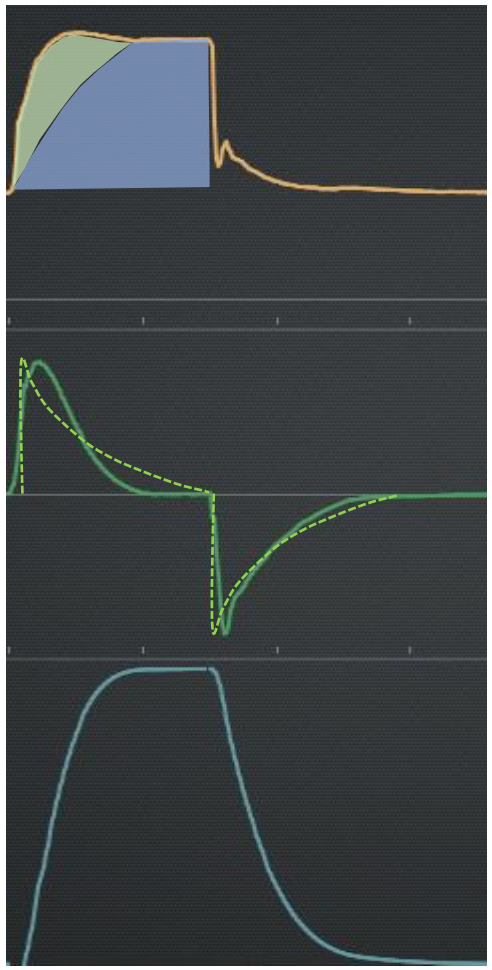


Effects of Increased Loads

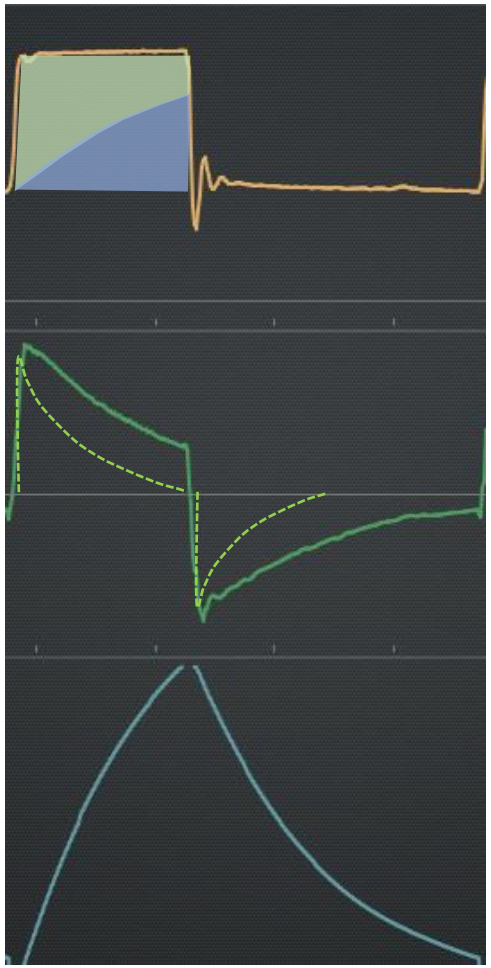


$$P_{vent} = EV + R\dot{V}$$
$$= P_R + P_E$$

Increased Elastic Load

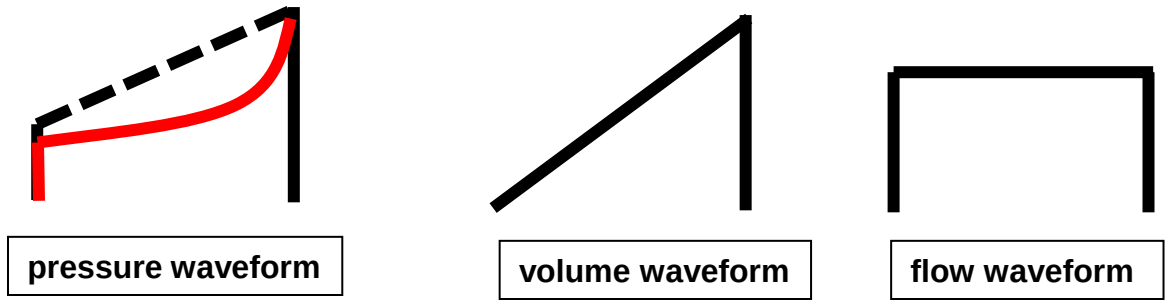


Increased Resistive Load



Effects of Insipratory Effort (P_{mus})

$$P_{vent} + P_{mus} = E \times V + R \times \dot{V}$$

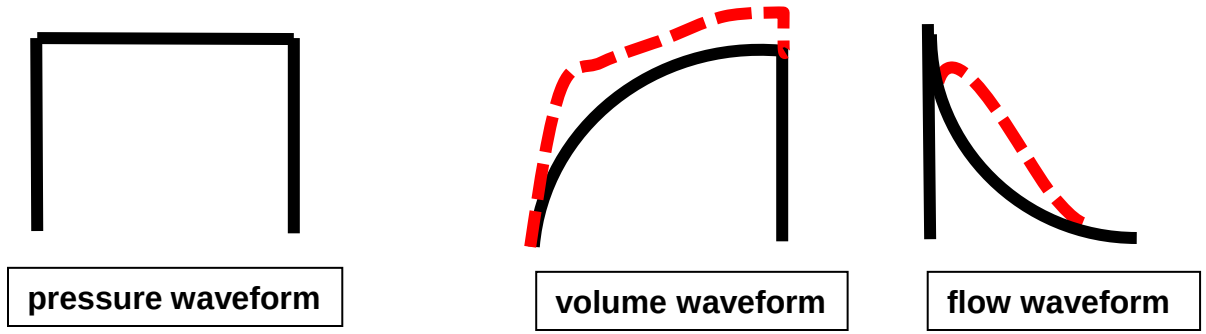


Volume Control

this side preset

Effects of Insipratory Effort (P_{mus})

$$P_{vent} + P_{mus} = E \times V + R \times \dot{V}$$



Pressure Control

this side preset

Step 3 – Define the PVI

3. Define Patient-Ventilator Interaction

Trigger

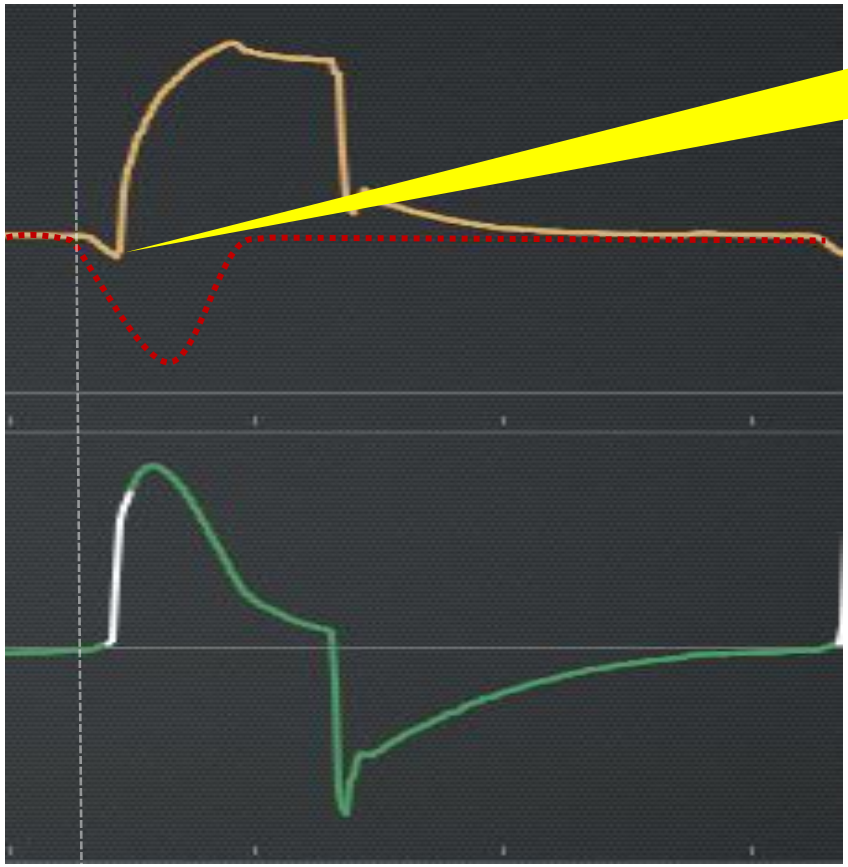
- ☐ Normal
- ☐ Early
- ☐ Late
- ☐ False
- ☐ Failed

Trigger Synchrony - Normal

Pressure

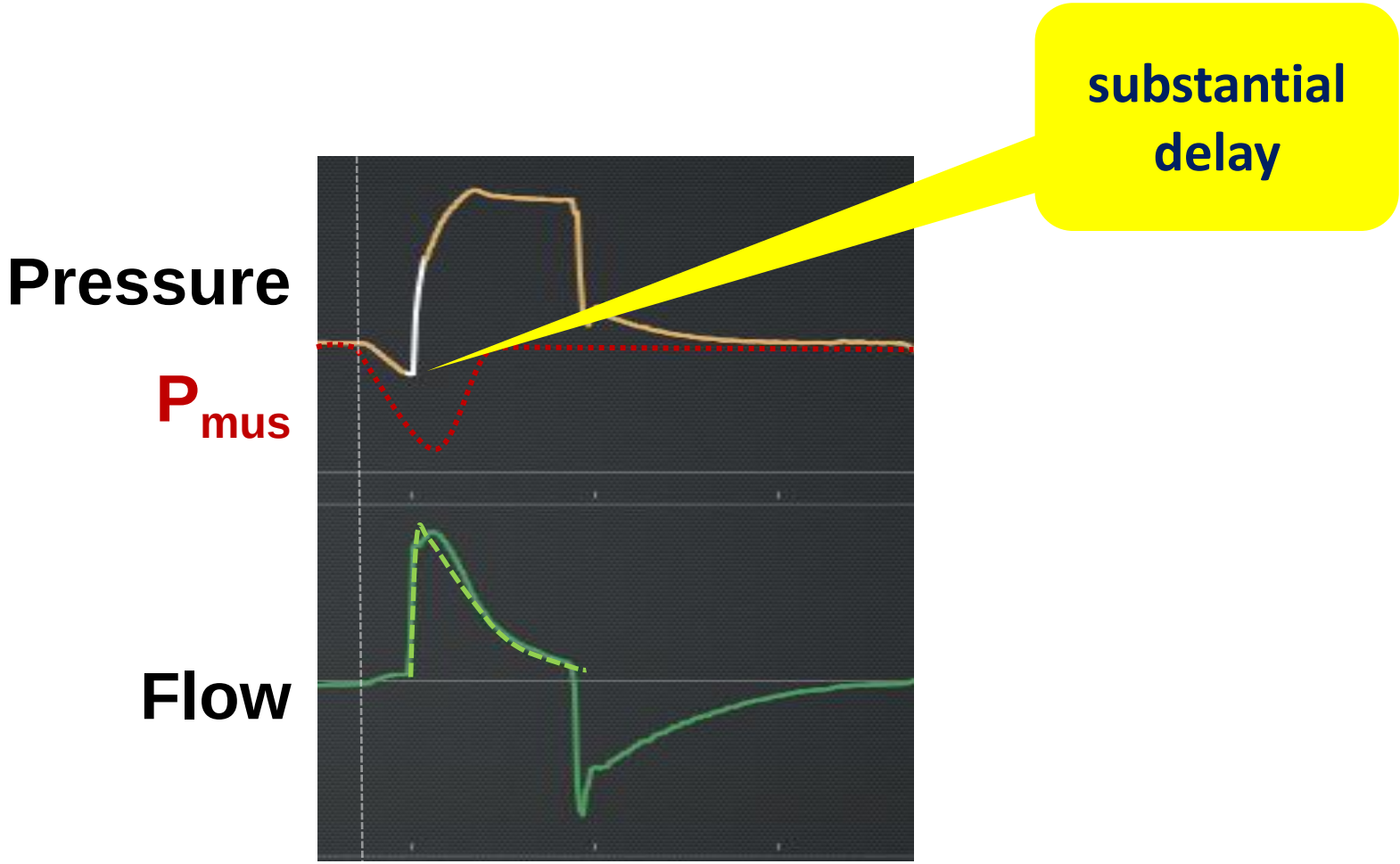
P_{mus}

Flow



flow starts shortly after effort starts

Trigger Synchrony - Late

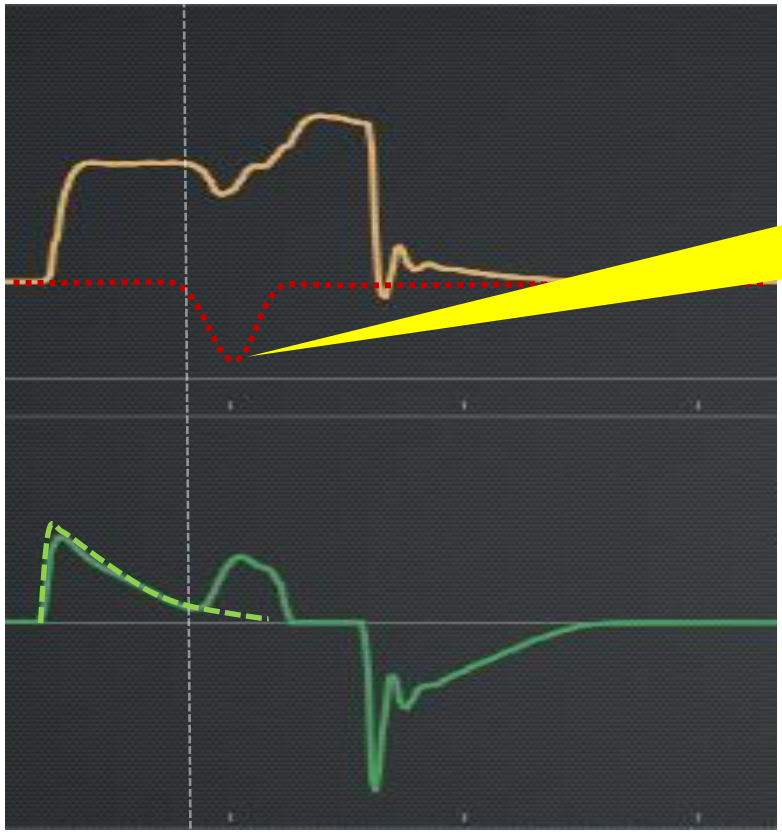


Trigger Synchrony – Early (aka reverse trigger)

Pressure

P_{mus}

Flow

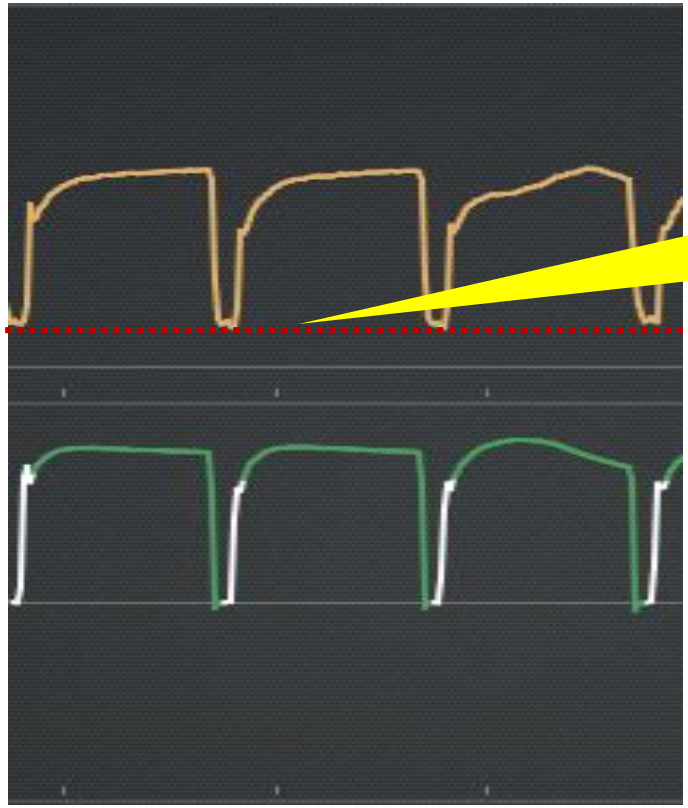


patient effort after machine trigger

Trigger Synchrony - False

Pressure

P_{mus}



Flow

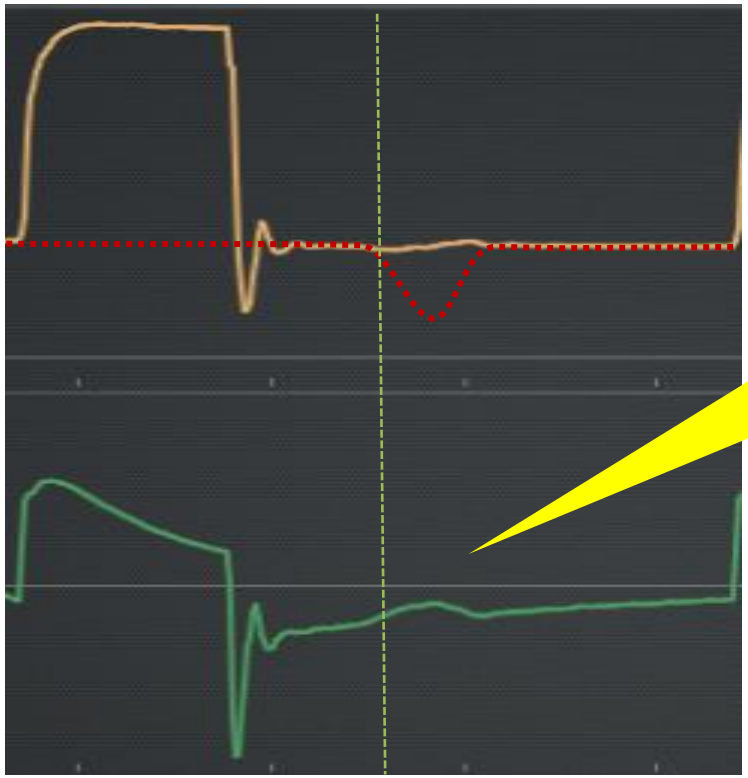
no patient effort
no expiratory flow
LARGE LEAK

