



Co-Sponsored by The LTC Section of the Society of Actuaries



# Cardiovascular Case Studies

Comparing risk within three  
product lines:  
Life, LTC, DI

THE ELEVENTH ANNUAL INTERCOMPANY LONG TERM CARE INSURANCE CONFERENCE





# Case # 1

- 60 year old male executive
- 5'10", 176 pounds (BMI 25)
- Exercises 4 x a week
- Receives “executive physicals” with blood work, EKG, treadmill test, colonoscopy



# Case # 1 APS

- History of prostate cancer (2005)
- Hypercholesterolemia: Lipitor
- Mild sleep apnea, hypoxemia when supine, treated with tennis ball in the T shirt
- 2/07 calcium score 212 : ( approximately 75<sup>th</sup> %ile for his age)



# Case # 1 APS continued

- 2/09 6 beat run of ventricular tachycardia (while hospitalized for cellulitis)
- CT angiogram: small lesion in the mid anterior descending artery, 50% stenosis
- Exercise test/Cardiolite showed excellent exercise capacity (15 METS), no ischemia or arrhythmias
- Echocardiogram 4/09, mild LVH, aortic valve sclerosis, possible patent foramen ovale
- Sleep study repeated, mild sleep apnea



# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk



# Case # 1 Discussion

## *Favorable*

- Single vessel disease, non-obstructive
- Risk factors well controlled
- Excellent exercise capacity

## *Unfavorable*

- Ventricular tachycardia, 6 beat run
- Calcium score 75<sup>th</sup> %ile

## *Neutral*

- Aortic valve sclerosis, PFO, LVH



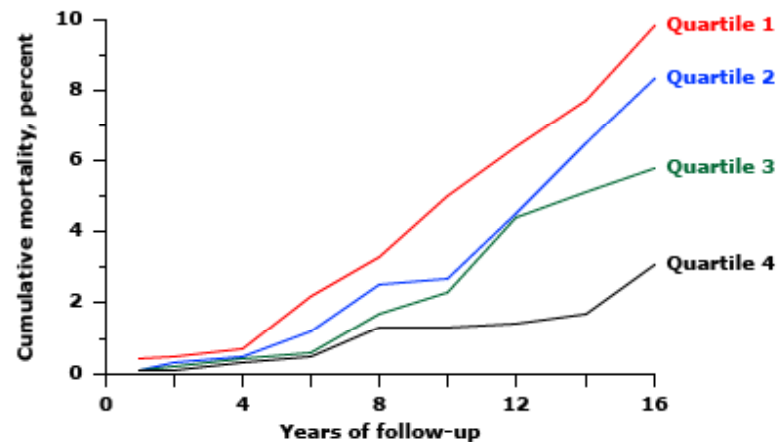
# Exercise Capacity

- What is a MET? Metabolic Equivalent of Task
- 1 MET = quiet sitting
- 2 METS = walking at a slow pace (3 km/h), requires about twice the energy level
- 8 METS = jogging in place



# Exercise Capacity as a predictor of longevity

## Graded survival benefit of physical fitness



Cumulative age-adjusted mortality from cardiovascular cause over 16 years of follow-up, according to fitness quartile in healthy, middle-aged, Norwegian men. Mortality varied inversely with fitness (estimated from total work performed on a bicycle ergometer), being lowest in those who were most fit (Quartile 4).

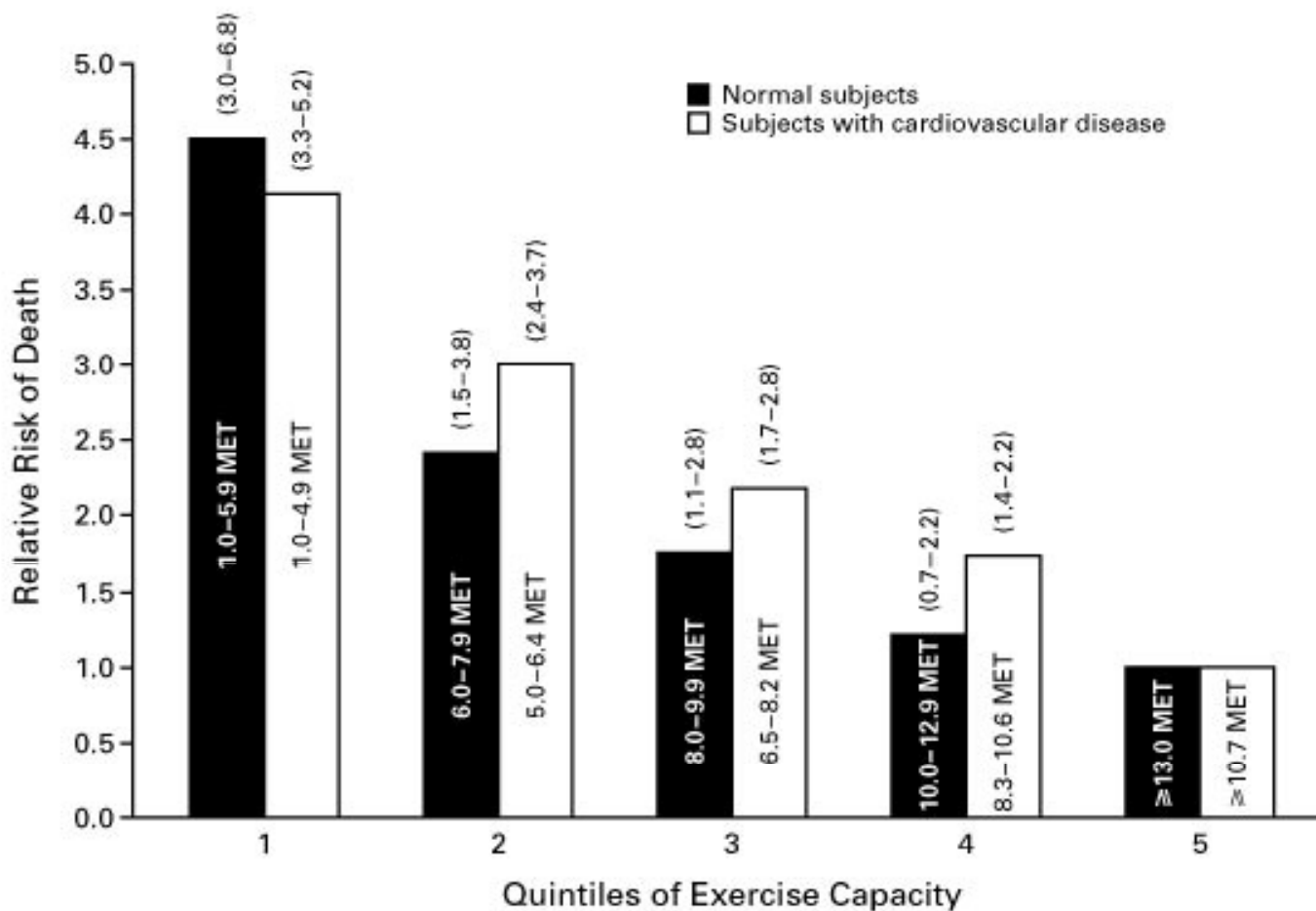
Data from: Sandvik, L, Erikssen, J, Thaulow, E, et al, *N Engl J Med* 1993; 328:533.





