Infective Endocarditis Complicating Delivery in Pregnancy: Risk Factors, Complications, and Delivery Outcomes

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ABSTRACT

Background: Infective endocarditis (IE) is a rare but serious complication of pregnancy. Its impact on delivery outcomes is unknown. In this study, we use a national administrative database to compare outcomes of deliveries complicated by IE to non-IE deliveries.

Methods: The National Readmissions Database was used to identify discharges between Oct. 2015 and Dec. 2017 for deliveries in patients aged 12 – 55 years with concomitant IE, which were compared to those deliveries without IE. Demographics, comorbidities, and outcomes were obtained. Differences between groups were analyzed using weighted Chi-squared test for categorical variables and weighted linear regression for continuous variables. Weighted multivariate regression models adjusted for demographic, facility, and comorbidity conditions were used to evaluate the association between IE and delivery outcomes.

Results: We identified 88 individuals with IE complicating their delivery hospitalization, corresponding to a national estimate of 162 admissions during the study period, who were compared to 4,401,879 delivery hospitalizations not complicated by IE (weighted national estimate 8,375,536). Patients with IE were more likely to reside in ZIP codes with median incomes in the lowest national quartile (46.3% vs. 28.1%, P = 0.003) and were more likely to be insured by Medicaid (76.5% vs. 42.1%, P < 0.001). Rates of pre-existing cardiac valve disease (39.9% vs. 0.2%, P < 0.001) and congenital heart disease (6.6% vs 0.1%, P < 0.001) were higher in those with IE, as well as drug abuse (69.3% vs. 2.6%, P < 0.001). Unadjusted analyses demonstrated higher rates of in-hospital mortality for IE-associated admissions (12.1% versus 0.005%), along with high rates of severe maternal morbidity, stillbirth, preterm birth, and cesarean birth, and longer lengths of stay and total hospital costs. These differences persisted despite adjustment using multivariate methods.

Conclusion: The presence of IE during an admission for delivery is associated with poorer outcomes for both pregnant patients and their fetuses. The occurrence of IE during pregnancy was associated with lower income, a history of cardiac disease, and drug abuse.

INTRODUCTION

- Infective endocarditis (IE) is a rare complication of pregnancy
- Due to the low incidence, most data regarding IE complicating pregnancy arise from case reports and the effect of IE on delivery outcomes is unknown
- Our study uses a large cohort to compare delivery outcomes in patients with and without a diagnosis of IE
- Objectives:
    1. Describe the characteristics of patients who deliver with IE
    2. Compare maternal and fetal outcomes of delivery in patients who deliver with and without IE

METHODS

- Data obtained from Nationwide Readmissions Database[1] (NRD), an all-payer database of inpatient hospitalizations
- The 2017 NRD contains data from 28 states and accounts for 58.2% of all hospital admissions
- Patients who were hospitalized for delivery were included and grouped according to the presence or absence of a diagnosis of IE

Inclusion Criteria (Figure 1)
- October 2015 - December 2017
- Females of reproductive age (12 – 55 years)
- Admitted for delivery

Severe Maternal Morbidity Index[2]: set of 21 indicators compiled by the Center for Disease Control and Prevention reflecting unexpected outcomes of labor/delivery with short or long-term health implications

Statistical Analysis
- **Categorical variables**: weighted Chi-squared test
- **Continuous variables**: weighted linear regression
- **Weighted multivariate regression models** adjusted for demographic, facility, and comorbidity conditions to evaluate differences in delivery outcomes

RESULTS

Figure 1. Derivation of study sample from the Nationwide Readmissions Database (NRD)

NRD (Oct. 2015 – Dec. 2017) N = 39,447,383 → Males, Females aged <12 or >55, Non-delivery hospitalizations → Hospitalized for Delivery N = 4,401,967 → No Infective Endocarditis N = 4,401,879 | Infective Endocarditis N = 88
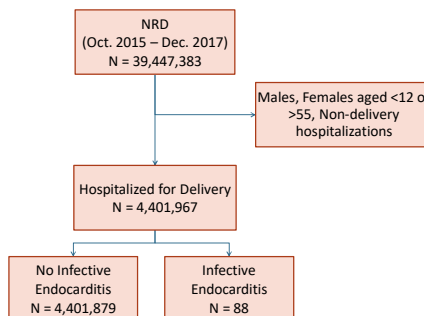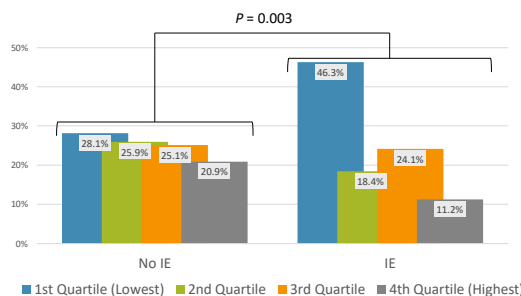
Table 1. Demographics and medical comorbidities of patients admitted for delivery with and without IE

