Duke University School of Medicine

Scientific Sessions

CORE LAB VERSUS COMPUTER: PEDIATRIC ECHOCARDIOGRAM MEASUREMENT AGREEMENT BETWEEN EXPERT HUMAN AND AI READERS

Lindsay Edwards, MD | Duke University School of Medicine

American Heart Association.

#AHA25

DISCLOSURES

I have no actual or potential conflict of interest in relation to this presentation.

Grant/Research Support: NIH K12AR084231 and R21CA277746, the Rally Foundation, and the Unravel Pediatric Cancer Foundation.

I will be discussing “off-label” pediatric use of Us2.ai’s AI-based fully automated echocardiographic measurement tool.

Us2.ai provided complimentary access to software and hardware for the analysis.

BACKGROUND

Deep learning algorithm-based software promise to improve efficiency and accuracy of medical image interpretation.

Several AI-based software are FDA approved for automated echo interpretation.

Validated in adults, for adults.

What about the kids?

Multicenter dataset of children undergoing routine echo surveillance during and after cancer therapy.

Computed variance components for subject, echo, and reader using linear mixed models.

Calculated the intraclass correlation coefficient (ICC) with 95% confidence intervals based on the 2.5 and 97.5 percentiles of the distribution of 1000 parametric bootstraps.

EXTANT CORE LAB-MEASURED DATASET

153 childhood cancer survivors without congenital heart disease	
Age at cancer diagnosis, y, median (Q1,Q3)	7.0 (3.0,11.0)
Female, n (%)	63 (41.2%)
White non-Hispanic, n (%)	66 (43.1)
Anthracycline exposure, n (%)	152 (99.3%)
Heart radiotherapy, n (%)	62 (40.5%)
Age at last follow-up, y, median (Q1,Q3)	17.0 (13.0,19.0)
Cardiomyopathy, n (%)	47 (30.7%)
Cardiomyopathy treatment, n (%)	25 (53.2%)

652 echocardiograms	
# echos per survivor, median (Q1,Q3)	4 (3,5)
Time between echos, y, median (Q1,Q3)	1.3 (0.9,2.2)
Year of echo Range Median (Q1,Q3)	 2004 – 2020 2012 (2009, 2014)
Age at echo, y, median (Q1,Q3)	13.0 (9.0,16.0)
Weight at echo, kg, median (Q1,Q3)	48.2 (30.9,61.9)
Height at echo, cm, median (Q1,Q3)	154.5 (134.1,168.9)
BSA (Hancock), m^2, median (Q1,Q3)	1.4 (1.1,1.7)
LV shortening fraction ≤28% or ejection fraction ≤50%, n (%)	105 (16%)

17 PARAMETERS OF LV SIZE AND FUNCTION

LV septal thickness diastole (mm), 2D

LV end-diastolic dimension (mm), 2D

LV posterior wall thickness diastole (mm), 2D

LV end-systolic dimension (mm), 2D

LV mass (g), 2D

Biplane LV ejection fraction (%)

Apical 4-chamber global longitudinal strain (%)

Mitral E (m/s)

Mitral A (m/s)

Mitral E/A

Mitral S' (m/s)

Mitral E' (m/s)

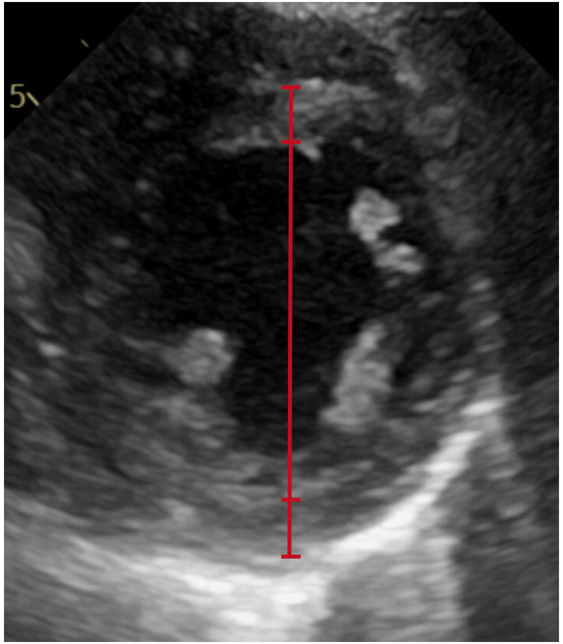
Mitral A' (m/s)

