

# Increased Detection of Acute Myocardial Infarction in Women Using Sex-Specific Upper Reference Limits in Clinical Pathways for Patients Presenting with Suspected Acute Coronary Syndrome

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Sex differences are common across multiple aspects of cardiovascular care including diagnosis, treatment, and outcomes.<sup>1-3</sup> Large multi-centered randomized clinical trials have shown that women are under-recognized for acute myocardial infarction (AMI) and consistently have higher fatality rates compared to men, even following adjustments for age and comorbid conditions.<sup>1</sup> Women tend to have atypical symptoms when presenting to Accident and Emergency (A&E) and as such, tend not to be recognized for experiencing AMI without male-patterned chest pain symptoms.<sup>2</sup> Thus, significant efforts across stakeholders have culminated in a greater awareness with improved measures to recognize and manage AMI and coronary artery disease (CAD) in women. Included in these measures are guideline recommendations for the implementation of sex-specific upper reference limits into clinical pathways for patients that present to A&E with suspected acute coronary syndrome.<sup>4-5</sup> This is based on the fact that women tend to have smaller hearts with lower left ventricular mass compared to men, and consequently, have less circulating levels of cardiac troponin in the blood stream. Research suggests the differences between sexes in the upper reference limits (URLs) of seemingly healthy individuals can be as high as 50%.<sup>6</sup> Recognizing that poorer outcomes for women vs. men post-intervention may result from delayed diagnosis of women, and with full appreciation that some men may be more aggressively treated based on use of lower upper reference limits that lack sex discrimination, the Biochemistry & Immunology Department at Kokilaben Dhirubhai Ambani Hospital & Medical Research Institute (KDAH) team sought to investigate the opportunity to move from an overall URL to sex-specific URLs consistent with guideline-based care. This integrated clinical care team simultaneously sought to improve workflow efficiencies, leading to improvements across the care continuum. Site-wide education was crucial for physicians and patients to ensure earlier recognition of disease risk while maximizing treatment pathways for optimized patient care.



PATIENT



CLINICIAN



HOSPITAL  
ADMINISTRATION



PAYOR

## KEY PARTNERS / STAKEHOLDERS



**Barnali Das**  
MD, DNB, PGDHHM

Consultant, Laboratory Medicine  
Chair, AACC India Section &  
Executive Committee, IFCC  
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**Deane Maria Dmello**  
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**Sanjay Sm Mehta**  
MD

Director, Accident &  
Emergency Department



**Jamshed Dalal**  
MD, DM, PhD

Director, Cardiac Sciences

# SITUATION ANALYSIS

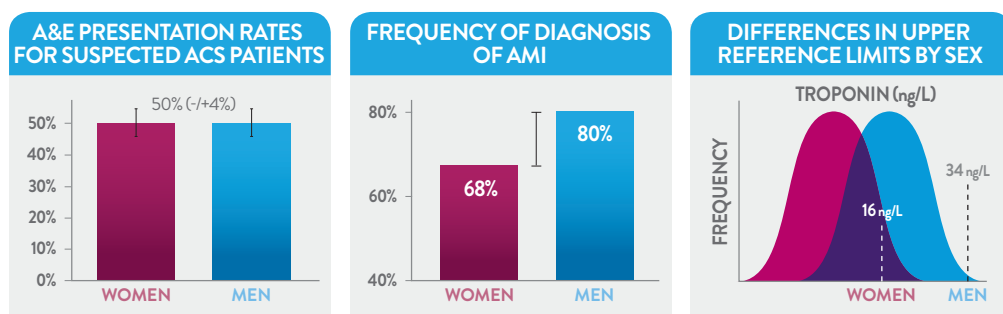
- Acute myocardial infarction (AMI) is a leading cause of death world wide<sup>7-9</sup>
- Early and accurate diagnosis of acute myocardial infarction is essential for successful treatment and improved outcomes<sup>10-12</sup>
- Women have been classically underdiagnosed and undertreated for AMI<sup>1-3</sup>

## INCREASED DETECTION OF ACUTE MYOCARDIAL INFARCTION IN WOMEN USING SEX-SPECIFIC UPPER REFERENCE LIMITS IN CLINICAL PATHWAYS FOR PATIENTS PRESENTING WITH SUSPECTED ACUTE CORONARY SYNDROME

