

# Institutional Variation in Patient Radiation Doses During Transcatheter Valve Interventions

David A. McNamara MD MPH<sup>a</sup>, Jeremy Albright PhD<sup>b</sup>, Devraj Sukul MD<sup>b</sup>, Stanley Chetcuti MD<sup>b</sup>, Annemarie Forrest MS MPH<sup>b</sup>, Paul Grossman MD<sup>b</sup>, Raed M Alnajjar MD<sup>c</sup>, Himanshu Patel MD<sup>b</sup>, Hitinder S Gurm MBBS<sup>b</sup>, Ryan D. Maddar MD<sup>a</sup>

a) Frederik Meijer Heart & Vascular Institute, Corewell Health West, Grand Rapids, Michigan; b) Department of Internal Medicine, Division of Cardiovascular Medicine, University of Michigan, Ann Arbor, Michigan; c) Department of Cardiothoracic Surgery, Henry Ford Macomb, Clinton Township, Michigan Rapids, Michigan

## Background

- High patient radiation doses are associated with adverse health effects.
- Significant variability in radiation doses during coronary angiography occurs and the institution at which the procedure is performed is the largest predictor of patient radiation doses
- Despite rapid procedural growth, little is known about how radiation doses differ by institution during transcatheter valve interventions.

## Objectives

- To evaluate institutional variability in radiation doses during transcatheter valve interventions.

## Methods

- Using a large statewide registry, transcatheter edge-to-edge mitral valve repair, transcatheter mitral valve replacement, and transcatheter aortic valve replacement procedures between Jan 1, 2020 – Dec 31, 2022 with an air kerma (AK) were analyzed.
- Patient and procedural characteristics were compared between cases with AK  $\geq 2$  and  $< 2$  Gy.
- Associations of variables with AK  $\geq 2$  Gy were investigated using Bayesian random effects modeling and median odds ratios (MOR) for the performing hospital.

## Results

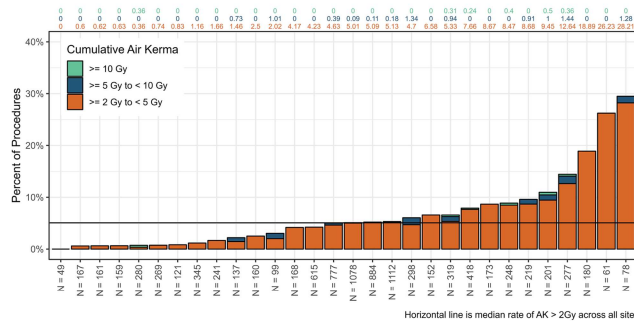
Variable	Overall	< 2Gy	$\geq 2$ Gy	p
N	9446	8913	533	
Procedure Type (%)				<0.001
TAVR	8376 (88.7)	7899 (88.6)	477 (89.5)	
TEER	921 (9.8)	884 (9.9)	37 (6.9)	
TMVR	149 (1.6)	130 (1.5)	19 (3.6)	
Age, years (mean (SD))	78.01 (8.81)	78.24 (8.73)	74.10 (9.15)	<0.001
Sex = Male (%)	5244 (55.5)	4870 (54.6)	374 (70.2)	<0.001
Race (%)				0.413
White	8808 (94.0)	8313 (94.0)	495 (93.2)	
African American	501 (5.3)	467 (5.3)	34 (6.4)	
Other/Multiple Race(s)	66 (0.7)	64 (0.7)	2 (0.4)	

## Disclosures

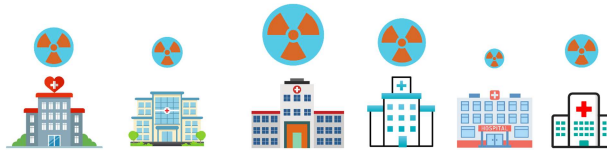
Support for MSHIC is provided by Blue Cross and Blue Shield of Michigan (BCBSM) and Blue Care Network as part of the BCBSM Value Partnerships program. Although BCBSM and MSHIC work collaboratively, the opinions, beliefs and viewpoints expressed by the authors do not necessarily reflect the opinions, beliefs, and viewpoints of BCBSM or any of its employees. Further, BCBSM does not have access to MSHIC data, and all patient episodes occurring at engaged hospitals are included in the data registry, regardless of payer. There are no conflicts directly related to this work. Dr. Patel is a consultant for Medtronic. Devraj Sukul receives salary support from the Blue Cross Blue Shield of Michigan Foundation for his role in quality improvement for the Blue Cross Blue Shield of Michigan Cardiovascular Consortium (BMC2). Outside this work, Hitinder Gurm receives research support from Blue Cross and Blue Shield of Michigan paid to his institution. He is the co-founder of, owns equity in, and is a consultant to Amplitude Vascular Systems. He also owns equity in Jaxing Biotech Medical Technology Partnership and has previously consulted for Optry Medical. He is the chair of the Clinical Events Committee for the PERFORMANCE trial sponsored by Contego Medical. Dr. Maddar has received speaker honoraria from Abbott Vascular, Corindas, and Infraredx; has served as a consultant to Abbott Vascular, Angiowave Imaging, Corindas, Infraredx, RapidAI, and Spectrawave; has received research support from Corindas and Infraredx; and serves on the advisory boards of Medtronic and Spectrawave. Dr. Grossman receives registry support from Blue Cross Blue Shield of Michigan and research support from Medtronic Cardiovascular, Edwards Life Sciences, and the National Institutes of Health. Dr. Alnajjar consults for Edwards Lifesciences and Medtronic, is a proctor for Intuitive Surgical and Abbott, and is a consultant and on the advisory board for Ethicon Surgical Technologies. Dr. Chetcuti is a consultant for Medtronic. The remaining authors have nothing to disclose.

## Results (con't)

In 9446 cases, across 30 hospitals, there was wide institutional variability in procedural radiation doses during transcatheter valve interventions.



Compared with any patient or procedural factor, the hospital where the procedure was performed was the strongest predictor of AK  $> 2$  Gy.



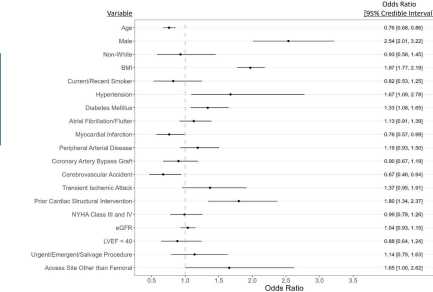
Additional studies are needed to further define factors and inform quality projects to improve radiation safety practices across institutions.

## Conclusions

- In a large, multicenter state-wide registry, there is wide institutional variability in patient-level radiation doses during transcatheter valve interventions.
- The performing hospital has a higher odds of an AK  $\geq 2$  Gy than any patient or procedural factors.
- Given the harmful effects of ionizing radiation, future interventions are warranted to reduce procedural-related variation in radiation exposure.

- Institutional frequency of AK  $\geq 2$  Gy ranging from 0.0% to 29.5%.
- Modeling identified the performing hospital as more strongly associated with the odds of a procedural AK  $\geq 2$  Gy than any patient or procedural factors (hospital MOR 3.54 [95% credible interval 2.52, 16.66]).

## Patient, Clinical, and Procedural Variables Independently Associated with a Procedural Air Kerma $\geq 2$ Gy During Transcatheter Valve Interventions Using a Hierarchical Bayesian Model



The numbers shown are the fixed odds ratios (95% credible intervals) of having a procedural AK  $\geq 2$  Gy during transcatheter valve interventions