	Delivery without IE N = 4,401,879 (Weighted N = 8,375,536)	Delivery with IE N = 88 (Weighted N = 162)	P-value
	N (%)	N (%)	
Age (SD)	28.7 (5.8)	27.8 (4.8)	0.12
Primary expected payer			<0.001
Medicaid	3,525,651 (42.1)	124 (76.5)	
Private insurance	4,412,647 (52.7)	24 (14.9)	
General Comorbidities			
Chronic kidney disease	9,307 (0.1)	*	0.007
Pregestational diabetes	97,174 (1.2)	*	0.89
Chronic hypertension	192,540 (2.3)	13 (8.1)	0.004
Drug abuse	219,130 (2.6)	112 (69.3)	<0.001
Cardiac Comorbidities			
Cardiac valve disease	13,870 (0.2)	64 (39.9)	<0.001
Congestive heart failure	917 (0.0)	11 (6.7)	<0.001
Ischemic heart disease	2,815 (0.0)	*	<0.001
Congenital heart disease	8,430 (0.1)	11 (6.6)	<0.001
History of valve replacement	939 (0.0)	*	<0.001
History of other cardiac prosthesis	3,681 (0.0)	*	<0.001

* N < 10; data cannot be displayed due to data use restrictions

Figure 2. Distribution of participants by median household income determined by ZIP code

P = 0.003

No IE: 1st Quartile (Lowest) 28.1%, 2nd Quartile 25.9%, 3rd Quartile 25.1%, 4th Quartile (Highest) 20.9%
IE: 1st Quartile (Lowest) 46.3%, 2nd Quartile 18.4%, 3rd Quartile 24.1%, 4th Quartile (Highest) 11.2%

Figure 3. Comparison of delivery outcomes stratified by IE status

- IE
- No IE

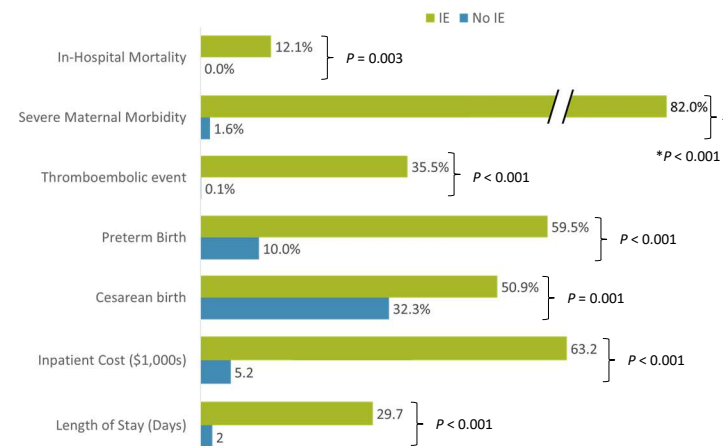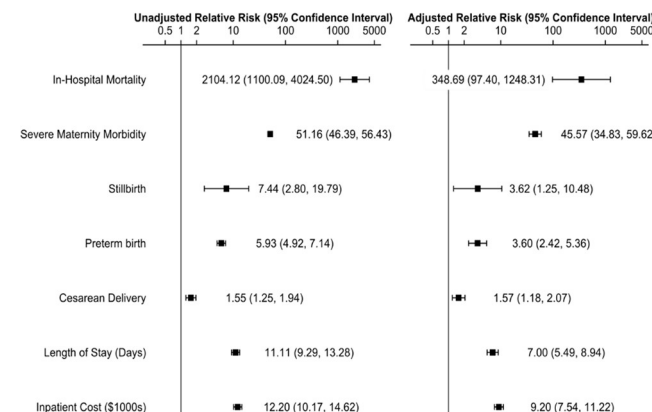| Outcome	IE	No IE	P
In-Hospital Mortality	12.1%	0.0%	P = 0.003
Severe Maternal Morbidity	82.0% *	1.6%	*P < 0.001
Thromboembolic event	35.5%	0.1%	P < 0.001
Preterm Birth	59.5%	10.0%	P < 0.001
Cesarean birth	50.9%	32.3%	P = 0.001
Inpatient Cost ($1,000s)	63.2	5.2	P < 0.001
Length of Stay (Days)	29.7	2	P < 0.001

Figure 4. Unadjusted and adjusted relative risk of delivery outcomes in IE-complicated deliveries compared to uncomplicated deliveries

Outcome	Unadjusted Relative Risk (95% Confidence Interval)	Adjusted Relative Risk (95% Confidence Interval)
In-Hospital Mortality	2104.12 (1100.09, 4024.50)	348.69 (97.40, 1248.31)
Severe Maternity Morbidity	51.16 (46.39, 56.43)	45.57 (34.83, 59.62)
Stillbirth	7.44 (2.80, 19.79)	3.62 (1.25, 10.48)
Preterm birth	5.93 (4.92, 7.14)	3.60 (2.42, 5.36)
Cesarean Delivery	1.55 (1.25, 1.94)	1.57 (1.18, 2.07)
Length of Stay (Days)	11.11 (9.29, 13.28)	7.00 (5.49, 8.94)
Inpatient Cost ($1000s)	12.20 (10.17, 14.62)	9.20 (7.54, 11.22)

CONCLUSION

- The presence of IE during a delivery admission is associated with a higher risk of maternal in-hospital mortality and severe maternal morbidity
- IE complicating a pregnancy admission significantly increases the risk of preterm birth and stillbirth
- IE during a delivery admission is associated with lower median household income, a history of cardiac disease, and drug abuse

REFERENCES

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2. Center for Disease Control and Prevention. (2019, December 26). How does the CDC identify severe maternal morbidity? Retrieved from https://www.cdc.gov/reproductivehealth/maternalinfanthealth/smm/severe-morbidity-ICD.htm