ABSTRACT:
The proportion of elderly population in the world is increasing with improving health care. Cardiovascular disease is the most frequent diagnosis in elderly people and is the leading cause of death in both men and women older than 65 years of age. The high morbidity and mortality from cardiovascular disease in the elderly warrant aggressive approaches to prevention and treatment that have been shown to be effective in older patients. Few trials of cardiovascular therapies have enrolled significant numbers of men or women older than 75 years of age. However, the risk of in-hospital mortality declined as a function of the number of guideline-recommended therapies given in patients aged 75 years and older, with greater benefits with use of guideline-recommended therapies in older compared to younger patients. Special attention is required as cardiovascular disease in older people is not seen in isolation. Comorbid illness may influence medical decision making and drugs need to be adjusted to creatinine clearance. The projected increase in numbers of older people from previously understudied and undertreated groups presents both medical and economic challenges for cardiovascular disease treatment.

INTRODUCTION:
Cardiovascular disease is the most frequent diagnosis in elderly people and is the leading cause of death in both men and women older than 65 years of age. The Cardiovascular disease in older people is not seen in isolation, eighty percent of older Americans have at least one chronic medical condition, and half have at least two. The prevalence of Alzheimer’s disease is estimated at 10% in community-dwelling Caucasians older than 65 years. The high morbidity and mortality from cardiovascular disease in the elderly warrant aggressive approaches to prevention and treatment that have been shown to be effective in older patients. Compelling data demonstrate reduced morbidity and mortality rates for the treatment of hypertension, heart failure, atrial fibrillation, acute coronary syndromes, stroke, diabetes, and lipid abnormalities in older patients 60-74 years of age, although data on minorities and women are limited. The projected increase in numbers of older people from previously understudied and undertreated groups presents both medical and economic challenges for cardiovascular disease treatment.

DEMOGRAPHICS / EPIDEMIOLOGY:
The proportion of people aged 65 years and older in the United States is projected to increase from 12.4% (35 million) of the population in 2000 to 19.6% in 2030 (71 million) and 82 million in 2050. The number of people older than 80 years of age is projected to double from 9.3 million in 2000 to 19.5 million in 2030 and more than triple by 2050. Global trends are similar, with the worldwide population older than 65 years of age projected to increase to 973 million or 12% in 2030 and make up about 20% of the population in 2050. Increases will be greatest in underdeveloped nations.

PATHOPHYSIOLOGY:
The World Health Organization uses 60 years of age to define “elderly”, whereas most U.S. classifications use the age of 65 years. Gerontologists subclassify older age groups into young old (60-74 years), old old (75-85 years), and very old (older than 85 years of age). Clinicians often separate older patients into two groups – those 65 to 80 years of age and those older than 80 years of age – to highlight the frailty, reduced capacity (physical and mental), and presence of multiple disorders that are more common after 80 years.

PREVALENCE AND INCIDENCE IN CORONARY ARTERY DISEASE (CAD):
Both the prevalence and severity of atherosclerotic CAD increase with age in men and women. Using electrocardiogram (ECG) evidence of myocardial infarction (MI), abnormal echocardiogram, carotid intimal thickness, or abnormal ankle-brachial index as measures of subclinical vascular disease in community-dwelling elderly in the Cardiovascular Health Study, abnormalities were detected in 22% of women and 33% of men aged 65-70 years and 43% of men and 45% of men older than 85 years. The lifetime risk of developing symptomatic CAD is estimated in 1 in 3 for men and 1 in 4 for women with onset of symptoms about 10 years earlier in men compared with women.

ESTIMATION OF RISK:
Risk factors and tools such as developed from the Framingham
study in younger populations may be less accurate in the very old. Predictive models that incorporate traditional risk factors and age specific markers such as pulse pressure or arterial stiffness with further adjustment for sex may provide the best current estimates of cardiovascular risk in older people without known CAD. The Cardiovascular Health Study, a large population based prospective study of community dwelling adults older than age 65, has found the strongest predictors of death caused by an acute cardiac event to be a history of cardiac disease, myocardial infarction or heart failure.

**HISTORY:**

Anginal symptoms are more likely to be absent and ischaemia is more likely to be silent in older patients. Symptoms are likely to be termed atypical in older patients because the description differs from the classic description of substernal pressure with exertion. Symptoms may described primarily as dyspnoea, shoulder or back pain, weakness, fatigue, or epigastric discomfort and may be precipitated by concurrent illness. Lack of symptoms during evidence of ischaemia on ECG (silent ischaemia) has been reported in 20-50 % of patients 65 years or older.

