|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** |
| **Age (year) ± SD** | 72±10 | 72±9 | 72±9 | 71±10 | 71±11 | 71±10 | 71±11 | 71±10 | 71±10 | 71±11 | 71±10 | 71±10 |
| **Female - no. (%)** | 50.1% | 50.7% | 49.6% | 53.9% | 53.7% | 53.9% | 54.9% | 58.4% | 54.1% | 52.1% | 54.6% | 52.1% |
| **White** | 85.9% | 84.0% | 82.8% | 82.9% | 81.0% | 82.7% | 77.2% | 81.5% | 78.5% | 79.7% | 79.1% | 78.7% |
| **Black** | 5.1% | 7.5% | 3.9% | 5.2% | 7.4% | 6.7% | 7.1% | 6.2% | 6.9% | 6.0% | 8.0% | 7.8% |
| **Hispanic** | 5.0% | 3.8% | 7.5% | 5.8% | 5.5% | 5.0% | 8.6% | 6.1% | 7.0% | 5.0% | 5.7% | 5.7% |
| **Hypertension** | 43.3% | 46.5% | 46.4% | 49.2% | 48.4% | 56.1% | 60.2% | 59.7% | 64.2% | 66.9% | 67.9% | 69.4% |
| **Diabetes** | 15.5% | 17.8% | 17.7% | 17.3% | 20.2% | 23.6% | 22.5% | 22.2% | 25.0% | 26.8% | 28.4% | 26.9% |
| **Prior Sternotomy** | 2.7% | 2.1% | 2.4% | 3.0% | 3.6% | 3.6% | 4.8% | 4.0% | 6.0% | 5.8% | 4.7% | 6.0% |
| **Chronic Pulmonary Disease** | 21.8% | 19.7% | 25.6% | 25.4% | 25.2% | 23.3% | 23.1% | 22.3% | 24.9% | 26.1% | 23.9% | 27.8% |
| **Atrial Fibrillation/Flutter** | 65.2% | 68.4% | 68.5% | 69.7% | 65.4% | 60.4% | 66.8% | 65.9% | 68.4% | 72.1% | 69.1% | 71.2% |
| **Anemia** | 9.1% | 10.5% | 15.5% | 15.1% | 21.2% | 20.7% | 24.2% | 23.0% | 26.4% | 22.9% | 20.9% | 19.7% |
| **Coagulopathy** | 19.2% | 22.4% | 25.8% | 27.0% | 26.8% | 28.1% | 31.9% | 29.6% | 38.3% | 38.2% | 41.5% | 41.6% |
| **Conduction Disease** | 1.2% | 2.2% | 2.7% | 2.5% | 2.2% | 2.4% | 3.6% | 3.4% | 4.2% | 3.9% | 4.7% | 4.3% |
| **Vascular Disease** | 6.7% | 7.7% | 7.3% | 7.5% | 10.2% | 12.2% | 12.3% | 11.2% | 14.6% | 13.5% | 13.5% | 16.4% |
| **Chronic Renal Disease**  | 6.6% | 7.8% | 9.5% | 15.8% | 17.1% | 15.2% | 17.7% | 19.7% | 21.6% | 22.6% | 22.7% | 22.4% |
| **Hemodialysis** | 0.0% | 0.0% | 0.2% | 1.3% | 2.2% | 1.8% | 3.0% | 2.5% | 2.1% | 2.5% | 2.4% | 2.4% |
| **Coronary Artery Disease** | 61.3% | 58.1% | 54.6% | 53.2% | 52.5% | 52.8% | 55.4% | 55.4% | 56.4% | 54.9% | 54.4% | 56.8% |
| **Metastatic Cancer** | 0.1% | 0.3% | 0.4% | 0.3% | 0.0% | 0.3% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% | 0.3% |
| **Liver Disease** | 0.8% | 1.0% | 1.2% | 1.5% | 0.8% | 1.6% | 1.6% | 2.1% | 1.5% | 1.7% | 3.0% | 3.2% |
| **Liver Cirrhosis** | 0.4% | 0.5% | 0.4% | 1.0% | 0.4% | 0.2% | 0.8% | 0.8% | 0.8% | 0.6% | 1.2% | 1.5% |