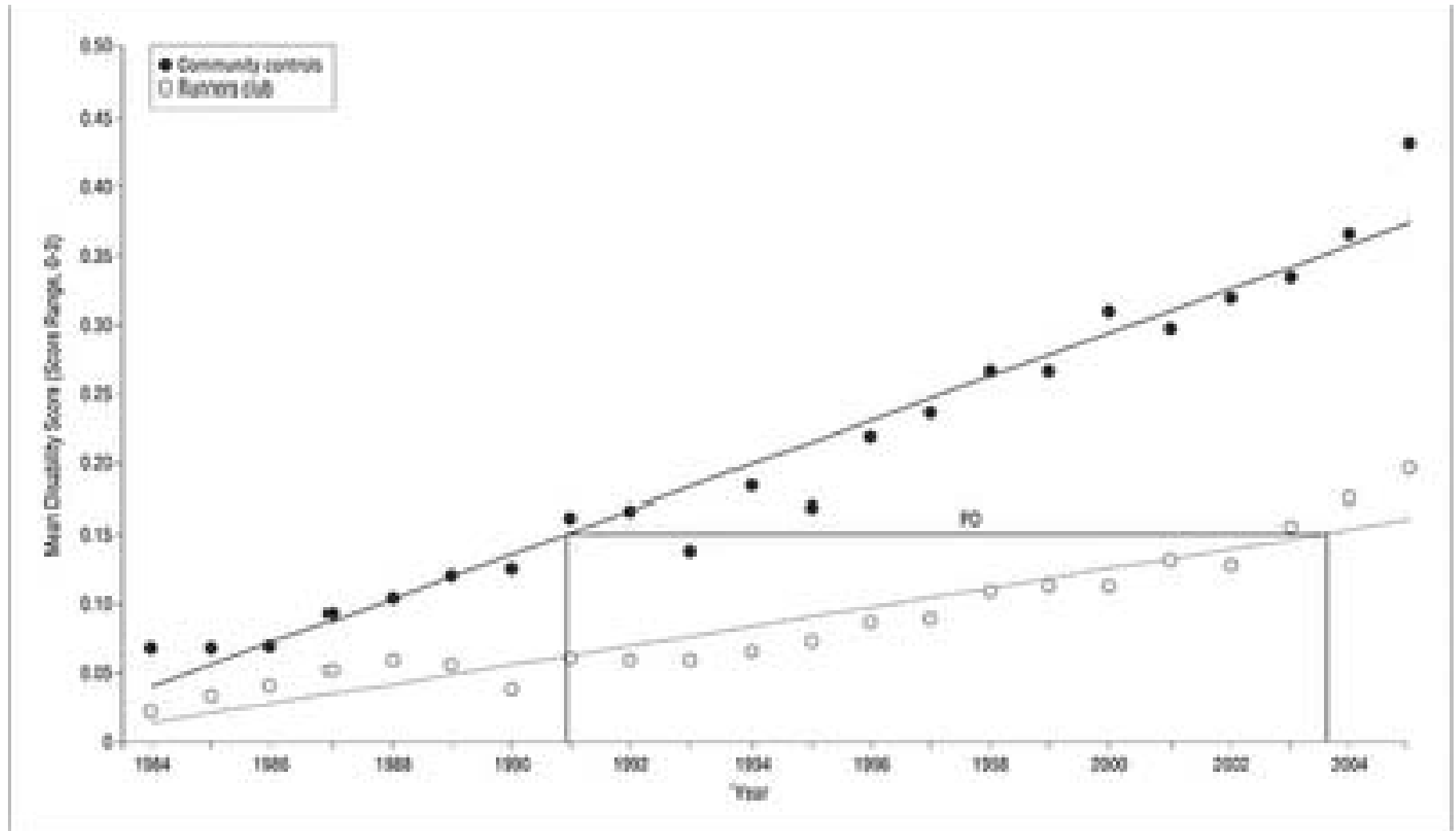


## Age-Adjusted Relative Risks of Death from Any Cause According to Quintile of Exercise Capacity among Normal Subjects and Subjects with Cardiovascular Disease.





- Does decreased mortality/increased longevity associated with greater exercise capacity translate to decreased morbidity?





