

# Why Focus On Postoperative Respiratory Failure?

Premier Healthcare Alliance

Postoperative Respiratory Failure Sprint

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# Disclosures

- **Agency for Healthcare Research and Quality (AHRQ) “Support for Quality Indicators” Project Team Member**
- **No commercial interests**

# Overview

- **What is postoperative respiratory failure?**
- **Is it an important problem?**
- **Why does it occur?**
- **Why use it as a quality indicator?**
- **Is the indicator accurate?**
- **How is the indicator helpful?**

# Definitions of PRF

- **Mechanical ventilation >48 hrs**

*Svensson, J Vasc Surg, 1991*

- **Mechanical ventilation >5 days**

*Money, Am J Surg, 1994*

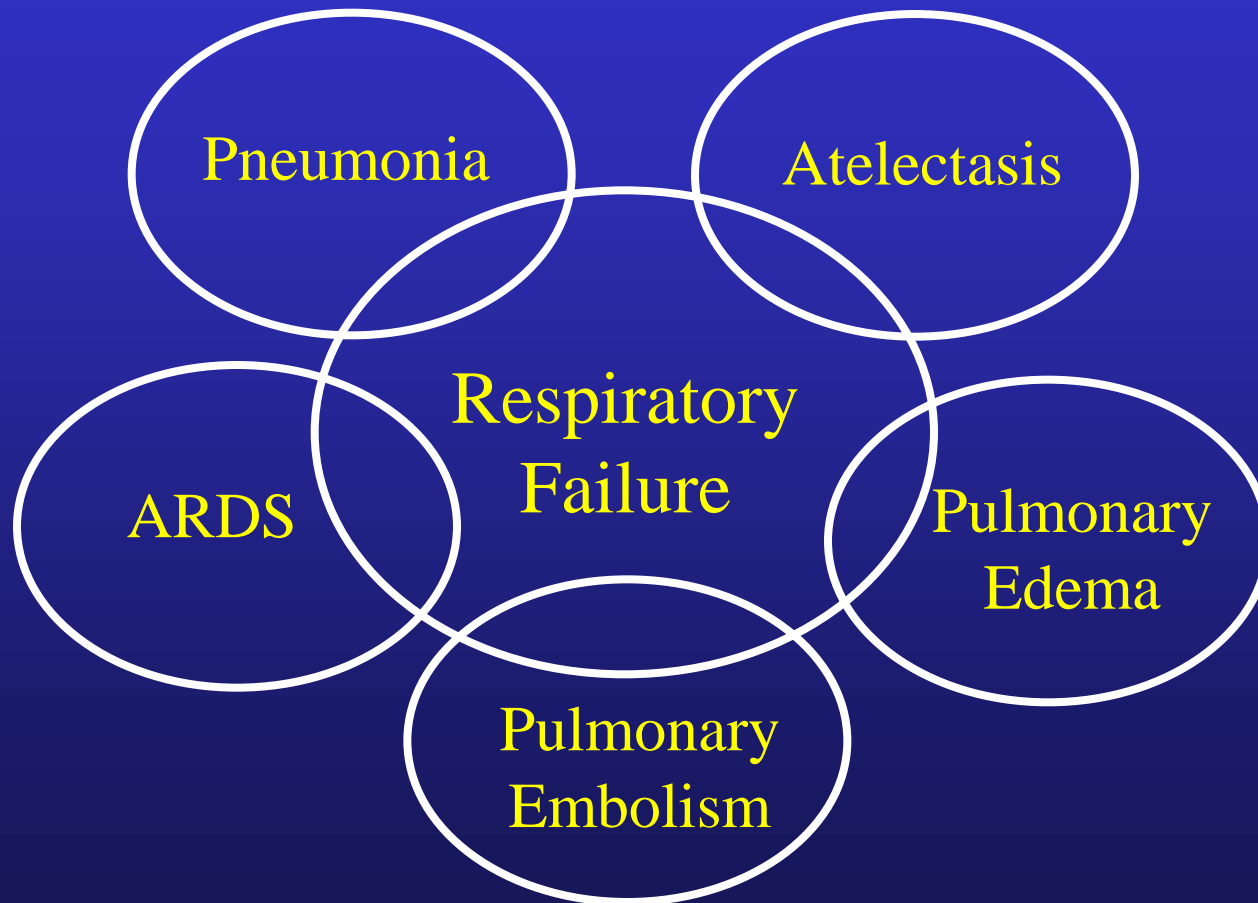
- **Mechanical ventilation >48 hrs or unplanned reintubation**