**eTable-1**

**Temporal Trends in the Prevalence of Major Comorbidities Among Patients Undergoing**

**Bioprosthetic Mitral Valve Replacement Combined with Other Cardiac Surgery**

SD; standard deviation, no; number

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** |
| **Age (year) ± SD** | 70±12 | 68±14 | 69±13 | 68±13 | 68±12 | 67±13 | 67±13 | 68±12 | 69±12 | 68±14 | 67±14 | 68±13 |
| **Female - no. (%)** | 62.4% | 56.9% | 57.4% | 57.7% | 63.3% | 56.8% | 58.0% | 62.6% | 57.4% | 54.2% | 54.6% | 58.9% |
| **White** | 79.9% | 81.0% | 81.3% | 75.2% | 77.1% | 76.1% | 70.5% | 76.9% | 72.6% | 73.4% | 72.6% | 73.1% |
| **Black** | 9.6% | 8.1% | 7.4% | 10.7% | 9.7% | 9.9% | 13.8% | 10.7% | 11.3% | 11.8% | 13.4% | 13.8% |
| **Hispanic** | 7.3% | 7.3% | 7.1% | 7.4% | 6.2% | 5.9% | 8.4% | 5.7% | 7.4% | 7.5% | 6.7% | 6.6% |
| **Hypertension** | 40.6% | 46.0% | 46.7% | 51.5% | 50.3% | 57.2% | 58.2% | 57.1% | 65.9% | 63.9% | 66.5% | 70.3% |
| **Diabetes** | 12.1% | 16.2% | 13.1% | 16.0% | 16.6% | 19.8% | 20.9% | 22.4% | 24.0% | 18.7% | 20.8% | 20.6% |
| **Prior Sternotomy** | 8.4% | 6.6% | 9.5% | 8.3% | 8.1% | 9.8% | 12.9% | 8.7% | 10.4% | 15.5% | 13.2% | 12.8% |
| **Chronic Pulmonary Disease** | 19.3% | 20.4% | 25.5% | 22.8% | 23.9% | 23.4% | 25.9% | 22.4% | 28.6% | 26.2% | 29.2% | 24.3% |
| **Atrial Fibrillation/Flutter** | 64.3% | 60.2% | 54.5% | 57.0% | 53.1% | 49.5% | 54.8% | 48.8% | 58.7% | 56.1% | 57.2% | 55.9% |
| **Anemia** | 10.4% | 14.4% | 13.7% | 16.0% | 21.9% | 21.1% | 23.7% | 21.1% | 26.5% | 21.5% | 24.7% | 21.0% |
| **Coagulopathy** | 17.9% | 15.1% | 17.6% | 18.1% | 22.3% | 21.1% | 25.3% | 21.9% | 30.6% | 32.9% | 34.4% | 38.3% |
| **Conduction Disease** | 1.2% | 0.9% | 1.8% | 2.1% | 2.4% | 1.7% | 3.7% | 2.4% | 2.5% | 3.2% | 2.2% | 4.5% |
| **Vascular Disease** | 4.2% | 4.6% | 4.8% | 4.3% | 6.5% | 7.3% | 8.7% | 6.9% | 10.1% | 8.6% | 9.1% | 12.2% |
| **Chronic Renal Disease**  | 6.2% | 6.6% | 9.7% | 16.2% | 17.2% | 16.1% | 15.2% | 16.1% | 23.7% | 18.9% | 20.1% | 20.8% |
| **Hemodialysis** | 0.0% | 0.0% | 0.2% | 2.6% | 2.0% | 3.5% | 1.8% | 2.0% | 2.3% | 2.4% | 3.9% | 2.1% |
| **Coronary Artery Disease** | 17.8% | 22.3% | 21.8% | 20.9% | 23.1% | 22.1% | 32.1% | 25.6% | 25.4% | 27.7% | 25.8% | 33.4% |
| **Metastatic Cancer** | 0.0% | 0.0% | 0.4% | 0.4% | 0.4% | 0.0% | 0.3% | 0.2% | 0.2% | 0.2% | 0.0% | 0.5% |
| **Liver Disease** | 0.6% | 2.2% | 1.0% | 0.9% | 1.4% | 1.9% | 1.5% | 1.0% | 2.8% | 2.2% | 3.0% | 2.6% |
|  **Liver Cirrhosis** | 0.4% | 0.7% | 0.4% | 0.6% | 0.2% | 0.6% | 0.5% | 0.4% | 0.7% | 0.9% | 0.9% | 1.4% |

