Coronary Artery Disease In Older Adults

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UW/CME
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FACULTY DISCLOSURE DECLARATION

FINANCIAL OR OTHER RELATIONSHIP(S) DISCLOSURE:

Dr. Chen has indicated that he has not had financial or other relationships with commercial interests, related to this presentation, within the past 12 months.

Objectives

- Describe the pathophysiology of CAD
- Understand the risk factors and treatment of CAD in older adults
- Understand how the presentation and management of CAD can differ in older adults

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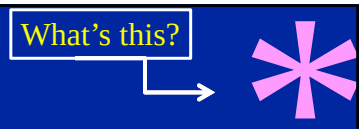
General Points



- The presentation of CAD in older adults can be atypical
- Few patients ≥ 75 or 80 y/o included in randomized trials
- Large % of eligible older patients not receiving evidence-based therapy
- Older adults often stand to benefit the most from therapy but also have increased risk from therapies

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Outline

Epidemiology

Manifestations

Risk Factors & Risk Factor Management

Secondary Prevention

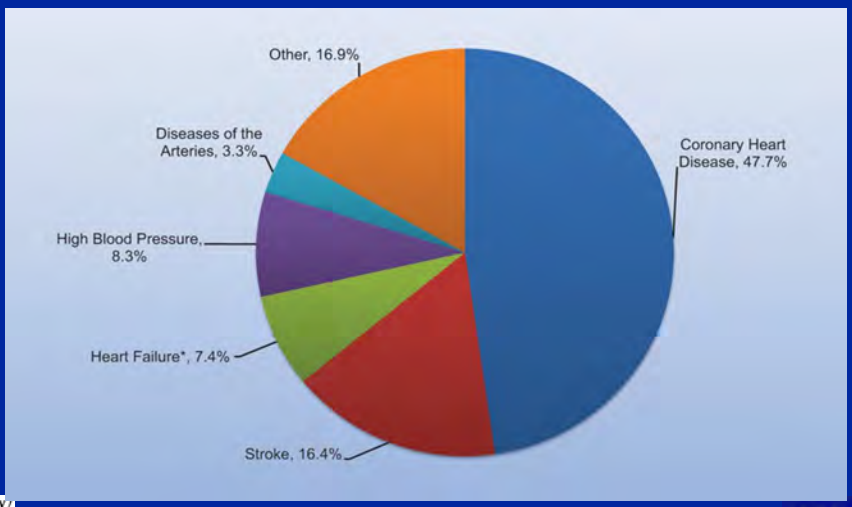
Acute Care

Coronary Artery Disease
Epidemiology

- Most preventable CVD; in the U.S. each year:
  - 375,467 deaths in 2021
    - 80% in those >65y
  - 805,000 MI per year
    - 605,000 1st; 200,000 are recurrent
- ≥ 75y
  - 30% of patients with stable CAD (>3 million)
  - 30-40% of all hospitalized with ACS

2023 Heart Disease & Stroke Statistics

Percentage of deaths attributable to cardiovascular disease (United States: 2011)



HARBORVIEW American Heart Association.

Dariush Mozaffarian et al. Circulation. 2015;131:e29-e322

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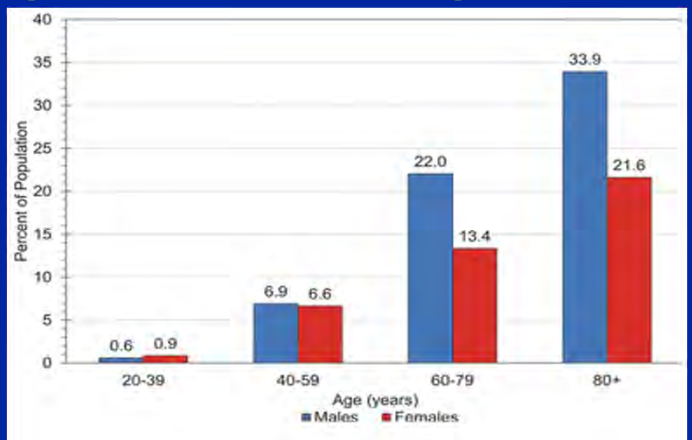
Prevalence of CAD per 100,000 by Age and Sex (NHANES 2015-2018)



Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Health and Nutrition Examination Survey (NHANES,) public use data files. Accessed April 15, 2021. https://www.cdc.gov/nchs/nhanes/. Reprinted with permission from Tsao CW, et al. *op. cit.* Copyright 2022 American Heart Association, Inc.

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Coronary Artery Disease

- Atherosclerosis appears early in childhood and correlates with risk factors
- Autopsy studies of trauma victims have demonstrated fatty streaks in coronary atherosclerosis in a high % of young men
- The atherosclerotic process can be greatly slowed by preventive measures

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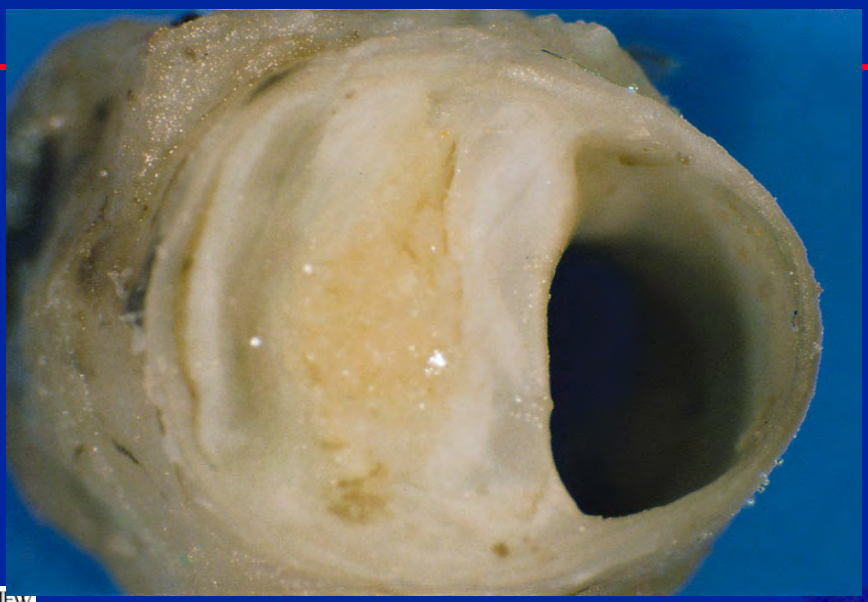

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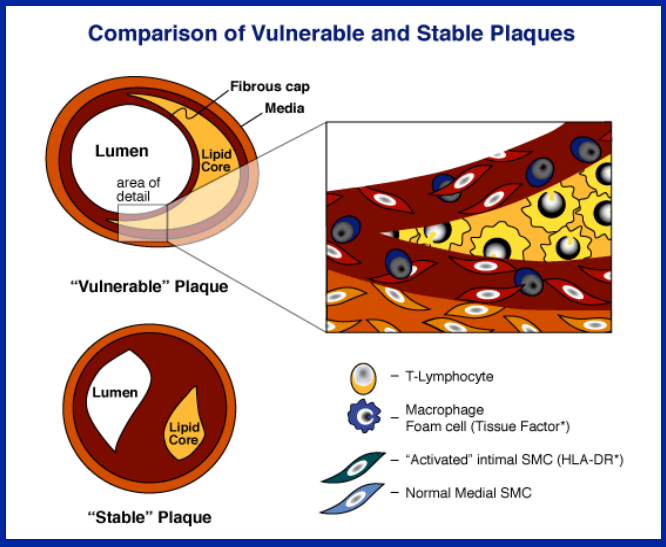
Coronary Artery Disease



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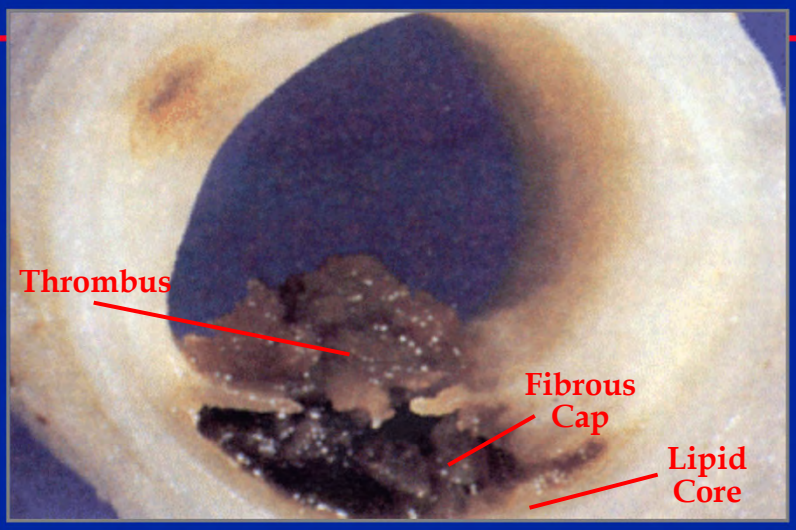