**TESTING FOR ISCHAEMIA:**

ACC/AHA Guidelines on Exercise Testing estimate a slightly higher sensitivity (84%) and lower specificity (70%) in patients older than 75 years than in younger patients (see www.acc.org or www.americanheart.org). Echocardiography and nuclear can be used to overcome some of the limitations of ECG interpretation. In older patients unable to exercise, pharmacological agents such as dipyridamole or adenosine can be used with nuclear scintigraphy to assess myocardial perfusion at rest and after vasodilatation, or agents such as dobutamine can be combined with echocardiography or other imaging techniques to assess ventricular function at rest and during increased myocardial demand.

**TREATMENT:**

**Medical:** Therapeutic goals and management goals that have been established for chronic stable angina are targeted at symptom relief with nitrates, bet-blockers, calcium antagonists, or risk reduction and slowing the progression of disease with lifestyle modifications, lipid lowering agents, and aspirin. The Heart Protection Study (HPS) enrolled significant numbers of women those older than age 73 years with CAD and concomitant disease. The HPS demonstrated decreased total mortality in prespecified subgroups of women, patients older than 75 years of age, diabetics, and patients without elevated LDL cholesterol levels.

The PROspective Study of of Pravastatin in Elderly at Risk (PROSPER) studied equal numbers of men and women aged 70 to 82 years who either had CHD or were at risk for cardiac events. A significant reduction in primary composite end point of CHD death, nonfatal MI, and stroke, as well as in the secondary endpoint of CHD death plus nonfatal MI after 3 years of treatment was reported. Prespecified subgroup analysis showed benefit for secondary prevention but not primary prevention, and in men but not in women. Risk reduction was related to HDL but not LDL cholesterol or apolipoprotein B.

The elderly have not been the target of most primary prevention trials of lipid lowering. AFCAPS/TexCAPS study enrolled men up to age 64 and in Prevention of coronary heart disease with pravastatin in men with hypercholesterolaemia had an upper age cut off of 79 years. ALLHAT compared unbound treatment of hypertension plus lipid lowering therapy with usual care in hypertensives with at least one additional CHD risk factor. Half of the participants were older than age 65 years. No benefit of statin therapy was found in any subgroup, with cholesterol reduction in the treatment group smaller than in prior placebo controlled statin trials. ASCOT-LLA tested the effects of lipid lowering in hypertensive patients up to the age 79 years without increased lipids but with three additional CHD risk factors. Prespecified subgroups of women, diabetics, patients with metabolic syndrome, non-obese, and those with prior vascular diseases did not show CHD benefit though the study was stopped after 3.3 years because of a significant reduction in the composite cardiovascular endpoint of fatal and non-fatal cardiac events without significant differences in all-cause mortality.

**REVASCULARIZATION:**

Half of all percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) procedures are performed in patients older than 65 years of age, with one third of coronary revascularization procedures performed in patients older than 70 years of age. Early CABG mortality rates increase from less than 2 percent in patients younger than 60 years of age to between 6 and 8 percent in patients older than age 75 years with rates approaching 10 percent in patients older than 80. Registry data suggest in hospital mortality risk of PCI of less than 1 percent in patients younger than 60 years of age that increases to about 4 percent in patients older than 75 years and is greater than 5 percent in patients older than 80 years of age. The Northern New England Cardiovascular Disease Study Group reported preliminary non randomized data from nearly 1700 patients older than the age of 80 treated for two- or three- vessel disease (excluding left main) that found better in-hospital mortality and short term survival for PCI versus CABG (in-hospital mortality 3 percent versus 6 percent respectively). For those surviving past 6 months, survival was better for patients who underwent CABG. PCI data were from bare metal stent implants, and CABG data were from on-pump procedures in more than 85 percent. Non-fatal complications with procedures also increase with age. PCI is associated with a slightly less than 1 percent risk of permanent stroke or coma, and CABG is associated with a 3 to 6 percent incidence of stroke or coma in patients older than 75 years of age. The risk of postoperative cognitive impairment in older patients detected with neuro-psychological testing has been estimated as 25 to 50 percent after CABG. In the immediate post
operative period, longer durations of ventilator support, greater need for inotropic support and intra-aortic balloon placement, and greater incidence of atrial fibrillation, bleeding, delirium, renal failure, perioperative infarction and infection are seen in older patients compared with younger patients.\textsuperscript{14-21}

ACC/AHA Coronary Artery Bypass Surgery and PCI Guidelines conclude that age alone should not be used as sole criterion when considering revascularization procedures.

