

## Complications Associated with Mortality in the National Surgical Quality Improvement Program Database

**Presenting Author:** Robert E. Freundlich, MD, MS<sup>1</sup>

**Coauthors:** Michael D. Maile, MD, MS<sup>2</sup>, Joseph J. Sferra, MD, MBA, FACS<sup>3</sup>, Elizabeth S. Jewell, MS<sup>2</sup>, Sachin Kheterpal MD, MBA<sup>2</sup>, Milo Engoren, MD<sup>2,4</sup>

<sup>1</sup> Vanderbilt University Medical Center, Department of Anesthesiology, Nashville, Tennessee

<sup>2</sup> University of Michigan, Department of Anesthesiology, Ann Arbor, Michigan

<sup>3</sup> University of Toledo College of Medicine and Life Sciences, ProMedica Toledo Hospital, Department of Surgery, Toledo, Ohio

<sup>4</sup> ProMedica Toledo Hospital, Department of Anesthesiology, Toledo, OH

**Introduction:** Attributing causes of postoperative mortality is challenging, as death may be multifactorial. A better understanding of complications which occur in patients who die is important, as it allows clinicians to focus on the most impactful complications. We sought to determine the postoperative complications with the strongest independent association with 30-day mortality.

**Methods:** Data were obtained from the 2012-2013 National Surgical Quality Improvement Program (ACS-NSQIP) Participant Use Data Files. All inpatient or admit day of surgery cases present in the database were eligible for inclusion in this study. A multivariable parsimonious, hierarchical logistic regression analysis was used to adjust for patient preoperative and intraoperative risk factors for mortality. Attributable mortality was calculated using the population attributable fraction (PAF) method: attributable mortality = number of complications  $\times ((P(D|C+) - P(D|C-)))$ , where  $P(D|C+)$  is the probability of death given a complication and  $P(D|C-)$  is the probability of death without a complication. E.g., if  $P(D|C+)$  is 5% (0.05) and  $P(D|C-)$  is 1% (0.01) and 1000 patients had the complication, then the attributable mortality is  $1000 \cdot (0.05 - 0.01) = 40$  deaths. Patients were separated into ten age groups to facilitate analysis of age-related differences in mortality.

**Results:** A total of 1,195,825 patients were analyzed. 9,255 were deceased within thirty days (0.77%). A complication independently associated with attributable mortality was found in 5635 cases (60.9%). The most common causes of attributable mortality were respiratory failure, septic shock, bleeding, and renal failure. Some complications, such as deep venous thrombosis (DVT), failure to wean, and pneumonia, were associated with attributable mortality only in older patients. When grouped by organ system, respiratory complications accounted for the largest share of attributable mortality ( $n = 1805$ , 19.5%) followed by

infectious (n = 1478, 16.0%), renal (n = 673, 7.3%), and cardiovascular (n = 427, 4.6%) complications. After adjustment for both age and frequency of fatal complications, reintubation (28487 [25995, 30674] years [95% confidence interval]), bleeding (23809 [16847, 29938] years), and septic shock (23408 [19205, 27080] years) were associated with the greatest number of years of life lost.

**Conclusions:** We found that 61% of all 30-day mortality is independently attributable to a postoperative complication. The most common are reintubation, septic shock, and bleeding, which are associated with the greatest number of years of life lost. Resources should be focused on preventing and better treating complications associated with the largest attributable mortality, such as respiratory failure, infections, and hemorrhage. This is particularly important for complications that disproportionately impact younger patients, given their longer life expectancy.

# Attributable Mortality in Population, by Complication