### DISCOVERY

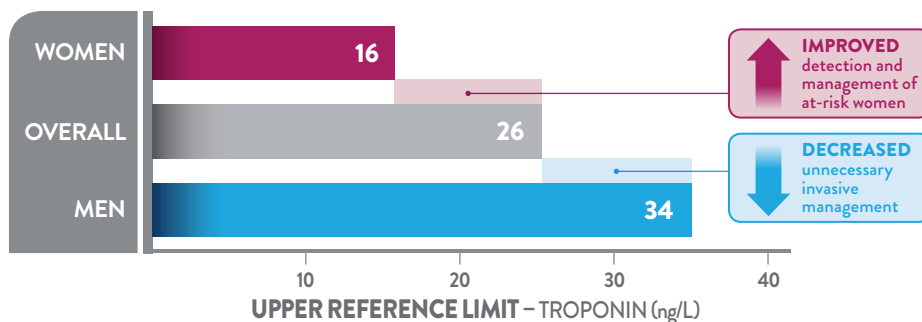
Data from the Accident and Emergency Department (A&E) of Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute indicate that men and women with suspected Acute Coronary Syndrome (ACS) present at comparable rates (50% (-/+4%)). Nevertheless, women are less likely to be diagnosed with AMI. This potential for under diagnosis may be explained by sex differences in the URL of seemingly healthy individuals, whereby women tend to have half the levels of circulating troponin compared to men.

The URL used in clinical care for troponin at Kokilaben Dhirubhai Ambani Hospital was 26 ng/L regardless of sex, whereas sex-specific URLs for this troponin method would be 16 ng/L for women and 34 ng/L for men based on manufacturing data.<sup>13</sup>



### HYPOTHESIS

Implementation of sex-specific upper reference limits with hs-cTn will help enable earlier and more sensitive detection of acute myocardial infarction in women.



### SPECIAL MENTION TO:

- Vipin Lal V, MBBS, DNB Student 2<sup>nd</sup> Year, Accident & Emergency
- Rashmi Patil, MSc, Technical Executive, Biochemistry Department
- Sameer Rathi, MBBS, D Ortho, MEM Consultant, Emergency Medicine
- All the Consultants of Cardiac Sciences
- Laboratory Medicine Team

### PARTNERS

Changes to clinical care pathways are complex and require input and alignment across disciplines. Cardiac pathways involve diverse stakeholders with varying needs and expectations for optimal delivery of care. This clinical care project involved cross-functional discussions among A&E physicians, cardiology, laboratory medicine, and administrators to optimize and implement a new pathway for patients with suspected ACS that addressed all stakeholder needs, while maximizing patient care.

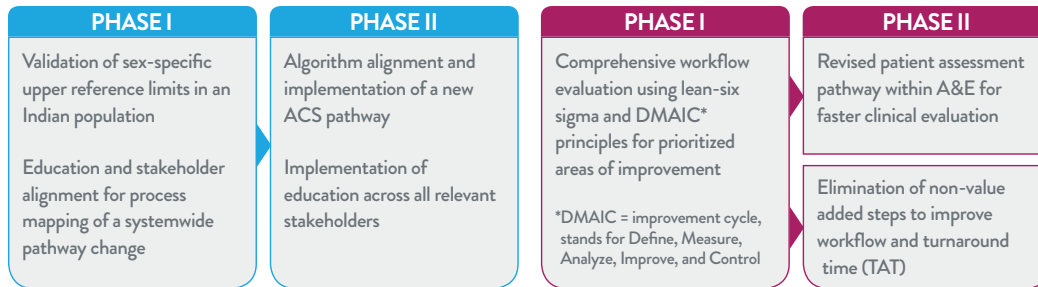


# INCREASED DETECTION OF ACUTE MYOCARDIAL INFARCTION IN WOMEN USING SEX-SPECIFIC UPPER REFERENCE LIMITS IN CLINICAL PATHWAYS FOR PATIENTS PRESENTING WITH SUSPECTED ACUTE CORONARY SYNDROME

## SUCCESS FACTORS

### EXECUTION

Implementation efforts involved multistep processes including strategic assessment and enactment of a new clinical pathway, as well as operational workflow changes.