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Coronary Artery Disease
Clinical Manifestations

- **Angina Pectoris**
  - Pain/Pressure/Squ
  - Exertional
  - Relieved by rest or
- **Acute Coronary Sy**
  - **Unstable Angina**
    - Accelerating pain/
    - High risk for MI
- **Myocardial Infarct**
  - **Blood test evidenc**
  - **Non-ST elevation**

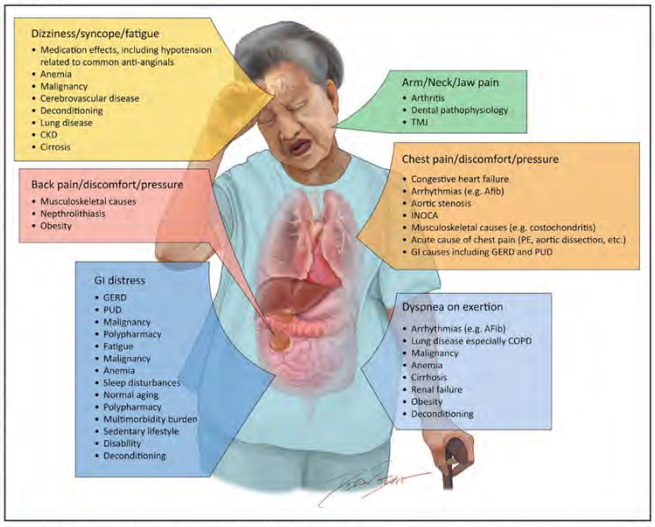

Figure 2. Interpretation of symptoms in older adults with multimorbidity.
Some of the multitude of symptoms that are potentially associated with stable ischemic heart disease in older adults and examples of the potential competing conditions that can contribute to the burden of that particular symptom. Afib indicates atrial fibrillation; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; GERD, gastroesophageal reflux disease; GI, gastrointestinal; INOCA, ischemia with nonobstructive coronary arteries; PE, pulmonary embolism; PUD, peptic ulcer disease; and TMJ, temperomandibular joint.

Stable Coronary Syndromes

- Initial Strategy: Medical Therapy
  - Multiple randomized controlled trials (with limitations) and current guideline recommendations
  - Revascularization indicated in patients with breakthrough symptoms and those with high-risk anatomy
- Medical Therapy & Revascularization
  - Present unique challenges: multimorbidity, polypharmacy, variable goals and priorities
  - Symptoms & QOL

Question

- Which of the risk factors for CAD that has been identified in younger adults is NOT a risk factor in patients ≥ 75 years old?
  a) Hypertension
  b) Dyslipidemia (LDL, HDL, TG)
  c) Diabetes
  d) Cigarette Smoking
  e) Physical Inactivity
  f) Obesity

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Question

- Which of the risk factors for CAD that has been identified in younger adults is NOT a risk factor in patients ≥ 75 years old?
  a) Hypertension
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  c) Diabetes
  d) Cigarette Smoking
  e) Physical Inactivity
  f) Obesity

All are risk factors!

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Coronary Artery Disease
Risk Factors

- **Modifiable Risk Factors**
  - Hypertension
  - Dyslipidemia (LDL, HDL, TG)
  - Diabetes
  - Cigarette Smoking
  - Physical Inactivity
  - Obesity
- **Non-modifiable Risk Factors**
  - Family History (1°M < 55y, F < 65y)
  - Gender
  - Age (M ≥ 45y, F ≥ 55y)
- **Emerging Risk Factors**
  - Homocysteine
  - Inflammatory factors
    - C-reactive protein
    - LP-PLA2
  - Infectious factors

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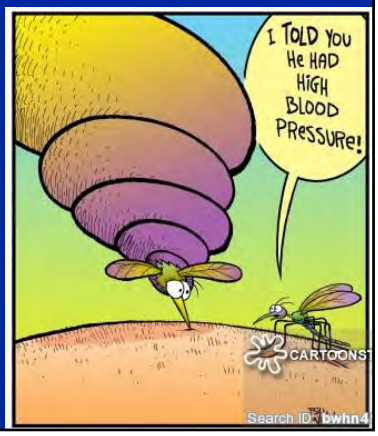
Hypertension



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HTN & Older Adults

- HTN prevalence ~70% in those ≥ 65y age, with a lifetime risk of 90%
- Most prevalent modifiable risk factor with greatest population attributable risk for CAD, Cerebrovascular disease and PAD
- > 70% of older adults with incident MI, stroke, acute aortic syndromes, and heart failure have HTN

Lloyd-Jones DM, et al. JAMA. 2005;294:466; Aronow WS, et al. Circulation. 2011;123:2434; RogerVL, et al. Circulation. 2012;125:e12.

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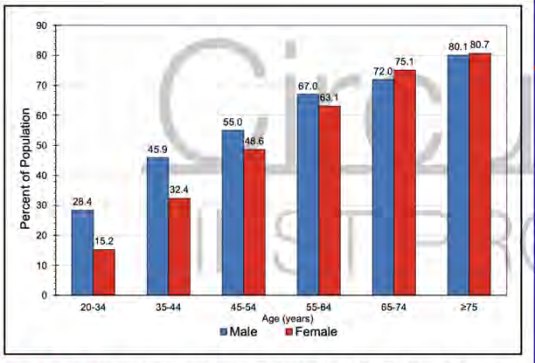

Chart 8-1. Prevalence of hypertension in US adults ≥20 years of age by sex and age (NHANES 2017–2020).
In March 2020, the COVID-19 pandemic halted NHANES field operations. Because data collected in the partial 2019 to 2020 cycle are not nationally representative, they were combined with previously released 2017 to 2018 data to produce nationally representative estimates.[119] Hypertension is defined in terms of NHANES BP measurements and health interviews. A person was considered to have hypertension if he or she had SBP ≥130 mm Hg or DBP ≥80 mm Hg, if he or she said "yes" to taking antihypertensive medication, or if the person was told on 2 occasions that he or she had hypertension.

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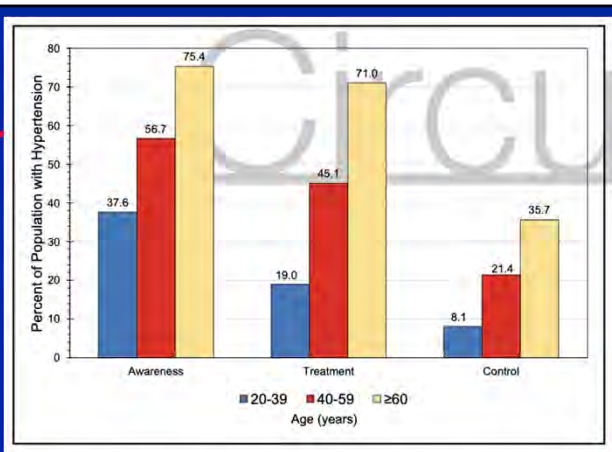

Chart 8-4. Extent of awareness, treatment, and control of HBP by age, United States (NHANES 2017–2020).
In March 2020, the COVID-19 pandemic halted NHANES field operations. Because data collected in the partial 2019 to 2020 cycle are not nationally representative, they were combined with previously released 2017 to 2018 data to produce nationally representative estimates.[119] Hypertension is defined in terms of NHANES BP measurements and health interviews. A person was considered to have hypertension if he or she had SBP ≥130 mm Hg or DBP ≥80 mm Hg or if he or she said "yes" to taking antihypertensive medication.

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HTN & CVD Risk

- The BP relationship to risk of CVD is continuous, consistent, and independent of other risk factors
- Each increase of 20/10 mmHg doubles the risk of CV disease across the entire BP range starting from 115/75 mmHg

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CDC. Vital signs. *MMWR*. 2011;60(4):103-8. Lewington S, et al. Lancet. 2002;360:1903–1913.

