



# GUARD YOUR HEART



- **EPIDEMIOLOGY**
- **PATHOPHYSIOLOGY**
- **SYMPTOMS AND RISK FACTORS**

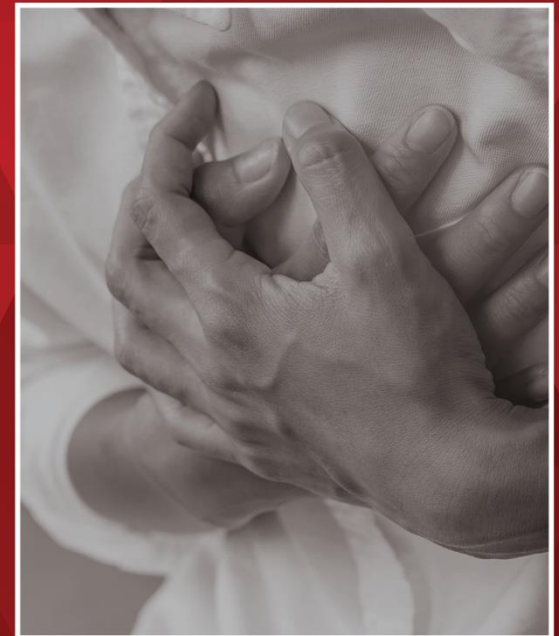




**EPIDEMIOLOGY**



**PATHOPHYSIOLOGY**



**SYMPTOMS**



# EPIDEMIOLOGY ISCHAEMIC HEART DISEASE GLOBALLY

## ACCORDING TO THE LATEST ESTIMATES FROM THE WORLD HEALTH ORGANIZATION

- Ischaemic heart disease (IHD) is the **LEADING CAUSE OF DEATH** globally
- High burden of disease in **HIGH INCOME COUNTRIES** - **17%** of all deaths
- An increase in mortality in **LOW AND MIDDLE INCOME COUNTRIES** between 6% - 20% of deaths in 2016
- Negative implications for **HEALTHCARE ECONOMICS** and **RESOURCES**

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1. Disease burden and mortality estimates [Internet]. World Health Organization. 2019 [cited 8 January 2019]. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/](https://www.who.int/healthinfo/global_burden_disease/estimates/en/)

2. Projections of mortality and causes of death, <br>2016 to 2060 [Internet]. World Health Organization. 2019 [cited 8 January 2019]. Available from: [http://www.who.int/healthinfo/global\\_burden\\_disease/projections/en/](http://www.who.int/healthinfo/global_burden_disease/projections/en/).



# EPIDEMIOLOGY

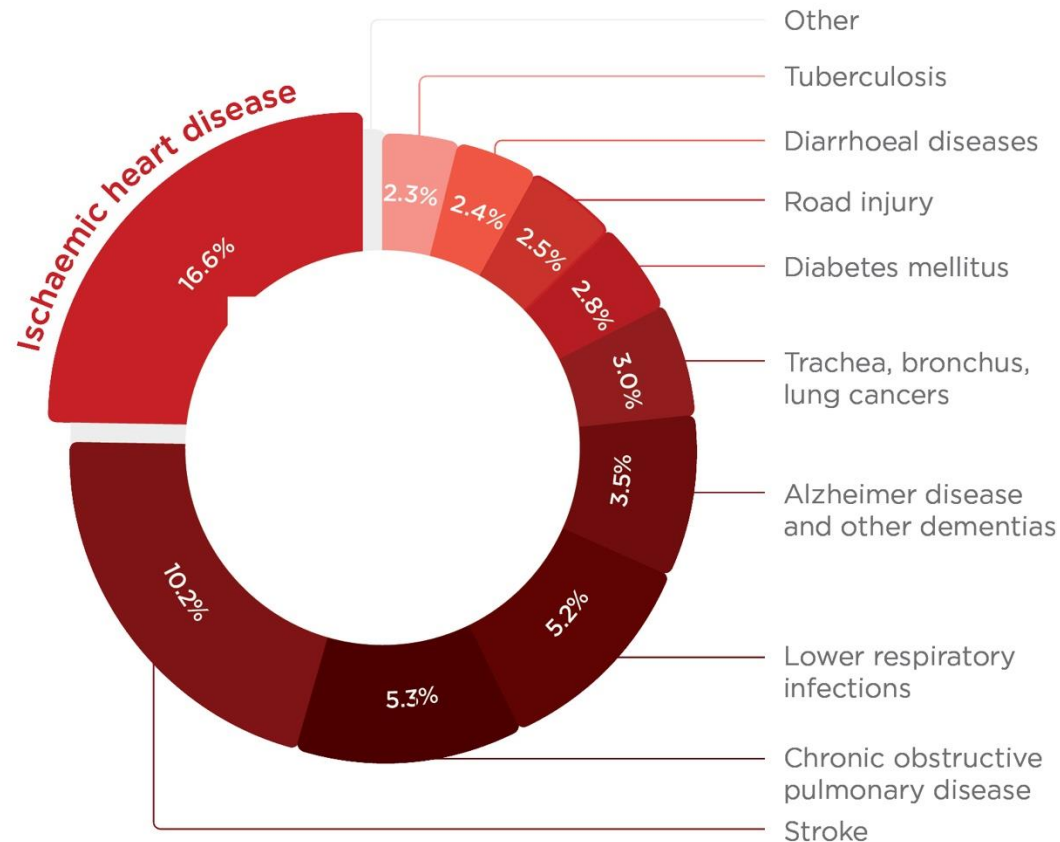
## ISCHAEMIC HEART DISEASE GLOBALLY

- **AMI** is a leading cause of death worldwide<sup>1</sup>
- Approximately **46%** of all deaths from cardiovascular disease are due to **ISCHAEMIC HEART DISEASE**, including myocardial infarctions<sup>2</sup>
- Men have a **HIGHER PREVALENCE OF AMI** than women<sup>3</sup>
- Incidence of AMI increases with advancing age for both genders<sup>3</sup>
- **AFRICAN AMERICANS** have a higher incidence of AMI<sup>3</sup>
- Incidence is increasing in **DEVELOPING AND TRANSITIONAL COUNTRIES**, partly due to increasing longevity, urbanisation and lifestyle changes<sup>2</sup>

1. Thygesen K, Alpert JS, White HD. Universal definition of myocardial infarction. Journal of the American College of Cardiology. 2007 Nov 27;50(22):2173-95.  
2. Mendis S, Puska P, Norrving B, World Health Organization. Global atlas on cardiovascular disease prevention and control. Geneva: World Health Organization; 2011.  
3. Writing Group Members, Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, Borden WB, Bravata DM, Dai S, Ford ES, Fox CS. Executive summary: heart disease and stroke statistics—2012 update: a report from the American Heart Association. Circulation. 2012 Jan 3;125(1):188-97.



**ISCHAEMIC  
HEART DISEASE  
IS THE LEADING  
CAUSE OF DEATH,  
ACCOUNTING  
FOR 9 MILLION  
DEATHS IN 2016.**

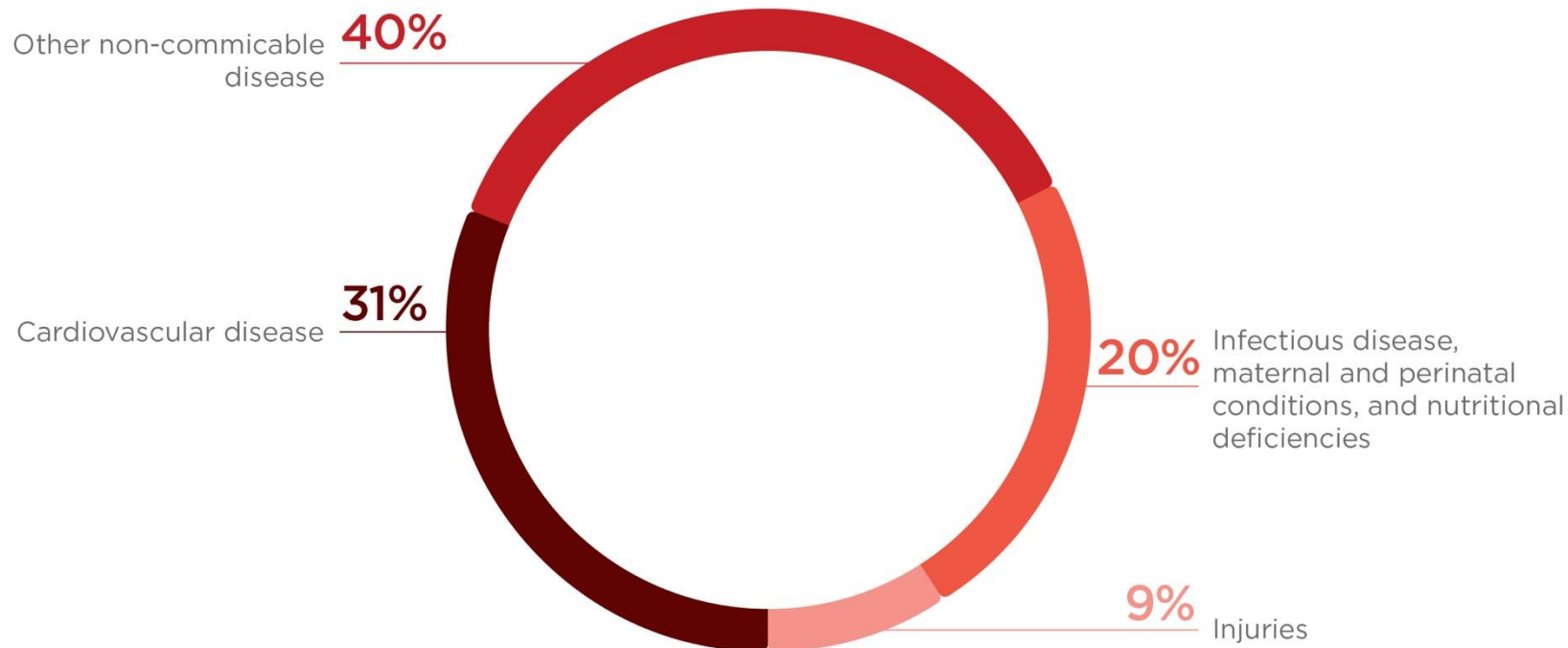


Disease burden and mortality estimates [Internet]. World Health Organization. 2019 [cited 8 January 2019]. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/](https://www.who.int/healthinfo/global_burden_disease/estimates/en/)