# Interactive Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above



## Case #2

- 58 year old male, 6'0", 185 lbs (BMI = 25)
- Works full time as inventory manager
- Reports atrial fibrillation since 1991, chronically on Coumadin (warfarin)
- Cardiac catheterization in 2008
- Hypertension: Nadolol
- Urinary frequency: Detrol
- 4 knee surgeries: Anticipates knee replacement in 7-8 years



## Case # 2 APS

- Hyperlipidemia, well controlled with Lipitor
- Exercises on an elliptical/treadmill 4x/wk
- Noncompliant with monthly laboratory testing (prothrombin time) due to the \$20 copay
- Thallium exercise tests normal (13.5 METS)
- Episodes of atrial fibrillation are rare (alcohol related)
- Volunteers with Habitat for Humanity (Climbs tree with a chain saw)



## Case # 2, APS cont

- Calcium score 334, 75<sup>th</sup>-90<sup>th</sup> %ile for age
- CT angio 11/08
  - Three areas of plaque in the left anterior descending artery (LAD), one 60-70%
  - Mild plaque in right coronary and circumflex arteries
- Cardiac catheterization 4/09
  - LAD: 60-70% stenosis proximally, “hemodynamically significant on intravascular ultrasound”
  - The diagonal branch was larger than the LAD



## Case # 2, APS cont

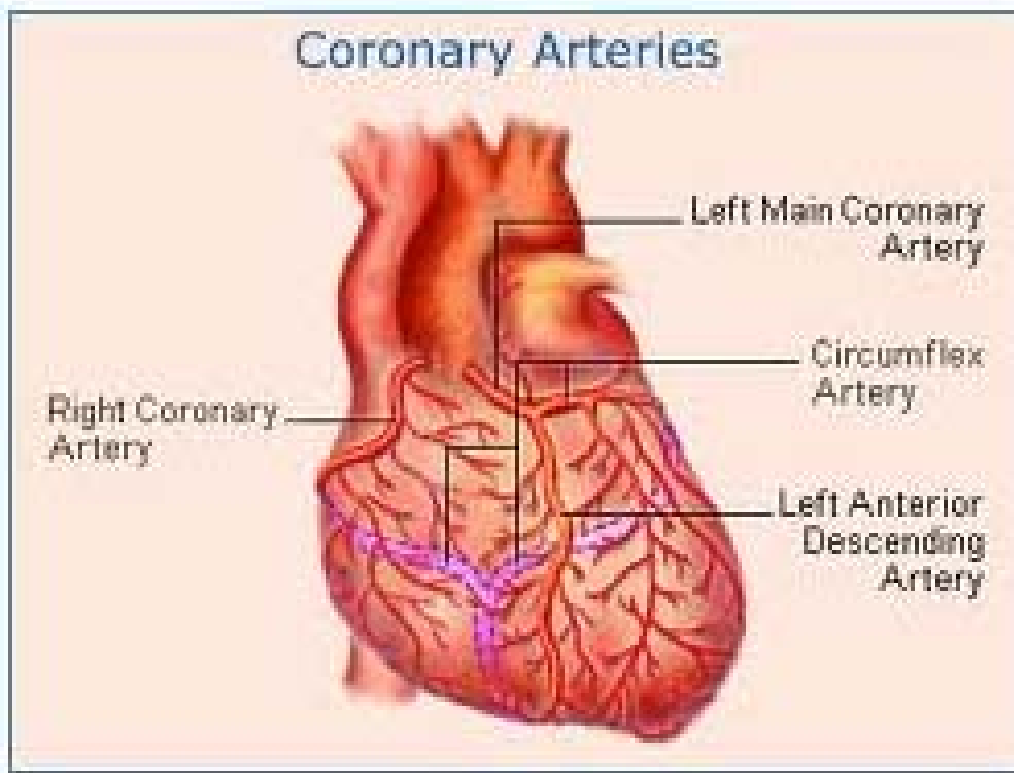
- Client deemed to have “silent ischemia,” asymptomatic
- Angioplasty and stent felt to be high risk as it might occlude the large diagonal branch and cause a myocardial infarction, and would require antiplatelet therapy in addition to Coumadin increasing risk of bleed





# Interactive Polling Questions

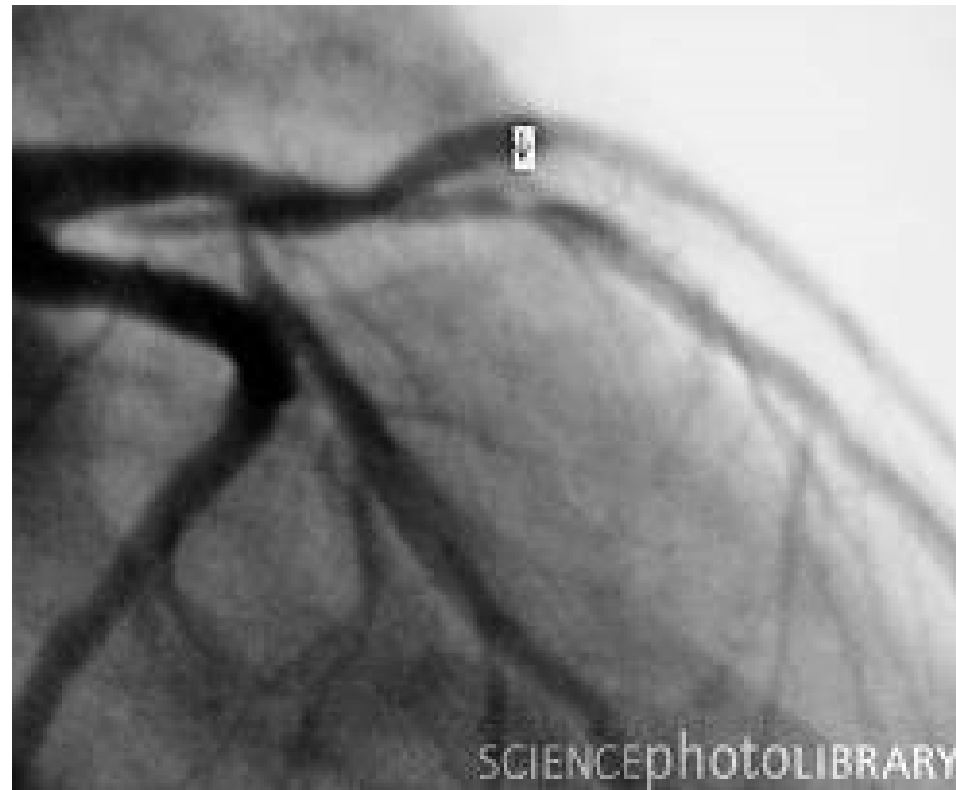
- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk





