Coronary Heart Disease: Introductory Material

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Objectives

- Review the prevalence of cardiovascular disease (CVD) in the US
- Describe coronary heart disease's (CHD) contribution to CVD morbidity and mortality
- Explain the prevalence of CHD in the US based on age and sex
- Identify risk factors for CHD
- Describe the association between reduction in CHD mortality and risk factor modifications
- Highlight how pharmacist involvement can affect CHD mortality risk by focusing on risk factors

Objectives Continued

- Review coronary circulation, highlighting macro- and microcirculation
- Describe the pathophysiology of atherosclerosis in the coronary arteries
- Explain the importance of endothelial health in CHD
- Distinguish between ischemia and angina
- Describe the pathophysiology of angina in patients with:
  - Macrovascular disease
  - Vasospastic disease
  - Microvascular disease

Objectives Continued

- Discuss how a patient with complaints of chest pain is evaluated
- Characterize chest pain to determine if the complaint is likely due to CHD
- Classify type of chest pain based on characteristics
- Discuss the physical examination used to diagnose CHD and review typical exam results
- Review revascularization strategies to treat CHD

Coronary Heart Disease: Part 1 Statistics

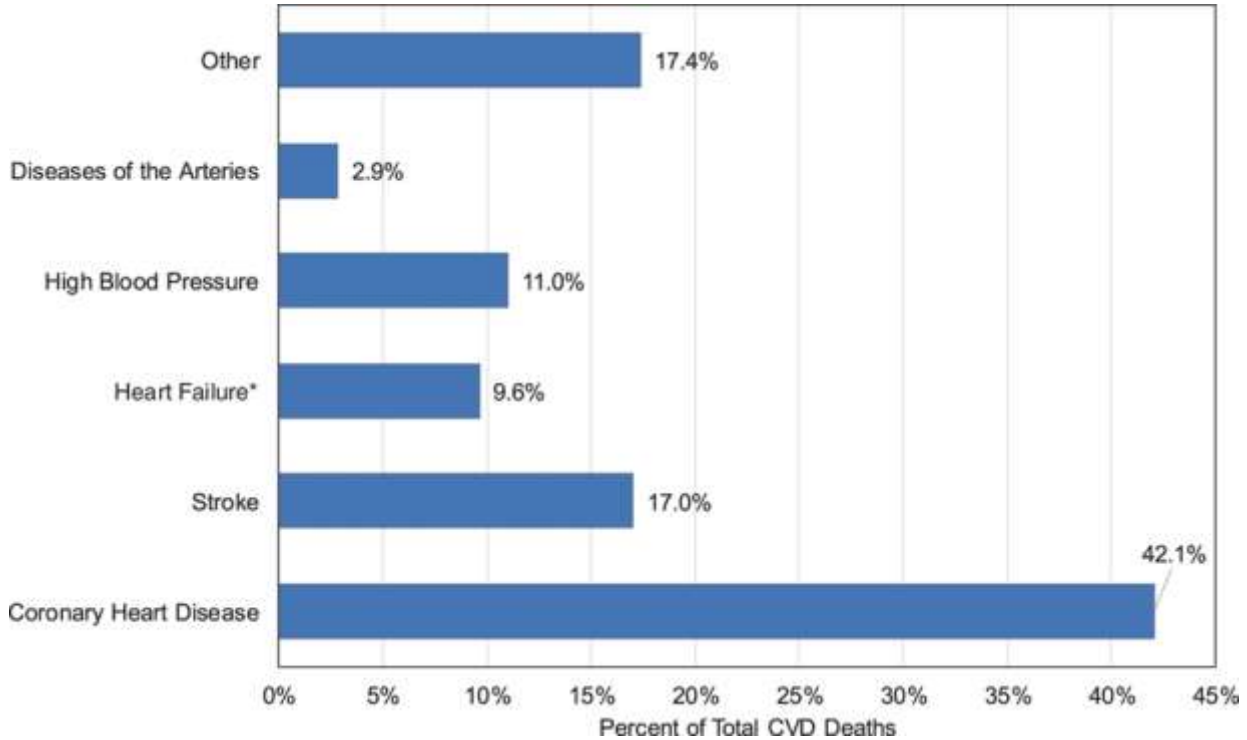
CVD in the US

- CVD includes HTN, CHD, CVA, HF
- 126.9 million Americans have 1 or more forms of CVD in 2018
- CVD accounted for ~ 30% of all deaths in the U.S. in 2018
  - Remains #1 killer in US (even during the pandemic of 2020) in all ethnic groups
  - Mortality rate higher in men vs women
  - ~ 1 death every 40 seconds

AHA/ASA Heart Disease and Stroke Statistics – 2021 Update

Percentage of Deaths Attributed to CVD in US (2018)

Salim S. Virani. Circulation. Heart Disease and Stroke Statistics—2021 Update, Volume: 143, Issue: 8, Pages: e254-e743, DOI: (10.1161/CIR.0000000000000950)



CHD in the US

- **CHD = CAD → Coronary Syndromes (ACS, CCS)**
- 20.1 million Americans have CHD
  - Total prevalence rate 7.2% (8.3% M v. 6.2% W)
  - Lifetime risk of developing CHD after age of 40 years is 49% for men and 32% for women

	Men >/= 20 years	Women ≥ 20 yrs
Whites	8.7%	6.0%
Blacks	6.7%	7.2%
Hispanics	6.8%	6.4%
Asians	5%	3.2%
Am Indian/ Alaska Natives	9.3% in all adults >/= 18 years of age	