Trigger Synchrony - Failed

Pressure

P_{mus}

Flow



patient effort
not large enough
to get flow to cross zero

Step 3 – Define the PVI

3. Define Patient-Ventilator Interaction

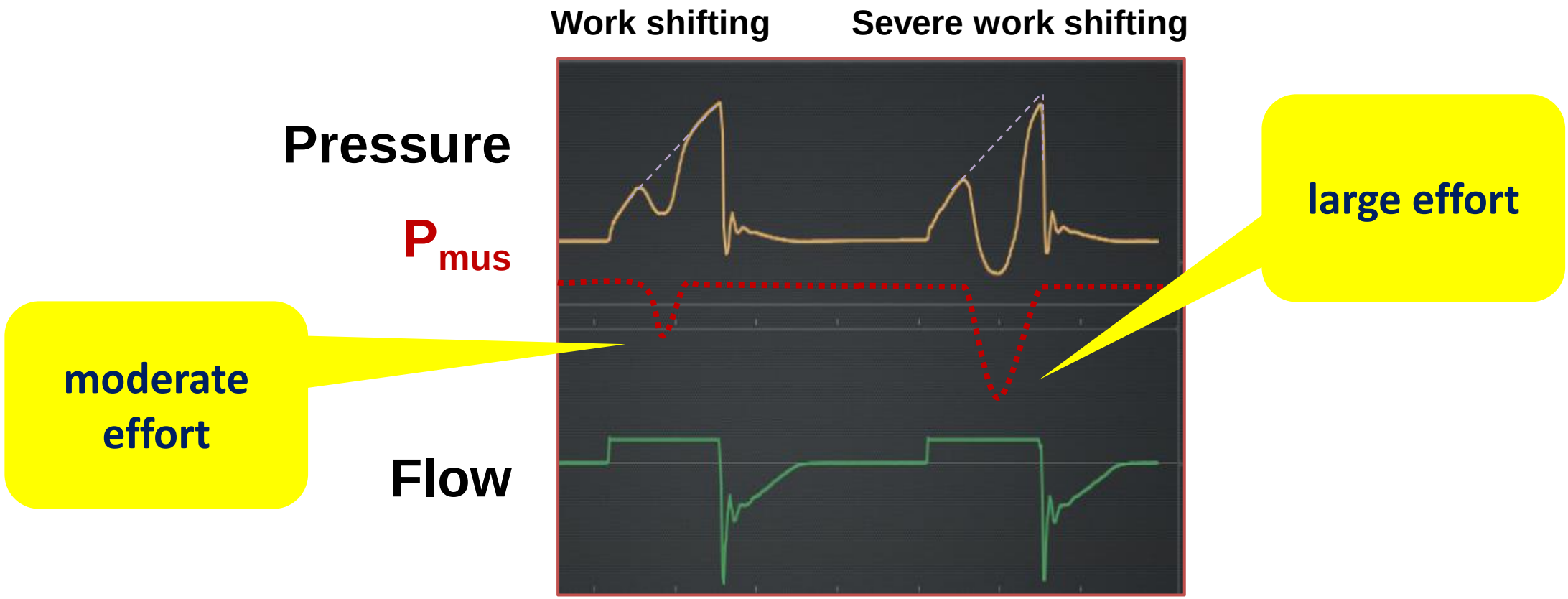
Trigger

- ☐ Normal
- ☐ Early
- ☐ Late
- ☐ False
- ☐ Failed

Inspiration

- ☐ Normal
- ☐ Work shifting
- ☐ Work shifting, severe

Work Shifting in Volume Control

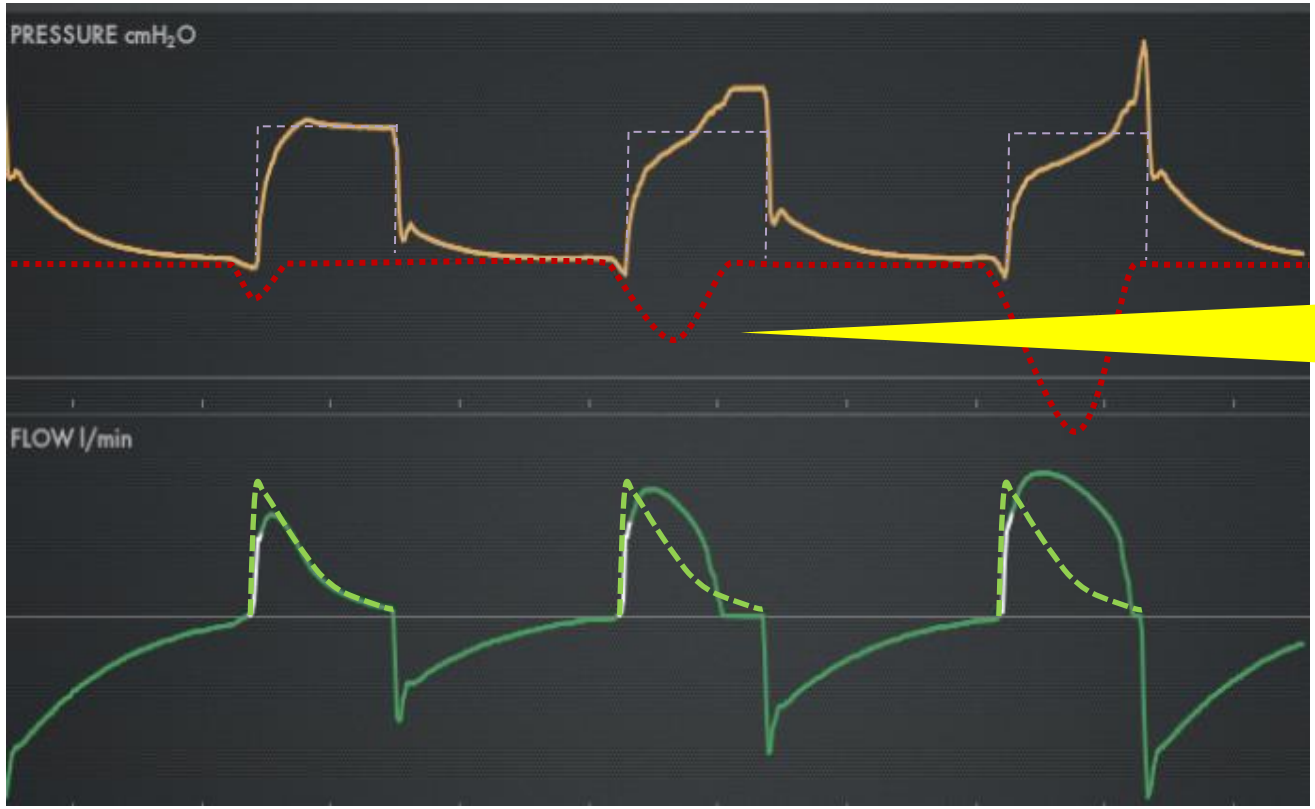


Work Shifting in Pressure Control

Pressure

P_{mus}

Flow



increasing effort

Step 3 – Define the PVI

3. Define Patient-Ventilator Interaction

Trigger

- ☐ Normal
- ☐ Early
- ☐ Late
- ☐ False
- ☐ Failed

Cycle

- ☐ Normal
- ☐ Early
- ☐ Late

Inspiration

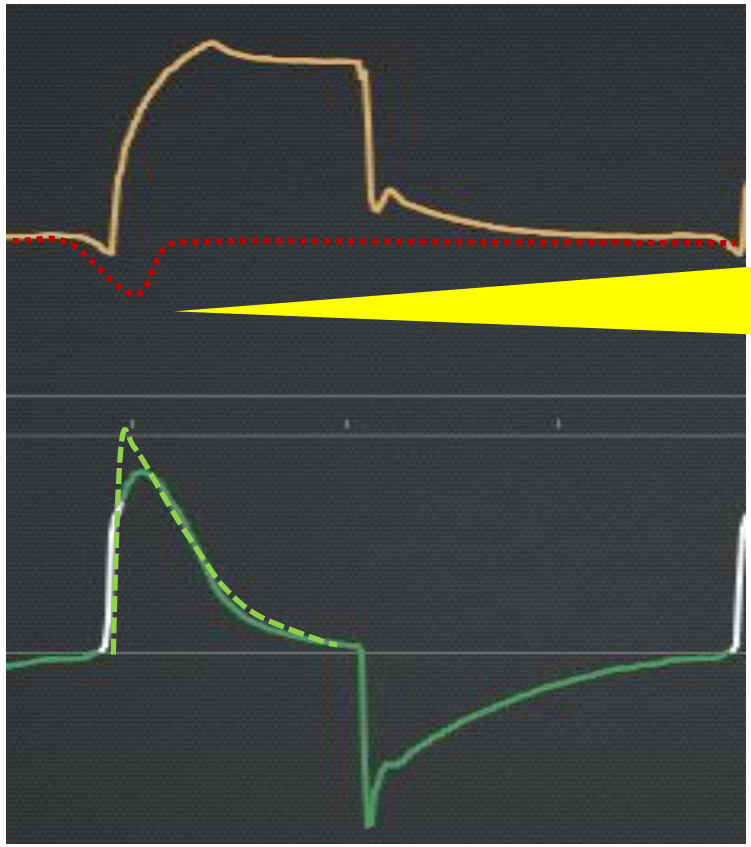
- ☐ Normal
- ☐ Work shifting
- ☐ Work shifting, severe

Cycle Synchrony - Normal

Pressure

P_{mus}

Flow



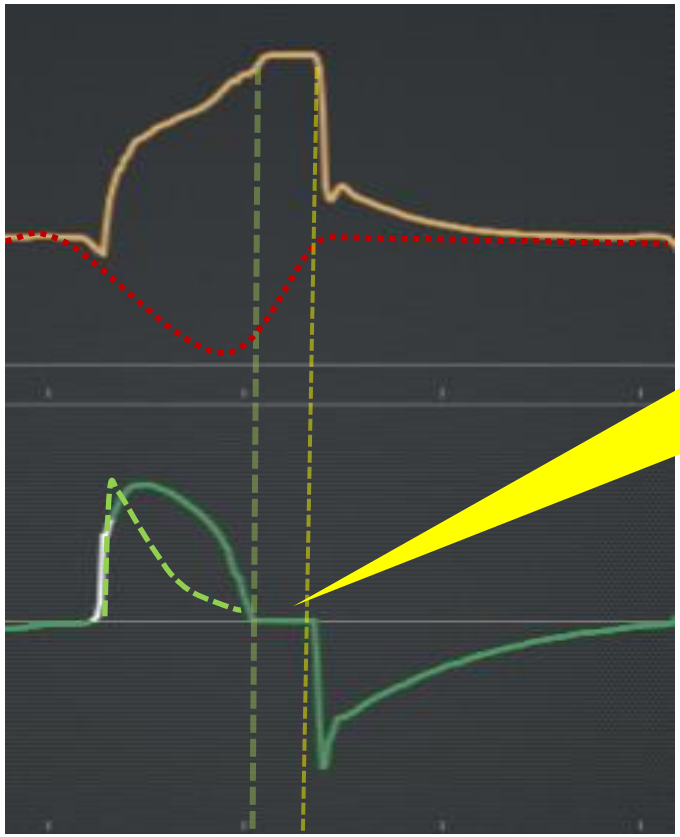
just enough
effort
to trigger breath

Cycle Synchrony - Late

Pressure

P_{mus}

Flow



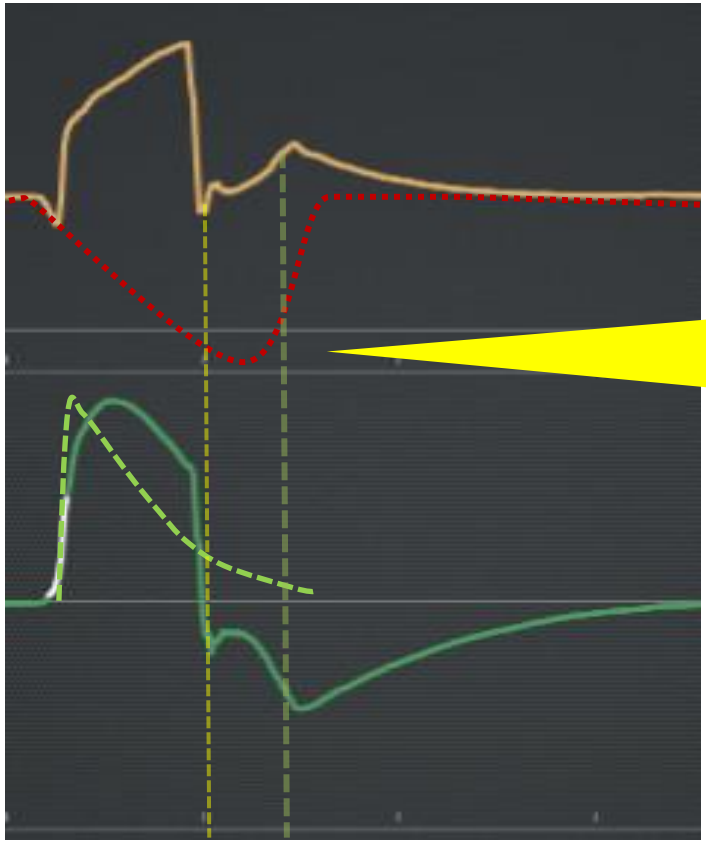
inspiratory time continues after patient effort stops

Cycle Synchrony – Early

Pressure

P_{mus}

Flow



patient effort continues after inspiration cycles off

Step 3 – Define the PVI

3. Define Patient-Ventilator Interaction

Trigger

- ☐ Normal
- ☐ Early
- ☐ Late
- ☐ False
- ☐ Failed

Inspiration

- ☐ Normal
- ☐ Work shifting
- ☐ Work shifting, severe

Cycle

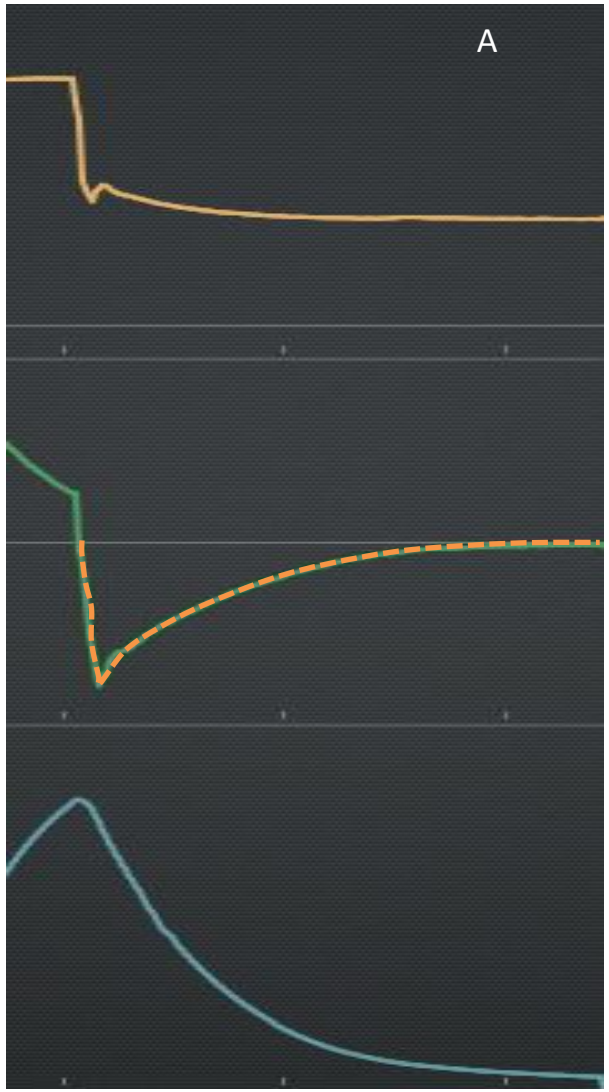
- ☐ Normal
- ☐ Early
- ☐ Late

Expiration

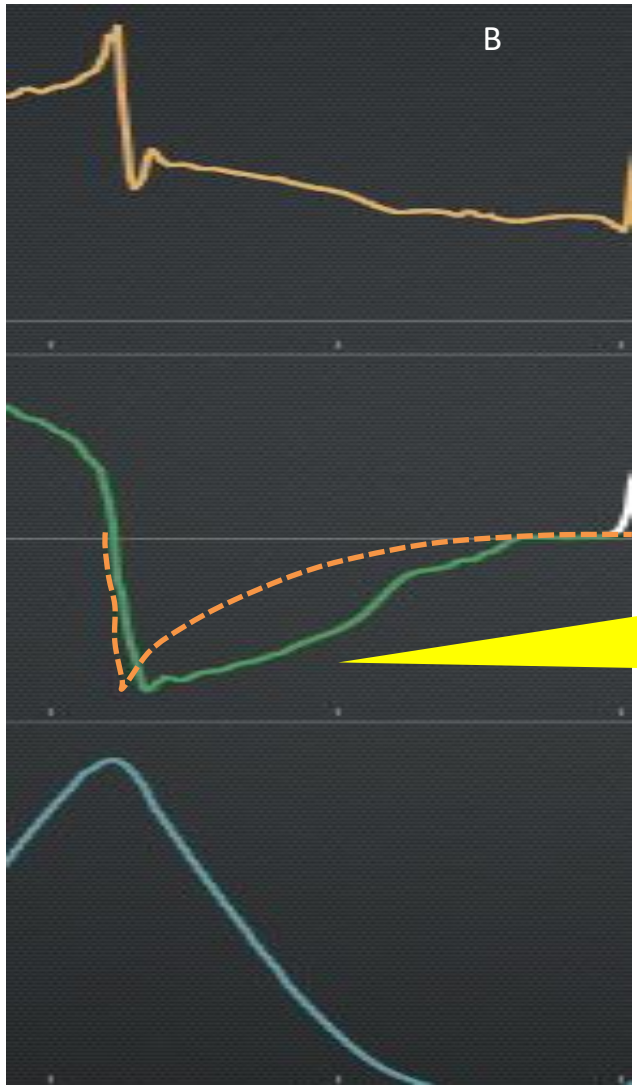
- ☐ Normal
- ☐ Expiratory work

Expiratory Work

Passive, normal load



P_{mus} present, exp work



distorted expiratory flow

Step 4 – Recommend Interventions

4. Interventions

What is the main goal (choose one only)?

☐ Safety ☐ Comfort ☐ Liberation.

