Be the Difference: Similar Outcomes & Superior Patient Comfort

High velocity therapy challenges the accepted standard treatment for patients with an acute exacerbation of moderate-severe COPD.

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Director, Professional Development & RT Education

Medical Affairs

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Respiratory Associates

AARC Approved Live Respiratory CEUs

Disclaimer

Speaker Disclosure

Matt Pavlichko is an employee of Vapotherm.

Matt Pavlichko has a fiduciary relationship with AARC, PSRC, and RT Sidebar Podcast

Disclaimer

Vapotherm's high velocity therapy is a tool for treating respiratory distress. The following slides convey study results in relation to the use of high velocity therapy, but individual results may vary. For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

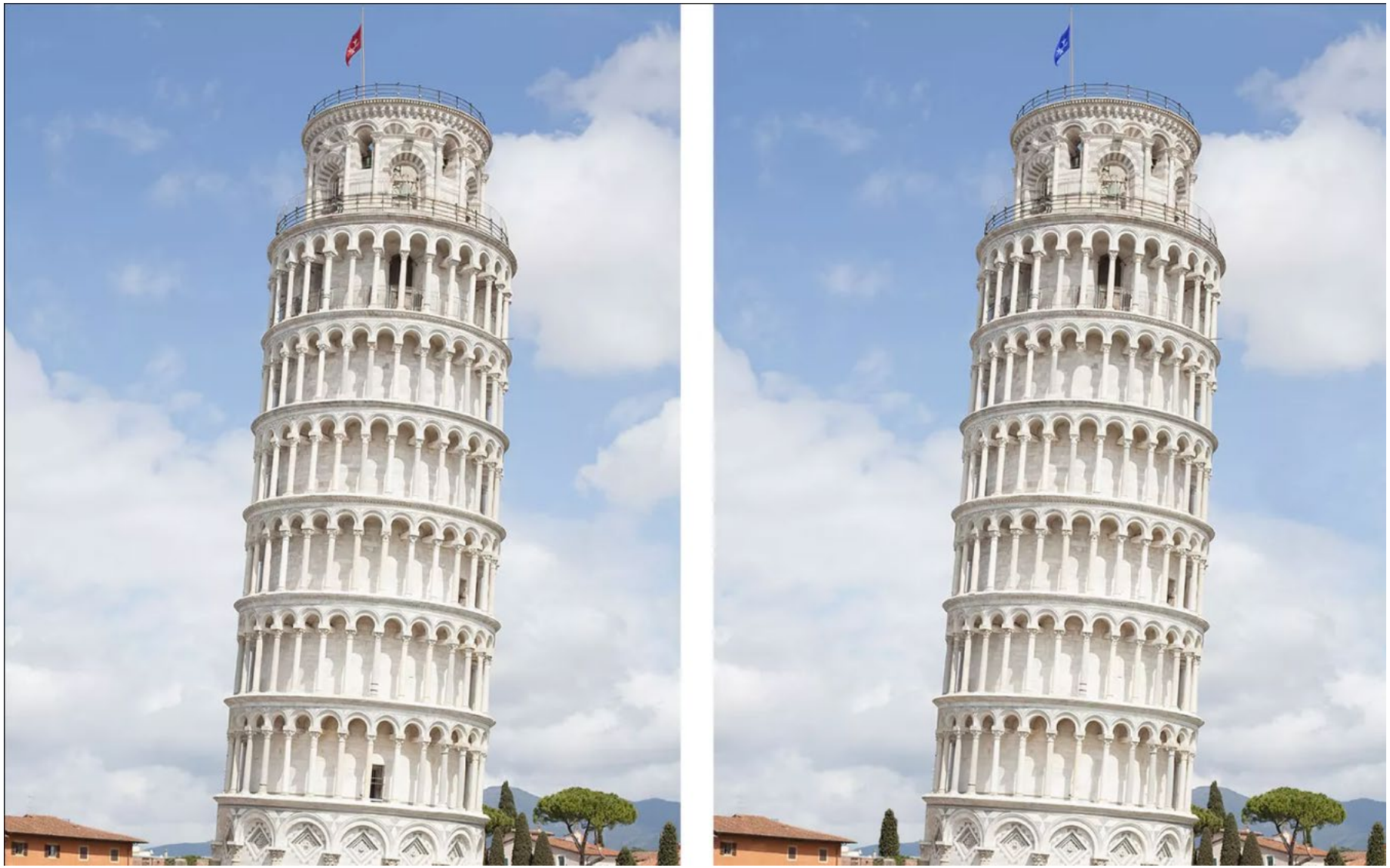
Vapotherm does not practice medicine or provide medical services or advice, any clinical recommendations provided herein are solely those of the speaker.

Practitioners should refer to the full indications for use and operating instructions of any products referenced before use.

Are you reading this?

Caution: U.S. Federal law restricts this device to sale by or on the order of a physician.

Spot the Difference



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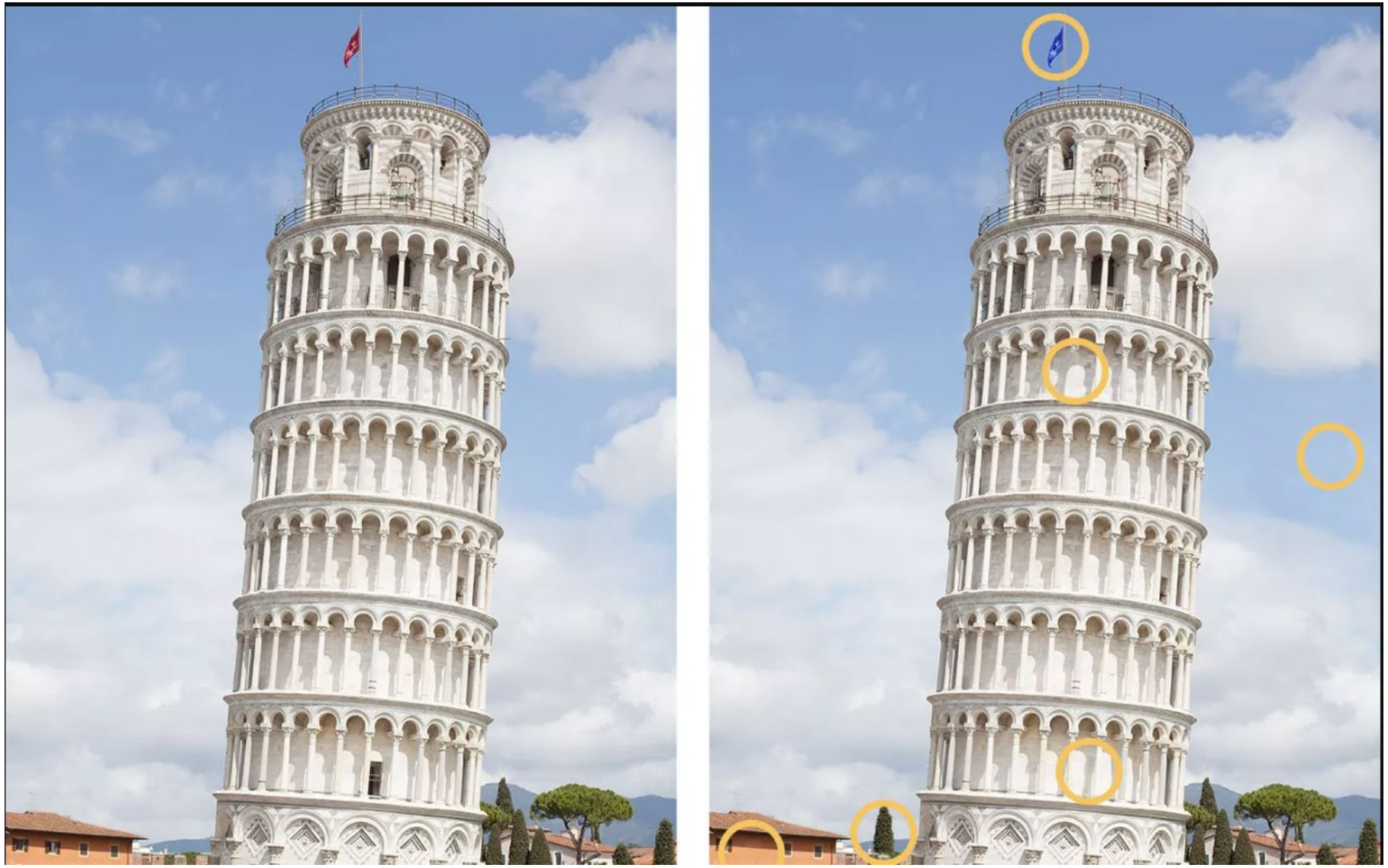

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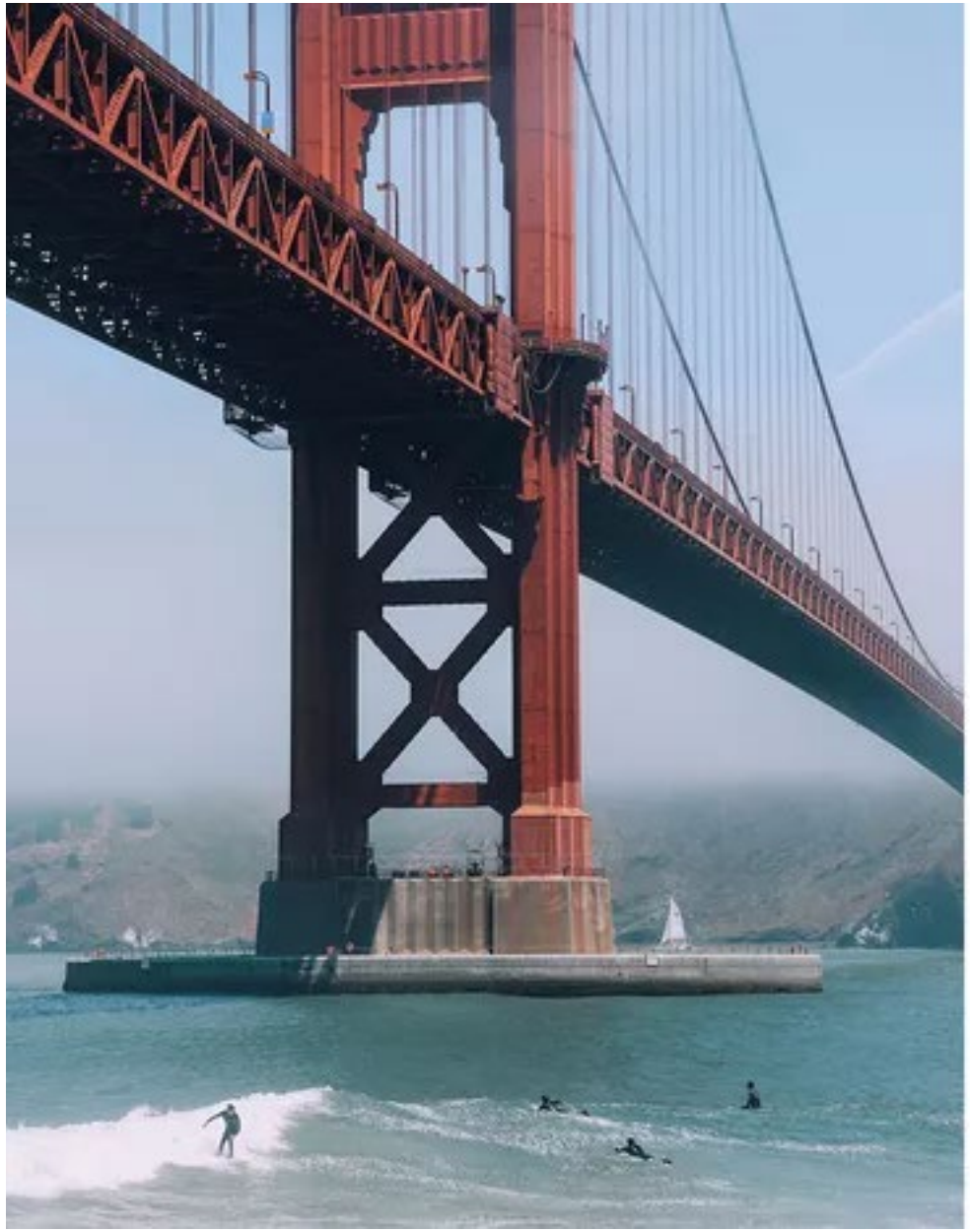

