# Supplementary Online Content

Lerman BJ, Popat RA, Assimes TL, Heidenreich PA, Wren SM. Association of left ventricular ejection fraction and symptoms with mortality after elective noncardiac surgery among patients with heart failure. *JAMA*. doi:10.1001/jama.2019.0156

This supplementary material has been provided by the authors to give readers additional information about their work.

**eTable 1.** Examples of Standard, Intermediate, and Complex Procedures in the VA Surgical Complexity Matrix

| Specialty | Standard | Intermediate | Complex |
|---|---|---|---|
| ENT | • Septoplasty<br>• Tonsillectomy<br>• Tympanoplasty | • Cleft lip reconstruction<br>• Parotidectomy<br>• Cochlear implant | • Radical neck dissection<br>• Maxillectomy<br>• Laryngectomy |
| General Surgery | • Appendectomy<br>• Hernia repair<br>• Lymph node biopsy | • Colectomy<br>• Splenectomy<br>• Small bowel resection | • Hepatectomy<br>• Esophagectomy<br>• Whipple |
| Neurosurgery | N/A | N/A | • Skull base surgery<br>• Aneurysm repair<br>• Posterior fossa excision |
| Orthopedic Surgery | • Surgery of upper extremity tendons or ligaments<br>• Treatment of leg and ankle fracture | • Excision of pelvis or hip tumor<br>• Hip arthroplasty<br>• Complex upper limb reconstruction | N/A |
| Thoracic Surgery | • Pacemaker insertion or reposition of leads | • Pericardiectomy<br>• Pleurodesis<br>• Hiatal or paraesophageal hernia repair<br>• Partial pneumonectomy | • Complete pneumonectomy<br>• Sternal debridement<br>• Esophagectomy |

| eTable 2. Clinical Characteristics of Heart Failure Patients | |
|---|---|
| Characteristic | No. (%) |
| Left Ventricular Ejection Fraction[a] | |
| Preserved (≥50%) | 28,742 (59.9) |
| Mildly Reduced (40-49%) | 7,612 (15.9) |
| Moderately Reduced (30-39%) | 6,048 (12.6) |
| Severely Reduced (<30%) | 4,185 (8.7) |
| Not Available | 1,410 (2.9) |
| | |
| Medication | |
| Beta Blocker | 44,030 (91.7) |
| ACE Inhibitor/ARB | 44,280 (92.3) |
| Potassium-Sparing Diuretic | 16,588 (34.6) |
| | |
| Signs or Symptoms within 30 Days | |
| No | 42,091 (87.3) |
| Yes | 5,906 (12.7) |

Abbreviations: ACE angiotensin-converting enzyme ARB Angiotensin Receptor Blocker
[a] 82% of echo readings within 1 year of surgery

**eTable 3.** Odds Ratios of 90-Day Post-Operative Mortality between Heart Failure and Non-Heart Failure Patients by Presence of Active Signs or Symptoms and Left Ventricular Ejection Fraction