*Arozullah, Ann Surg, 2001*

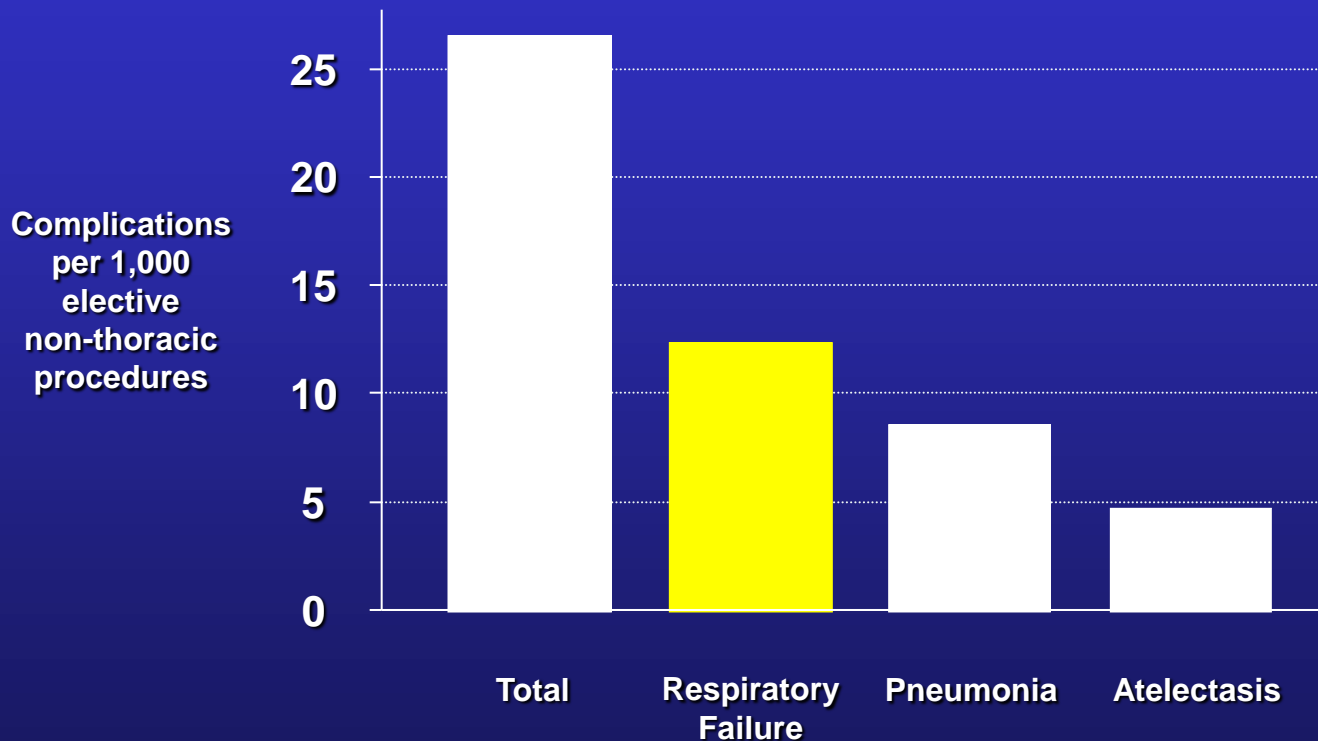
- **Mechanical ventilation >24 hrs or intubation >1 hr after procedure**

*Park, Ann Surg, 2001*

# PRF and Other Complications



# Incidence of PRF



# **PRF Is Associated With ...**

- **Increased cost**
- **Increased length of stay**
- **Increased 30-day mortality**
- **Increased 5-year mortality**

# Why Does PRF Occur?

- **Impaired ventilation**
  - Diminished ventilatory drive
  - Inadequate lung expansion
  - Inadequate ventilatory muscle function
  - Excessive work of breathing
  - Alveolar hypoventilation
- **Impaired oxygenation**
  - V/Q mismatch
  - Hypoventilation
- **Inadequate or threatened airway**



# Patient Factors and PRF

- Age
- History of COPD, CHF
- Smoking
- Functional dependence
- Serum albumin  $<3.0$  g/dL
- BUN  $>30$  mg/dL
- ASA class

# Anesthetic Factors and PRF

- **General anesthesia**
  - Decreases FRC, increases atelectasis
  - Promotes V/Q mismatch
- **Neuraxial blockade vs. general anesthesia**
- **Residual neuromuscular blockade**
- **Postoperative epidural analgesia**
- **Patient controlled vs. on demand analgesia**