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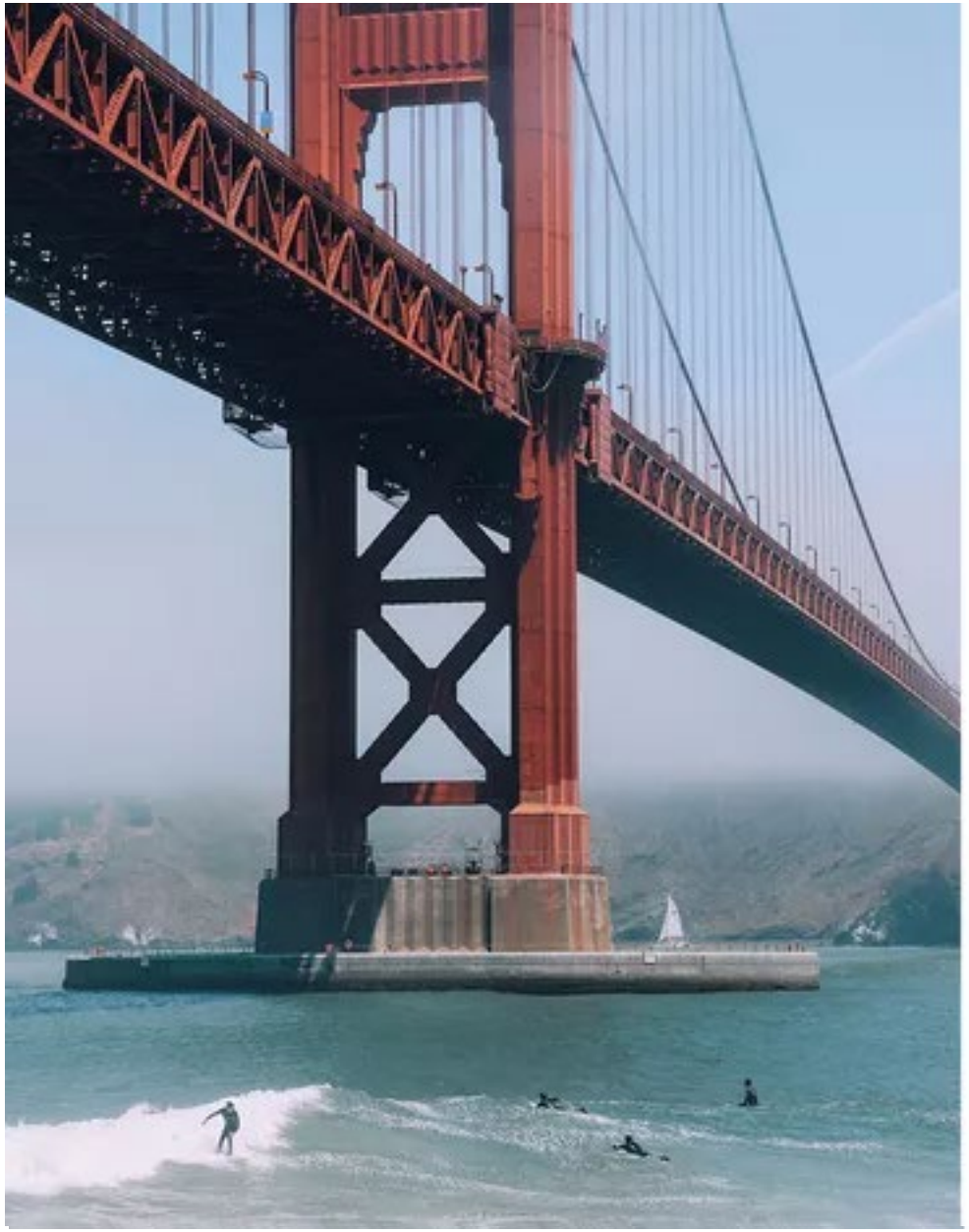
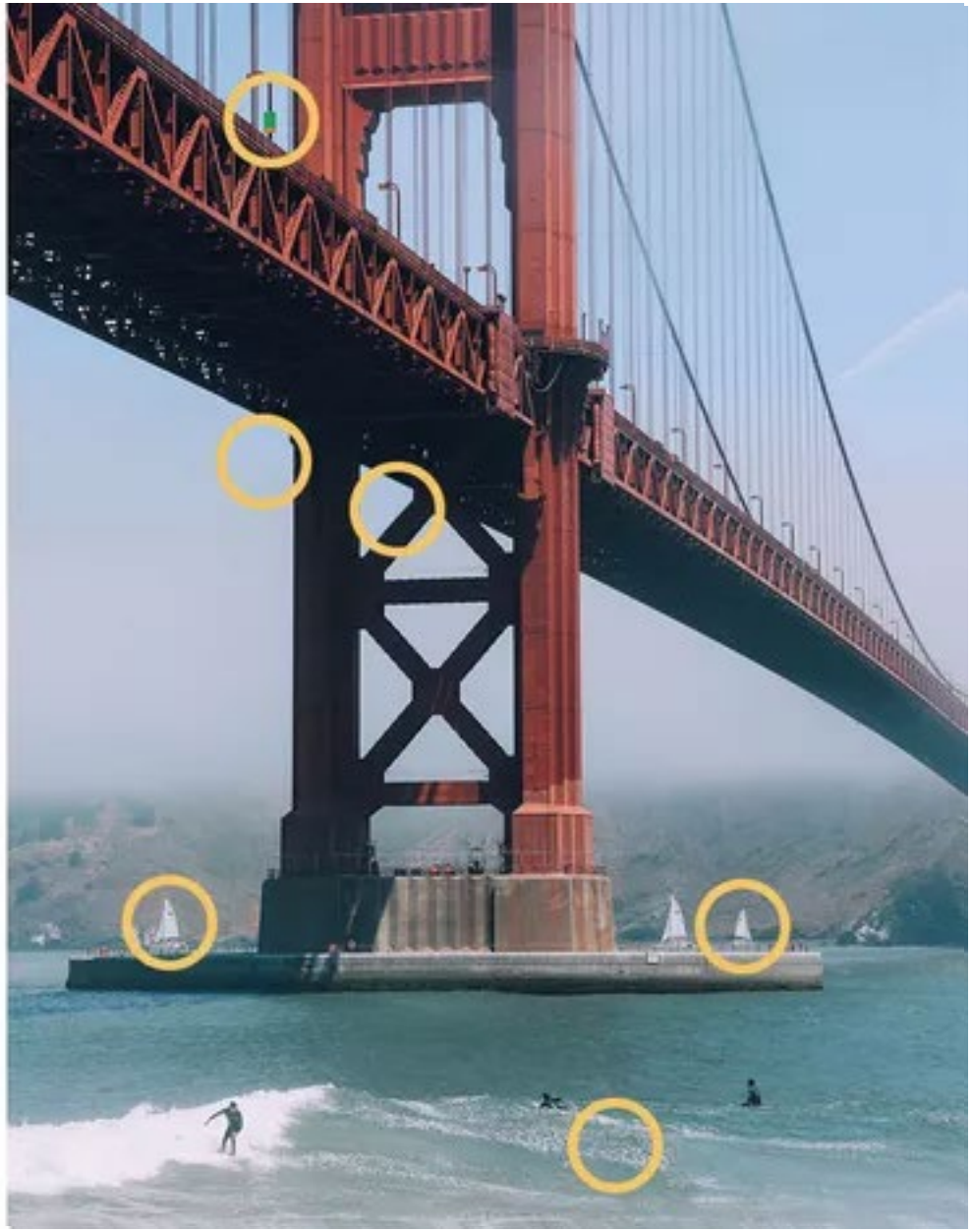




Spot the Difference

High Velocity Therapy*

Noninvasive Positive Pressure Ventilation (NiPPV)

High Velocity Therapy is a mask-free form of noninvasive ventilation (NIV)

*For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

Spot the Difference

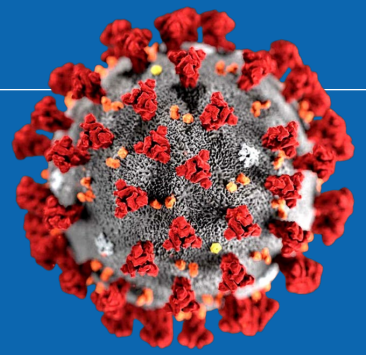
Are all Nasal Cannulas the Same?

High Velocity Therapy

High Flow Nasal Cannula

For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

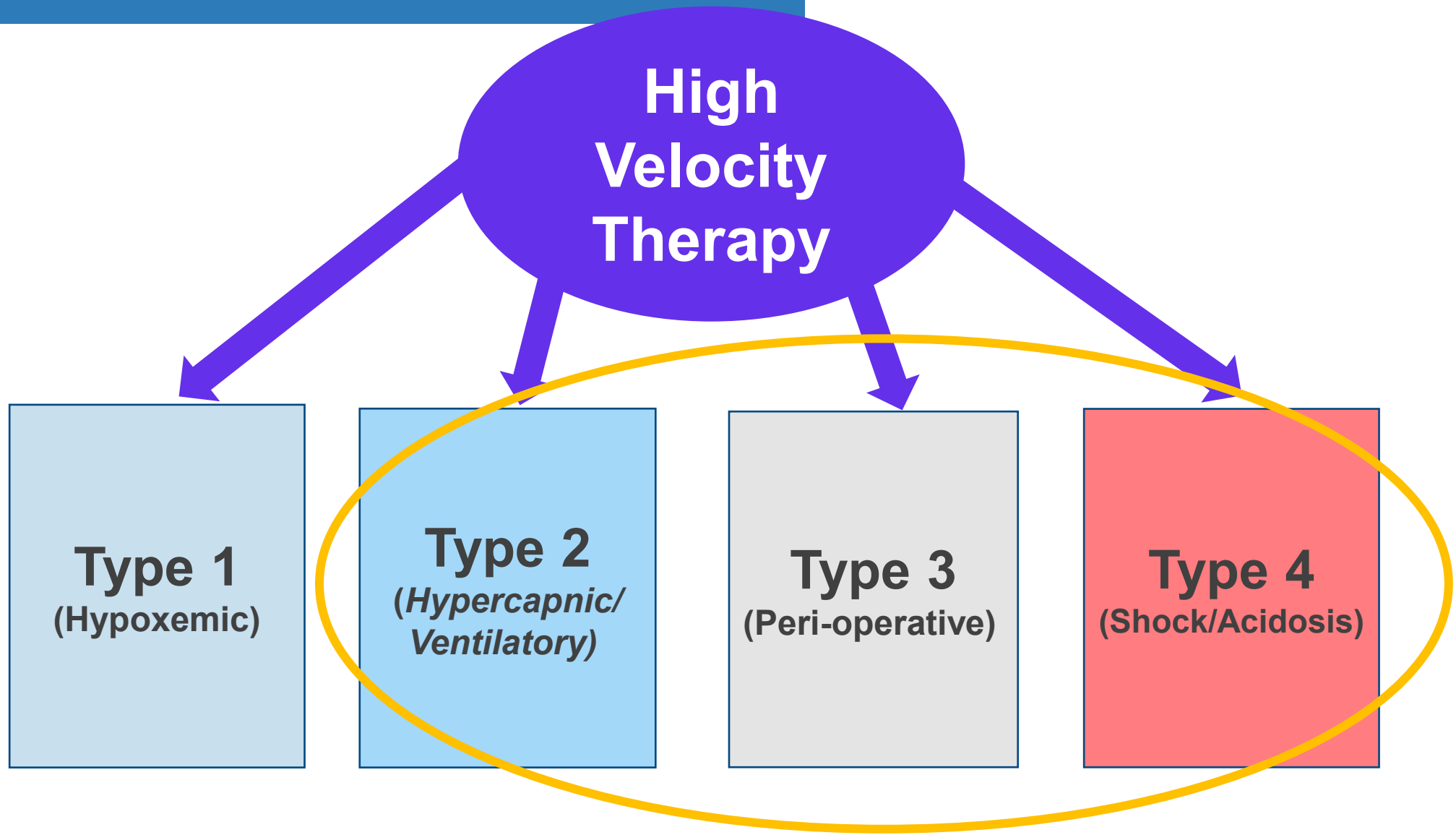
Traditional High Flow Nasal Cannulas…



- Delivery of conditioned medical gas at higher flow rates compared to conventional low-flow nasal oxygen
  - Heated humidified medical gas conditioned for the nasal airway (comfort)
  - Delivered via nasal cannula interface
  - Meets or exceeds the patient's inspiratory demand
  - Allows precise FiO2 delivery to the patient (minimal air entrainment)
  - Interface leak?

Williams, RB. Respir Care Clin N Am 1998 Jun; 4 (2): 215-28

Acute Respiratory Failure?



Learning Objectives

- Describe how high velocity therapy compares to other non-invasive respiratory support modalities including Non-invasive Positive Pressure (NiPPV) support.
- Understand the clinical evidence that supports the use of high velocity therapy for hypercapnia.
- Describe the mechanisms of action for high velocity therapy.

A patient presents in the ED with a pCO_2 of 78 and pH of 7.28…what respiratory support device is your go-to?