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Benefits of Lowering BP

	Average % Reduction
Stroke incidence	35 – 40%
Myocardial infarction	20 – 25%
Heart failure	50%

In the HYVET trial of 3845 ≥ 80 y, with SBP ≥ 160mmHg, treatment was associated with:

- 39% decrease in fatal stroke
- 21% decrease in all cause mortality
- 64% decrease in heart failure

Beckett NS. *NEJM*. 2008;358:1887.

Blood Pressure--Ranges

Blood Pressure Categories

American Heart Association | American Stroke Association

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

https://www.cdc.gov/bloodpressure/facts.htm

Goal blood pressure thresholds from different society guidelines according to underlying comorbidity

Underlying comorbidity	ACC/AHA[1]	ESC/ESH[2]	CHEP[3]	NHFA[4]	JHS[5]	NICE[6]	ACP/AAFP[7]	ADA[8]	KDIGO[9]
Established atherosclerotic cardiovascular disease*	<130/80	<130/80	<120/80	<120/80	<130/80	<140/90			
Heart failure	<130/80	<130/80	<120/80	<120/80	<130/80	<140/90			
Diabetes mellitus	<130/80	<130/80	<130/80	<120/80	<130/80	<140/90		<140/90¶	
Chronic kidney disease	<130/80	<130/80	<120/80	<120/80	<130/80	<140/90			<120/80
High cardiovascular risk△	<130/80	<130/80	<120/80	<120/80	<130/80	<140/90			
Older adults◇	<130/80	<140/80	<120/80	<120/80	<140/90	<140/90	<150/90§		
No comorbidity	<130/80	<130/80	<140/90	<140/90	<130/80	<140/90			

All targets listed are predicated on therapy being well tolerated. (In general, if a patient cannot tolerate the target blood pressure, then the target must be adjusted upward.)

All values are in mmHg. All targets assume that blood pressure is monitored optimally (eg, with standardized office measurement, automated oscillometric blood pressure monitoring).

ACC/AHA: American College of Cardiology/American Heart Association; ACP/AAFP: American College of Physicians/American Academy of Family Physicians; ADA: American Diabetes Association; CHEP: Canadian Hypertension Education Program; ESC/ESH: European Society of Cardiology/European Society of Hypertension; JHS: Japanese Hypertension Society; KDIGO: Kidney Disease Improving Global Outcomes; MI: myocardial infarction; NHFA: National Heart Foundation of Australia; NICE: National Institute for Health and Care Excellence (United Kingdom).

* Established atherosclerotic cardiovascular disease includes patients with prior MI, stroke, and peripheral artery disease.

¶ ADA suggests a lower target (<130/80) mmHg in patients with diabetes at high cardiovascular risk.

△ Defined as an elevated calculated 10-year risk of having an atherosclerotic cardiovascular event; "elevated" in this context often means ≥10 or ≥15% 10-year risk.

◇ CHEP and JHS define older adults as ≥75 years, ACP/AAFP defines older adults as ≥60 years, and other societies define older adults as ≥65 years.

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UptoDate, February, 2024

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Benefits of Lifestyle Modifications on Blood Pressure

Modification	Approximate SBP reduction
Weight reduction	5–20 mmHg/10 kg wt loss
Adopt DASH diet	8–14 mmHg
Sodium reduction	2–8 mmHg
Physical activity	4–9 mmHg
Moderation of EtOH consumption	2–4 mmHg

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HTN & CVD in Older Adults: Pearls

- Because of physiologic changes in the arteries, systolic HTN in 90% of those >70y
- Older women's HTN is more difficult to control
- Most older adults will require at least 2 agents
- NSAID use & dietary indiscretion (Na^{2+}) can worsen control

Lloyd-Jones DM, et al. *JAMA*. 2005;294:466.

Anti-HTN therapy for older adults based on comorbidities

Compelling Indication	Initial Therapeutic Choice
Heart failure	Thiazide, β-blocker, ACE inhibitor, angiotensin receptor antagonist, calcium channel blocker, aldosterone antagonist
Previous myocardial infarction	β-Blocker, ACE inhibitor, aldosterone antagonist, angiotensin receptor antagonist
CHD or high-risk CVD	Thiazide, β-blocker, ACE inhibitor, calcium channel blocker
Angina pectoris	β-Blocker, calcium channel blocker
Aortopathy/aortic aneurysm	β-Blocker, angiotensin receptor antagonist, ACE inhibitor, thiazide, calcium channel blocker
Diabetes mellitus	ACE inhibitor, angiotensin receptor antagonist, calcium channel blocker, thiazide, β-blocker
Chronic kidney disease	ACE inhibitor, angiotensin receptor antagonist
Recurrent stroke prevention	Thiazide, ACE inhibitor, angiotensin receptor antagonist, calcium channel blocker
Early dementia	Blood pressure control

Most patients will require combination therapy. ACE indicates angiotensin-converting enzyme; CHD, coronary heart disease; and CVD, cardiovascular disease.
Adapted from Aronow et al[97] with permission. © 2011, American Heart Association, Inc.

Lipids

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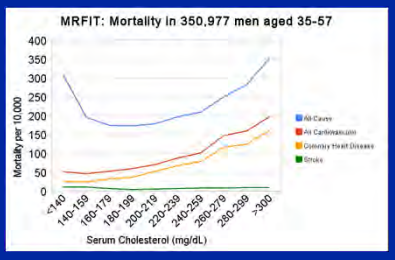
Lipids, CAD and Older Adults

- U shaped association between total cholesterol and total mortality
  - Exaggerated in the elderly



- Likely due to an increase in cancer, malnutrition and other comorbidities
- LDL cholesterol is strongly associated with CAD events in older adults
  - Although relative risk decreases with age, absolute or attributable risk increases

Wong ND, et al. *Ann Intern Med*. 1991;115:687; Lewington S, et al. *Lancet*. 2007;370:1829–1839.

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ATP III Classifications

Total Cholesterol (mg/dL)

<200	Desirable
200 – 239	Borderline
≥240	High

LDL Cholesterol (mg/dL)

<100	Optimal
100 – 129	Near optimal
130 – 159	Borderline
160 – 189	High
≥190	Very High

Triglycerides (mg/dL)

< 150	Normal
150-199	Borderline
200-499	High
500	Very high

HDL (mg/dL)

< 40	Low
>/= 60	High

TC = HDL + LDL + TG/5

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Trial (ref)	Intervention	Age Subgroup (n)	All-Cause Death RRR%/ARR%	CHD Death RRR%/ARR%	CHD Events RRR%/ARR%	Stroke RRR%/ARR%	Comment
4S[53]	S20-40 vs PL	65–70 (1021)	34/6.2*	43/6.0	34/13.3 33/7.1†	NR	↓CV admissions by 21%
LIPID[54]	P40 vs PL	65–75 (3514)	21/4.5	24/2.9*	26/3.3	12/1.3	
CARE[55]	P40 vs PL	65–75 (1283)	NR	45/4.5	32/9* 39/6.7‡	40/2.9	32% RRR/5.2% ARR for PCI/CABG
HPS[56]	S40 vs PL	70–80 (5806)	NR	NR	18/5.1‡	NR	9.2% ARR in primary end point in patients 75–80 y (n=1263)
PROSPER[57]	P40 vs PL	70–82 (5804)	NS	24/0.9	19/2.1‡	NS	25% ↑ cancer risk with P40
PROVE-IT TIMI 22[58]	A80 vs P40	≥70 (634)	NR	NR	40/8 LDL-C < 70 vs LDL-C ≥70 mg/dL (in death/MI/UAP*)	NR	AE rate similar to young
TNT[59]	A80 vs A10	65–75 (3809)	NS	NS	19/2.3* (A80 vs A10)	21/0.9-NS	↑LFTs w A80 vs A10
SAGE[60]	A80 vs P40	65–85 (893)	67/2.7	67/0.9 based on 8 deaths	29/3.1‡ (*P*=0.11)	Too few to compare	↑LFTs w A80 vs P40
Meta-analysis[61]		65–82 (19569)	22/3.1*	30/2.6	17/2.1‡ 26/2.3 NFMI	25/1.7	30%↓PCI/CABG

A indicates atorvastatin; AE, adverse events; ARR, absolute risk reduction; CABG, coronary artery bypass grafting; CARE, The Cholesterol and Recurrent Events; CHD, coronary heart disease; CV, cardiovascular; HPS, Heart Protection Study; LDL-C, low-density lipoprotein cholesterol; LIPID, Long-Term Intervention with Pravastatin in Ischaemic Disease; LFTs, liver function tests; MI, myocardial infarction; NFMI, nonfatal myocardial infarction; NR, not reported; NS, not significant; P, pravastatin; PCI, percutaneous coronary intervention; PL, placebo; PROSPER, PROspective Study of Pravastatin in the Elderly at Risk; PROVE IT–TIMI 22, Pravastatin or Atorvastatin Evaluation and Infection Therapy–Thrombolysis in Myocardial Infarction 22; S, simvastatin; w, with; RRR, relative risk reduction; SAGE, Study Assessing Goals in the Elderly; TNT, Treating New Targets; and UAP, unstable angina.