# Procedure Factors and PRF

- Thoracic, abdominal, vascular, head/neck procedures
- Emergency procedures
- Prolonged procedures
- Open vs. laparoscopic
- Nasogastric tube

# Measures That Prevent PRF

- **Good or fair evidence:**
  - Lung expansion exercises
  - Selective use of nasogastric tubes (abdominal cases)
  - Short-acting neuromuscular blockade
- **Conflicting or insufficient evidence:**
  - Epidural anesthesia/postoperative analgesia
  - Preoperative smoking cessation
  - Laparoscopic technique
  - Routine total enteral or parenteral nutrition
  - Routine pulmonary artery catheterization

# AHRQ and the PSIs

- **Need for measures of quality of care**
- **Hospitalization discharge data**
- **Complications Screening Program (Iezzoni)**
- **AHRQ Quality Indicators**
  - **Prevention Quality Indicators**
  - **Inpatient Quality Indicators**
  - **Patient Safety Indicators**
  - **Pediatric Quality Indicators**
- **Other uses: hospital comparison, P4P**

# Rationale for PSIs

- **Data vital to assess quality of care**
- **Discharge data already collected**
- **Discharge data is virtually complete**
  - **Allows comparison**
- **Many adverse events are preventable**
- **Incentive for improving care**

# Patient Safety Indicators

## Selected postoperative complications

- Postoperative pulmonary embolism or deep vein thrombosis
- Postoperative respiratory failure
- Postoperative sepsis
- Postoperative physiologic and metabolic derangement
- Postoperative wound dehiscence in abdominopelvic surgical patients
- Postoperative hip fracture
- Postoperative hemorrhage or hematoma

## Selected technical adverse events

- Pressure ulcer
- Central venous catheter-related bloodstream infection

## Technical difficulty with procedures

- Iatrogenic pneumothorax
- Accidental puncture or laceration
- Foreign body left during procedure

## Other

- Complications of anesthesia
- Death in low-mortality DRGs
- Death among surgical inpatients
- Transfusion reaction

## Obstetric trauma and birth trauma

- Birth trauma – injury to neonate
- Obstetric trauma – vaginal delivery with instrument
- Obstetric trauma – vaginal delivery without instrument
- Obstetric trauma – cesarean section delivery

# Weaknesses of PSIs

- **Lack of standard definitions**
- **Available codes may not apply well**
- **Data may be miscoded**
- **Data may not reflect what happened**
- **Diagnoses may have been present on admission**
- **Adverse events ≠ medical errors**
- **PSIs could influence coding practices or patient selection**



# PSI 11: PRF

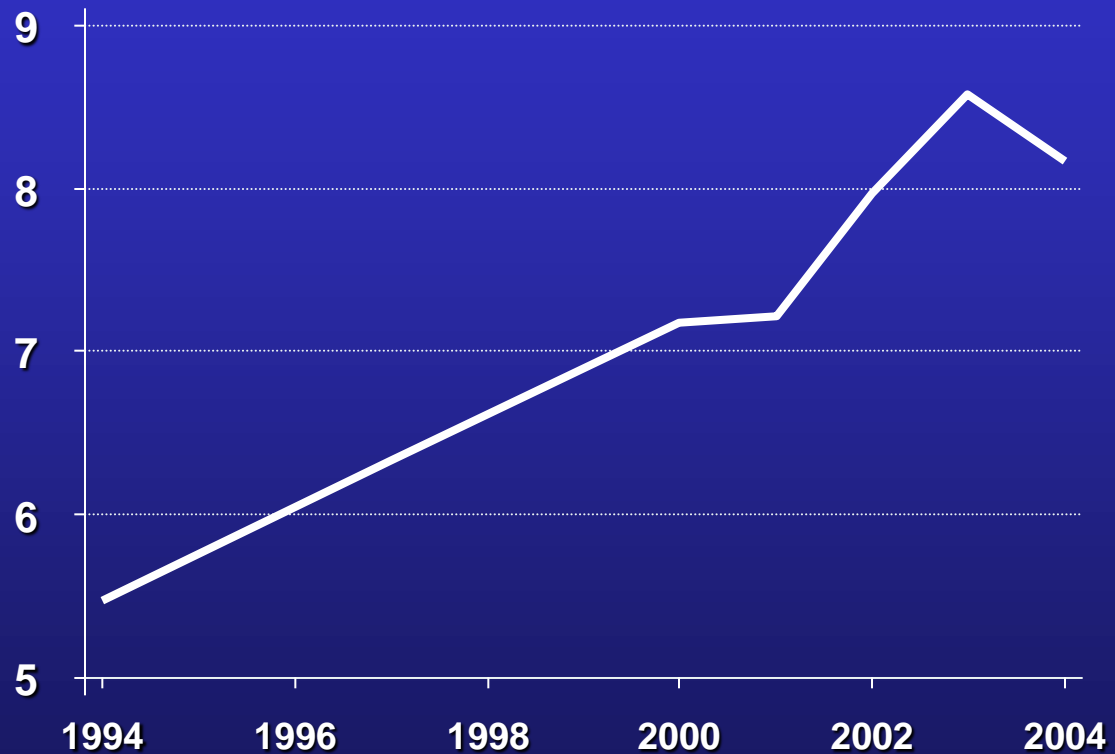
- **Numerator:**
  - “Acute respiratory failure” (518.81) as a secondary diagnosis  
OR
  - One of the following:
    - “Insertion of endotracheal tube” (96.04)  
≥1 day after main procedure
    - “Continuous mechanical ventilation of unspecified duration” (96.70) or  
“Continuous mechanical ventilation for <96 hrs” (96.71)  
≥2 days after main procedure
    - “Continuous mechanical ventilation for ≥96 hrs” (96.72)  
≥0 days after main procedure
- **Denominator:**
  - Adults undergoing elective operations
  - Excludes
    - Diagnoses of respiratory failure on admission
    - Tracheostomy before or during the main procedure
    - Patients with primary respiratory, circulatory, or pregnancy-related process  
or a neuromuscular disorder

