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Play Smart Youth Heart Screening Program Reduces False-Positive Rates for Screening Electrocardiograms after Adoption of Refined Interpretation Criteria

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Background

- The Play Smart Youth Heart Screening program (Play Smart) is a free community-based electrocardiogram (ECG) screening program sponsored by the Providence Heart Institute in Portland, Oregon. The goal of Play Smart is to identify young people who may need further follow-up and treatment of newly diagnosed, asymptomatic heart disease.
- The majority of sudden cardiac arrests in young people are caused by cardiac conditions that may be diagnosed by a 12-lead ECG, including hypertrophic cardiomyopathy, Long QT Syndrome and Wolff-Parkinson-White Syndrome. While some individuals may have previously experienced symptoms such as chest pain, shortness of breath or syncope, many experience sudden cardiac arrest as their initial presenting symptom.
- Since its inception in 2012, Play Smart has screened over 35,000 children ages 12-18 years. Each participant completes a brief health questionnaire and receives a blood pressure measurement, an ECG and written information about sudden cardiac arrest and heart disease prevention. If the screening ECG is abnormal, participants are encouraged to either seek medical attention for a confirmed diagnosis (Wolff-Parkinson-White Syndrome, Long QT Syndrome) or schedule a free screening echocardiogram for evaluation of possible structural heart disease (hypertrophic cardiomyopathy). If the follow-up echocardiogram is interpreted as normal, the abnormal ECG is considered to be a false-positive ECG.

Hypothesis / Objective

Objective:

- The purpose of this study was to evaluate whether Play Smart's false-positive rates changed following adoption of updated ECG interpretation criteria.
- Play Smart initially utilized guidelines published by the European Society of Cardiology (2010) [1]. In subsequent years, Play Smart revised its ECG interpretation criteria in accordance with new guidelines including the Seattle Criteria (2013) [2], the Modified Seattle Criteria (2014) [3], and the International Consensus on Electrocardiographic Interpretation (2017) [4].

Hypothesis:
Play Smart's false positive rates have declined consistently in correlation with adoption of more specific interpretation criteria.

Methods

- A false-positive was defined as an abnormal ECG followed by a normal echocardiogram. The false positive rate was calculated per year from 2014 to 2019.
- Of those with a positive screening ECG, there were 52 with a diagnosis of Wolff-Parkinson-White syndrome, and 32 with a diagnosis of Long QT syndrome. These 84 individuals were excluded from the false-positive analysis, as these diagnoses do not trigger a follow-up echocardiogram.

Results

- From January 2014 to April 2019, Play Smart screened 31,923 children. The demographic characteristics of those screened are summarized in Table 1.
- Among participants who had a follow-up echocardiogram, the false-positive rate decreased over time, beginning with 3.5% in 2014, followed by 1.22% in 2015, 0.85% in 2016, 0.36% in 2017, 0.44% in 2018, and 0.32% in 2019 (Figure 1,Table 2).

Table 1: Demographic Information

	Number	Percent
Age (years)		
<=12	2,065	6.47
13	2,196	6.88
14	7,225	22.63
15	8,333	26.1
16	5,222	16.36
17	4,209	13.18
>=18	2,673	8.37
Gender		
Female	15,490	48.52
Male	16,433	51.48
Race and Ethnicity		
African-American/Black	806	2.52
Asian/Pacific Islander	2,003	6.27
Caucasian/White	21,229	66.50
Hispanic/Latino	3,384	10.60
Native American	156	0.49
Other	3,987	12.49
Unknown	358	1.12

Results (Continued)

Figure 1: False-positive Rates by Year

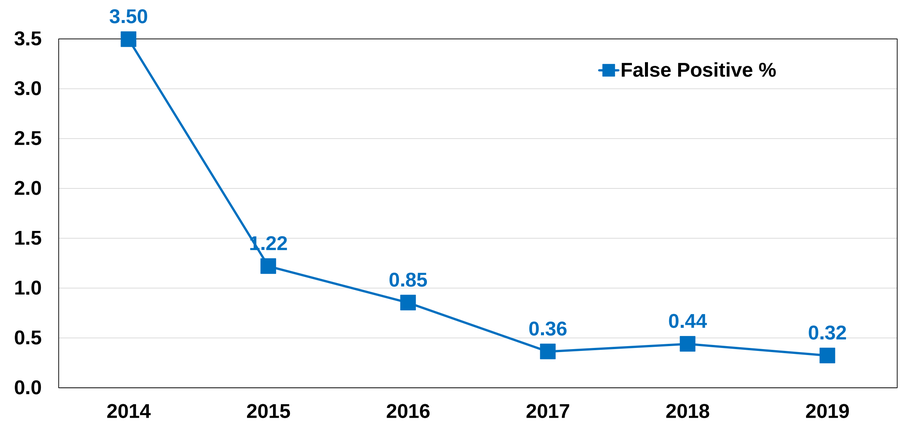

Table 2: Play Smart Screening Results

Year	Number Screened	Abnormal ECG, Normal Echo	False Positive %	Abnormal Echo	Long QT	Wolff Syndrome	Total Positive	True Positive %
2014	2,975	104	3.50	9	12	2	23	0.77
2015	2,951	36	1.22	1	3	7	11	0.37
2016	4,099	35	0.85	3	1	8	12	0.29
2017	8,802	32	0.36	1	4	16	21	0.24
2018	9,081	40	0.44	3	8	13	24	0.26
2019	4,015	13	0.32	0	4	6	10	0.25
Total	31,923	260	0.81	17	32	52	101	0.32

Conclusions

- In a large, community-based youth electrocardiogram screening program, false-positive rates decreased consistently over a six-year period.
- We attribute the decline in false-positive rates to adoption of more refined interpretation criteria over time.

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