

# Screening and Treatment of Adolescents to Prevent Adult Cardiovascular Disease

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# Alex G.

- Alex G. a 13 year old male from a NY suburb presents for medical evaluation because his previously healthy father had recently died suddenly from a heart attack at the age of 44. His mother was worried about whether Alex might suffer the same fate.
- Further history revealed that Alex was in good physical condition, playing on school and community sports teams. He had no serious health problems, was on no medications, had had no operations or hospitalizations He had received all his immunizations and well care visits.
- Physical examination and routine blood work were unremarkable.

# Question 1

- Besides a comprehensive physical examination, what is the recommended next step in Alex's care?

1. Cardiology consult
2. Fasting lipid profile
3. Reassurance

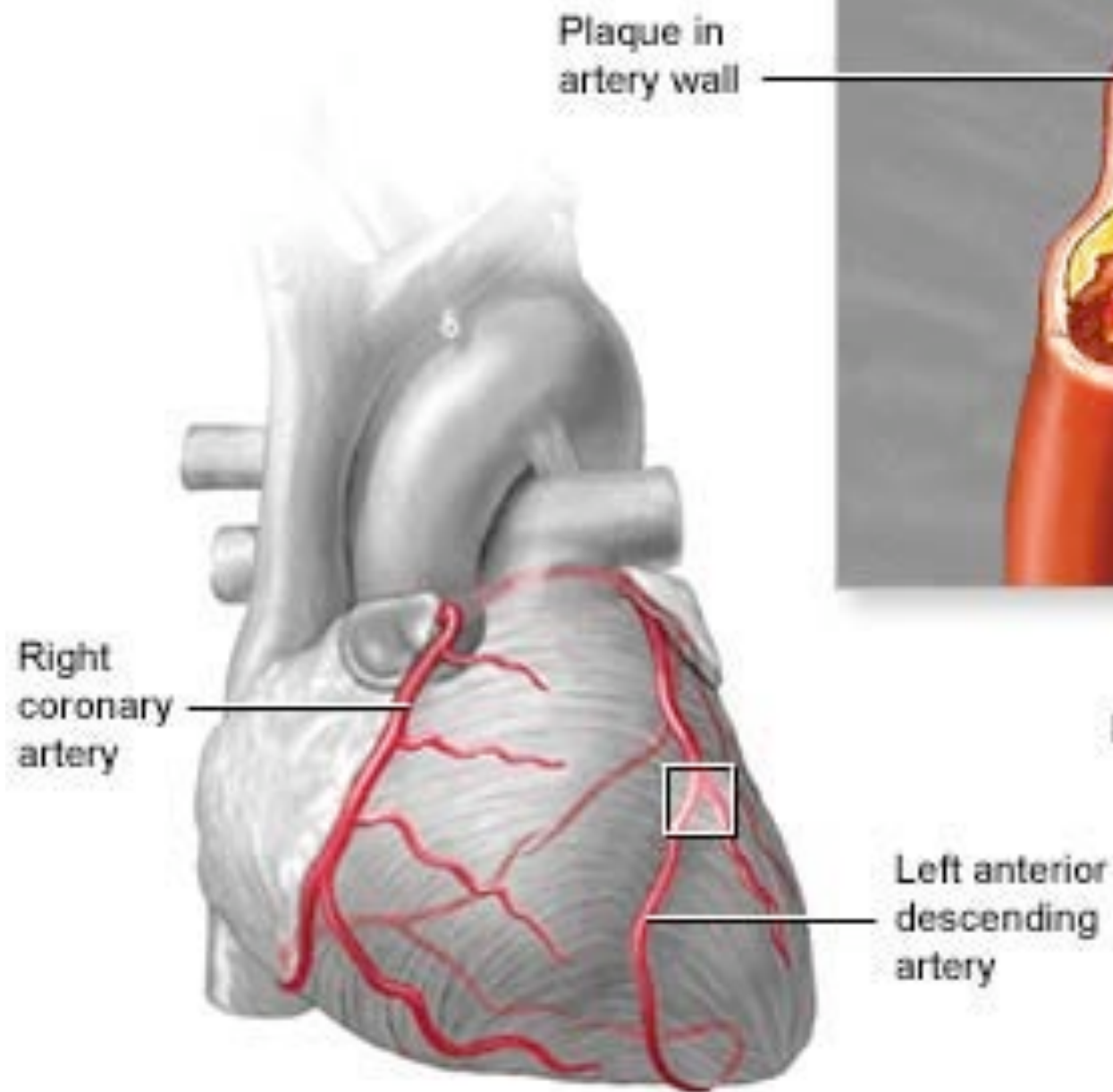
# Question 2

- What are the health implications for Alex of his father's of sudden death from CVD?
  1. Alex has a 75% probability of sudden death himself.
  2. Alex has a 40% probability of sudden death himself.
  3. Alex has a 25% chance of sudden death himself.
  4. Alex has no greater risk than any other boy his age.