☐ Adjusted Settings: which?_____

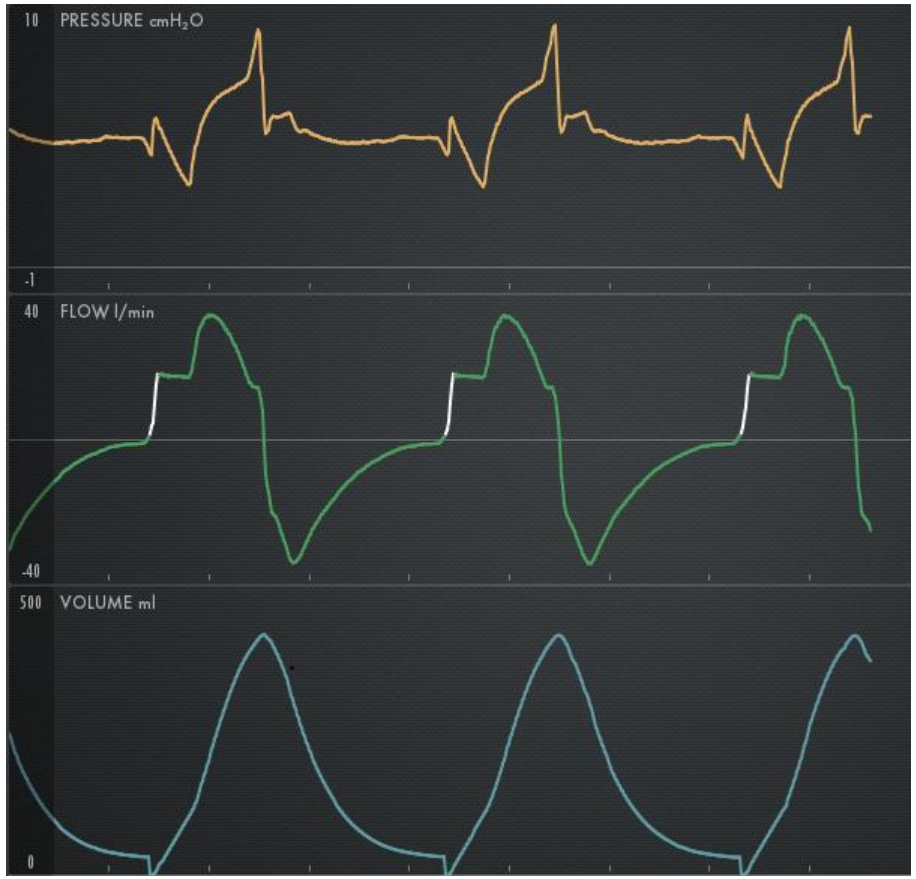
☐ Changed mode: To what?_____

☐ None

☐ Other_____

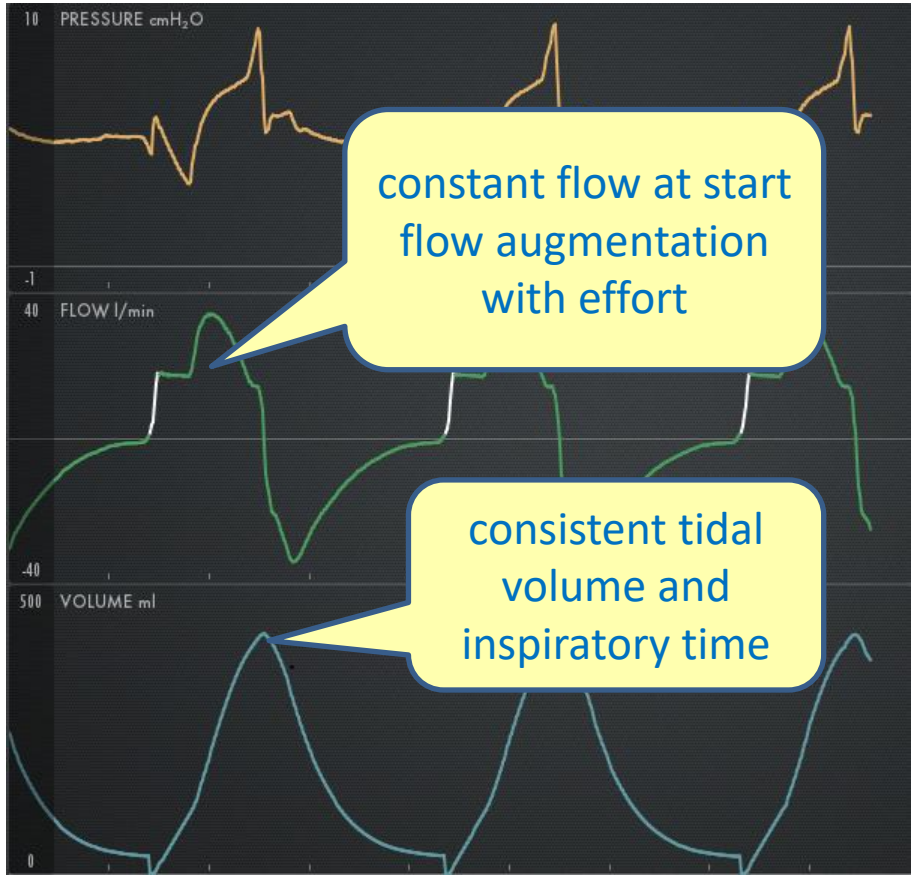
Example

1. **What is the mode TAG**



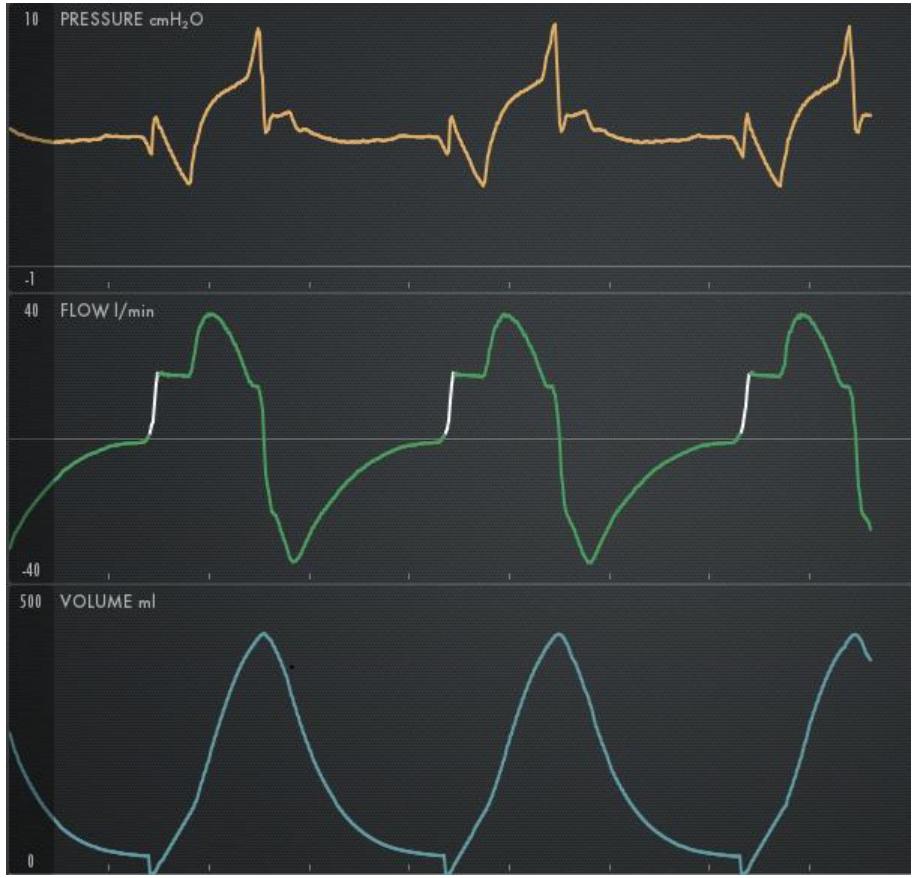
Example

1. **What is the mode TAG**
   - VC-CMVd



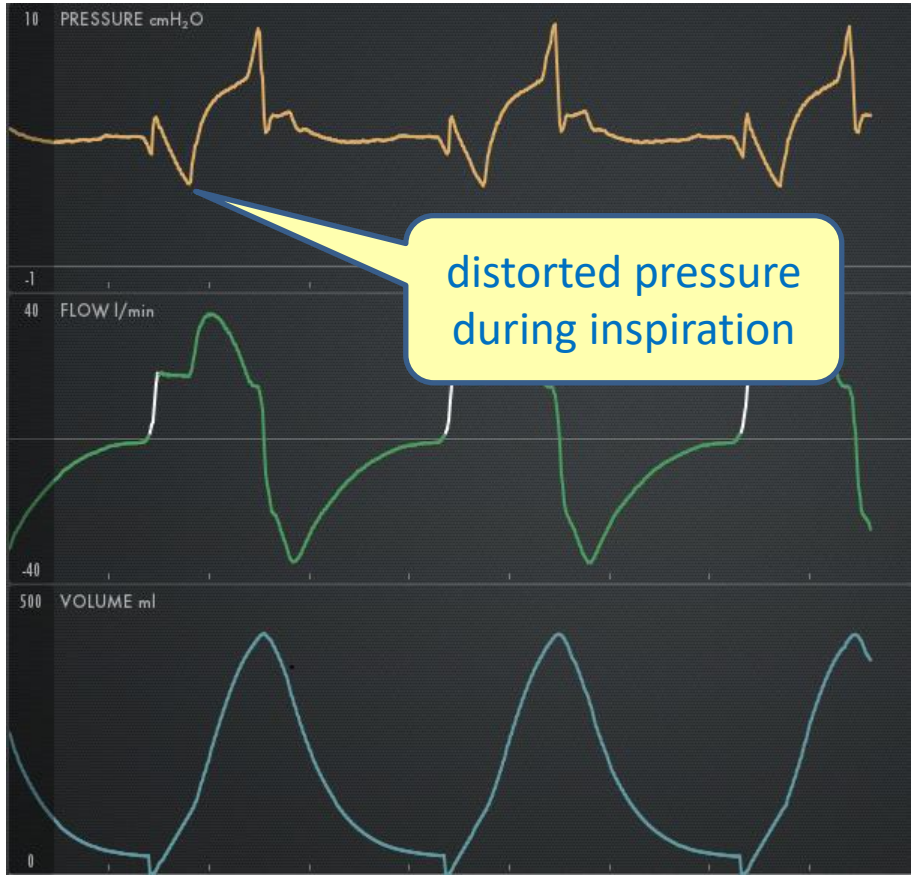
Example

1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**



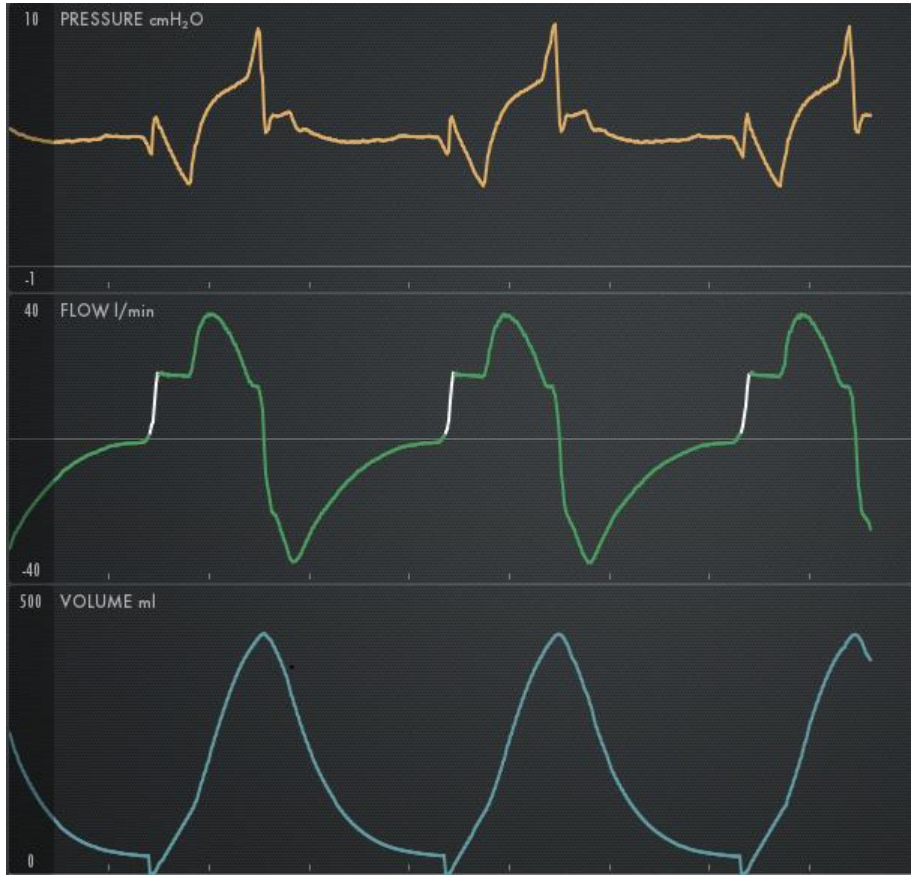
Example

1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**
   - Inspiratory Pmus



Example

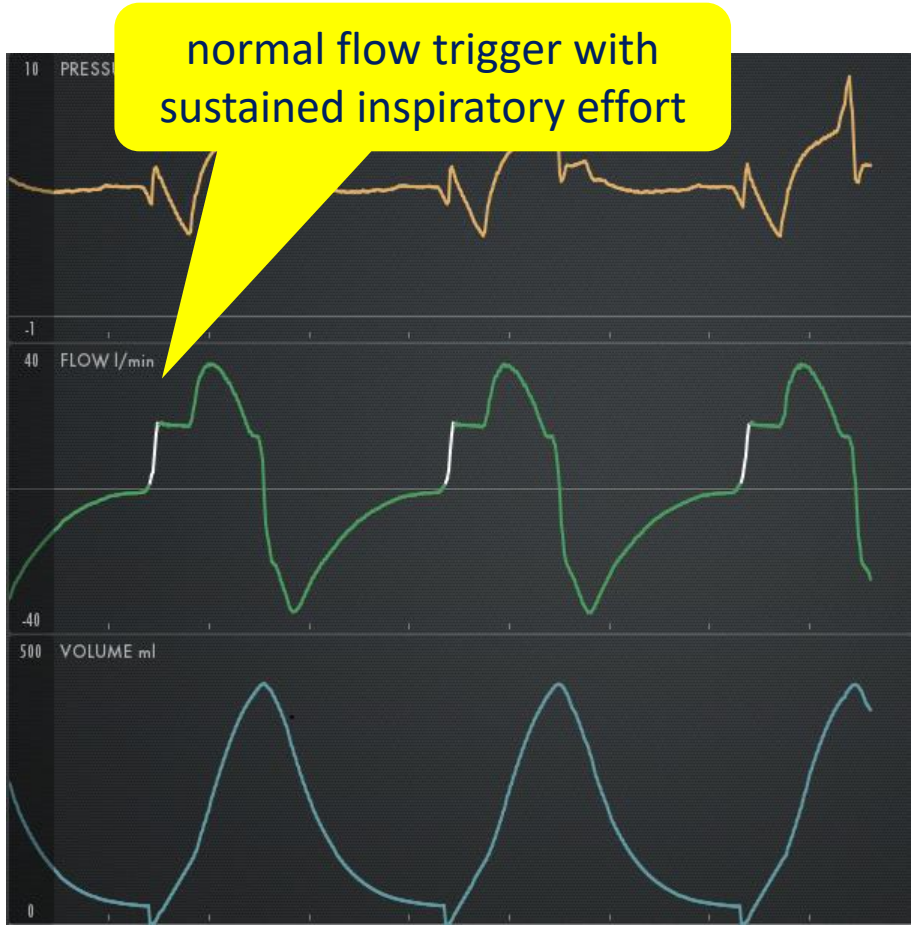
1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**
   - Inspiratory Pmus
3. **What is the patient-ventilator interaction status**



Example

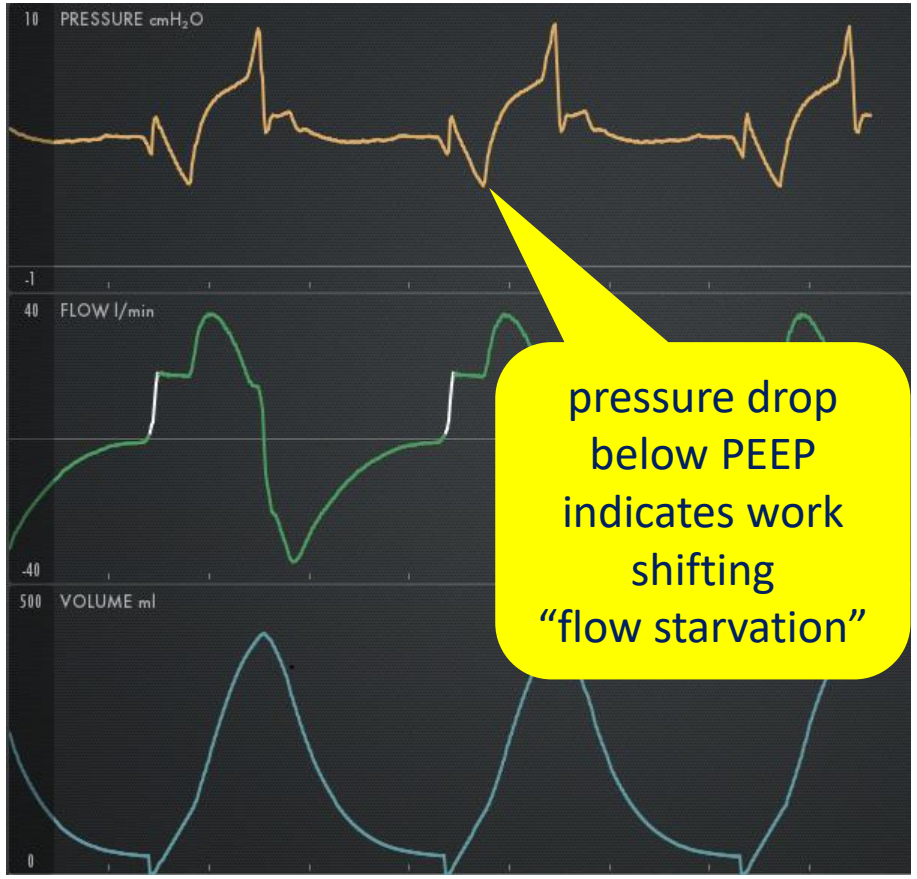
1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**
   - Inspiratory Pmus
3. **What is the patient-ventilator interaction status**

   A. Trigger: normal flow trigger



Example

1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**
   - Inspiratory Pmus
3. **What is the patient-ventilator interaction status**
   A. Trigger: normal flow trigger
   B. Inspiratory phase: work shifting



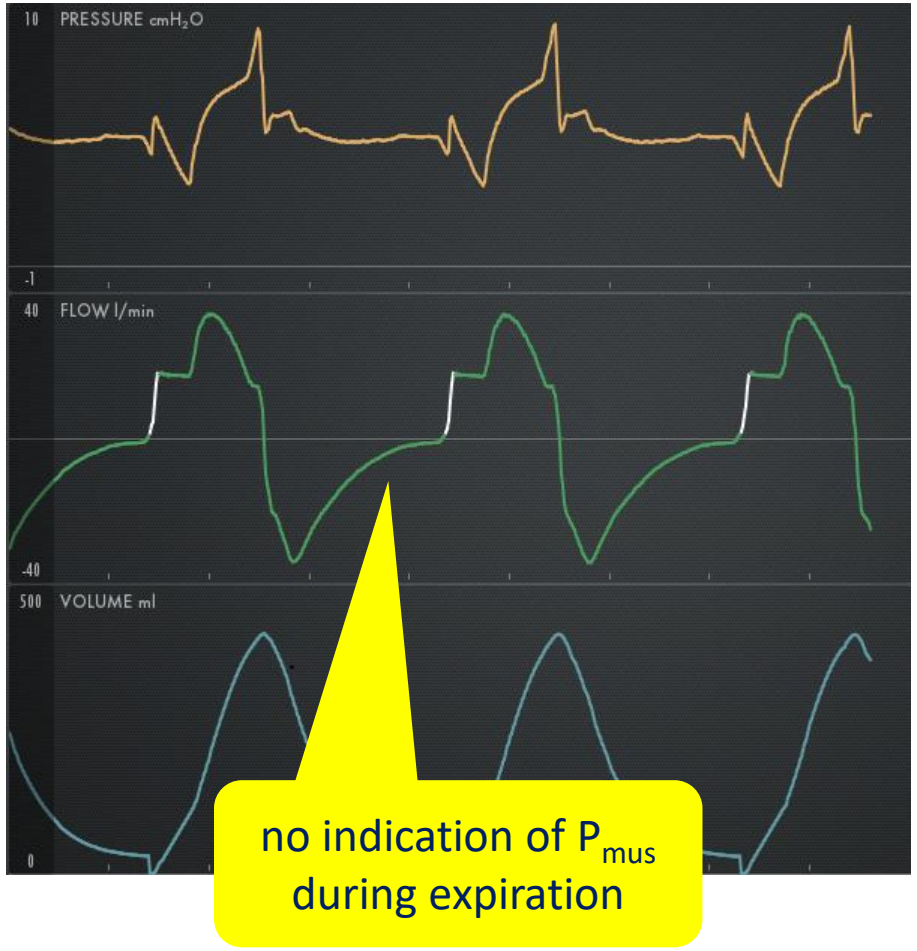
Example

1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**
   - Inspiratory Pmus
3. **What is the patient-ventilator interaction status**
   A. Trigger: normal flow trigger
   B. Inspiratory phase: work shifting
   C. Cycle: normal

no distortion of peak expiratory flow

Example

1. **What is the mode TAG**
   - VC-CMVd
2. **What is the load**
   - Inspiratory Pmus
3. **What is the patient-ventilator interaction status**
   A. Trigger: normal flow trigger
   B. Inspiratory phase: work shifting
   C. Cycle: normal
   D. Expiratory phase: normal



Summary

- **The equation of motion is essential to understand mechanical ventilation**
- **We now have taxonomies for**
  - Modes of ventilation
  - Patient-ventilator interactions
- **Taxonomies for ventilation just as important as generic names for drugs**
- **Selection of the appropriate mode is based on your assessment of the goal**
  - **Safety, Comfort, Liberation**
- **Learning to interpret ventilator waveforms is just as important as learning to interpret ECG waveforms**
  - This skill helps us optimize the mode and settings required to serve the goal of ventilation and meet the patient's needs

Simulator – Hamilton C6 Ventilator

- Free
- Fully simulated user interface with most modes
- Real-time waveforms and digital displays
- Standard patient models (normal, ARDS, COPD)
- Monitoring parameters for the patient's oxygenation and ventilation, including a simulated BGA
- Responds to recruitment maneuvers and changes in PEEP

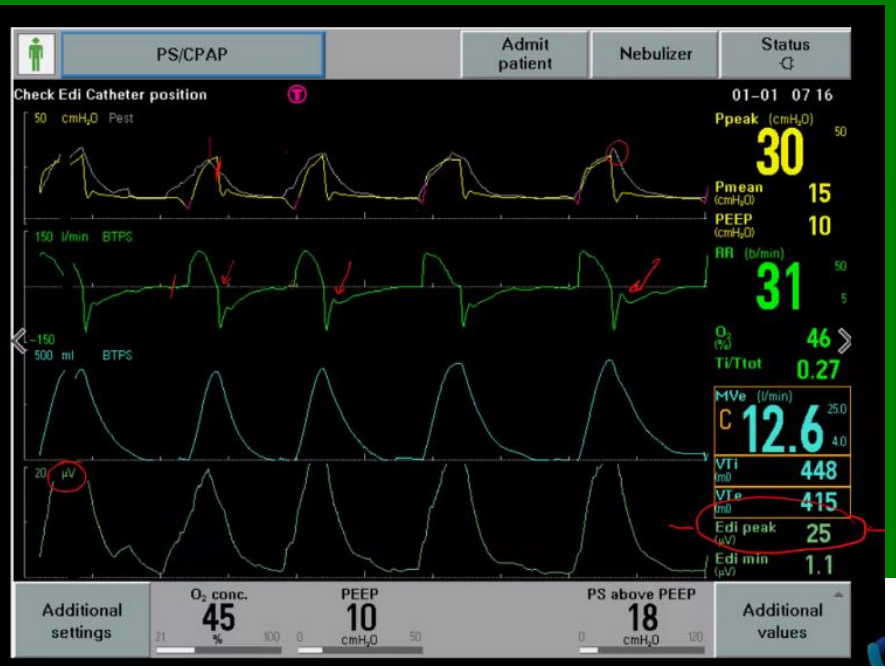
Cleveland Clinic
Respiratory Institute

FREE - Open to Public

SEVA VentRounds

WEBEX

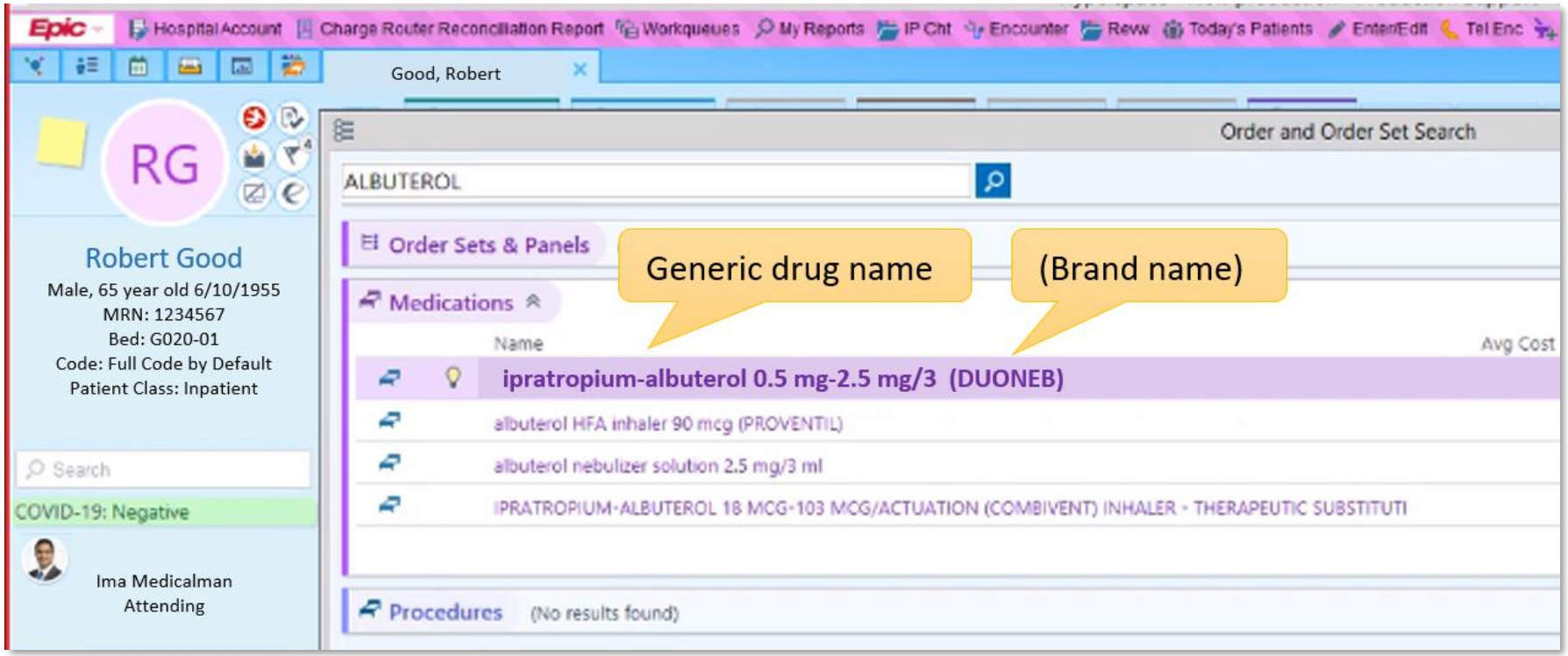
1. What is the TAG?
   PC-CSVs
2. What is the Load?
   Elastic
   Resistive
   Pmus
   i: Pmus e: E
3. Any P-V discordance?
   A. Trigger
      A. Normal 4,5
      B. Early
      C. Late 2,3
      D. False
      E. Failed
   B. Inspiration
      A. Normal
      B. Work shifting
   C. Cycle
      A. Normal
      B. Early
      C. Late
   D. Expiration
      A. Normal
      B. Expiratory Work



Every other Tuesday 2:00 – 2:30 pm EST

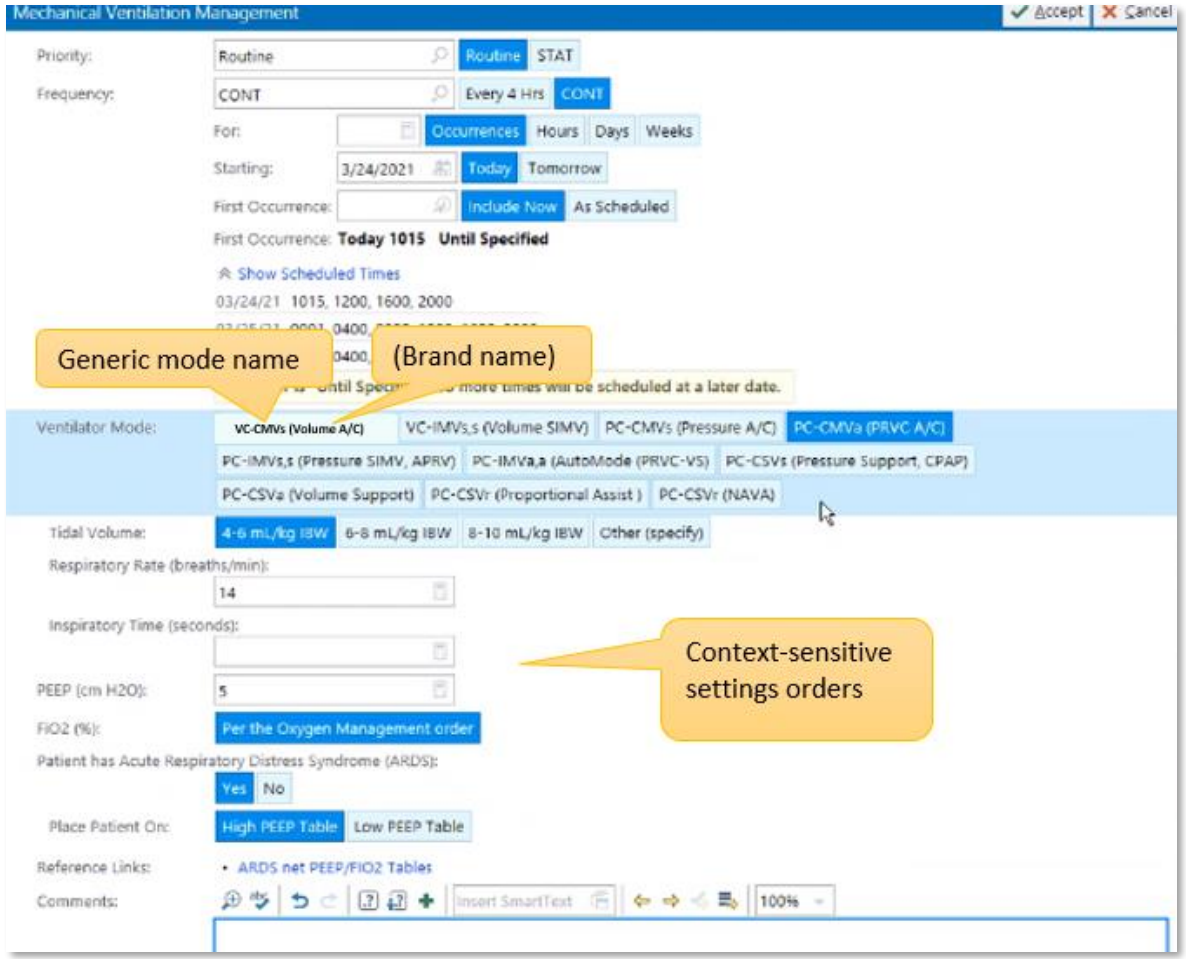
Epic Order Entry Screen for Drugs

- Drug lookup by generic name (brand name)



Epic Order Entry for Ventilator Mode

- Vent modes ordered by generic mode name (brand name)



Epic Order Entry for Ventilator Mode

Standardizing electronic health record ventilation data in the pediatric long-term mechanical ventilator-dependent population

Lara J. Kanbar PhD[1,2] | Judith W. Dexheimer PhD[3] | Janet Zahner BS[4] | Evanette K. Burrows MPH[5] | Robert Chatburn MHHS, RRT-NPS, FAARC[6] | Amanda Messinger MD[7] | Christopher D. Baker MD[7] | Christine L. Schuler MD, MPH[1,8,9] | Dan Benscoter DO[1,3] | Raouf Amin MD[1,9] | Nathan Pajor MD[1,2,9]

Abstract

Background: Sharing data across institutions is critical to improving care for children who are using long-term mechanical ventilation (LTMV). Mechanical ventilation data are complex and poorly standardized. This lack of data standardization is a major barrier to data sharing.

Objective: We aimed to describe current ventilator data in the electronic health record (EHR) and propose a framework for standardizing these data using a common data model (CDM) across multiple populations and sites.

Methods: We focused on a cohort of patients with LTMV dependence who were weaned from mechanical ventilation (MV). We extracted and described relevant EHR ventilation data. We identified the minimum necessary components, termed "Clinical Ideas," to describe MV from time of initiation to liberation. We then utilized existing resources and partnered with informatics collaborators to develop a framework for incorporating Clinical Ideas into the PEDSnet CDM based on the Observational Medical Outcomes Partnership (OMOP).