# 50% Stenosis







# Case # 2 Discussion

- CAD multivessel (plus a high calcium score)
- “Hemodynamically significant LAD stenosis,” risk of treating with angioplasty too high
  - Anatomical reasons
  - Combination of Plavix and Coumadin
- Coumadin
  - Risk in a compliant well monitored patient
  - Risk in a noncompliant poorly monitored patient
- Positive and negative aspects of the self perception of good health



# Interactive Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above



# Case #3

- 55 year old female, LPN
- 5' 6", 124 pounds (BMI=20)
- Cardiovascular Risk Factors:
  - Hypertension (treated with three medications)
  - Hypercholesterolemia (Vytorin)
  - Tobacco abuse for 20 years (currently 2 cigs/day)
- On telephone interview she reported having just completed an exercise tolerance test and Holter monitor for palpitations, “all normal.”



# Case #3 APS

- 8/05 : Calcium score 363 (> 95<sup>th</sup> %ile)
- CT angiogram: “Plaque” in the left main artery, left anterior descending artery, right coronary artery
- 10/05: Cardiac catheterization: No formal report in APS. There is a diagram showing patency in all vessels except the left anterior descending





# Case #3 APS cont

- 10/07: Hypertension difficult to control on medications: MRA of renal arteries showed 50-60% renal artery stenosis “amenable to stenting.”
- Renal angiogram advised. No record of the procedure
- Several (almost annual) ETT/thallium for “palpitations”
  - No ischemia
  - 8 METS
  - Holter shows premature atrial and premature ventricular beats, considered benign



# Case # 3 Summary

- 55 year old female with multiple cardiac risk factors and evidence of vascular disease in two organs (kidneys and heart)
- No evidence of ischemia (the blockage is not obstructing blood flow to the heart muscle)
- Ongoing tobacco use



# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk



# Case #3 Discussion

- Risk of diffuse vascular disease even if nonobstructive
- Exercise capacity on ETT (8 METS)
- Symptomatic with palpitations
- Significance of calcium score
  - Stratification of %iles
  - Calculation of “coronary age”



# Calcium Score

- Original test was the EBCT (electron beam computed tomographic scanning) and most studies are from scores obtained by that method
- CT angio or MDCT (multidetector or multislice CT) has become more widely available to give a picture of the arteries; also provides a calcium score



# Calcium Score

- Scoring by %ile
- Predictive of adverse cardiac event
- Independent of the standard risk factors (smoking, hypertension, hyperlipidemia, diabetes, obesity)

