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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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## 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.

## 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

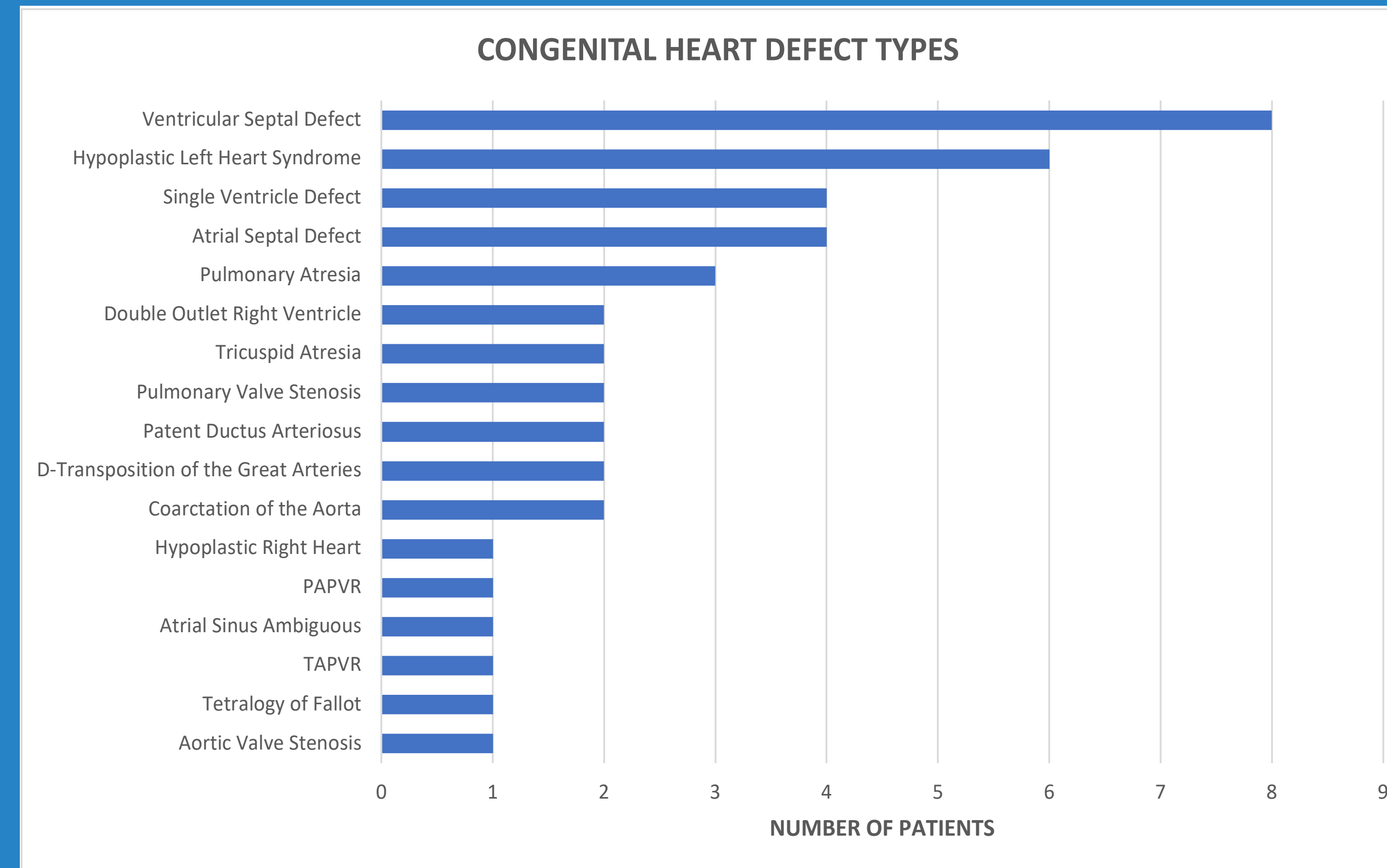
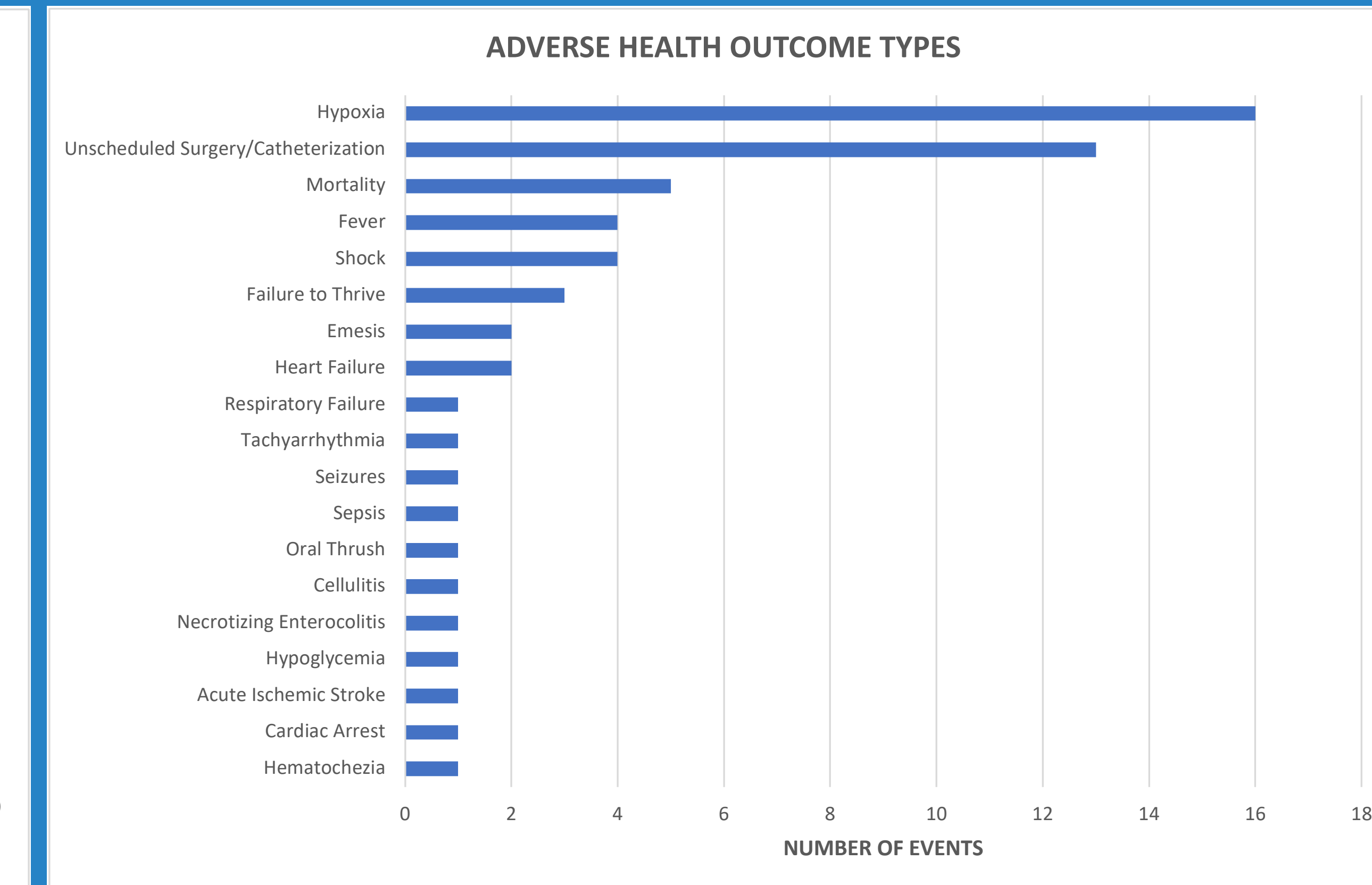


Figure 2. Frequency of adverse health outcome events amongst study cohort



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  |