## EPIDEMIOLOGY

# CVD IS A MAJOR CAUSE OF DEATH GLOBALLY



CVD, cardiovascular disease

Disease burden and mortality estimates [Internet]. World Health Organization. 2019 [cited 8 January 2019]. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/](https://www.who.int/healthinfo/global_burden_disease/estimates/en/)



## EPIDEMIOLOGY

# ACS MORTALITY AROUND THE WORLD

### HIGH-INCOME COUNTRIES

- UK ▶ In-hospital mortality has fallen from 20% to 5% in the last 30 years
- USA ▶ In-hospital mortality: 5-6%<sup>2</sup>  
▶ 1-year mortality: 7-18%<sup>2</sup>

### LOW AND MIDDLE – INCOME COUNTRIES

- India ▶ @ 30 days: 2.1 - 6.7% (DEMAT & CREATE registries)<sup>3</sup>
- China ▶ In-hospital: 4% (CRACE registry)<sup>3</sup>
- Eastern Europe ▶ In-hospital: 9% (Euro Heart Survey 2009 AMI Snapshot)<sup>3</sup>
- Middle East ▶ @ 12months: 12% (Gulf RACE-2 registry)<sup>3</sup>

ACS, acute coronary syndrome

1. Myocardial infarction with ST-segment elevation: acute management. Clinical guideline [Internet]. 2013 [cited 8 January 2019]. Available from: <https://www.nice.org.uk/guidance/cg167>  
2. O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction. J Am Coll Cardiol 2013;61 :e78-e140.  
3. Vedanthan R, Seligman B, Fuster V. Global Perspective on Acute Coronary Syndrome. Circulation Research. 2014;114(12):1959-1975.

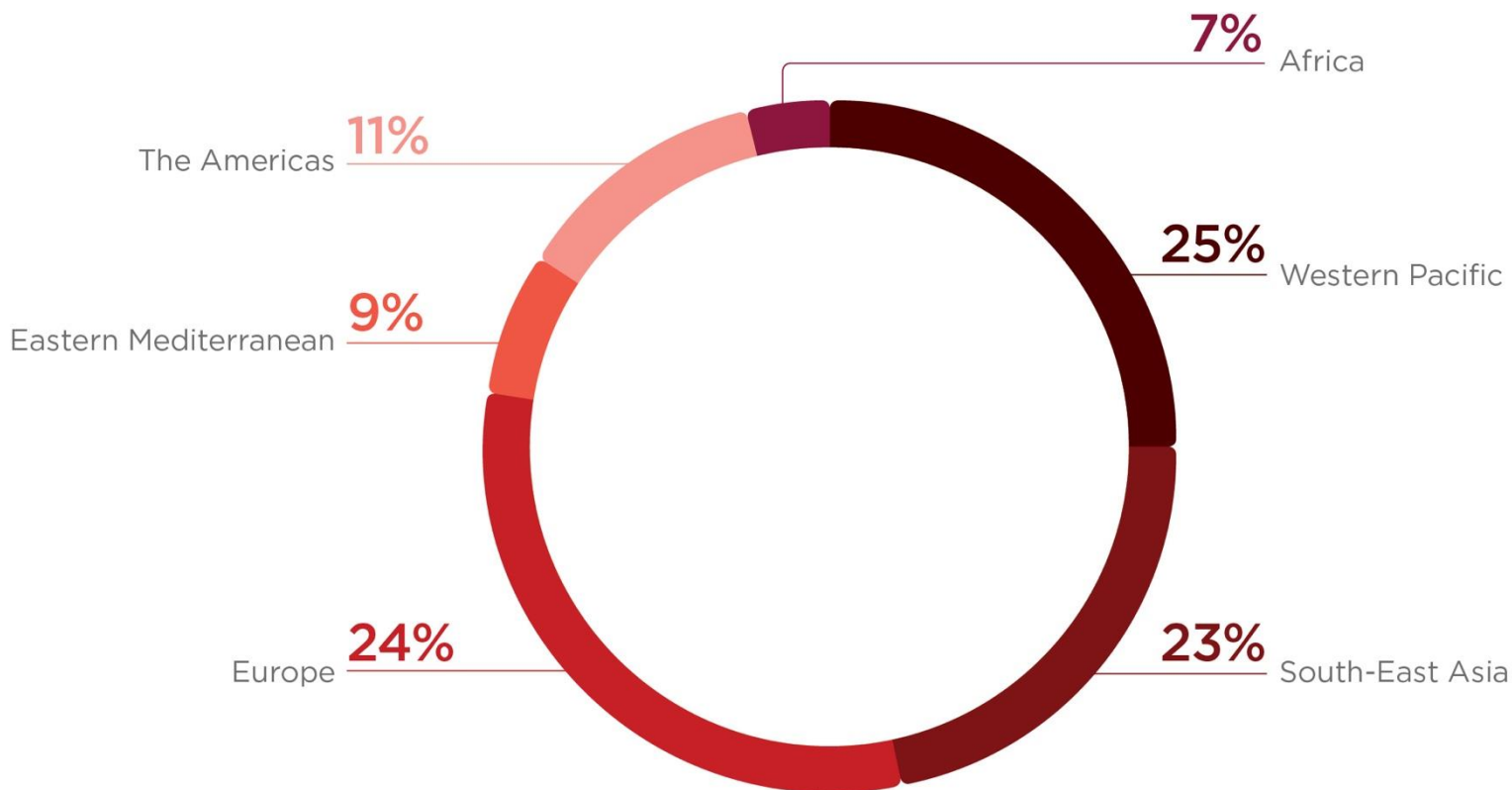




## EPIDEMIOLOGY

# GEOGRAPHICAL DIFFERENCES IN MORTALITY FROM ISCHAEMIC HEART DISEASE (IHD), ESTIMATES 2016

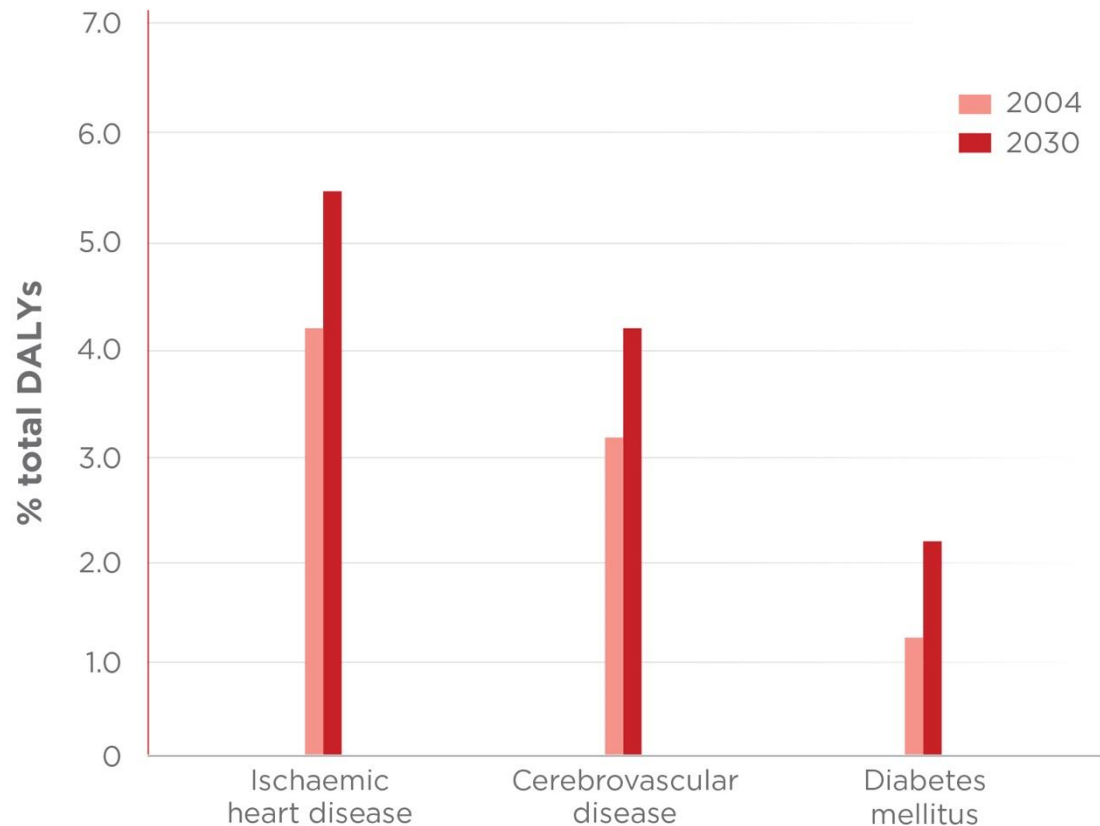
### Percentage of deaths from IHD in WHO regions



Disease burden and mortality estimates [Internet]. World Health Organization. 2019 [cited 8 January 2019]. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/](https://www.who.int/healthinfo/global_burden_disease/estimates/en/)

## EPIDEMIOLOGY

# CHANGING GLOBAL BURDEN OF DISEASE (% TOTAL DALYs), IN 2004 AND PREDICTED FOR 2030



DALYs, disability adjusted life years

Mendis S, Puska P, Norrving B, World Health Organization. Global atlas on cardiovascular disease prevention and control. Geneva: World Health Organization; 2011.