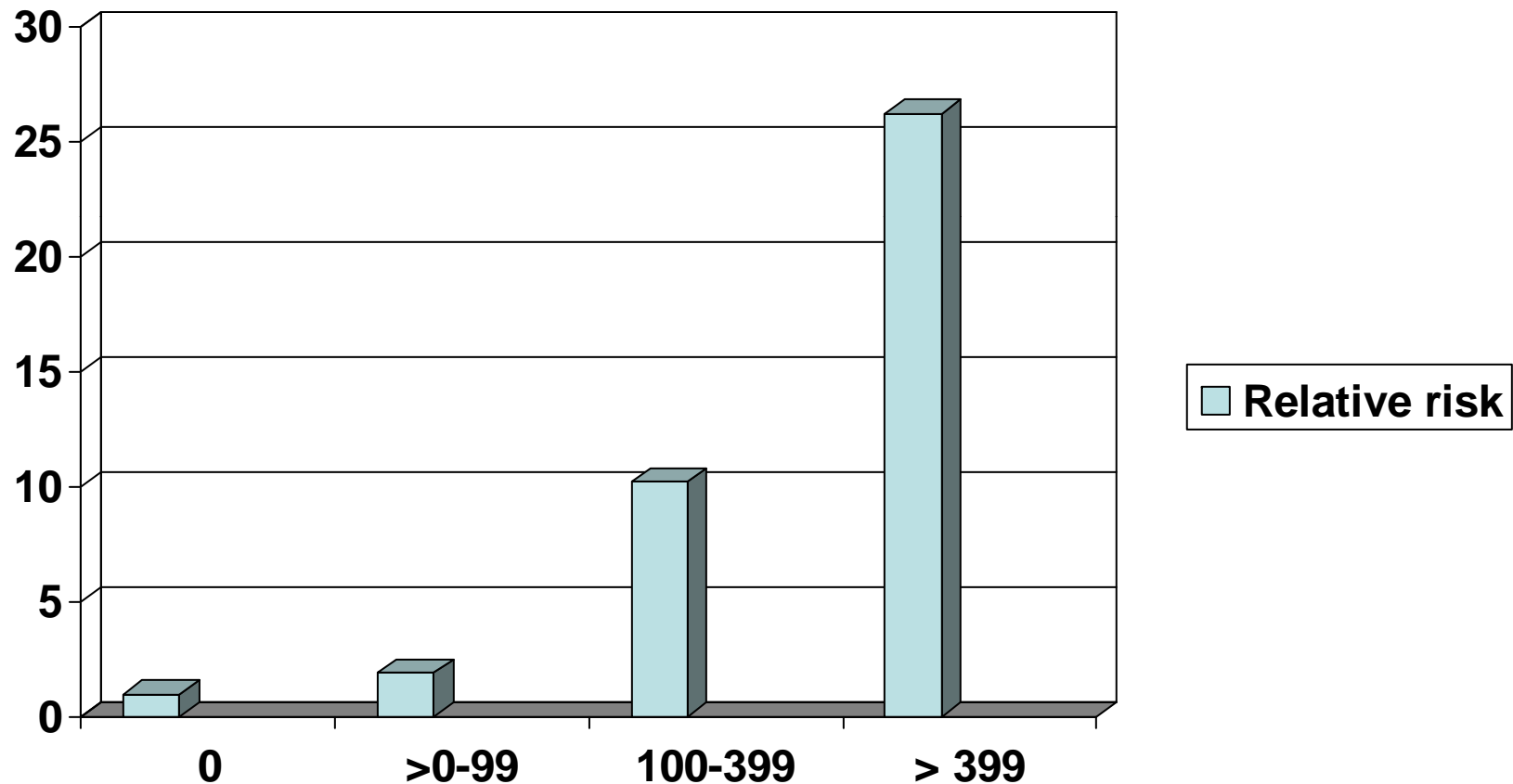


# Calcium Score, cont

- High calcium scores predict a high overall plaque burden
- The absence of coronary artery calcium (CAC) is a strong predictor of no CAD
- Score interpretation
  - 0 – No disease
  - 1-99 – mild disease
  - 100-399 – moderate disease
  - > 399- severe disease



# Calcium Score/adverse coronary event (cardiac death, nonfatal MI, PTCA or CABG)







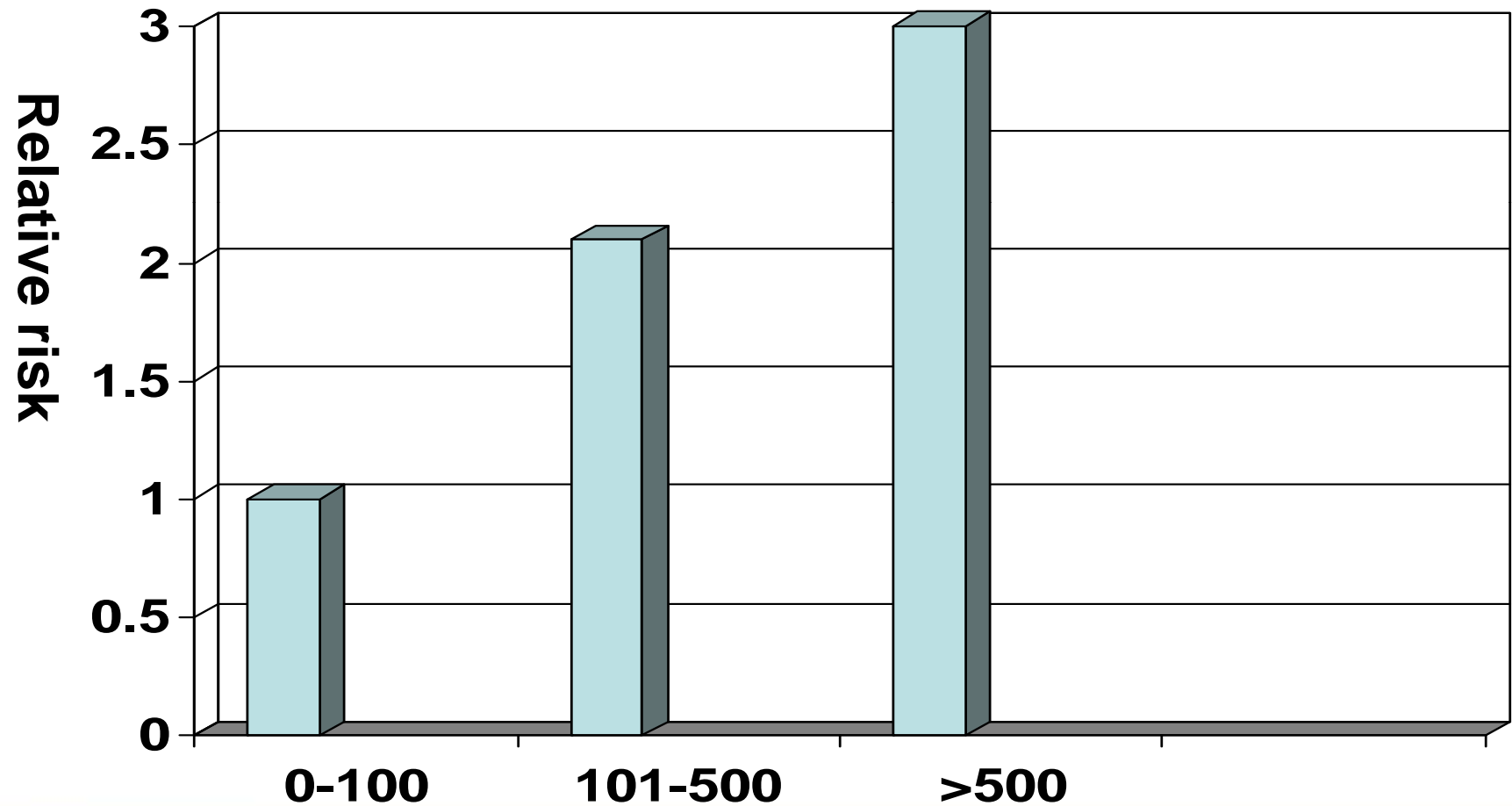
# Calcium Score/Stroke risk

- Dutch Study
- 2000+ subjects
- Rise in stroke incidence with rise in calcium scores

Calcium score	Number of subjects	Number of strokes
0-100	927	10 (1.1%)
100-500	533	14 (2.6%)
>500	553	26 (4.7%)



