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EDITORIAL

Ethnic and Gender Disparities in the Uptake of Transcatheter Aortic Valve Replacement in the United States

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ABSTRACT

Introduction: Little is known about ethnic and gender disparities for transcatheter aortic valve replacement (TAVR) procedures in the United States.

Methods: We queried the Nationwide Inpatient Sample (NIS) database (2011–2014) to identify patients who underwent TAVR. We described the temporal trends in the uptake of TAVR procedures among various ethnicities and genders.

Results: Our analysis identified 39,253 records; 20,497 (52.2%) were men and 18,756 (47.8%) were women. Among all TAVRs, 87.2% were Caucasians, 3.9% were African Americans (AA), 3.7% were Hispanics, and 5.2% were of other ethnicities. We found a significant rise in the trend of TAVRs in all groups: in Caucasian men (coefficient = 0.946, $p < 0.001$), Caucasian women (coefficient = 0.985, $p < 0.001$), AA men (coefficient = 0.940, $p < 0.001$), AA women (coefficient = 0.864, $p < 0.001$), Hispanic men (coefficient = 0.812, $p = 0.001$), Hispanic women (coefficient = 0.845, $p < 0.001$). Hence, the uptrend was most significant among Caucasian women, and relatively least significant among Hispanic men. Multivariate regression analysis was conducted to evaluate in-hospital mortality among different groups after adjusting for demographics and baseline characteristics. After multivariable regression for baseline characteristics overall, the in-hospital mortality per 100 TAVRs was highest among Hispanic men 5.5%, followed by Caucasian women 5.0%, Hispanic women 4.6%, AA women 3.7%, AA men 3.4%, and Caucasian men 3.38% (adjusted p value = 0.004).

Conclusions: In this observational study, we demonstrated that there is evidence of ethnic and gender differences in the overall uptake and adjusted mortality of TAVRs in the United States.

Keywords: Gender disparities; Racial disparities; Transcatheter aortic valve replacement

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Transcatheter aortic valve replacement (TAVR) emerged as alternative to surgical replacement for patients with severe aortic stenosis [1–3]. However, little is known about ethnic and gender disparities for TAVR procedures in the United States. This study aimed to evaluate the temporal changes in the uptake of TAVR procedures among the major ethnic groups.

Using the Nationwide Inpatient Sample (NIS) database years 2011–2014, we identified patients who underwent TAVR procedures using International Classification of Diseases procedure code-9; (trans-femoral 35.05 and trans-apical 35.06). Using linear logistic regression analysis, we described the temporal trends in number of TAVR procedures and mortality among various ethnicities and genders. Effect sizes were expressed using co-efficient of regression. Multivariable regression analysis was conducted to compare in-hospital mortality among different study groups. The model included the following variables: age, hypertension, diabetes mellitus, congestive heart failure, chronic lung disease, chronic kidney disease (CKD), obesity, anemia, hypothyroidism, liver disease, fluid/electrolytes abnormalities, peripheral vascular disease, pulmonary circulation disorders, smokers, history of PCI, history of coronary artery bypass grafting, prior MI, and access route for TAVR.

From 2011 to 2014, 42,189 records underwent TAVR. After excluding records with missing data regarding ethnicity (2936), the final cohort included 39,253 records; 20,497 (52.2%) were men and 18,756 (47.8%) were women. Among all TAVRs, 34,229 (87.2%) were Caucasians, 1527 (3.9%) were African Americans (AA), 1471 (3.7%) were Hispanics and 2027 (5.2%) were of other ethnicities. Among Caucasians, 18,023 (52.7%) were men and 16,206 (47.3%) were women, among AA ethnicity 589 (38.6%) were men and 937 (61.4%) were women, while among Hispanics 825 (56.1%) were men and 646 (43.9%) were women. Baseline characteristics for different study groups are outlined in Table 1.

From 2011 to 2014, there was an increase in TAVRs in Caucasian men from 493 in the 2011 quarter (q)4 to 2470 in 2014-q4 with a significant change of trend (coefficient = 0.946, $p < 0.001$), and in Caucasian women from 381 in 2011-q4 to 2280 in 2014-q4 (coefficient = 0.985, $p < 0.001$). Among AA men, TAVRs increased from 11 in 2011-q4 to 85 in 2014-q4 (coefficient = 0.940, $p < 0.001$), and in AA women TAVRs increased from 37 in 2011-q4 to 140 in 2014-q4 (coefficient = 0.864, $p < 0.001$). In Hispanic men, there was an increase in TAVRs from 11 in 2011-q4 to 100 in 2014-q4 (coefficient = 0.812, $p = 0.001$), while in Hispanic women, TAVRs increased from 11 in 2011-q4 to 90 in 2014-q4 (coefficient = 0.845, $p < 0.001$) (Fig. 1). Hence, the uptrend was most significant among Caucasian women, and relatively least significant among Hispanic men.