Clinical Evidence supporting high velocity therapy for hypercapnic patients

Clinical Evidence supporting high velocity therapy for hypercapnic patients

Alternative to NIPPV
Doshi RCT, 2018

Independently Verified
Plotnikow, 2021

How severe?
HYPERACT, 2024

Clinical Evidence supporting high velocity therapy for hypercapnic patients

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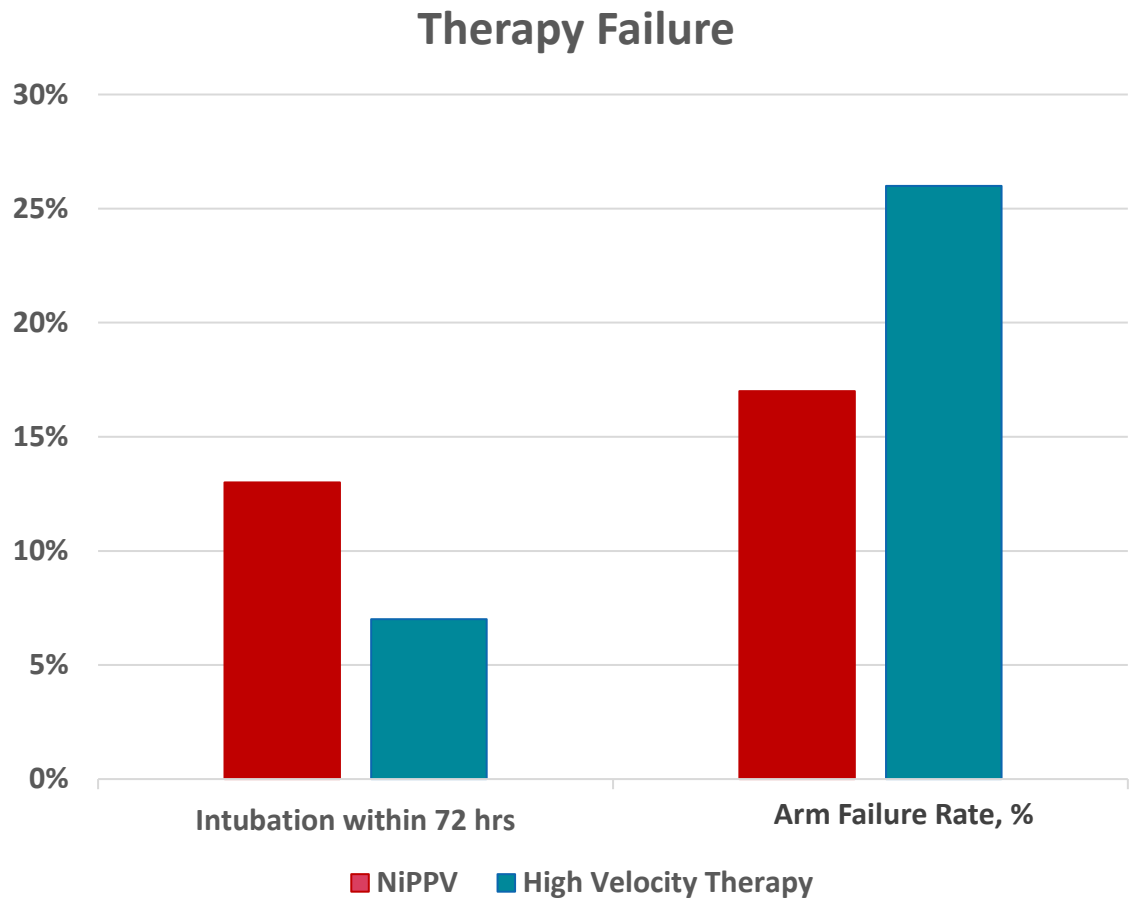
Plotnikow, 2021

How severe?

HYPERACT, 2024

Doshi: High velocity therapy comparable to NIPPV for failure to intubate

- **n = 204**
- **Primary endpoint:** Intubation or crossover to other therapy within 72 hours
- **No statistical difference** in the likelihood of needing intubation or crossover to other therapy

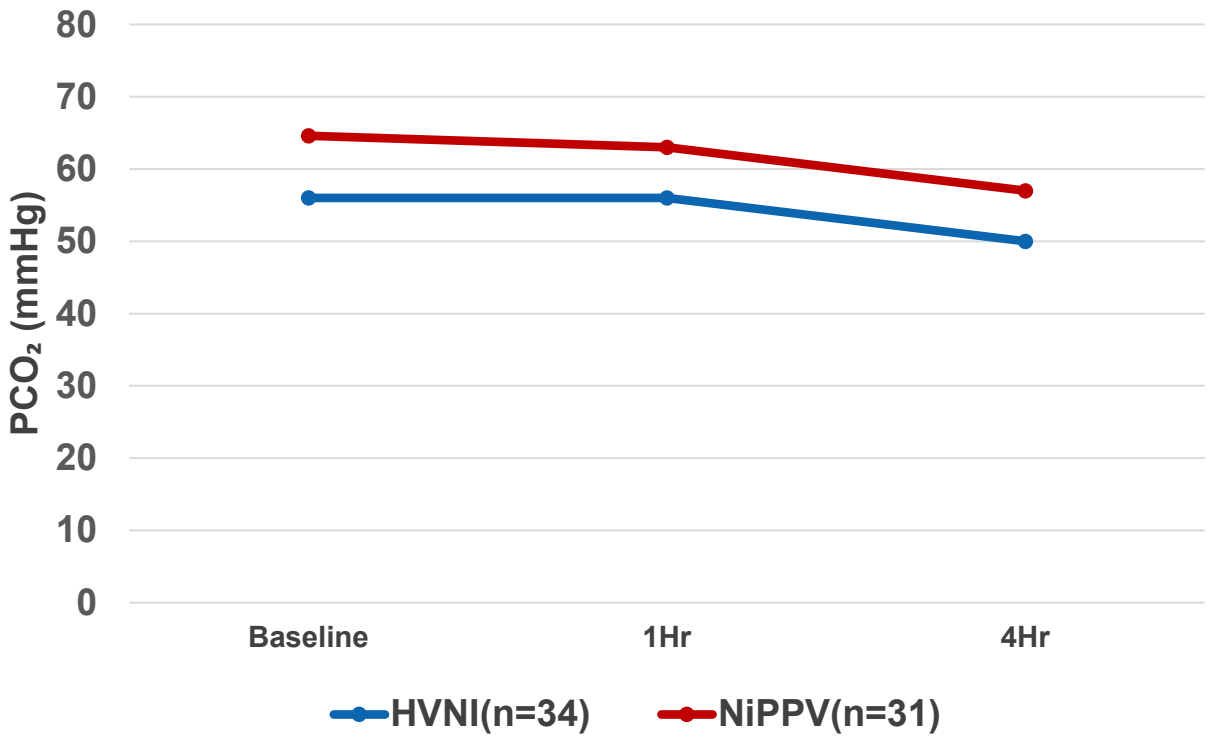


High velocity therapy was used exclusively in the study

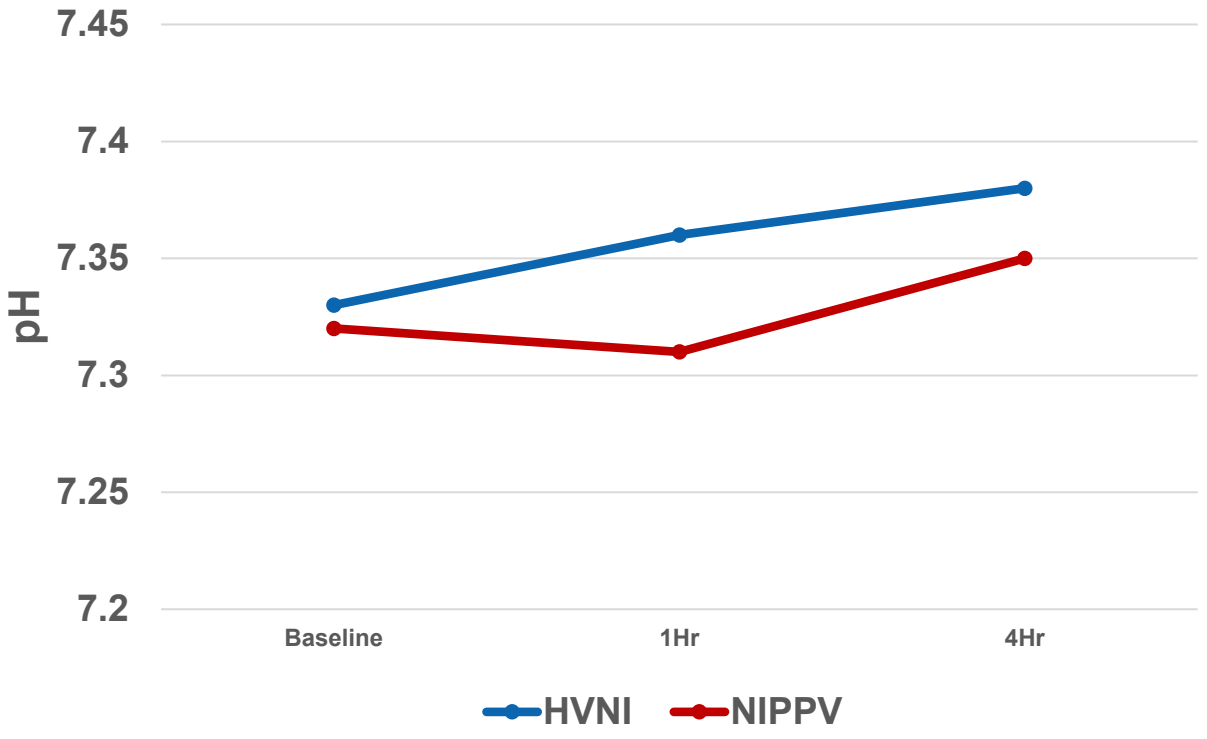
1. Doshi P et al. High-Velocity Nasal Insufflation in the Treatment of Respiratory Failure: A Randomized Clinical Trial. Ann Emerg Med. 2018 Jul;72(1):73-83.e5.

Doshi Subgroup Analysis: High velocity therapy is effective for hypercapnic patients

- pCO_2 levels trended similarly over time



- pH levels trended similarly over time



High velocity therapy does not provide the total ventilatory requirements of patients

n = 65

Clinical Evidence supporting high velocity therapy for hypercapnic patients

Independently Verified
Plotnikow, 2021

Alternative to NIPPV
Doshi RCT, 2018

How severe?
HYPERACT, 2024

Independently verified - Plotnikow

ORIGINAL CLINICAL REPORT

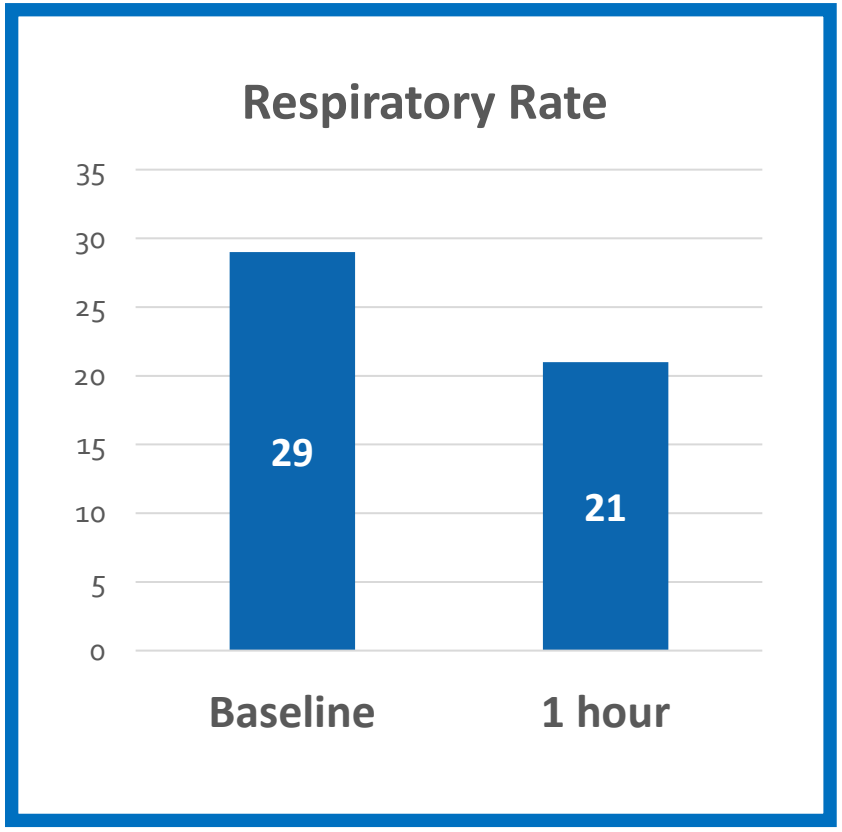
High-Flow Oxygen Therapy Application in Chronic Obstructive Pulmonary Disease Patients With Acute Hypercapnic Respiratory Failure: A Multicenter Study

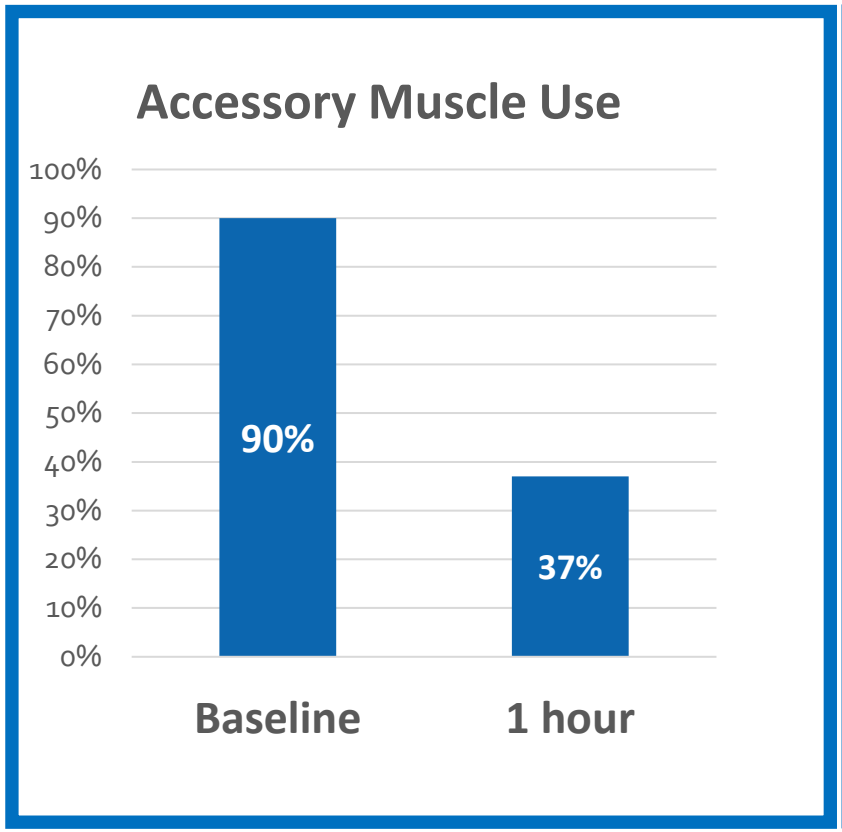
Plotnikow, Gustavo A. RT[1]; Accoce, Matias RT[2]; Fredes, Sebastián RT[3,4]; Tiribelli, Norberto RT[4]; Setten, Mariano RT[5]; Dorado, Javier RT[2]; Guaymas, Maria MD[4]; Ilutovich, Santiago MD[3]; Rodriguez, Pablo O. MD[5]; Cesio, Cristian E. MD[2]; Scapellato, Jose L. MD[1]; Vasquez, Daniela N. MD[1]