**ACUTE CORONARY SYNDROMES:**

About 60 percent of hospital admissions for acute myocardial infarction (AMI) are in people older than 65 years, and approximately 85 percent of deaths caused by AMI occur in this group. Mortality rates are usually higher in older women than in older men with AMI. Fewer older patients present within 6 hours of symptom onset. Angiographic evidence of collateral circulation to infarct related arteries also decreases markedly after age 70 years. Mortality is at least three fold higher in the patient older than 85 years compared with patient younger than 65 years.

Chest pain or discomfort is the most common complaint in patients up to age 75 years, but after age 80 years a minority of patients complain of chest pain and the prevalence of diaphoresis decreases. Non specific symptoms such as altered mental status, confusion, and fatigue become increasingly common manifestations of MI in the oldest patients. Older patients may also present with sudden pulmonary edema or neurological symptoms such as syncope or stroke.

The ECG is also more likely to be non diagnostic without ST-segment elevation but with baseline abnormalities of ventricular hypertrophy or intraventricular conduction or pacing.

**Thrombolysis:** For patients up to the age of 75 years, most trials show that fibrinolytic, antiplatelet, and antithrombin therapy is associated with a survival advantage compared with placebo that may be similar to or less than that seen in younger patients.\textsuperscript{22} Population based studies have suggested that elderly patients older than age 75 years treated with thrombolytics have an increased risk of intracranial hemorrhage (ICH) that approximates 1.4 percent.\textsuperscript{23} Cardiac rupture risk with thrombolysis is also increased in patients older than 70 years of age and in women, with an incidence of 0.5 to 2 percent.

**Antithrombotic agents:** Trial data show aspirin reduces mortality in patients older than 70 years and is recommended for routine administration to older patients with AMI. The addition of clopidogrel to aspirin after non-ST-elevation MI reduces major event rates by 20 percent, with similar absolute reductions in patients younger and older than 65 years, without significant data on patients older than 75 years.\textsuperscript{24} A review of the U.S. Food and Drug Administration adverse event reports in the presence of GP IIb/IIIa inhibitor administration found the deaths in patients with a mean age of 69 to be associated with excessive bleeding, with ICH as the most common site of fatal bleeds.\textsuperscript{25}

**Invasive Strategies:** Results from several studies and database reviews have suggested that primary angioplasty in experienced centers is associated with improved outcomes compared with thrombolytic strategies in elderly patients with ST elevation AMI.\textsuperscript{26} The potential benefits of PCI compared with those of fibrinolysis in older patients with AMI were directly compared in the Senior PAMI study. The study was stopped early because of low recruitment, but preliminary reports found primary PCI to be superior to thrombolytic therapy from ages 65 to 79 with no advantage of primary PCI over thrombolysis in those older than 80 years of age. Death rates were 16 to 19 percent in patients older than 80 years of age. The only subset of older patients with AMI that have long term survival advantages with early revascularization compared with medical stabilization in clinical trials is the subset with cardiogenic shock caused by LV failure.\textsuperscript{26,27}

**Additional Pharmacological agents:** Beta blocker administration is recommended for all patients with AMI regardless of age in the absence of contraindications. Age related dosage adjustments are appropriate. In the presence of LV systolic dysfunction or anterior wall MI, ACE inhibitors are recommended within the first 24 hours of onset of AMI. ACE inhibitors are recommended after 24 hours for all other MI patients especially those with reduced LV ejection and prior MI. As with other agents in the elderly, smaller initial doses and slower titration are indicated, as is close monitoring of renal function.

**Conclusions:** In an analysis In an analysis of community practice outcomes as part of of the Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA Guidelines (CRUSADE), the use of five recommended therapies, including early use of aspirin, beta blockers, heparin, GP IIb/IIIa inhibitors and cardiac catheterization, were evaluated. The risk of in-hospital mortality declined as a function of the number of guideline-recommended therapies given in patients aged 75 years and older, with greater benefit with use of guideline-recommended therapies in older compared with younger patients. The guidelines recommend special attention to altered dosing and sensitivity of older patients and the need for close observation for adverse effects of intensive medical and interventional management in elderly subgroups with acute coronary syndromes.\textsuperscript{28}

**REFERENCES:**

1. Libby et al. Braunwald's Heart Disease: A Text Book of Cardiovascular Medicine, 8th edition