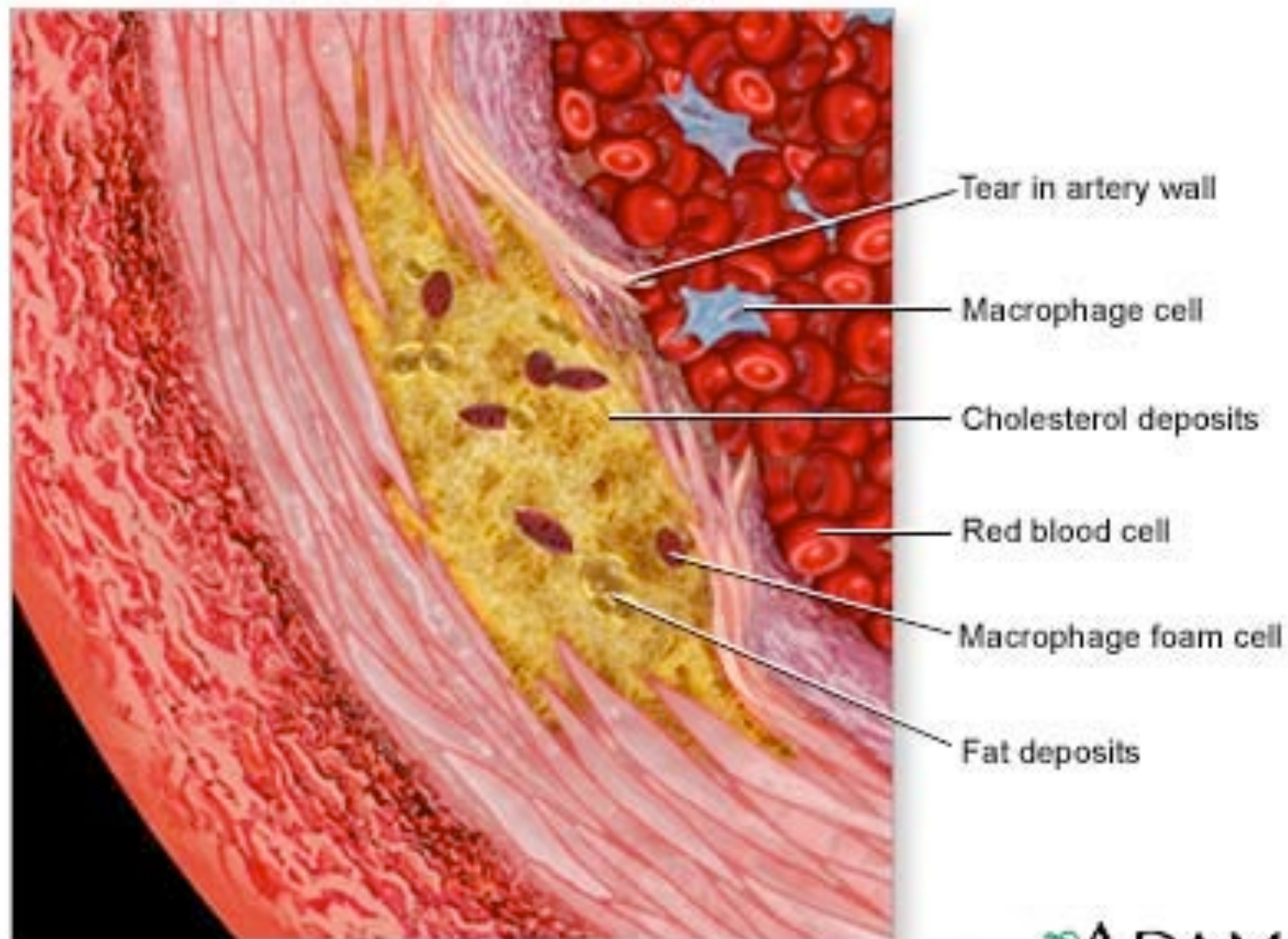
## Rank of the 10 Leading Causes of Death

