Impact of United States COVID-19 Regional Changes on Prenatal Diagnosis and Surgical Outcomes of Congenital Heart Disease: A Fetal Heart Society and Society of Thoracic Surgeons Collaborative Study

Objective: To describe regional practice changes in fetal cardiology during the 1st year of the COVID-19 pandemic and assess impact of restrictions on prenatal diagnosis, surgical outcomes and disparities for neonatal critical congenital heart disease (CCHD) in the United States.
Methods: A multi-institutional retrospective cohort study of CCHD (surgery<60 days of birth) neonatal outcomes was performed. Pandemic era regional practice changes were obtained from a prospective cross-sectional Fetal Heart Society survey including regional policies, fetal cardiology triage and referral fluctuations. Society of Thoracic Surgeons Congenital Heart Surgery Database provided data on patients. CCHD neonates born in the pre-pandemic era (2/1/19-2/2/20) were compared to those born during peak pandemic (03/13/20-11/1/20). Prenatal diagnosis, demographics, outcome data and area deprivation index (ADI) were collected. Wilcoxon rank-sum and chi-squared tests performed univariable analyses.
Results: Surveys completed by 73 fetal cardiologists nationally (9 US regions) indicated 54(75%) institutions implemented restrictions by 3/20/20 which eased by 11/1/20 for 30(72%). Forty-nine (69%) respondents agreed that pandemic restrictions led to triage changes and decreased referrals/visits. Sixty-four (89%) respondents reported clinic visit decreases ranging from 1-20% (n=15), 21-40% (n=22), 41-60% (n=21), and 61-80% (n=6). Comparing CCHD patients born during the pre-pandemic (n=4637) vs pandemic era (n=1806), there was increased prenatal vs postnatal diagnosis during the pandemic (1184(66%) vs 2915(63%); P<0.05); no differences in complications or mortality were found (Table). Increased hospital length of stay (24 (8,83) vs 26(9,91)days; (P<0.001), increased use of hybrid stage 1 for left heart hypoplasia (n=48 vs 28; P<0.05), worse patient state ADI (5.71 ±2.53 vs 5.5±2.56; P <0.02) and better hospital state ADI (4.11±2.35 vs 4.33±2.37; P<0.001) emerged (Table). Regional variations were noted, including higher LOS in specific regions (Figure).
Conclusion: Our study highlights healthcare system resilience in managing CCHD during the COVID-19 pandemic. While pandemic-driven adjustments affected fetal cardiology referrals and triage, core aspects of prenatal diagnosis and perioperative outcomes and survival remained robust. Regional differences underscore the need for sub-analyses to identify opportunities to mitigate regional disparities for future healthcare emergencies.

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	Pre-Pandemic (n= 4637)	Pandemic Era (n= 1806)	*P* value
	Count (%)/ Median (15^{th}/50^{th}/85^{th})		
Prenatal Diagnosis	2915 (63)	1184 (66)	.043
Premature Birth	1037 (22)	430 (24)	.081
Postoperative LOS	6/16/66	7/18/73	.0037
Patient Median State Rank	2.5/5.5/9	3/6/9	.017
Hospital Median State Rank	2/4/7	1/4/7	.0006
No preoperative factors identified	1885(41)	698(39)	.14
Mortality / Major postoperative complication	839(22)	341(22)	.7

Table: The table shows variations in characteristics in neonates born with critical congenital heart disease (CHD) between the pre-pandemic and COVID-19 pandemic era.

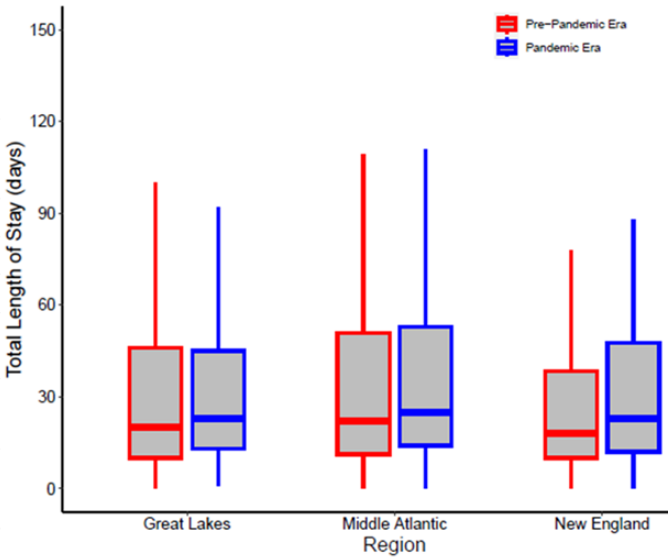

Figure: The figure shows the increased total length of stay (LOS) during hospitalization of neonates born with critical congenital heart disease (CHD) in the COVID-19 pandemic era compared to the pre-pandemic ($P<0.05$)specifically in the Great Lakes, Middle Atlantic, and New England regions of the United States.