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Fleg JL, et al. Circ. 2013;128:1

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Lipids and CAD

- Good evidence for secondary prevention w/ medications to ~85y/o (mostly subgroup analysis)
  - Unless issues of polypharmacy, comorbidity, frailty make treatment seem unwise/unwanted
- RCT data suggest a 1-3 year lag time for benefits for CAD and stroke end points
- Statins also reduce stroke risk and PAD symptoms
- Case series suggest statins can contribute to cognitive dysfunction/memory loss

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Fleg JL, et al. Circ. 2013;128;1; Afilalo J, et al. JACC. 2008;51:37;Baigent C, et al.Lancet. 2010;376:1670.

Adverse Events

- Case series suggest statins may be associated with cognitive dysfunction/memory loss
- Many clinical trials did not find a difference in adverse events in older vs. younger
- Aggressive lipid lowering trials had higher rates of abnormal LFTs
- Muscle abnormalities (from myalgias to rhabdo) are difficult to tease out
  - Often dose related
  - More common in women, small stature/low BMI, use of fibrates, cytochrome p450 agents (lova,simva,atorva), use during surgery, with renal/hepatic dysfunction, fatty liver, hypothyroidism, DM, heavy EtOH use
- Avoid fibrates (esp. Gemfibrozil) + Statins

Roberts CG, et al. J Gerontol A Biol Sci Med Sci.2007;62:879; Tomaszewski M, et al.Pharmacol Rep. 2011;63:859; McKenney JM, et al. Am J Cardiol. 2006;97:89C.

Lipid Management

- Lifestyle modifications
  - Diet, Exercise (including Cardiac Rehab)
- ACC/AHA Risk calculator (only up to age 79)
  - https://tools.acc.org/ascvd-risk-estimator-plus/#!/calculate/estimate/
  - **10-year risk for ASCVD is categorized as:
    Low-risk (<5%)
    Borderline risk (5% to 7.4%)
    Intermediate risk (7.5% to 19.9%)
    High risk (≥20%)
    Indicates a field required to calculate current 10-year ASCVD risk for patients age 40-79 or Lifetime risk for patients age 20-59. Risk will automatically calculate once these fields are populated.

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Table 1. High-Intensity and Moderate-Intensity Statin Therapy, According to 2013 American College of Cardiology–American Heart Association (ACC-AHA) Cholesterol Guidelines.

High-intensity statin therapy
Daily dose lowers LDL cholesterol level by approximately ≥50% on average
Recommended: atorvastatin, 40 to 80 mg; rosuvastatin, 20 to 40 mg
Moderate-intensity statin therapy
Daily dose lowers LDL cholesterol level by approximately 30 to <50% on average
Recommended: atorvastatin, 10 to 20 mg; rosuvastatin, 5 to 10 mg; simvastatin, 20 to 40 mg; pravastatin, 40 to 80 mg; lovastatin, 40 mg; extended-release fluvastatin, 80 mg; fluvastatin, 40 mg twice a day; pitavastatin, 2 to 4 mg

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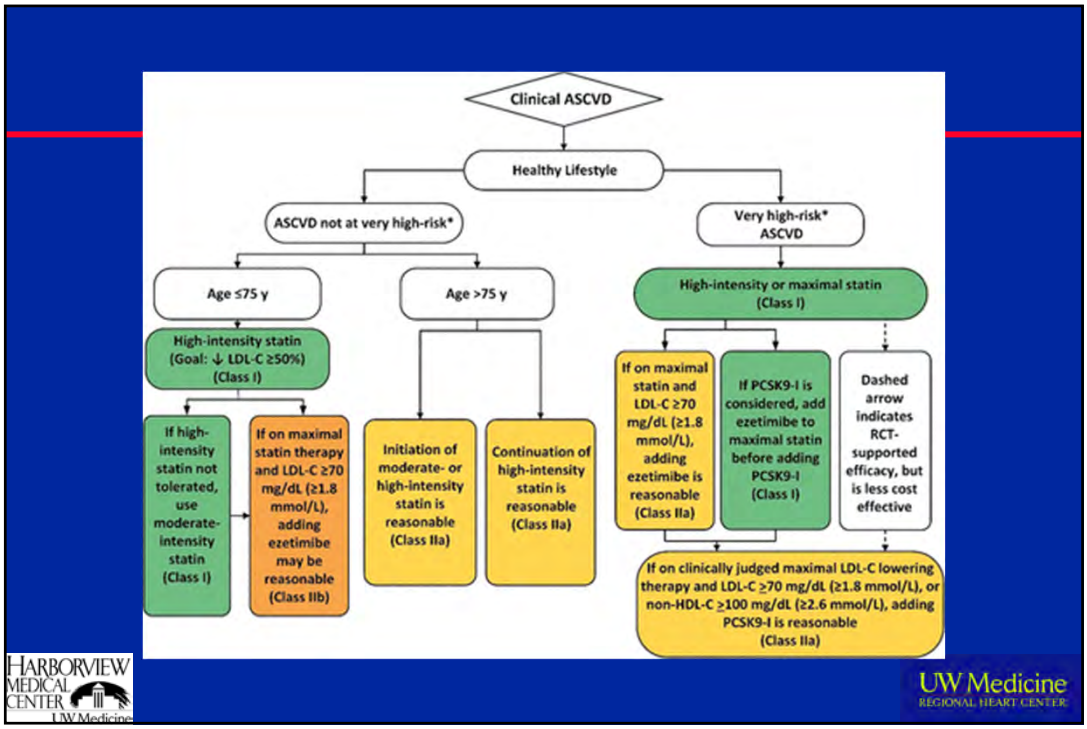
Keaney JF, et al. NEJM 2014:370:275.