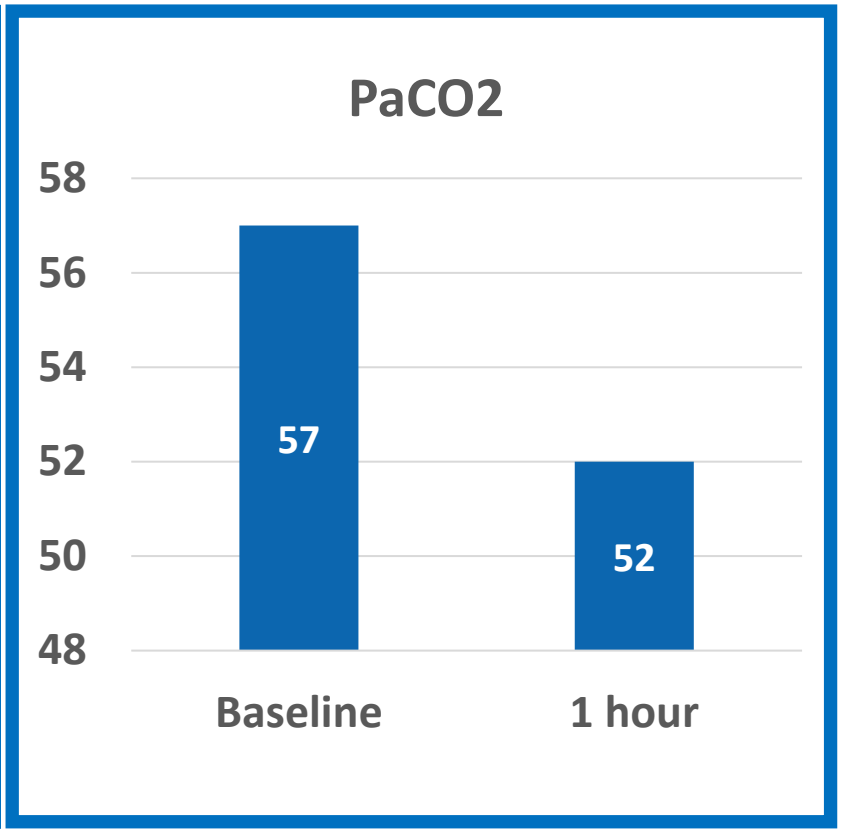
Author Information

Critical Care Explorations: February 2021 - Volume 3 - Issue 2 - p e0337
doi: 10.1097/CCE.0000000000000337

Demonstrating patient improvement in one hour…







2. Plotnikow G, Accoce M, Fredes S, et al. High-Flow Oxygen Therapy Application in Chronic Obstructive Pulmonary Disease Patients with Acute Hypercapnic Respiratory Failure: A Multicenter Study. Critical Care Explorations. February 2021;3:1-8 p e0337

Clinical Evidence supporting high velocity therapy for hypercapnic patients

How severe?
HYPERACT, 2024

Independently Verified
Plotnikow, 2021

Alternative to NIPPV
Doshi RCT, 2018

Randomized Multi-Center Clinical Trial

Locations: 7 hospitals
- 3 academic
- 3 community
- 1 military

Primary Outcome:
- Dyspnea severity 4 hours after initiation of treatment measured by modified Borg Scale.[6-9]

Population: Symptomatic ED patients with suspected or known COPD
PCO_2 > 60 mmHg and pH 7.0 - 7.35

- Randomized 1:1 High velocity therapy (n=36) or NIPPV (n=32)

Mean Values (at Randomization)

	High Velocity Therapy	NIPPV
PCO_2	77.8	76.5
pH	7.27	7.27
Dyspnea Score	5.4	5.6

Secondary Outcomes:
- Physiologic parameters changes: SpO_2 & VS
- VBG parameter changes: PCO_2, pH
- Dyspnea at 30 min, 60 min & need for intubation
- Patient and physician perceptions of clinical stability & comfort

5. Yamane, D.P., et. al.(2024), *High-flow Nasal Insufflation vs. Non-Invasive Ventilation for Acute Exacerbation of COPD: A Randomized Clinical Trial.*. Crit Care Med, 2024. 52(1): p. s21.
6. Vapotherm Doc REPO-001430: HYPERACT Clinical Trial Summary and Report

How severe? HYPERACT Study

Population: Symptomatic ED patients with suspected or known COPD

PCO_2 > 60 mmHg and pH 7.0 - 7.35

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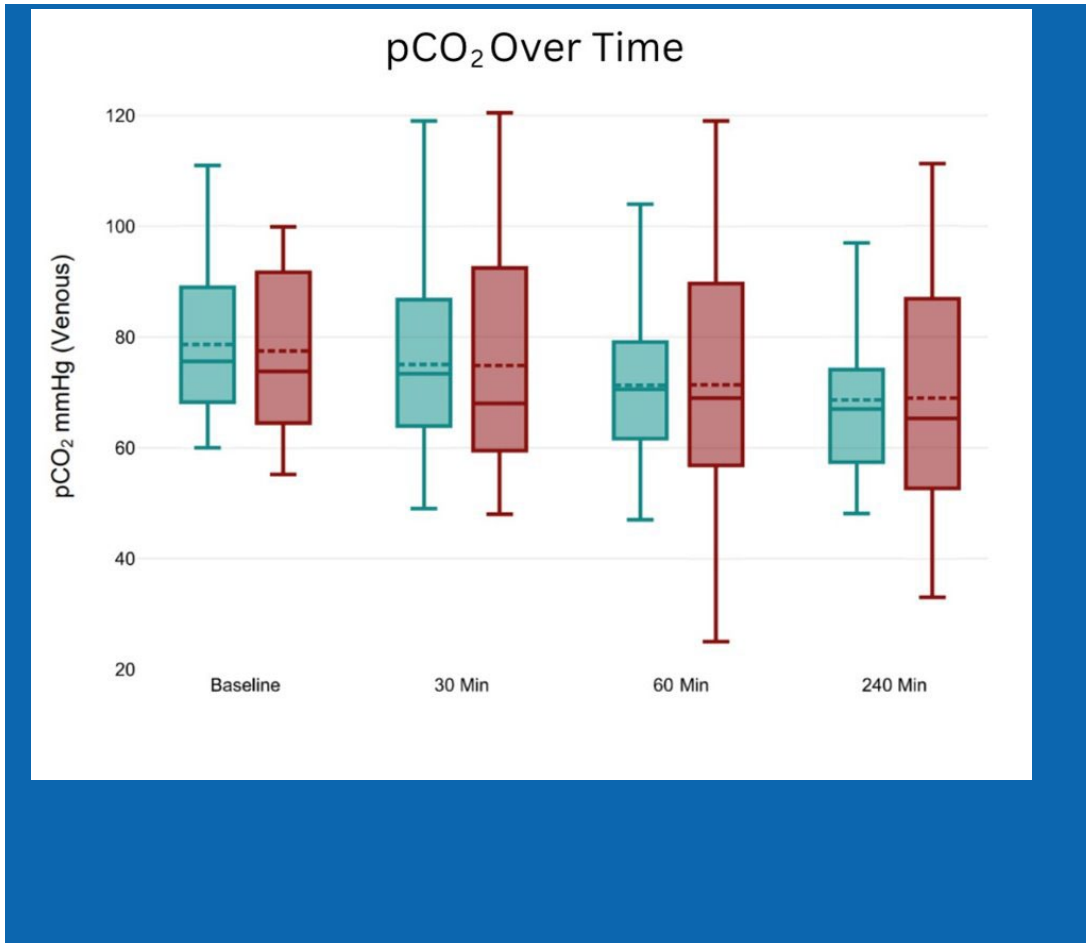
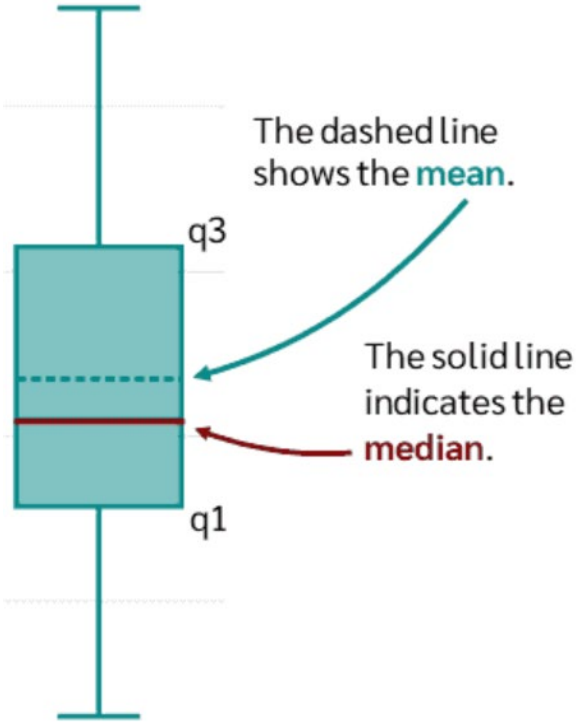
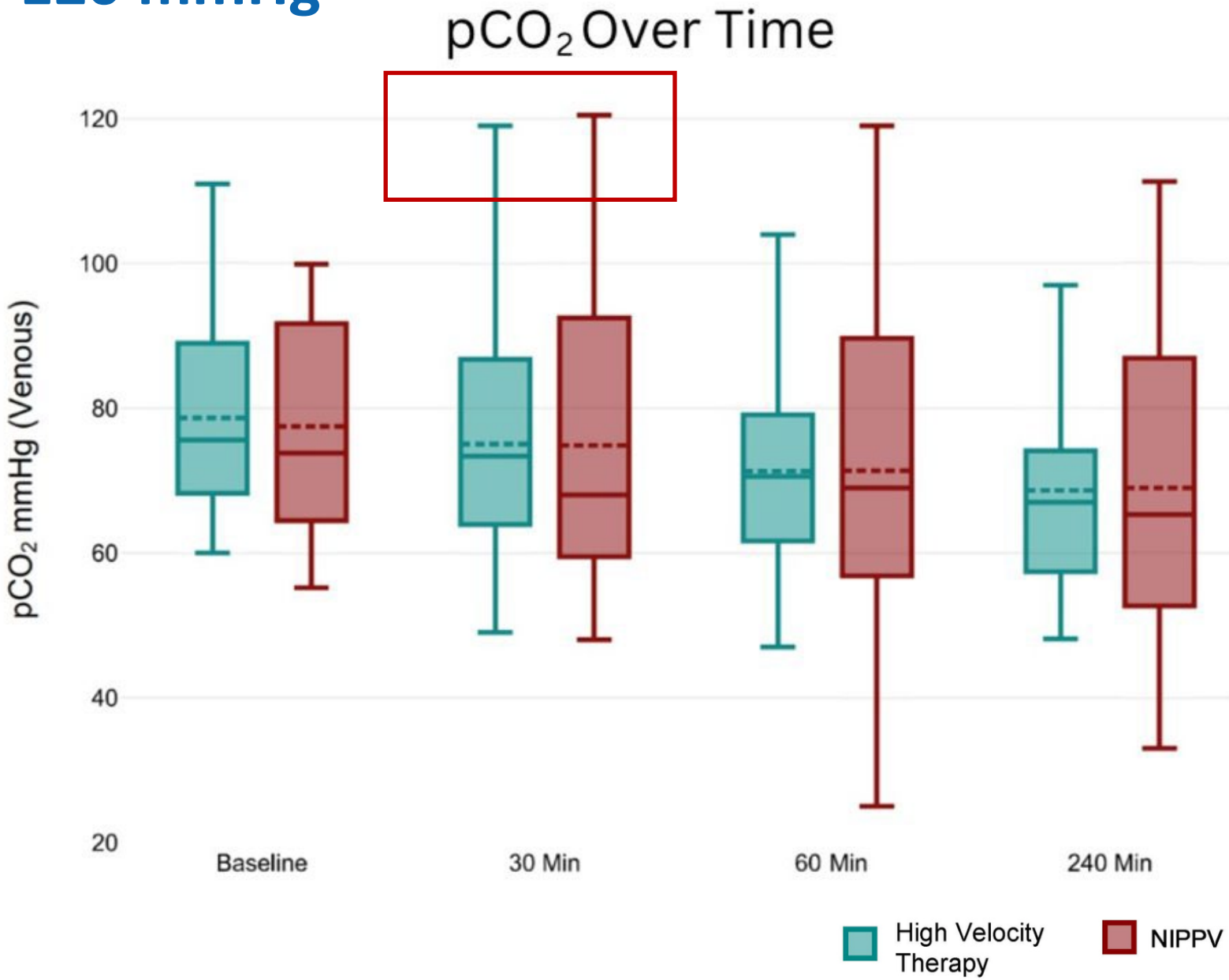


3. Yamane, D.P., et. al.(2024), *High-flow Nasal Insufflation vs. Non-Invasive Ventilation for Acute Exacerbation of COPD: A Randomized Clinical Trial.*. Crit Care Med, 2024. 52(1): p. s21.