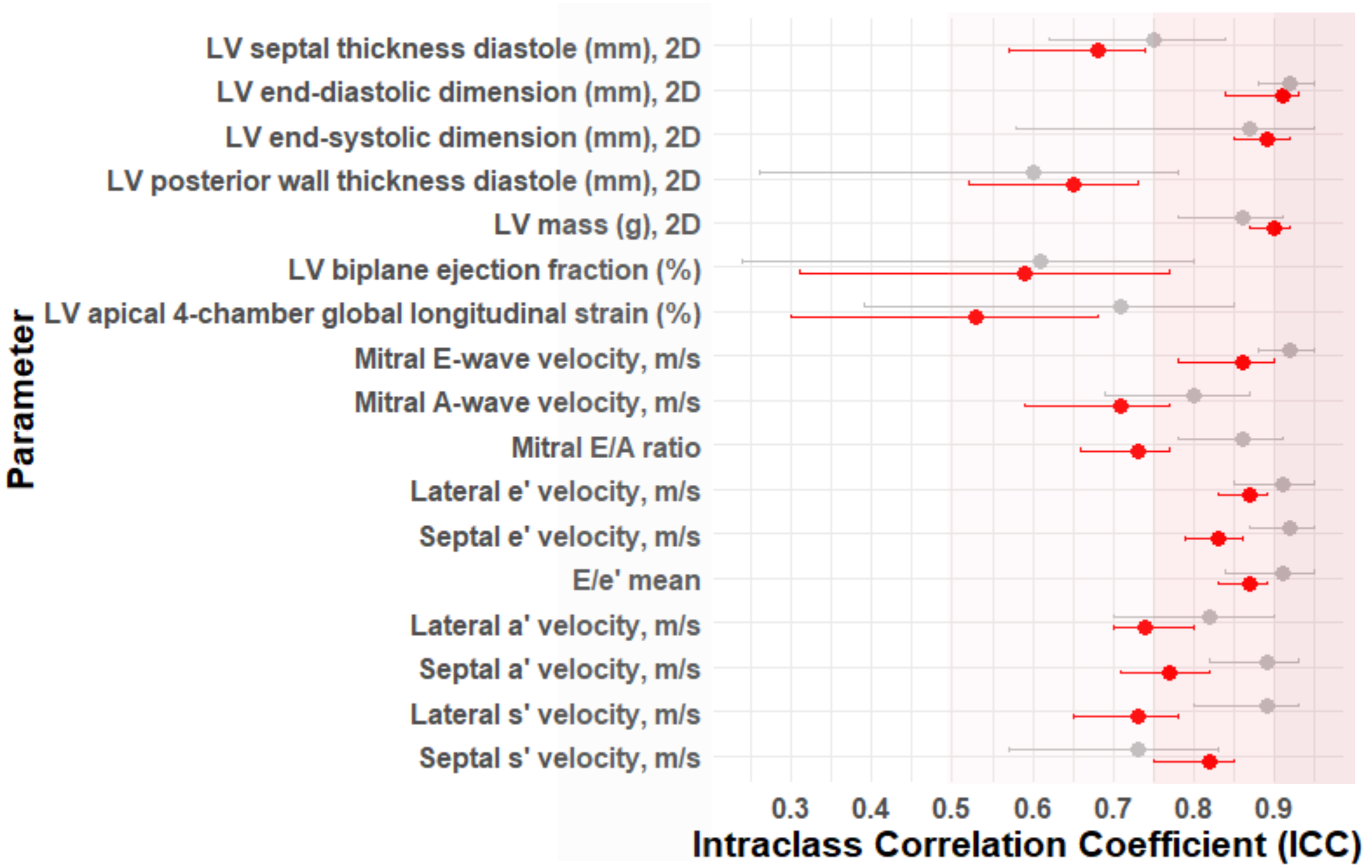
Septal S' (m/s)