Clinical ASCVD
Healthy Lifestyle
ASCVD not at very high-risk*
Very high-risk* ASCVD
Age ≤75 y
Age >75 y
High-intensity or maximal statin (Class I)
High-intensity statin (Goal: ↓ LDL-C ≥50%) (Class I)
If high-intensity statin not tolerated, use moderate-intensity statin (Class I)
If on maximal statin therapy and LDL-C ≥70 mg/dL (≥1.8 mmol/L), adding ezetimibe may be reasonable (Class IIb)
Initiation of moderate- or high-intensity statin is reasonable (Class IIa)
Continuation of high-intensity statin is reasonable (Class IIa)
If on maximal statin and LDL-C ≥70 mg/dL (≥1.8 mmol/L), adding ezetimibe is reasonable (Class IIa)
If PCSK9-I is considered, add ezetimibe to maximal statin before adding PCSK9-I (Class I)
Dashed arrow indicates RCT-supported efficacy, but is less cost effective
If on clinically judged maximal LDL-C lowering therapy and LDL-C ≥70 mg/dL (≥1.8 mmol/L), or non-HDL-C ≥100 mg/dL (≥2.6 mmol/L), adding PCSK9-I is reasonable (Class IIa)
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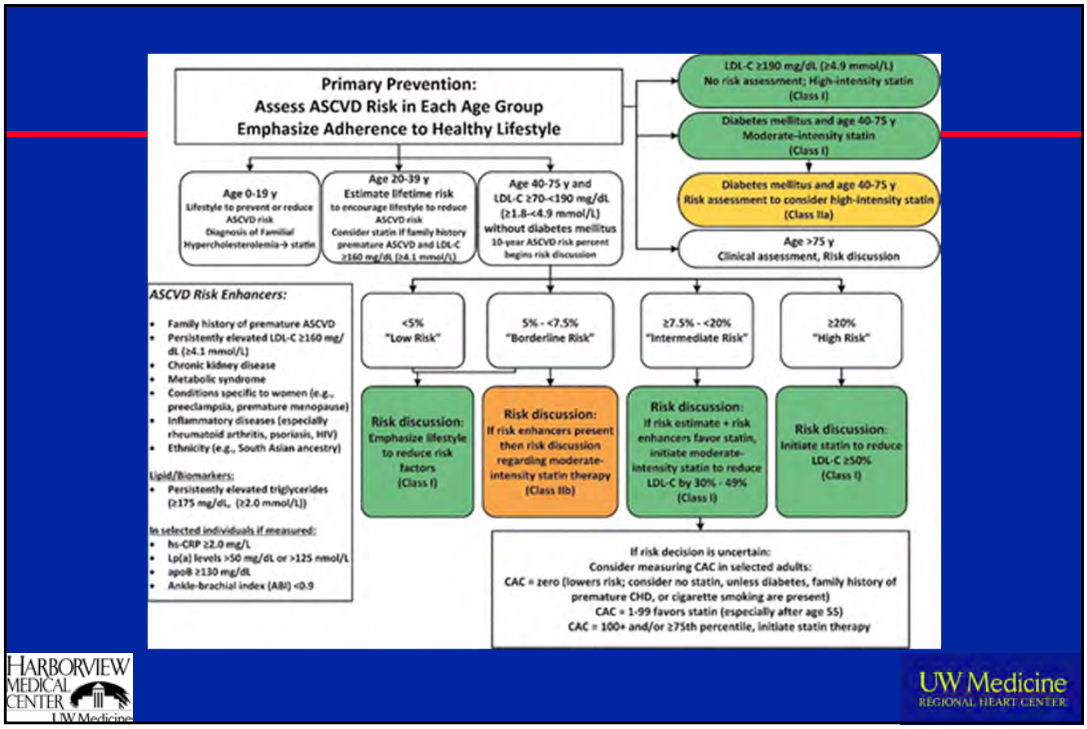
Primary Prevention:
Assess ASCVD Risk in Each Age Group
Emphasize Adherence to Healthy Lifestyle
Age 0-19 y
Lifestyle to prevent or reduce ASCVD risk
Diagnosis of Familial Hypercholesterolemia→ statin
Age 20-39 y
Estimate lifetime risk to encourage lifestyle to reduce ASCVD risk
Consider statin if family history premature ASCVD and LDL-C ≥160 mg/dL (≥4.1 mmol/L)
Age 40-75 y and LDL-C ≥70-<190 mg/dL (≥1.8-<4.9 mmol/L) without diabetes mellitus
10-year ASCVD risk percent begins risk discussion
LDL-C ≥190 mg/dL (≥4.9 mmol/L)
No risk assessment; High-intensity statin (Class I)
Diabetes mellitus and age 40-75 y
Moderate-intensity statin (Class I)
Diabetes mellitus and age 40-75 y
Risk assessment to consider high-intensity statin (Class IIa)
Age >75 y
Clinical assessment, Risk discussion
ASCVD Risk Enhancers:
Family history of premature ASCVD
Persistently elevated LDL-C ≥160 mg/dL (≥4.1 mmol/L)
Chronic kidney disease
Metabolic syndrome
Conditions specific to women (e.g., preeclampsia, premature menopause)
Inflammatory diseases (especially rheumatoid arthritis, psoriasis, HIV)
Ethnicity (e.g., South Asian ancestry)
Lipid/Biomarkers:
Persistently elevated triglycerides (≥175 mg/dL, (≥2.0 mmol/L))
In selected individuals if measured:
hs-CRP ≥2.0 mg/L
Lp(a) levels >50 mg/dL or >125 nmol/L
apoB ≥130 mg/dL
Ankle-brachial index (ABI) <0.9
<5% "Low Risk"
5% - <7.5% "Borderline Risk"
≥7.5% - <20% "Intermediate Risk"
≥20% "High Risk"
Risk discussion: Emphasize lifestyle to reduce risk factors (Class I)
Risk discussion: If risk enhancers present then risk discussion regarding moderate-intensity statin therapy (Class IIb)
Risk discussion: If risk estimate + risk enhancers favor statin, initiate moderate-intensity statin to reduce LDL-C by 30% - 49% (Class I)
Risk discussion: Initiate statin to reduce LDL-C ≥50% (Class I)
If risk decision is uncertain:
Consider measuring CAC in selected adults:
CAC = zero (lowers risk; consider no statin, unless diabetes, family history of premature CHD, or cigarette smoking are present)
CAC = 1-99 favors statin (especially after age 55)
CAC = 100+ and/or ≥75th percentile, initiate statin therapy
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Diabetes & Obesity

Diabetes

- 2021: 11.6% of the US (38 million—2 million Type 1)
- ~ 1/3 of all cases of diagnosed DM in those >/=65
- ~29% (16.5 million) of those >/= 65y have DM
- $423 Billion: Total cost 2022 of diagnosed diabetes

https://diabetes.org/about-diabetes/statistics/aboutdiabetes#:~:text=Prevalence%20in%20seniors%3A%20The%20percentage,18%20and%20older%20had%20prediabetes.

Obesity

- > 1/3 of those >/= 65y and over were obese in 2007–2010
- Prevalence 65–74 > 75 and over in both men & women
- Between 1999–2002 and 2007–2010, the prevalence of obesity among older men increased
- Additionally ~33% overweight (BMI 25-30kg/m^2)
  - So nearly 2/3 of seniors are either overweight or obese

https://diabetes.org/about-diabetes/statistics/aboutdiabetes#:~:text=Prevalence%20in%20seniors%3A%20The%20percentage,18%20and%20older%20had%20prediabetes.

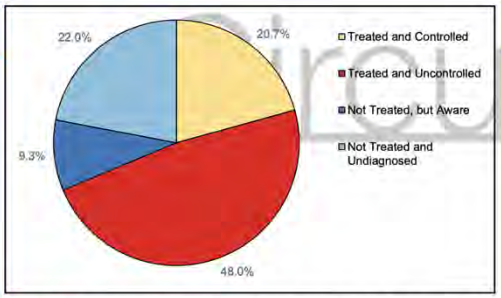


Chart 9-6. Awareness, treatment, and control of diabetes in US adults ≥20 years of age (NHANES 2017–2020).
In March 2020, the COVID-19 pandemic halted NHANES field operations. Because data collected in the partial 2019 to 2020 cycle are not nationally representative, they were combined with previously released 2017 to 2018 data to produce nationally representative estimates.[181] Controlled is defined as currently treated (taking insulin or diabetic pills to lower blood sugar) and fasting glucose <126 mg/dL. Uncontrolled is defined as currently treated (taking insulin or diabetic pills to lower blood sugar) and fasting glucose ≥126 mg/dL.

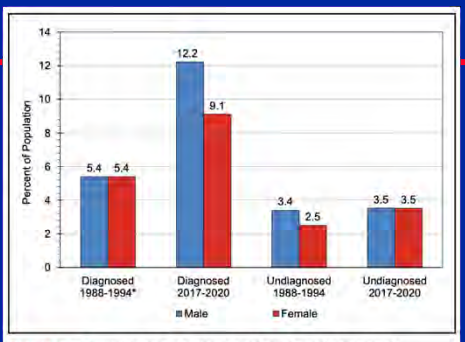
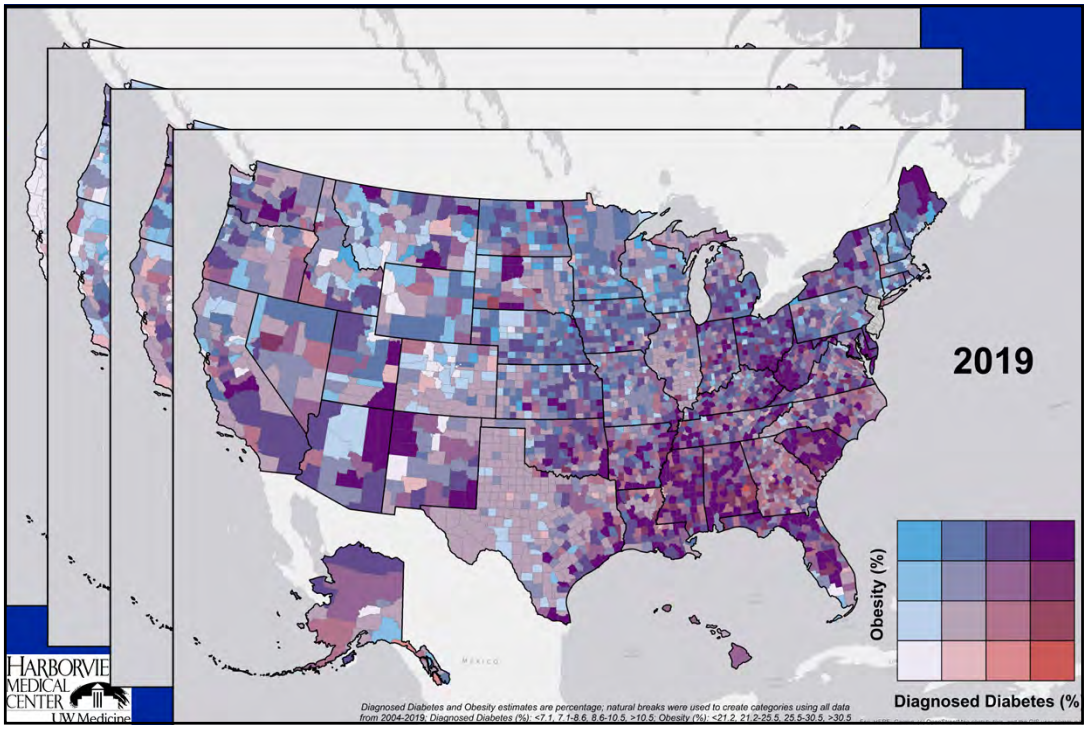