# EPIDEMIOLOGY

## POPULATIONS BASED ON DATA FROM THE USA



**-30%**

Proportion of STEMI **PATIENTS WHO ARE WOMEN**

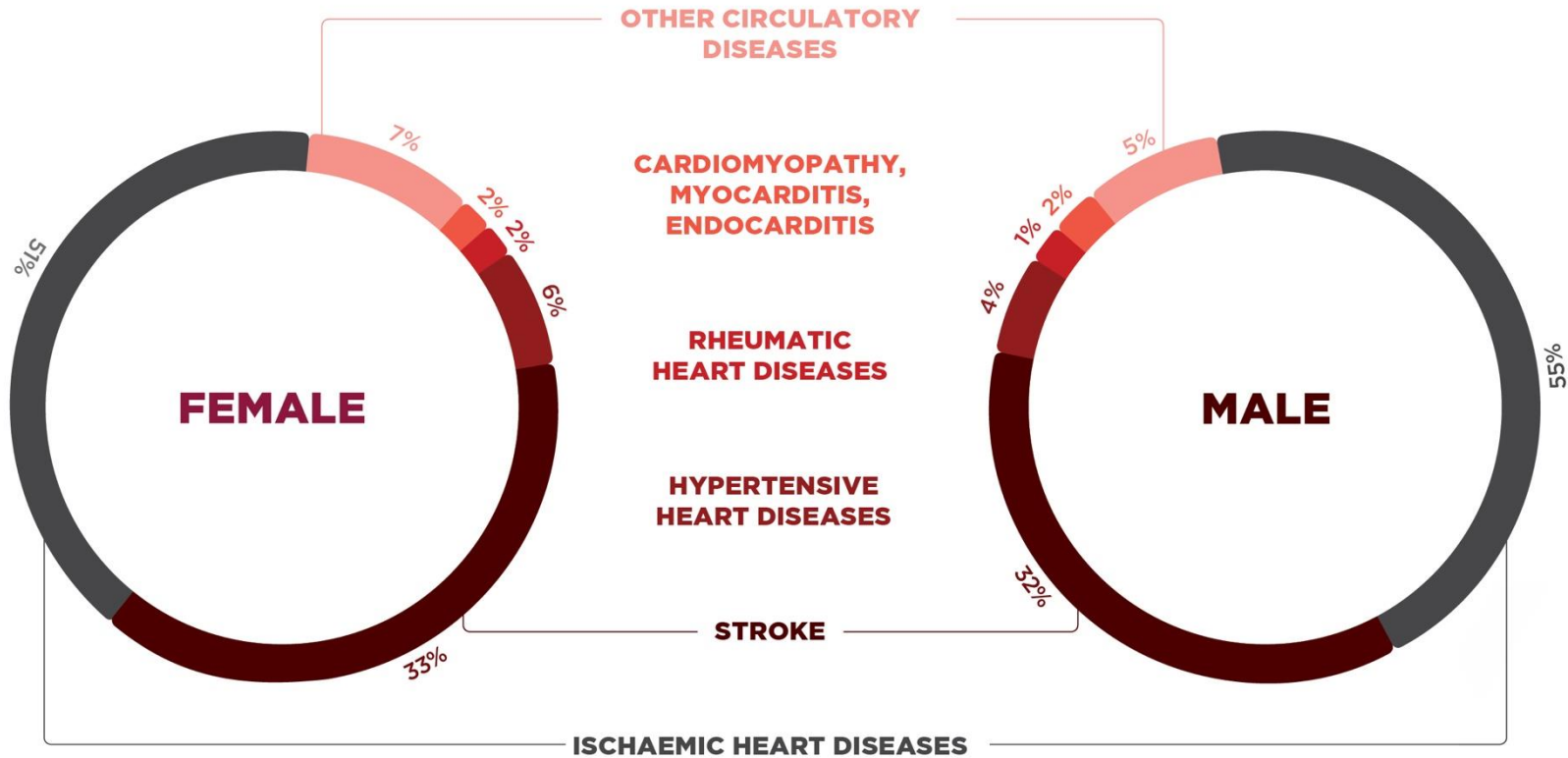
**13.3%**

Proportion of STEMI **PATIENTS WHO ARE NOT CAUCASIAN**

**23%**

Proportion of STEMI **PATIENTS WHO ARE DIABETIC**

## GLOBAL GENDER DIFFERENCES IN DEATH FROM CARDIOVASCULAR DISEASE



1. Disease burden and mortality estimates [Internet]. World Health Organization. 2019 [cited 8 January 2019]. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/](https://www.who.int/healthinfo/global_burden_disease/estimates/en/).

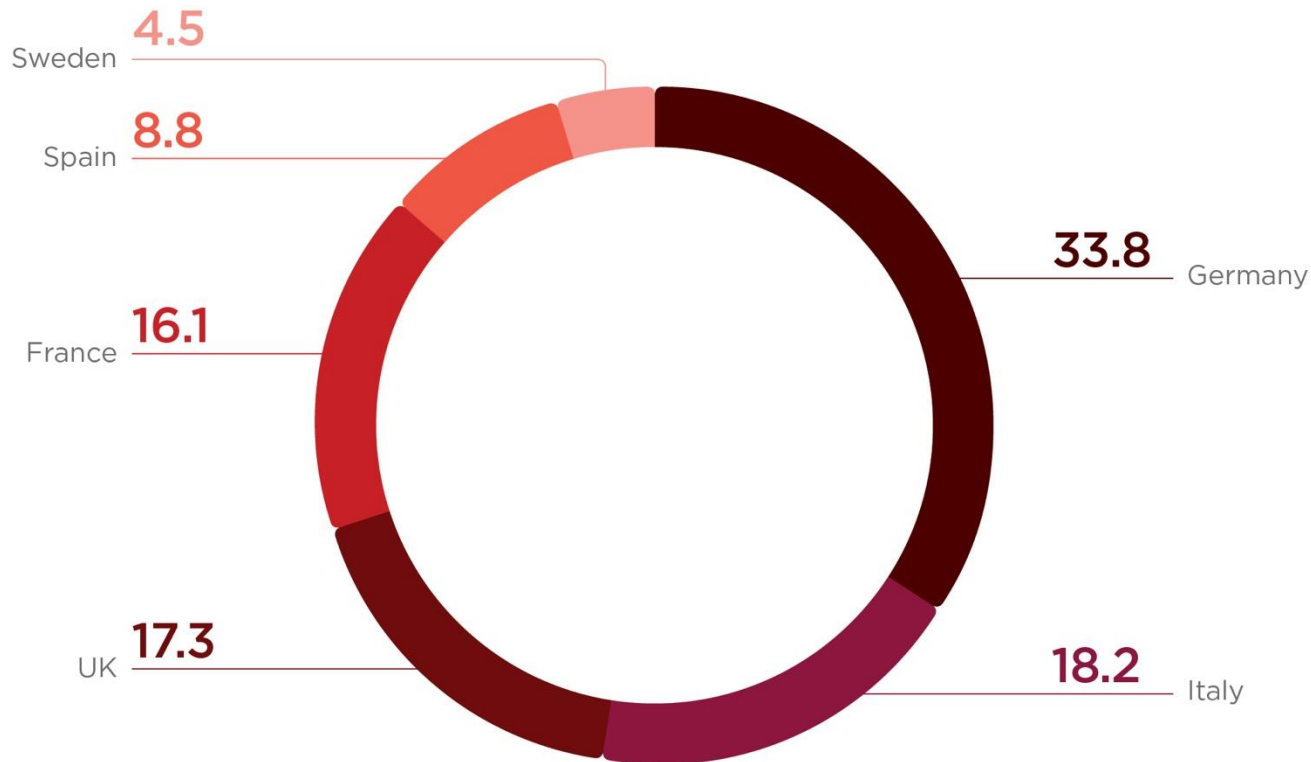




## EPIDEMIOLOGY

# THE ECONOMIC IMPACT OF CVD

**Healthcare cost of CVD predicted to rise to 98.7 billion Euro in 2020**



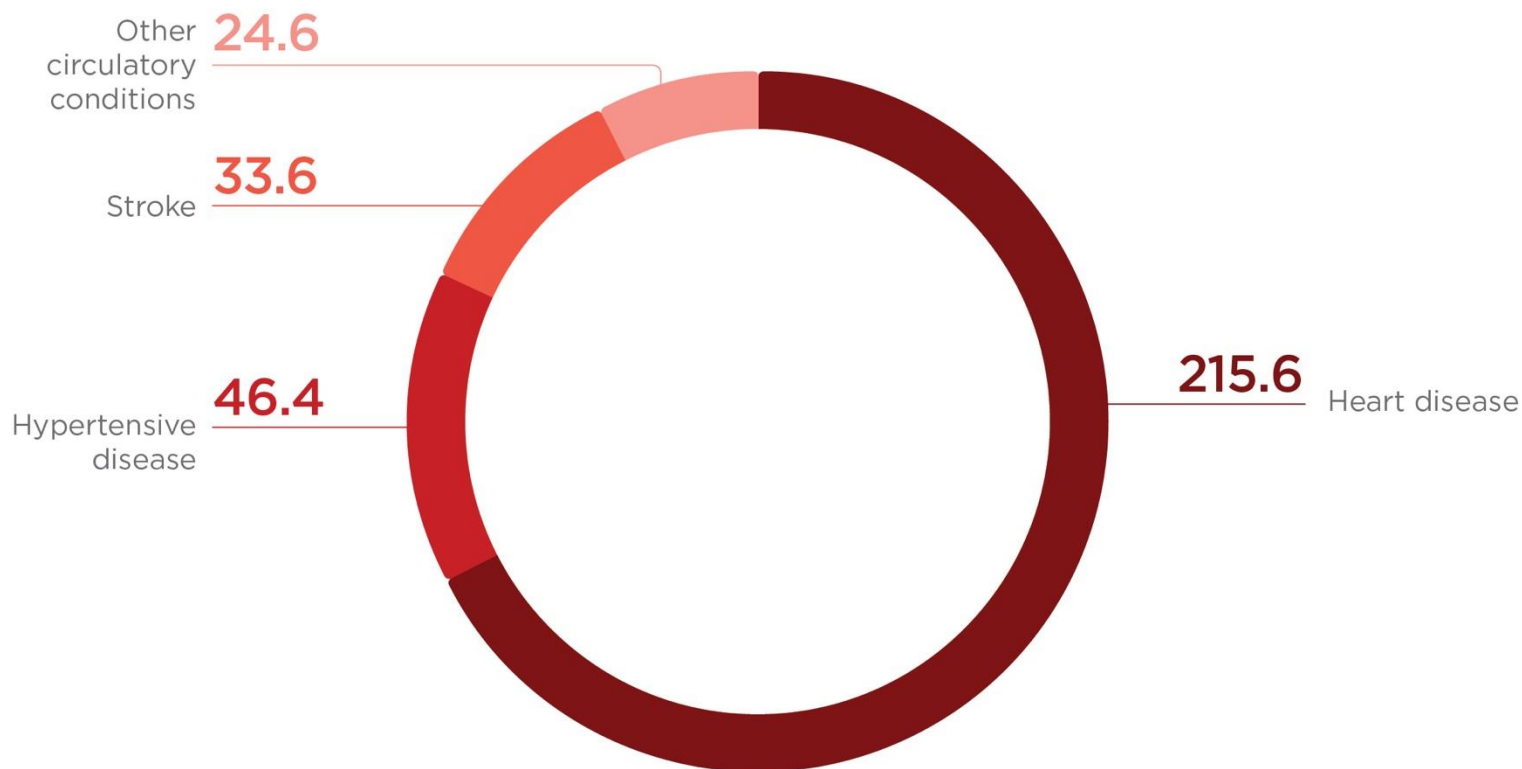
Adapted from: The economic cost of cardiovascular disease from 2014-2020 in six European economies [Internet]. London; 2014 [cited 8 January 2019]. Available from: <https://www.cebr.com>.



