VOL. 11, NO. 6, 2018
ISSN 1936-8798/$36.00

Letters

TO THE EDITOR

The Kaltenbach Bonzel Bare Wire

Not the Full Story

I read with interest the letter in the Research Correspondence from Martin Kaltenbach, entitled "40 Years of Percutaneous Coronary Intervention: A Historical Remark on the Development and Evolution of Guidewire Technology" (1). The late 70s and early 80s were an exciting time in interventional cardiology. Prof. Kaltenbach was not only an innovator, but his support and contribution to angioplasty needs to be emphasized. Not everyone was as supportive of this young East German immigrant usurping the surgical approach to coronary artery disease. Kaltenbach invited and welcomed Andreas Gruentzig to perform procedures at his hospital and supported Andreas at a time where not everyone was his friend. At the 40th anniversary of percutaneous coronary intervention, both Kaltenbach, Tassaio Bonzel, and others were part of that early team that need more recognition for their outstanding and selfless support of technology and treatment that many of us take for granted (2).

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https://doi.org/10.1016/j.jcin.2018.01.270

Please note: Dr. Heuser has reported that he has no relationships relevant to the contents of this paper to disclose.

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RESEARCH CORRESPONDENCE

Costs of Transcatheter Aortic Valve Replacement

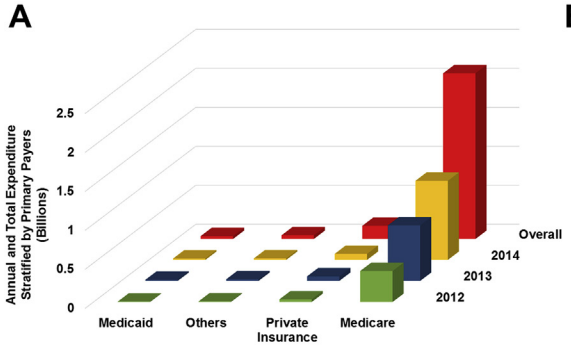
Implications of Proposed Medicare Cuts

Severe aortic stenosis (AS) is a progressive life threatening "surgical" illness. Previous studies have shown a substantial improvement in quality of life as well as survival after valve replacement in patients with severe AS (1). Transcatheter aortic valve replacement (TAVR) is recommended for the treatment of severe AS in patients who are at prohibitive or high risk for valve replacement surgery (1). Due to recent advancement of TAVR technology and indications (e.g., including intermediate risk patients), a rise in number of TAVR procedures is expected for the treatment of severe AS. However, the economic burden of TAVR procedures in severe AS, a disease of aging, has not been described. We explored the expenditure of TAVR hospitalizations by different primary payers, and performed cost comparison with surgical aortic valve replacement (SAVR) hospitalizations. Furthermore, due to proposed Medicare cuts in the forthcoming health care bill, we examined the contribution of Medicare as a primary payer in TAVR hospitalizations.

We retrospectively studied the National Inpatient Sample (NIS) from 2012 to 2014. The details of using NIS database have been described previously (2). International Classification of Diseases-9th Revision-Clinical Modification procedural codes 35.05 and 35.06, 35.20, and 35.21 were used to identify TAVR and SAVR hospitalizations, respectively (2). Hospitalizations for aortic valve replacement with age <18 years were excluded. We also excluded hospitalizations, which had TAVR and SAVR during the same admission. The NIS variables were used to identify primary payers (e.g., Medicare, Medicaid, private insurance, and others). Cost of hospitalization was calculated by multiplying total hospital charge with cost-to-charge ratio provided by Healthcare Cost and Utilization Project-NIS (3). The total annual expenditure associated with TAVR hospitalizations was calculated by multiplying number of hospitalizations with cost of hospitalization for the calendar year, and data were stratified by primary payer (3). Average cost

FIGURE 1 Economic Burden of TAVR Hospitalizations and Cost Savings Compared to SAVR Hospitalizations for Severe AS

A



B

Variable	TAVR (N=33,650)	SAVR (N=33,650)	P value
Age, Years	79.7 (8.6)	79.5 (8.3)	0.16
Female	45.3%	45.5%	0.78
White	81.2%	80.8%	0.32
Black	3.7%	4.2%	
Other	15.1%	15%	
Elixhauser Comorbidities			
Diabetes	29.7%	30.2%	0.55
Hypertension	79.3%	78.7%	0.37
Renal Failure	32.4%	33.6%	0.06
Liver Disease	2.4%	2.8%	0.10
Chronic Pulmonary Disease	31.8%	32.8%	0.22
Obesity	15.6%	15.4%	0.73
Congestive Heart Failure	6.6%	6.6%	0.88
LOS, Median (IQR)	6 (4-9)	9 (6-15)	<0.001
Cost, Mean (SD) $	$57,290 ($31,364)	$61,792 ($46,932)	<0.001

Data are presented as mean ± SD or median (interquartile range) or %.

