

Why Focus On Postoperative Respiratory Failure?

Premier Healthcare Alliance

Postoperative Respiratory Failure Sprint

November 10, 2010



Garth H. Utter, MD MSc
University of California, Davis



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

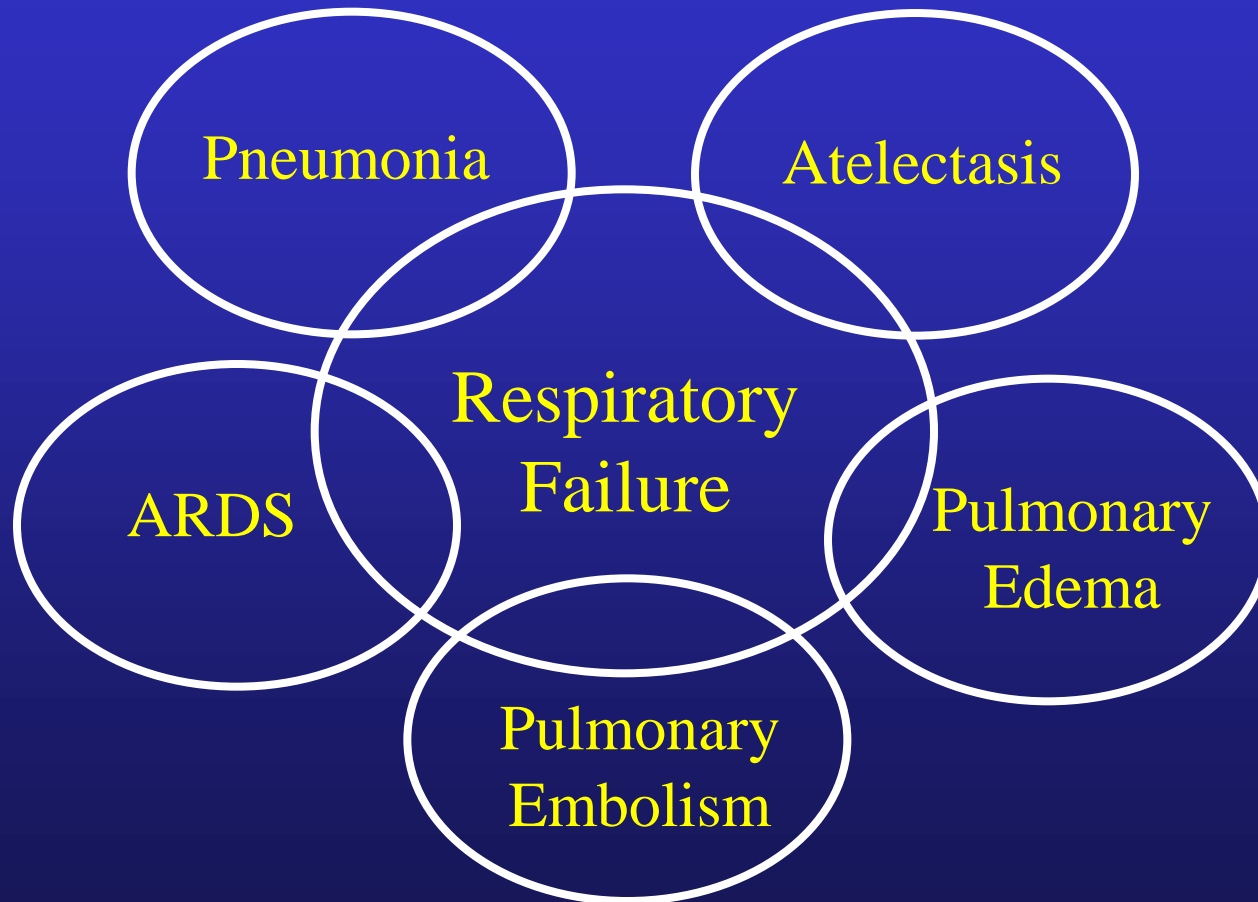
- **Mechanical ventilation >48 hrs or unplanned reintubation**

