

# Optimizing access to cardiac investigations. How centralized triage and artificial intelligence can reduce costs to the system and increase safety for patients.

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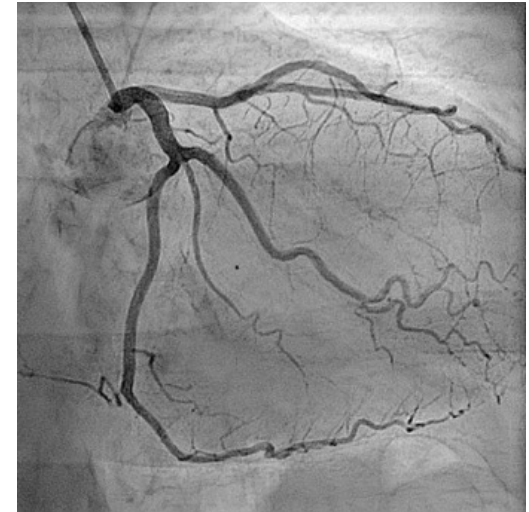
Scientist, Population Health Research Institute

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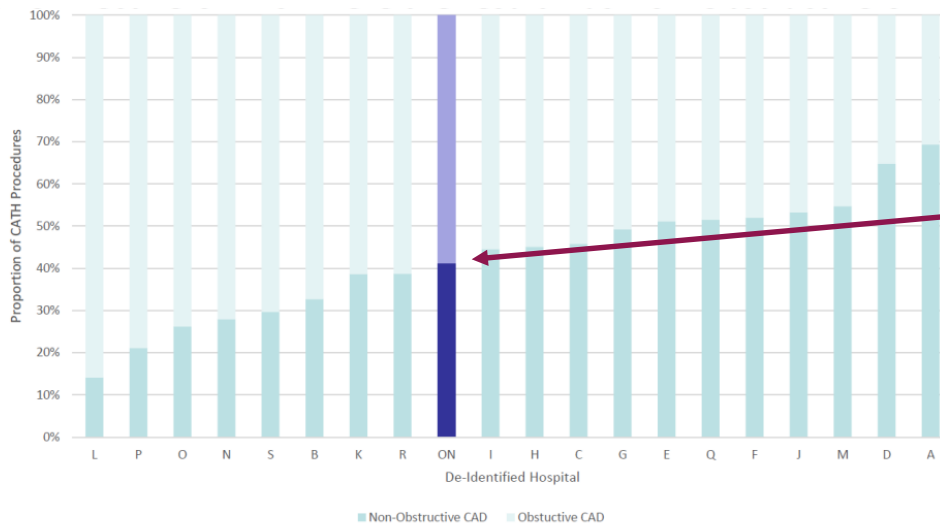
# Diagnosis of Coronary Artery Disease



- Invasive Coronary Angiography (ICA) has long been the gold standard to diagnose Coronary Artery Disease (CAD) and is essential to facilitate life-saving revascularization when applied to the right patient.
- However, when applied to a suboptimal population, it increases **costs** to the system and carries potential **risks** to patients.



# Not a small problem



- >40% of Invasive Coronary Angiograms in elective patients do not have significant CAD
- This approaches **60-70%** in low-to-mod risk patients

Data are from the CCN Cardiac Registry; Non-Obstructive CAD includes 'Normal Coronary Anatomy' and Non-Significant CAD

## In search of an optimal balance

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- Cardiac CT Angiography (CCTA) is an evidence-based alternative to ICA for the diagnosis of obstructive disease in select populations that is **less expensive** and **lower risk**
- However, a CCTA first strategy is not ideal for every patient and can introduce the problem of double-testing, where patients with obstructive disease may also proceed to ICA
- Ideally, we would have a model of care that can optimize patient selection for CCTA vs. ICA

# A priority for Ontario



Office of the Auditor General of Ontario

2021



- Coronary Computed Tomographic Angiography (CCTA) is a non-invasive test that is highly sensitive and specific for the detection of CAD in **select** populations
  - (NEJM 2022).