Standardizing electronic health record ventilation data

Free Phone App

Android

Ventilator Mode Map for Android and iPhone

iOS

Ventilator Mode Map

Cleveland Clinic • Medical

Description

This app is designed to implement the taxonomy (classification system) for modes of mechanical ventilation described by Chatburn et al in *Respir Care 2014;59(11):1747-1763*. It has photographs, model names, and manufacturer names for over 35 ventilators. Nearly 300 modes of ventilation are named and classified exactly as described in recent textbooks:

Respiratory Care Equipment *Volsko et al; Jones and Bartlett Learning,2016.*

Respiratory Care Principles and Practice, 3rd edition*, Hess et al; Jones and Bartlett Learning, 2016*

Egan's Fundamentals of Respiratory care 11th edition, *Kacmarek et al; Elsevier (in press)*

With this app you can do:

1. Identify ventilator name and manufa
2. List all mode names on every ventila
3. Show the classification of any mode
4. Determine which modes are the sam
5. List all mode names associated with

This app is the perfect tool for physicia
care workers who need to identify and

Screen Shots

Continue Your Journey

SEVA-basic

Basic concepts of mechanical ventilation
Introduces course topics and key terminology

SEVA-theory

Deep dive into physics of mechanical ventilation plus physiology and taxonomy of modes

SEVA-lab

Practice applying theory concepts plus waveform analysis using software simulator

ONLINE

SEVA-method

Interprovessional team-based learning focused on mode selection and waveform analysis

SEVA-optivent

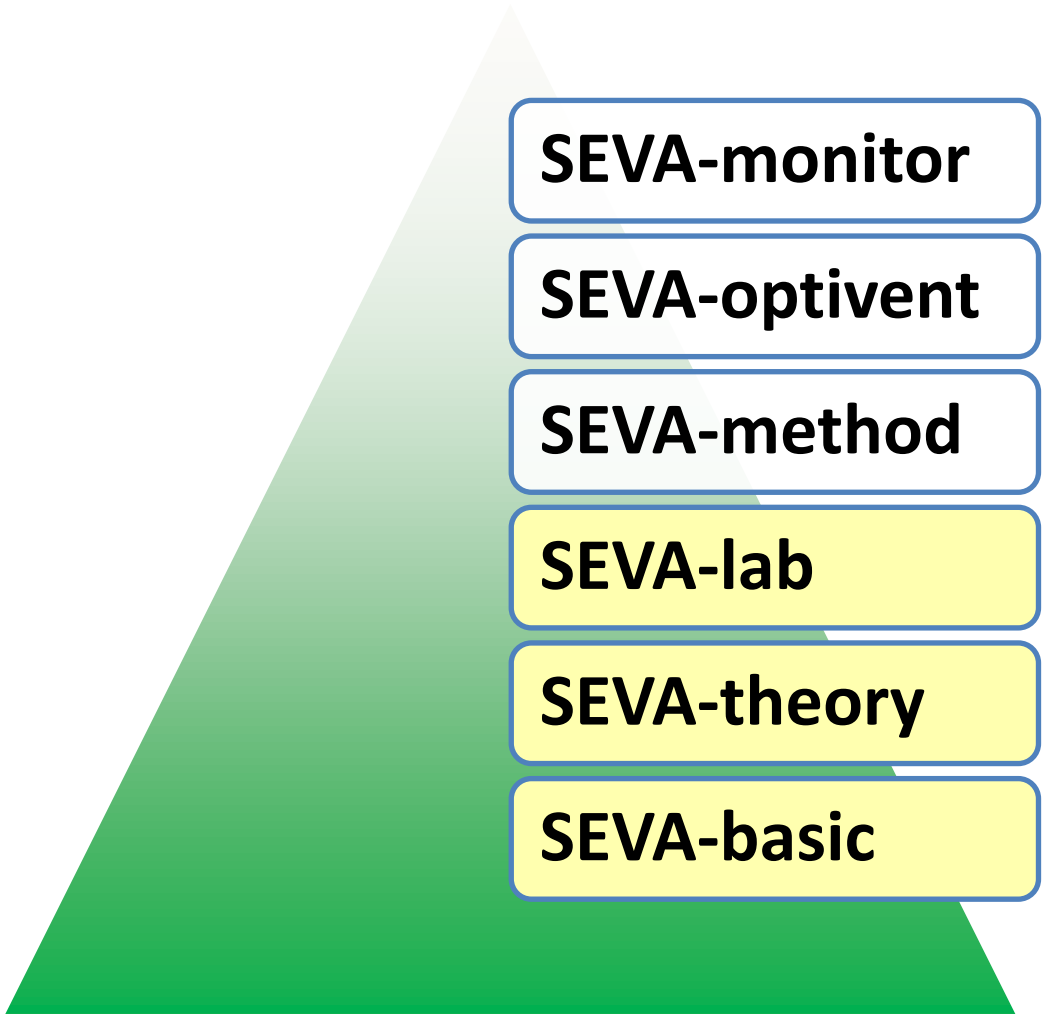
Goal directed mechanical ventilation for ARDS and OLD desease states using simulated patient response

SEVA-monitor

Advanced bedside physiologic monitoring of gas exchange and lung mechanics

IN-PERSON

Continue Your Journey to Mastery



Online (MyLearning)
Self-Directed


"That's all Folks!"

Enhancing Student-Preceptor Dynamics

Corey Smith, MBA, RRT, RRT-NPS

Disclosures

About Me

- Director of Respiratory Therapy and Sleep Center
  - Dupont Hospital
- Respiratory Therapy Program Director
  - University of Saint Francis
- Master of Business Administration
  - University of Saint Francis
- Bachelor of Science in Health Services
  - University of Saint Francis
- Associate of Applied Science in Respiratory Therapy
  - Ivy Tech

Objectives

- Explore the importance of preceptor-student relationships in respiratory therapy education.
- Identify key factors influencing interactions between respiratory therapy students and preceptors.
- Discuss strategies for improving communication and collaboration between students and preceptors.
- Examine the impact of effective preceptor-student dynamics on student learning and professional development.
- Share best practices and resources for optimizing the preceptorship experience in respiratory therapy education.

CoARC Terms

Preceptor	Instructor
2:1 student ratio	6:1 student ratio
Employed by the clinical site	Employed by the University

- How many attendees were once respiratory therapy students?
- How many of you had a bad experience at a clinical site?
- Did you work at the clinical site where you had the bad experience?
- How many of you had a good experience at a clinical site?
- Did you work at the clinical site where you had the good experience?

Workforce Data

Respiratory Therapists

PRINTER-FRIENDLY

Summary | What They Do | Work Environment | How to Become One | Pay | **Job Outlook** | State & Area Data | Similar Occupations | More Info

Job Outlook

About this section

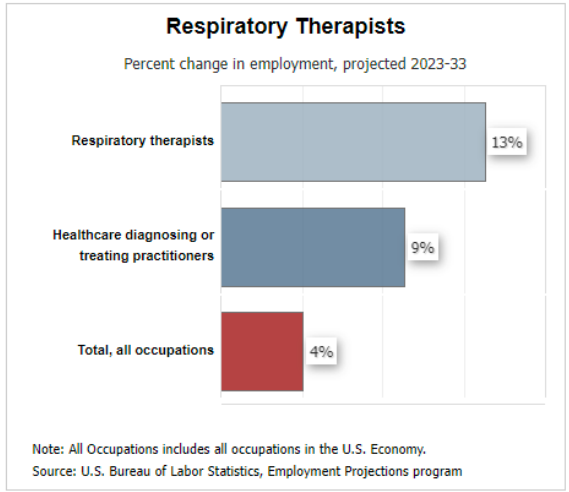
Employment of respiratory therapists is projected to grow 13 percent from 2023 to 2033, much faster than the average for all occupations.

About 8,200 openings for respiratory therapists are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.

Employment

Growth in the older adult population will lead to an increased prevalence of respiratory conditions such as pneumonia, chronic obstructive pulmonary disease (COPD), and other disorders that restrict lung function. This, in turn, will lead to increased demand for respiratory therapy services and treatments, mostly in hospitals.

In addition, a growing emphasis on reducing readmissions to hospitals and on providing patient care in outpatient facilities may result in more demand for respiratory therapists in health clinics and in doctors' offices.



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Other respiratory conditions that affect people of all ages, such as problems due to smoking and air pollution or those arising from emergencies, will continue to create demand for respiratory therapists.

Employment projections data for respiratory therapists, 2023-33

Occupational Title	SOC Code	Employment, 2023	Projected Employment, 2033	Change, 2023-33		Employment by Industry
				Percent	Numeric	
Respiratory therapists	29-1126	133,900	151,400	13	17,500	Get data
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

<- Pay

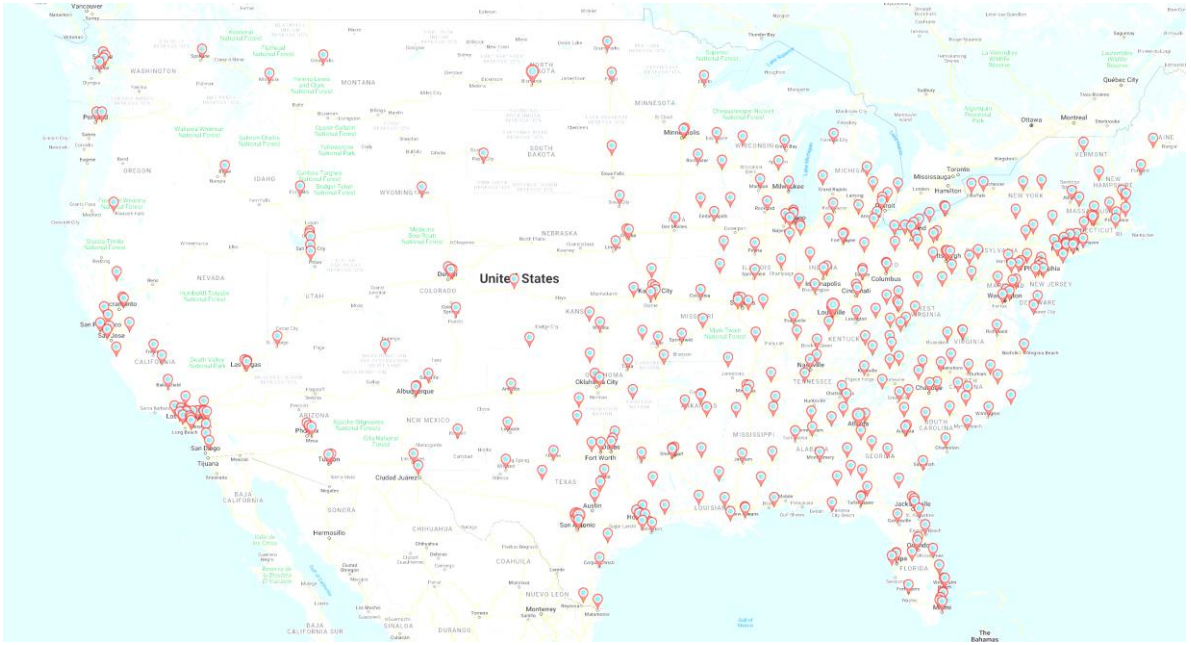
State & Area Data ->

University Data

- 410 Entry to Practice
- 29 Degree Advancement
- 7 Additional Degree
- 1 APRT

- For 2022, there were 7,560 enrollments in Associate entry-into-practice programs, this was a 3.7% decrease compared to 2021.

- There were 6,035 entry into practice graduates in 2022. This is a 1.1% increase compared to 2021 and a 25.8% decrease compared to its peak in 2012. The mean number of graduates per program was 13.



What does that mean in 10 years?

8,200 openings filled by 6,035 graduates = 2,165 open jobs

2,165 x 10 = 21,650 job openings by 2033

Understanding How People Learn

- VARK Model
  - Developed by Neil Fleming in the 1980's

- V - visual
- A - auditory
- R - reading/writing
- K - kinesthetic

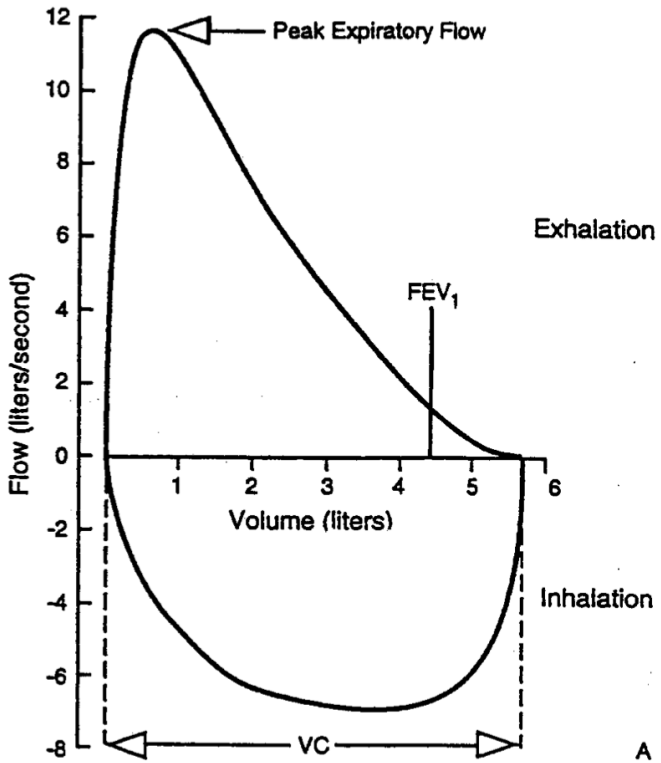
Understanding VARK

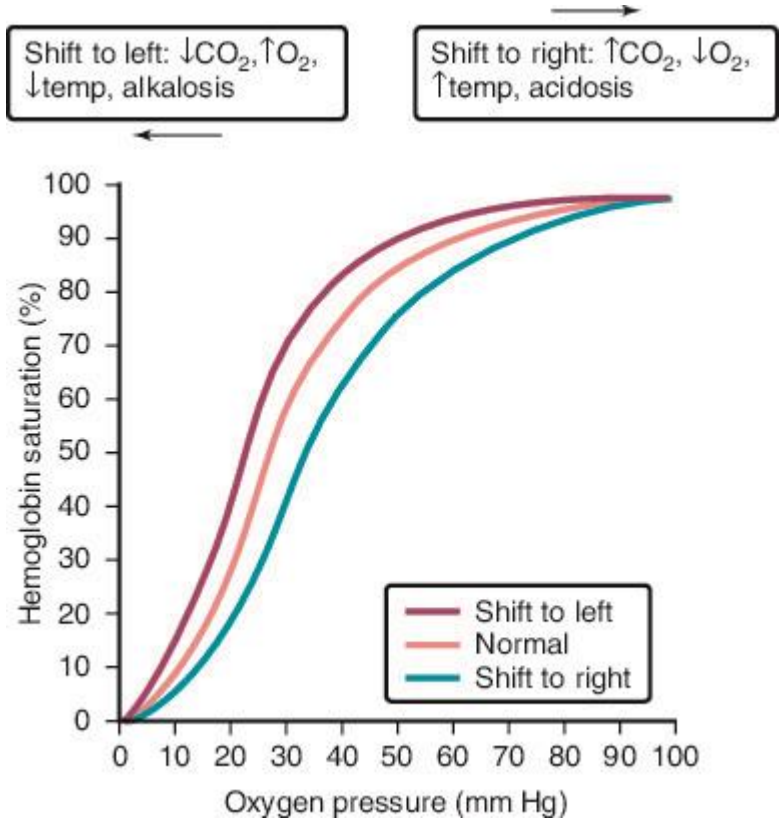
Three main ideas

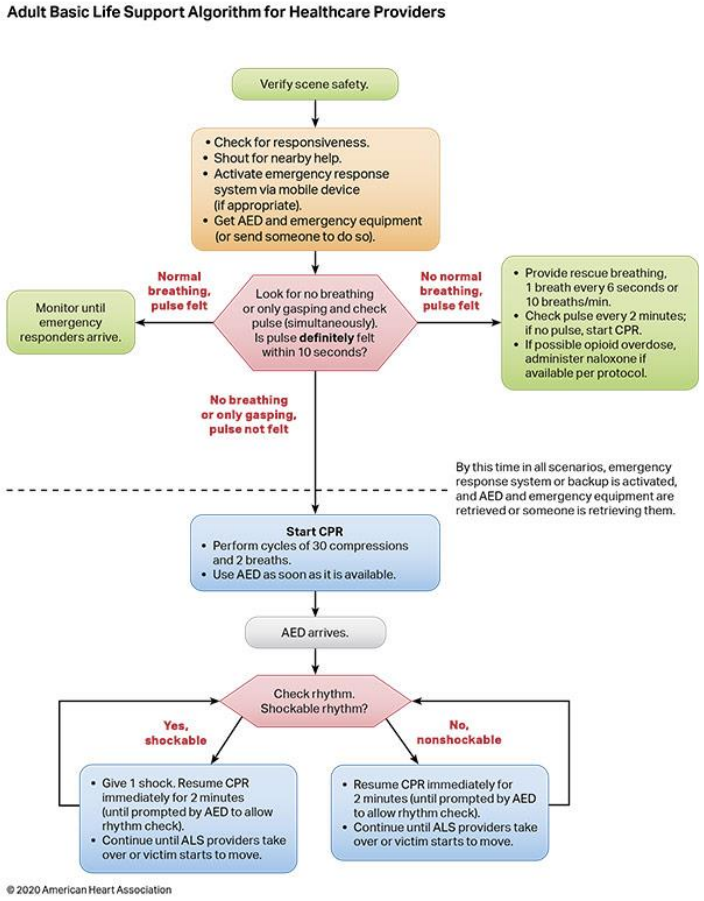
- Students' preferred learning modes have a significant influence on their behavior and learning
- Students' preferred learning modes should be matched with appropriate learning strategies
- Information that is accessed through students' use of their modality preferences shows an increase in their levels of comprehension, motivation, and metacognition

Visual

- Visual learners prefer the use of images and graphs to access and understand new information





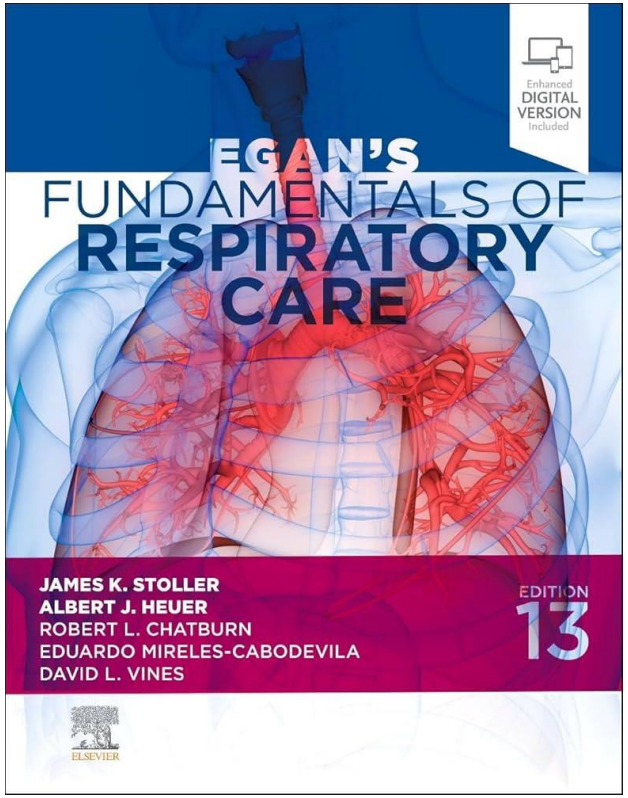


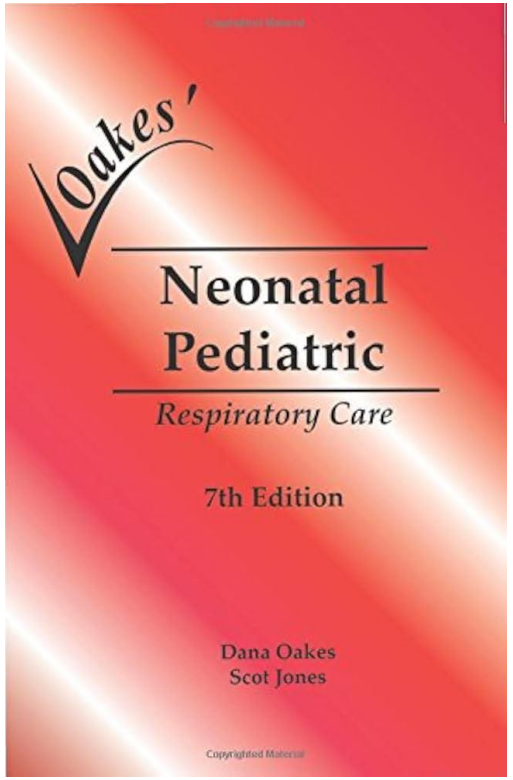
Auditory

- Auditory learners understand new content through listening and speaking, especially in situations like lectures and group discussions.

Reading/Writing

- Students with a strong reading/writing preference learn best through words. These students may present themselves as copious note takers or avid readers, and are able to translate abstract concepts into words and essays





Kinesthetic

- Students are kinesthetic learners best understand information through tactile representations of information. These students are hands-on learners and learn best when figuring things out by hand

VARK Questionnaire

- 16 questions
- Free version with results and strategies

Your Results

Your learning preference:
Mild Kinesthetic

People with your preference like: practical exercises, experiences, examples, case studies, trial and error, things that are *real*, ...

