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# Can Home ECG Monitoring Be Used to Evaluate Heart Rate Variability in Infants with Congenital Heart Disease?

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## INTRODUCTION

- Reduced heart rate variability (HRV), an indicator of autonomic nervous system dysfunction, can be used to identify critically ill patients at higher risk for adverse outcomes<sup>1</sup>.
- Limited data exists on HRV in children with cardiac disease.
- Early detection of reduced HRV with home monitoring systems may lead to improved outcomes in high-risk infants with complex congenital heart disease.

## HYPOTHESIS

- Home ECG monitoring is a valid method to obtain HRV data.

## METHODS

- Retrospective chart review of 15 infants with complex congenital heart disease undergoing home monitoring at UC Davis Medical Center.
- Raw ECG data was extracted from Dictum Health.
- Max and min HR on ECGs were analyzed based on R-R intervals. HRV was calculated using the difference between max and min R-R.

Figure 1. Frequency of congenital heart defects amongst study cohort

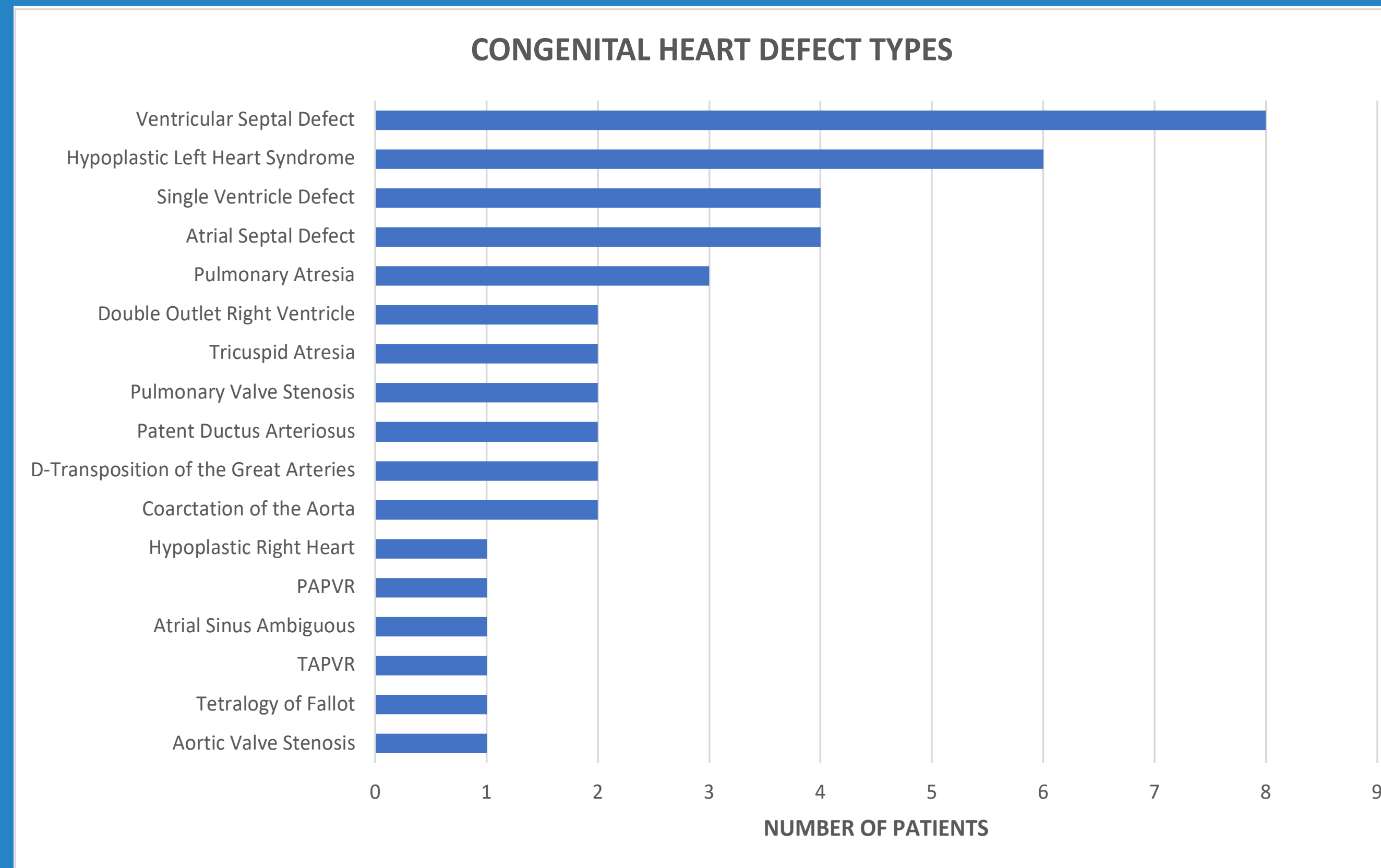
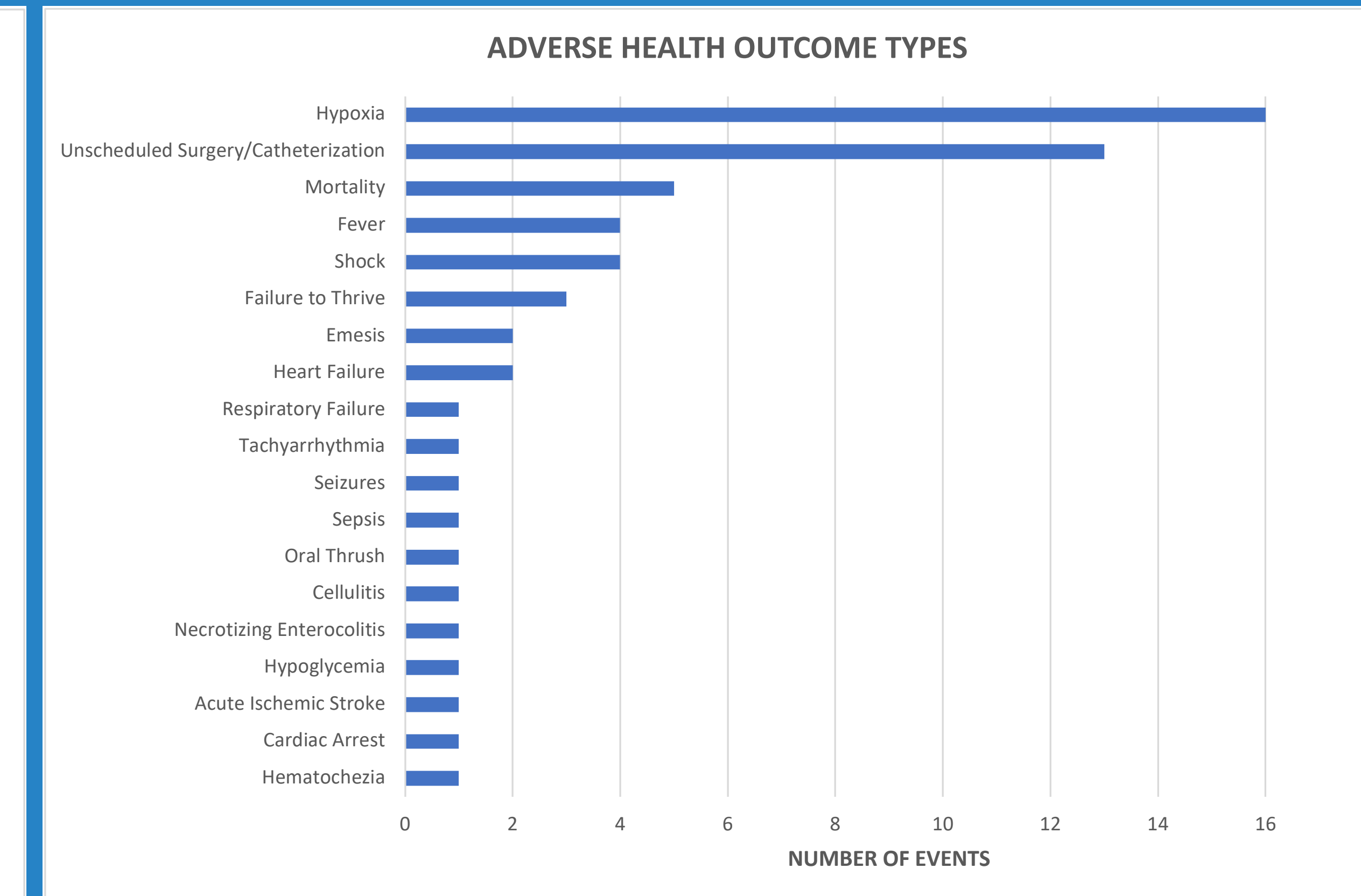