Chart 9-5. Prevalence of diagnosed and undiagnosed diabetes in US adults ≥20 years of age by sex (NHANES 1988–1994 and 2017-2020).
In March 2020, the COVID-19 pandemic halted NHANES field operations. Because data collected in the partial 2019 to 2020 cycle are not nationally representative, they were combined with previously released 2017 to 2018 data to produce nationally representative estimates.[181] The definition of diabetes changed in 1997 (from glucose ≥140 to ≥126 mg/dL).



Diabetes in Older Adults

- Increasing insulin resistance
  - Especially skeletal muscle, visceral adiposity and higher fat:lean body mass
- Decreasing insulin secretion
  - Low β-cell function
- 30% of older adults with DM have CAD 2x that of non-DM
- Especially high risk, but heterogeneous population, needing individualized care

Scheen AJ. Diabetes Metab. 2005;31(spec no 2):5S27; Røder ME, et al. J Clin Endocrinol Metab. 2000;85:2275; Selvin E, et al. Diabetes Care. 2006;29:2415.

Diabetes in Older Adults--Management

- Lifestyle: weight loss, diet, exercise
- Due to risks associated w/ intensive control, HbA1c target of 7-7.9% for most, especially those w/ comorbidities
  - Even higher in especially frail, short life expectancy
- Medication choices: Renal, hepatic disease, heart failure
  - Metformin favored, then glipizide, repaglinide
  - Insulin: ultra long-acting and very short acting prandials
- Control of concurrent HTN and dyslipidemia is critical

Ismail-Beigi F, et al. Ann Intern Med. 2011;154:554; Lee SJ, et al. J Am Geriatr Soc. 2011;59:666; Soe K, et al. Maturitas. 2011;70:151.

Obesity in Older Adults

- Decreased metabolic rate + eating habits
- Reduced physical activity
- Medications associated with weight gain
  - Hypoglycemic drugs, anti-depressants, steroids
- Obesity also associated with other RF (HTN, HLP, DM)
- Complex association with total mortality, stronger <85y, as well as cardiovascular mortality

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Poirier P, et al. Circulation. 2006;113(6):898; Roger VL, et al. Circulation. 2012;125;e12.

Obesity in Older Adults--Management

- Lifestyle: Diet, exercise
- Benefits of weight loss
  - HTN control, dyslipidemia, glucose control
  - Improved physical function, QOL
- Dietary only weight loss risks loss of muscle mass (esp. in Women)
- Exercise, including resistance training should accompany dietary changes
- Maintenance challenging

Beavers KM, et al. Am J Clin Nutr. 2011;94:767; Whelton PK, et al. JAMA. 1998;279:839; Williamson DA, et al. Arch Intern Med. 2009;169:163; Houston DK, et al. Obes Res. 2005;13:1793.

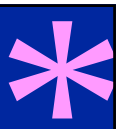
Tobacco

Smoking & Smoking Cessation

- 8.3% of those >/= 65y current smokers (about ½ of younger adults)
- ~50% of men and 30% of women are former smokers
- Risk for recurrent CAD and other vascular events
- Quitting reduces
  - Mortality by 36% and nonfatal MI by 32%
  - Sudden death
  - New/recurrent stroke
  - Claudication symptoms
  - Decline in pulmonary function
- Benefits of quitting even in those >/= 80y

https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm

Smoking & Smoking Cessation



- CV risk reduction dramatic in first 1-2 years post quitting
  - Risk of stroke falls to/near a never smoker 2-5 years post quit
- Most effective cessation programs involve structure & group support, and the use of nicotine substitutes and other medications
  - Limited data in very old

Critchley JA, et al.JAMA. 2003;290:86; Gellert C, et al. Arch Intern Med.2012;172:837; Alvarez LR, et al. Eur J Prev Cardiol. 2013;20:486; Goldenberg I, et al. Arch Intern Med. 2003;163:2301; Lee PN, et al. BMC Med. 2010;8:84.

Physical Activity

Physical Activity

- Low rates of regular physical activity in older adults
- Physical activity favorably influences CAD risk factors and improves prognosis in those with disease
- Benefits cognitive function, falls reduction, mental health and QOL
- Combinations of aerobic/endurance type training and strength training may be ideal

Thompson PD, et al.Circ. 2003;107:3109; Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Committee Report. 2008. Washington, DC: US DHHS; 2008; Audelin MC, et al. J Cardiopulm Rehabil Prev. 2008;28:163.

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Cardiac Rehabilitation

- Systematized multi-modality approach to CV risk reduction
- Usually done after a cardiac event (MI, Stenting, Valve/CABG surgery, Heart transplantation, Angina)
- Phase I, II, III
- Benefits (meta-analysis)
  - 20% reduction in all-cause mortality
  - 25% reduction in cardiac mortality

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Mechanisms of Benefit for Exercise in CHD

Anti-atherosclerotic
Improved lipid profile
Lower BP
Reduced adiposity
↑ Insulin sensitivity
↓ Inflammation

Anti-thrombotic
↓ Platelet adhesiveness
↑ Fibrinolysis
↓ Fibrinogen
↓ Blood viscosity

Anti-ischemic
↓ Myocardial O2 demand
↑ Coronary flow
↓ Endothelial dysfunction

Anti-arrhythmic
↑ Vagal tone
↓ Adrenergic tone
↑ HR Variability

Other benefits
Psychosocial

↑ Exercise Capacity
↑ Skel. Musc. Cap Density
↑ SV, CO, EF

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Cardiac Rehabilitation

- Referral and participation rates low
  - 20% referral rate
  - Medicare participation ~12% of eligible
  - Automated/protocol driven referrals are most effective
- Covered diagnoses
  - Myocardial infarction < 12 months
  - s/p Coronary artery bypass grafting
  - Stable Angina
  - s/p Valve repair or replacement
  - s/p Coronary angioplasty or stenting
  - s/p Heart or heart-lung transplant
  - Stable chronic heart failure

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Treatment of Stable CAD

- Goals
- Lifestyle measures: Diet, exercise, smoking cessation
- Medications:
  - Aspirin, other anti-platelets
  - Lipid lowering therapy
  - Antianginals
    - Beta-blockers, Calcium Channel Blockers
    - Nitrates
    - Ranolazine, Ivabradine
- Revascularization
  - Symptoms
  - High risk anatomy

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Traditional Indications for CABG

- Mortality benefits (younger patients)
  - 3v CAD
  - Left Main CAD
  - Diabetes
  - Impaired EF
- Patient selection & shared decision-making

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Revascularization in Stable CAD

- 81 y/o M h/o HTN, CVA, Afib (on Apixaban), CAD s/p NSTEMI with chronic angina.
  - Used to be able to walk 50m before stopping for CP & dyspnea
  - Now can only walk 15-20m
  - Current medications: Asa, Atorvastatin, Metoprolol Succinate, Amlodipine, Imdur, Ranolazine.
  - Also has intermittent LH, dizziness and orthostasis clinic VS: HR 60bpm, BP 117/60mmHg

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Revascularization in Stable CAD

- Has known chronic total occlusion of the circumflex.
- Nuclear vasodilator stress shows a normal LVEF, moderate area of moderate ischemia in the lateral wall
- Referred for Cath, and PCI performed to the circumflex CTO
- Discharged on Apixaban & Clopidogrel
- Medication/dose reduction done with return to prior exercise tolerance

