all-cause mortality (6.1% vs 6.1%; RR 1.02, 95% CI 0.64 to 1.63, p = 0.95, $I^2 = 0\%$), MI (0.9% vs 2.0%; RR 0.50, 95% CI 0.18 to 1.40, p = 0.19, $I^2 = 0\%$), and major stroke (1.8% vs 1.5%; RR 1.26, 95% CI 0.50 to 3.18, p = 0.63, $I^2 = 0\%$) (Figure 1).

In this meta-analysis of 4 RCTs including 1,086 patients predominately undergoing transfemoral TAVR, SAPT was associated with lower incidence of life-threatening or major bleeding and any bleeding, without an increased risk of ischemic events including all-cause mortality, MI and major stroke at a mean of 9.2 months. There was no evidence of statistical heterogeneity for all outcomes.

Various antithrombotic protocols have been evaluated post-TAVR in order to minimize ischemic and hemorrhagic complications in TAVR patients. While several RCTs have evaluated the use of SAPT versus DAPT post-TAVR, however; none of these trials were adequately powered to detect differences in individual outcomes.[3-6] The present analysis included the most updated RCTs and constitutes the totality of available randomized data on this topic. We demonstrated that aspirin alone offers a safer profile compared with DAPT post TAVR without an increased risk of ischemic events. This analysis is limited by the lack of patient-level data as well as data on subclinical valve thrombosis, which warrants further investigation.

## Disclosures

All the authors have no conflicts of interest to disclose.

## Declaration of interests

The authors declare that they have no known competing financial interests or personal relations that could have appeared to influence the work reported in this study.

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## Impact of Atrial Fibrillation in Aortic Stenosis (From the United States Readmissions Database)

Even though atrial fibrillation (AF) is present in more than 30% of patients with aortic stenosis (AS),[1] it is typically not included in the decision-making algorithm for the timing or need for aortic valve replacement (AVR), either by transcatheter (TAVR) or surgical (SAVR) approaches.[2] Therefore, we aimed to compare patient characteristics, and in-hospital and 6-month in-hospital outcomes of AS patients with and without AF who underwent AVR and no-AVR from a nationwide population-based registry.

We used the publicly available Nationwide Readmissions Database 2016 to 2017, developed by Healthcare Cost and Utilization Project for this retrospective study.[3] The dataset uses unique patient linkages which aids in following patients during a calendar year. We used the International Classification of Diseases-10th revision codes to identify AS patients $\geq$ 18 years of age, and without endocarditis, and categorized them into AS with AF and AS without AF cohorts. Treatment strategies identified were TAVR, SAVR, and no-AVR. In-hospital complications such as mortality, stroke, acute kidney injury, major bleeding requiring transfusion (bleeding), pacemaker implantation, and in-hospital mortality within 6 months of being discharged alive were compared in the 2 cohorts. We used the weight variable provided by the Nationwide Readmissions Database to present national estimates of the results.

Of 740,978 eligible AS patients, 40.4% had AF at the time of admission to the hospital. TAVR, SAVR, and no-AVR were done in 7%, 9.3%, and 83.7% of AS with AF patients respectively (Table 1). Similarly, majority (84.4%) of AS without AF patients were managed with no-AVR. AS patients with AF were older than those without AF. Of note, congestive heart failure was most frequently found in patients who underwent TAVR in both AS with and without AF cohorts. In-hospital mortality was significantly higher for AS with than without AF patients who underwent TAVR (1.7% vs 1.1%; odds ratio [OR]: 1.394; 95% confidence interval [CI]: 1.138 to 1.707; $p < 0.001$) and no-AVR (6.0% vs 3.8%; OR: 1.344; 95% CI: 1.301 to 1.388; $p < 0.001$). Complications such as acute kidney injury and bleeding were significantly worse for AS with than without AF patients who underwent TAVR, SAVR, or no-AVR. Of patients discharged alive, a significantly more number of AS with AF patients died in-hospital during any readmission within 6 months. A multivariate regression analysis with adjustment for age, gender, heart failure, previous valve