# What Makes a PSI Valid?

- **Face validity—it makes sense**
- **Sensitivity**
- **Specificity**
- **Captures real variation in quality**
- **Performs well in different patient groups**
- **Easy to apply**
- **Fosters real quality improvement**

# Incidence of PSI 11

Cases per  
1,000 elective  
surgical  
patients



Source: HCUPnet

# Related Indicators

- **Predecessor (CSP3)**
  - **33/44 cases = 75% PPV**

Weingart, *Med Care*, 2000

- **Not associated with process failures**

Iezzoni, *Int J Qual Health Care*, 1999

- **Pediatric version of indicator: few cases preventable**

Scanlon, *Pediatrics*, 2008

# Possible Weaknesses

- **Accuracy**
  - Unreliability of physician diagnosis
  - Overlap with airway management
  - Alternative codes: 518.5
  - Non-invasive positive pressure ventilation
- **Utility**
  - Strong case mix bias
  - Questionable preventability
  - Wide variety of mechanisms: no simple solution

# Does PSI 11 Detect Real PRF?

- **90% of cases coded correctly**
  - 5% not elective
  - 3% numerator code error (mostly 518.81)
  - 1% PRF present on admission
- **83% of cases both coded correctly and met clinical criteria**
  - 4% airway protection
  - 1% cardiac arrest rather than PRF per se
  - 1% respiratory failure after admission but before the operation

# What Are Confirmed Cases Like?

<b>Characteristic</b>	<b>PRF Confirmed (n=507)</b>
<b>Age, years</b>	<b>60 ± 15</b>
<b>Comorbid condition, n (%)</b>	<b>252 (50)</b>
<b>Body Mass Index ≥ 35, n (%)</b>	<b>82 (17)</b>
<b>Abdominal operation, n (%)</b>	<b>274 (54)</b>
<b>ASA III or greater, n (%)</b>	<b>409 (81)</b>
<b>Duration of procedure, hours</b>	<b>5.0 ± 3.2</b>
<b>Time from operation to PRF, days</b>	<b>3 (1-6)</b>

# Outcomes of Confirmed Cases

Outcome	PRF Confirmed (n=507)
<b>Disposition of survivors, n (%)</b>	
Home	274 (54)
Another acute care hospital	12 (3)
SNF, other long-term care facility	98 (25)
Inpatient rehabilitation/psych	71 (18)
Other	10 (2)
Length of stay, days	20 (11-35)
Tracheostomy, n (%)	113 (22)
Death, n (%)	116 (23)



# Further Questions

- Does PSI 11 detect most cases of PRF?
- Can the coding of elective status be improved?
- Can the PRF-related codes be improved?
- Should the diagnosis criteria be kept?
- Could more be done to prevent PSI 11 cases?

# Review

- What is postoperative respiratory failure? → **Prolonged mechanical ventilation**
- Is it an important problem? → **Yes, both common and morbid**
- Why does it occur? → **Many factors**
- Why use it as a quality indicator? → **Coding**
- Is the indicator accurate? → **PPV fairly good**
- How is the indicator helpful? → **Jury is still out**

**Questions?**