

Increasing Compliance with Low-Tidal-Volume Ventilation in Patients with ARDS: Preliminary Report on a Quality Improvement Project

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1 Background

Nearly 37% of all critically ill patients do not receive commonly recommended best practices (Ilan et al., 2007). It has been 13 years since the Acute Respiratory Distress Syndrome (ARDS) Network published its landmark, multi-center, randomized controlled trial demonstrating that use of low-*tidal-volume* ventilation (LTVV) (defined as a tidal volume [V_T] of 6 mL/kg predicted body weight [PBW]) was associated with a 9% decrease in mortality compared to traditional approaches to mechanical ventilation (10 to 15 mL/kg PBW) (Brower, Matthay, Schoenfeld, Thompson, & Wheeler, 2000). Needham et al. (2012) reported that each milliliter above 6 mL/kg PBW increased mortality by nearly 20% over a two-year period.

However, LTVV has not been widely adopted into clinical practice. There is considerable evidence that among ICUs nationwide, up to 70% of patients with ARDS do not consistently receive LTVV, resulting in an estimated 5,465 preventable deaths each year (Pronovost et al., 2004). Dennison, Mendez-Tellez, Wang, Pronovost, and Needham (2007) have suggested barriers included lack of knowledge, diagnostic uncertainty, error calculating appropriate tidal volume, unspecified protocol, communication failures, and concern with patient discomfort.

Adherence to LTVV is unacceptably low at Johns Hopkins Hospital (JHH). Needham et al. (2012) reported that among ARDS patients recruited from four academic hospitals in Baltimore, which included JHH and Bayview Medical Center, 86% received ≤50% of their ventilator settings adherent to LTVV. Furthermore, 37% never received LTVV at all. Thus, increasing adherence to a lung protective ventilation (LPV) strategy is an important quality improvement (QI) opportunity.

We therefore undertook a QI project to increase adherence to LTVV in patients with ARDS. The aim of this project was to determine whether an educational and teamwork program could improve adherence with the recommended LPV strategy.

2 Methods

Overview of project design: This QI project was conducted using a structured QI framework (Translating Research into Practice [TRiP] model; Pronovost, Berenholz, & Needham, 2008) and was evaluated using a before-after design.

Study site: Surgical and Weinberg ICUs at JHH.

Patient population: For the before (pre-intervention) period, we abstracted information on mechanical ventilation settings for all mechanically-ventilated patients admitted to the ICUs from January 1, 2011 to December 31, 2012 and receiving mechanical ventilation for at least 48 hours.

Identifying local barriers to LTVV

- **Providers' Perception Survey:** Evaluated clinicians' perceptions regarding ARDSNet LTVV guidelines and barriers to the 2012 ARDSNet LTVV protocol. An online survey was distributed to nurses, respiratory therapists (RTs), house staff, residents, and attending physicians for both ICUs.
- **ICU organizational factors:** Examined use of ARDSNet protocol (2012), nurse-to-patient and RT-to-patient ratios (obtained during healthcare team observations during daily ICU rounds).
- **Patient factors:** Included patient's height, weight, and gender (medical record review).
- **Clinician factors:** Obtained daily ventilator settings (through medical record review, abstracted initial settings at onset of ARDS diagnosis and daily settings up to 48 hours post-diagnosis).
- **ICU teamwork-related factors:** Observed health care team interactions during daily ICU rounds (participation by nurses, RTs, residents in advocating for LTVV during daily ICU rounds).