(A) Annual and total expenditure associated with transcatheter aortic valve replacement (TAVR) hospitalizations stratified by insurance payers from 2012 to 2014. **(B)** Comparison of cost after propensity score matching between TAVR and surgical aortic valve replacement (SAVR) hospitalizations. AS = aortic stenosis; IQR = interquartile range; LOS = length of stay.

of hospitalization in the given year was used for calculation in case cost of hospitalization was not available (3). To compare the costs of index TAVR and SAVR hospitalization, a propensity score-matched model was generated. Logistic regression modeling was performed using demographic variables such as age, sex, race, and comorbidities to calculate a propensity score for each hospitalization. All hospitalizations were matched using a 1-to-1 scheme without replacement with the nearest-neighbor matching method. We used paired Student *t* test for comparison of continuous variables after propensity matching. To obtain national estimates, discharge weights were used for analyses (2).

A total of 40,875 TAVR hospitalizations were identified from 2012 to 2014. The mean age of TAVR hospitalizations was 81 ± 9 years, and 48% of them were women. The median length of stay was 6 days, and the mean cost of TAVR hospitalizations was $57,702.

Medicare was the primary payer among 90% (n = 36,787) of TAVR hospitalizations. Medicare contributed approximately $2.1 billion toward TAVR hospitalizations during the study period (**Figure 1A**). After propensity matching, we observed that the mean cost of TAVR hospitalizations was significantly lower compared with SAVR hospitalizations ($57,290 vs. $61,792; $p < 0.001$) (**Figure 1B**).

In Medicare beneficiaries, TAVR hospitalizations increased from 6,865 in 2012 to 17,925 in 2014. As a result of increasing TAVR hospitalizations, Medicare's spending has increased from $0.4 billion in 2012 to $1 billion in 2014 on TAVR (**Figure 1A**).

Hospitalizations for TAVR primarily occurred in Medicare beneficiaries. TAVR hospitalizations offer considerable cost savings, and were ~$4,500 lower as compared with SAVR. This observation strengthens the economic advantage of TAVR in patients with severe AS. Furthermore, there has been a 2.5-fold increase in Medicare's annual expenditure on TAVR hospitalizations from 2012 to 2014. Recently, the Congressional Budget Office provided the budgetary impact of the proposed Medicare cuts (4). Under the newly proposed regulations, net federal expenditure on Medicare may be reduced by $473 billion over the next decade (4). These Medicare cuts will be compensated by increasing insurance premiums of Medicare beneficiaries (4). Additionally, the Centers for Medicare and Medicaid services has already proposed ~6% cuts on reimbursement for TAVR hospitalization starting from 2018 (5). The aforementioned policy changes will jointly create stringent financial burden on Medicare beneficiaries seeking TAVR procedures. Although TAVR procedures are rapidly increasing, they may lose sustainability due to an adverse economic environment as well as major reliance on the Medicare program. Having said that, actual impact of these health care policy changes on TAVR would be influenced by the state laws, health expenditure, and market dynamics. We would also like to note that our analysis from NIS has limitations that have been previously recognized (2) such as lack of patient-level data, which can allow longitudinal follow-up.

To summarize, Medicare has shouldered majority (~90%) of the economic burden for the TAVR

JACC: CARDIOVASCULAR INTERVENTIONS VOL. 11, NO. 6, 2018
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procedures. Medicare beneficiaries may not be able to withstand anticipated cuts, and if cutting health care payments is inevitable, we need to make dedicated efforts to make sure life-saving procedures such as TAVRs are not affected. We need to focus our efforts on customizing health care reforms by involving all the relevant stakeholders in the restructuring of Medicare.

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https://doi.org/10.1016/j.jcin.2018.01.234

Please note: This work was supported in part by the Walter B. Frommeyer Junior Fellowship in Investigative Medicine that was awarded to Dr. Pankaj Arora by the University of Alabama at Birmingham. Dr. Patel is supported by National Institutes of Health grant no. 1T32HL129948-01A1. Dr. Bajaj is supported by National Institutes of Health grant no. 5T32HL094301-07. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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