## RESPONSE FROM CORHEALTH ONTARIO

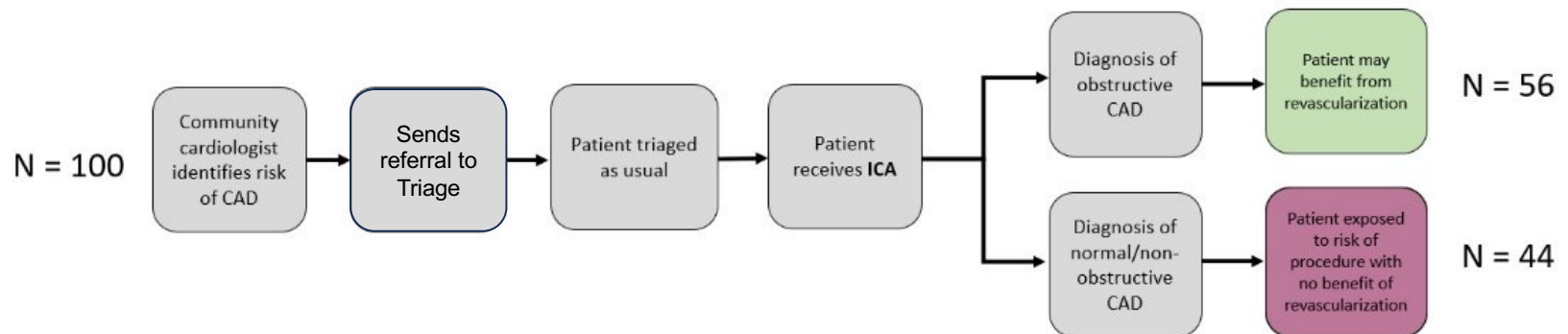
CorHealth agrees with this recommendation and continues to work with the Ministry of Health and other system partners to ensure a co-ordinated approach to provincial adoptions, planning and funding of new technologies. The clinical evidence continues to evolve as to which patients are best suited to undergo coronary computed tomography angiography (CCTA) diagnostics versus diagnosis using coronary angiography. CorHealth is currently working with a clinical team at Hamilton Health Sciences on a project that will focus on gaining an understanding of the current wait-times and utilization of CCTA for the detection of coronary artery disease in Ontario. In addition, a review of outcomes from the Hamilton Niagara Haldimand Brant LHIN's CarDIA Study (CCTA to Optimize the Diagnostic Yield of Invasive Angiography in Lower Risk Patients) will be conducted to determine whether this could inform a provincial best-evidence diagnostic pathway using CCTA for low-risk coronary artery disease patients.