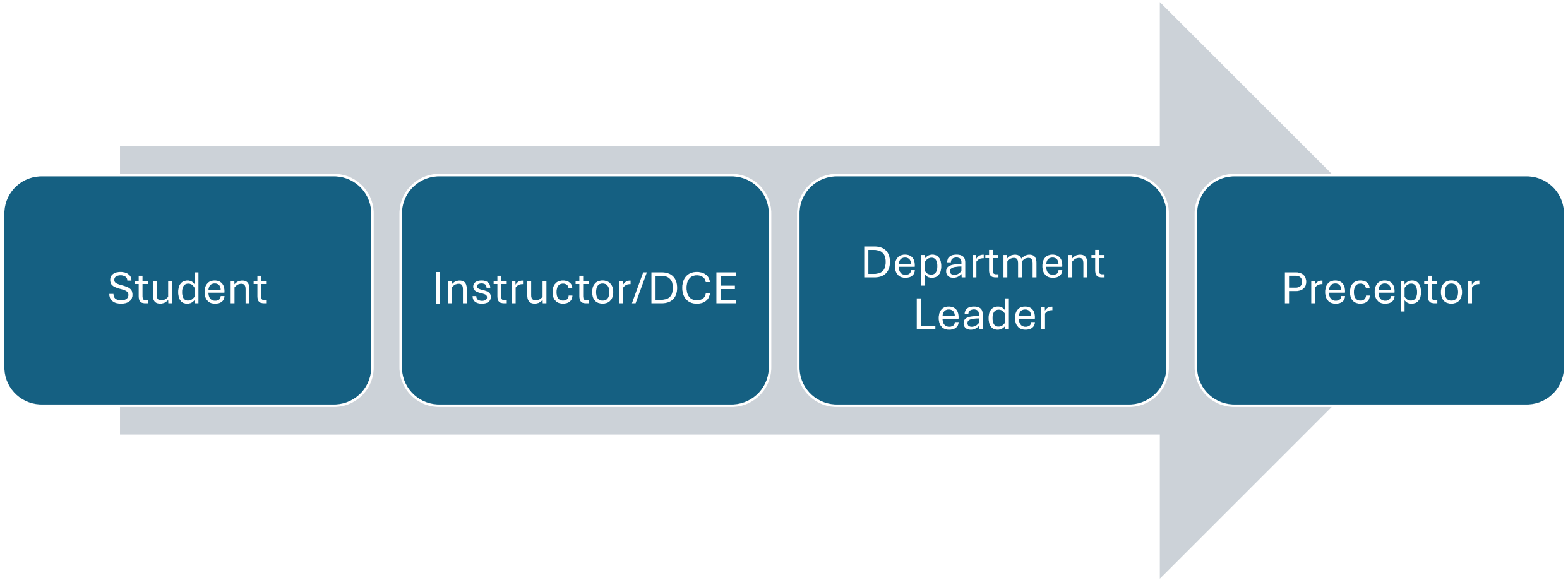
Your scores were:

- Visual 2
- Aural 7
- Read/Write 7
- Kinesthetic 10

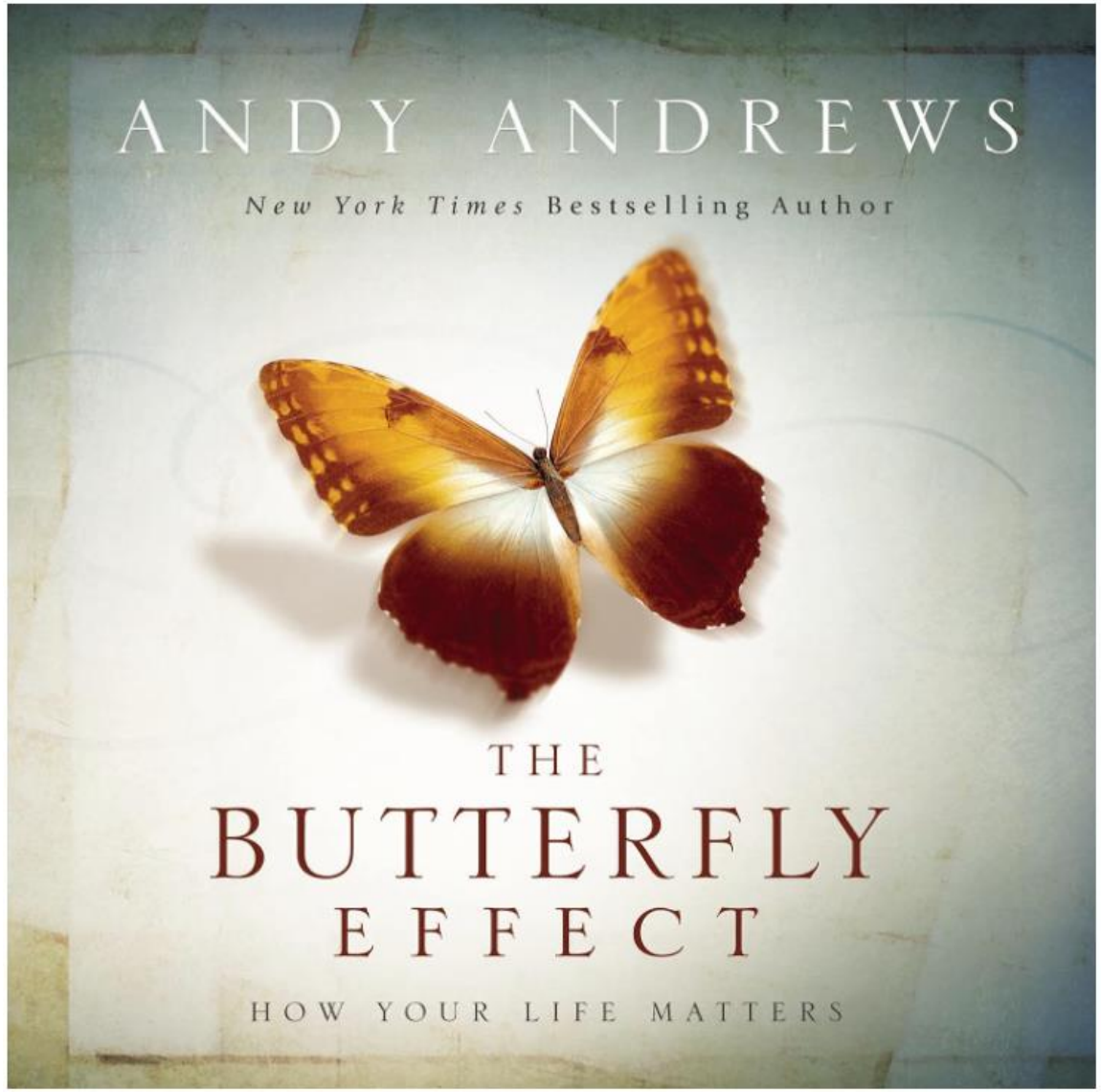
Use the following helpsheet for strategies that apply to your VARK preference:

- Kinesthetic Strategies
- Understanding the results

Application



The Butterfly Effect



References

- U.S. Bureau of Labor Statistics. (n.d.). *Employment projections home page*. U.S. Bureau of Labor Statistics. https://www.bls.gov/emp/
- *Home - COARC - commission on accreditation for respiratory care*. CoARC. (2024, July 13). https://coarc.com/
- *Vark questionnaire: How do you learn best?*. VARK. (2024, April 26). https://vark-learn.com/the-vark-questionnaire/#google_vignette

Questions

INDIANA
DONOR NETWORK

Donation after Circulatory Death
Through the Eyes of a Respiratory Therapist

October 3, 2024

Kate Brewer, BS, RRT
Hospital Liaison

Objectives

The learner will be able to:

- Gain a comprehensive understanding of the role and functions of an organ procurement organization
- Identify the key elements of the RT's role in the Donation after Circulatory Death (DCD) process
- Identify significant grief support programs offered to donor families

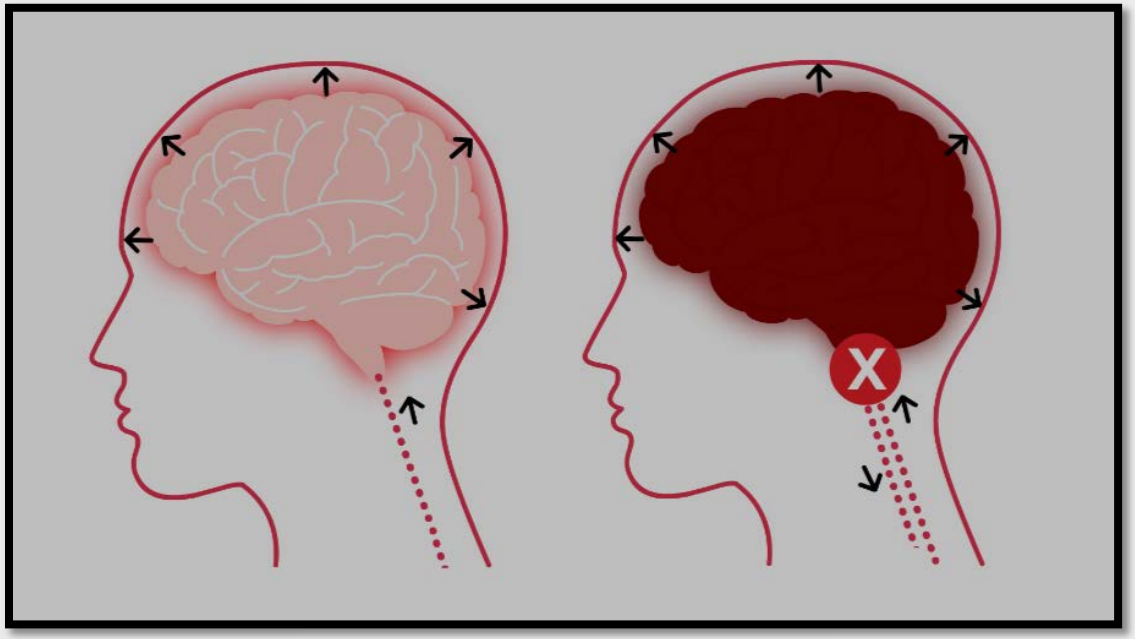
Who is Indiana Donor Network?

A little history lesson

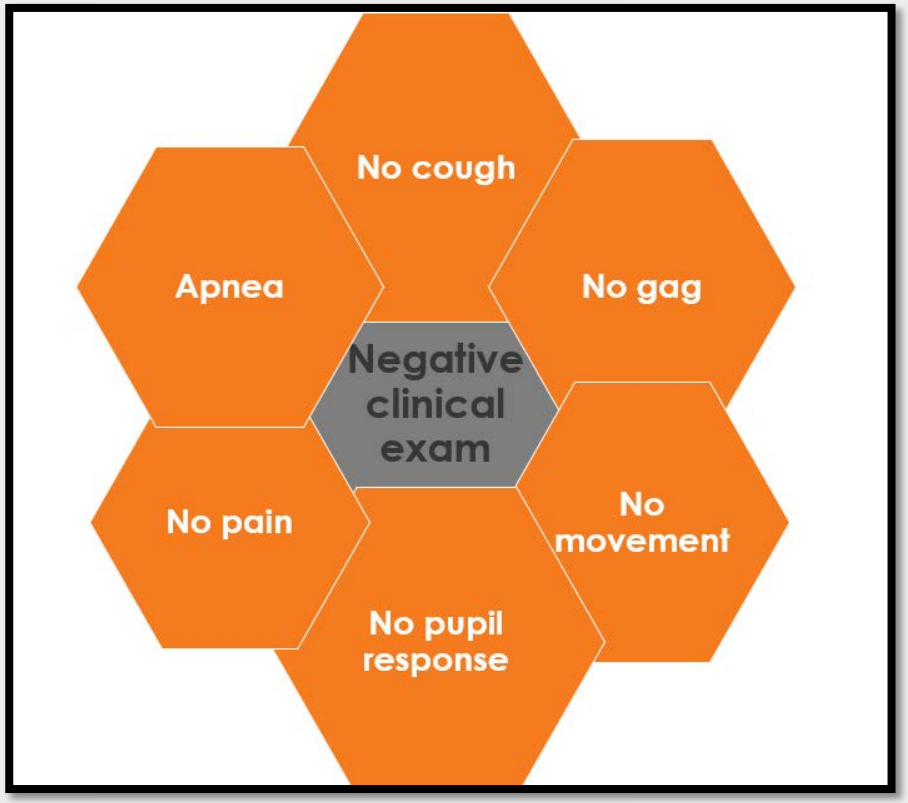
1954

New Discovery in 1968

Ancillary Studies

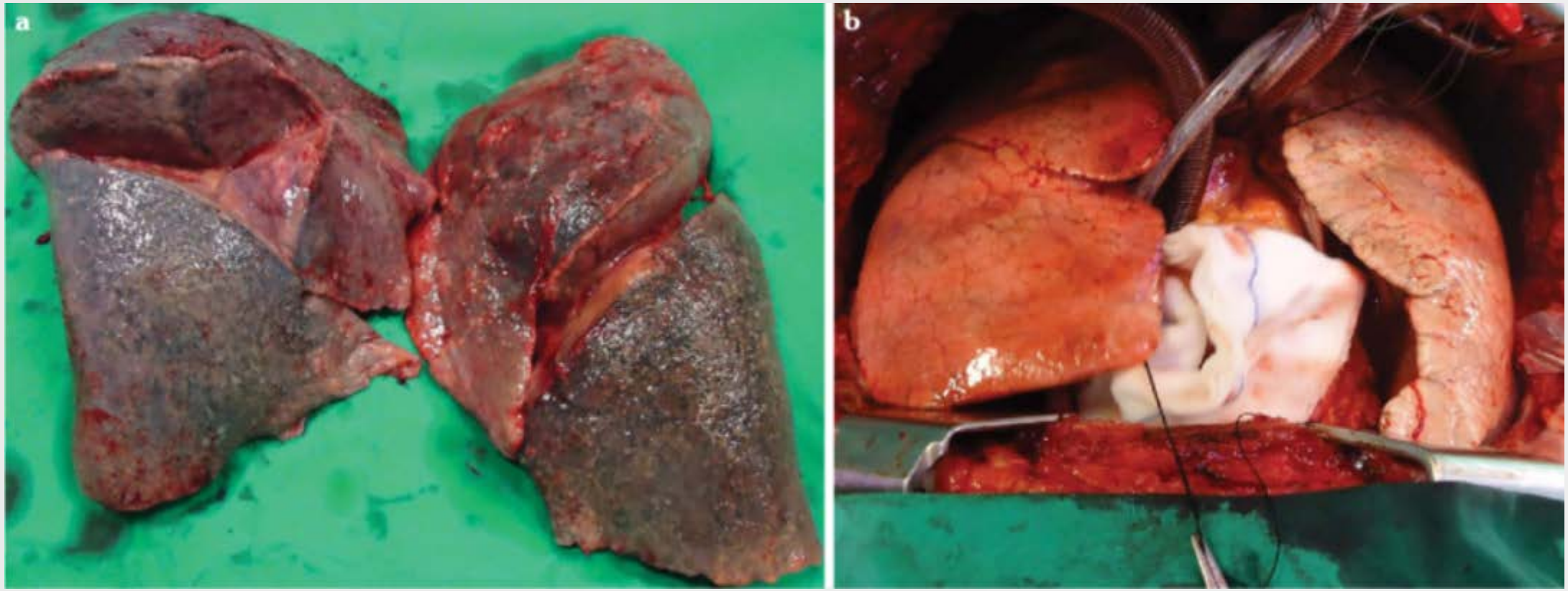


Clinical Exam



Advancements continue

Lung Transplant

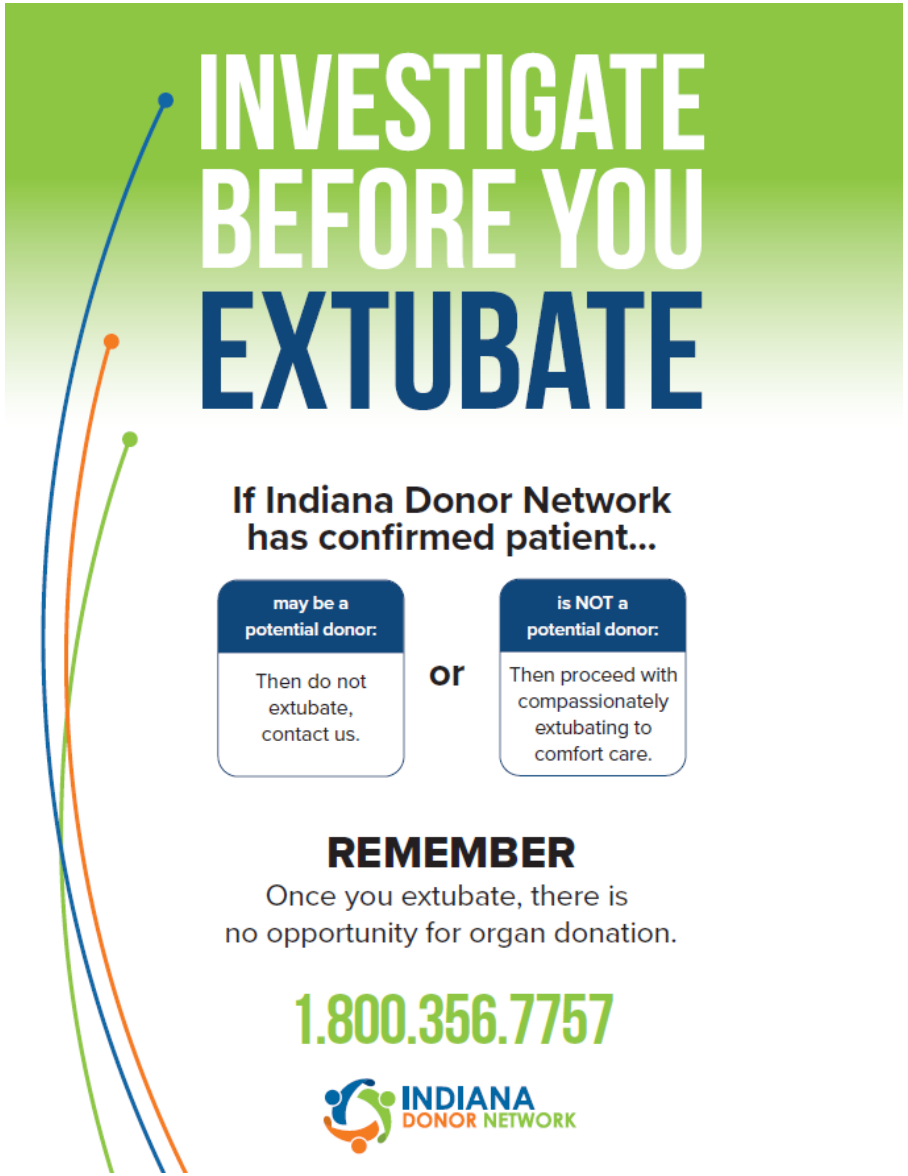


Renewed Interest

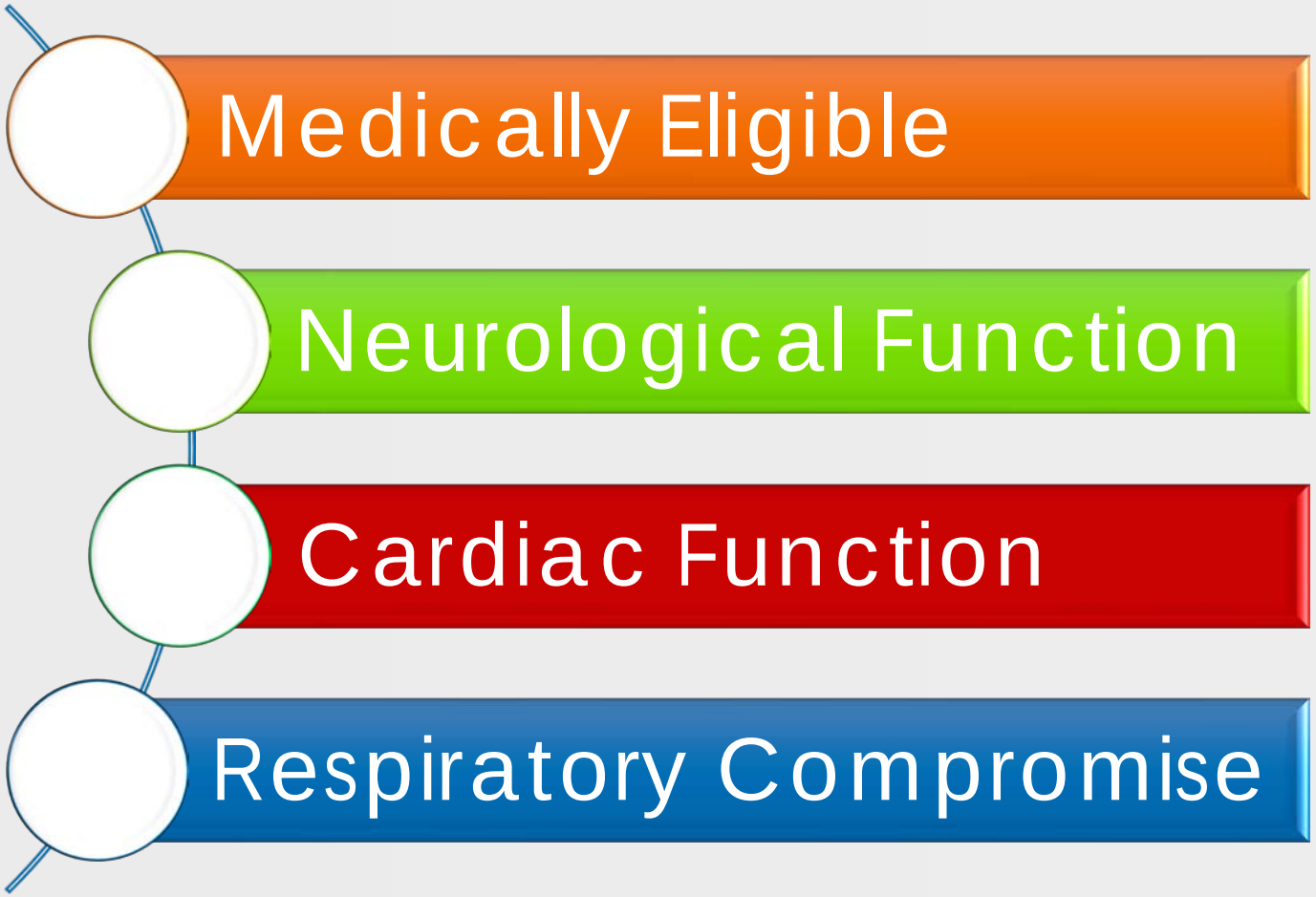
Who May Be Considered

A patient is eligible for evaluation of DCD when they meet all the following criteria:

- ✓ The patient does **not** meet brain death criteria.
- ✓ The patient has no chance of a meaningful recovery.
- ✓ The patient's family makes the decision to withdraw medical therapy.


INVESTIGATE BEFORE YOU EXTUBATE
If Indiana Donor Network has confirmed patient...
may be a potential donor:
Then do not extubate, contact us.
or
is NOT a potential donor:
Then proceed with compassionately extubating to comfort care.
REMEMBER
Once you extubate, there is no opportunity for organ donation.
1.800.356.7757
INDIANA DONOR NETWORK

Determining Eligibility



Collaborative Care

Pulmonary Eval and Management

- **Labs**
  - Serologies, blood typing, infectious disease
- **Serial CXRs**
- **Serial breathing treatments**
  - Bronchodilators
  - Inhaled corticosteroids
  - Antibiotic coverage post gram stain results
- **Chest CT**
- **Serial ABGs**
- **Lung recruitment maneuvers**
  - Input of RT and MD
- **Bronchoscopy**
  - Diagnostic or therapeutic

Goals of Lung Management

O2 Challenge	PEEP, I:E, FiO2, recruitment
PCO2 35-45	Rate, Tidal Volume, I:E
pH 7.3-7.6	
Plateau pressures <30	TV 6-8ml/kg
Lung Compliance	

BEDSIDE INTERVENTIONS

HOB >30 degrees

Reverse Trendelenburg

Adequate ET cuff pressures 25-30cm

Suction, oral care

Positioning

- Turn 1-2 hours per protocol
- Prone positioning

Want volume status running negative

Matching

- Waiting time
- Donor/recipient immune system compatibility
- Prior living donor
- Distance from donor hospital
- Survival benefit
- Pediatric status

- Medical urgency
- Distance from donor hospital
- Pediatric status

- Medical urgency
- Distance from donor hospital
- Pediatric status

Lung Matching

- Medical urgency
- Likelihood of survival within 5 years post transplant
- Immune system matching
- Height match/Chest cavity size
- Blood type
- Pediatric status
- Prior living donor
- Travel efficiency
- Proximity efficiency