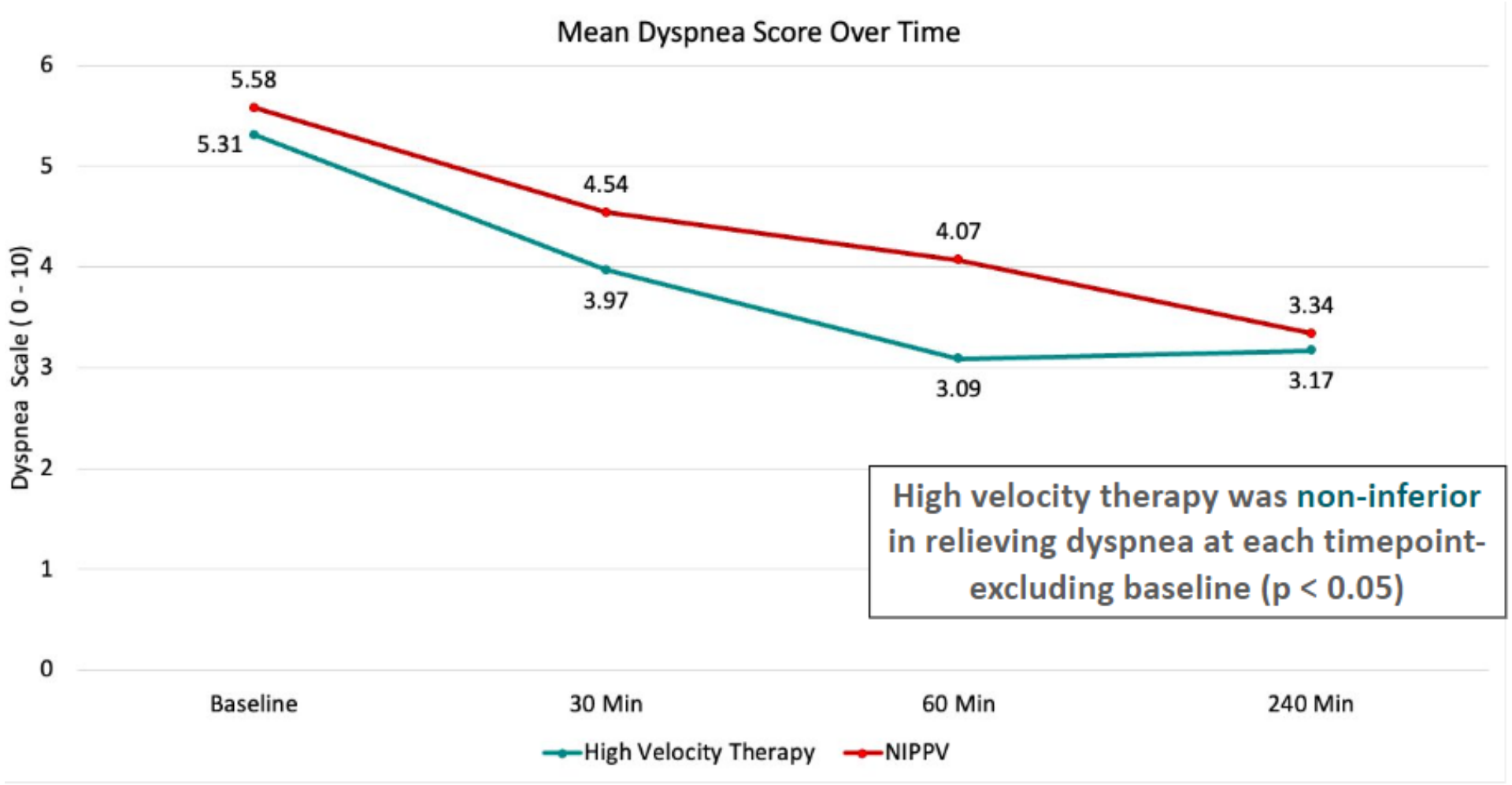
pCO2 ranged to 120 mmHg





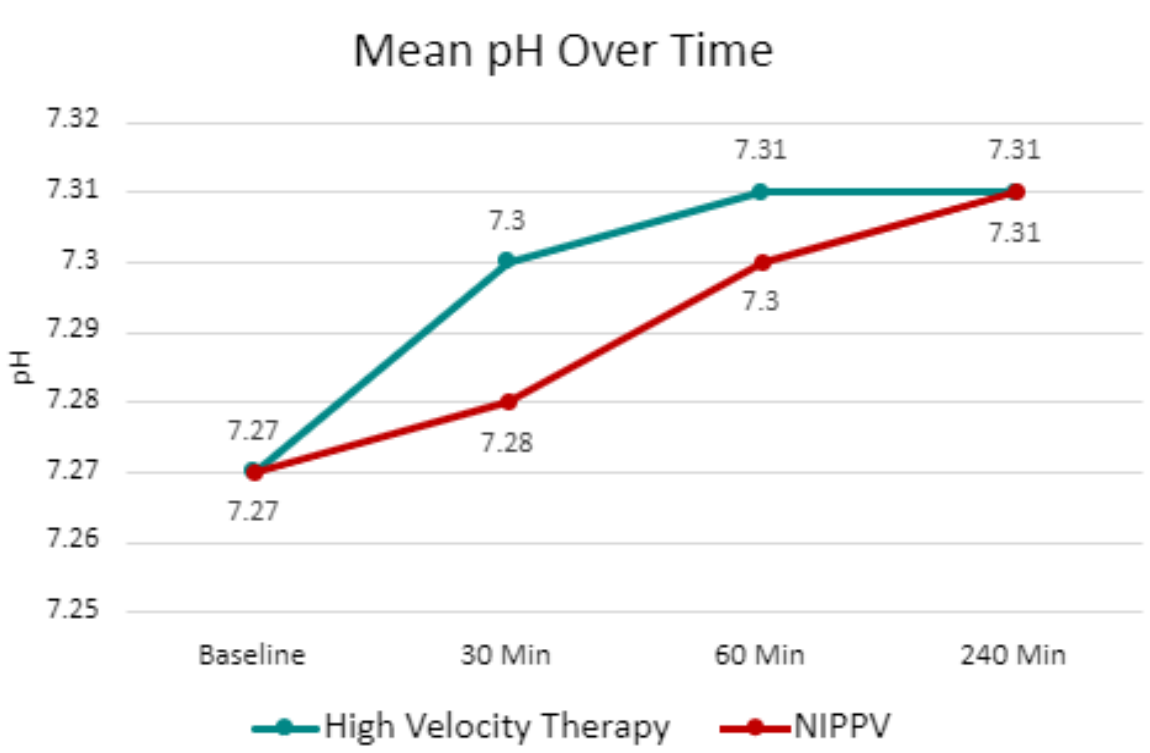
HYPERACT Primary Outcome - Dyspnea

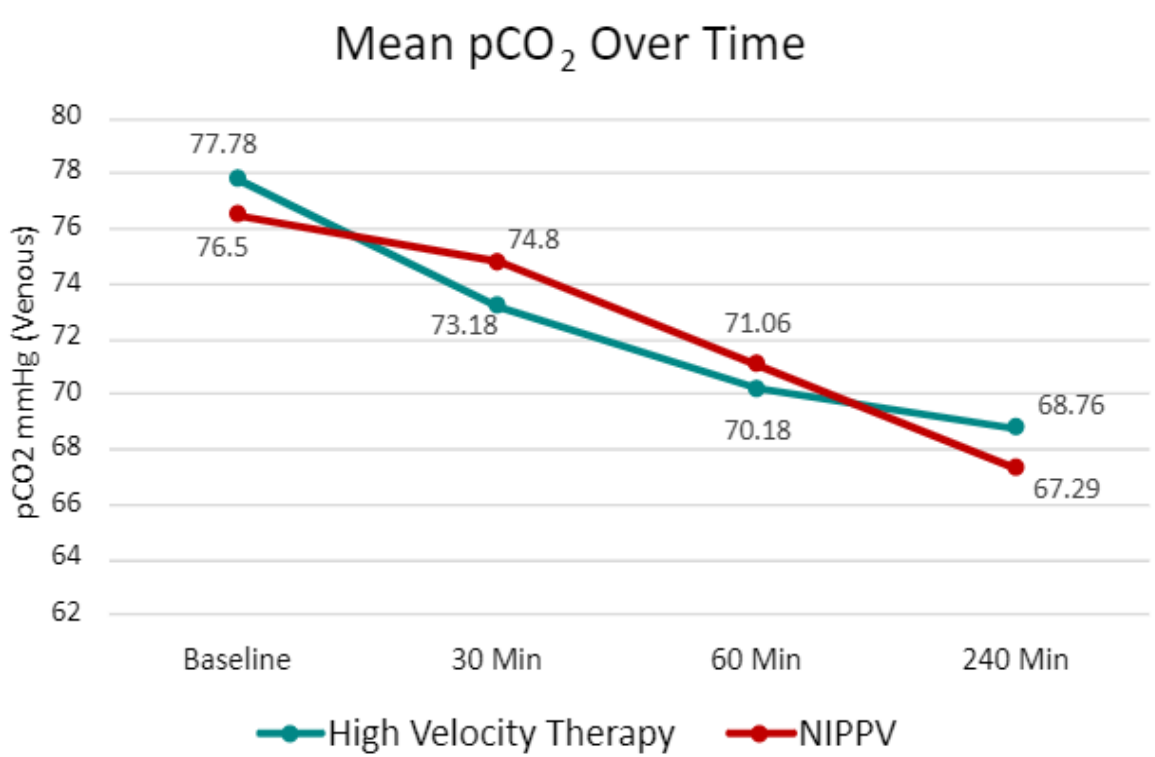
High velocity therapy is a viable alternative to NiPPV for relieving dyspnea



Rated Perceived Dyspnea (RPD) within 4 Hours

Noninferior Changes in pH and PCO_2 Values



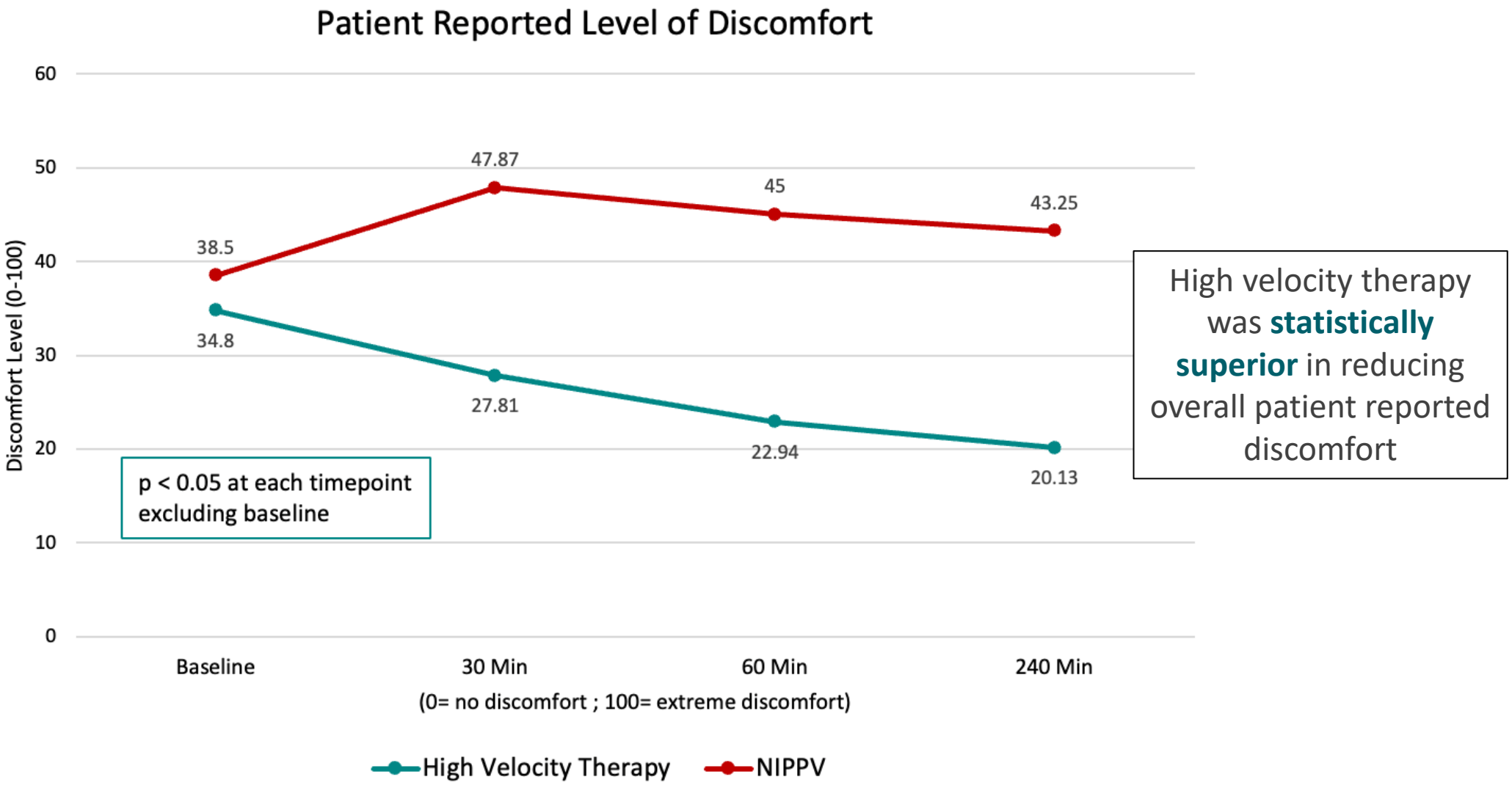


4 Hour Mean Values

	High Velocity Therapy*	NiPPV	*p* value
pH	7.31	7.31	0.498
PCO_2	68.76	67.29	0.631

*For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

Spot the difference – what about overall levels of patient discomfort?