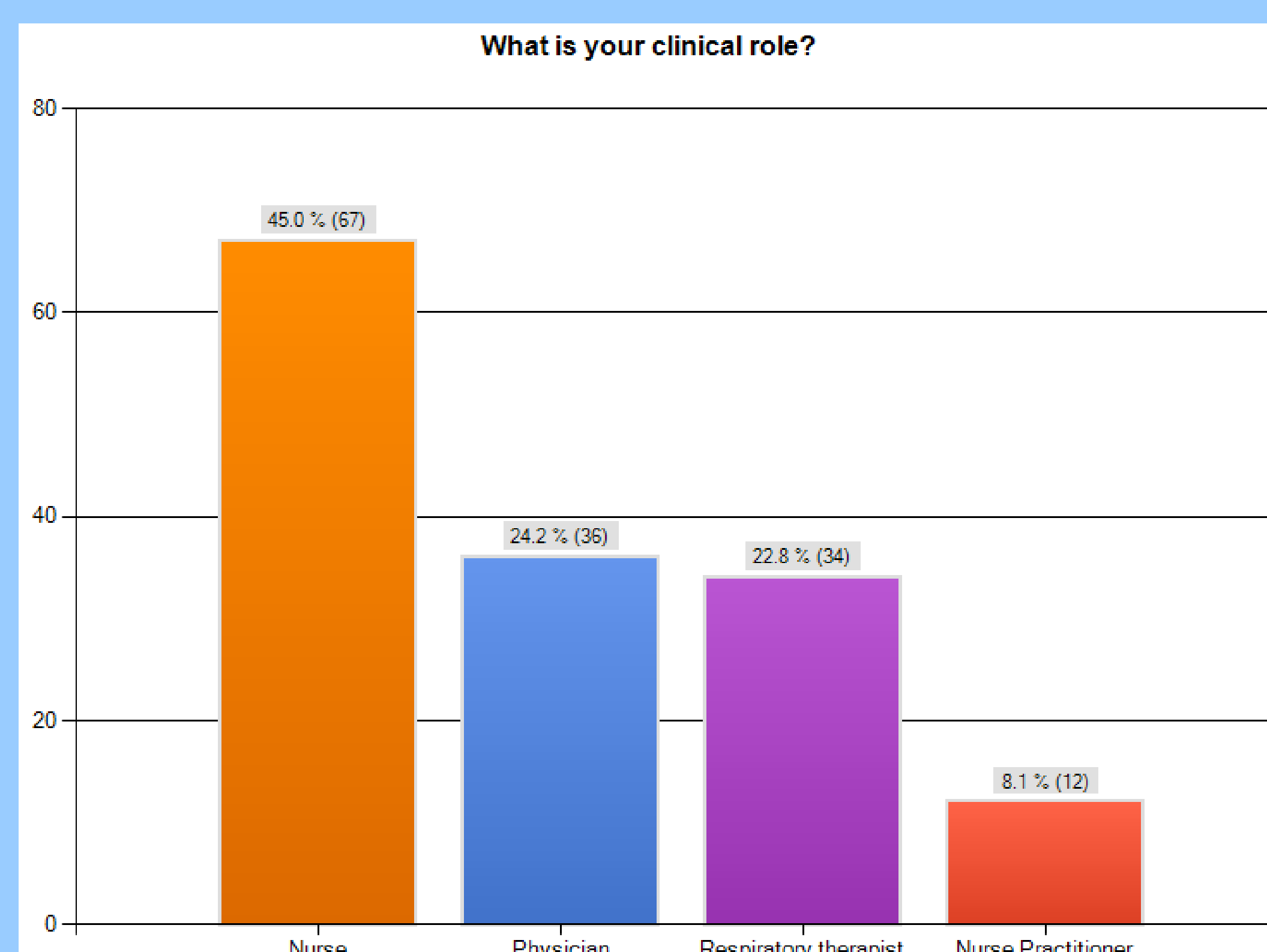
Ensure compliance with intervention (engage, educate, execute, evaluate)

- **Education modules:** VoiceThread PowerPoint to be implemented for all clinicians in the next phase of the project.

3 Preliminary Results

Providers' Perception Survey

- 149 providers participated. Themes are summarized below.



ICU organizational factors

- Nurse-to-patient and RT-to-patient ratios were not associated with low adherence to LTVV, but RT presence during rounds was.

Patient factors

- The team reviewed 374 records (203 SICU, 171 WICU). Patient gender and BMI were as follows: 42% female, 58% male; 5.3% underweight, 25.7% normal weight, 30.2% overweight, 38.8% obese.
- Overall, women and obese patients were more likely to receive high tidal volumes.

Clinician factors

- Clinicians often did not recognize ARDS at onset.
- Clinicians were often unaware that ARDS patients were not receiving LTVV.
- Clinicians, particularly nurses, reported being unfamiliar or unaware of ARDS Network guidelines for LTVV.
- RTs were frequently absent during ICU rounds.

ICU teamwork-related factors

- Clinicians reported that formal ARDSNet LTVV protocol (as an order set) was rarely prescribed.
- Although height is readily available on POE, clinicians often incorrectly estimated tidal volume using actual weight rather than PBW.
- Difficulties with teamwork (communication, coordination, cooperation, leadership) resulted in inconsistent use of LTVV.