Maximum Organ Preservation Times

Kidney

Pancreas

Liver

Heart/Lung

Advances in Donation and Transplantation

OR Preparation for Care Team

PROVIDER NOTE CONFIRMING WITHDRAW

TEAM HUDDLE

MEDICATIONS

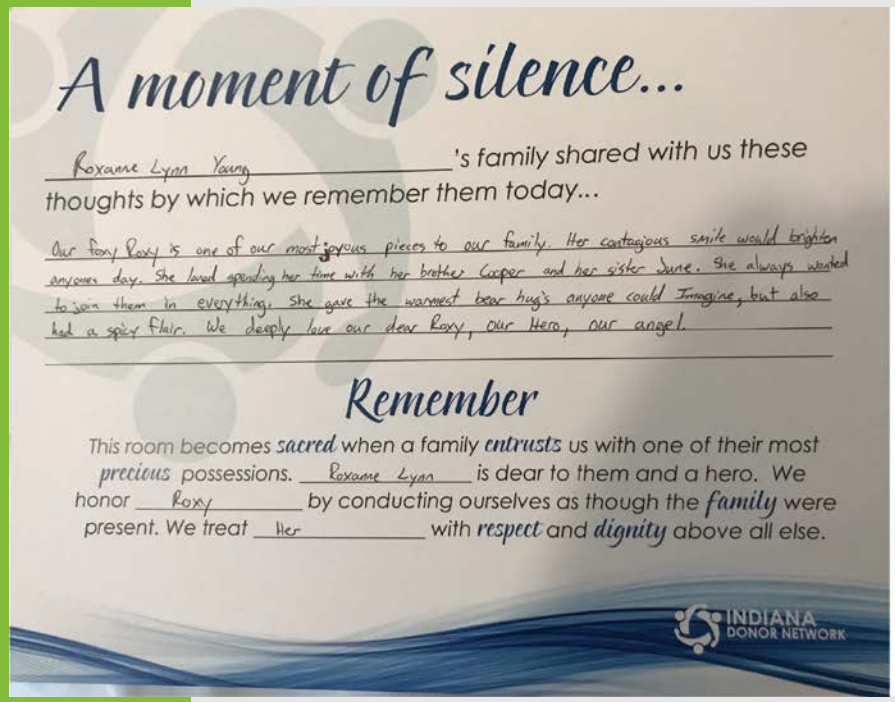
OR Preparation for Family

DRAPING INSTRUMENTS

DIMMING LIGHTS

MUSIC OF FAMILY'S CHOOSING

Donor Hero Moment of Silence and Honor Walk



1. Timeout

2. Withdrawal of medical therapy

3. Pronouncement of death

4. No touch period

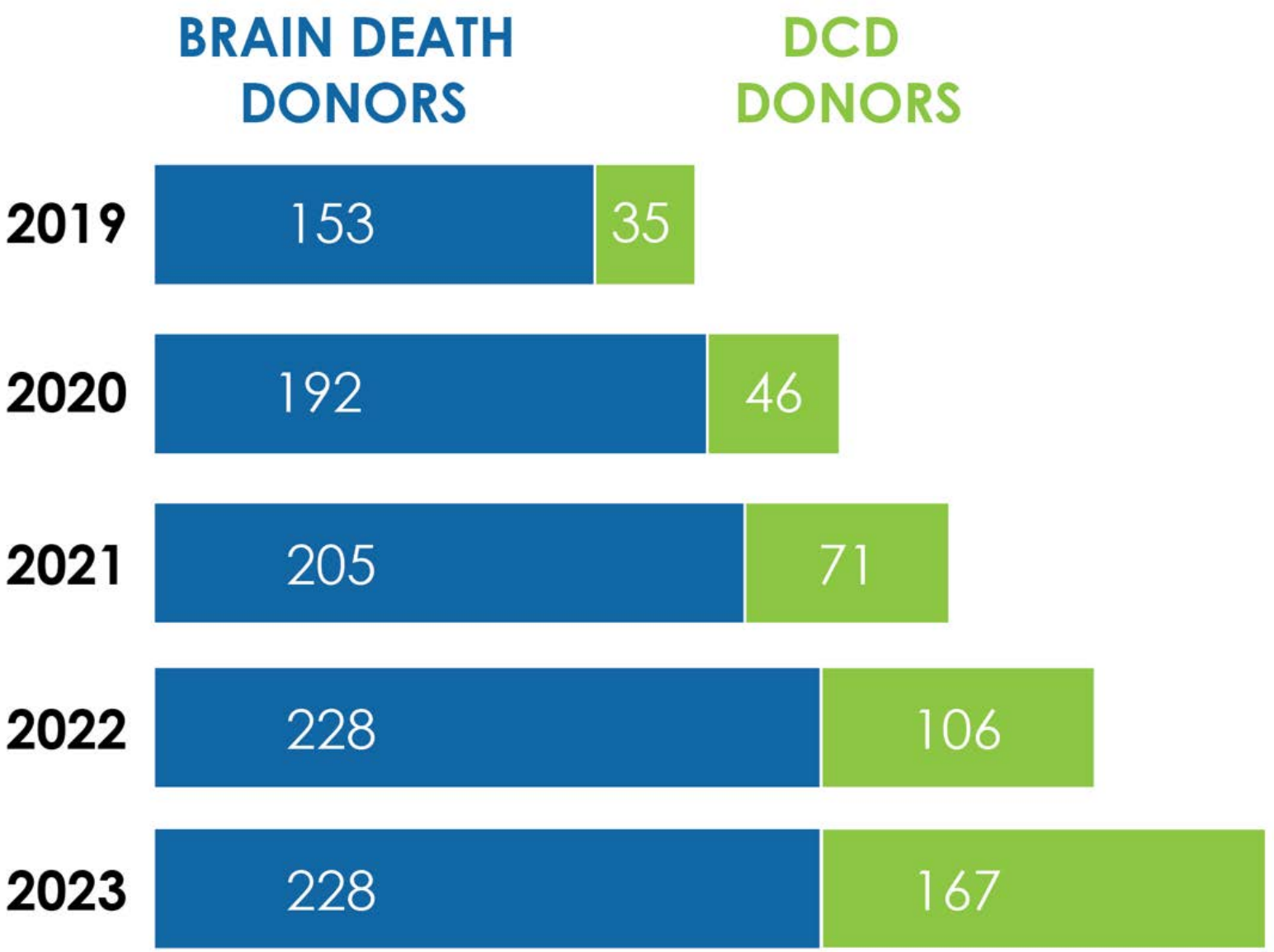
5. Organ recovery begins

RT Specific Roles

- Transporting and setting up ventilator in OR
  - Make sure to have syringe to deflate cuff
- Ensuring adequate amount of O2 is available while OR team is prepping for donation
- Await instruction for extubation
  - Ensure family is ready
  - Await dose of heparin to be circulated
  - Upon request, extubate patient and remove ETT holder, if applicable
  - Take ventilator out of OR to allow family near loved one
- RT role complete post extubation
  - Keep voices low, be respectful of donor hero and family present
  - Upon death, may stay in OR to watch recovery

If lungs are being recovered...

- RT will perform initial extubation of patient
- Upon death, donor will need reintubated
- Recovering surgeon will instruct designated provider/RT/IDN to re-intubate donor and place on vent
- Recovering surgeon will direct lung recruitment maneuvers
- Once recruitment if performed, RT role is complete and can leave or stay to view the full recovery


BRAIN DEATH DONORS
DCD DONORS
2019
153
35
2020
192
46
2021
205
71
2022
228
106
2023
228
167

Organs Transplanted by DCD

2023

Organs Transplanted

Organ Group	Organ Count	% of Total
Heart	9	2.63%
Kidney	277	80.99%
Liver	38	11.11%
Lung	18	5.26%
Total	**342**	**100.00%**

2024

Organs Transplanted

Organ Group	Organ Count	% of Total
Heart	16	5.39%
Kidney	217	73.06%
Liver	42	14.14%
Lung	18	6.06%
Pancreas	4	1.35%
Total	**297**	**100.00%**

data through 8/30/24

Aftercare Services

Story of Hope

Happy RT Week!

Thank you!

Questions?

Kate Brewer
KBrewer@INDonorNetwork.org


NBRC
The National Board for Respiratory Care
EXCELLENCE
defines us
An Update from the NBRC
Melanie Thomas
Sr. VP, Credentialing Operations

Objectives

1. Define the NBRC's role in the profession
2. Discuss updates to the credentialing system
3. Describe NBRC resources to leverage for success

Meet the NBRC Board of Trustees

9 Respiratory Therapists

aarc
American Association for Respiratory Care

9 Physicians

American Society of Anesthesiologists®

CHEST™
AMERICAN COLLEGE of CHEST PHYSICIANS

ATS American Thoracic Society

1 Public Member

Many, Many More Dedicated Volunteers

Examination Committee Consultants

Item Writers

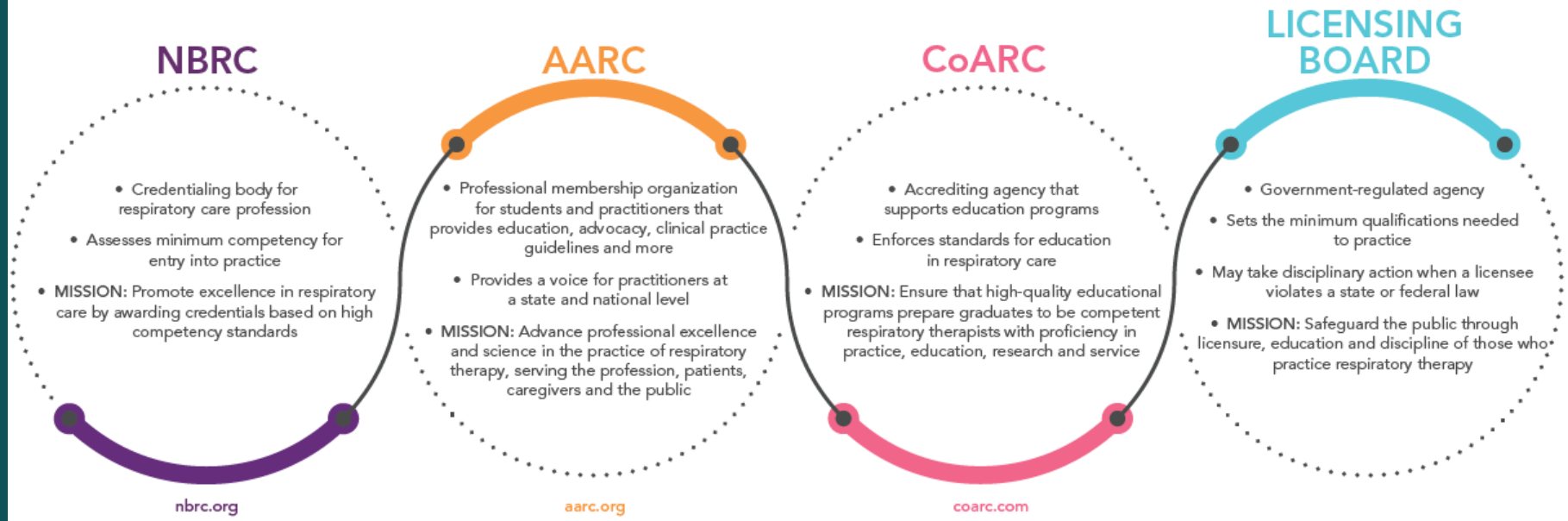
CMP Panel Members

Social Media Ambassadors

NBRC
The National Board for Respiratory Care®

Respiratory Care Organizations: Who We Are

Working collaboratively with other national organizations that share the universal goal of protecting and enhancing patient lives through excellence in respiratory care, we come together to promote and serve the profession. Below, you can learn more about how each organization commits to the greater whole of respiratory care.



NBRC Credentials of Excellence

- Certified Respiratory Therapist (CRT)
- Registered Respiratory Therapist (RRT)
- Certified Pulmonary Function Technologist (CPFT)
- Registered Pulmonary Function Technologist (RPFT)
- Neonatal/Pediatric Respiratory Care Specialist (RRT-NPS)
- Sleep Disorders Specialist (CRT-SDS or RRT-SDS)
- Adult Critical Care Specialist (RRT-ACCS)
- Asthma Educator Specialist (AE-C) <<< NEW!

NBRC
The National Board for Respiratory Care

Information for AE-C Credential Holders

Program Changes

- CMP assessment is a renewal option as of January 1, 2024
- Reduced renewal fee
  - $125 for 5-year cycle, collected $25 annually
- CEUs required reduced from 35 to 30
- Expiration date changed to align with other NBRC credentials
- RTs can manage credentials in one place

Features Staying the Same

- 5-year credential cycle
- Multi-disciplinary credential

NBRC
The National Board for Respiratory Care

Leveraging NBRC Resources

Credential Maintenance Program
Specialty Credentials
Career Ladders

EXCELLENCE
defines us.

Credential Maintenance Program

EXCELLENCE
defines us.

I earned my credential, now what?

- Credentials are valid for 5 years
- $25 annual maintenance fee
- Participate in the Credential Maintenance Program (CMP) to maintain credentials

Three ways to participate:

Participate in quarterly assessments and/or document CEUs

- AARC CRCE approved courses
- CE courses accepted by your state licensing board

Take a new exam

Re-take and pass the exam associated with your highest held credential

NBRC
The National Board for Respiratory Care

CMP Assessment Details

Developed by a panel of subject matter experts

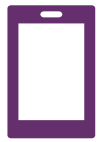
- RTs
- Physicians
- Pharmacists
- Nurses

Administered quarterly

CRT/RRT – 10 items

Specialty – 5 items

Open until January 31 of the next year



Access through a phone, tablet, or computer

Items can be answered all at once or return later to complete the assessment

Ability to use resources

- Must work independently
- Cannot disclose information

CMP Assessment FAQs

1. Am I required to take the assessments?
2. I forgot to do an assessment; can I do it now?
3. I didn't perform well on an assessment. Am I going to lose my credential?
4. I checked my dashboard and got zero points for an assessment. How is that possible?
5. I received a reminder about completing the CMP assessment. Is my credential about to expire?

NBRC
The National Board for Respiratory Care

Have CMP Questions?

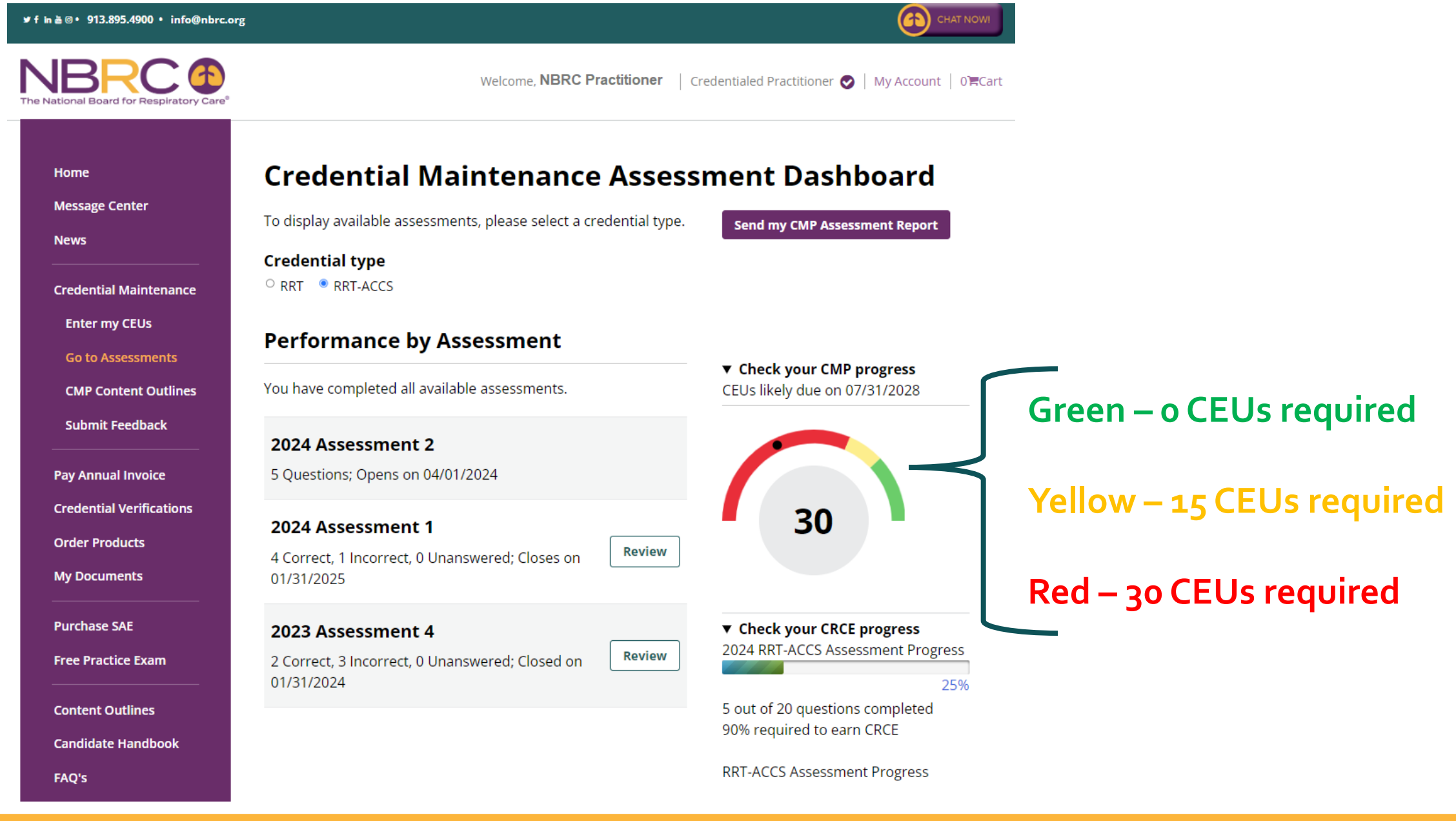
Answers to the questions from the CMP survey

CMP FAQs

"What is the Credential Maintenance Program?" video

For additional assistance, email **cmpsupport@nbrc.org**

NBRC
The National Board for Respiratory Care

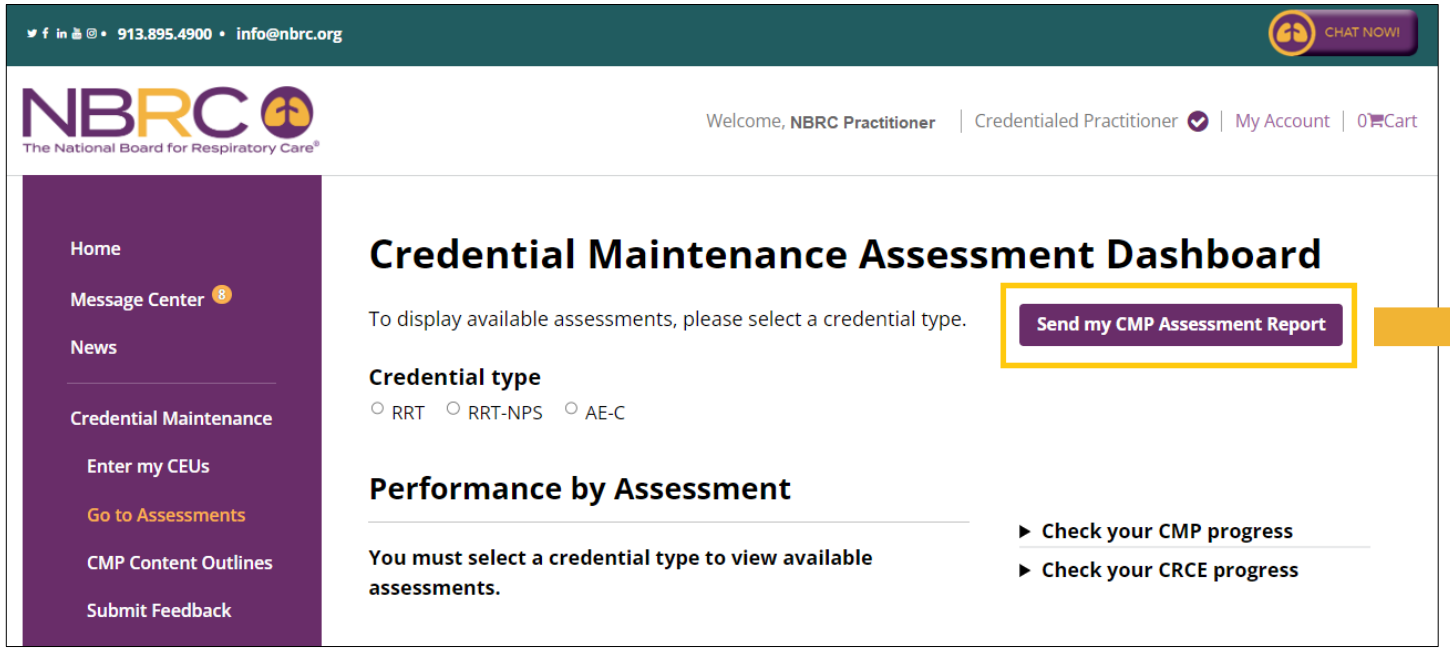


Green – 0 CEUs required

Yellow – 15 CEUs required

Red – 30 CEUs required

CMP Assessment Report



Credential Maintenance Report Example

NBRC
The National Board for Respiratory Care®

Credential Maintenance Assessment Performance Report

Kellie R. Carroll, RRT, RRT-NPS, AE-C 2

Credential: RRT

2020	Correct	Incorrect	Unanswered
Assessment 1	0	0	10
Assessment 2	0	0	10
Assessment 3	0	0	10
Assessment 4	0	0	10
Total Assessment Score	0	0	40

2021	Correct	Incorrect	Unanswered
Assessment 1	0	0	10
Assessment 2	0	0	10
Assessment 3	0	0	10
Assessment 4	0	0	10
Total Assessment Score	0	0	40

2022	Correct	Incorrect	Unanswered
Assessment 1	0	0	10
Assessment 2	0	0	10
Assessment 3	0	0	10
Assessment 4	0	0	10
Total Assessment Score	0	0	40

2023	Correct	Incorrect	Unanswered
Assessment 1	0	0	10
Assessment 2	0	0	10
Assessment 3	0	0	10
Assessment 4	0	0	10
Total Assessment Score	0	0	40

2024	Correct	Incorrect	Unanswered
Assessment 1	0	0	10
Assessment 2	0	0	10
Total Assessment Score	0	0	20

NBRC
The National Board for Respiratory Care®

Credential Maintenance Assessment Performance Report

Credential: AE-C

2024	Correct	Incorrect	Unanswered
Assessment 1	0	0	5
Assessment 2	0	0	5
Total Assessment Score	0	0	10

NBRC
The National Board for Respiratory Care®

Credential Maintenance Assessment Performance Report

Credential: NPS

2020	Correct	Incorrect	Unanswered
Assessment 1	0	0	5
Assessment 2	0	0	5
Assessment 3	0	0	5
Assessment 4	0	0	5
Total Assessment Score	0	0	20

2021	Correct	Incorrect	Unanswered
Assessment 1	0	0	5
Assessment 2	0	0	5
Assessment 3	0	0	5
Assessment 4	0	0	5
Total Assessment Score	0	0	20

2022	Correct	Incorrect	Unanswered
Assessment 1	0	0	5
Assessment 2	0	0	5
Assessment 3	0	0	5
Assessment 4	0	0	5
Total Assessment Score	0	0	20

2023	Correct	Incorrect	Unanswered
Assessment 1	0	0	5
Assessment 2	0	0	5
Assessment 3	0	0	5
Assessment 4	0	0	5
Total Assessment Score	0	0	20

2024	Correct	Incorrect	Unanswered
Assessment 1	0	0	5
Assessment 2	0	0	5
Total Assessment Score	0	0	10

Why Participate in Assessments?

No cost

No risk

- There is no risk to your credential if you don't perform as well as you'd like.
- Participation can only reduce or eliminate the CEUs required for renewal.

No commitment required

- No requirement to continue doing assessments after trying it for one quarter.

Earn CRCE Credit!

Complete at least 90% of assessment questions in a calendar year to earn CRCE credits!

- 6 CRCE credits – general RT assessments
- 3 CRCE credits – specialty assessments

2022 – 16,063 CRCE certificates awarded

2023 – 17,404 CRCE certificates awarded

MAINTAINING YOUR CREDENTIALS IS ESSENTIAL

THE CONSEQUENCES OF LETTING YOUR NBRC CREDENTIAL EXPIRE

NBRC
The National Board for Respiratory Care

1. You are no longer allowed to use the credential acronyms (CRT, RRT, etc.) due to federal trademark laws. This includes when signing a patient chart or medical document, applying for a state license as an individual holding a credential, or seeking employment as a credentialed respiratory care practitioner.
2. Your job may be at risk if your employer requires a current NBRC credential to maintain your position.
3. You may face NBRC disciplinary action if you use your expired credential designation for any purposes.
4. You may put your state-issued license at risk as many states require you to maintain an active NBRC credential.

Specialty Credentials

Specialty Credentials

- Specialty credentials available include:
  - ACCS, AE-C, NPS, CPFT, RPFT and SDS

- Many benefits, including:
  - demonstrating the skills and strengths required to provide the highest quality of patient care
  - specialization helps showcase up-to-date expertise

Specialty Exams Second-Chance-Free Guarantee

- Apply between July 1 and December 31, 2024
- First time test takers only
  - ACCS, AE-C, NPS, PFT, SDS
- If you do not pass your first attempt, get a second attempt for FREE!
  - Second attempt is valid for the same exam program only
  - Must apply for and take your free exam by December 31, 2025

Specialty Credential Stories

ACCS

AE-C

NPS

PFT

SDS

Read about how specialty credentials have impacted practitioners' careers

Career Ladders

Career ladders encourage:

- Better patient care
- Increased therapist engagement
- Persistence in the job
- Showing a roadmap for career progression

See examples at nbrc.org/careerladder

Typical characteristics of career ladders

- Describes how money can be spent on career-supporting expenses and how personnel are compensated.
- Often leverages achievement and maintenance of academic degrees, licenses, and credentials as necessary steps for advancement.
  - CMP assessments
  - Specialty credentials
- Defines domains of enriching activities in which therapists can also engage to advance.
  - Clinical
  - Educational
  - Leadership

Examples of Career Ladder Components

- Monetary
  - Hourly or salaried
  - Increased compensation with ladder advancement
  - Reimbursing fees
- Continuing education credit levels
- Academic degrees – undergraduate or graduate
- General or specialty NBRC credential achievement and maintenance

Supporting the Profession

Investing in the Future of the Profession

- In March 2024, the NBRC announced its investment of more than $4 million in scholarship funds for education programs
- Each CoARC-accredited program will receive **$10,000** to use toward scholarships for current and future respiratory therapists
- Program Directors were emailed with instructions to receive the scholarship money
  - Forms due by October 31, 2024
  - If a program did not receive the email, contact Scholarships@NBRC.org for assistance.