## EPIDEMIOLOGY

# DIRECT AND INDIRECT COSTS OF CARDIOVASCULAR DISEASE AND STROKE, USA 2011

Billions of dollars



Mozaffarian. Heart disease and stroke statistics-2015 update: a report from the American Heart Association (vol 131, pg e29, 2015). Circulation. 2015 Jun 16;131(24):E535-.



## EPIDEMIOLOGY

# LOCAL DISEASE BURDEN AND MORTALITY

- Cardiovascular disease is the **LEADING CAUSE OF DEATH IN SOUTH AFRICA AFTER HIV/AIDS**
- More South Africans die of CVD than of **ALL CANCER COMBINED**
- Cardiovascular disease is responsible for almost **1 IN 6 DEATHS (17.3%)** in South Africa
- **215 PEOPLE DIE** every day from **CARDIOVASCULAR DISEASE**
- Every **HOUR** in South Africa: **5 PEOPLE HAVE HEART ATTACKS, 10 PEOPLE HAVE STROKES** and of those events, **10 PEOPLE WILL DIE AS A RESULT.**

# EPIDEMIOLOGY

## LOCAL DISEASE BURDEN AND MORTALITY

### QUADRUPLE BURDEN OF DISEASE EPIDEMIC IN RSA:

- **HIGH INCIDENCE OF COMMUNICABLE DISEASES (HIV/AIDS & TUBERCULOSIS)**
- **HIGH INCIDENCE IF NON-COMMUNICABLE DISEASES (NCDS);**
- **MATERNAL AND CHILD HEALTH**
- **VIOLENCE AND INJURY**







- Ischaemic heart disease (IHD) has **RISEN** to the list of **TEN LEADING UNDERLYING CAUSES OF DEATH** in 2015, in both men and women.
- Shortage of **CLINICIANS** in South Africa:
  - Ratio of 0.8 doctor per 1000 patients
  - Compared to USA and UK: 3 doctors per 1000 patients<sup>2</sup>
- Incidence of ischemic heart disease and risk factors increasing, combined with limited **MEDICAL RESOURCES**

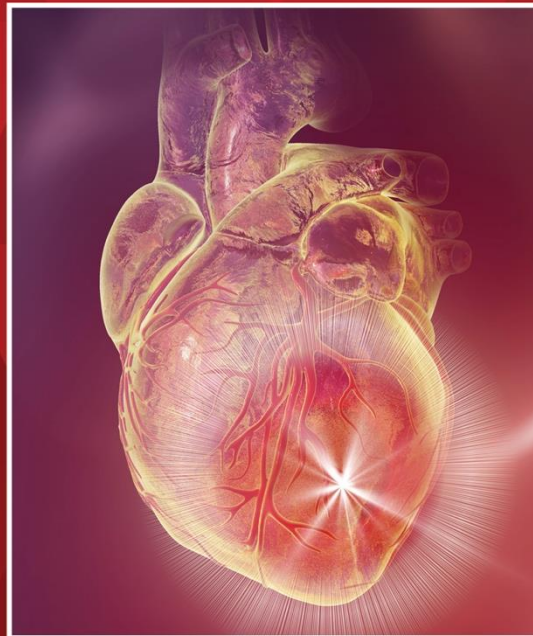
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1. Mortality and causes of death in South Africa, 2016: Findings from death notification [Internet]. 2018 [cited 8 January 2019]. Available from: <http://www.statssa.gov.za>

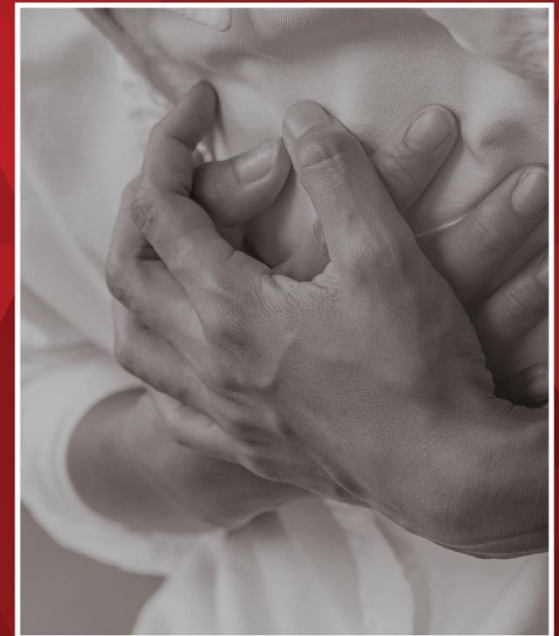
2. Physicians (per 1,000 people) | Data [Internet]. Data.worldbank.org. 2019 [cited 8 January 2019]. Available from: <https://data.worldbank.org/indicator/SH.MED.PHYS.ZS?end=2016&locations=ZA-GB-US&start=1960&view=chart>



**EPIDEMIOLOGY**



**PATHOPHYSIOLOGY**



**SYMPTOMS**



# PATHOPHYSIOLOGY

## DEFINITIONS

### **ACUTE CORONARY SYNDROME (ACS)**

is an umbrella term that refers to myocardial ischaemia symptoms resulting from acute coronary occlusion<sup>1</sup>

### **MYOCARDIAL ISCHAEMIA**

results from reduced blood flow and lack of oxygen supply to the myocardium  
- usually caused by a restriction/occlusion of one or more coronary artery<sup>2</sup>

Occurs when there is an imbalance between oxygen demand and blood supply,<sup>2</sup>

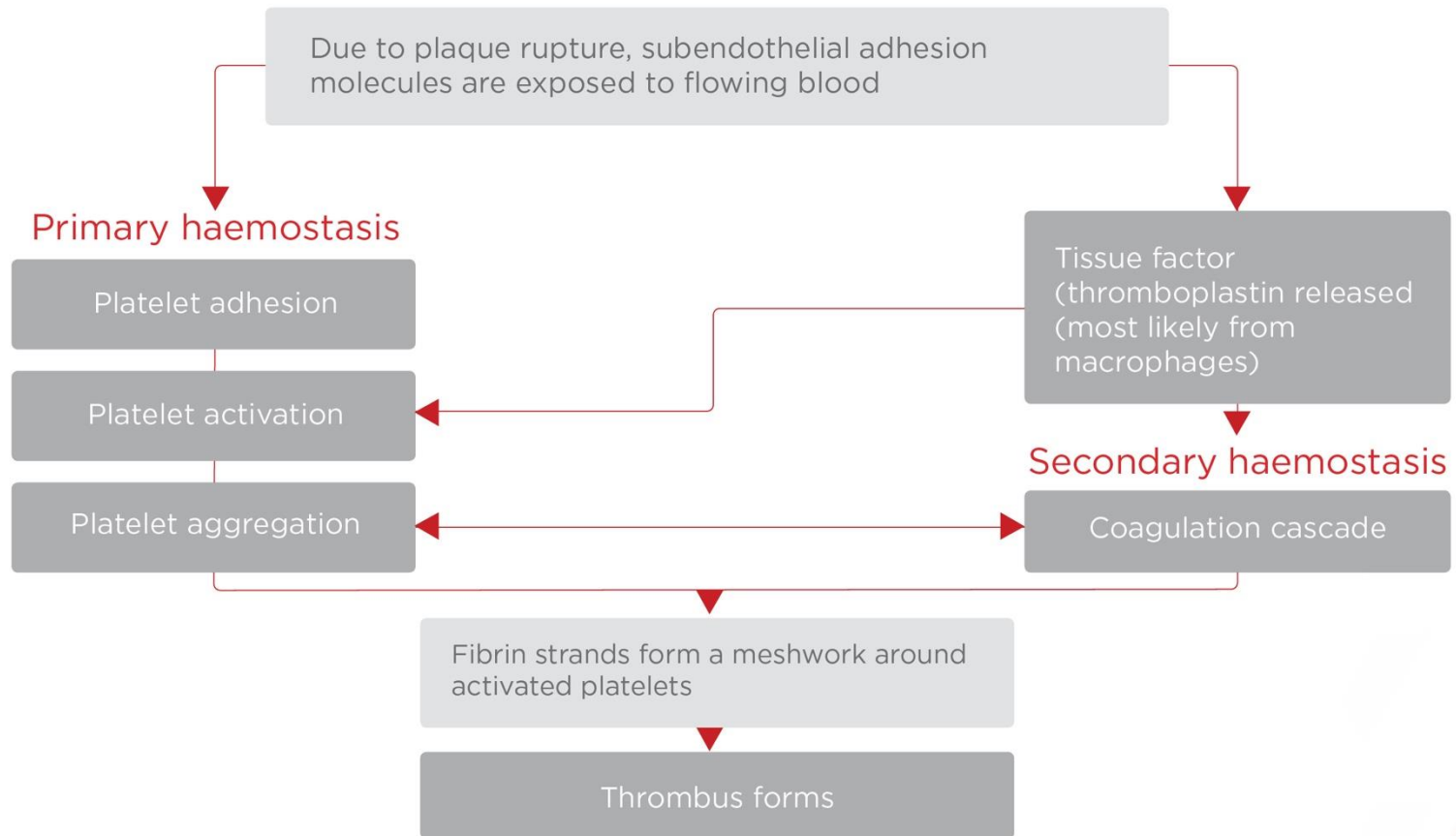
### **ACUTE MYOCARDIAL INFARCTION (AMI)**

indicates significant ischaemic myocardial injury requiring urgent time-dependent management, failing which and/or if left untreated results in substantial myocardial necrosis — atherothrombosis (plaque) is the most common cause of AMI<sup>3</sup>

1. Acute Coronary Syndromes Definition and Review | LearntheHeart.com [Internet]. Healio.com. 2019 [cited 8 January 2019]. Available from: <https://www.healio.com/cardiology/learn-the-heart/cardiology-review/topic-reviews/acute-coronary-syndromes>.