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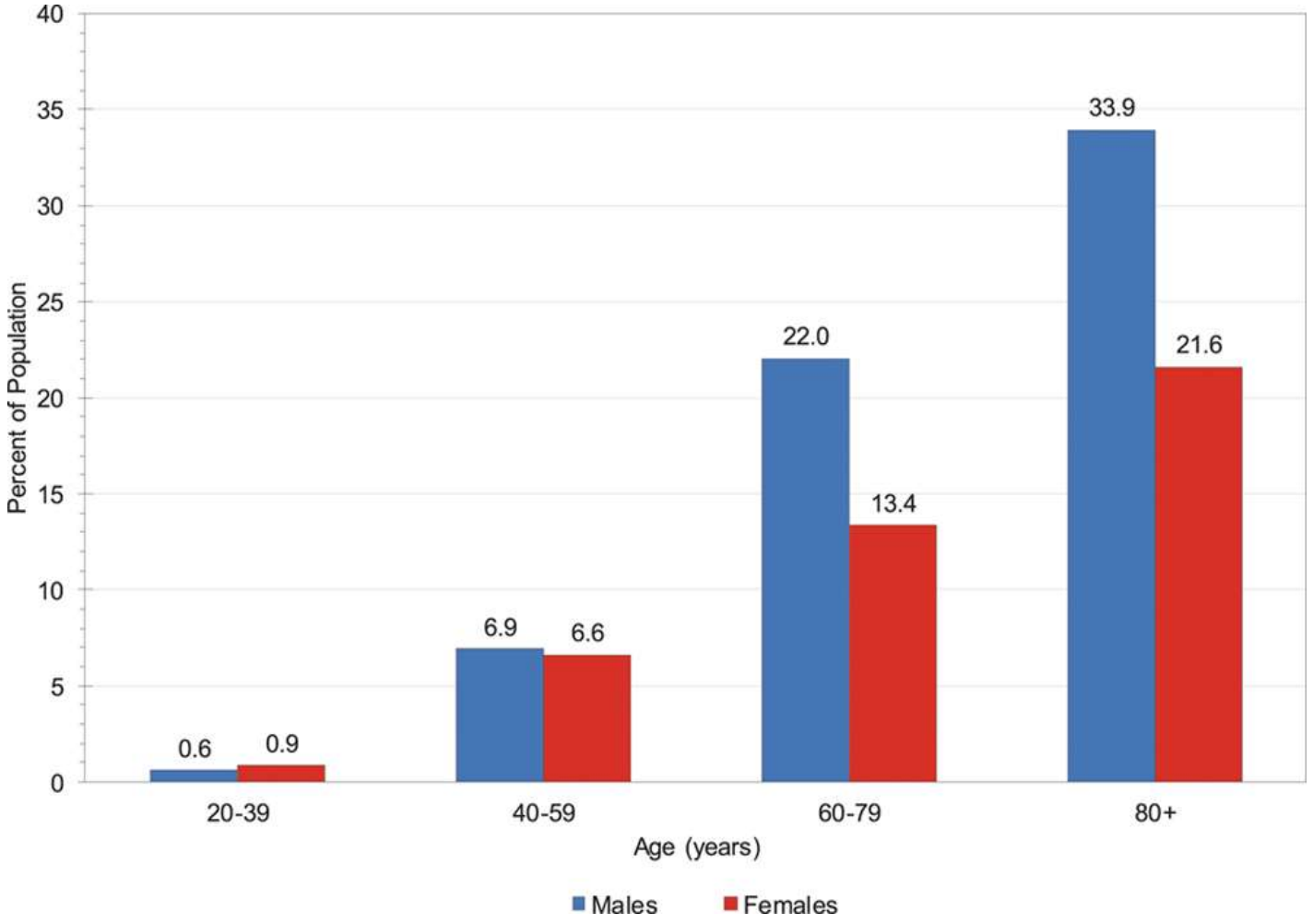
Prevalence of CHD by Age and Sex

(NHANES: 2015–2018)



More men have CHD, more women die from it.

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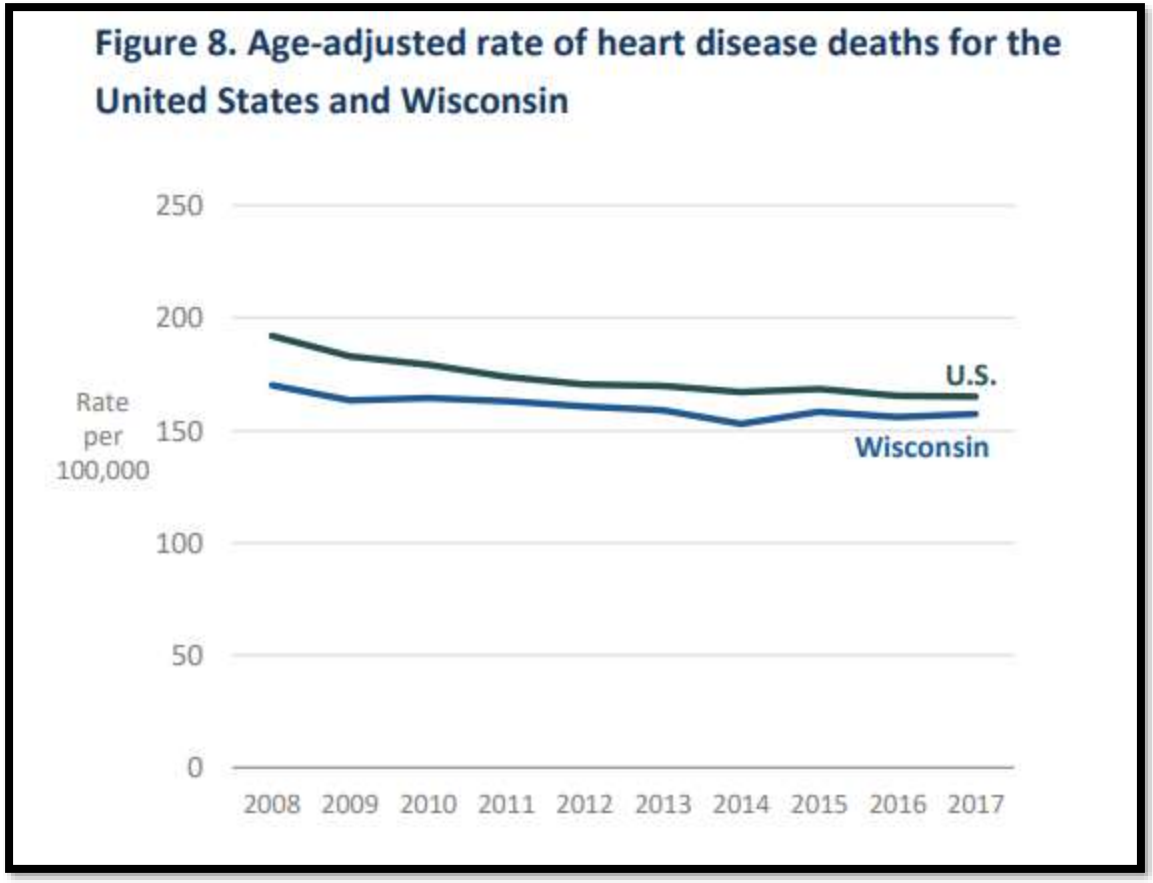
WI Death Rates – 2008-2017