Lambda Beta Society Scholarships and Awards

Any student currently enrolled in a respiratory care program accredited by CoARC may apply.

These awards also include $750 in travel expenses and registration to AARC Congress

Applications closed on May 31.
More info at lambdabeta.org.

Frederic Helmholz, MD Scholarship – Up to $2,500

Presented on the merit of an independent, original narrative review of literature related to respiratory care practice.

CoARC Stephen P. Mikles, EdD, RRT, FAARC Media Award – $2,000

Presented on the merit of an original presentation relevant to respiratory care.

NBRC Leadership Award – Up to $2,000

Presented to a student who has shown exemplary leadership in their educational career and volunteer and community service.

American Respiratory Care Foundation Awards

Awards include airfare, lodging, and registration for AARC Congress

Applications closed on June 1. More info at arcfoundation.org.

NBRC Frederic Helmholz, Jr., MD Educational Research Fund – Up to $5,000

Awarded to qualified investigators in the field of respiratory care for educational or credentialing research.

NBRC Gareth B. Gish, MS, RRT, Memorial Postgraduate Education Recognition Award – Up to $5,000

Presented to a respiratory therapist pursuing postgraduate education leading to an advanced degree.

NBRC William W. Burgin, Jr., MD & Robert M. Lawrence, MD Education Recognition Award – Up to $7,500

Presented to a third- or fourth-year student enrolled in a CoARC-accredited respiratory therapy program leading to a baccalaureate degree.

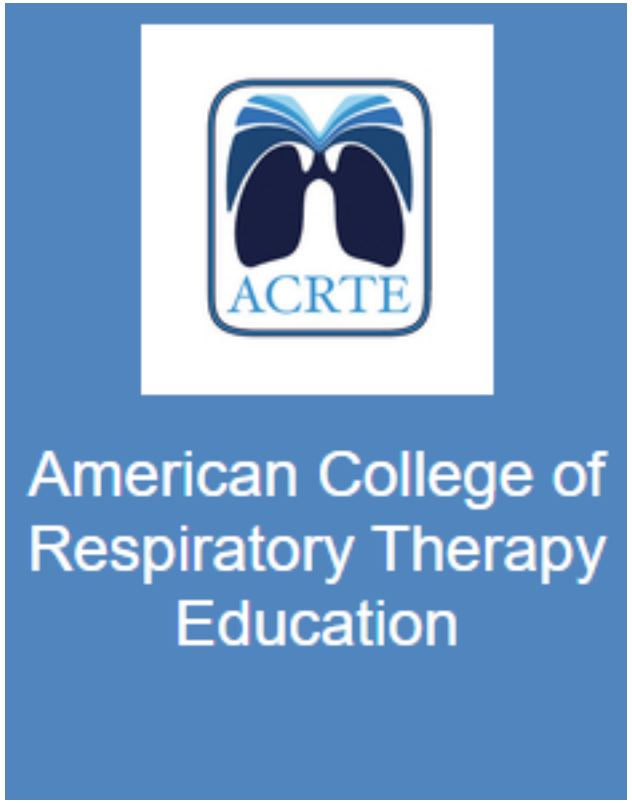
NBRC Gary A. Smith Educational Award for Innovation in Education Achievement – $2,500

Presented to an individual who uses innovative educational methods in formal respiratory care education programs, clinical education training programs and patient education programs that address current challenges in respiratory care education.

ACRTE Scholarships

- The NBRC supports annual scholarships for baccalaureate and graduate respiratory care students

- Apply by **October 1** at http://cobgrte.org/2024scholarships.html



NBRC
The National Board for Respiratory Care

American Heart Association's KC STEM Goes Red

- NBRC staff members and local RT volunteers
  - Hosted a respiratory therapy-focused breakout session
  - Participated in mentoring sessions to answer RT questions and provide professional support
- Over **100** high school girls from the Kansas City area attended
  - Learned about STEM careers, including respiratory therapy!

The NBRC has joined forces with the AARC and CoARC to increase recognition of the difference you make in patients' lives – and the growing need for more RTs.

We are all working toward the same goal.

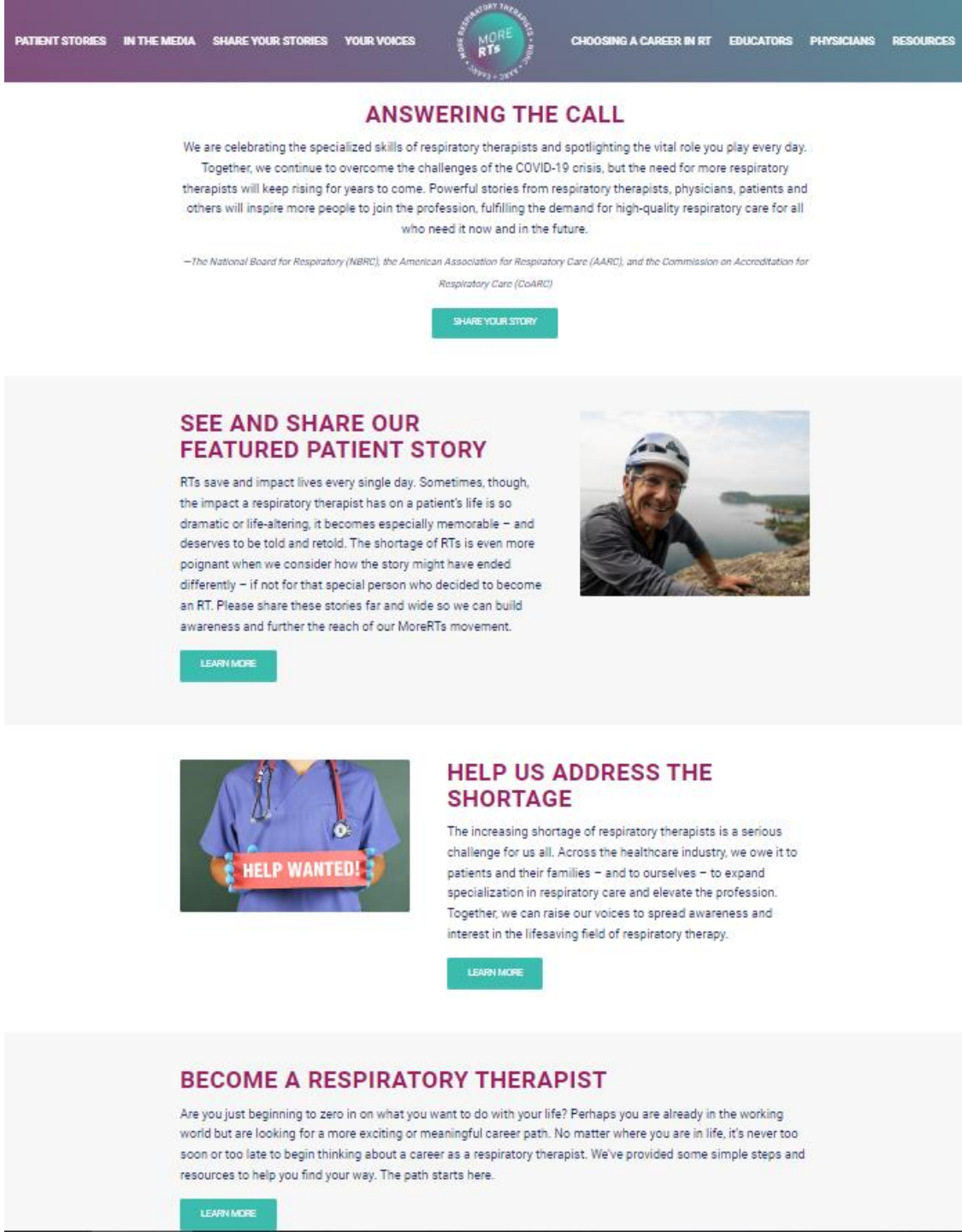
DELIVERING SOLUTIONS

The NBRC, AARC and CoARC have launched a multi-year, national campaign to:

1. Raise public awareness of the value of the respiratory care profession

2. Recruit and retain more respiratory therapists

3. Identify, shape and inspire new leadership in the profession



Your Voices From the Front Lines

Tavorius Crocker, RRT
Chesapeake, VA

Lynda Gonzalez, RRT
Temple, TX

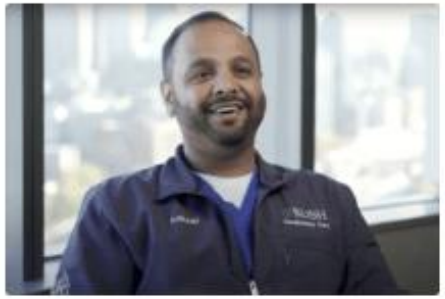
Paulogne Guillaume, RRT, RRT-ACCS, RRT-NPS
Jersey City, NJ

Shontae Hill, RRT, AE-C
Salt Lake City, Utah

Robert B. Johnson, RRT; Courtney Bates, CRT
Birmingham, AL

Jomell Cruz, RRT
San Antonio, TX

Katy McWhorter, Respiratory Therapy Student
Louisville, KY



Ankeet Patel, RRT, RRT-ACCS
Chicago, IL

NBRC
The National Board for Respiratory Care®

Share Your Story

PATIENT STORIES | IN THE MEDIA | SHARE YOUR STORIES | YOUR VOICES | CHOOSING A CAREER IN RT | EDUCATORS | PHYSICIANS | RESOURCES

SHARE YOUR STORY

MAKE A TIKTOK

CONTACT US

#ChooseRT
#MoreRTs

HOW YOU CAN HELP

Each of us has something unique to offer this effort to raise awareness and overcome the RT shortage, and we welcome all types of support:

Are you thinking about entering the respiratory care field?

Check out our resources on **Becoming an RT** to learn more and get started.

Are you an experienced respiratory therapist who wants to help educate new generations of RTs?

Explore more about how you can start that path today.

Do you have a story about the impact of respiratory therapy?

If you are a respiratory therapist, a physician or clinical colleague, a respiratory care educator or student, a patient, or anyone else whose life is affected by the work of RTs, **tell us that story** to join our collective voice and bolster our power to make a difference.

Do you know an organization that may be interested in funding our effort?

Contact us to introduce potential financial contributors so we can make the most of our campaign.

If we are united in this shared purpose of growing interest, awareness and numbers in the profession, we will strengthen the future by ensuring access to high-quality respiratory care for everyone who needs it. Join us!

NBRC
The National Board for Respiratory Care

Examination Updates

Examination Changes Coming in 2027

- A single, multiple-choice exam - Respiratory Therapy Examination
- Streamlines the transition from graduation to entry into practice
- Will assess:
  - Breadth of knowledge
    - organized around the same content domains as the TMC
  - Depth of clinical judgment
    - organized around the following elements of the CSE:
      - Patient types (e.g., chronic airways disease, trauma, cardiac)
      - Settings (in-hospital, out-of-hospital)
      - Patient ages (neonate, pediatric, adult)
      - Clinical activities (information gathering, decision making)

More information will be available as implementation nears in 2027

Credentialing Examination Admission and Content Updates

NPS Examination

- Job analysis started in 2023
- New content will be implemented in 2025

ACCS Examination

- Job analysis begins in 2024

NPS CMP Assessment

- Job analysis begins in 2024

Respiratory Therapy Examination

- Job analysis begins in 2024

PFT Examination

- Modified the admission policy to require 62 semester hours of college credit without requiring PFT experience

Look for an email sent later this summer!

Job Analysis Process

Every practitioner with the credential receives a link to a survey

- Asks about how important each task is to your job
- Asks if other tasks should be added

Your feedback drives the creation of the next detailed content outline

Your Participation is Critical to Keeping Exam Content Up-to-Date

APRT Status Update

- 1 program currently accredited by CoARC
- 14 APRT graduates
- 2 practicing APRTs @ VA Baltimore
- 2 states introducing licensure bills
- NBRC developing an outcomes assessment

NBRC
The National Board for Respiratory Care

Examination Security

QUIET. TESTING IN PROGRESS.

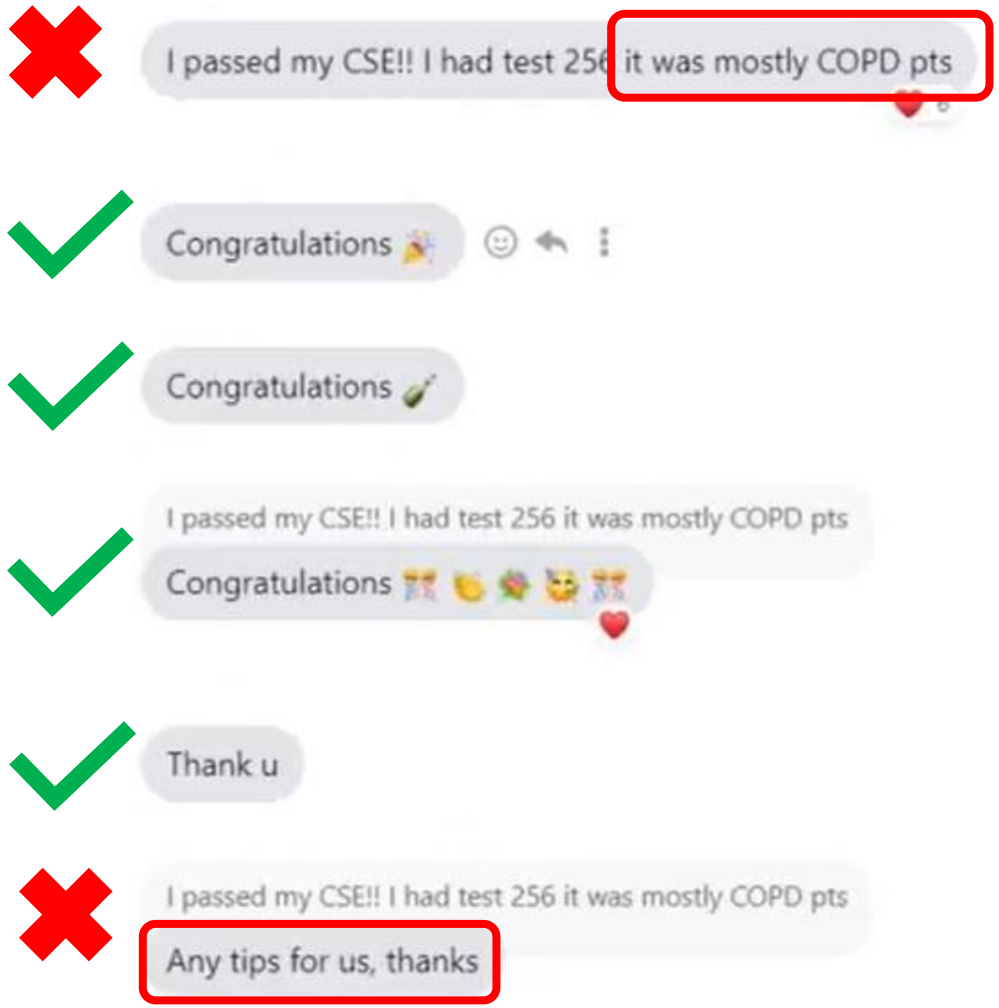
Sharing can be a good thing, but not when it comes to test content.

When you apply for an NBRC Examination, you agree to keep information about the test confidential. This means you should not provide details about the exam with anyone including friends, colleagues, teachers or mentors. Sharing information about the examination could jeopardize your credentials as well as your colleague's.

PROTECT YOURSELF. DON'T SHARE.

POSTING ABOUT YOUR EXAM

You are in an online group or chat room. Someone says that they ran out of time on the exam and asks what the correct answer is for the COPD problem. It is OK to tell the person how much time you spent on the exam, but it is NEVER OK to ask for information about examination content or provide information to someone who asks.


I passed my CSE!! I had test 256 it was mostly COPD pts
Congratulations
Congratulations
I passed my CSE!! I had test 256 it was mostly COPD pts
Congratulations
Thank u
I passed my CSE!! I had test 256 it was mostly COPD pts
Any tips for us, thanks

I passed my test today with high cut!

I had the shunt equation-just had to identify it, alveolar air equation, static compliance, Ve- just had to identify, heliox- my number was 60, so 2 is the factor. That's all that I can remember from calculations.

Had tons of cpap questions, some on trachs, calibration, quality control, lots of copd and asthma questions. Vent questions and auto peep. Had maybe 3 loops to identify and how to correct. Two ekg questions. And a few X-rays were on there. Also had some on neonates-know those ABGs.

Know your pathologies! Pneumonia, pneumothorax (quite a few), pleural effusion, pulmonary embolism, pulmonary edema, CHF. Had some PFT/spirometry questions too.

I was nervous, but I told myself I was sitting down and taking a practice test like I do in this group. As I read questions, I just pretended it was [redacted] telling/explaining things to me like she does in this group. I took practice test after practice test. Printed all of these out on here and just wrote on them whatever she would tell us. I took the nbrc practice test multiple times. Space the tests out from each other so you don't "memorize" them. Most of the questions I had, were just worded differently or had a different scenario. Listen to the recordings over and over and take notes. Good luck to each of you! Thank you @[redacted] !!

❤️ 36

TALKING ABOUT YOUR EXAM

Your colleague approaches you at work wanting to know if there is anything on the examination he/she should know. It is NEVER OK to tell anyone about examination content. The NBRC provides Detailed Content Outlines for all examinations on our website that list all subject matter that could be included on the examinations.

All candidates deserve a fair and equal opportunity to succeed.

Help us safeguard the integrity and security of our credentialing programs.

Visit nbrc.org for more information about exam security.

EXCELLENCE
defines us.

Examination and Credential Misuse Reporting

- We launched a platform on our website to report examination and credential misuse.
- We must all work together to ensure the integrity of our profession's credentials and examinations
- Additional documentation is available for easy access, including the Judicial and Ethics policies, code of conduct for RTs, and more.

Launched in 2024

NBRC
The National Board for Respiratory Care

Credentials being misused (expired or unearned).

Examination cheating.

Do NOT report information regarding patient care or activity that should be reported to your organization's Human Resources team or state licensure agency.

Test questions being shared.

Other activities that could impact the reputation of the NBRC's credentials.

Volunteering

Volunteering with the NBRC

Item Writer

Write questions for the examinations

Contracted periodically for item writing assignments

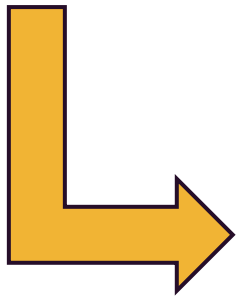
CMP Panel Member

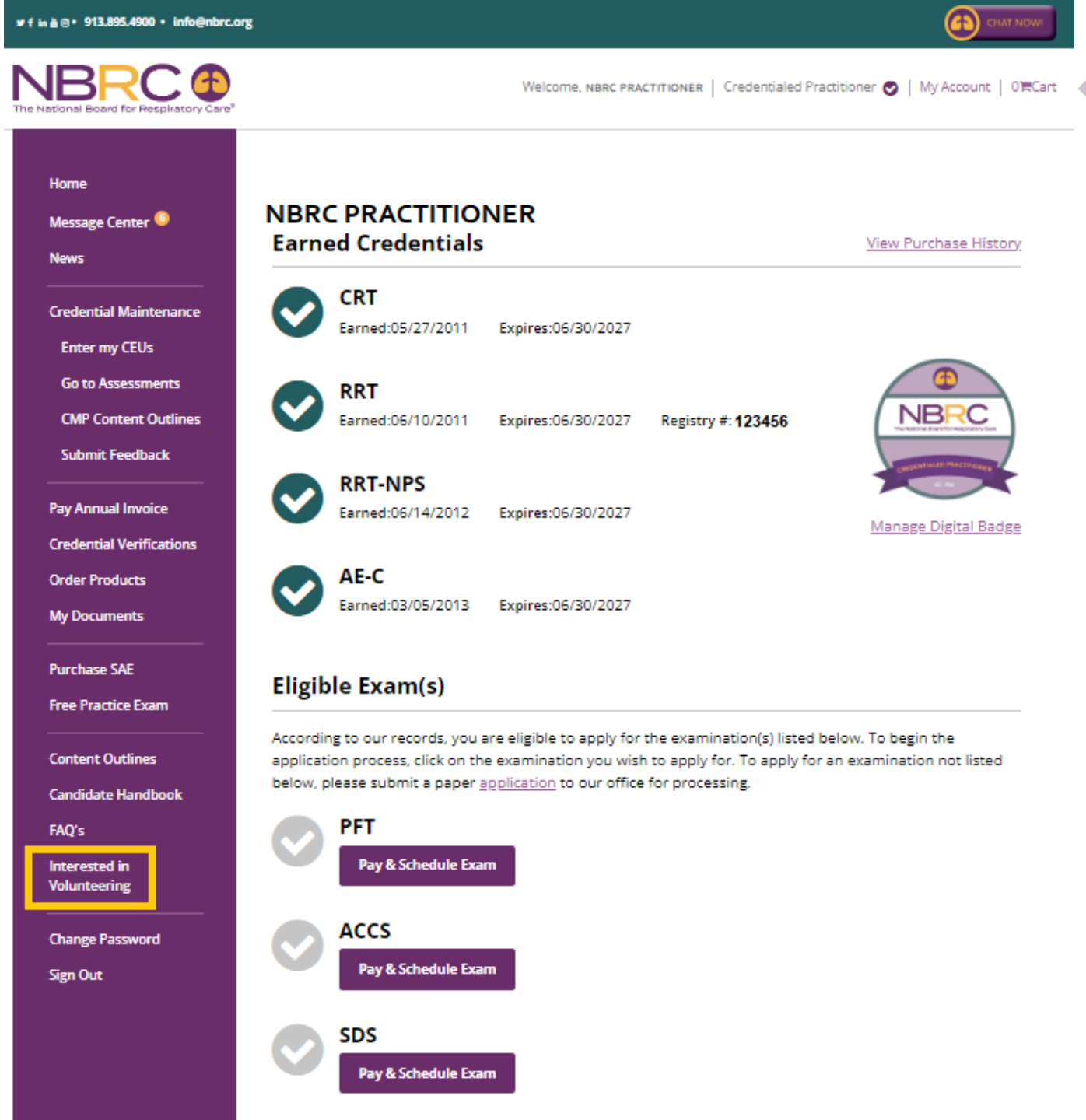
Develop content for the CMP assessments

Item writing experience required

Appointed for one year

Want to Volunteer?