2. Crea F, Lanza G. Myocardial ischaemia: definition and causes [Internet]. Oxfordmedicine.com. 2019 [cited 8 January 2019]. Available from: <http://oxfordmedicine.com/view/10.1093/med/9780198784906.001.0001/med-9780198784906-chapter-327>,

3. Mendis S, Thygesen K, Kuulasmaa K, Giampaoli S, Mahonen M, Ngu Blackett K et al. World Health Organization definition of myocardial infarction: 2008-09 revision. International Journal of Epidemiology. 2010;40(1):139-146.



Adapted from:

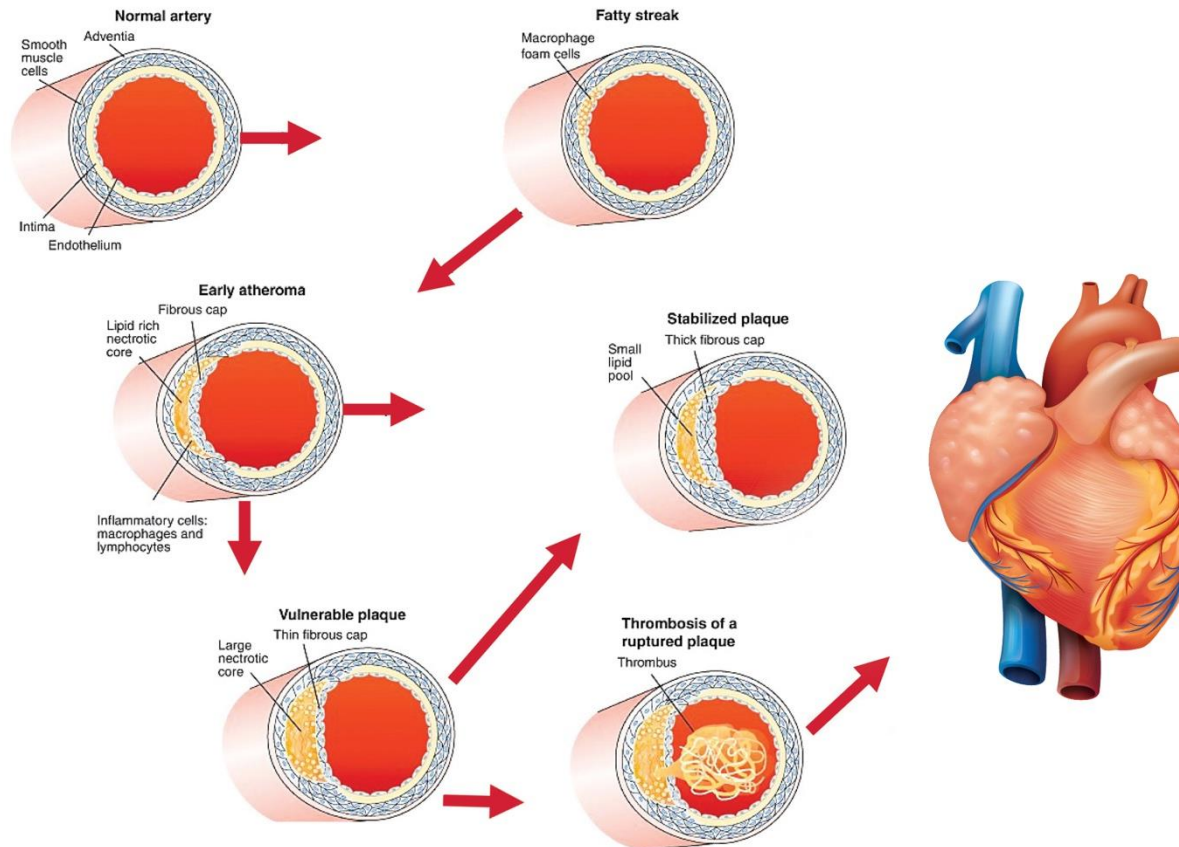
1. Gale AJ. Continuing education course# 2: current understanding of hemostasis. Toxicologic pathology. 2011 Jan;39(1):273-80.

2. Constantinides P. Plaque fissures in human coronary thrombosis. Journal of Atherosclerosis Research. 1966 Jan 2;6(1):1-7.





# PATHOPHYSIOLOGY PROGRESSION OF CORONARY ARTERY BLOCKAGE



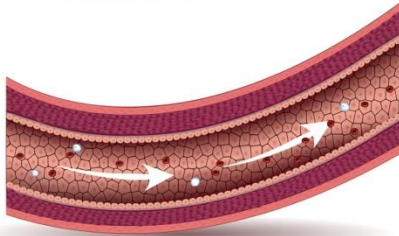
Redrawn and adapted from: Lusis AJ. Genetics of atherosclerosis. Trends in Genetics. 2012 Jun 1;28(6):267-75.



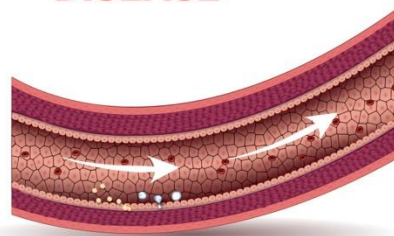
# PATHOPHYSIOLOGY

## PROGRESSION OF CORONARY ARTERY BLOCKAGE

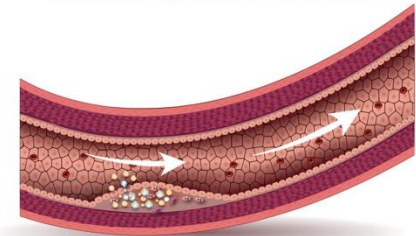
**1. NORMAL CORONARY ARTERY**



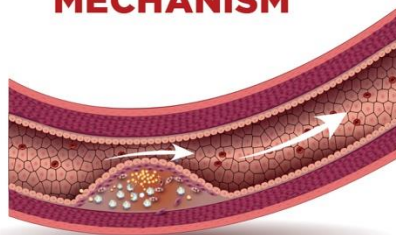
**2. CORONARY ARTERY DISEASE**



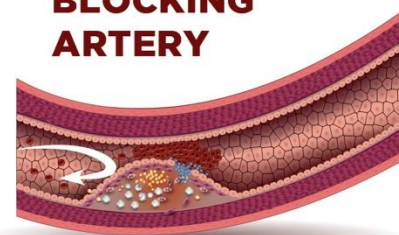
**3. DISRUPTION OF CORONARY ARTERY PLAQUE**



**4. CLOTTING MECHANISM**

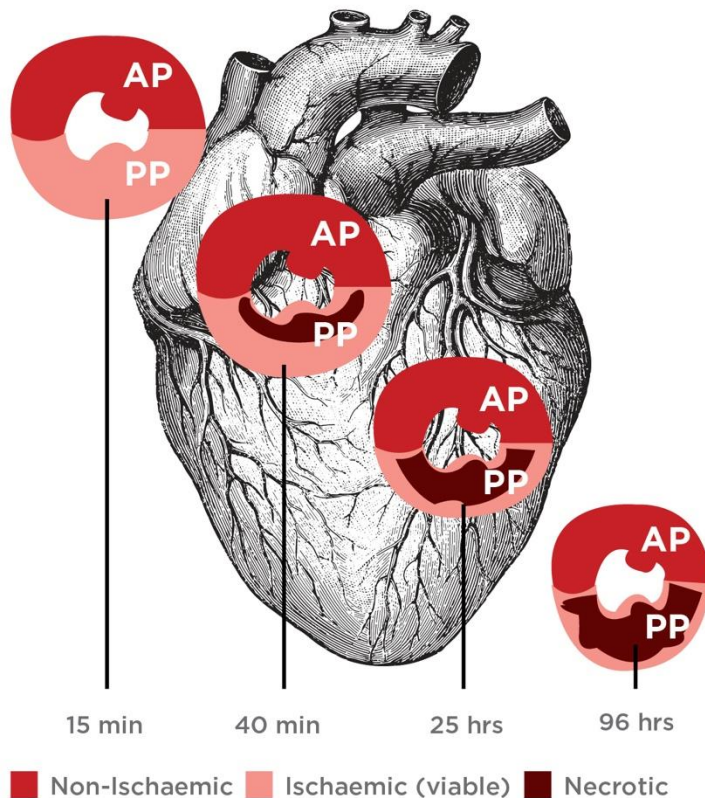


**5. THROMBUS FORMS, BLOCKING ARTERY**



# PATHOPHYSIOLOGY

## ADVANCING NECROSIS IN MI



Cell death does not occur immediately, depending on the **COLLATERAL CIRCULATION**, extent of the arterial occlusion, and other factors<sup>1</sup>

**IRREVERSIBLE CELL DEATH** of the myocardium begins and function is disrupted<sup>1</sup>

**EARLY REPERFUSION IS ESSENTIAL** to prevent loss of myocardial function

**TIME SAVED = MUSCLE SAVED**

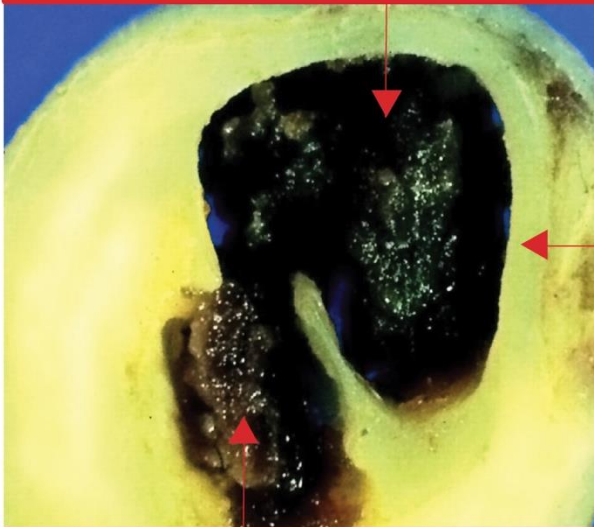
AP = Anterior papillary muscle; PP = Posterior papillary muscle

1. Thygesen K, Alpert JS, White HD. Universal definition of myocardial infarction. Journal of the American College of Cardiology. 2007 Nov 27;50(22):2173-95.
2. Jennings RB, Reimer KA. Factors involved in salvaging ischemic myocardium: effect of reperfusion of arterial blood. Circulation. 1983 Aug 1;68:1-25.

