**Supplemental Table 1.** Types of congenital heart defects and corresponding International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes.

|  |  |  |
| --- | --- | --- |
| **Category** | **Defect** | **ICD-9-CM Code** |
| Mild | Ventricular septal defect | 745.4 |
| Atrial septal defect | 745.5 |
| Patent ductus arteriosus | 747.0 |
| Moderate\* | Common truncus | 745.0 |
| Pulmonary valve stenosis | 746.02 |
| Tetralogy of Fallot | 745.2 |
| Complex\* | Tricuspid atresia and stenosis | 746.1 |
| Hypoplastic left heart syndrome | 746.7 |
| Common ventricle | 745.3 |
| Transposition of the great arteries | 745.1 |
| \*Congenital heart defects selected for this study and referred to as specific moderate-complex CHDs |

**Supplemental Table 2.** Detailed demographic and clinical characteristics of study population in model validation cohort (n = 596)

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics** | **Cases (n = 111)** | **Controls (n = 485)** | **P-value\*** |
|  | Means (±SD) or N (%) |   |
| **Age (years)** | 34.06 (±10.82) | 47.00 (±9.61) | <0.0001 |
| 20-34 | 63 (56.76) | 59 (12.16) | <0.0001 |
| 35-49 | 31 (27.93) | 201 (41.44) | 0.008 |
| 50-60 | 17(15.32) | 225 (46.39) | <0.0001 |
| **Sex** |  |  |  |
| Females | 70 (57.85) | 264 (52.91) | 0.328 |
| **Race** |  |  | 0.113 |
| Non-Hispanic white | 79 (80.61) | 302 (68.79) |  |
| Non-Hispanic black | 16 (16.33) | 123 (28.02) |  |
| Asian | 1 (1.02) | 8 (1.82) |  |
| Hispanic | 2 (2.04) | 4 (0.91) |  |
| Native American/Pacific Islander | 0(0.00) | 2 (0.46) |  |
| **PR interval (msec)** | 156.6 (±51.42) | 155.50 (±28.77) | 0.833 |
| **QRS duration (msec)** | 131.1 (±31.24) | 88.88 (±13.72) | <0.0001 |
| **QRS axis (degrees)** | 66.80 (±75.61) | 42.78 (±39.07) | 0.0015 |
| **Heart rate (bpm)** | 72.76 (±11.01) | 70.95 (±13.73) | 0.1388 |
| **Atrial enlargement, right, left or biatrial**  | 32 (26.45) | 183(36.67) | 0.034 |
| **Rhythm not sinus** | 34 (28.0) | 36 (7.21) | <0.0001 |
| **RVH** | 20 (16.53) | 5 (1.00) | <0.0001 |
| **LVH** | 15 (12.4) | 36 (7.21) | 0.063 |
| **RBBB** | 79 (65.29) | 106 (21.24) | <0.0001 |
| **LBBB** | 17 (14.05) | 36 (7.21) | 0.0158 |
| **BNP**  |  |  |  |
| BNP (pg/ml) | 374.1 (±765.00) | 449.90 (±583.30) | 0.630 |
| BNP > 100 pg/ml | 27 (24.32) | 17 (3.51) | <0.0001 |
| **Abbreviations:** BNP, B-type natriuretic peptide; bpm, beats per minute; LBBB, left bundle branch block; LVH, left ventricular hypertrophy; msec, milliseconds;pg/ml, picogram per milliliter; RBBB, right bundle branch block; RVH, right ventricular hypertrophy |
| \*All tests were chi-square for categorical variables and Student's t-tests for continuous variables at 0.05 significance level.  |

**Supplemental Table 3.** Proportion of completeness (missing) for study variables among cases and controls for the model derivation and validation cohorts

|  |  |  |
| --- | --- | --- |
| **Study variables\*** | **Model derivation cohort** | **Model validation cohort** |
| **Cases ( n = 485)** | **Controls ( n = 1,899)** | **Cases (n = 111)** | **Controls (n = 485)** |
| **N (%)** |
| **Race/ethnicity** | 77 (15.88)  | 343 (18.06)  | 21 (18.92) | 89 (18.35)  |
| **Hemoglobin concentration**  | 61 (12.58)  | 338 (17.8)  | 20 (18.02)  | 90 (18.56)  |
| **BNP concentration** | 283 (58.35)  | 1,783 (93.89)  | 70 (63.06)  | 452 (93.20)  |

 **Abbreviations:** BNP, B-type natriuretic peptide;

\*Only those with ages (20-60 years old) and had at least one Electrocardiogram (EKG) exam were included (see Figure 1 for more details).

**Supplemental Table 4.** Description of variables included in models

|  |  |
| --- | --- |
| **Model\*** | **Variables** |
| Non-biomarker Model (ACHD Model) | Age, sex, QRS duration, rhythm not sinus, right ventricular hypertrophy, left ventricular hypertrophy, right buddle branch block, and left buddle branch block |
| Simplified Model **A**  | Age, sex, QRS duration, QRS axis, rhythm not sinus, right ventricular hypertrophy, left ventricular hypertrophy, and right buddle branch block |
| Simplified Model **B**  | Age, sex, QRS duration, rhythm not sinus, right ventricular hypertrophy, left ventricular hypertrophy, right buddle branch block, and left buddle branch block |
| Simplified Model **C**  | Age, sex, QRS duration, QRS axis, rhythm not sinus, right ventricular hypertrophy, left ventricular hypertrophy, right buddle branch block, and BNP |
| Categorical Model  | Age (20-29, 30-39, 40-49, 50-60) sex (male, female), BNP (>100 pg/mL coded as present otherwise is absent), QRS duration (<80, 80-119, 120-149, ≥150), QRS axis (continuous); the following variables were coded as present or absent by EKG machine: rhythm not sinus, right ventricular hypertrophy, left ventricular hypertrophy, right buddle branch block, and left buddle branch block |
| Full Model | Age, sex, QRS duration, QRS axis, rhythm not sinus, right ventricular hypertrophy, left ventricular hypertrophy, right buddle branch block, left buddle branch block, and BNP |
| Abbreviations: BNP, B-type natriuretic peptide; EKG, electrocardiogram; pg/ml, picogram per milliliter\*Full-model contained variables found to be statistically significant during the multivariate logistic regression stage. The ACHD Model excludes BNP from the Full-Model. The Simplified Model A excludes left bundle branch block and BNP from the Full-Model. The Simplified Model B excludes QRS axis & BNP from the Full-Model. The Simplified Model C excludes left bundle branch block, QRS axis & BNP from the Full-Model. The Categorized model includes all variables in the Full-Model except that age and QRS duration are split into quartiles tertiles and quartiles, respectively.  |

**Supplemental Table 5.** Performance characteristics for adult moderate or complex congenital heart defect (ACHD) score for thresholds of 10-12

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Threshold score** | **Sensitivity (%)** | **Specificity (%)** | **PPV (%)** | **NPV (%)** |
| 10 | 96.4 | 80.0 | 52.5 | 99.0 |
| 11 | 93.7 | 90.7 | 69.8 | 98.4 |
| 12 | 88.3 | 93.6 | 76.0 | 97.2 |
| **Abbreviations:** NPV, negative predictive value; PPV, positive predictive value  |