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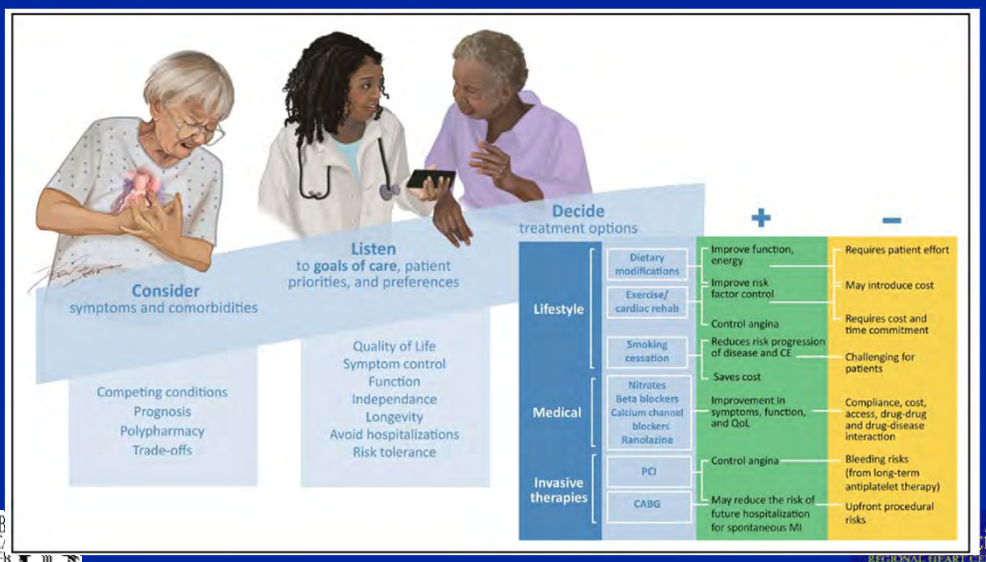
Proposed approach to stable CAD in Older Adults



Acute Coronary Syndromes

Case Presentation

- 84 y/o woman presents to the ER brought in by her family after experiencing 2 days of nausea and belching. She only informed her family of this on day 2 when she began to also have some left jaw discomfort which was worse when walking around her apartment.

Case Presentation, continued

- She has a past medical history of hypertension, hyperlipidemia, “borderline” diabetes, osteoarthritis, osteoporosis, recent c/o memory problems.
- On presentation, after 2 sl. NTG, ASA 325mg po and supplemental O2, she reports feeling better with resolved symptoms.

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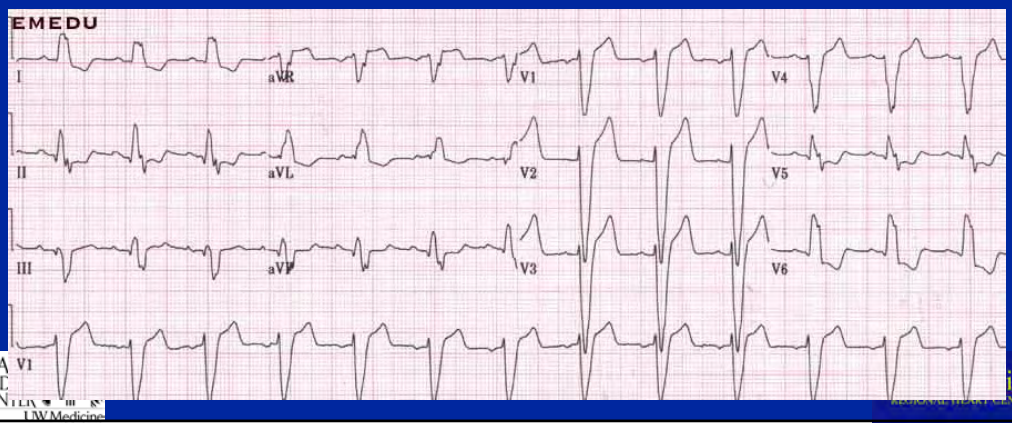
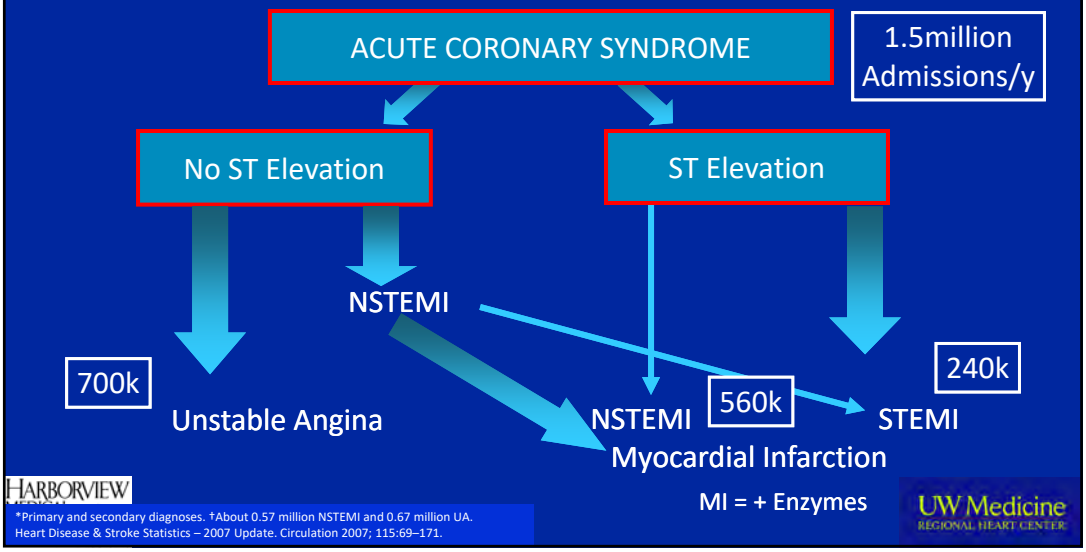
Case Presentation, continued

- Vitals: HR 94 BP 117/66 RR 15 O2sat 98% on 2L NC



Definitions



*Primary and secondary diagnoses. †About 0.57 million NSTEMI and 0.67 million UA.
Heart Disease & Stroke Statistics – 2007 Update. Circulation 2007; 115:69–171.

Case, continued

- Patient brought to Coronary Intensive Care Unit for monitoring
- Echocardiogram
- Treatment included:
  - Aspirin & Plavix
  - Heparin drip
  - Metoprolol
  - Lisinopril
  - Atorvastatin
- Cath discussed but patient declined
  - Counseling regarding smoking cessation
  - Referral to cardiac rehabilitation for further risk factor modification

CAD in Older Adults

- More calcified, tortuous and multi-vessel CAD
- Higher rates (~25%) of peripheral arterial disease
- More comorbidities
  - Renal dysfunction
- Procedural success rates high
  - E.g. PCI >90% in older adults
  - Complication rates higher (e.g. bleeding, vascular complications)
- Revascularization with PCI or CABG can have benefits in ACS
  - MACE, QOL, Anginal class, health status (TIME, COURAGE)
  - Complications higher
- CABG vs. PCI in those >75 y is not well studied

Pfisterer M et al. Circulation. 2004;110:1213; Boden WE, et al. N Engl J Med. 2007;356:1503.

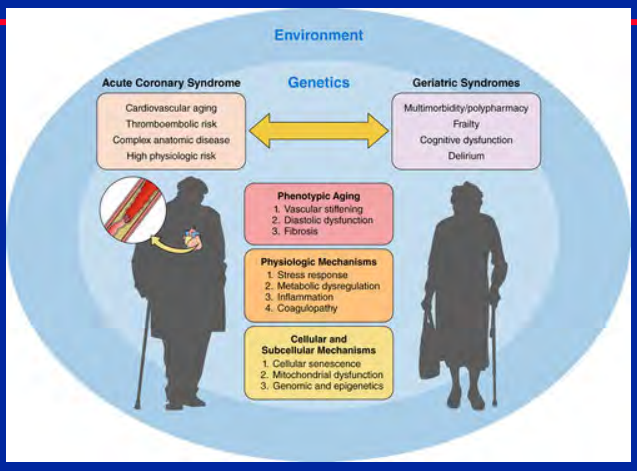


Figure 1. The bidirectional association between acute coronary syndrome and geriatric syndromes. Several factors influence this bidirectional association including phenotypic aging, physiological mechanisms, cellular and subcellular mechanisms, genetics, and the environment.