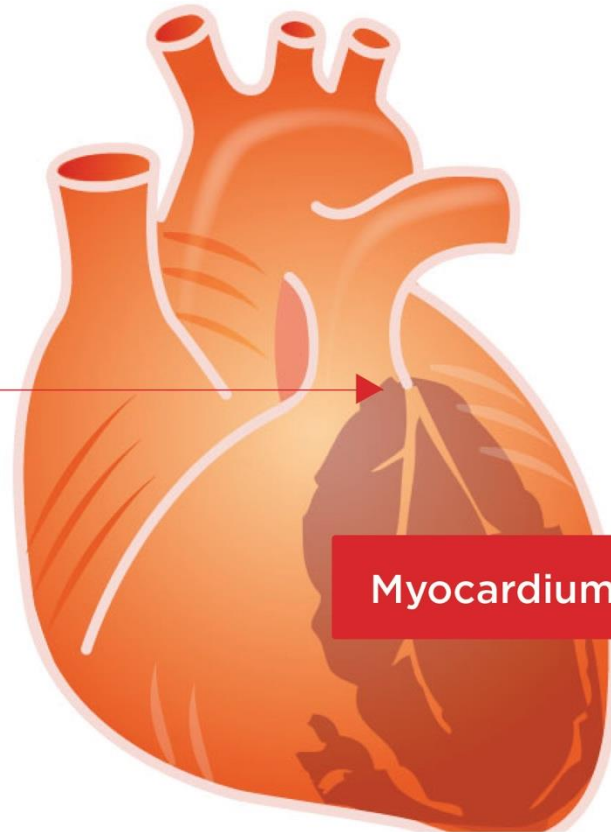
# IMPORTANCE OF EARLY REPERFUSION



Clot within the main lumen  
Of the coronary artery



Ruptured plaque  
with hemorrhage

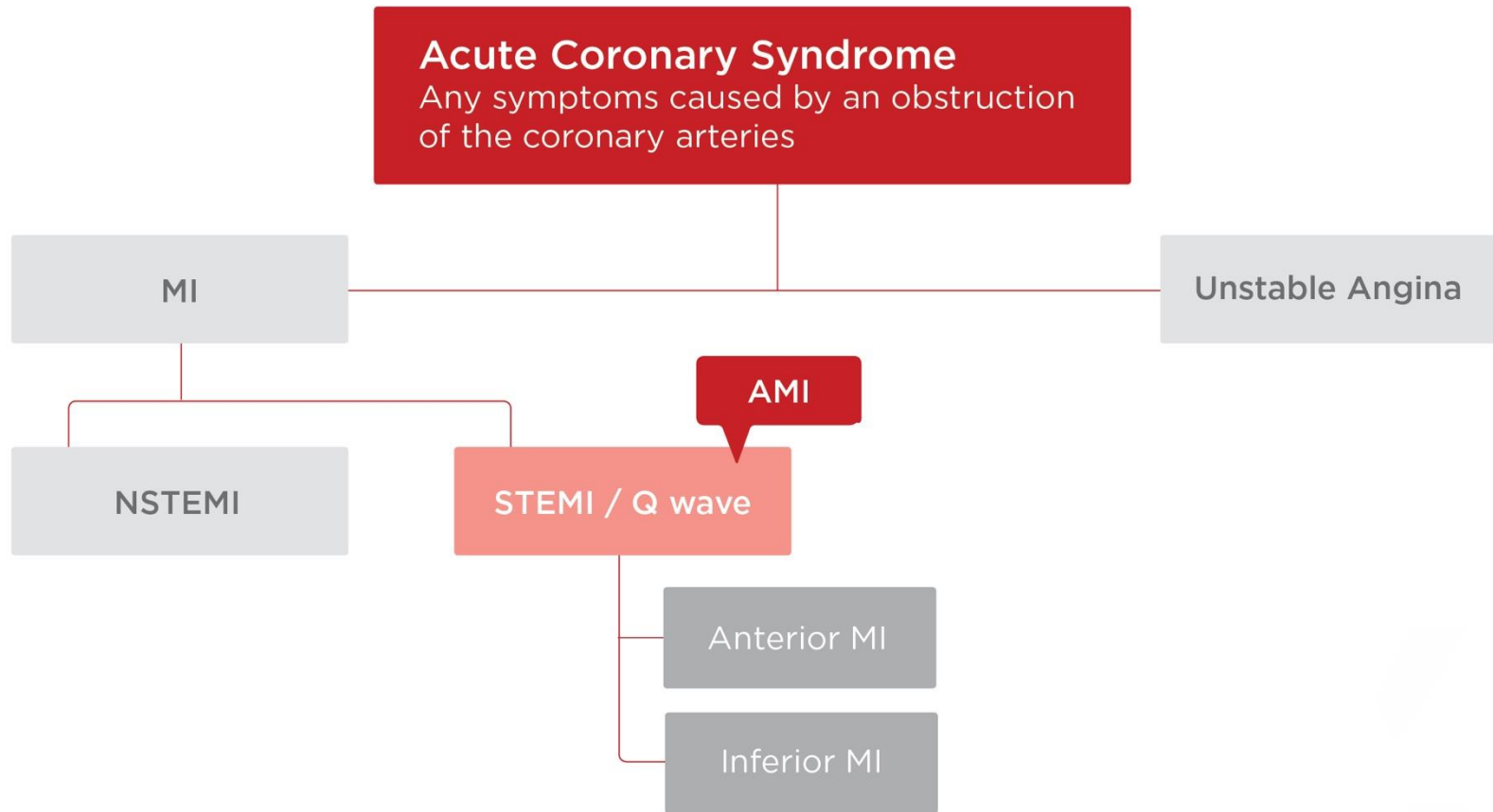


Myocardium at risk



# PATHOPHYSIOLOGY

## ACS CLASSIFICATION



AMI: Acute myocardial infarction; MI: myocardial infarction

Alpert JS, Thygesen K, Antman E, Bassand JP. Myocardial infarction redefined--a consensus document of The Joint European Society of Cardiology/American College of Cardiology Committee for the redefinition of myocardial infarction. 2000 Sep;36(3):959-69.

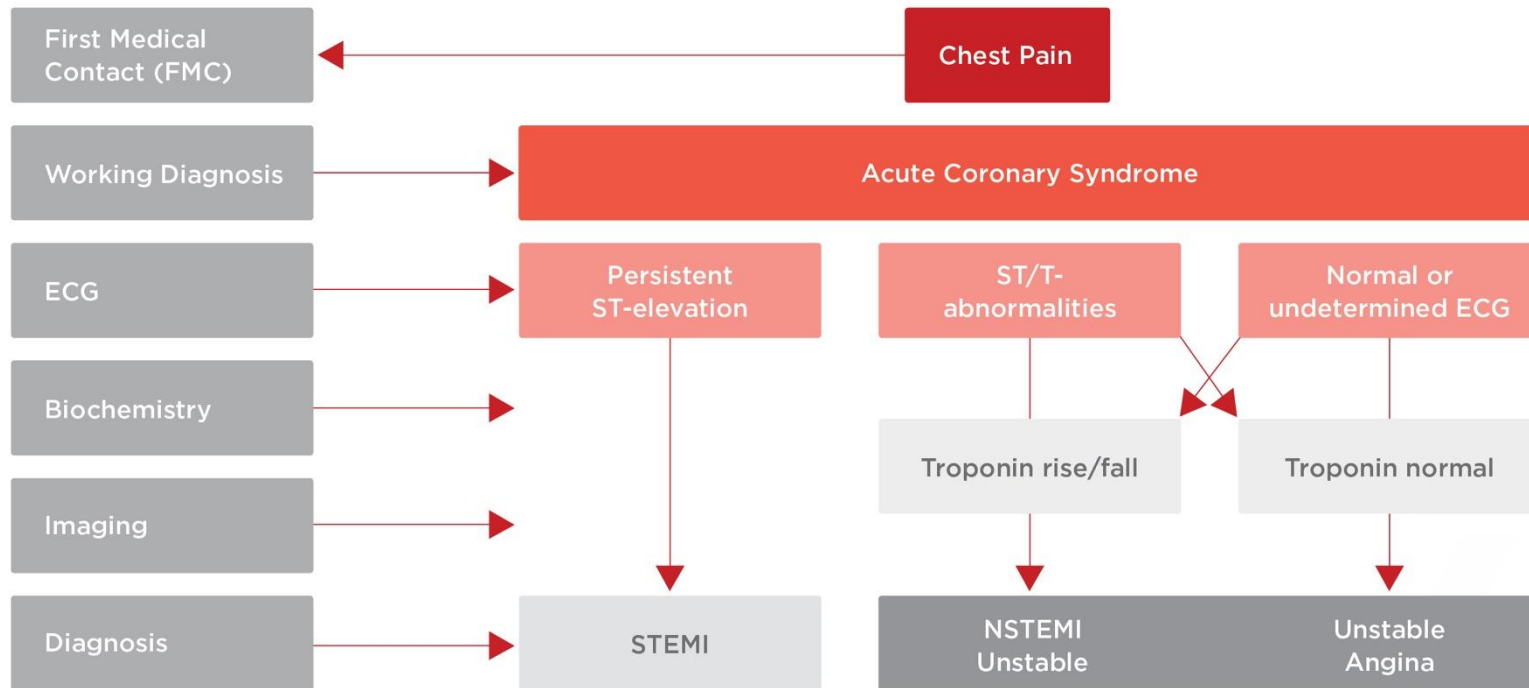


# PATHOPHYSIOLOGY

## ACUTE CORONARY SYNDROME (ACS)



One disease process but different clinical manifestations and management strategies



STEMI, ST-elevation myocardial infarction  
NSTEMI, non ST-elevation myocardial infarction

Authors/Task Force Members, Hamm CW, Bassand JP, Agewall S, Bax J, Boersma E, Bueno H, Caso P, Dudek D, Gielen S, Huber K. ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes (ACS) in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC). European heart journal. 2011 Aug 26;32(23):2999-3054.