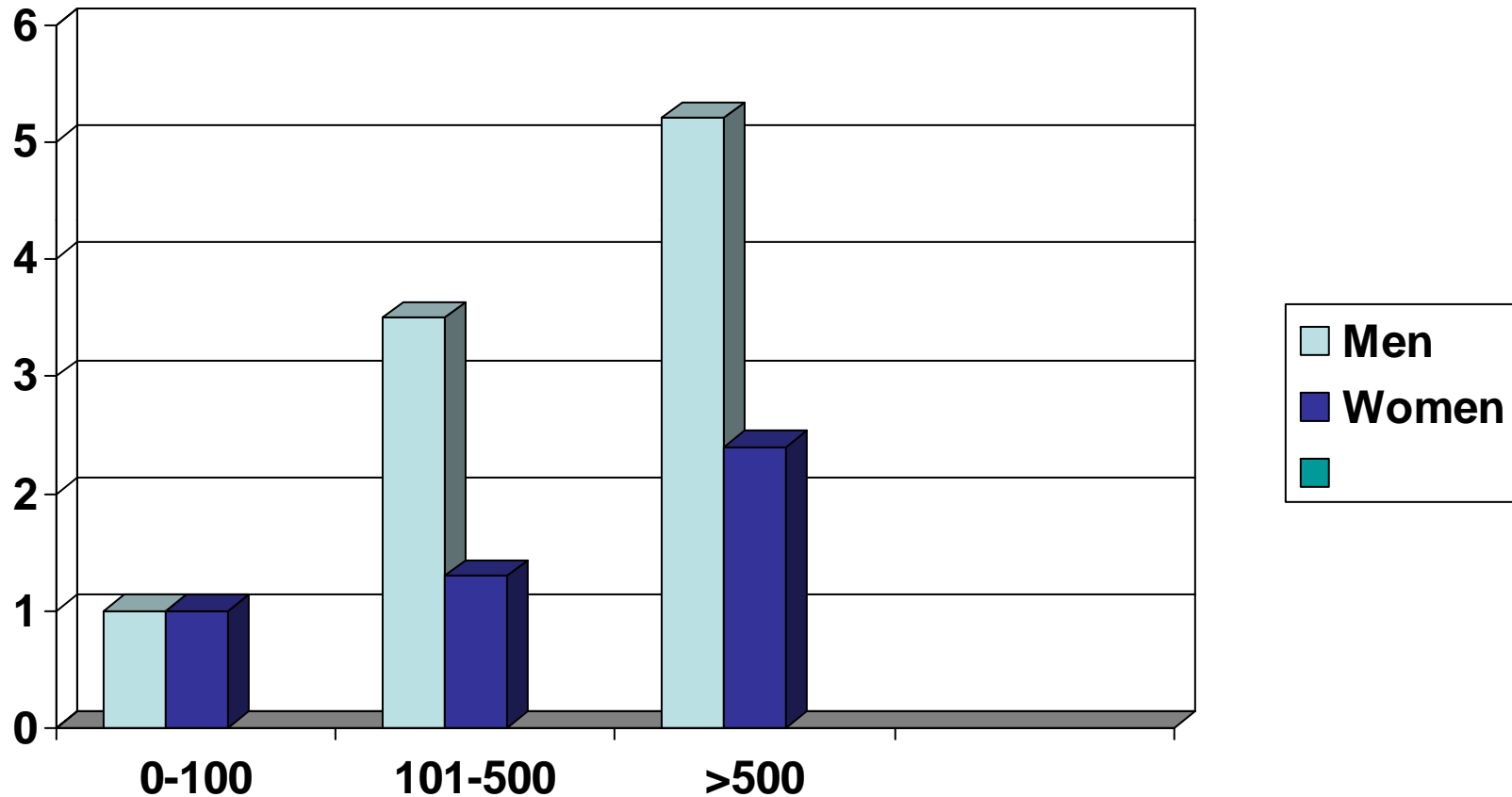
# Calcium Score/stroke





# Calcium score/stroke risk

## Gender differences





# Interactive Polling Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above



# Case # 4

- 55 year old man, applying September 2010
- 6' 3" 190 pounds, (BMI = 23.7)
- Reported he was hospitalized 5/10 for three days for a heart arrhythmia
- Arrhythmia was under control with verapamil. Repeat Holter monitor was planned for 10/10



# Case # 4 APS

- Past history of kidney stones, high cholesterol (Lipitor), GERD and scoliosis
- 4/10: Atypical chest pain
- Stress echocardiogram: ischemia suggested
  - Ventricular tachycardia
  - Septal hypokinesis
- Cardiac catheterization negative
- Verapamil started (after electrophysiologic study)



# Case # 4 APS

- After hospitalization he developed abnormal liver function tests and a positive mononucleosis test
- History revealed marijuana use 4-5 x/week and 2 uses of cocaine 5 years ago
- 7/10 reported to cardiologist to be feeling better but occasionally getting an “unusual chest feeling” and mild decline in endurance (attributed to mono)
- New murmur on auscultation II-III/VI
- Echocardiogram ordered
- Holter in 10/10 scheduled



# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk





# Case # 4 APS additional

- 10/10 Holter: Large amount of ventricular ectopy (2, 3, 4 beat runs, bigeminy, trigeminy), no symptoms
- Echocardiogram: mild-moderate mitral regurgitation, mild left ventricular hypertrophy, mild enlargement of left ventricle
- 10/10 cardiology follow-up, having symptoms of chest fullness with exercise
- Reviewed echocardiogram, concluded mild cardiomyopathy, probably viral from the mononucleosis infection
- Cardiac MRI ordered



# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk



# Case # 4 Discussion

- **Cardiomyopathy**
  - Definition: diseases affecting heart muscle
  - Multiple causes
    - Primary: infections (viral, bacterial, parasitic), toxic (alcohol, medication, drug), congenital (HCM), numerous other
    - Secondary: ischemic, hypertensive (not cardiomyopathies in the true sense)
- Applications with dangling pieces of information



