Composite deep learning ECG algorithm trained to identify structural heart disease can identify clinically ascertained hypertrophic cardiomyopathy

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Disclosures

Geisinger receives funding from Tempus for ongoing development of predictive modeling technology and commercialization.

None of the Geisinger authors have ownership interest in any of the intellectual property resulting from the partnership.

Greg, Martin, Arun, David, Brandon, Ruijun and John are Tempus employees.
Hypertrophic Cardiomyopathy (HCM) is **actionable and underdiagnosed**.

Massive hypertrophy of the myocardium in a patient with HCM\(^1\)

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Hypertrophic Cardiomyopathy (HCM) is **actionable** and **underdiagnosed**

1 out of 6 patients remain undiagnosed!

Two strategies to address the HCM diagnostic gap

#1 Single Model
- AUROC: 90%
- Sensitivity: 90%
- PPV: 40% @ 5% prevalence

#2 Composite Model
Triaged diseases based on common diagnostic endpoint enables PPV boost
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rECHOmmend: an ensemble to assess risk of incident structural heart disease

- **Disease Targets:**
  - Ejection Fraction < 40%
  - Interventricular Septal Thickness > 15mm
  - Aortic Stenosis, Regurgitation
  - Mitral Stenosis, Regurgitation
  - Tricuspid Regurgitation

- **Shared Actionability:**
  Triaged disease targets share downstream diagnostic enabling “composite modeling”

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- **Shared Actionability:**
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- **AUROC:** 0.90
- **PPV:** 0.77; **Sensitivity:** 0.50 @ prevalence 18%

Hypothesis: Despite being trained without HCM-specific labels, rECHOnnend can reliably identify HCM patients

- Septal thickening and mitral regurgitation are often observed in HCM patients\(^1,2\)

- 73\% of patients in the HCM cohort have a “rECHOnnendable” features

- IVSd>15mm, mitral regurgitation and ejection fraction < 40\% are commonly observed in our HCM population

We retrospectively evaluated rECHOmmend’s ability to find incident HCM by testing it against an HCM-specific CNN on a heldout set of ECGs.
Despite being trained **without HCM labels**, rECH0mmend achieves comparable **AUROC** and higher sensitivity to an HCM classifier.

*Sensitivity was calculated on an operating point optimized for an algorithm-specific F1-score.*
**Conclusion & Future Directions**

**rECHOmmend**, a composite deep learning algorithm trained to identify structural heart diseases can identify clinically ascertained HCM with good performance, despite being trained without HCM-specific labels.

- We plan to evaluate rECHOmmend on other disease endpoints (amyloid, congenital heart disease) to better understand generalizability.

- We built rECHOmmend under design controls as an investigational medical device and are studying via our ECG-AID study (NCT05442203).
Thank you!

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  Alvaro Ulloa Cerna, Dustin Hartzel, Dan Rocha, Chris Haggerty

- **Tempus Cardiology Team:**
  Martin Kang, Arun Nemani, Brandon Fornwalt, RuiJun Chen, John Pfeifer, David Vidmar

We’d love to chat and showcase our platform @ booth #2606!