# PATHOPHYSIOLOGY

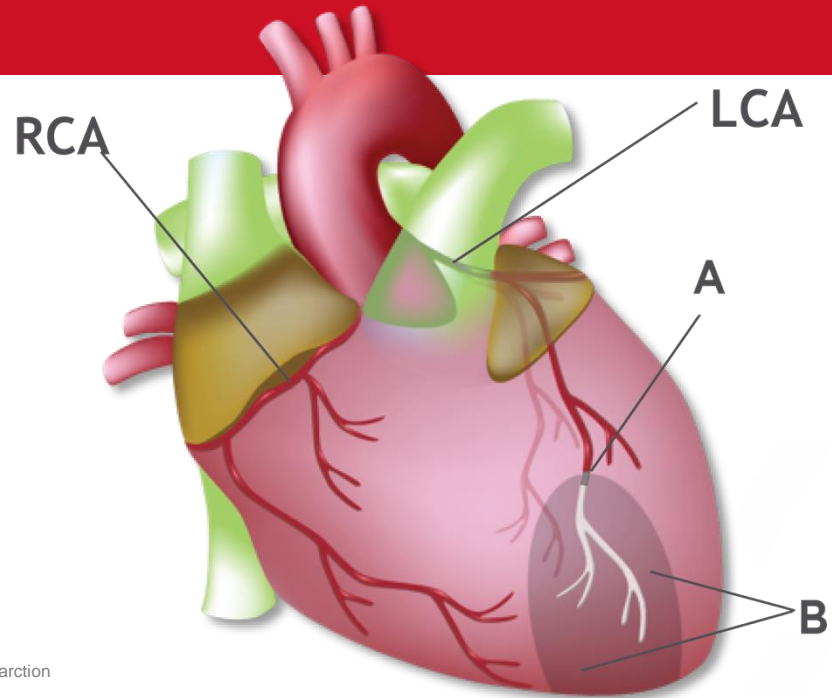
## DEFINITION OF STEMI



A clinical syndrome defined by characteristic symptoms of myocardial ischaemia in association with persistent ECG ST-elevation and subsequent release of biomarkers of myocardial necrosis<sup>1</sup>

**STEMI:** full thickness damage (myocardial cell death) of cardiac muscle

**NSTEMI:** partial thickness damage of cardiac muscle



A = Obstructive artery; B = infarcted area, non-ST-elevation myocardial infarction  
RCA = right coronary artery; LCA = left coronary artery; NSTEMI = non-ST-elevation myocardial infarction

O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction. J Am Coll Cardiol 2013;61:e78-e140.



# PATHOPHYSIOLOGY ST ELEVATION MYOCARDIAL INFARCTION - STEMI

**STEMI IS USUALLY TRIGGERED BY THE ABRUPT INSTABILITY OF AN ATHEROMATOUS PLAQUE LEADING TO:**

- Platelet adhesion
- Fibrin clot formation
- Vessel occlusion
- Muscle necrosis

**INFARCTION OF THE MYOCARDIUM WITH RESULTING NECROSIS OCCURS WITHIN A FEW HOURS OF THE ONSET OF CORONARY ARTERY OCCLUSION**

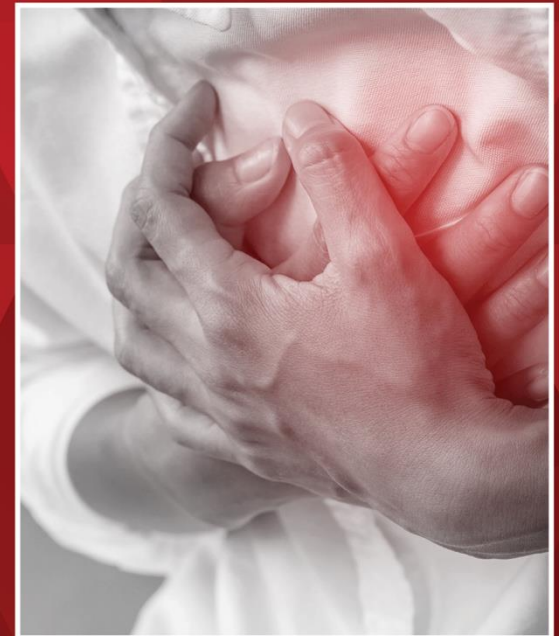
**THE ROLE OF THROMBOLYSIS IS TO DISSOLVE THE CLOT AND RESTORE BLOOD FLOW BEFORE PERMANENT, LIFE-THREATENING DAMAGE IS DONE**



**EPIDEMIOLOGY**



**PATHOPHYSIOLOGY**



**SYMPTOMS**



## SYMPTOMS RISK FACTORS FOR ACS<sup>1,2</sup>



Increasing age



Hypertension



Diabetes  
mellitus



Smoking



Dyslipidaemia  
(cholesterol)



Family history:  
CAD



Obesity:  
Sedentary lifestyle



Stress



Alcohol use



HIV  $\pm$  HAART (PI)

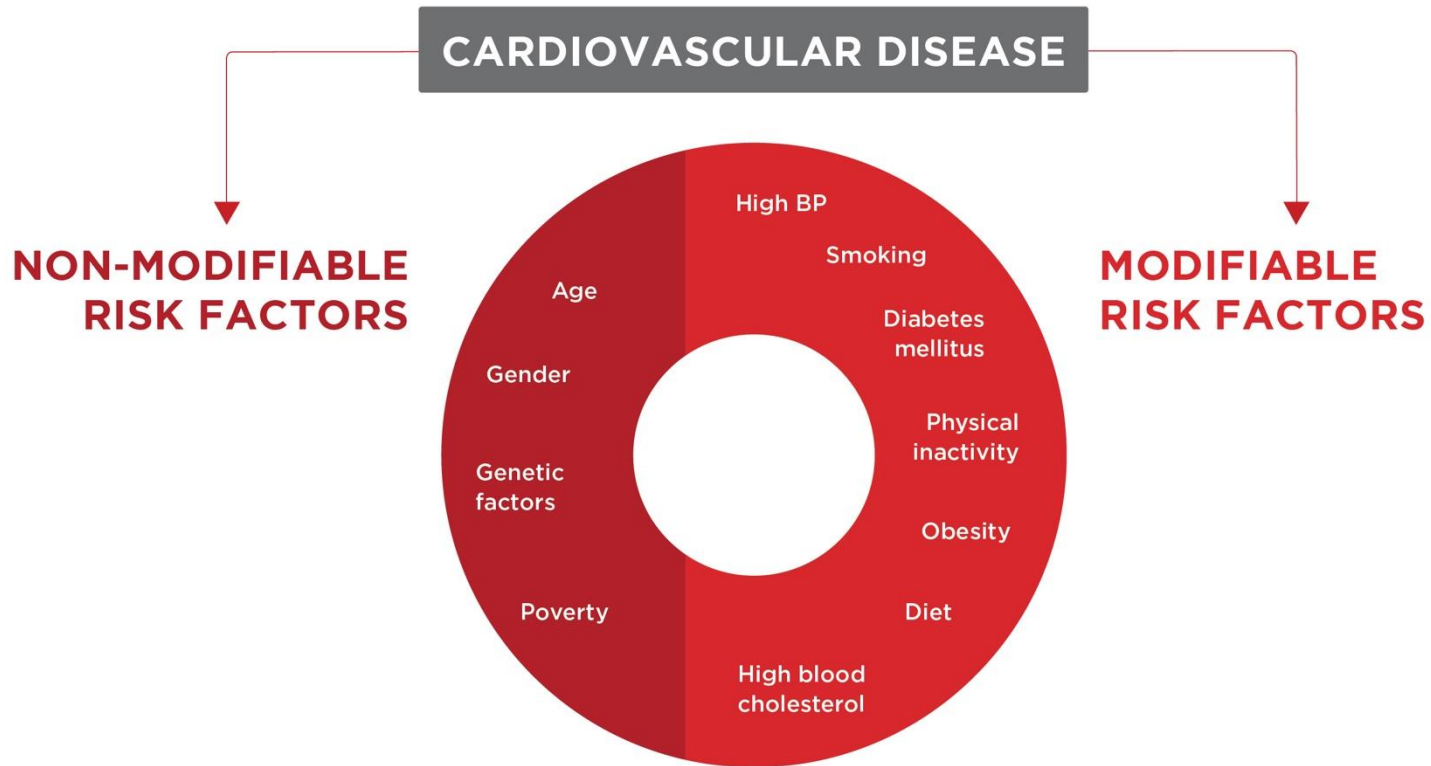
1. Cerrato E, D'Ascenzo F, Biondi-Zoccai G, Omedè P, Moretti C, Cicalini S, Parthasarathi G, Sheiban I, Gaita F. Acute coronary syndrome in HIV patients: from pathophysiology to clinical practice. Cardiovascular diagnosis and therapy. 2012 Mar;2(1):50.  
2. Causes of heart disease | Heart & Stroke Foundation South Africa [Internet]. Heart & Stroke Foundation South Africa. 2019 [cited 14 January 2019]. Available from: <http://www.heartfoundation.co.za/causes-of-heart-disease/>





## SYMPTOMS

# MAJOR MODIFIABLE AND NON-MODIFIABLE RISK FACTORS FOR CARDIOVASCULAR DISEASE





## SYMPTOMS

## OTHER RISK FACTORS

### GENDER

Although men are generally considered to be at the greater risk for coronary heart disease, post-menopausal women have an increased risk compared to pre-menopausal women.<sup>1</sup>

### HEREDITY AND FAMILY HISTORY

Increased risk if first-degree relative had coronary heart disease or stroke<sup>2</sup>

- Having a sibling with a history of CVD is associated with a 45% increased risk of CVD<sup>2</sup>

### SUMMARY

In terms of attributable deaths, globally, CV risk factors are<sup>3</sup>:

- Raised blood pressure (accounting for 13% of global deaths)
- Tobacco use (9%)
- Raised blood glucose (6%)
- Physical inactivity (6%)
- Overweight and obesity (5%)