| | No. | Crude Mortality (%) | Crude OR (95% CI) | Adjusted OR (95% CI)[a] | Crude Risk Difference (%; 95% CI) | Adjusted Risk Difference (%; 95% CI)[b] |
|---|---|---|---|---|---|---|
| Non-Heart Failure | 561,738 | 1.22 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| | | | | | | |
| Heart Failure—Asymptomatic[c] | | | | | | |
| Preserved LVEF (≥50%) | 25,891 | 4.42 | 3.73 (3.50-3.97) | 1.46 (1.35-1.57) | 3.20 (3.05-3.34) | 0.66 (0.54-0.79) |
| Mildly Reduced LVEF (40-49%) | 6,579 | 4.50 | 3.80 (3.37-4.28) | 1.40 (1.23-1.60) | 3.28 (3.00-3.55) | 0.58 (0.43-0.75) |
| Moderately Reduced LVEF (30-39%) | 5,014 | 5.96 | 5.11 (4.54-5.76) | 1.79 (1.56-2.03) | 4.74 (4.43-5.05) | 1.23 (1.05-1.44) |
| Severely Reduced LVEF (<30%) | 3,313 | 6.61 | 5.70 (4.97-5.56) | 1.99 (1.70-2.32) | 5.39 (5.01-5.77) | 1.60 (1.38-1.85) |
| | | | | | | |
| Heart Failure—Symptomatic[d] | | | | | | |
| Preserved LVEF (≥50%) | 2,851 | 9.08 | 8.06 (7.07-9.18) | 2.13 (1.83-2.46) | 7.86 (7.45-8.27) | 2.03 (1.80-2.30) |
| Mildly Reduced LVEF (40-49%) | 1,033 | 9.00 | 7.97 (6.44-9.89) | 2.23 (1.77-2.84) | 7.78 (7.10-8.45) | 2.20 (1.87-2.60) |
| Moderately Reduced LVEF (30-39%) | 1,034 | 9.57 | 8.53 (6.93-10.52) | 2.15 (1.71-2.70) | 8.35 (7.67-9.02) | 2.11 (1.79-2.51) |
| Severely Reduced LVEF (<30%) | 872 | 14.91 | 14.13 (11.70-17.05) | 3.67 (2.98-4.52) | 13.69 (12.95-14.42) | 5.87 (5.30-6.44) |

Abbreviations: OR Odds Ratio; CI Confidence Interval; HF Heart Failure; LVEF Left Ventricular Ejection Fraction

[a] Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

[b] Calculated using the following formula, with average adjusted predicted probabilities for each group calculated via the corresponding regression model (footnote a): [Average adjusted predicted probability in exposed] – [Average predicted probability in unexposed]

[c] OR compares heart failure patients with the given left ventricular ejection fraction and presence or absence of symptoms to all non-heart failure patients. Does not include 2.9% patients with missing left ventricular ejection fraction.

[d] Classified per the ACS-NSQIP and VASQIP definitions of symptomatic congestive heart failure: the presence of dyspnea, orthopnea, paroxysmal nocturnal dyspnea, increased jugular venous distension, or pulmonary rales within 30 days of surgery

**eTable 4,** Odds Ratios of 30-Day Post-Operative Mortality between Heart Failure and Non-Heart Failure Patients with Subset Analyses by Systolic Function and Presence of Symptoms

| | No. | Mortality (%) | Crude OR (95% CI) | Adjusted OR (95% CI)[a] | Crude Risk Difference (%; 95% CI) | Adjusted Risk Difference (%; 95% CI)[b] |
|---|---|---|---|---|---|---|
| **Heart Failure (Overall)** | | | | | | |
| Non-Heart Failure | 561,738 | 0.54 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure | 47,997 | 2.50 | 4.72 (4.41-5.05)s | 1.56 (1.43-1.69) | 1.96 (1.89-2.03) | 0.39 (0.32-0.47) |
| | | | | | | |
| **Heart Failure (HF) by Systolic Function[c]** | | | | | | |
| Non-Heart Failure | 561,738 | 0.54 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| HF with Preserved LVEF (≥50%) | 28,742 | 2.24 | 4.22 (3.87-4.60) | 1.46 (1.33-1.61) | 1.70 (1.60-1.79) | 0.31 (0.23-0.40) |
| HF with Mildly Reduced LVEF (40-49%) | 7,612 | 2.36 | 4.46 (3.83-5.19) | 1.47 (1.25-1.74) | 1.80 (1.65-1.99) | 0.32 (0.22-0.43) |
| HF with Moderately Reduced LVEF (30-39%) | 6,048 | 2.86 | 5.42 (4.64-6.34) | 1.65 (1.39-1.95) | 2.32 (2.13-2.51) | 0.47 (0.37-0.59) |
| HF with Severely Reduced LVEF (<30%) | 4,185 | 3.89 | 7.46 (6.36-8.76) | 2.20 (1.85-1.61) | 3.35 (3.12-3.58) | 0.97 (0.84-1.13) |
| | | | | | | |
| **Heart Failure by Recent Symptoms[d]** | | | | | | |
| Non-Heart Failure | 561,738 | 0.54 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure, Asymptomatic | 42,091 | 2.13 | 4.01 (3.72-4.32) | 1.42 (1.30-1.55) | 1.59 (1.50-1.66) | 0.28 (0.21-0.36) |
| Heart Failure, Symptomatic | 5,906 | 5.13 | 9.96 (8.83-11.24) | 2.41 (2.11-2.77) | 4.59 (4.39-4.78) | 1.27 (1.19-1.36) |