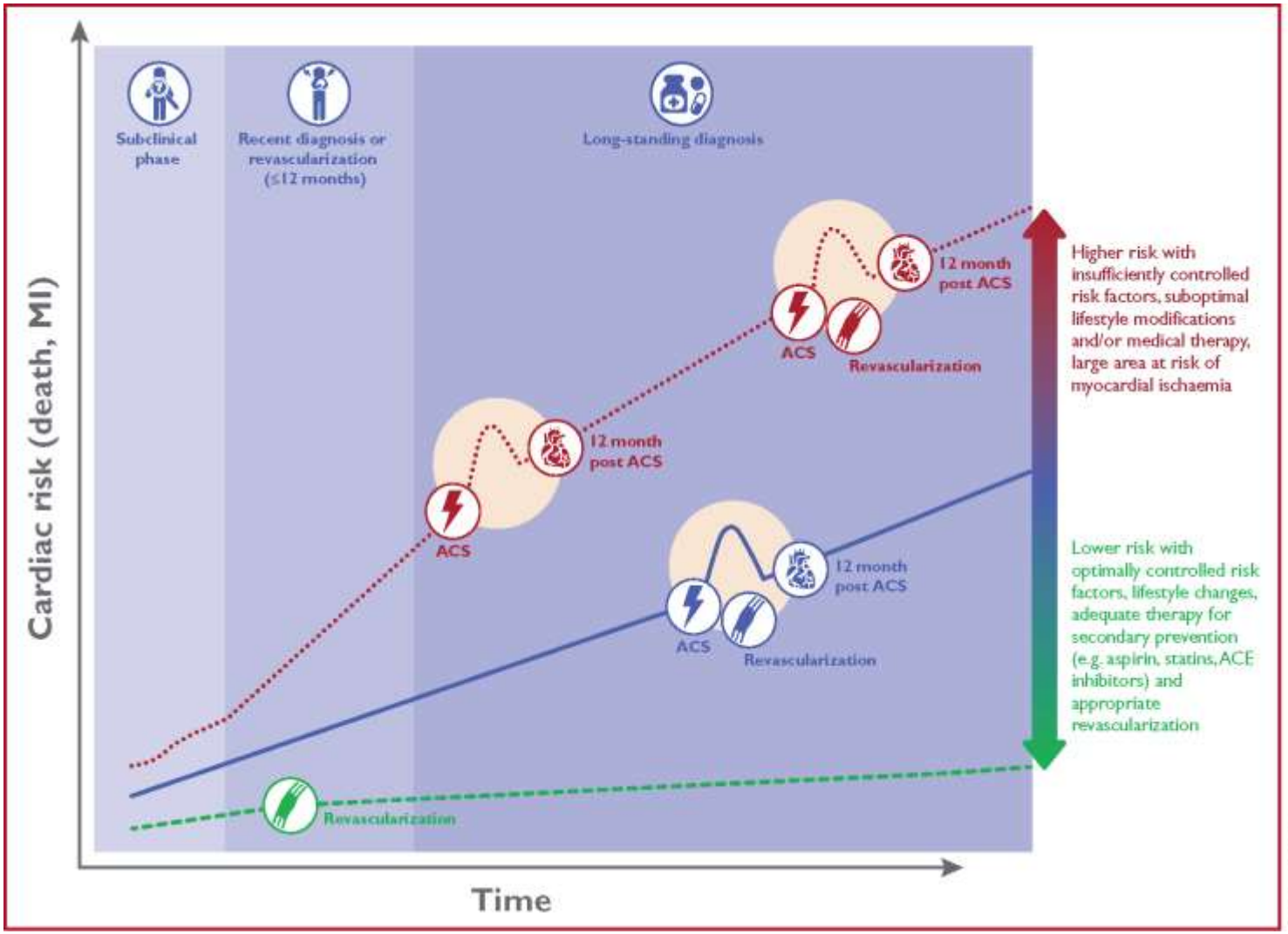


Burden of Heart Disease and Stroke in WI 2017
https://www.dhs.wisconsin.gov/publications/p01170-19-heartdisease.pdf

Definition of CHD

- Chronic disorder that spans multiple decades
  - Defined phases:
    - asymptomatic
    - stable angina (chronic coronary syndrome)
    - progressive angina
    - unstable angina or acute MI (acute coronary syndrome)
  - May also present as ischemia without clinical symptoms or ischemia due to coronary vasospasm (Prinzmetal's angina) or microvascular disease
  - Patients transition from ACS to CCS

Figure 1 Schematic illustration of the natural history of chronic coronary syndromes.



Coronary Heart Disease: Part 2 Risk Factors

2013 ACC/AHA CV Risk Assessment Guidelines

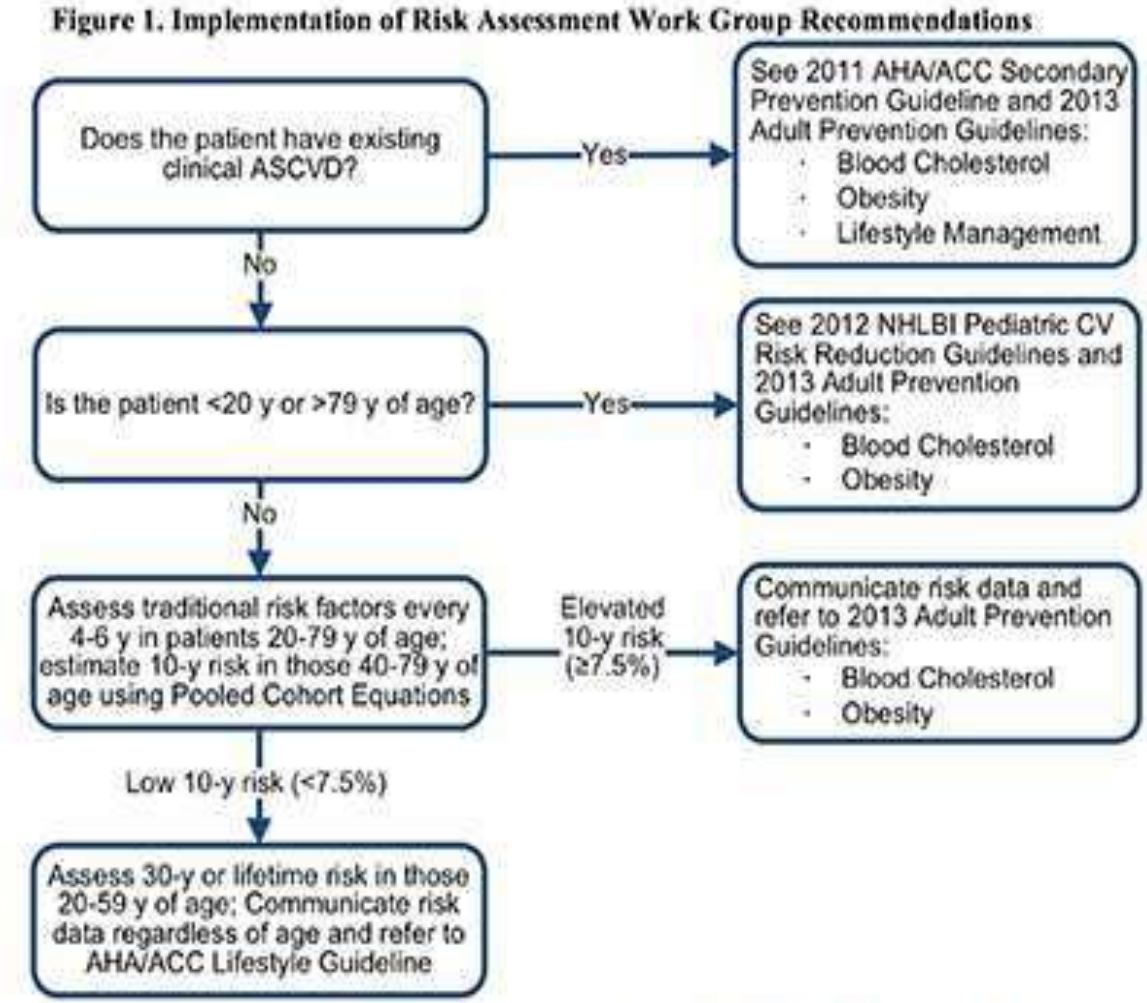


Figure 1. Implementation of Risk Assessment Work Group Recommendations

Risk Factors for ASCVD:

- ***Age***
- ***Sex***
- ***Total cholesterol***
- ***HDL-C***
- ***SBP***
- ***Take BP meds***
- ***DM***
- ***Current smoking***

Other CHD Risk Factors

Family history
Chronic kidney disease
Autoimmune diseases
Obesity
Physical inactivity
Diet
Stress
Depression
Personality type

Elevated lipoprotein(a)
Cancer
HIV
Heavy EToH use

Cardiovascular

Anger Is Fast Trigger for Heart Attack or Stroke

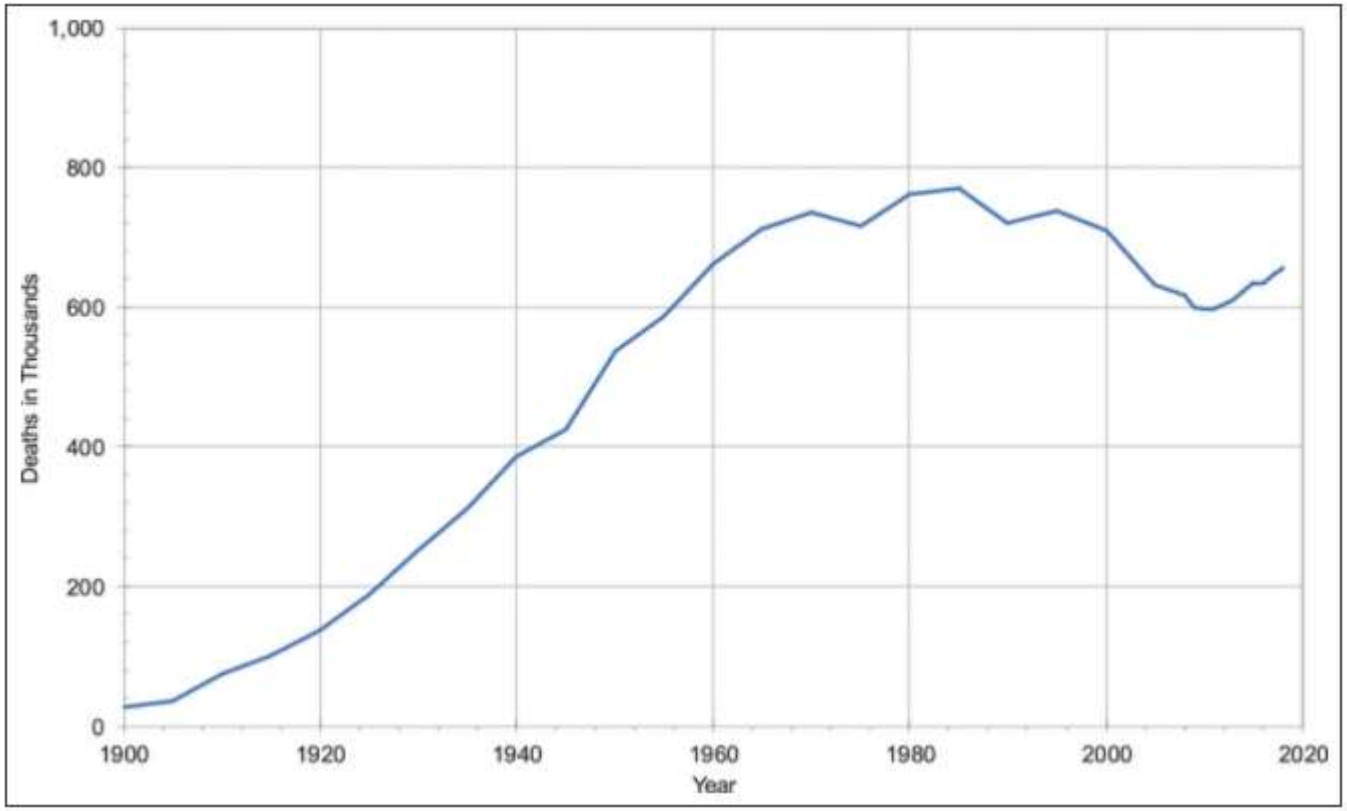
Published: Mar 3, 2014 | Updated: Mar 4, 2014

Long et al. Am J Emerg Med 2018

Risk Factors for Wisconsin

- 29.6% have HTN
- 36.1% have dyslipidemia
- 9.8% have DM
- 17.1% are current smokers (≥18 yo)
- 5.3% use e-cigarettes
- 66.2% are overweight or obese
- 21.6% had no physical activity in the past month
- 22.7% have 5 or more servings of fruits/vegetables per day
- 49.5% received a flu shot in 2016 flu season (≥65 yo)

Deaths Attributable to Heart Disease in US, 1900-2018



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CHD Mortality Rate was Declining!

- Annual death rate declined 34.4% from 2005-2015
- ~47% of the decrease was attributable to the following treatments:
  - Secondary preventive therapies after MI or revascularization
  - Initial treatments for ACS
  - Treatments for HF
  - Revascularization for stable angina
  - Primary preventive therapies

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CHD Mortality Rate was Declining!