Sepal E' (m/s)

Septal A' (m/s)

E/e' mean



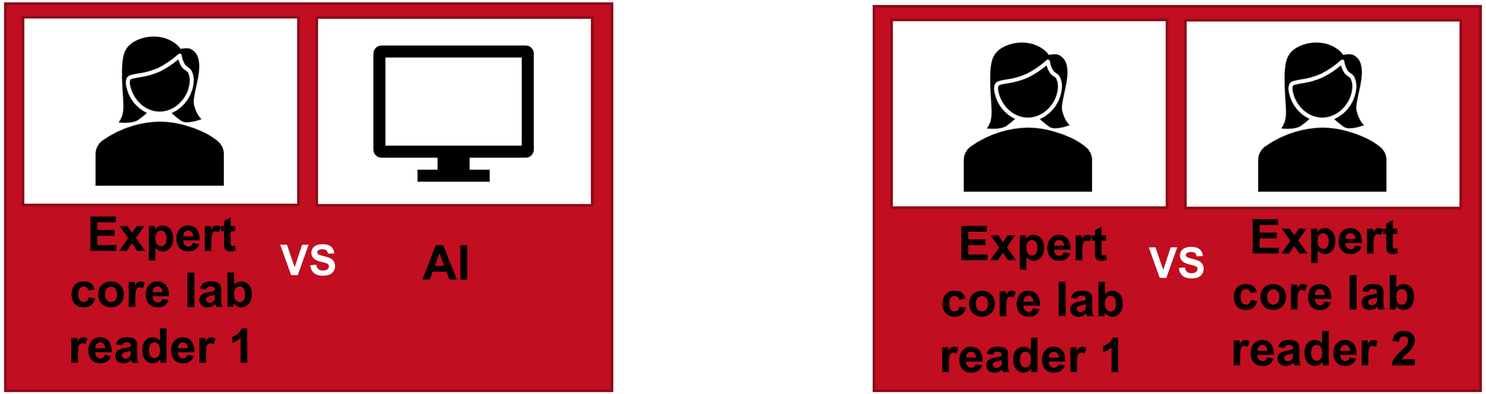


ICC	Agreement
0.9 – 1.0	Excellent
0.75 – 0.89	Good
0.5 – 0.74	Moderate
< 0.5	Poor

Core lab versus computer

Parameter	Reader 1 vs AI ICC	Reader 1 vs Reader 2 ICC	Interpretation of AI reliability versus expert humans
LV size			
Dimensions	0.89 – 0.91	0.87 – 0.92	Similar good to excellent agreement
Wall thicknesses	0.65 – 0.68	0.60 – 0.75	Similar moderate agreement
Mass	0.90	0.86	Similar good to excellent agreement
LV function			
Biplane EF	0.59	0.61	Similar moderate agreement
Apical 4-chamber GLS	0.53	0.71	Worse but still moderate agreement
Mitral inflow	0.71 – 0.86	0.80 – 0.92	Moderate to good versus good to excellent agreement
Tissue Doppler imaging	0.70 – 0.87	0.73 – 0.92	Moderate to good versus moderate to excellent

Core lab versus computer:
Pediatric echocardiogram measurement agreement between expert human and AI readers



Independent validation of an automated echocardiographic measurement software in a pediatric dataset demonstrated at least moderate agreement of all measurements with gold-standard core lab measurements.

THANK YOU

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