Table 1
Patient characteristics and Outcomes

| Variable | TAVI | | | SAVR | | | No-AVR | | |
|---|---|---|---|---|---|---|---|---|---|
| | AS with AF(n=20,876) | | AS without AF(n=35,618) | AS with AF(n=27,911) | | AS without AF(n=33,232) | AS with AF(n=250,364) | | AS without AF(n=372,977) |
| Age (years) | 83 (78-87) | | 81 (75-86) | 73 (68-78) | | 70 (63-76) | 84 (76-89) | | 80 (71-87) |
| Women | 8846 (42.4%) | | 16650 (46.7%) | 9004 (32.3%) | | 12005 (36.1%) | 124032 (49.5%) | | 198217 (53.1%) |
| Obesity | 3191 (15.3%) | | 6168 (17.3%) | 6773 (24.3%) | | 8534 (25.7%) | 30846 (12.3%) | | 53087 (14.2%) |
| Heart failure | 15829 (75.8%) | | 23108 (64.9%) | 10090 (36.2%) | | 9071 (27.3%) | 157361 (62.9%) | | 156231 (41.9%) |
| Prior valve surgery | 999 (4.8%) | | 1006 (2.8%) | 1612 (5.8%) | | 1172 (3.5%) | 19101 (7.6%) | | 17443 (4.7%) |
| Hypertension | 9241 (44.3%) | | 18045 (50.7%) | 17134 (61.4%) | | 21479 (64.6%) | 152277 (60.8%) | | 246881 (66.2%) |
| Diabetes mellites | 7024 (33.6%) | | 12515 (35.1%) | 9100 (32.6%) | | 11790 (35.5%) | 84871 (33.9%) | | 137242 (36.8%) |
| Dyslipidemia | 14851 (71.1%) | | 25737 (72.3%) | 20086 (72%) | | 23116 (69.6%) | 147536 (58.9%) | | 220432 (59.1%) |
| Chronic lung disease | 5058 (24.2%) | | 8702 (24.4%) | 4865 (17.4%) | | 5726 (17.2%) | 64534 (25.8%) | | 87146 (23.4%) |
| Prior pacemaker | 3257 (15.6%) | | 2078 (5.8%) | 1187 (4.3%) | | 869 (2.6%) | 31822 (12.7%) | | 19255 (5.2%) |
| History of CVA | 99 (0.5%) | | 89 (0.2%) | 79 (0.3%) | | 93 (0.3%) | 938 (0.4%) | | 1082 (0.3%) |
| Renal failure | 6304 (30.2%) | | 9394 (26.4%) | 3918 (14%) | | 4147 (12.5%) | 78463 (31.3%) | | 105550 (28.3%) |
| Syncope | 199 (1.0%) | | 430 (1.2%) | 419 (1.5%) | | 552 (1.7%) | 6728 (2.7%) | | 13808 (3.7%) |
| Smoker | 7859 (37.6%) | | 13692 (38.4%) | 11710 (42%) | | 13967 (42%) | 87363 (34.9%) | | 139361 (37.4%) |
| Prior MI | 2492 (11.9%) | | 3850 (10.8%) | 2021 (7.2%) | | 2074 (6.2%) | 29115 (11.6%) | | 40583 (10.9%) |
| Prior PCI | 4420 (21.2%) | | 7786 (21.9%) | 2945 (10.6%) | | 2921 (8.8%) | 30314 (12.1%) | | 45167 (12.1%) |
| Prior coronary bypass | 4372 (20.9%) | | 7132 (20%) | 1738 (6.2%) | | 1702 (5.1%) | 38242 (15.3%) | | 46360 (12.4%) |
| **Outcomes** | | | | | | | | | |
| in-hospital mortality | 358 (1.7%) | (p<0.001) | 385 (1.1%) | 772 (2.8%) | (p=0.222) | 866 (2.6%) | 14955 (6.0%) | (p<0.001) | 14125 (3.8%) |
| in-hospital stroke | 419 (2.0%). | (p=0.009) | 607 (1.7%) | 597 (2.1%) | (p<0.001) | 449 (1.4%) | 11345 (4.5%) | (p<0.001) | 15339 (4.1%) |
| Acute kidney injury | 2519 (12.1%). | (p<0.001) | 2644 (7.4%) | 6242 (22.4%) | (p<0.001) | 5011 (15.1%) | 68959 (27.5%) | (p<0.001) | 88064 (23.6%) |
| Major bleeding requiring transfusion | 1412 (6.8%) | (p<0.001) | 1958 (5.5%) | 6281 (22.5%) | (p<0.001) | 6593 (19.8%) | 22835 (9.1%) | (p<0.001) | 32461 (8.7%) |
| Pacemaker implantation | 2233 (10.7%) | (p=0.899) | 3775 (10.6%) | 1535 (5.5%) | (p=0.002) | 1595 (4.8%) | 5728 (2.1%) | (p<0.001) | 7086 (1.9%) |
| 6-month in-hospital mortality† | 270 / 10864 (2.5%) | (p<0.001) | 251 / 17311 (1.4%) | 196 / 14781 (1.3%) | (p<0.001) | 138 / 17653 (0.8%) | 7810/139996 (5.6%) | (p<0.001) | 8020/202484 (4.0%) |