- ~44% was attributable to changes in RF:
  - Lower total cholesterol (24%)
  - Lower SBP (20%)
  - Lower smoking prevalence (12%)
  - Decreased physical inactivity (5%)
  - Nevertheless, these favorable improvements in RF are offset by increases in BMI (8%) and in DM prevalence (10%)

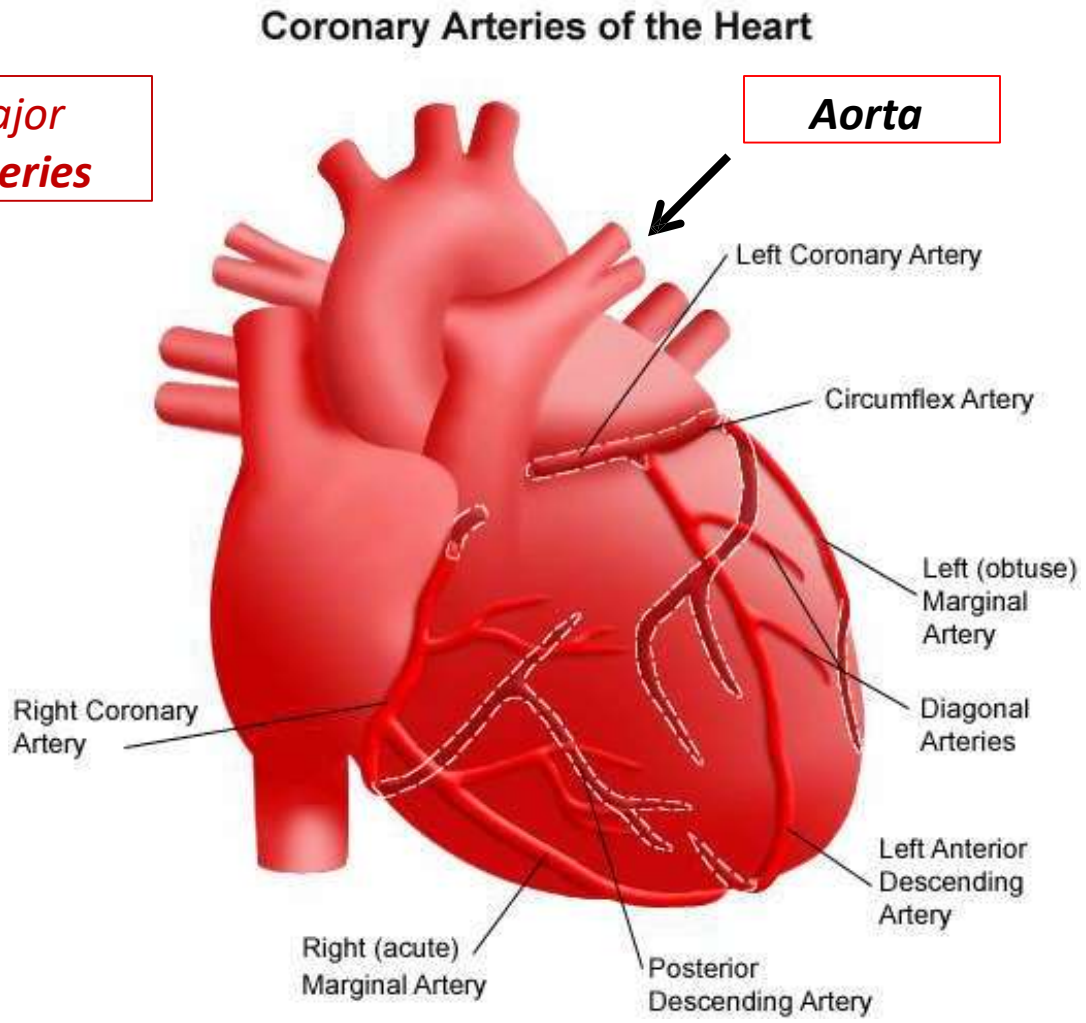
What is my role?

- Educate patients about the risk factors for heart disease
- Remind the public on the signs/symptoms of heart attack and stroke
- Support patients who are living with heart disease
- Educate the public about heart healthy living
- Be an example to your family and patients

Coronary Heart Disease: Part 3 Coronary Circulation and Atherosclerosis

Coronary Macrocirculation

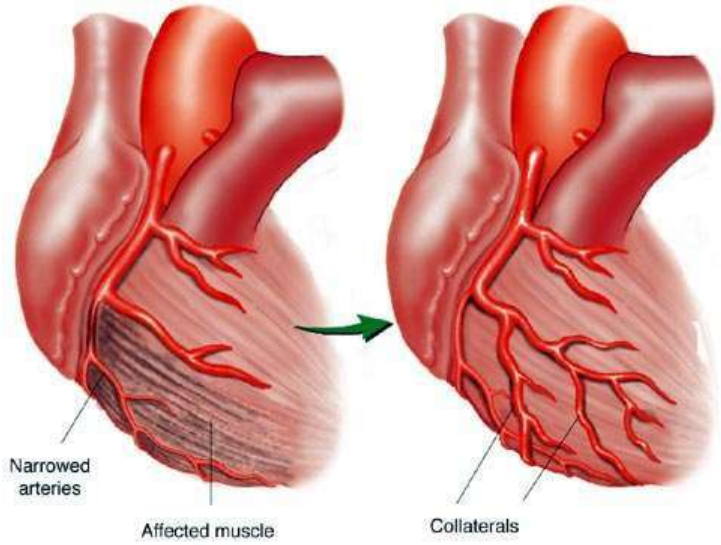
Circle the major ***Epicardial Arteries***



Macrocirculation Continued

Collaterals- vessels that branch off epicardial arteries

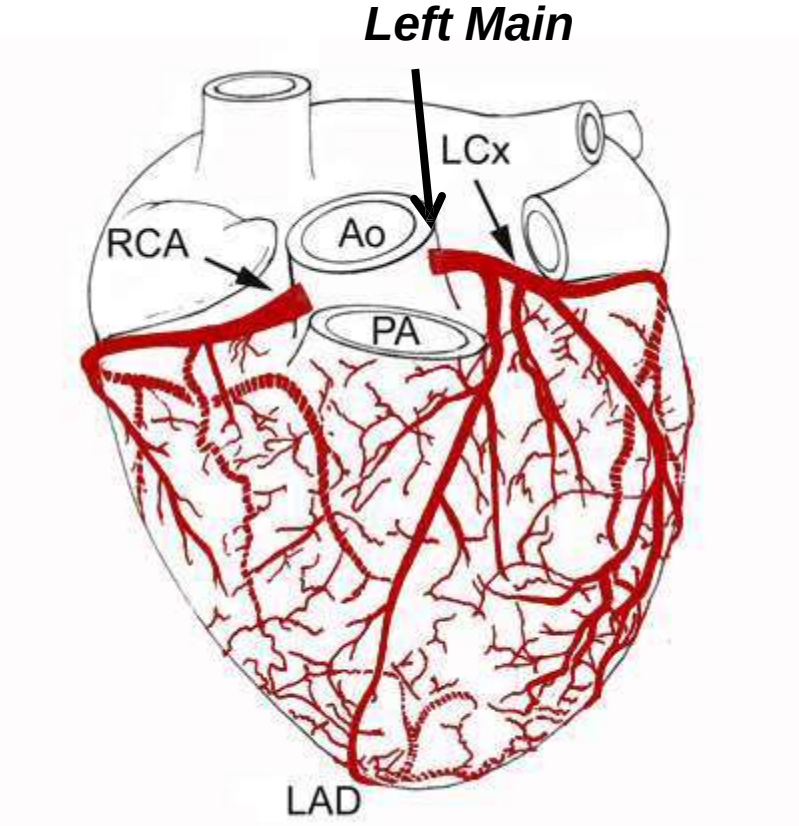
- Normally poorly developed in young people
- Become enlarged in older patients, particularly those with CHD, to supply blood to tissue downstream from an occluded epicardial artery