Multivariate regression analysis was conducted to evaluate in-hospital mortality among different groups after adjusting for demographics and baseline characteristics. Overall, the in-hospital mortality per 100 TAVRs was highest among Hispanic men 5.5% (45/825), followed by Caucasian women 5.0% (804/15,402), Hispanic women 4.6% (30/646), AA women 3.7% (35/937), AA men 3.40% (20/589), and Caucasian men 3.38% (610/18,023) (adjusted p value = 0.004). Temporal changes in the in-hospital mortality among different groups are outlined in Fig. 1. Overall, there was no significant change in the trends, despite some numerical differences along the years.

In this observational study, we demonstrated that there is evidence of ethnic and gender differences in the overall uptake of TAVRs in the US. According to the United States Census Bureau, AA and Hispanics represent 13% and 17.1% of the general population, respectively [5]. However, in our study, they only represented 3.9% and 3.7% of the TAVR procedures, respectively. We have demonstrated a significant uptrend in the number of TAVRs in all groups, which was most significant in Caucasian women, and least in Hispanic men. Data from the Society of Thoracic Surgeons/American College of Cardiology Transcatheter Valve Therapy (TVT) have reported ethnic differences in the uptake of TAVRs in the United States [4]. In their report including 26,378 TAVRs from 2012 to 2014, the majority were Caucasians (93.8%) and AA represented only 3.8% of all TAVRs [4]. The present study extends our

Table 1 Baseline characteristics among different study groups

Characteristics	White females (n = 16,206)		White males (n = 18,023)		AA females (n = 937)		AA males (n = 589)		Hispanic females (n = 646)		Hispanic males (n = 809)		P value
	N	%	N	%	N	%	N	%	N	%	N	%	
Hypertension	13,006	80.3	14,195	78.8	788	84.0	474	80.5	526	81.4	679	82.3	< 0.001
Diabetes mellitus	5088	31.4	6354	35.3	424	45.3	240	40.7	295	45.7	384	46.6	< 0.001
Heart failure	2015	12.4	2014	11.2	140	14.9	80	13.6	75	11.6	90	10.9	< 0.001
Chronic lung disease	5300	32.7	6298	34.9	269	28.7	184	31.2	196	30.3	259	31.4	< 0.001
CKD	4595	28.4	7248	40.2	390	41.6	375	63.6	196	30.3	400	48.5	< 0.001
Obesity	2594	16.0	2046	11.4	240	25.6	80	13.6	120	18.6	75	9.1	< 0.001
Chronic anemia	4436	27.4	4325	24.0	343	36.6	230	39.0	201	31.1	250	30.3	< 0.001
Coagulopathy	3454	21.3	4539	25.2	249	26.6	170	28.9	160	24.8	290	35.2	< 0.001
Hypothyroidism	4594	28.3	2514	13.9	165	17.6	50	8.5	155	24.0	105	12.7	< 0.001
Chronic liver disease	373	2.3	462	2.6	20	2.1	30	5.1	15	2.3	31	3.8	< 0.001
Fluid and electrolyte disorders	4492	27.7	4297	23.8	333	35.5	165	28.0	196	30.3	210	25.5	< 0.001
Pulmonary circulation disorders	680	4.2	600	3.3	25	2.7	45	7.6	30	4.6	25	3.0	< 0.001
Tobacco use	3268	20.2	6369	35.3	160	17.1	195	33.1	105	16.3	239	29.0	< 0.001
History of PCI	2638	16.3	3839	21.3	95	10.1	95	16.1	90	13.9	164	19.9	< 0.001
History of CABG	2033	12.5	5822	32.3	55	5.9	65	11.0	70	10.8	245	29.7	< 0.001
Prior myocardial infarction	1591	9.8	2900	16.1	80	8.5	80	13.6	60	9.3	85	10.3	< 0.001
Trans-femoral TAVR	12,601	77.8	14,933	82.9	803	85.6	505	85.6	476	73.6	571	69.2	< 0.001
Trans-apical TAVR	3630	22.4	3139	17.4	135	14.4	85	14.4	171	26.4	254	30.8	< 0.001

CKD chronic kidney disease, *AA* African American, *PCI* percutaneous coronary intervention, *CABG* coronary artery bypass grafting

knowledge by examining other ethnicities and evaluating gender differences as well. Further, we demonstrated ethnic and gender disparities in the adjusted in-hospital mortality rate, which was highest among Hispanic men followed by Caucasian women.