# Interactive Polling Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above



# Case # 5

- 62 year old male, owner heat/AC business
- 5' 8", 188 pounds (BMI 28.6)
- No history on application but meds:
  - Zocor (cholesterol)
  - Altace (antihypertensive)
  - Toprol (antihypertensive or CAD)



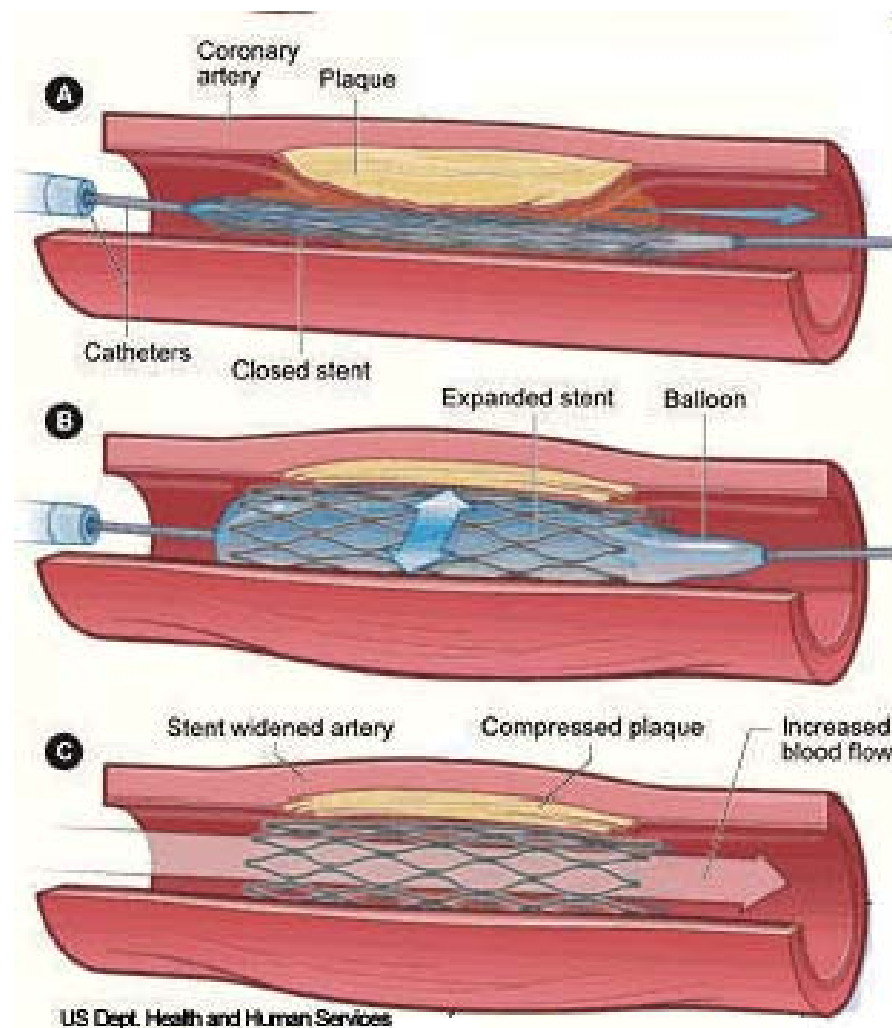
# Case # 5, APS

- Myocardial Infarction age 55
- Angioplasty age 58, 2 stents
- Reactive airway disease, albuterol
- No tobacco or alcohol, vigorous exerciser
- Chest pain when stressed, takes SL NTG
- Stress echo 9/09 “good results”
- Carotid ultrasound 6/08: mild plaque
- 4/09 Hb A1c 6.3. Advised weight loss and exercise
- 2/10 advised to repeat Hb A1c. No return.



# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk







## Case # 5 Discussion

### Multiple unfavorable factors

- Myocardial infarction at a young age
- Angioplasty and stent 3 years later, indicative of disease progression
- Continued symptoms of angina
- Diabetes as an additional risk factor



# Interactive Polling Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above



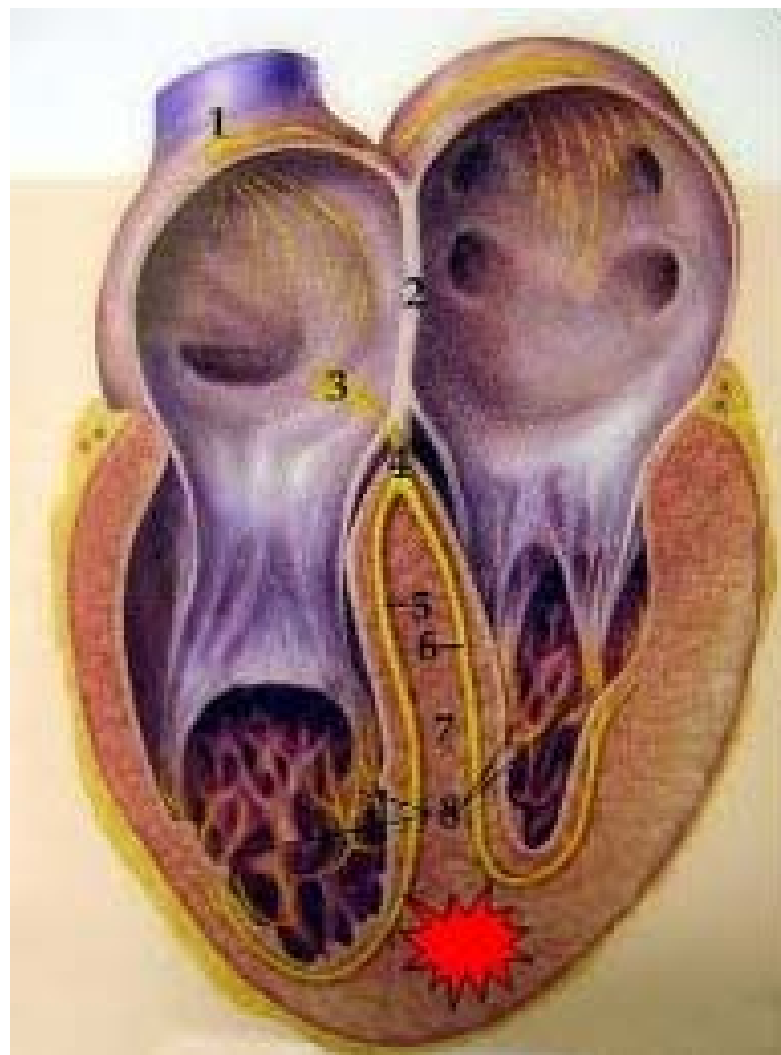
# Case #6

- 50 year old male, 6'0, 225 lbs (BMI 30.5)
- Mitral valve repair in 8/09
- Meds: metropolol and enalapril
- Reports an exercise tolerance test April 2010