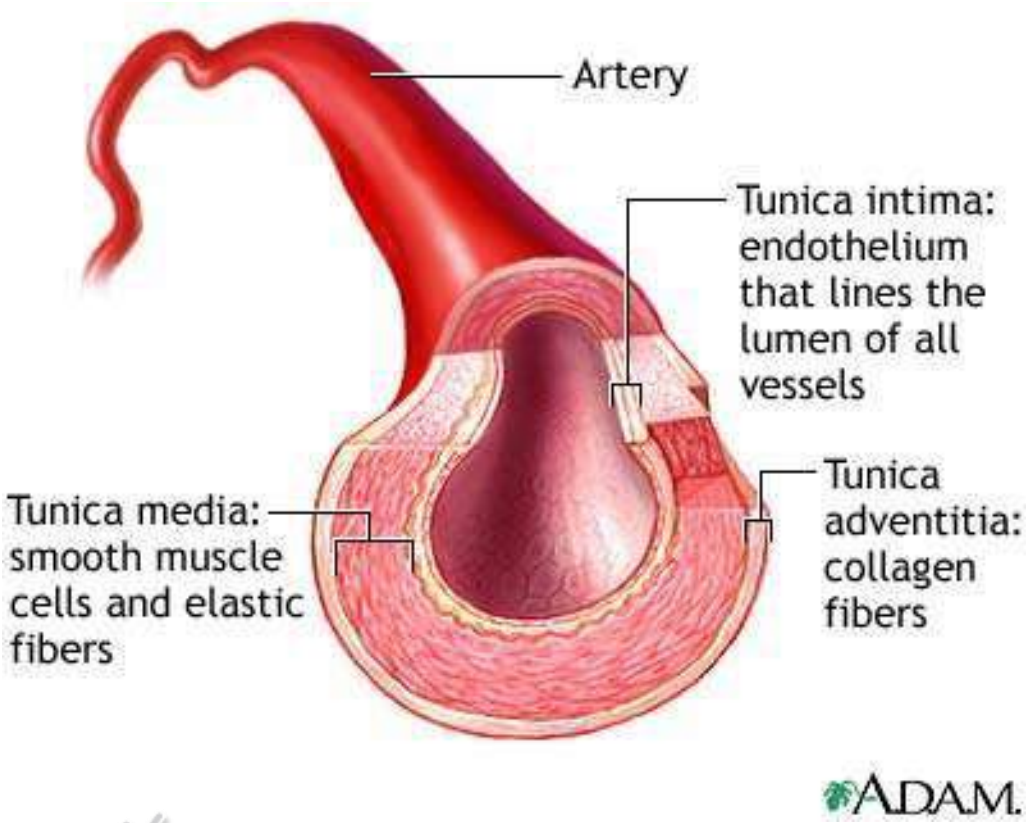
Coronary Microcirculation

Intramyocardial arteries and arterioles- transverse the ventricles to penetrate the muscle layer (myocardium) and reach the inner lining (endocardium)

- When do these arteries supply blood to the myocardium during the cardiac cycle?



Coronary Heart Disease is an Inflammatory Disease!



"You are as old as your endothelium."

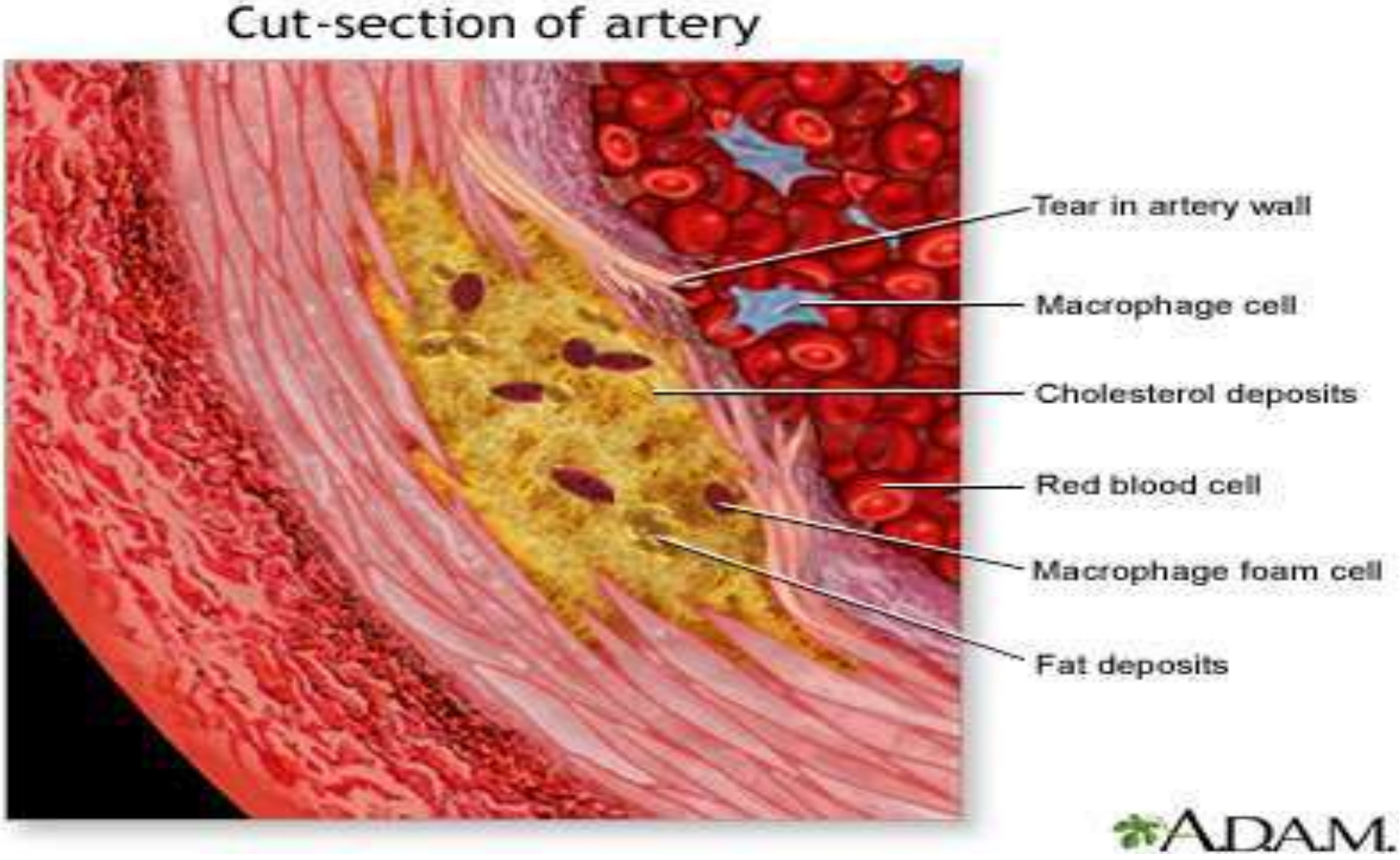
Ralph Altschul 1954

Vascular Endothelium

- Vascular endothelium function includes:
  - Protective surface
  - Barrier between blood and smooth muscle
  - Promotes vascular smooth muscle relaxation
- Damaged endothelium is vulnerable to vasoconstriction, thrombogenesis, and atherosclerosis
  - Causes:
  - Therapies that promote endothelial health:

Atherosclerosis Review

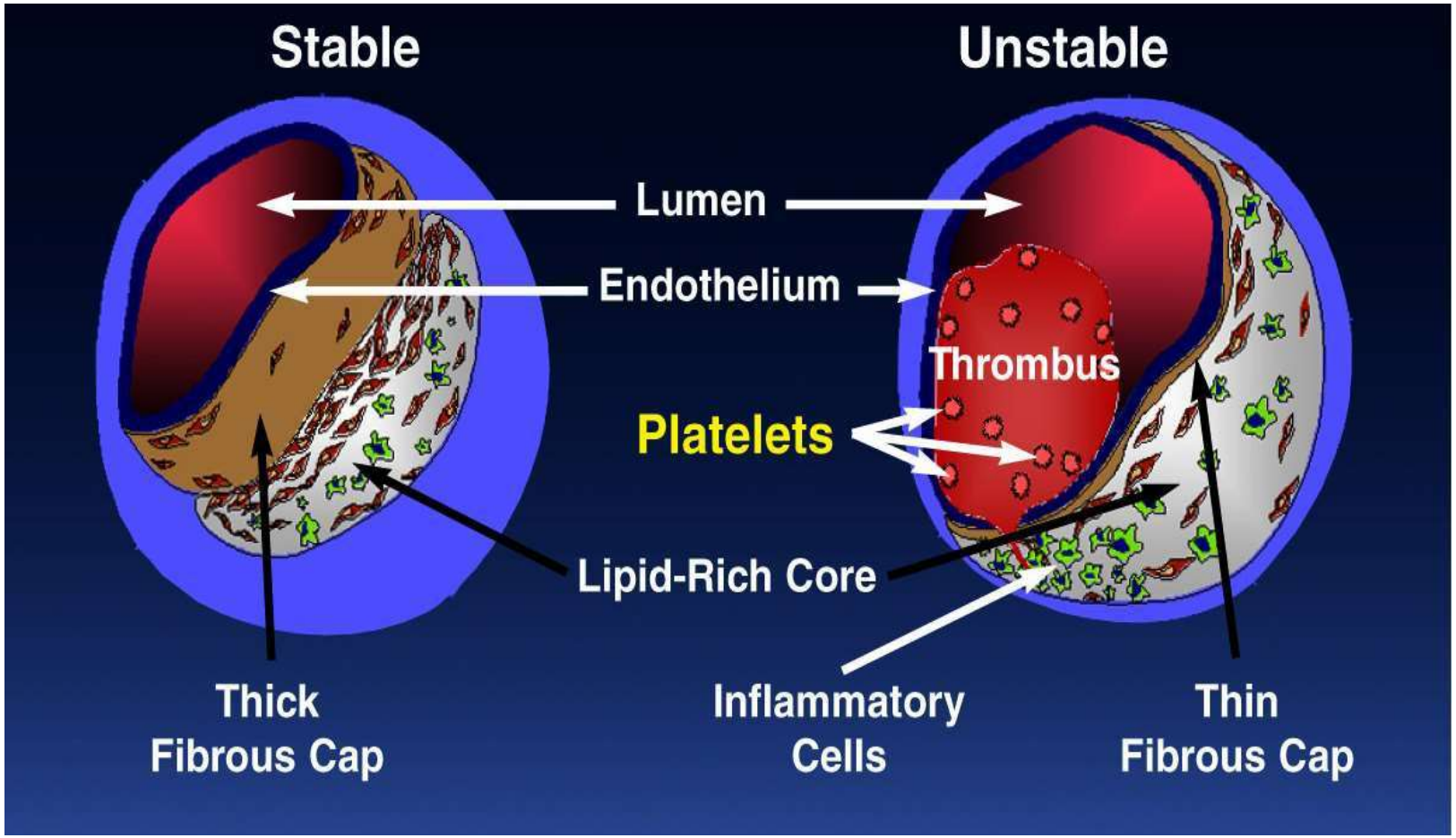
- Atherosclerotic lesions develop from the deposition of LDL cholesterol into the intima of the vessel wall
- LDL is then oxidized which recruits monocytes that differentiate into macrophages
- Autoantibodies formed against oxidized LDL cause increased uptake of macrophages in the vessel wall
- Macrophages phagocytize oxidized LDL to form foam cells
- Oxidized LDL is cytotoxic to endothelial cells and stimulates the release of other lipids promoting further enlargement of the atherosclerotic plaque


Cut-section of artery
Tear in artery wall
Macrophage cell
Cholesterol deposits
Red blood cell
Macrophage foam cell
Fat deposits
A.D.A.M.