4 Conclusions & Recommendations

- Because women and obese patients are more likely to receive inappropriate tidal volumes due to errors in calculation, we suggest the use of a **simplified tidal volume protocol** (males 450 mL and females 350 mL). Among clinicians, this approach was found to reduce error and increase adherence to LTVV by 80% (Walkey & Wiener, 2012).
- The lack of provider awareness and adherence to the ARDSNet LTVV guidelines suggests the need for **targeted education** modules to nurses, RTs, and physicians.
- Given targeted education, **nurses, RTs, and medical residents should be empowered to speak up** if teams do not adhere to the ARDSNet LTVV guidelines. RTs, in particular, should be encouraged to join daily rounds.

5 Future Directions

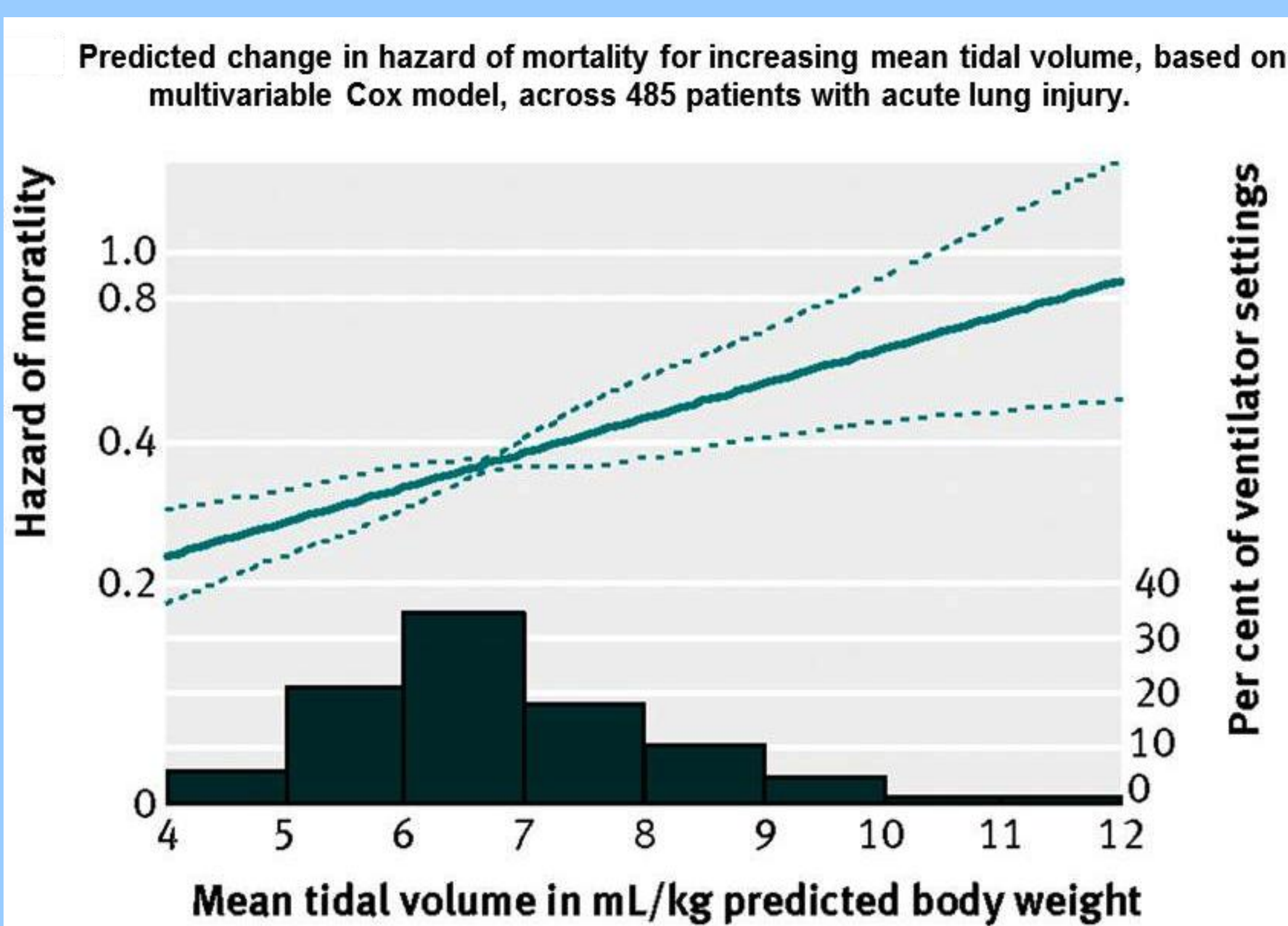
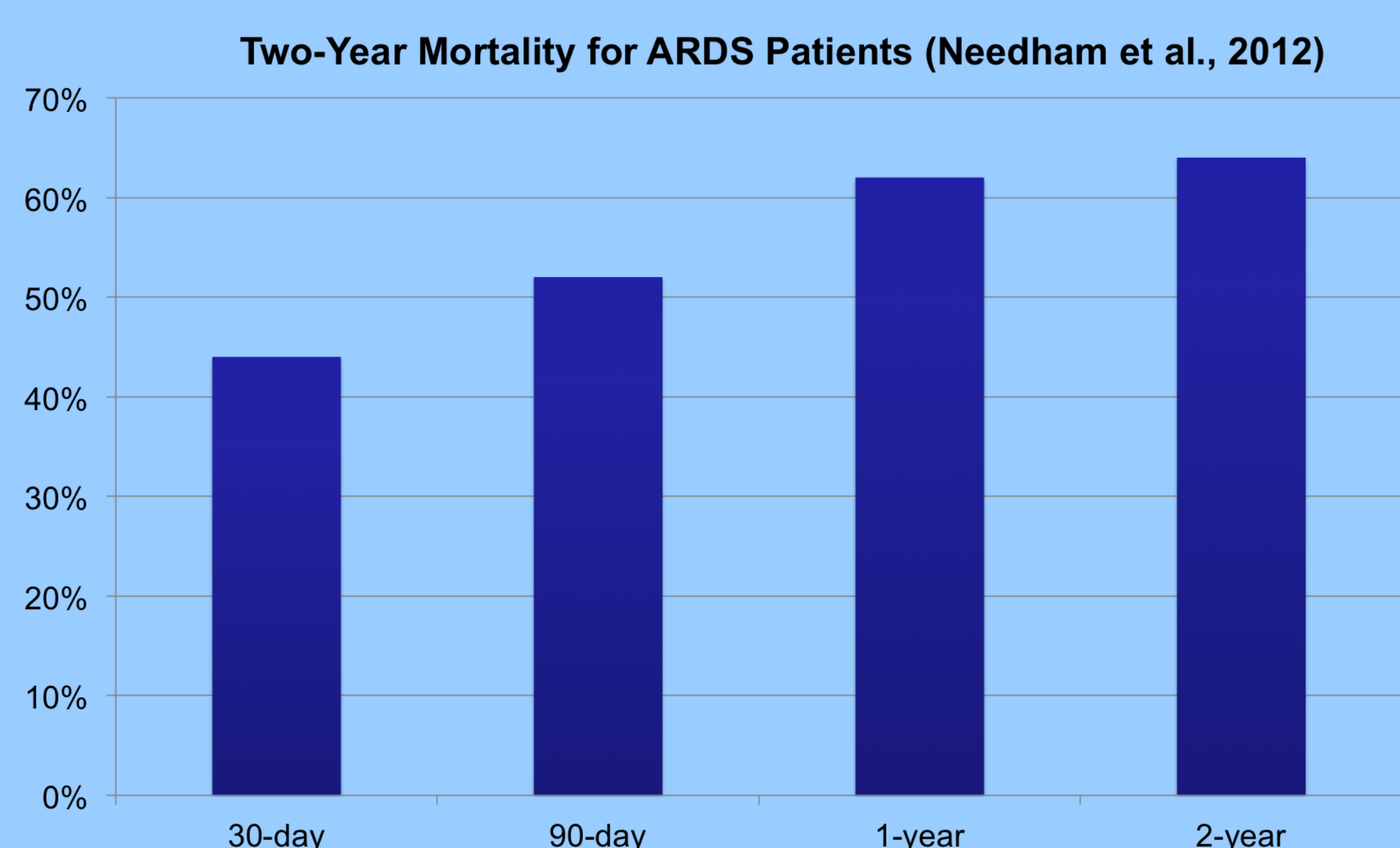
The next phase of this quality improvement project involves comparing adherence rates before and after presentation of education modules to nurses, RTs, and physicians, as well as use of simplified tidal volume protocols.

6 References

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(Needham et al., 2012)