Using the ICD-10 codes, we identified Aortic Stenosis (ICD-10: I06.0, I35.0, Q23.0) and Atrial Fibrillation patients (ICD-10: I48.0, I48.1, I48.2, I48.91) undergoing TAVI (ICD-10: 02RF37H, 02RF37Z, 02RF38H, 02RF38Z, 02RF3JH, 02RF3JZ, 02RF3KH, 02RF3KZ) and SAVR (ICD-10: 02RF0, 02RF4, X2RF032, X2RF432). Dyslipidemia, defined as disorders of lipid metabolism (E78.0, E78.00, E78.01, E78.1, E78.2, E78.3, E78.4, E78.5, E78.81, E78.89, E8889, E78.9) and obesity defined as obese, overweight and/or having a BMI 30 or higher (E66.x, O9921.x, Z683.x, Z684.x, Z6854) were identified using their ICD-10 codes. Continuous variables expressed as median (IQR 25-75), and compared using Mann−Whitney U test or Student t-test. Categorical variables expressed as n (%) or n/total n (%) and were compared using Fisher's exact test or chi-squared test. †Includes only patients discharged alive between January and June 2016-2017 (to allow for 6 month follow up) who could be followed up for 6 months. AS = aortic stenosis; AF = atrial fibrillation; CVA = cerebrovascular accidents; MI= myocardial infarction; PCI= percutaneous coronary intervention; TAVI = transcatheter aortic valve implantation; SAVR = surgical aortic valve replacement; AVR=aortic valve replacement; ICD = International Classification of Diseases.

surgery, diabetes mellitus, dyslipidaemia, hypertension, renal failure, and liver disease showed a significant association of the presence of AF with in-hospital mortality for AS patients who underwent TAVR (OR: 1.394; 95% CI: 1.138 to 1.707; $p < 0.001$) and no-AVR (OR: 1.344; 95% CI: 1.301 to 1.388; $p < 0.001$), but not for SAVR (OR: 0.896; 95% CI: 0.778 to 1.031; $p = 0.125$).

We observed worse in-hospital complications and 6-month in-hospital mortality for AS patients with than without AF. AS patients with AF had better outcomes with AVR than with no-AVR. We also found that the outcomes of TAVR patients were better than for SAVR patients. This may be reasonable because valve replacements are being achieved for AS patients through a lesser invasive transcatheter approach. Not surprisingly, out of the treatment strategies analyzed, the incidence of bleeding was most frequently seen in SAVR patients. Medically optimizing modifiable risk factors like AF before AVR may help lower the rates of in-hospital complications and readmission, thereby also lowering the cost of hospitalization to the patient. This reflects a need for incorporating AF into the decision-making algorithm for AVR.

This study has limitations relating to the data source, which lacks data on the duration of AF and the severity of AS. However, AF has been shown to be an independent predictor of worse outcomes and a major predictor of morality in patients regardless of its duration or the severity of AS.[4]

In conclusion, this nationwide study showed that AF increases the risk of complications for AS patients irrespective of the treatment strategy. Moreover, outcomes of AS patients with AF were better with AVR than without AVR.

## Declaration of Interests

The authors declare that they have no known competing financial interests or personal relations that could have appeared to influence the work reported in this study.

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# Ten Years Mortality Trends of Tricuspid Regurgitation in the United States, 2008 to 2018

Tricuspid regurgitation (TR), particularly secondary or functional TR, is the most prevalent right heart valvular lesion associated with significant morbidity and mortality.[1] Moderate-to-severe functional TR affects approximately 1.6 million people in the United States, with only 8,000 undergoing surgical repair, yearly, often in the setting of left heart surgery, as surgical repair is limited to severe TR based on current guidelines (Class I, Level of Evidence − C).[2,3] Currently, heart failure (HF) is associated with a high prevalence of 5.7 million in the United States, with an alarming projection of 46% increase in prevalence by the year 2030.[4] Despite these concerning epidemiological estimates, the data outlining the mortality burden of non-rheumatic TR which includes functional TR in the United States is not known, but relevant in the context of clinical care, patient education, guideline development and policy-related changes. This study aimed to assess the burden of mortality from non-rheumatic TR using national representative data assessing death certificates in the United States.

The present analysis utilized deidentified records from the public-use "Multiple Cause of Death data" via the Centers for Disease Control and Prevention Wide−Ranging On-line Data for Epidemiologic Research (CDC WONDER) datasets, 2008 to 2018. The Multiple Cause of Death data comprises of national mortality and population data based on death certificates containing a single underlying cause of death, up to 20 additional multiple causes, and demographic data for the United States counties. Deaths associated with non-rheumatic TR were identified using the International Classification of Disease, tenth revision (ICD-10) code I36.1 as either underlying or contributing cause of death. This analysis was restricted to patients with age over 45 years so as to reflect patients whose deaths were most likely due to functional TR. Non-rheumatic TR deaths per 100,000 major cardiovascular deaths (I00-I78) were calculated. Crude death rates and age-adjusted death rates per 100,000 population were also computed for each year with a confidence interval of 95%. Age-adjusted death rates with a 95% confidence interval (CI) were calculated using the population of year 2000 as the standard population. We used Jointpoint Regression Program version 4.7.0.0 to analyze temporal trends in mortality from 2008 to 2018. Average annual percentage change with 95% CI was calculated for crude and age-adjusted mortality rate trend lines to provide a summary estimate of trend. The trend was considered increasing or decreasing