Assessing the Impact of Hospital Characteristics on Outcomes of Outpatient Cardiac Procedures: An Analysis of the HCUP-NASS 2019 Database

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Background

- Outpatient cardiac procedures address any issues that may arise in the heart which include the insertion or removal of a pacemaker or cardioverter-defibrillator (AICD), valve replacement surgery, and coronary angioplasty.
- These procedures have increasingly been shifting from hospitals to the outpatient setting in the form of ambulatory surgery centers (ACS) across the United States with multiple clinical trials supporting the safety of this shift.[1,2,3]
- Cardiac procedures still remain challenging with the technical and imaging nuances being more complex than other medical procedures.[4]
- The study sought to evaluate the difference in adverse events in patients undergoing cardiac procedures based on hospital size to better understand if adverse events were more likely to occur after controlling for other hospital characteristics.

Methods and Materials

- Claims data from the HCUP-US Nationwide Ambulatory Surgery Sample (NASS) database for 2019 informed this retrospective analysis.
- Small/medium hospitals had 299-beds or less.
- Cardiac procedures were defined using the Clinical Classifications Software (CCS) designations 43, 48, and 49.
- Two statistical approaches were applied to understand the relationship between hospital size and adverse events: 1) multivariable logistic regression and 2) propensity score match (PSM) with regression.
- The odds of an adverse event following an outpatient cardiovascular procedure was calculated with each approach.

Results

- A total of 204,685 patients from 1,653 hospitals who had undergone a cardiac procedure.
- Small and medium hospitals constituted 66% (1084) of the hospitals and 33% (67,546) of the patients.
- There were statistically significant differences, p value <0.001, between small/medium and large hospitals for the following characteristics: US Census region of the hospital, urban or rural status, teaching status, public or private (not-for-profit or investor-owned).
- Odds ratios for small and medium hospitals from multivariable logistic regression before and after PSM were similar and associated with more adverse events after controlling for hospital characteristics and procedure type (1.79, 95% CI 1.55-2.07, p-value=<0.001 vs 1.84, 95% CI 1.59-2.12, p-value=<0.001).

Table 1. Multivariable outcome analysis without PSM

	OR	95% C.I. for EXP(B)		P value
		Lower	Upper	
Hospital size				
Large	Reference			
Small/medium	1.788	1.549	2.065	<0.001
Region				
West	Reference			
Northeast	0.663	0.535	0.82	<0.001
Midwest	0.422	0.355	0.501	<0.001
South	0.505	0.429	0.593	<0.001
Location				
Rural	Reference			
Urban	2.301	1.864	2.84	<0.001
Teaching status				
Nonteaching	Reference			
Teaching	1.057	0.9	1.241	0.500
Control/ownership				
Private, investor-owned	Reference			
Public	1.252	0.964	1.625	0.091
Private, not-for-profit	0.975	0.81	1.173	0.787
Cardiac procedure				
Other OR heart procedures	Reference			
Heart valve procedures	0.698	0.478	1.02	0.063
Pacemaker, cardioverter/defibrillator	0.266	0.225	0.316	<0.001

Table 2. Multivariable outcome analysis after PSM

	OR	95% C.I. for EXP(B)		P value
		Lower	Upper	
Hospital size				
Large	Reference			
Small/medium	1.80	1.558	2.08	<0.001
Region				
West	Reference			
Northeast	0.696	0.561	0.863	<0.001
Midwest	0.447	0.374	0.534	<0.001
South	0.533	0.452	0.629	<0.001
Location				
Rural	Reference			
Urban	1.831	1.406	2.385	<0.001
Teaching status				
Nonteaching	Reference			
Teaching	0.977	0.825	1.157	0.790
Control/ownership				
Private, investor-owned	Reference			
Public	1.264	0.971	1.646	0.082
Private, not-for-profit	0.941	0.778	1.137	0.529
Cardiac procedure				
Other OR heart procedures	Reference			
Heart valve procedures	0.775	0.528	1.136	0.191
Pacemaker, cardioverter/defibrillator	0.303	0.254	0.363	<0.001

Discussion and Conclusions

- This research sought to examine adverse event rates following an outpatient cardiac procedure as they relate to the size of the hospital and other characteristics.
- Retrospective data provides limited information that could explain for a higher likelihood of an adverse event at small and medium hospitals.
- This study demonstrated that an adverse event after an outpatient cardiac procedure is more likely to occur at small and medium facilities versus large facilities.
- The driving of technology and advancements in clinical expertise will continue to allow more cardiac procedures to be performed in the outpatient setting.
- This research provides a basis for future studies to build upon.
- Further studies are needed with more clinical information to assess whether this increase in risk is explainable due to some factor that is absent in an administrative claims database.

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References

1. Anderson, M. (2020, June 16). *The Benefits Of Shifting Cardiovascular Procedures To Outpatient Settings*. Becker's ASC Review. https://www.beckersasc.com/cardiology/the-benefits-of-shifting-cardiovascular-procedures-to-outpatient-settings.html?oly_enc_id=5701J8483178J7Z
2. Block, P. C., Ockene, I., Goldberg, R. J., Butterly, J., Block, E. H., Degon, C., Beiser, A., & Colton, T. (1988). A Prospective Randomized Trial of Outpatient versus Inpatient Cardiac Catheterization. *N Engl J Med*, *319*(19), 1251–1255. https://doi.org/10.1056/nejm198811103191904
3. Córdoba-Soriano, J. G., Jiménez-Mazuecos, J., Rivera Juárez, A., Gutiérrez-Díez, A., Gutiérrez Ibañes, E., Samaniego-Lampón, B., Lozano, I., Gallardo-López, A., Díaz, L., & Sanz-Ruiz, R. (2017). Safety and Feasibility of Outpatient Percutaneous Coronary Intervention in Selected Patients: A Spanish Multicenter Registry. *Revista Española de Cardiología (English Edition)*, *70*(7), 535–542. https://doi.org/10.1016/j.rec.2017.01.022
4. Gad, M. M., Ahuja, K. R., Bazarbashi, N., Karrthik, A. K., Kaur, M., Mick, S. L., Reed, G. W., Tuzcu, E. M., Krishnaswamy, A., & Kapadia, S. R. (2019). The Impact of Hospital Characteristics on the Outcomes of Interventional Cardiac Procedures. *JACC: Cardiovascular Interventions*, *12*(18), 1872–1874. https://doi.org/10.1016/j.jcin.2019.05.033