**eTable-2**

**Temporal Trends in the Prevalence of Major Comorbidities Among Patients**

**Undergoing Isolated Bioprosthetic Mitral Valve Replacement**

SD; standard deviation, no; number

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics**  | **OR** | **95% C.I. for EXP(B)** | **P value**  |
|  | **Lower** | **Upper** |  |
| **Age** | 1.045 | 1.034 | 1.056 | <0.001 |
| **Female** | 1.649 | 1.306 | 2.081 | <0.001 |
| **Medical Comorbidity** |   |   |   |   |
| **Hypertension** | 0.665 | 0.529 | 0.835 | <0.001 |
| **Atrial Fibrillation/Flutter** | 0.656 | 0.524 | 0.821 | <0.001 |
| **Coagulopathy** | 1.371 | 1.082 | 1.736 | 0.009 |
| **Peripheral Vascular Disease**  | 1.434 | 1 | 2.056 | 0.05 |
| **Chronic Renal Failure** | 2.422 | 1.876 | 3.126 | <0.001 |
| **Coronary Artery Disease**  | 0.592 | 0.451 | 0.778 | <0.001 |
| **Liver disease** | 2.271 | 1.154 | 4.469 | 0.018 |
| **IABP /LV Assist Device Use** | 6.048 | 4.663 | 7.845 | <0.001 |
| **Surgery on day 0-1 of admission** | 0.63 | 0.503 | 0.789 | <0.001 |

eTable-3:

**Multivariate Logistic Regression Analysis for Predictors of In-Hospital Mortality Among Patients**

**Undergoing Isolated Mitral Valve Replacement for Mitral Regurgitation Between 2003-2014**

IABP; intra-aortic balloon pump, LV; left ventricle, CI; confidence interval.

Variables included in the univariate model included: age, gender, race, hypertension, diabetes, prior sternotomy, chronic pulmonary disease, atrial fibrillation and atrial flutter, anemia, coagulopathy, rhythm conduction disorder, peripheral vascular disease, chronic renal failure, coronary artery disease, metastatic cancer, liver disease, need for ventricular assist device, hospital size, hospital location, admission status (elective vs. non-elective), surgery day, insurance status, and median household income.

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics** | **OR** | **95% C.I. for EXP(B)** | **P value** |
| **Lower** | **Upper** |
| **Age** | 1.03 | 1.022 | 1.038 | <0.001 |
| **Female** | 1.307 | 1.153 | 1.482 | <0.001 |
| **Hypertension** | 0.619 | 0.543 | 0.705 | <0.001 |
| **Atrial Fibrillation/Flutter** | 0.448 | 0.393 | 0.511 | <0.001 |
| **Anemia** | 0.739 | 0.623 | 0.876 | <0.001 |
| **Coagulopathy** | 1.202 | 1.058 | 1.367 | 0.005 |
| **Conduction Disorders** | 0.628 | 0.413 | 0.954 | 0.029 |
| **Peripheral Vascular Disease** | 1.438 | 1.206 | 1.715 | <0.001 |
| **Chronic Renal Failure** | 1.834 | 1.576 | 2.134 | <0.001 |
| **Coronary Artery Disease** | 0.616 | 0.531 | 0.714 | <0.001 |
| **Liver disease** | 3.018 | 2.144 | 4.248 | <0.001 |
| **Coronary artery bypass** | 1.604 | 1.364 | 1.885 | <0.001 |
| **Aortic valve replacement** | 1.64 | 1.433 | 1.877 | <0.001 |
| **Tricuspid valve replacement** | 2.011 | 1.386 | 2.918 | <0.001 |
| **Tricuspid Valve Repair** | 1.267 | 1.021 | 1.572 | 0.032 |
| **Cox Maze Ablation** | 1.194 | 1.016 | 1.404 | 0.031 |
| **Open ASD\VSD Repair** | 1.281 | 1.023 | 1.606 | 0.031 |
| **IABP /LV Assist Device Use** | 5.307 | 4.625 | 6.09 | <0.001 |
| **Rural location** | 1.445 | 1.021 | 2.046 | 0.038 |
| **Non-elective Admission** | 1.416 | 1.249 | 1.605 | <0.001 |
| **Private Insurance Status** | 0.77 | 0.631 | 0.939 | 0.01 |
| **Household income 51-75th percentile** | 0.788 | 0.661 | 0.939 | 0.008 |
| **Household income 76-100th percentile** | 0.764 | 0.642 | 0.909 | 0.002 |

eTable 4:

**Multivariate Logistic Regression Analysis for Predictors of In-Hospital Mortality Among Patients Undergoing Combined Mitral Valve Replacement for Mitral Regurgitation Between 2003-2014**

ASD; atrial septal defect, VSD; ventricular septal defect, IABP; intra-aortic balloon pump, LV; left ventricle,

CI; confidence interval.