High velocity therapy was **statistically superior** in reducing overall patient reported discomfort

High velocity therapy Failure Rate = **11%**

NIPPV Failure Rate = 19% (no statistical difference)

How is this possible?

Mechanisms of Action

…High Velocity Therapy improves the efficiency of alveolar ventilation, just as NiPPV does by increasing tidal volume

Minute Ventilation = Tidal Volume x Respiratory Rate

Alveolar Ventilation = (Inspired Volume – Dead Space) x Respiratory Rate

NiPPV

High Velocity Therapy*

*For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

Spot the Difference

Not all cannulas are the same.

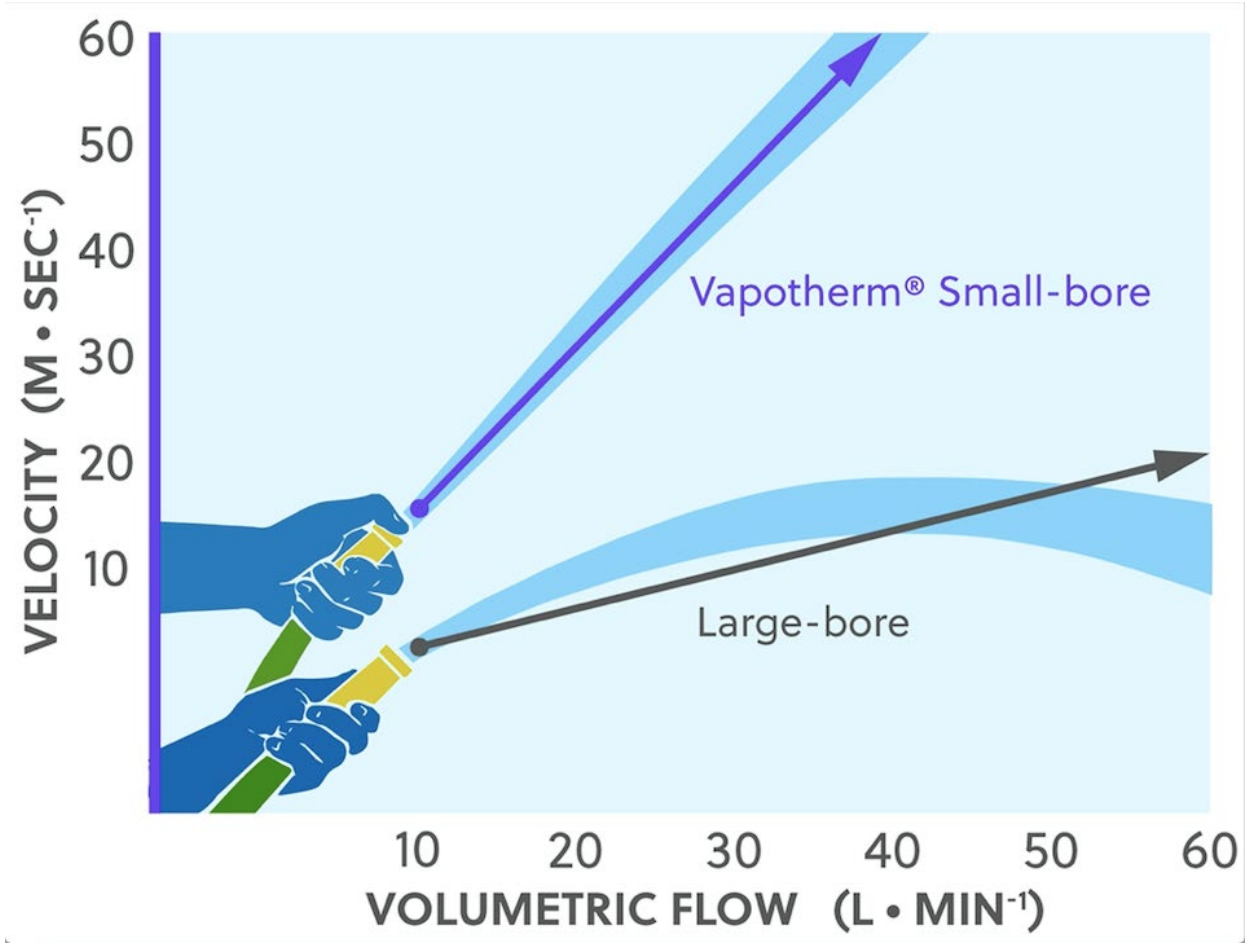
High Velocity Therapy is an advanced form of high flow nasal cannula

High Velocity Therapy

High Flow Nasal Cannula

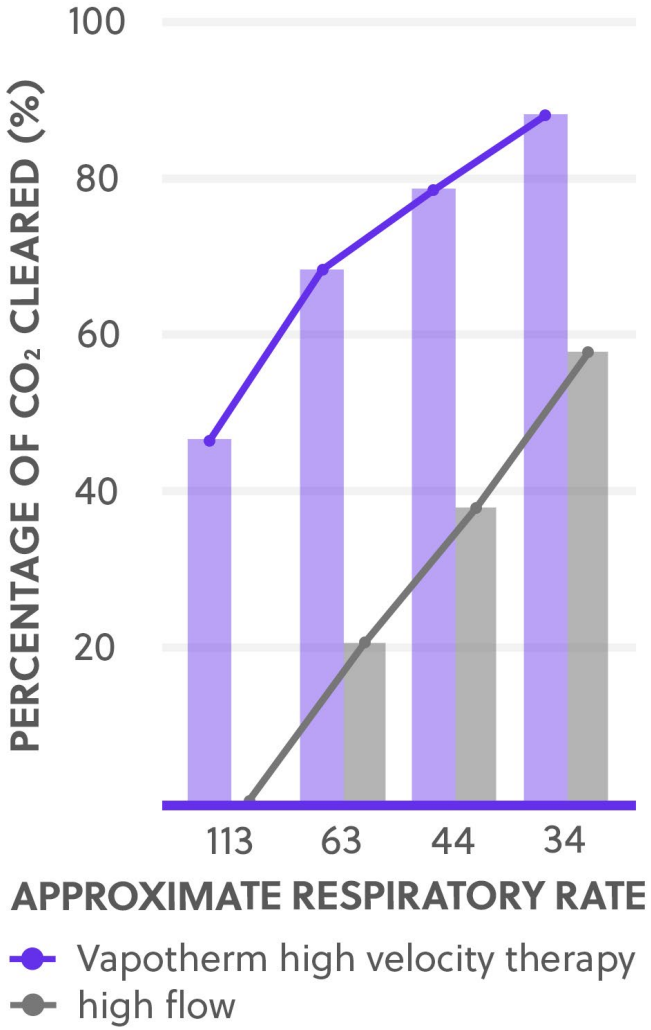
For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

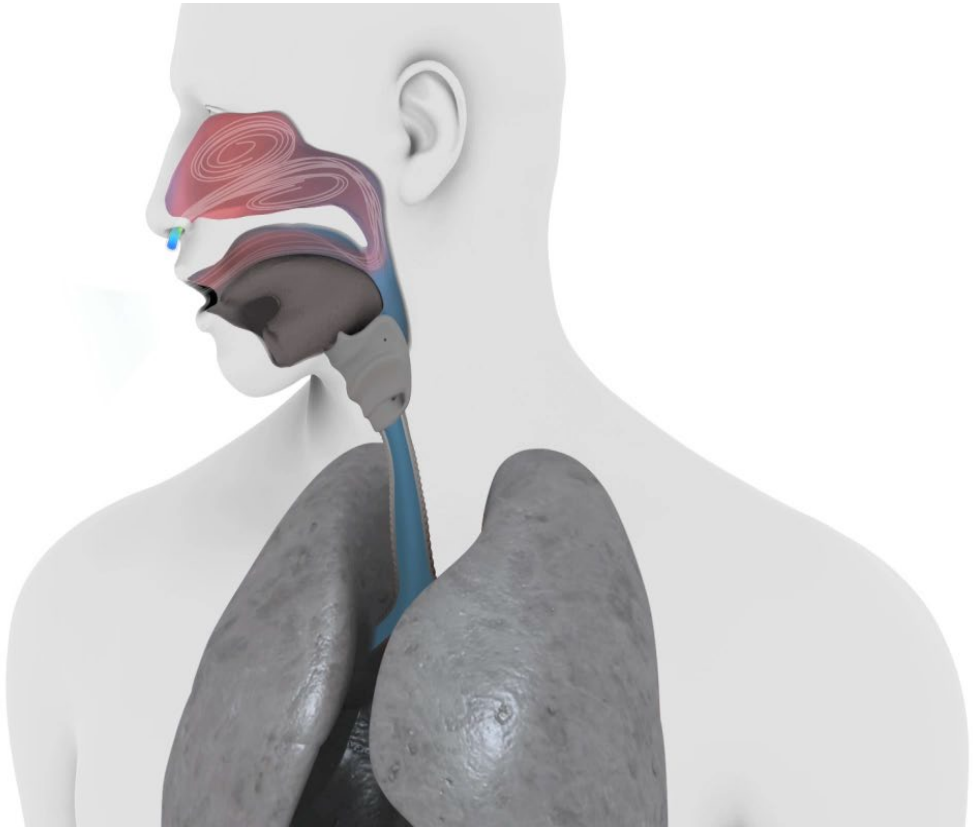
What's the difference between high flow and high velocity therapy? Gas Flow vs Gas Velocity



For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

The higher velocity flows result in a greater efficiency of flush at higher respiratory rates



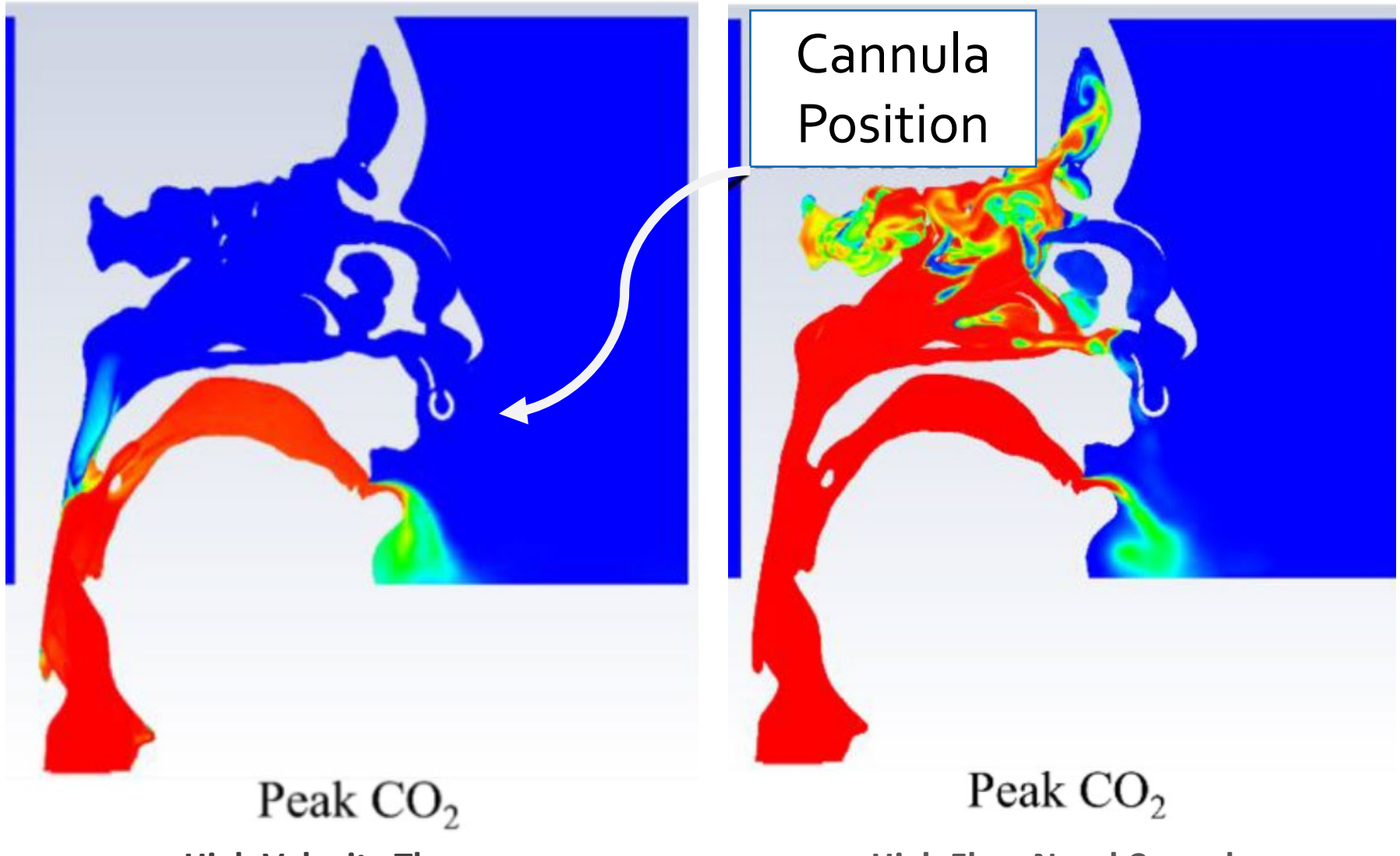


Decreasing Rebreathed CO_2 & Functional Dead Space

Miller TL, et al Computational Fluid Dynamics Modeling of Extrathoracic Airway Flush: Evaluation of High Flow Nasal Cannula Design Elements. J Pulm Respir Med 6:376.