Atherosclerosis Continued

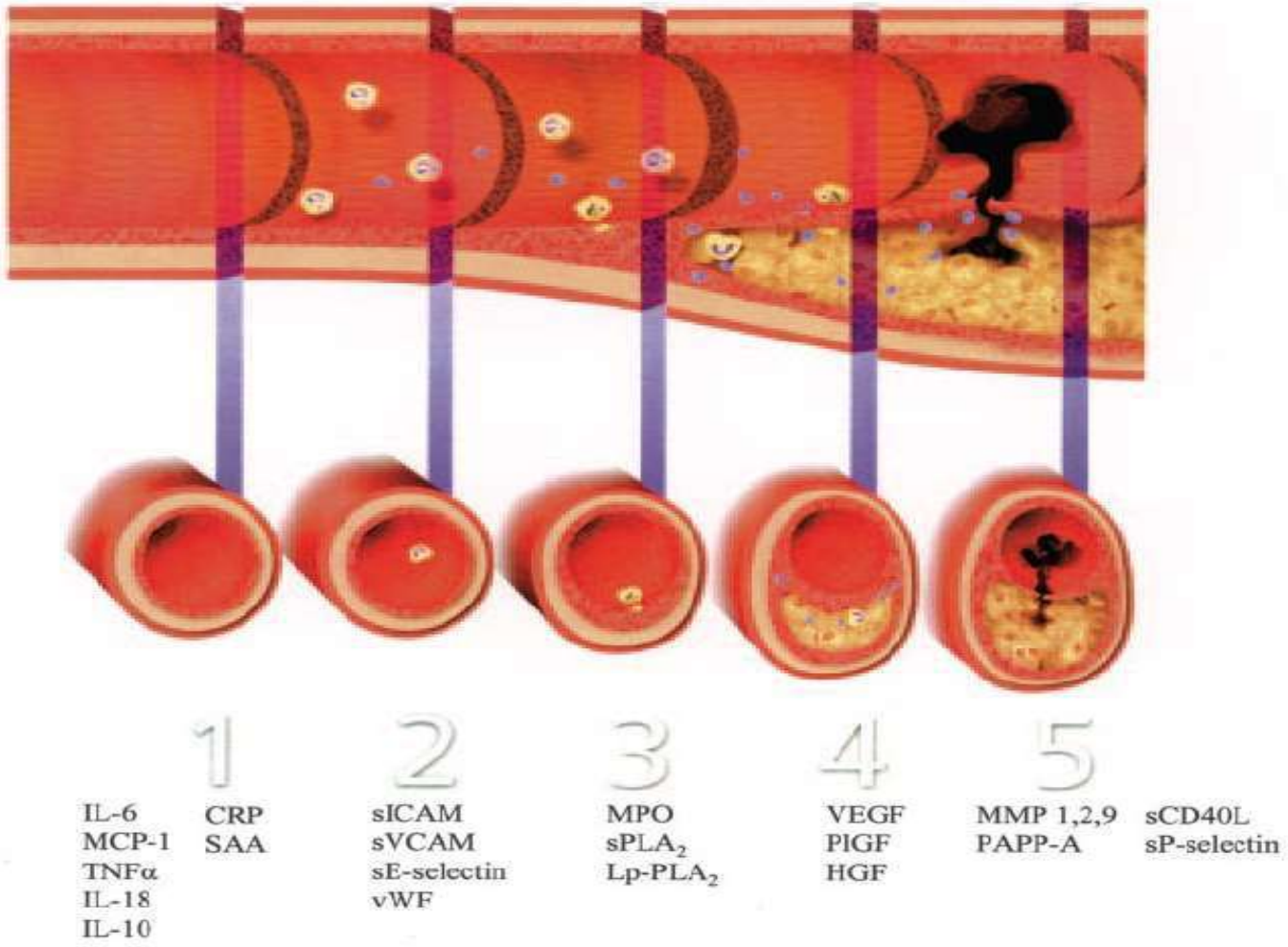
- Cytokine and growth factors are activated forming a fibrous cap through cell proliferation
- Fibrous cap protects underlying core of lipids, collagen, calcium, and inflammatory cells
- Maintenance of fibrous cap is important to prevent rupture and thrombosis
  - Risk factors for rupture include:

Plaque Types and Stability

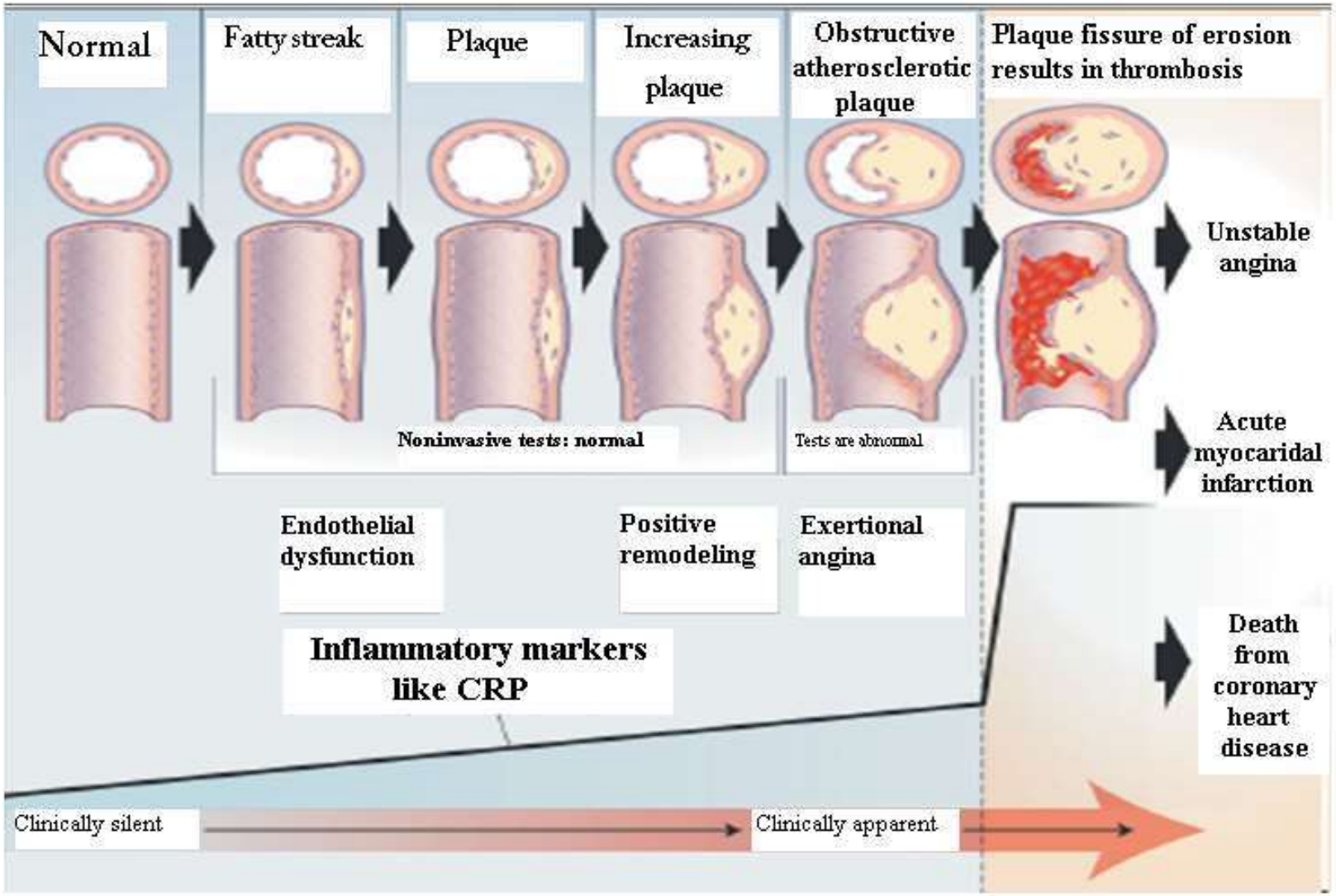


Adapted from Circulation 1995;92:657-671

Serum Inflammatory Markers and CHD



Adapted from Circulation 2006;113:72-75



Adapted from NEJM 2005;352:2524-2533

Coronary Heart Disease: End of Part I