Variables included in the univariate model included: age, gender, race, hypertension, diabetes, prior sternotomy, chronic pulmonary disease, atrial fibrillation and atrial flutter, anemia, coagulopathy, rhythm conduction disorder, peripheral vascular disease, chronic renal failure, coronary artery disease, metastatic cancer, liver disease, need for ventricular assist device, concomitant cardiac surgery, percutaneous coronary intervention, hospital size, hospital location, admission status (elective vs. non-elective), surgery day, insurance status, and median household income.

|  |  |  |
| --- | --- | --- |
|  | ***Combined MVR Cohort*** | ***Isolated MVR Cohort*** |
| **Characteristics**  | **Males** | **Females** | ***P value*** | **Males** | **Females** | ***P value*** |
| Age- mean (SD), y | 71 (10) | 71 (10) | <0.001 | 68 (13) | 68 (13) | 0.203 |
|  White race | 4757 (82.3) | 5208 (79.5) | <0.01 | 1743 (79.5) | 2238 (72.7) | <0.001 |
|  Black race | 276 (4.8) | 533 (8.1) | 181 (8.3) | 402 (13.1) |
|  Hispanic race | 338 (5.8) | 395 (6) | 129 (5.9) | 239 (7.8) |
|  Hypertension | 1428 (20.7) | 4473 (57.4) | 0.60 | 1495 (57.5) | 2027 (55.8) | 0.182 |
|  Diabetes | 372 (5.4) | 1844 (23.5) | <0.001 | 450 (17.2) | 713 (19.4) | 0.026 |
|  Prior Sternotomy | 1578 (22.9) | 240 (3.1) | <0.001 | 386 (14.8) | 267 (7.3) | <0.001 |
|  Chronic Pulmonary Disease | 4636 (67.3) | 1987 (25.3) | 0.001 | 581 (22.2) | 951 (25.9) | 0.001 |
|  Atrial Fibrillation/Flutter | 1286 (18.7) | 5334 (68) | 0.39 | 1453 (55.6) | 2061 (56.2) | 0.659 |
|  Anemia | 2100 (30.7) | 1569 (20) | 0.04 | 464 (17.8) | 776 (21.2) | 0.001 |
|  Coagulopathy | 234 (3.4) | 2500 (32.1) | 0.07 | 677 (26) | 874 (24.1) | 0.075 |
|  Conduction Abnormalities | 813 (11.8) | 235 (3) | 0.16 | 61 (2.3) | 91 (2.5) | 0.711 |
|  Peripheral Vascular Disease | 1297 (18.8) | 850 (10.8) | 0.06 | 199 (7.6) | 263 (7.2) | 0.502 |
|  Chronic Renal Disease  | 135 (2) | 1195 (15.2) | <0.001 | 457 (17.5) | 527 (14.4) | 0.001 |
|  Hemodialysis | 4319 (62.7) | 126 (1.6) | 0.10 | 56 (2.1) | 64 (1.7) | 0.255 |
|  Coronary Artery Disease | 8 (0.1) | 3846 (49) | <0.01 | 720 (27.6) | 849 (23.1) | <0.001 |
|  Metastatic Cancer | 129 (1.9) | 19 (0.2) | 0.07 | 4 (0.2) | 10 (0.3) | 0.318 |
|  Liver Disease | 54 (0.8) | 121 (1.6) | 0.12 | 56 (2.2) | 54 (1.5) | 0.049 |
|  Liver Cirrhosis | 4757 (82.3) | 54 (0.7) | 0.50 | 24 (0.9) | 16 (0.4) | 0.018 |
|  Teaching Hospital | 4732 (68.9) | 5530 (70.6) | 0.02 | 1860 (71.3) | 2604 (71.2) | 0.922 |
|  Rural location  | 146 (2.1) | 183 (2.3) | 0.38 | 167 (6.4) | 264 (7.2) | 0.981 |
| Non-elective Admission  | 2809 (40.9) | 3074 (39.3) | 0.04 | 473 (18.1) | 630 (17.2) | 0.017 |
| Surgery day 0-1 of admission | 3554 (51.6) | 4015 (51.2) | 0.60 | 1968 (75.5) | 2763 (75.6) | 0.001 |
| Primary Payer- no (%) |  | <0.001 |  |  | <0.001 |
|  Medicare / Medicaid | 5242 (76.1) | 6386 (81.4) |  | 1789 (68.5) | 2826 (77) |  |
|  Private including HMO | 1353 (19.7) | 1259 (16.1) | 701 (26.8) | 702 (19.1) |  |
|  Self-pay/No charge/Other | 289 (4.2) | 199 (2.6) | 122 (4.6) | 140 (3.8) |  |

eTable 5:

**Differences in Baseline Characteristics Between Males and Females Among Patients Undergoing Mitral Valve Replacement for Mitral Regurgitation Between 2003-2014**

|  |  |  |
| --- | --- | --- |
|  | ***Combined MVR Cohort*** | ***Isolated MVR Cohort*** |
| **Clinical Outcomes** | **Males** | **Females** | ***P value*** | **Males** | **Females** | ***P value*** |
|  In-Hospital Death | 605 (8.8) | 776 (9.9) | 0.02 | 130 (5) | 254 (6.9) | 0.001 |
|  Vascular Complications | 270 (3.9) | 375 (4.8) | 0.01 | 105 (4) | 153 (4.2) | 0.77 |
|  Vascular Complications Requiring Surgery | 148 (2.1) | 206 (2.6) | 0.06 | 50 (1.9) | 69 (1.9) | 0.92 |
|  Permanent Pacemaker Implantation | 963 (14) | 1141 (14.5) | 0.33 | 308 (11.8) | 424 (11.6) | 0.78 |
|  Clinical Stroke | 158 (2.3) | 223 (2.8) | 0.04 | 63 (2.4) | 89 (2.4) | 0.97 |
|  Acute Kidney Injury  | 1810 (26.3) | 1849 (23.6) | <0.001 | 523 (20) | 662 (18) | 0.05 |
|  Acute Kidney Injury Requiring Dialysis  | 337 (4.9) | 386 (4.9) | 0.94 | 120 (4.6) | 185 (5) | 0.41 |
|  Blood Transfusion | 2625 (38.1) | 3235 (41.2) | <0.001 | 1047 (40.1) | 1565 (42.7) | 0.04 |
|  Cardiac Tamponade | 77 (1.1) | 86 (1.1) | 0.90 | 22 (0.8) | 27 (0.7) | 0.64 |
|  Pneumonia | 476 (6.9) | 523 (6.7) | 0.55 | 146 (5.6) | 202 (5.5) | 0.89 |
|  Prolonged ventilation  | 595 (8.6) | 744 (9.5) | 0.07 | 199 (7.6) | 304 (8.3) | 0.34 |
|  Wound infection | 123 (1.8) | 120 (1.5) | 0.22 | 29 (1.1) | 39 (1.1) | 0.86 |
|  Pulmonary embolism | 23 (0.3) | 21 (0.3) | 0.46 | 9 (0.3) | 15 (0.4) | 0.68 |
|  Deep venous thrombosis | 41 (0.6) | 61 (0.8) | 0.18 | 24 (0.9) | 32 (0.9) | 0.85 |
|  Discharged Home | 4183 (66.6) | 3934 (55.66) | <0.001 | 1874 (75.5) | 2267 (66.4) | <0.001 |
|  Discharged SNF[[1]](#footnote-1)/NH[[2]](#footnote-2)/IC[[3]](#footnote-3) | 2083 (33.2) | 3116 (44.1) |  | 599 (24.1) | 1137 (33.3) |  |
| Length of stay- mean (SD), d | 15 (13) | 16 (15) | <0.001 | 13 (12) | 14 (13) | 0.01 |
| Length of stay > 5 days  | 6136 (89.1) | 7136 (91) | <0.001 | 2146 (82.2) | 3190 (87) | <0.001 |
| Hospital charges- mean (SD), $  | 231647 (190426) | 231072 (191491) | 0.86 | 192989 (174829) | 192037 (162051) | 0.83 |

eTable 6:

**Differences in Clinical Outcomes Between Males and Females Among Patients Undergoing Mitral Valve Replacement for Mitral Regurgitation Between 2003-2014**

1. Skilled nursing facility [↑](#footnote-ref-1)
2. Nursing home [↑](#footnote-ref-2)
3. Intermediate care [↑](#footnote-ref-3)