Abbreviations: OR Odds Ratio; CI Confidence Interval; HF Heart Failure; LVEF Left Ventricular Ejection Fraction

[a] Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

[b] Calculated using the following formula, with average adjusted predicted probabilities for each group calculated via the corresponding regression model (footnote a): [Average adjusted predicted probability in exposed] – [Average predicted probability in unexposed]

[c] OR compares heart failure patients with the given left ventricular ejection fraction and presence or absence of symptoms to all non-heart failure patients. Does not include 2.9% patients with missing left ventricular ejection fraction.

[d] Classified per the ACS-NSQIP and VASQIP definitions of symptomatic congestive heart failure: the presence of dyspnea, orthopnea, paroxysmal nocturnal dyspnea, increased jugular venous distension, or pulmonary rales within 30 days of surgery

**eTable 5.** Odds Ratios of 1-Year Post-Operative Mortality between Heart Failure and Non-Heart Failure Patients with Subset Analyses by Systolic Function and Presence of Symptoms

| | No. | Mortality (%) | Crude OR (95% CI) | Adjusted OR (95% CI)[a] | Crude Risk Difference (%; 95% CI) | Adjusted Risk Difference (%; 95% CI)[b] |
|---|---|---|---|---|---|---|
| **Heart Failure (Overall)** | | | | | | |
| Non-Heart Failure | 561,738 | 3.53 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure | 47,997 | 13.54 | 4.28 (4.15-4.41) | 1.77 (1.70-1.89) | 10.01 (9.82-10.20) | 3.11 (2.80-3.44) |
| | | | | | | |
| **Heart Failure (HF) by Systolic Function[c]** | | | | | | |
| Non-Heart Failure | 561,738 | 3.53 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| HF with Preserved LVEF (≥50%) | 28,742 | 12.31 | 3.84 (3.70-3.99) | 1.66 (1.58-1.73) | 8.78 (8.54-9.00) | 2.62 (2.32-2.84) |
| HF with Mildly Reduced LVEF (40-49%) | 7,612 | 13.15 | 4.13 (3.87-4.43) | 1.71 (1.58-1.85) | 9.62 (9.19-10.04) | 2.87 (2.49-3.27) |
| HF with Moderately Reduced LVEF (30-39%) | 6,048 | 15.63 | 5.06 (4.71-5.43) | 1.95 (1.79-2.11) | 12.10 (11.62-12.57) | 3.99 (3.50-4.52) |
| HF with Severely Reduced LVEF (<30%) | 4,185 | 18.90 | 6.37 (5.89-6.90) | 2.40 (2.19-2.62) | 15.37 (14.80-15.94) | 6.12 (5.55-6.74) |
| | | | | | | |
| **Heart Failure by Recent Symptoms[d]** | | | | | | |
| Non-Heart Failure | 561,738 | 3.53 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure, Asymptomatic | 42,091 | 12.55 | 3.92 (3.80-4.05) | 1.71 (1.65-1.79) | 9.02 (8.82-9.21) | 2.84 (2.54-3.16) |
| Heart Failure, Symptomatic | 5,906 | 20.62 | 7.10 (6.65-7.57) | 2.28 (2.11-2.46) | 17.09 (16.61-17.57) | 5.81 (5.34-6.31) |

Abbreviations: OR Odds Ratio; CI Confidence Interval; HF Heart Failure; LVEF Left Ventricular Ejection Fraction

[a] Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

[b] Calculated using the following formula, with average adjusted predicted probabilities for each group calculated via the corresponding regression model (footnote a): [Average adjusted predicted probability in exposed] – [Average predicted probability in unexposed]

[c] OR compares heart failure patients with the given left ventricular ejection fraction and presence or absence of symptoms to all non-heart failure patients. Does not include 2.9% patients with missing left ventricular ejection fraction.