United States, 2002

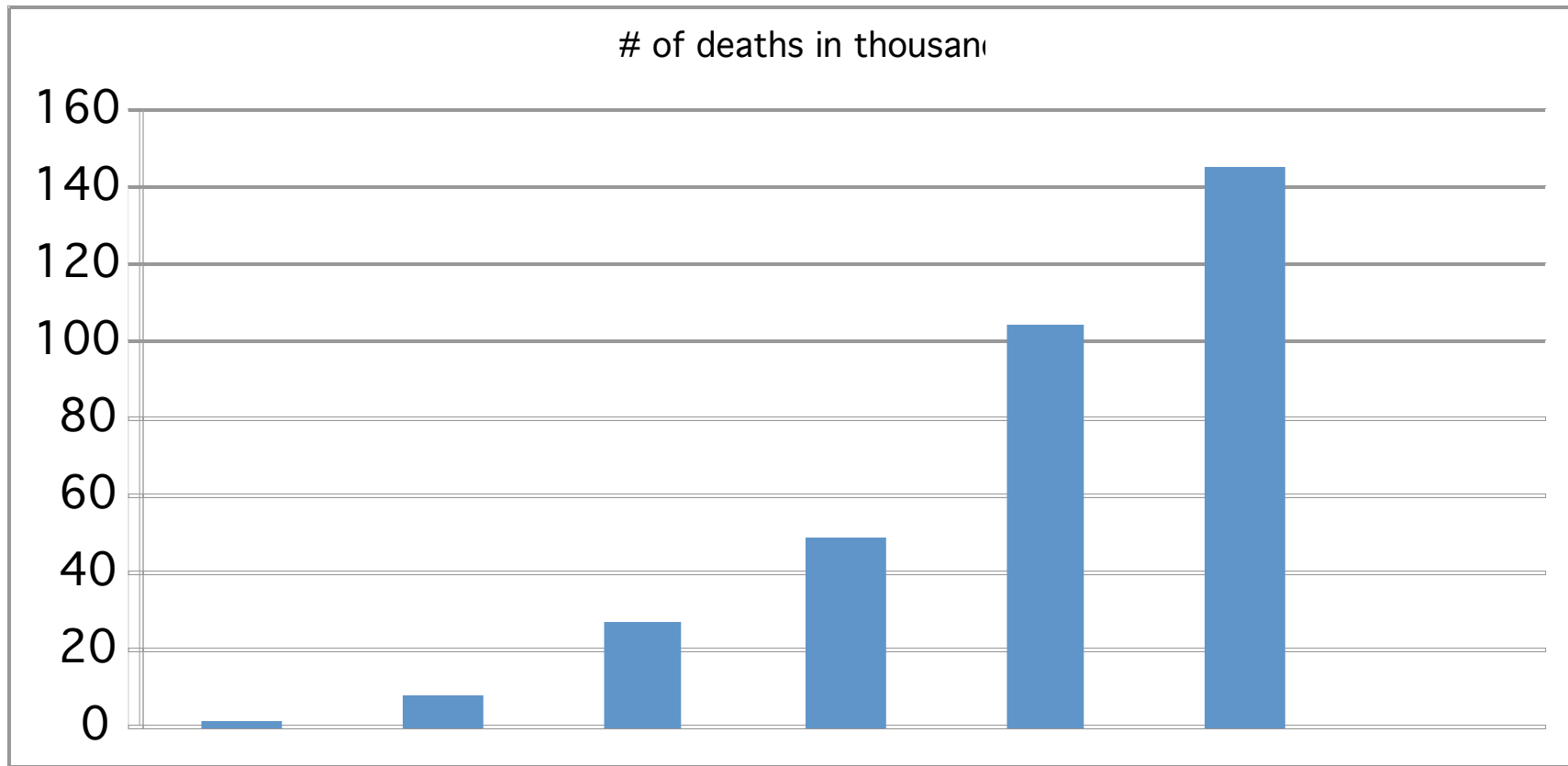
<b>Cardiovascular Diseases (I00-I99, Q20-Q28)</b>	1
<b>Cancer (C00-C97)</b>	2
<b>Chronic Lower Respiratory Diseases (J40-J47)</b>	3
<b>Accidents (V01-X59, Y85-Y86)</b>	4
<b>Diabetes Mellitus (E10-E14)</b>	5
<b>Influenza and Pneumonia (J10-J18)</b>	6
<b>Alzheimer's Disease (G30)</b>	7
<b>Nephritis and Nephrosis (N00-07, N17-19, N25-27)</b>	8
<b>Septicemia (A40-A41)</b>	9
<b>Intentional Self-Harm (Suicide) (X60-X84, Y87.0)</b>	10