# Case # 6 APS

- August 2007 mitral valve repair and ablation procedure for atrial fibrillation
- Atrial fibrillation recurred post-op, treated with amiodarone, maintained on Toprol
- March 2010 reported to his MD significant exertional shortness of breath, fatigue and lightheadedness, swollen ankles
- Exercise test showed very frequent premature ventricular contractions
- No medical records after the exercise test







# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk



# Case #6 (9 mos after decline)

- Client had been treated with sotalol (antiarrhythmic)
- Symptoms had resolved
- Stress echo 12/10
  - Exercised to 10 METS
  - Echo showed good function of the left ventricle
  - No ischemia





# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk



# Discussion

- Rate related cardiac symptoms and their treatment
- Reversibility of unfavorable underwriting decisions with evidence of appropriate medical care and resolution of symptoms



# Interactive Polling Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above



# Case #7

- 55 year old male attorney, working full time
- 5' 10", 200 lbs (BMI = 28.7)
- Tricor for high cholesterol
- Reports coronary artery disease diagnosed three years ago “one artery blocked but the body had created collateral/bypass”



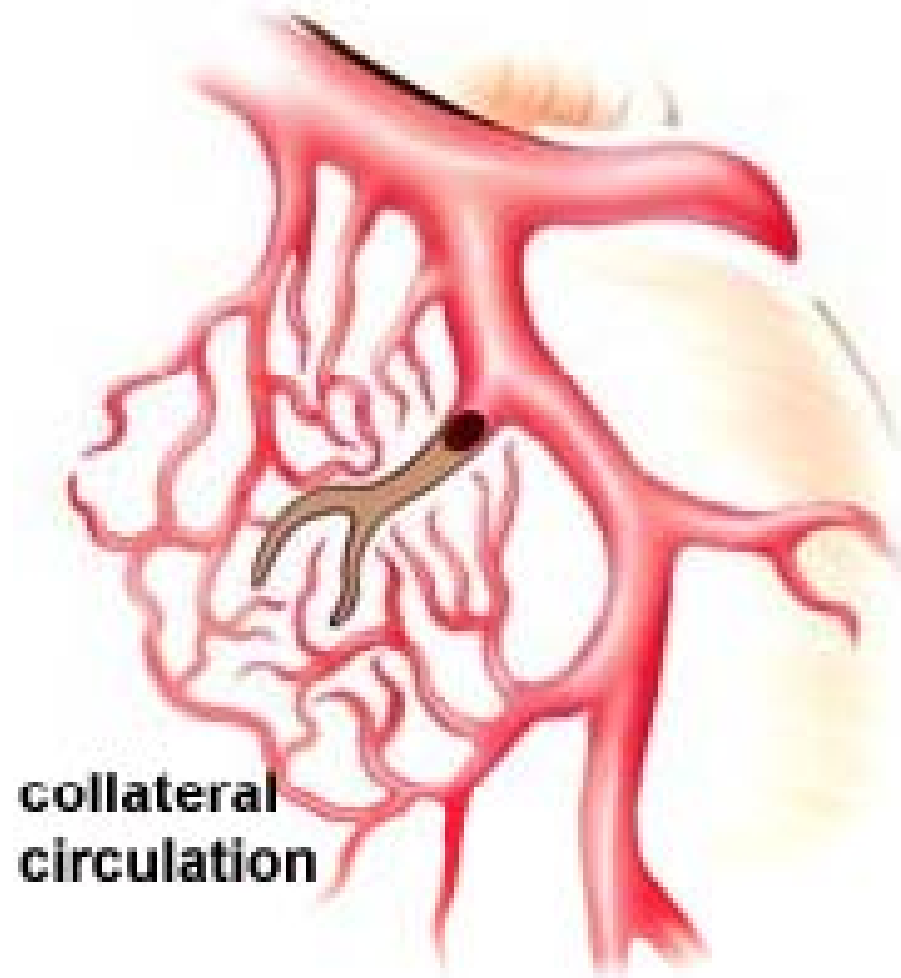
# Case # 7 APS

- Short of breath on exertion 5/07
- Risk Factors
  - Hyperlipidemia
  - Positive family history of premature coronary artery disease
- Cardiac catheterization 5/07
  - 90+ % occlusion left anterior descending artery
  - Extensive collateral circulation
  - Diffuse disease in his other coronary arteries
- ETT/echocardiogram annually since
  - Positive for ischemia
  - 6-7 METS (stopped for dyspnea and exhaustion)
  - Left ventricular hypertrophy
  - Hypokinesis (cardiac walls don't move well)



# Interactive Polling Questions

- How would you assess the medical risk of this applicant?
  - Low Risk
  - Moderate Risk
  - High Risk



**collateral  
circulation**



# Case # 7 Discussion

- Significance of collateral circulation
- Diffuse disease
- Evidence of ongoing ischemia and wall motion abnormalities on ETT
- Exercise Capacity: 6-7 METS





# Interactive Polling Questions

- Would you consider this applicant insurable for
  - Life insurance
  - Long term care insurance
  - Disability insurance
  - None of the above