# Why Add Artificial Intelligence to the mix?

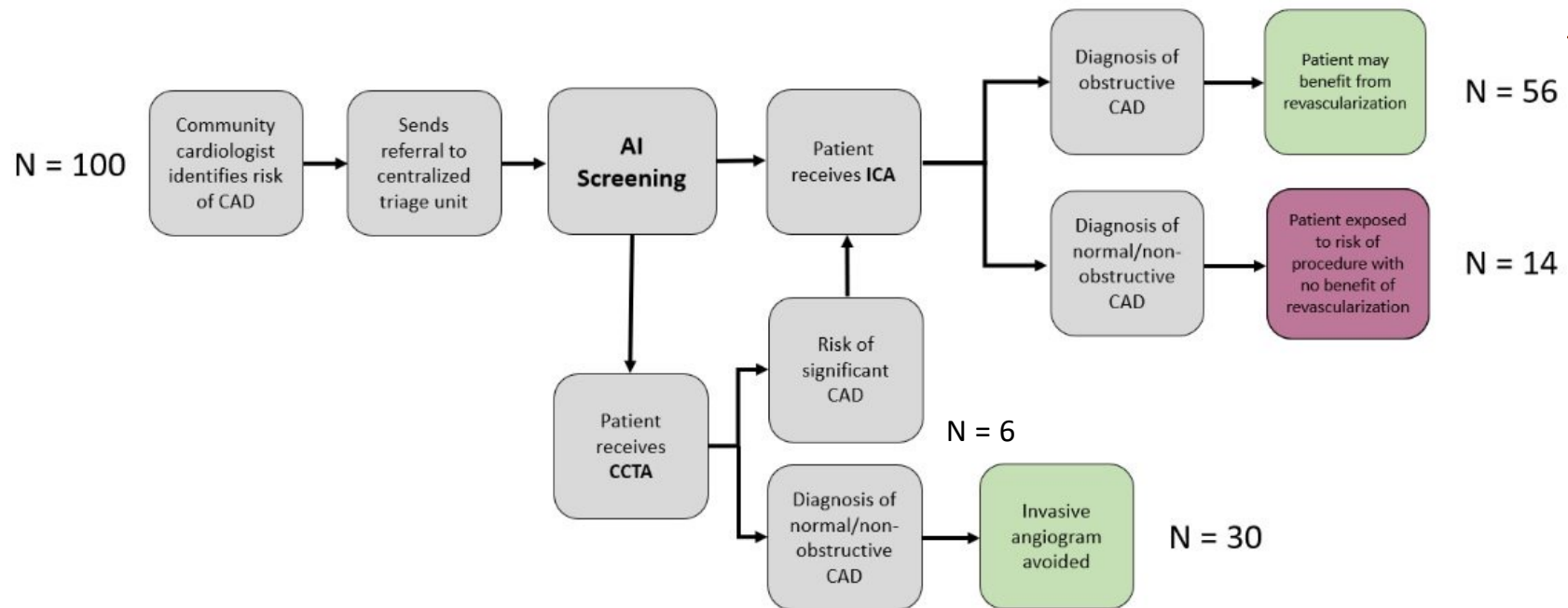
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- Our triage pathway required expert review of every referral. This was not sustainable
- Our crude algorithm to select patients used only a handful of variables to select their diagnostic test and resulted in noticeable gender inequalities
- Large provincial datasets with over 40 variables were at our disposal to enable Machine Learning model development and validation
- Opportunities to collaborate with Jeremy Petch and the CREATE group at Hamilton Health Sciences/McMaster University