## Cut-section of artery



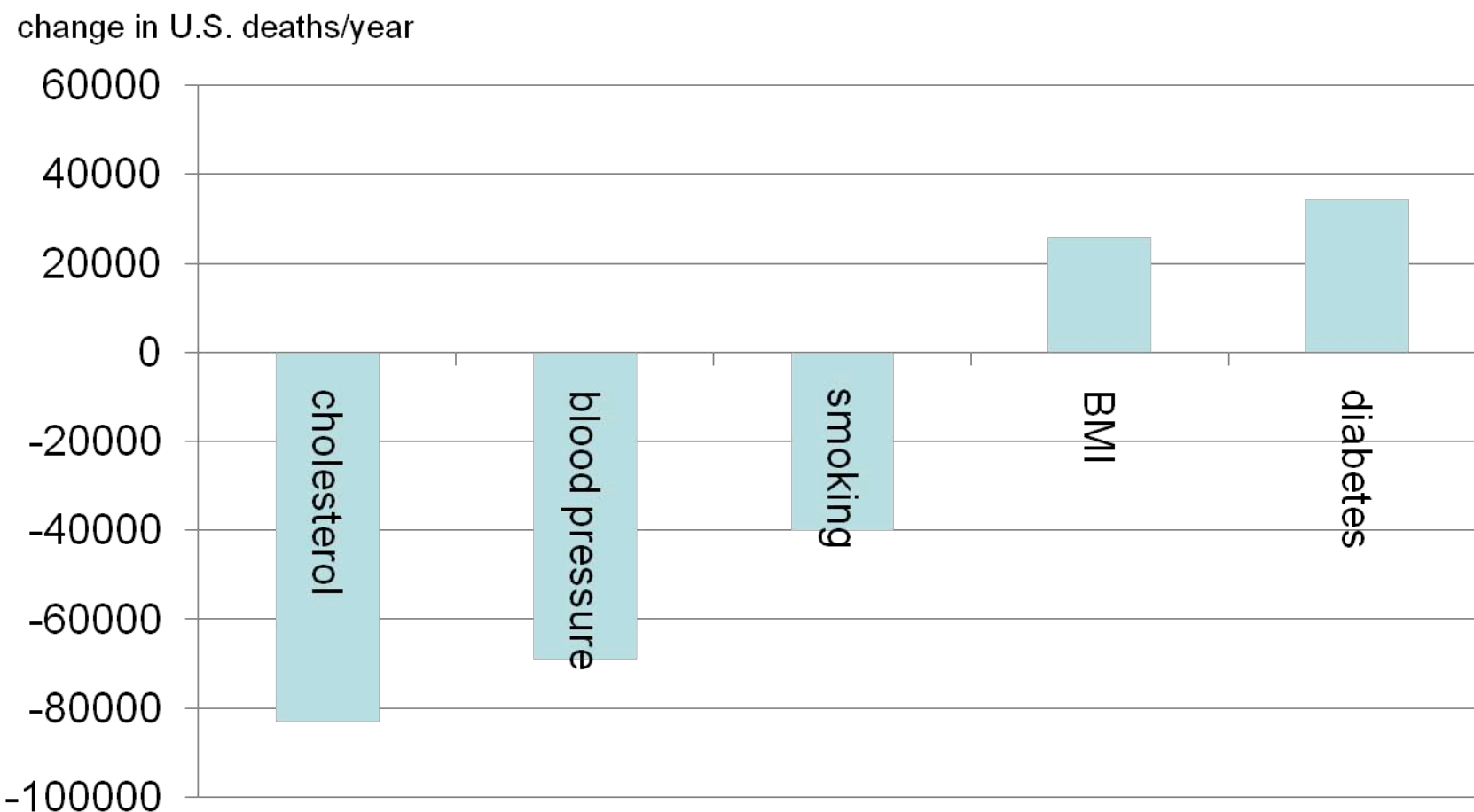
# Difference between observed and expected age adjusted CVD deaths in US.



Age(yrs) 25-34 35-44 45-54 55-64 65-74 75-84

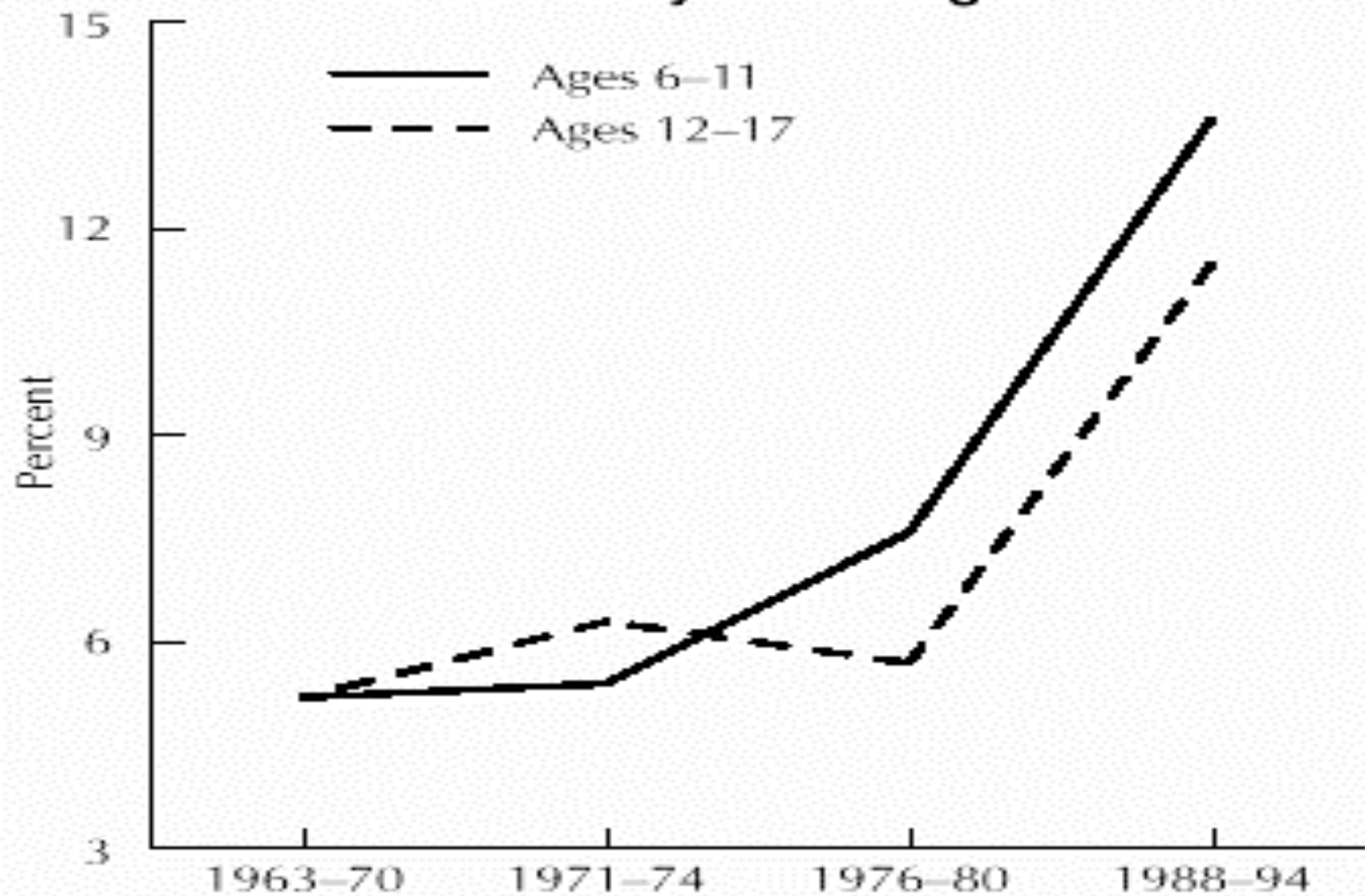
Ford ES et al Explaining the Decrease in U.S. Deaths from Coronary Disease, 1980–2000  
N Engl J Med 2007;356:2388-98