Question

- 83 y/o W presents as an urgent visit to her regular PCP's office complaining of dyspnea on exertion that began this morning. HR 90bpm, BP 130/70, 94% on RA. You obtain an ECG which shows 2mm of lateral ST depression. You transfer her to the ER where her troponin is mildly positive, and she is hospitalized for NSTEMI. Identify the true statement:

- A. Left bundle branch block is more common in middle aged than elderly patients
- B. Type II MI ("supply-demand mismatch") is less common in the elderly
- C. Because of an increased risk of catheter related complications, lytics are preferred to cath/percutaneous intervention in the very elderly
- D. In a large database, 77% of pts. <65 y/o had chest pain on presentation but only 40% of those ≥ 85 y/o
- E. In the elderly, STEMI is more common than NSTEMI

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Answer

- 83 y/o W presents as an urgent visit to her regular PCP's office complaining of dyspnea on exertion that began this morning. HR 90bpm, BP 130/70, 94% on RA. You obtain an ECG which shows 2mm of lateral ST depression. You transfer her to the ER where her troponin is mildly positive, and she is hospitalized for NSTEMI. Identify the true statement:

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- E. In the elderly, STEMI is more common than NSTEMI

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Epidemiology

- ACS: 35% of all deaths ≥ 65 y in the US
- Among people dying of ischemic heart disease, 83% are > 65y
- 60% of MI related deaths occur in the 6% of population >75y
- Age is a major predictor of mortality in ACS
- Adjusted odds for in-hospital death increases by 70% for each 10-year increase in age

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Alexander, K. P. et al. Circulation 2007;115:2549-2569

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ACS—Data/Research

- Many CAD trials have enrolled **no** pts. ≥ 75y
- Data available from
  - Some Randomized trials
  - Large (international) community registries
- Clinical Trials Population vs. Community
  - Younger, more often male, had less: renal dysfunction, HF, CVA. and renal dysfunction, as well as lower presenting HR & BP vs. community
  - Renal dysfunction (Cr >/= 2mg/dl): 9% in CRUSADE, 0.6% in VIGOUR trials

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Alexander, K. P. et al. Circulation 2007;115:2549.

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Presentation & Outcomes

- Atypical symptoms common
  - CP in only ~50% of those >85y (vs. 77-90% in <65y)
  - 1° complaint Elderly: 49% Dyspnea, 26% Diaphoresis, 24% N/V, 19% Syncope
  - Silent MIs account > 60% of MIs in those > 85y
- Elderly present later (♀, non-whites, 1st cardiac event)
- LBBB much more common in elderly (33.8%>/=85y; 5% <65y)
- ACS is more likely associated with another condition
  - "Demand Ischemia" or Type II MI
- Atypical presentation→worse prognosis (risk of in-hospital death, 13% vs. 4%)
  - Guidelines: 10-minutes to ECG for sg/sx of MI
    - CRUSADE: Ave 40 min, 7 min longer in>/= 85y vs. < 65y
    - 43% of >/= 85y had nondiagnostic ECGs (vs. 23% <65y)

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Alexander, K. P. et al. Circulation 2007;115:2549.

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Presentation & Outcomes

- Heart failure & Shock rates increase with age
- Free wall rupture in STEMI
  - Elderly who present late and get lytics—17%
- Minor and major bleeding also increased with age
  - Many elderly (>65% in >/=75y) are given doses that are too high (esp. Renally cleared) and this increases bleeding
  - Risk of ICH increased in >75y with STEMI
    - High risk for ICH: >75, W, AA, low BMI (<65kg W; <80kg M), prior CVA, SBP >160, tPA (vs. other agents)

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Alexander, K. P. et al. Circulation 2007;115:2549.

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Therapy-NSTEMI

- Risk-Treatment Paradox
  - Patients at the highest risk are treated less aggressively
  - STEMI reperfusion rates are lower in elderly, even if "ideal"
    - 80,456 Medicare pts. >65, <12h o/w eligible, 74% no RP <6h, 68% never
  - Factors associated with lack of reperfusion
    - Age >/= 75y, ♀, no CP, CHF, patient preference, contraindications
- Aspirin
  - Absolute and relative benefits greater in highest risk patients (including elderly)
  - Prescribed less often (GRACE 95% <65y vs. 87% >/=85y)
  - 24% of eligible Medicare patients not on ASA

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Alexander, K. P. et al. Circulation 2007;115:2549-2569

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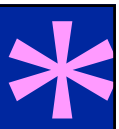
Tailored Care—From the guidelines



- Pharmacotherapy in older patients* with MI should be individualized and dose adjusted by weight and/or CrCl to reduce adverse events caused by age-related changes in pharmacokinetics/dynamics, volume of distribution, comorbidities, drug interactions, and increased drug sensitivity.
- Management decisions for older patients* with MI should be patient centered, considering patient preferences/goals, comorbidities, functional and cognitive status, and life expectancy.

*>75y

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Amsterdam EA, et al. J Am Coll Cardiol 2014;64:e139.

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Future Directions

- NIH Health Inclusion Across the Lifespan (2019)
- Studies with patient-centered outcomes
  - LIVE BETTER Trial (medications)
    - QOL, symptoms, mobilty in older adults with stable angina
- Studies of angina with non-obstructive CAD
- Geriatric Risk Models for CAD care
  - Stable & Unstable

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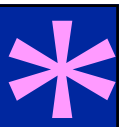
Summary



- The presentation of CAD in older adults can be atypical
- Few patients ≥ 80 y/o included in randomized trials
- Large % of eligible older patients not receiving evidence-based therapy
- Older adults often stand to benefit the most from therapy but also have increased risk from therapies
- Secondary prevention efforts are critical in reducing the burden of CAD on patients

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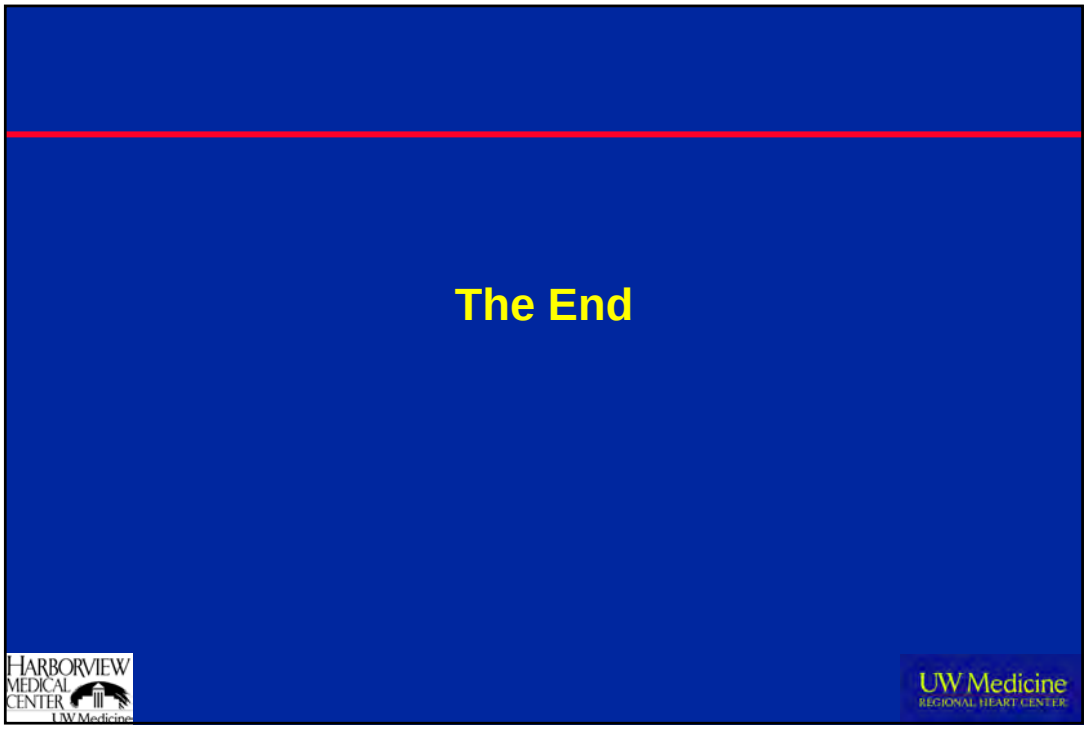
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