NBRC
The National Board for Respiratory Care

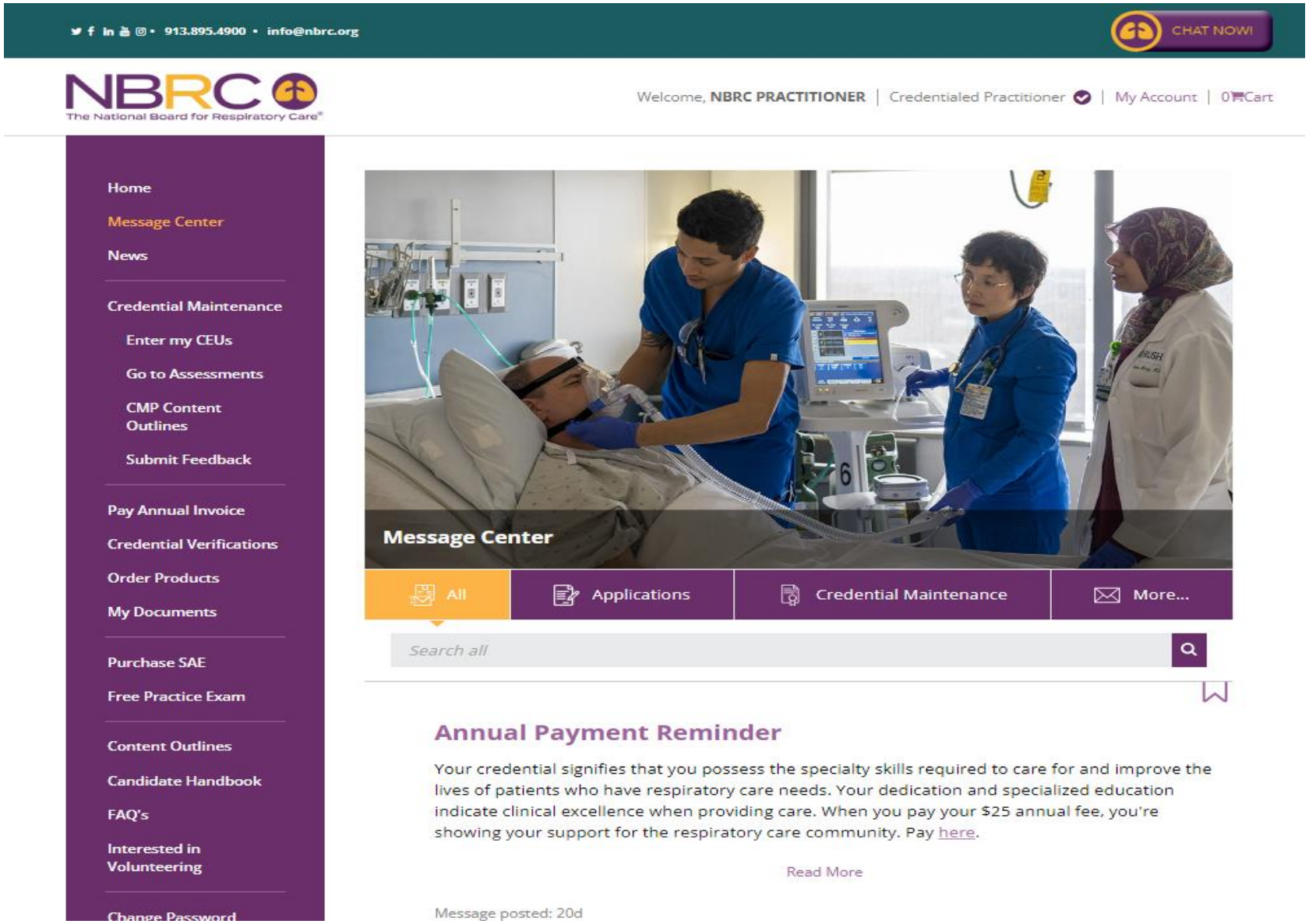
- One-year commitment
- Create at least one original post and story
- Share curated NBRC content monthly within specified timeframe
- Get incentives like gift cards or NBRC swag!
- Interested? Go to nbrc.org/social-media-ambassadors

Be one, know one, follow one!

EXCELLENCE
defines us.

Staying Up-to-Date

Message Center



Follow Us on Social Media

#NBRC #ExcellenceDefinesUs #ChooseRT #MoreRTs

NBRC
The National Board for Respiratory Care

NBRC
The National Board for Respiratory Care

@NBRC_tweets

@the_nbrc

NBRC
The National Board for Respiratory Care

@the_nbrc

How to contact us:

Mail:

- 10801 Mastin Street, Suite 300
  Overland Park, KS 66210

Phone:

- 913-895-4900

Email:

- info@nbrc.org

Live Chat:

- nbrc.org

NBRC
The National Board for Respiratory Care


NBRC
The National Board for Respiratory Care®
Thank you
for your time!
Working Together to Define Excellence

Non-Emergent neOnatal PRe-Intubation MEDication (NEOPRIMED) QI initiative

Devin Sanders BS RRT
NICU Clinical Specialist
Riley Hospital for Children

Riley Children's Health
Indiana University Health

Intubation is a risky procedure

- Endotracheal intubation is common procedure that comes with many potential adverse events:
  - Hypoxia, bradycardia, increased intracranial pressure and more
- An increased number of attempts has been shown to increase the number of adverse events (Neches 2023, Owaza-y 2019)
- These all combine to have a negative impact on morbidity and increase risk of mortality (Sauer 2016, Wallenstein 2016, Hatch 2016)

Premedication for intubation is it safe?

- Current evidence shows that regimens of premedication for the non-emergent intubation of neonates are safe, improve intubating conditions and decrease the time required to intubate (Neches, 2023) (Ozawa-y, 2019)

- While premedication for non-emergent intubation has been a recommendation by the American Academy Pediatrics(AAP) since 2010(Kumar, 2010), it is still inconsistently applied in NICUs. (Ozawa-y,2019)

- We reviewed our practices to make sure it was in line with the AAP recommendations and to ensure that we were complying with our own policy

Where it started

- In 2020, a multidisciplinary team was formed to review our best practices consisting of physicians, advanced practitioners, respiratory therapy, and nursing
- Prior to the project's start a premedication for non-emergent intubation protocol was already in place
- Patients were deemed by the medical team to be non-emergent if patient was not having circulatory compromise and could be stabilized via bag and mask ventilation
- Medications standardized by the protocol are
  - Atropine, Fentanyl, Rocuronium

What were our aims with this QI?

- Our global aim was to improve our intubation success rate in nonemergent intubations in our Newborn patients

- Our Smart Aim: increase our success rate of intubation on the first attempt by 10% within 9 months by using optimal premedication usage

- In the pursuit of achieving these goals we broke down all the roles involved in the intubation and made a driver diagram to discuss possible issues

Graphs not available. Pending Publication

Graphs not available. Pending Publication

Our NICU

- The study was conducted in a 60 bed Level IV NICU at Riley Hospital for Children in Indianapolis, Indiana
- Approximately 650 admissions per year
- All nonemergent intubations between July 2020 and April 2022 were included.

What we recorded

- Data is going to be presented in two groups. Pre-intervention and Post-intervention. Pre-intervention is the data collected prior to implementation of any interventions we implemented, and post-intervention is after we put started our interventions.

- Data was collected on paper surveys in real time at the patient's bedside during the intubation

Graphs not available. Pending Publication

Graphs not available. Pending Publication

What we recorded

- The main data we will talk about today is:
  - Success on 1st attempt
  - Compliance with protocol
  - Direct laryngoscope or Video
  - Trainee participation
  - Adverse effects: bradycardia/desaturations

- Proceduralists were also identified as "trainees" if they were residents or Advanced Practice Providers (Nurse Practitioners and Physican Assistants) that were in training and under direct supervision

Adverse events recorded and definitions

- Bradycardia (HR<80 for > 30 seconds)
- Desaturation (SpO2< 80 for >30 sec or < 65 for >30 sec if Cyanotic Congenital Heart Disease)
- Air leak (Pneumothorax present on CXR performed for ETT position)
- Reversal agent use
- Chest wall rigidity present
- Chest compressions during/immediately following the procedure
- Tachycardia (HR persisting > 180 bpm for > 5 minutes after intubation complete)
- Gums/Tongue/Oropharynx/Larynx bleeding or bruising
- Death during or within 4 hours following the procedure

Graphs not available. Pending Publication

Graphs not available. Pending Publication

Pre-intervention (July 2020 - December 2020) study outcomes

- Compliance with protocol was 95.9%
- Intubation success on first attempt was 63.5%
- Success within 4 attempts was 84%
- Direct Laryngoscope was used 88.3%
- Video Laryngoscope was used 8.5%
- The remaining 3.2% were non-emergent intubations that turned to critical airway requiring intubation via a bronchoscope from anesthesia or ENT.
- Adverse events at 22%

Pre-intervention, what was going on?

- Of the intubations that required more than 1 attempt, 44% required 4 or greater number of attempts
  - In other words, the intubations that required more than one attempt required a high number of attempts to successfully intubate

- We had two non-emergent intubations that turned into critical airway situations
  - One of the intubations took 10 attempts, the other had 8 attempts
  - We investigated and talked to the parties involved

Graphs not available. Pending Publication

Graphs not available. Pending Publication

Our interventions

- Seeing that 44% of the intubations that required more than 1 attempt had 4 or greater number of attempts, we decided to investigate our critical airways and our number of attempts per proceduralist.

- The QI group decided to implement a new policy of a max of two attempts per proceduralist. After two attempts by the same proceduralist then the next more experienced proceduralist would try. If the second proceduralist couldn't intubate after their two attempts an overhead critical airway alert would be called.

- An overhead critical airway alert is a process that has been in place for long time. However, in our hospital at the time, critical airways were uncommonly called in the NICU space and PICU RTs would respond to a critical airway in the NICU with a critical airway cart that was kept in PICU. In that cart was a video laryngoscope that the responding team would use. Many of the responding team was not aware that the NICU had its own video laryngoscope.

Our interventions

- To address this the QI team brought in anesthesia and ENT. Changes that were made were:
  - A critical airway sign was made for patients that were suspected or confirmed critical airways
  - A critical airway box that was specific for the NICU was created. This box was attached to our video laryngoscope cart.
  - If an overhead critical airway was called PICU would no longer respond and instead we would bring our video laryngoscope and critical airway

What's in the critical airway box

- Oral/nasal airways (all appropriate sizes for our patient population)
- ETTs (all sizes we keep in our airway boxes)
- LMAs
- Emergent Trach Kit/Trach set
- MaGill Forceps
- Suture kit
- Taping supplies
- Trach ties
- Suction tubing (to fit request)
- Suction catheters
- Oral suction adapter
- Gauze
- Pedi cap
- Flex adaptor

Graphs not available. Pending Publication

Graphs not available. Pending Publication

Graphs not available. Pending Publication

Post-intervention, study outcomes

- Improved our compliance with our protocol to 100% (from 95.9%)
- Improved our intubation on the first attempt to 71% (from 63.5%)
- Intubations that required less than 4 attempts improved to 95.2% (from 88%)
- Of the intubations that required more than 1 attempt, 17% required 4 or greater number of attempts (from 44%)
- Our highest number of attempts in an intubation was 6, improved from 10
- Our adverse events also improved from 22% to 11%

Overall results

- 111 infants requiring non emergent intubations
- Compliance with our premedication bundle 98%
- Intubation on the first attempt 68%
- Intubations that required less than 4 attempts 90%
- 45% of intubations was done by trainees
- 83.8% of Patients had no adverse effects

Graphs not available. Pending Publication

Graphs not available. Pending Publication

Our data compared to others

- We had the highest premedication usage with the highest intubation on first attempt rate we could find Post intervention
  - Despite having the highest reported trainee percentage at 45%

- Of the studies that were closest to ours in premedication usage and intubation success
  - Venkatesh 2011 – 94% premedication usage – 57% success on first attempt
    - Did not have a set protocol for medication usage and was based on physician preference for medication used and dosage
    - Morphine was used 82% of intubations and Midazolam 11%
    - Suxamethonium (paralytic) was used 85% of intubations
    - In the study they site that dosages of Morphine were too low and may have contributed to their lower success rate

Our data compared to others

- Shay 2021 – (Post-intervention) 96% premedication usage – 66% success on first attempt
  - QI project that resulted in making a standardized approach to medication administration
  - Prior to intervention, 96% premedication usage with a 33% success on first attempt
    - Prior to intervention, medication usage and dose was based on physician preference
    - Medication standardization – Atropine and Fentanyl, with an optional Rocuronium

Our data compared to others

- Of the studies that had a percentage of trainee intubations
  - Le et all 2014 – 40% trainees intubating, 58% Premedication usage, 43% overall intubation success with the trainee
    - Combined first, second, and third-year fellows into trainee. We did not.
    - Only reported data is with trainees
    - Study did not report success on first attempt
    - This study included first year, second year, and third year fellows in their definition of trainees when we did not.
    - Comparing intubations with and without premedication done by trainees. Of the patients that received premedication usage improved intubation success rate by trainees from 22% to 43%.

Our data compared to others

- Adverse events
  - The rate of all adverse events is not commonly reported however bradycardias and desaturations are commonly reported
  - Our Post-intervention rate of occurrence of bradycardias was 6.4%
  - Our Post-intervention rate of occurrence with desaturations was 11%
  - Bradycardias were reported in the literature we reviewed as low as 8% and as high as 23%
  - Desaturations were reported in the literature we reviewed as low as 10% and as high as 61%
  - Our rate of bradycardia and desaturations are on the low end of the range of occurrence rate

Why was our adverse events so much lower than those reported?

- We believe that our overall low rate of adverse events may have been due to our increased rate of intubation on the first attempt as increased number of attempts at intubation has been shown to increase adverse events (Neches, 2023), (Owaza-y, 2019)

- Our decreased rate of bradycardia may have been due to our use of atropine in a premedication bundle
  - Atropine has been shown to decrease the incidence of bradycardia during the intubation process (Neches, 2023)
    - This may be in part due to the insertion of the laryngoscope and ETT causing a vagal response (Marshal, 1984) which atropine counteracts as a vagolytic

Why were our intubation on first attempt rate so much higher than others reported?

- We theorize that our high adherence to a premedication bundle and our specific combination of medications has led us to an increased intubation on the first attempt rate
  - A standardized premedication bundle has been shown to increase intubation success (Herrick, 2021)
  - The AAP has had it as a recommendation since 2010
  - Our premedication bundle includes standardized medications and dosages
    - Atropine, Fentanyl, Rocuronium

Why were our intubation on first attempt rate so much higher than others reported?

- Morphine vs Fentanyl
  - Morphine has a long onset in neonates (6-30 minutes) (Pacifici, 2016)
  - Fentanyl is a quicker onset in neonates (2-3minutes) (Anand,2007)
  - Due to its quicker onset of action and increased potency (Anand, 2007), we theorize that Fentanyl leads to a quicker and more complete sedative intubation experience.

- Paralytic usage
  - Usage of a sedative and paralytic has been shown to increase intubation success over sedative alone, (Ozawa-y,2019)

Why were our intubation on first attempt rate so much higher than others reported?

- Subjectively, the culture we have with our intubations is one of a very calm environment
  - Our hospital has had many traveler RTs and a consistent trend I hear from them is our intubations are a very calm environment.
  - Our culture of teamwork and communication cannot be understated. We do have great teamwork that I am sure leads to improved outcomes.
  - Anecdotally, the time it takes to give the medications give time for the team to "decompress" without taking too much time
    - Atropine is a push, fentanyl protocol is a 3 minute over the pump and then another 3 minute flush, then Rocuronium is also push. Our median time between first medication given and first intubation attempt was 14 minutes.

Our interventions and our improvements

- 100% compliance on our premedication bundle
  - During the study, we relayed up to date information to staff of the results of the data. As well as educated staff on the literature of the importance of the premedication bundle.
  - We theorize that this led to the Post-intervention group being 100% compliant to our premedication bundle

- The improvement of our intubation success on first attempt may have been due to our trainees getting more experienced
  - While we didn't achieve our smart aim of an increase by 10%. We are still happy with the overall result of the QI
  - The experience level of our staff from the beginning of our study and the end improved and may have led to an increase in intubation on first attempt

Our interventions and our improvements

- The improvement in intubations that required less than 4 attempts, we believe was due to the change of only 2 attempts per proceduralist
  - This ensured that a more experienced proceduralist would attempt to intubate on the 3rd attempt if the first two were unsuccessful

- Our decrease in our high number attempt intubations
  - We believe these improvements came from the change of only 2 attempts per proceduralist as well as overhead critical airways to be called after 2 proceduralists have attempted.
  - This meant a max of 4 attempts were required before a critical airway is called and brings the critical airway team to bedside sooner.

Our interventions and our improvements

- Our rate of adverse events improved
  - We theorize this may have been achieved because of the increased success on first attempt and improvement in intubations requiring less than 4 attempts as a decrease in number of attempts has been shown to decrease the number of adverse events (Ozawa-y, 2019), (Neches, 2023)

- A decrease in oral bleeding and bruising
  - We believe this may have been caused by a combination of the increased experience of our proceduralist over the course of the QI and the decreased number of attempts we observed.

The take aways

- Our data continues to show that premedication for non-emergent intubations continues to be safe and effective
- Even with high trainee percentages, a high percentage of intubation on first attempt can be achieved
- Our data and other supporting studies continue to point to a high adherence to a standardized premedication bundle leads to higher success on first attempt.
- As supported by our data and other studies, this bundle should include specific medications and dosages.

The take aways

- We theorize also theorize that the specific medications of Atropine, Fentanyl, and Rocuronium leads to a more successful intubation

- While rare, critical airway processes need to be assessed periodically for barriers so they can be addressed

The challenges we faced in this QI

- Who is going to gather the data?
  - The initial idea was that the RTs would be the ones that collected the data. However, with RT staffing the way it was it proved to be difficult for the RTs to both care for the patient and fill out the paperwork.
  - It was then given to the nurse who had the job of recording during the intubation as the nurse was already recording some of the data and was in a place were filling out an additional paper wasn't too much of an

The challenges we faced in this QI

- Fatigue of filling out the surveys was a common complaint especially as we got further into the study
  - This did result in a drop in paper surveys that were being made. However, to fill in the gap we did searching the medical records for intubations in the NICU and collected the information we needed to from the charting.
  - To try and combat this the data was shared with staff and education was given to the high importance to of filling out the surveys
  - In future projects, I would like to try to have a dedicated team who work at the bedside on each shift to try to win over the hearts and minds

Acknowledgments

- Devin Sanders, BS-RRT, RCP
  - Riley Hospital for Children at Indiana University Health
- Laura Blazier, MSN, RN, ACCNS-P, RNC-NIC
  - Riley Hospital for Children at Indiana University Health
- Chad D Sikora MSN, NNP-BC, CPHQ
  - Department of Pediatrics, Indiana University School of Medicine, Indianapolis, Indiana, USA
- Beatrice Stefanescu, MD, MBA, MS
  - Department of Pediatrics, Indiana University School of Medicine, Indianapolis, Indiana, USA

References

- Shay, R., Weikel, B. W., Grover, T., & Barry, J. S. (2022). Standardizing premedication for non-emergent neonatal tracheal intubations improves compliance and patient outcomes. *Journal of perinatology : official journal of the California Perinatal Association*, *42*(1), 132–138. https://doi.org/10.1038/s41372-021-01215-2
- Carbajal, R., Lode, N., Ayachi, A., Chouakri, O., Henry-Larzul, V., Kessous, K., Normand, A., Courtois, E., Rousseau, J., Cimerman, P., & Chabernaud, J. L. (2019). Premedication practices for tracheal intubation in neonates transported by French medical transport teams: a prospective observational study. *BMJ open*, *9*(11), e034052. https://doi.org/10.1136/bmjopen-2019-034052
- Singh N. Premedication for neonatal intubations: an unrecognized area for improvement. J Lung Pulm Respir Res. 2018;5(3):92-95. DOI: 10.15406/jlprr.2018.05.00169
- Diego, E. K., Malloy, K., Cox, T., Broomall, A., Orr, L., Baxter, C., Meany, S., Baker, N., Fraser, J., Corbin, K. S., Gregoski, M. J., Wagner, C. L., & Ross, J. R. (2022). Implementation of a Standardized Premedication Bundle to Improve Procedure Success for Nonemergent Neonatal Intubations. *Pediatric quality & safety*, *8*(1), e622. https://doi.org/10.1097/pq9.0000000000000622
- Ozawa, Y., Ades, A., Foglia, E. E., DeMeo, S., Barry, J., Sawyer, T., Singh, N., Glass, K., Jung, P., Quek, B. H., Johnston, L., Kim, J., Napolitano, N., Shults, J., Nadkarni, V. M., Nishisaki, A., & National Emergency Airway Registry for Neonates (NEAR4NEOS) Investigators (2019). Premedication with neuromuscular blockade and sedation during neonatal intubation is associated with fewer adverse events. *Journal of perinatology : official journal of the California Perinatal Association*, *39*(6), 848–856. https://doi.org/10.1038/s41372-019-0367-0

Refrences

- Johnston, L., Sawyer, T., Ades, A., Moussa, A., Zenge, J., Jung, P., DeMeo, S., Glass, K., Singh, N., Howlett, A., Shults, J., Barry, J., Brei, B., Foglia, E., Nishisaki, A., & NEAR4NEOS Investigators (2021). Impact of Physician Training Level on Neonatal Tracheal Intubation Success Rates and Adverse Events: A Report from National Emergency Airway Registry for Neonates (NEAR4NEOS). *Neonatology*, *118*(4), 434–442. https://doi.org/10.1159/000516372
- Foglia, E. E., Ades, A., Sawyer, T., Glass, K. M., Singh, N., Jung, P., Quek, B. H., Johnston, L. C., Barry, J., Zenge, J., Moussa, A., Kim, J. H., DeMeo, S. D., Napolitano, N., Nadkarni, V., Nishisaki, A., & NEAR4NEOS Investigators (2019). Neonatal Intubation Practice and Outcomes: An International Registry Study. *Pediatrics*, *143*(1), e20180902. https://doi.org/10.1542/peds.2018-0902
- Neches, S. K., Brei, B. K., Umoren, R., Gray, M. M., Nishisaki, A., Foglia, E. E., & Sawyer, T. (2023). Association of full premedication on tracheal intubation outcomes in the neonatal intensive care unit: an observational cohort study. *Journal of perinatology : official journal of the California Perinatal Association*, *43*(8), 1007–1014. https://doi.org/10.1038/s41372-023-01632-5
- Le, C. N., Garey, D. M., Leone, T. A., Goodmar, J. K., Rich, W., & Finer, N. N. (2014). Impact of premedication on neonatal intubations by pediatric and neonatal trainees. *Journal of perinatology : official journal of the California Perinatal Association*, *34*(6), 458–460. https://doi.org/10.1038/jp.2014.32
- Venkatesh, V., Ponnusamy, V., Anandaraj, J., Chaudhary, R., Malviya, M., Clarke, P., Arasu, A., & Curley, A. (2011). Endotracheal intubation in a neonatal population remains associated with a high risk of adverse events. *European journal of pediatrics*, *170*(2), 223–227. https://doi.org/10.1007/s00431-010-1290-8

Refrences

- Kumar, P., Denson, S. E., Mancuso, T. J., & Committee on Fetus and Newborn, Section on Anesthesiology and Pain Medicine (2010). Premedication for nonemergency endotracheal intubation in the neonate. *Pediatrics*, *125*(3), 608–615. https://doi.org/10.1542/peds.2009-2863
- Sauer, C. W., Kong, J. Y., Vaucher, Y. E., Finer, N., Proudfoot, J. A., Boutin, M. A., & Leone, T. A. (2016). Intubation Attempts Increase the Risk for Severe Intraventricular Hemorrhage in Preterm Infants-A Retrospective Cohort Study. *The Journal of pediatrics*, *177*, 108–113. https://doi.org/10.1016/j.jpeds.2016.06.051
- Wallenstein, M. B., Birnie, K. L., Arain, Y. H., Yang, W., Yamada, N. K., Huffman, L. C., Palma, J. P., Chock, V. Y., Shaw, G. M., & Stevenson, D. K. (2016). Failed endotracheal intubation and adverse outcomes among extremely low birth weight infants. *Journal of perinatology : official journal of the California Perinatal Association*, *36*(2), 112–115. https://doi.org/10.1038/jp.2015.158
- Hatch, L. D., Grubb, P. H., Lea, A. S., Walsh, W. F., Markham, M. H., Maynord, P. O., Whitney, G. M., Stark, A. R., & Ely, E. W. (2016). Interventions to Improve Patient Safety During Intubation in the Neonatal Intensive Care Unit. *Pediatrics*, *138*(4), e20160069. https://doi.org/10.1542/peds.2016-0069