- Cardiac troponin (cTn) is the preferred biomarker for the diagnosis of acute myocardial infarction<sup>5</sup>
- High-sensitivity cardiac troponin (hs-cTn) assays enable accurate detection of low levels of circulating troponin, including the ability to distinguish differences between men and women<sup>6</sup>
- Sex-specific upper reference limits based on the 99<sup>th</sup> percentile of seemingly healthy individuals is recommended for established cardiology and laboratory medicine guidelines for the diagnosis of AMI<sup>4-5</sup>
- Education across disciplines is crucial for systemwide implementation of new clinical pathways

#### THE CORE LAB TEAM AT KDAH PLAYED A CRUCIAL ROLE IN TEAM SUCCESS



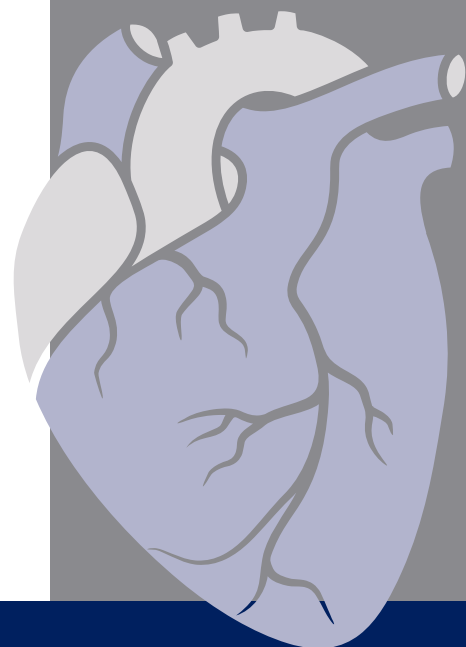
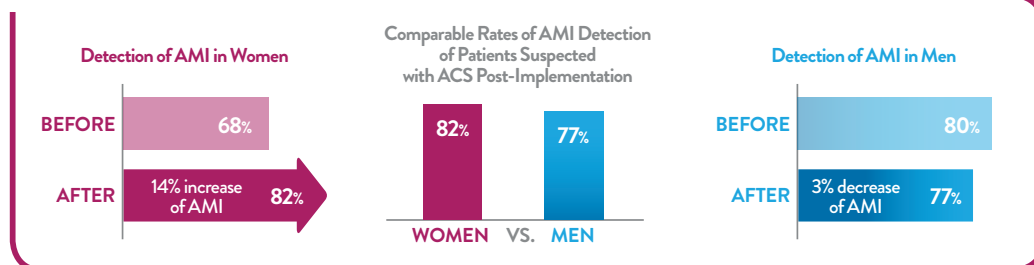
From Left to Right: Mr. Sufiyan Tamboli, Ms. Vishakha Tawde, Ms. Vrushi More, Ms. Reshma Morajkar, Ms. Poonima Shetty, Ms. Alisha Tauro, Dr. Barnali Das, Ms. Deane Maria Dmello, Ms. Rashmi Patil, Mr. Prashant Korpe, Ms. Poonam Mandavkar Pal, Mr. Sayyadain Raza Khan.

### PROOF OF VALUE

#### WITHIN LABORATORY METRICS



#### OUT OF LABORATORY METRICS



# SPOTLIGHT ON STAKEHOLDER SUCCESS



## PATIENT

### INCREASED PATIENT WELLNESS

“Earlier detection of women for acute myocardial infarction enables faster treatment, increasing the likelihood of better outcomes.”  
– Dr. Barnali Das, Consultant, Laboratory Medicine

Reduced the potential of unnecessary invasive procedures for men by 2.9%.

### EARLIER DIAGNOSIS

Implementation of sex-specific upper reference limits identified an additional 14% of at risk women with potential acute myocardial infarction.

### INCREASED PATIENT EXPERIENCE

“Any time we are able to offer personalized care to our patients they feel cared for and are more likely to be compliant in treatment. Reference intervals by sex enables personalized care.”

– Dr. Sanjay Sm Mehta, Director, Accident & Emergency Department



## CLINICIAN

### INCREASED CONFIDENCE

“Troponin is a significant tool in diagnosing AMI. With sex-specific criteria, I am even more confident that I am making the right decisions for my patients.”

– Dr. Jamshed Dalal, Director, Cardiology Sciences

### INCREASED SATISFACTION

“The workflow improvements and the personalized approach that we offer in A&E enables me to better care for my patients.”

– Sameer Rathi, Consultant, Emergency Medicine



## HOSPITAL ADMINISTRATION

### ENHANCED REPUTATION

Media recognition in two leading local newspapers recognized this site’s leadership in implementing a novel clinical pathway for patients with suspected acute coronary syndrome.



## PAYOR

### RISK MITIGATION

“Risk mitigation with earlier and accurate diagnosis and treatment enables improved outcomes and reduces risk of long-term complications.”

– Santosh S. Shetty, Executive Director & Chief Operating Officer

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