The background for ethnic disparities in the uptake of TAVR is multi-factorial. Socio-economic status and insurance coverage play important roles in preventing certain groups from receiving TAVRs. Reports from the United States Census Bureau suggested higher rates of non-insurance among minorities; reaching 10.5% in AA and 16% among Hispanics compared with 6.3% among Caucasians [5]. Cultural differences may also play a role, with reports of higher propensities to refuse invasive treatments among some minorities compared to Caucasians [6]. Importantly, minorities have been underrepresented in major clinical trials and specifically for TAVR [1].

This analysis is limited by the data source, which is an administrative database, and liable to documentation errors. Also, the NIS provides only data related to the index hospitalization, with no available long-term data. Being an

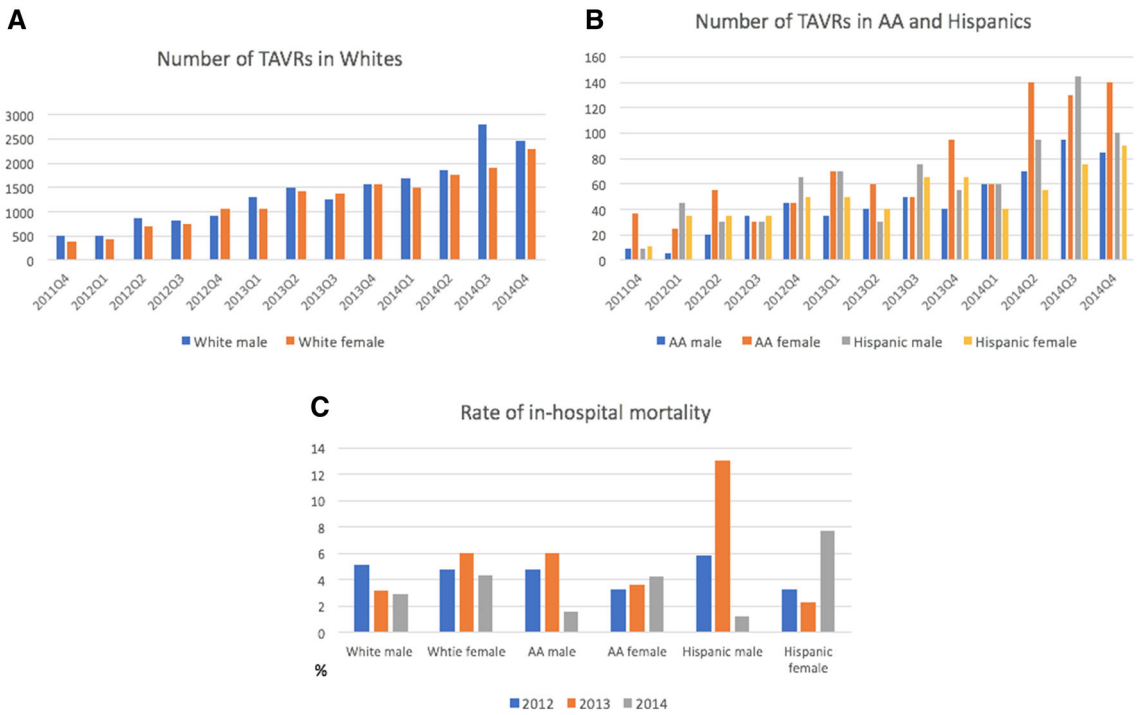

Fig. 1 Trends in number of TAVR procedures and the rate of in-hospital mortality among Caucasians, African Americans, and Hispanics

observation study, there is always potential for selection bias. However, we attempted to reduce allocation bias by conducting multivariable regression analyses. Useful information, such as medications, laboratory data, as well as type of TAVR valves, was unavailable through this database. Further studies are encouraged to identify barriers for uptake of TAVR by minorities, as well as to better specify ethnic and gender differences in outcomes of TAVR procedures.

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Compliance with Ethics Guidelines. This article does not contain any studies with human participants or animals performed by any of the authors.

Data Availability. All data generated or analyzed during this study are included in this published article/as supplementary information files.

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