Figure 2. Frequency of adverse health outcome events amongst study cohort



Note: n >15 because more than one defect was present in most of the infants.

Table 1. Infant demographics and clinical features

Characteristic	Patients (n = 15)
Sex, n (%)	
Female	4 (26.7)
Male	11 (73.3)
Race, n (%)	
Black	1 (6.7)
White	8 (53.3)
More Than One Race	1 (6.7)
Not Reported	5 (33.3)
Ethnicity, n (%)	
Hispanic or Latino	6 (40)
Non-Hispanic or Latino	9 (60)
Prenatal Diagnosis, n (%)	7 (46.7)
Mortality, n (%)	5 (33.3)
Average Number of Admissions	3.5
Average Height at Initial Admission (cm)	49.6
Average Weight at Initial Admission (kg)	3.3

Table 2. HRV calculations obtained from 5 ECGs for one patient

Patient ID	ECG Date	Estim. HR (BPM)	Max RR (sec)	Min RR (sec)	HRV (sec)	Max RR (BPM)	Min RR (BPM)	HRV (BPM)
HRV110	9/1/20	127.9129	0.8387	0.4193	0.4194	71.5370	143.0942	71.5572
HRV110	9/2/20	145.3051	0.4273	0.4094	0.0179	140.4151	146.5500	6.1348
HRV110	9/3/20	133.0079	0.6556	0.4098	0.2459	91.5192	146.4308	54.9115
HRV110	9/4/20	115.1961	0.5440	0.5154	0.0286	110.2941	116.4216	6.1275
HRV110	9/5/20	146.4330	1.4023	0.4012	1.0012	42.7858	149.5638	106.7779

## CONCLUSIONS

- ECGs obtained from home monitoring systems can be used to evaluate HRV in high-risk infants with congenital heart disease.

## FUTURE DIRECTIONS

- HRV on ECGs will be correlated with red flag health outcome events to investigate whether reduced HRV is associated with poor health outcomes.

## LIMITATIONS

- Small sample size of infants.
- Several HRV values were inappropriately high (i.e. 180bpm), suggesting the HRV algorithm needs to be refined to account for such outliers.

## REFERENCES

- Badke C, Marsillio L, Carroll M, Weese-Mayer D, Sanchez-Pinto L. Development of a Heart Rate Variability Risk Score to Predict Organ Dysfunction and Death in Critically Ill Children. *Pediatric Critical Care Medicine*. 2021; 22 (8): e437-e447. doi: 10.1097/PCC.0000000000002707.