# Effect on CVD deaths of change in risk factors for US population 1980 -2000



Ford ES et al Explaining the Decrease in U.S. Deaths from Coronary Disease, 1980–2000 N Engl J Med 2007;356:2388-98

## Percentage of Young People Who Are Seriously Overweight\*

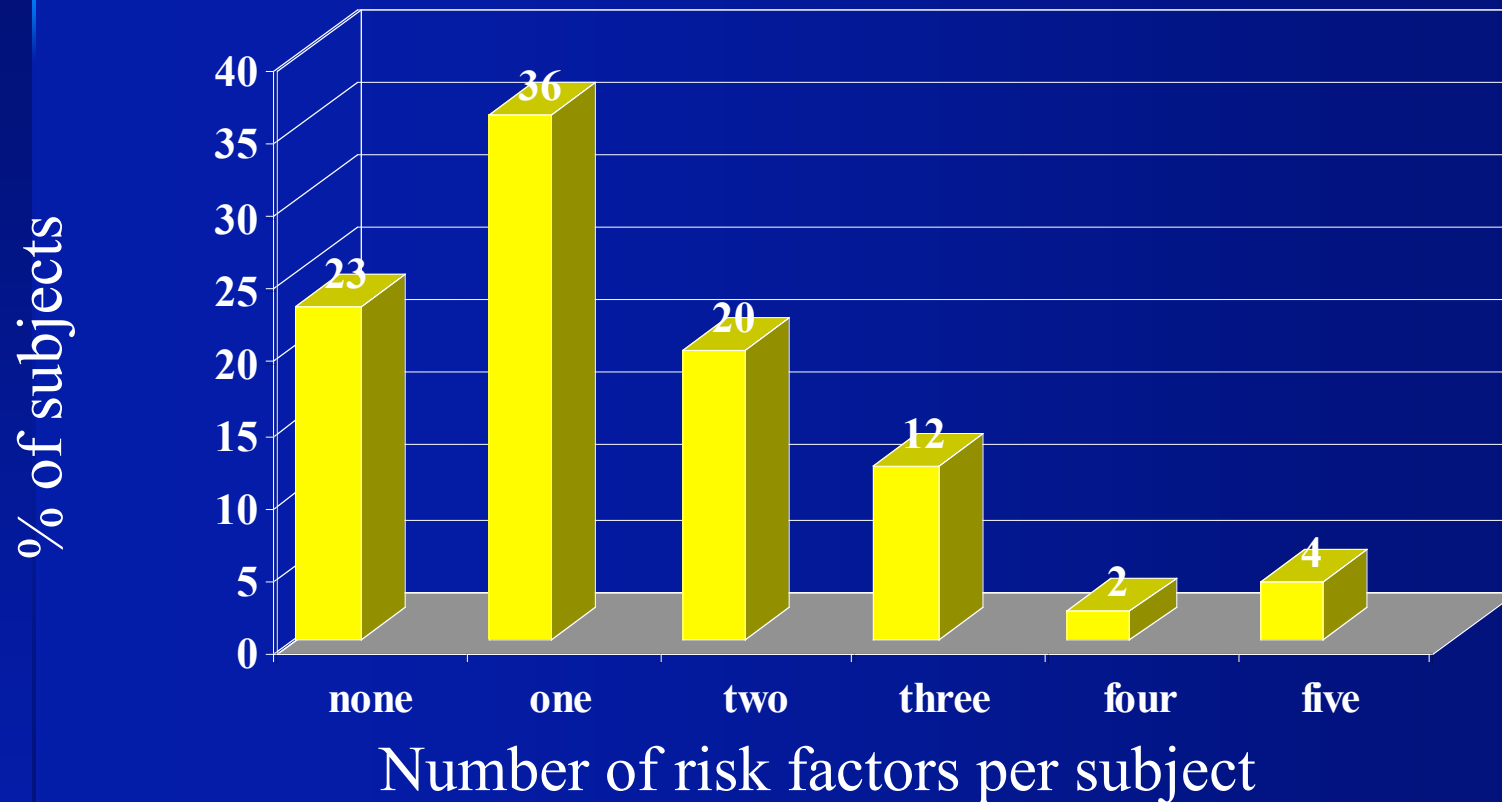


## Relation of Obesity (BMI $\geq$ 95th %tile) to Adverse Risk Factors in 5-10 yo Children

Risk Factor	Prevalence	OddsRatio
Cholesterol >200 mg/dl	21.0%	2.1
Triglycerides >130 mg/dl	17.3%	7.3
LDL-C >130 mg/dl	19.3%	2.1
HDL-C < 35 mg/dl	14.3%	4.7
Elevated insulin	21.3%	15.6