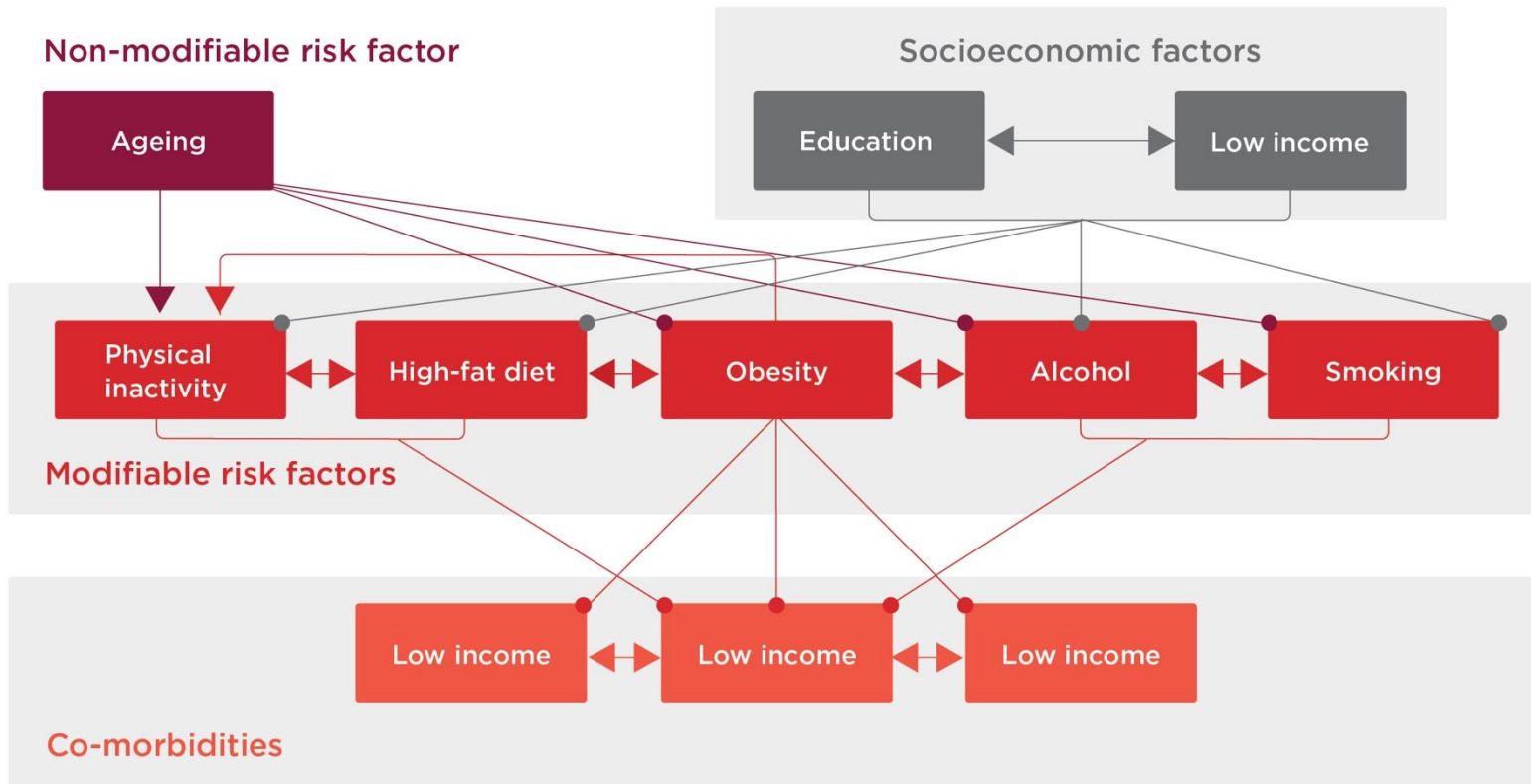
1. Bulliyya G. Risk of coronary heart disease in women after menopause. JOURNAL-INDIAN MEDICAL ASSOCIATION. 2001 Sep;99(9):478-82.

2. Murabito JM, Pencina MJ, Nam BH, D'Agostino RB, Wang TJ, Lloyd-Jones D, Wilson PW, O'Donnell CJ. Sibling cardiovascular disease as a risk factor for cardiovascular disease in middle-aged adults. Jama. 2005 Dec 28;294(24):3117-23.

3. World Health Organization. Global Health Risks: Mortality and burden of disease attributable to selected major risks [Internet]. 2009. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/GlobalHealthRisks\\_report\\_full.pdf](https://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf)

# SYMPTOMS

## RISK FACTORS FOR IHD RARELY OCCUR ALONE





## SYMPTOMS

# ISCHAEMIC SYMPTOMS - EXPLAINED

### MI OR Crescendo Angina/UAP?

- Discomfort or pain in the centre of the chest that lasts **more than 20 minutes**, it is likely to be an MI
- If it goes away and comes back, likely to be a Crescendo Angina/UAP
- **FEELS LIKE** an uncomfortable pressure, squeezing or burning. It often spreads to the neck/jaw, arms or the abdomen and is not dependent on respiration. Chest pain may also include back pain.
- **ACCOMPANYING SYMPTOMS INCLUDE** nausea, dizziness, vomiting, cold sweat, anxiety and possibly dyspnea.



**SYMPTOMS IN WOMEN ARE OFTEN DIFFERENT THAN IN MEN. WOMEN ARE MORE LIKELY TO EXPERIENCE NAUSEA, DIZZINESS, AND ANXIETY.**

## SYMPTOMS

# TYPICAL SYMPTOMS OF ACUTE MYOCARDIAL INFARCTION (AMI)



- Onset may be sudden or gradual
- Symptoms vary depending on the location of the infarct

Chest pain or discomfort	Often described as a tightness, heaviness or constriction in the chest usually in the centre of the chest, but radiate to neck, jaw, stomach, shoulder, back and arms (typically left arm)
Breathing difficulty / shortness of breath	Due to left ventricular dysfunction or dynamic mitral regurgitation
Profuse sweating	
Nausea and/or vomiting	
Dizziness	
Syncope	Usually due to an arrhythmia or severe hypotension
Tachycardia	Due to sympathetic nerve activation
Bradycardia	Patients with inferior STEMI may have bradycardia due to vagus nerve activation
Cardiogenic shock	Due to impaired myocardial function





# SYMPTOMS

## ISCHAEMIC SYMPTOMS

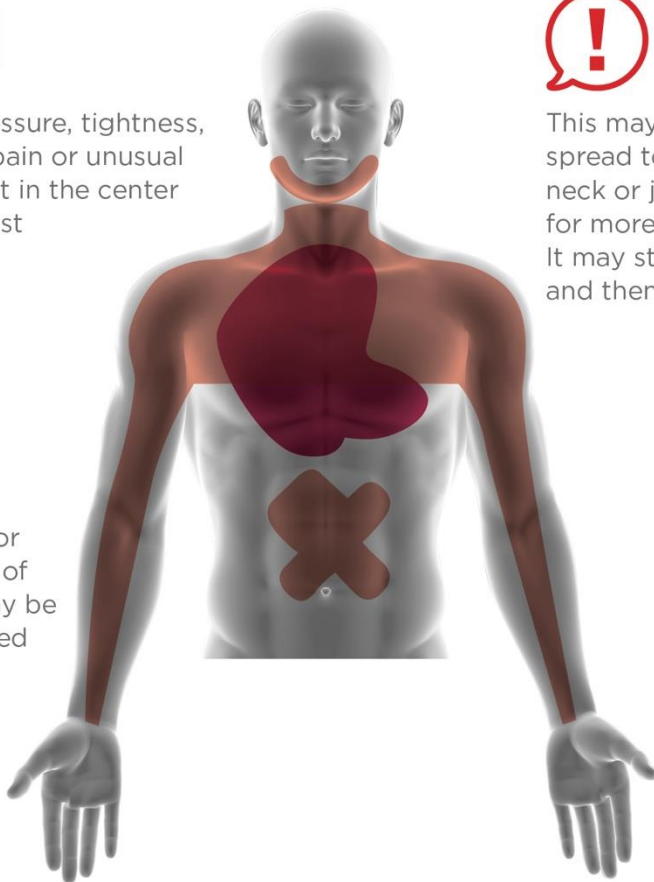
● Most typical discomfort/pain zones ● Other possible discomfort/pain zones



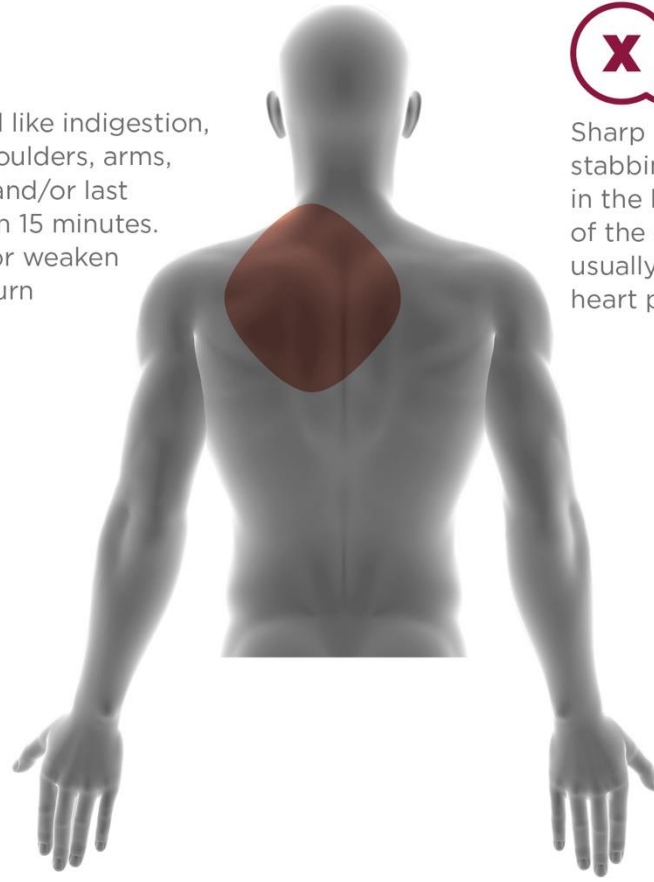
Heavy pressure, tightness, crushing pain or unusual discomfort in the center of the chest



Sweating, sickness, faintness or shortness of breath may be experienced



This may feel like indigestion, spread to shoulders, arms, neck or jaw and/or last for more than 15 minutes. It may stop or weaken and then return



Sharp stabbing pain in the left side of the chest is usually NOT heart pain