Spot the Difference

Dead Space Flush Efficiency (CFD)



High Velocity Therapy

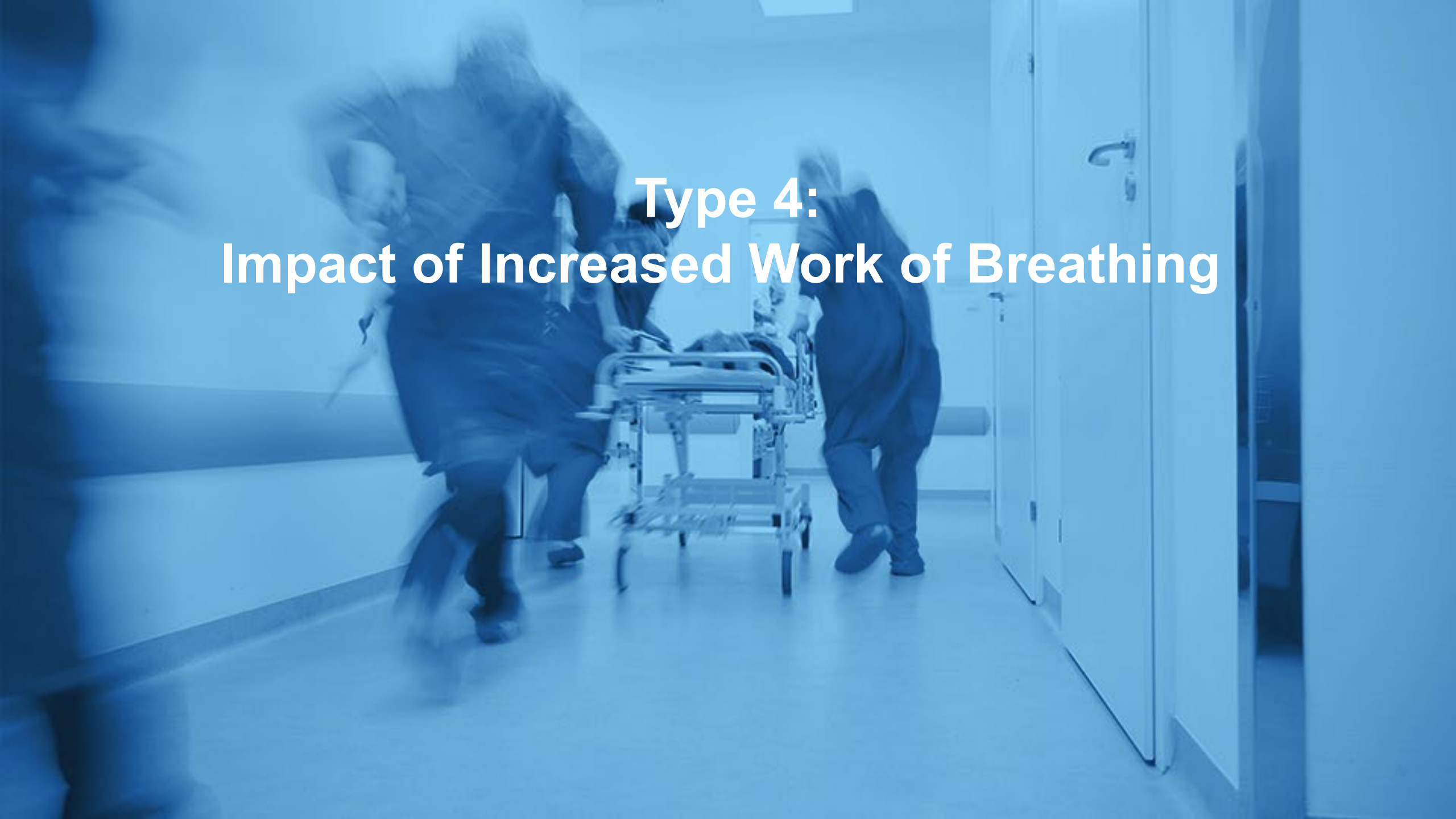
High Flow Nasal Cannula

Kacinski R et al. Characteristics of Flow in the Upper Airway, 8th Fluid and Thermal Dynamics Conference, May 2023

Type 3: Perioperative

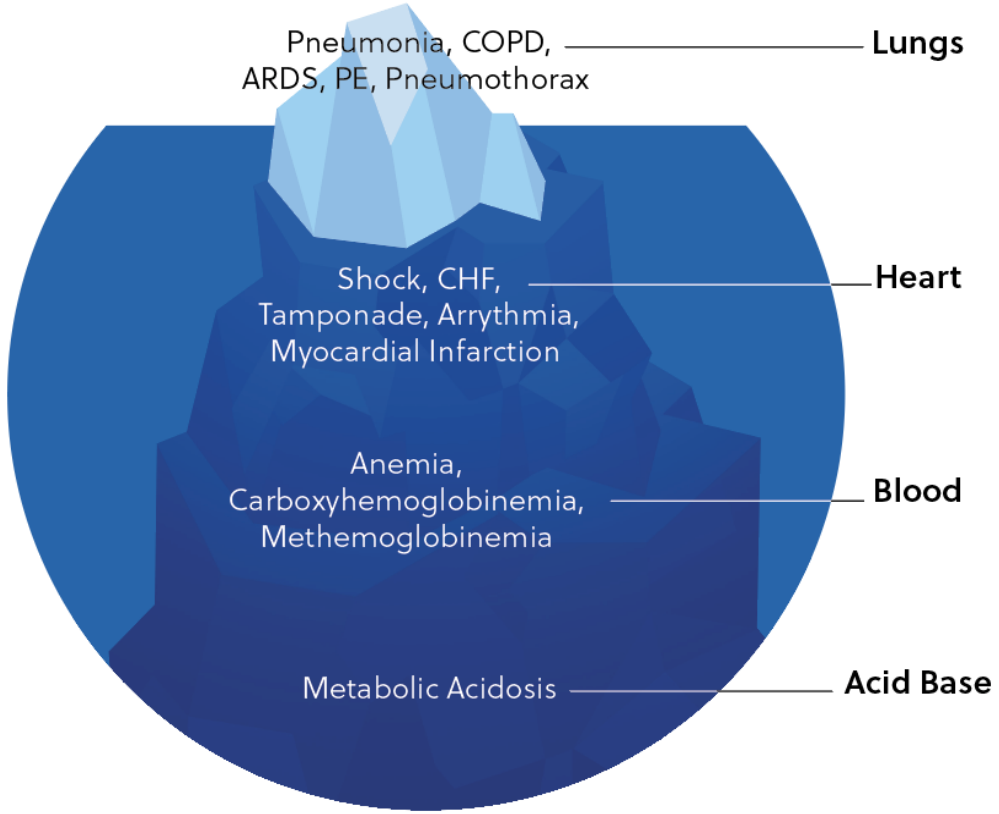
Preoxygenate prior to Intubation?
Recovery room?
Facilitate extubation?
Prevent post-op reintubation?

My Dad…



Type 4:
Impact of Increased Work of Breathing

Potential Causes of Increased WOB



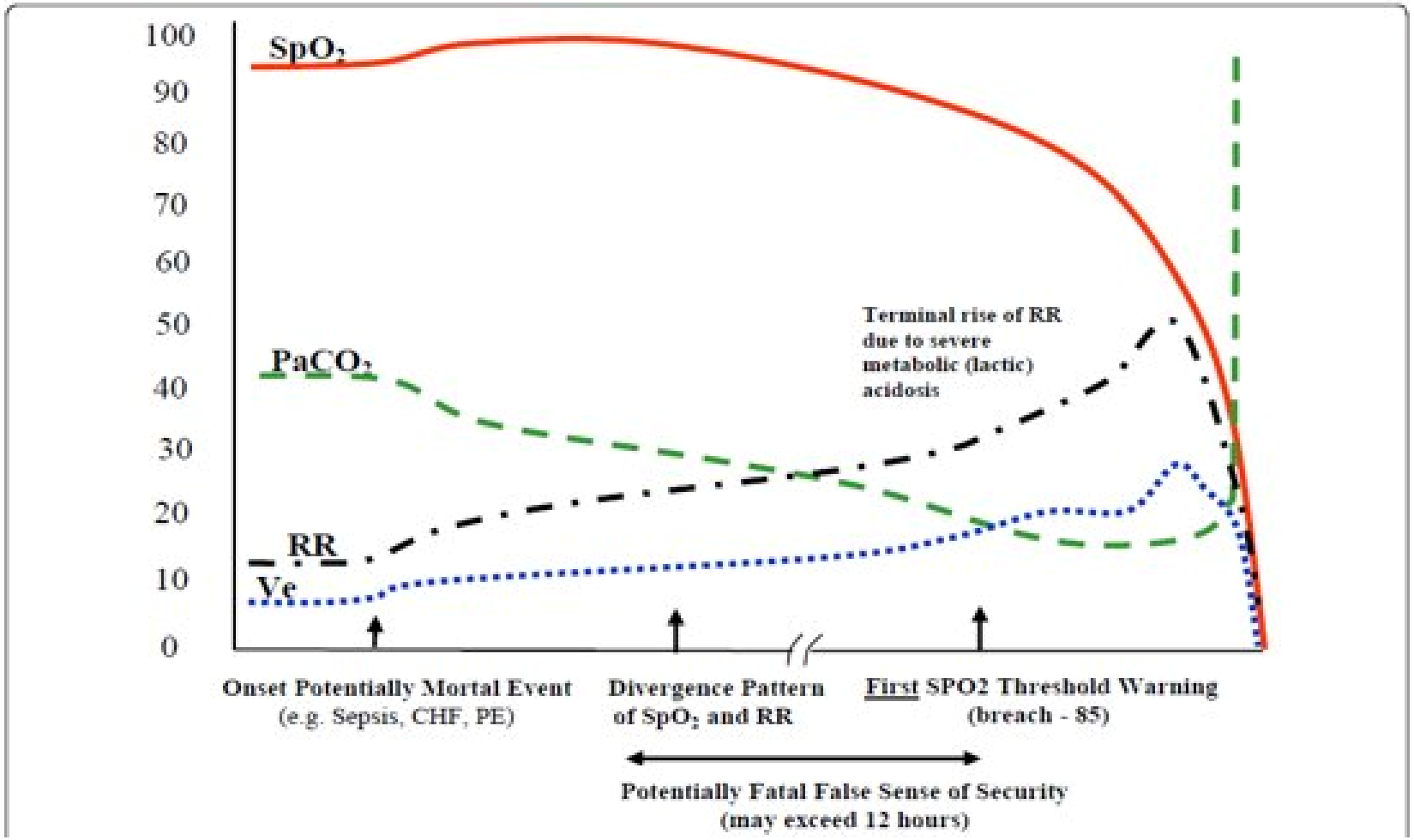
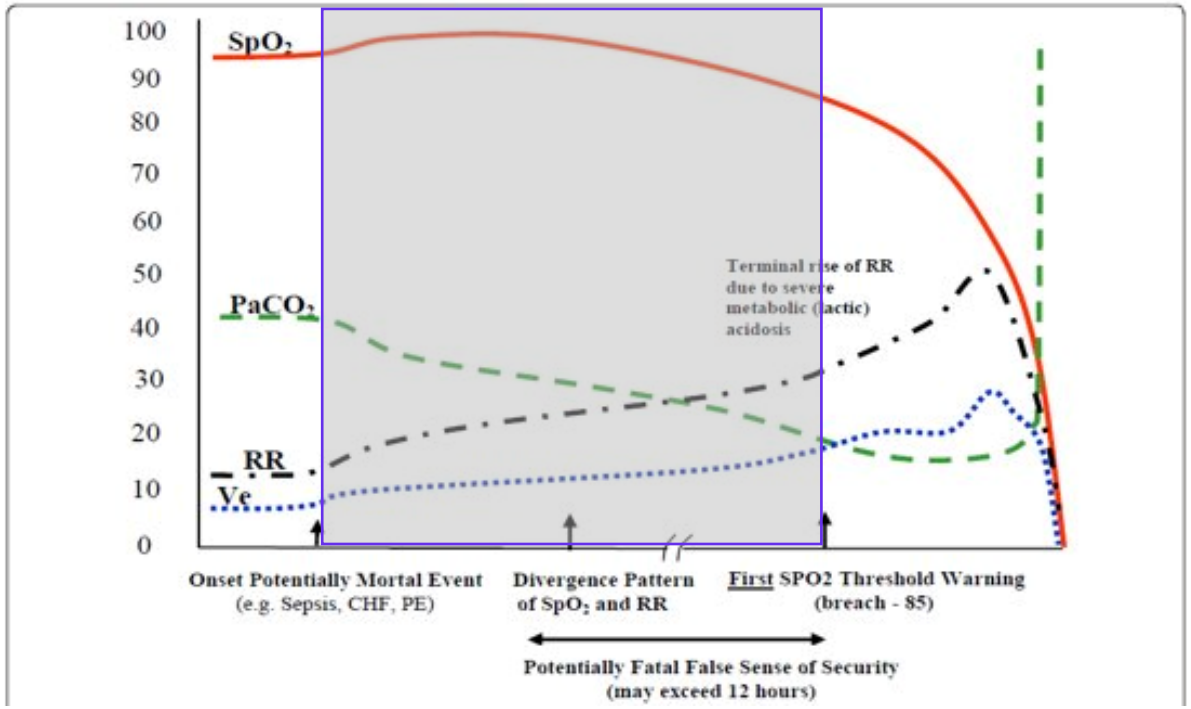