[d] Classified per the ACS-NSQIP and VASQIP definitions of symptomatic congestive heart failure: the presence of dyspnea, orthopnea, paroxysmal nocturnal dyspnea, increased jugular venous distension, or pulmonary rales within 30 days of surgery

**eTable 6.** 30-Day Post-Operative Complication Rates In Patients with and Without Heart Failure

| | Heart Failure No. (%) | Non-Heart Failure No. (%) | Crude OR (95% CI) | Adjusted OR (95% CI)[a] | Crude Risk Difference (%; 95% CI) | Absolute Risk Difference (%; 95% CI) |
|---|---|---|---|---|---|---|
| Any NSQIP Complication | 5,613 (11.7) | 30,880 (5.5) | 2.28 (2.21-2.34) | 1.05 (1.02-1.09) | 6.20 (5.98-6.42) | 0.30 (0.08-0.53) |
| Cardiac Arrest | 484 (1.0) | 1,104 (0.2) | 5.17 (4.64-5.76) | 1.63 (1.44-1.87) | 0.81 (0.76-0.86) | 0.17 (0.10-0.25) |
| Myocardial Infarction | 218 (0.5) | 745 (0.1) | 3.44 (2.95-3.98) | 1.14 (0.92-1.41) | 0.32 (0.29-0.36) | 0.02 (-0.01-0.05) |
| Stroke | 129 (0.3) | 672 (0.1) | 2.25 (1.83-2.72) | 1.12 (0.95-1.33) | 0.15 (0.12-0.18) | 0.01 (-0.03-0.06) |
| Major Bleed | 159 (0.3) | 531 (0.1) | 3.51 (2.94-4.19) | 1.27 (1.03-1.56) | 0.24 (0.21-0.27) | 0.03 (0.01-0.06) |

Abbreviations: OR Odds Ratio; CI Confidence Interval; NSQIP National Surgical Quality Improvement Program

[a] Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

**eTable 7.** Average Length of Stay Between Heart Failure and Non-Heart Failure Patients Among Inpatient Surgeries

|  | Mean (SD) | β (SE) | *P*-Value |
|---|---|---|---|
| Non-Heart Failure | 7.3 (9.4) |  |  |
| Heart Failure | 5.1 (6.9) | 0.39 (0.04) | <0.0001 |

Abbreviation: SD Standard Deviation

ª Parameter estimate from multivariable linear regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity

**eTable 8.** Complete Case Sensitivity Analysis—Adjusted Odds Ratios and Risk Differences of 90-Day Post-Operative Mortality between Patients with and without Heart Failure

| | No. | Crude Mortality (%) | Crude OR (95% CI) | Adjusted OR (95% CI)[a] | Crude Risk Difference (%; 95% CI) | Adjusted Risk Difference (%; 95% CI)[b] |
|---|---|---|---|---|---|---|
| **Model 1—Heart Failure (Overall)** | | | | | | |
| Non-Heart Failure | 503,695 | 1.30 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure | 45,260 | 5.62 | 4.51 (4.30-4.73) | 1.63 (1.54-1.73) | 4.32 (4.19-4.44) | 0.97 (0.64-1.33) |
| | | | | | | |
| **Model 2—Heart Failure (HF) Defined by Systolic Function[c]** | | | | | | |
| Non-Heart Failure | 503,695 | 1.30 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| HF with Preserved LVEF (≥50%) | 27,162 | 5.00 | 3.90 (3.76-4.24) | 1.52 (1.41-1.63) | 3.70 (3.55-3.85) | 0.71 (0.40-1.04) |
| HF with Mildly Reduced LVEF (40-49%) | 7,183 | 5.19 | 4.15 (3.63-4.62) | 1.50 (1.33-1.69) | 3.89 (3.62-4.16) | 0.70 (0.24-1.20) |
| HF with Moderately Reduced LVEF (30-39%) | 5,730 | 6.72 | 5.46 (4.91-6.07) | 1.84 (1.63-2.07) | 5.42 (5.12-5.72) | 1.29 (0.78-1.84) |
| HF with Severely Reduced LVEF (<30%) | 3,958 | 8.54 | 7.08 (6.31-7.93) | 2.35 (2.07-2.67) | 7.24 (6.88-7.60) | 2.33 (1.73-2.95) |
| | | | | | | |
| **Model 3—Heart Failure Defined by Presence of Recent Symptoms[d]** | | | | | | |
| Non-Heart Failure | 503,695 | 1.30 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure, Asymptomatic | 39,562 | 4.94 | 3.94 (3.74-4.15) | 1.50 (1.42-1.61) | 3.64 (3.51-3.76) | 0.70 (0.55-0.96) |
| Heart Failure, Symptomatic | 5,698 | 10.32 | 8.72 (7.98-9.53) | 2.37 (2.13-2.63) | 9.02 (8.71-11.72) | 2.53 (2.04-3.05) |