Arozullah, Ann Surg, 2001

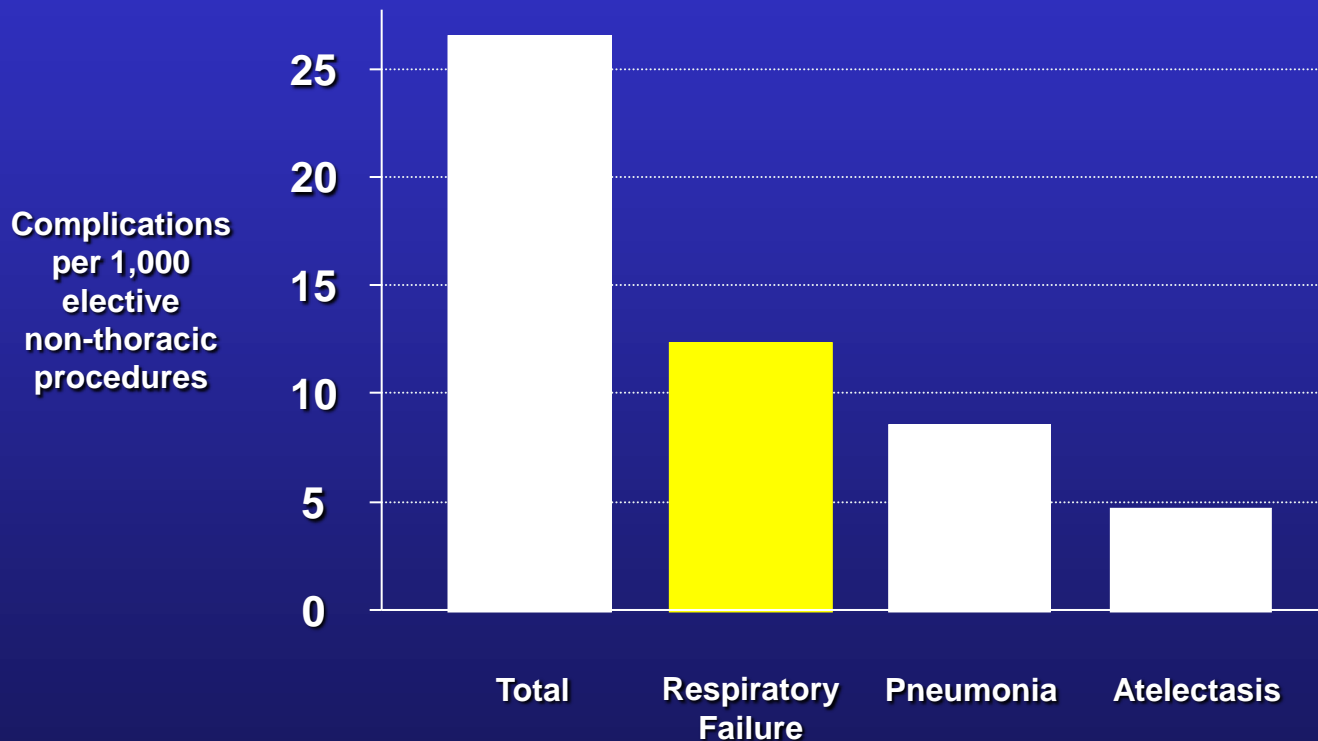
- **Mechanical ventilation >24 hrs or intubation >1 hr after procedure**

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

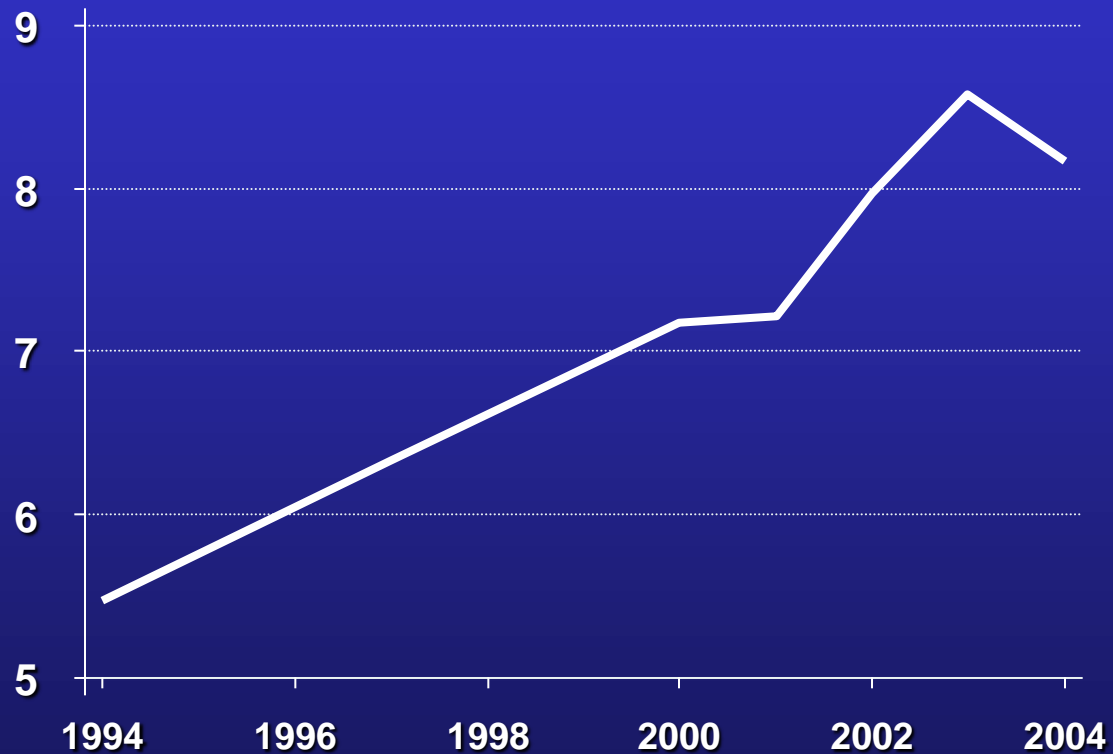
- **Numerator:**
 - “Acute respiratory failure” (518.81) as a secondary diagnosis
OR
 - One of the following:
 - “Insertion of endotracheal tube” (96.04)
≥1 day after main procedure
 - “Continuous mechanical ventilation of unspecified duration” (96.70) or
“Continuous mechanical ventilation for <96 hrs” (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?

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

Outcomes of Confirmed Cases

Outcome	PRF Confirmed (n=507)
Disposition of survivors, n (%)	
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?