Figure 1: Type 1 Pattern of Unexpected Hospital Death (e.g., Sepsis, CHF, PE). (Values on Y axis are for reference. Actual values for each parameter will vary significantly).

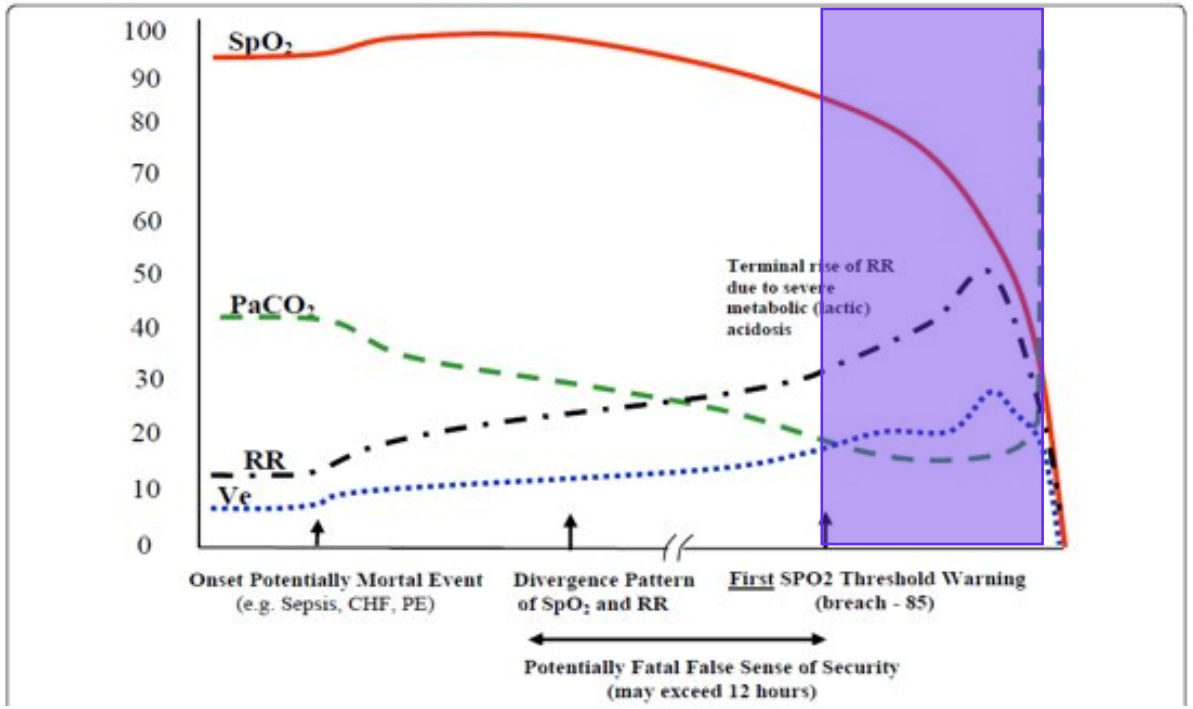
Lynn L, and Curry P. Patterns of unexpected in-hospital deaths: a root cause analysis. Patient Safety in Surgery 2011, 5:3

Increased respiratory rate/work of breathing may precede respiratory acidosis

ABG Normal



Patient Crashes



Type 1 Pattern of Unexpected Hospital Death (e.g., Sepsis, CHF, PE). (Values on Y axis are for reference. Actual values for each parameter will vary significantly).

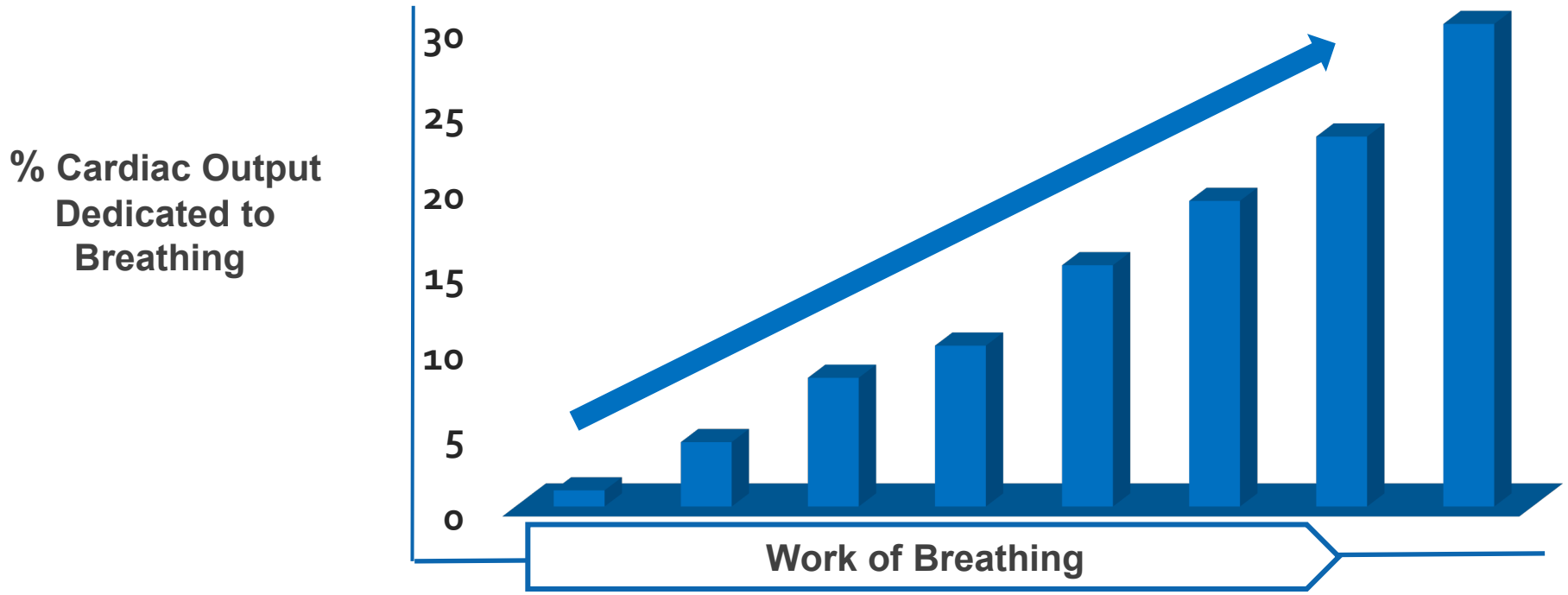
Dyspnea & Increased Risk of Death

Dyspnea Score Rating	Dyspnea = 0	Dyspnea 1-3	Dyspnea ≥4	p value
In-hospital mortality	0.8%	2.5%	3.7%	<0.001

- Increased dyspnea is associated with increased risk of death
- **Call to** assess & document dyspnea and allow interventions to reduce adverse outcomes

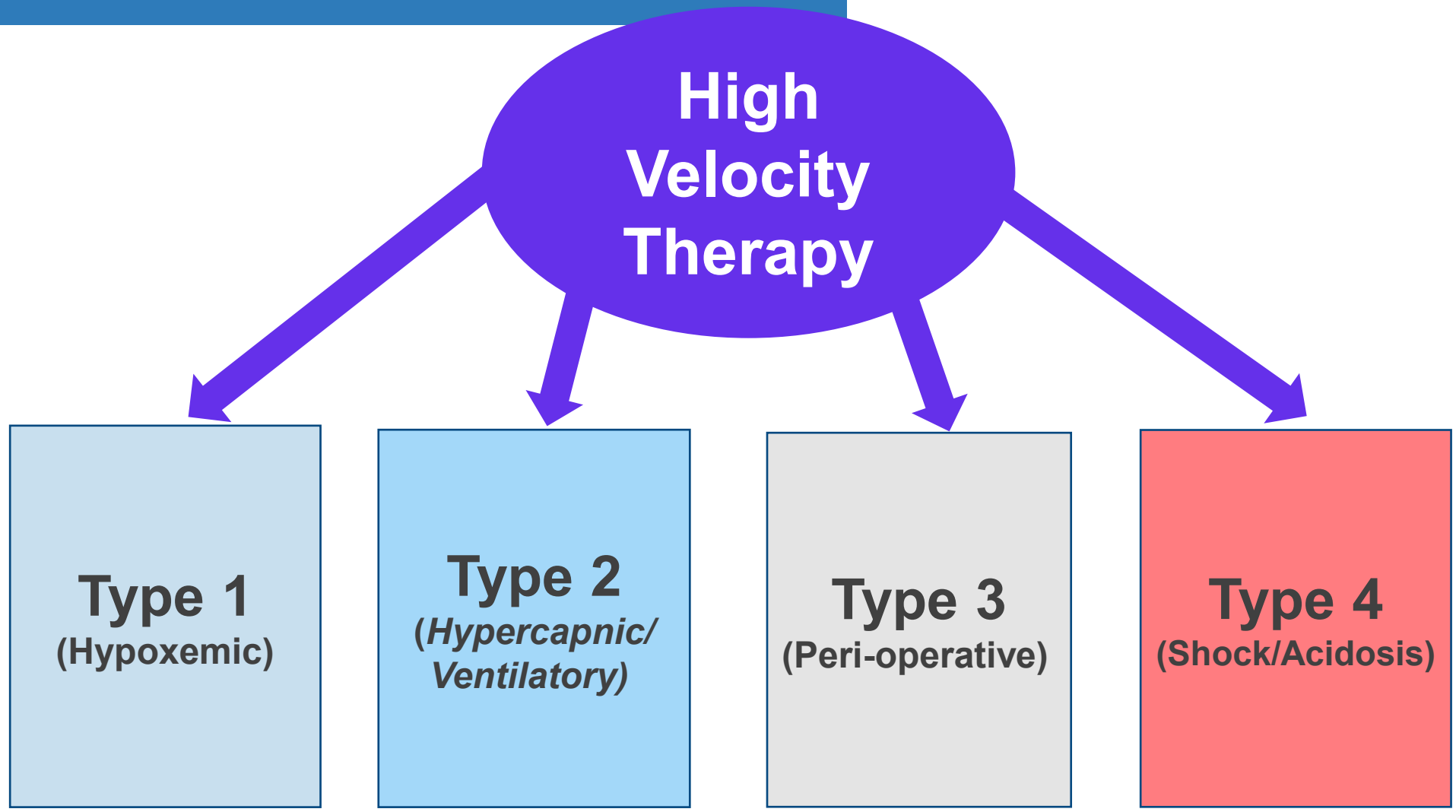
Stevens et al. Association of dyspnoea, mortality and resource use in hospitalised patients. European Respiratory Journal 2021 58: 1902107; DOI: 10.1183/13993003.02107-2019

Work of Breathing - Impact on Cardiac Output



Treacher DF, Leach RM. Oxygen transport-1. Basic principles. BMJ. 1998 Nov 7;317(7168):1302-6.

Acute Respiratory Failure



Takeaways: You can be the difference for your patients by considering High Velocity Therapy for Hypercapnia

- High velocity therapy is a reasonable alternative for patients with acute exacerbation of COPD who present to the ED with hypercapnic respiratory distress.
- High velocity therapy may lead to reduced rates of intubation for patients unable to tolerate NiPPV.

For spontaneously breathing patients. High velocity therapy does not provide total ventilatory requirements of the patient. It is not a ventilator.

A patient presents in the ED with a pCO2 of 78 and pH of 7.28…what respiratory support device would you now consider?

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