Abbreviations: OR Odds Ratio; CI Confidence Interval; HF Heart Failure; LVEF Left Ventricular Ejection Fraction

[a] Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

[b] Calculated using the following formula, with average adjusted predicted probabilities for each group calculated via the corresponding regression model (footnote a):

[Average adjusted predicted probability in exposed] – [Average predicted probability in unexposed]

[c] OR compares heart failure patients with the given left ventricular ejection fraction to all non-heart failure patients. Does not include 2.9% patients with missing left ventricular ejection fraction. *P* for trend <0.001

[d] Classified per the ACS-NSQIP and VASQIP definitions of symptomatic congestive heart failure: the presence of dyspnea, orthopnea, paroxysmal nocturnal dyspnea, increased jugular venous distension, or pulmonary rales within 30 days of surgery

| eTable 9. Propensity-Adjusted Sensitivity Analysis—Adjusted Odds Ratios and Risk Differences of 90-Day Post-Operative Mortality between Patients with and without Heart Failure | | | | | | |
|---|---|---|---|---|---|---|
| | No. | Crude Mortality (%) | Crude OR (95% CI) | Adjusted OR (95% CI)[a] | Crude Risk Difference (%; 95% CI) | Adjusted Risk Difference (%; 95% CI)[b] |
| **Model 1—Heart Failure (Overall)** | | | | | | |
| Non-Heart Failure | 561,738 | 1.22 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure | 47,997 | 5.49 | 4.68 (4.47-4.90) | 1.71 (1.62-1.82) | 4.26 (4.15-4.38) | 1.09 (1.97-1.22) |
| | | | | | | |
| **Model 2—Heart Failure (HF) Defined by Systolic Function**[c] | | | | | | |
| Non-Heart Failure | 561,738 | 1.22 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| HF with Preserved LVEF (≥50%) | 28,742 | 4.88 | 4.14 (3.90-4.39) | 1.47 (1.31-1.64) | 3.66 (3.52-3.80) | 0.79 (0.68-0.90) |
| HF with Mildly Reduced LVEF (40-49%) | 7,612 | 5.11 | 4.34 (3.91-4.82) | 1.59 (1.49-1.71) | 3.89 (3.63-4.14) | 0.91 (0.75-1.09) |
| HF with Moderately Reduced LVEF (30-39%) | 6,048 | 6.58 | 5.68 (5.12-6.31) | 1.76 (1.57-1.98) | 5.36 (5.07-5.64) | 1.17 (0.99-1.36) |
| HF with Severely Reduced LVEF (<30%) | 4,185 | 8.34 | 7.34 (6.56-8.21) | 2.16 (1.91-2.44) | 7.12 (6.77-7.46) | 1.79 (1.57-2.04) |
| | | | | | | |
| **Model 3—Heart Failure Defined by Presence of Recent Symptoms**[d] | | | | | | |
| Non-Heart Failure | 561,738 | 1.22 | 1.0 (Ref) | 1.0 (Ref) | 0 (Ref) | 0 (Ref) |
| Heart Failure, Asymptomatic | 42,091 | 4.84 | 4.10 (3.90-4.31) | 1.58 (1.49-1.69) | 3.62 (3.50-3.74) | 0.90 (0.79-1.03) |
| Heart Failure, Symptomatic | 5,906 | 10.11 | 9.07 (8.31-9.90) | 2.61 (2.36-2.89) | 8.89 (8.59-9.17) | 2.47 (2.16-2.68) |