# Usual care pathway for CAD diagnosis

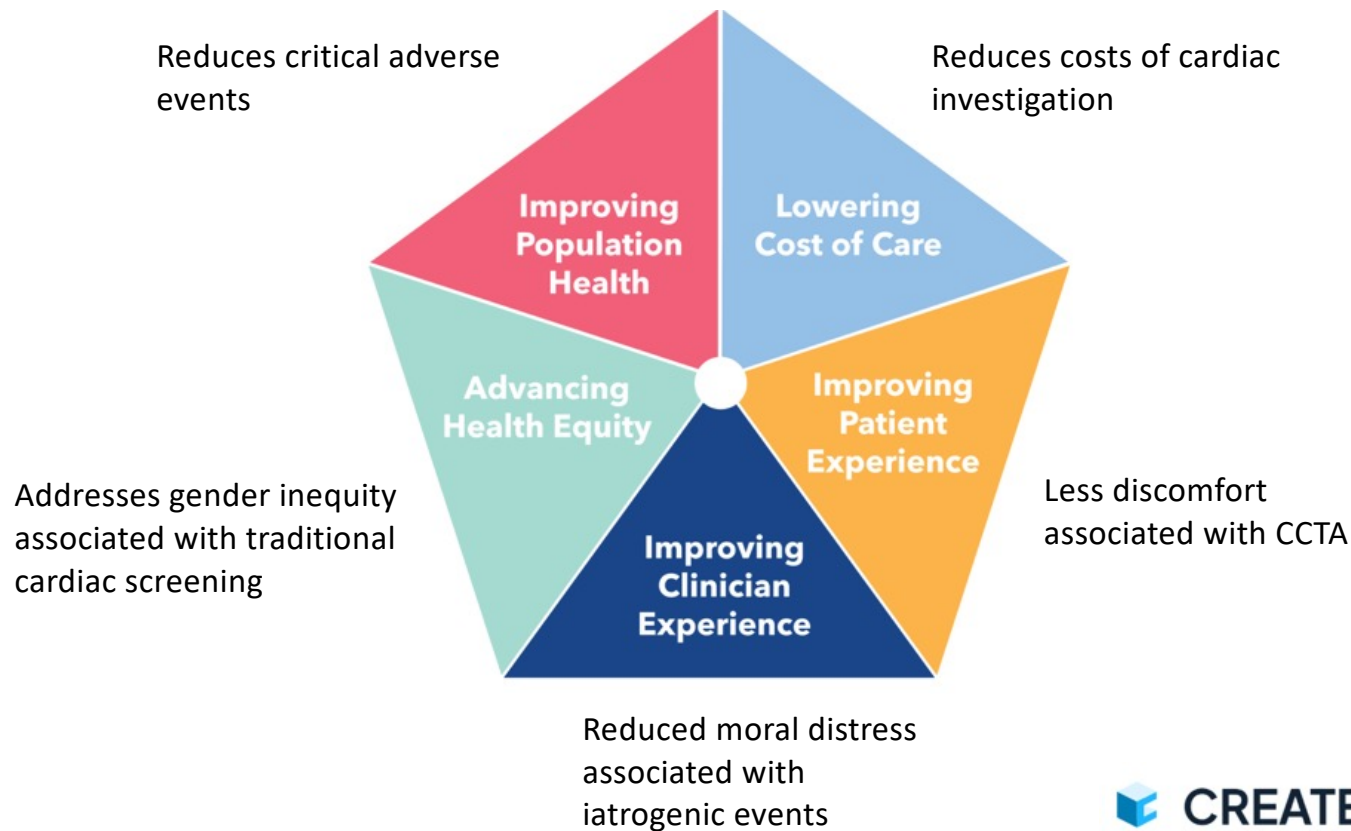


# AI-enabled diagnostic pathway for CAD





# Value of AI and Centralized Triage for optimizing cardiac investigation



# Program Evaluation:

CJC Open 5 (2023) 148–157

## Original Article

### Centralized Triage of Suspected Coronary Artery Disease Using Coronary Computed Tomographic Angiography to Optimize the Diagnostic Yield of Invasive Angiography

J.-D. Schwalm, MD, MSc,<sup>a,b,c,d</sup> Zachary Bouck, MPH,<sup>e</sup> Madhu K. Natarajan, MD, MSc,<sup>a,b,c,d</sup> Natalia Pinilla, MD,<sup>a,b,c,d</sup> Danielle Walker, MD,<sup>c,f</sup> Nida Syed, MD,<sup>c,f</sup> David Landry, MD,<sup>c,f</sup> Ali Sabri, MD,<sup>g</sup> Vikas Tandon, MD,<sup>b,c</sup> James Nkurunziza, MD,<sup>b,c</sup> Monica Taljaard, PhD,<sup>h,i</sup> and Tej Sheth, MD<sup>a,b,c,d</sup>



#### Research Letter

Using Artificial Intelligence to Optimize the Use of Cardiac Investigations in Patients With Suspected Coronary Artery Disease

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Original Article

### A machine learning–based clinical decision support algorithm for reducing unnecessary coronary angiograms

J.D. Schwalm MD, MSc,<sup>\* †</sup>  , Shuang Di MEd, MSc,<sup>† §</sup>, Tej Sheth MD,<sup>\* †</sup>, Madhu K. Natarajan MD,<sup>\* †</sup>, Erin O'Brien BA,<sup>\*</sup> Tara McCreedy PhD,<sup>\*</sup> Jeremy Petch PhD,<sup>\* † ‡ ¶</sup>

- External provincial Validation is near complete
- Two Silent trial (second is being completed)
- A multicentre Randomized Controlled Trial to start Fall 2024