Abbreviations: OR Odds Ratio; CI Confidence Interval; HF Heart Failure; LVEF Left Ventricular Ejection Fraction

[a] Multivariable logistic regression model adjusted for propensity for heart failure. Propensity score derived from predictive logistic regression model with the following inputs: sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

[b] Calculated using the following formula, with average adjusted predicted probabilities for each group calculated via the corresponding regression model (footnote a):
[Average adjusted predicted probability in exposed] – [Average adjusted predicted probability in unexposed]

[c] OR compares heart failure patients with the given left ventricular ejection fraction to all non-heart failure patients. Does not include 2.9% patients with missing left ventricular ejection fraction. *P* for trend <0.001

[d] Classified per the ACS-NSQIP and VASQIP definitions of symptomatic congestive heart failure: the presence of dyspnea, orthopnea, paroxysmal nocturnal dyspnea, increased jugular venous distension, or pulmonary rales within 30 days of surgery

**eTable 10.** E-Values for Heart Failure and 90-Day Post-Operative Mortality with Selected Sub-Populations

| Population | Adjusted Odds Ratio (95% CI)[a] | E-Value (Point Estimate)[b] | E-Value (Confidence Interval)[c] |
|---|---|---|---|
| Heart Failure | 1.67 (1.57-1.76) | 2.70 | 2.52 |
| Heart Failure, Asymptomatic | 1.53 (1.44-1.63) | 2.43 | 2.24 |
| Heart Failure, Asymptomatic with Preserved EF | 1.46 (1.35-1.57) | 2.28 | 2.04 |
| Heart Failure, Symptomatic | 2.37 (2.14-2.63) | 4.17 | 3.70 |

Abbreviation: CI Confidence Interval

[a] Results from Table 2 and e Table 3. Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility

[b] The point estimate E-Value is the minimum odds ratio of an unmeasured confounder that would attenuate the point estimate of the heart failure post-operative mortality association to the null

[c] E-value for the confidence interval range closest to the null

**eTable 11.** Adjusted Odds Ratios for the Independent Association with 90-Day Post-Operative Mortality of Selected Additional Covariates Included in Table 2, Model 3

*Note: This table serves only as a contextual reference for interpretation of the E-value for the heart failure post-operative mortality relationship. As this study was not* a priori *designed to examine any of the following relationships, these figures are not externally generalizable and should be interpreted only in the context of this limited analysis.*

| Risk Factor | Adjusted Odds Ratio (95% CI)[a] |
|---|---|
| Hypertension | 0.96 (0.91-1.02) |
| Atrial Fibrillation | 1.14 (1.08-1.20) |
| Diabetes | 1.09 (1.04-1.21) |
| Coronary Artery Disease | 1.15 (1.10-1.21) |
| Stroke | 1.33 (1.25-1.42) |
| Chronic Obstructive Pulmonary Disease | 1.48 (1.41-1.56) |
| Peripheral Vascular Disease | 1.33 (1.24-1.43) |
| Male Sex | 1.53 (1.33-1.78) |
| Age (per year) | 1.05 (1.04-1.05) |
| Body Mass Index | 0.97 (0.97-0.97) |
| Alcohol Use | 1.00 (0.92-1.09) |

Abbreviation: CI Confidence Interval

[a] Results from the model presented in Table 2, Model 3. Multivariable mixed effects logistic regression model adjusted for sex, age, body mass index, alcohol consumption, comorbidities (hypertension, atrial fibrillation, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, peripheral vascular disease), pre-operative creatinine, pre-operative hematocrit, American Society of Anesthesiologists class and surgical complexity, and VA facility