Elevated SBP	18.7%	11.0
Elevated DBP	12.3%	4.6

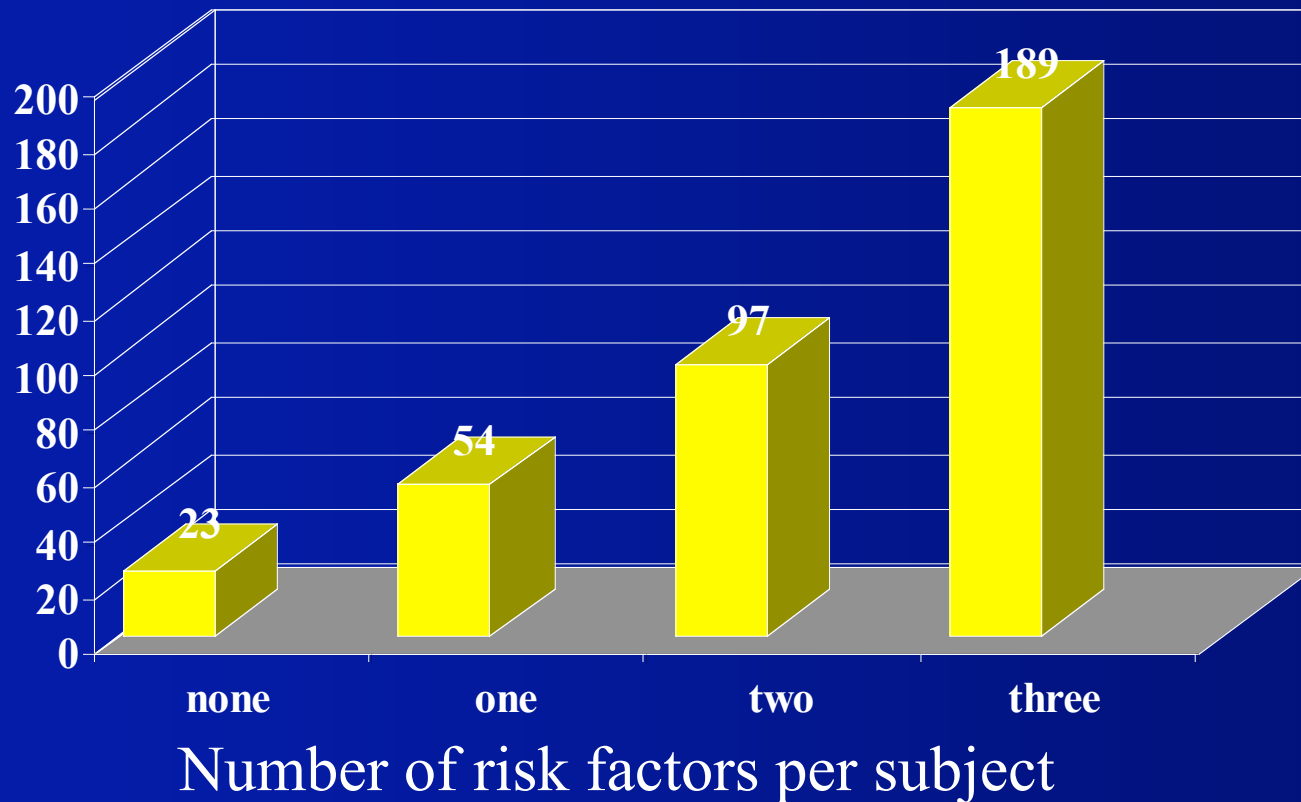
\*Freedman et al, *Pediatrics* 1999 (Bogalusa)

# Prevalence of multiple cardiovascular risk factors in adolescents



# Effect of multiple cardiovascular risk factors on 10 yr. risk of myocardial infarct

10 yr. incidence/ 1000 men



*CV pooling project*

# Alex's evaluation

- Comprehensive history and physical exam confirm Alex's current state of apparent good health including normal blood pressure and BMI. He is a non smoker.
- Fasting lipid profile was ordered in light of the positive family history:

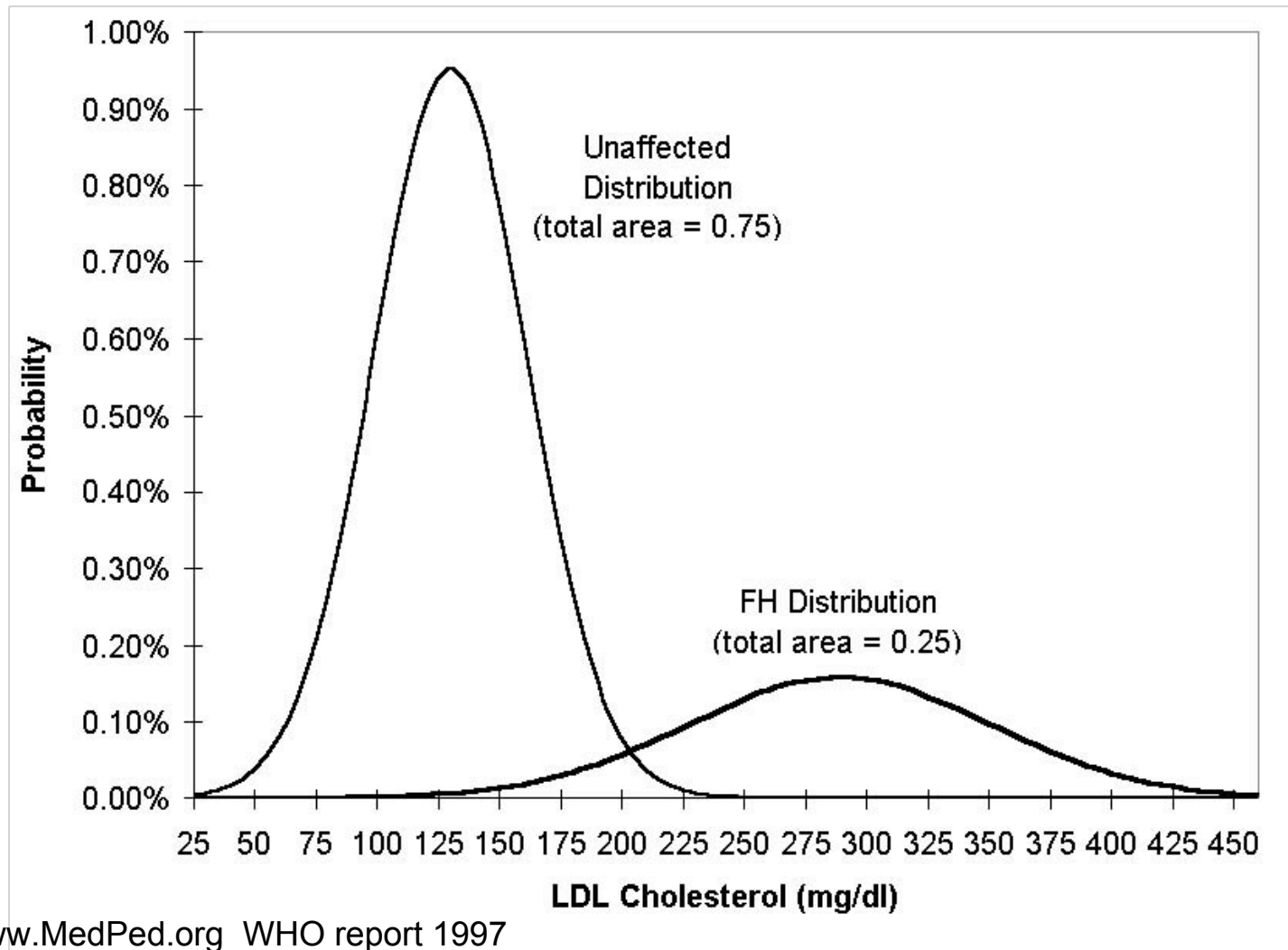
## Significant Results:

Total cholesterol                      260 mg/dl

LDL-C    195 mg/dl

Diagnosis: **Familial Hypercholesteremia.**

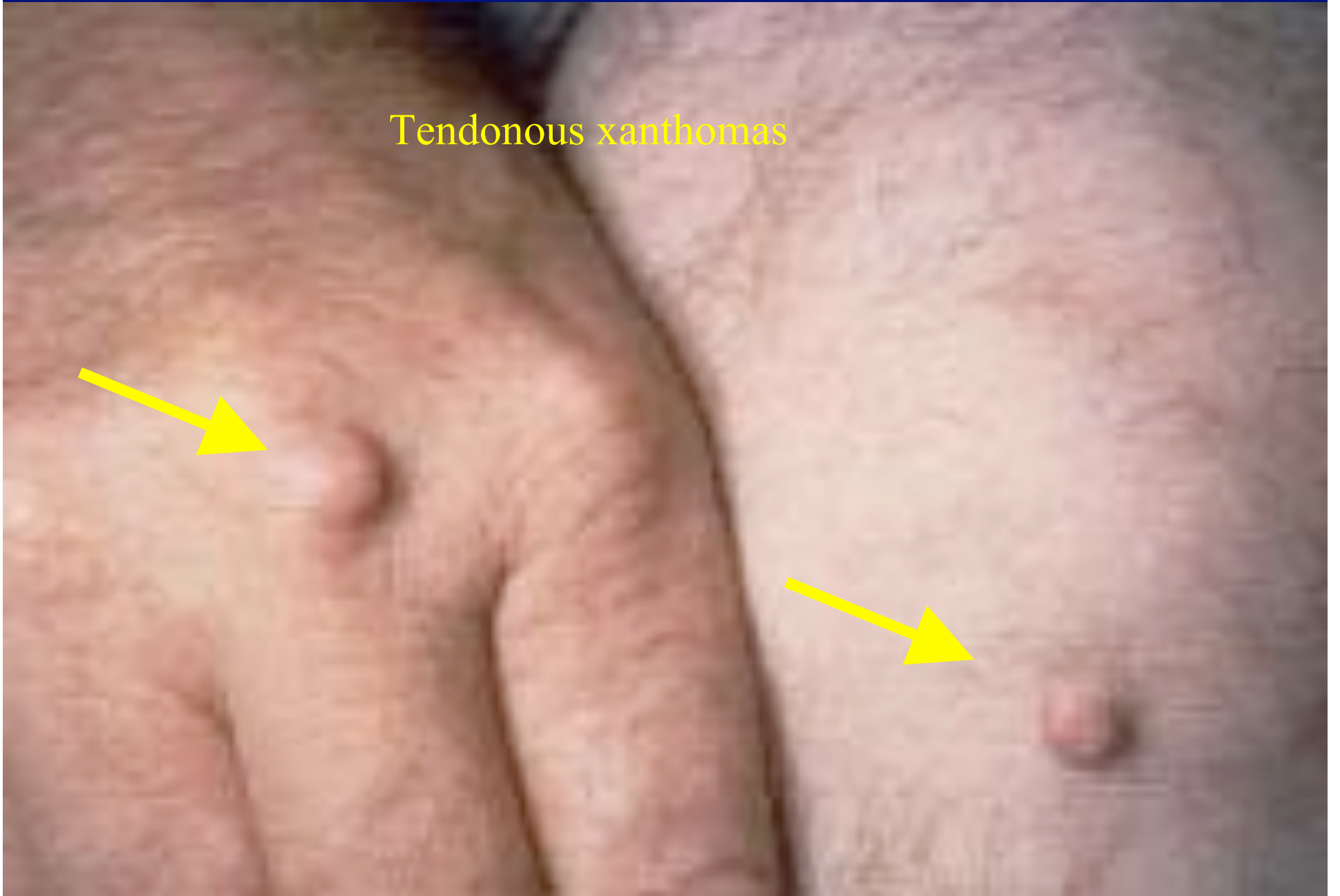
# LDL Cholesterol in diagnosis of Familial Hypercholesterolemia (FH)



# Xanthelasma



Tendonous xanthomas



# Question 3: Alex's management

What should be offered to Alex at this point?

1. Reassurance and lifestyle advice.
2. Cardiology consult.
3. Nutrition consult.
4. Drug therapy.
5. Coronary bypass graft.

# Recommendations for identifying adolescents at risk

# AAP screening recommendations

- In patients with family history of early CVD
- After age two measure random cholesterol
- If  $> 170$  mg/dl , repeat and if still high do fasting lipid profile
- Classify by LDL-C ( $<130$ mg/dl nl)
- First line of treatment is TLC
- Resins or Statins for Adolescents with LDL-C  $> 190$ mg/dl
-

# Cost effective strategy for CVD prevention

- 1 When comparing strategies across the whole age range, case finding amongst relatives of FH cases was the most cost-effective strategy, and universal systematic screening the least cost effective.
  - Systematic screening of 16 year olds using clinical methods of diagnosis appears to be similarly cost-effective to case finding.
  - The modeling results would support a combination of strategies. For example, systematic screening at 16 years of age could be carried out alongside both opportunistic screening of patients with an early MI (men aged 16–34 years, women aged 16–54 years) **and case finding** for family members of index cases (men aged 16–34 years, women aged 16–54 years).

# Pediatric Atherosclerosis Prevention Recommendations

- 1 Averaged over several days, fat intake should be no more than 30% and no less than 20% of kcalories.
- 2 Gradual introduction of change from age 2-5 years.
- 3 Replace fat calories with whole grains, fruits and vegetables.
- 4 Intakes of saturated fat < 10%, cholesterol < 300 mg/day.
- 5 Measure cholesterol after age 2 in cases of positive family history or with risk factors, *and in all teens.*
- 6 Refer those who fail to reach target LDL-C with TLC.

AAP Committee on Nutrition, *Pediatrics* 101: 141-147, 1998

Jacobson MS, *J Pediatr* 133:1-2 1998

# Medical management

# Treatment principles for adolescent hyperlipidemia:

- health promotion is the primary goal
- family, not the child or teen, is identified as the intervention target
- lowered saturated fat and simple carbohydrate diet
- increase habitual aerobic physical activity
- decrease sedentary activity
- medical follow up at regular intervals

# Nutrition education goals

- Healthy balance of macronutrients :  
(*20-30% fat*, 15% protein, 55-65% carbohydrate)
- Teach how to read food labels
- Tips for restaurants and take out
- Five a day fruit/vegetable plan
- Limits on sugar sweetened beverages

# Lipid Goals for Adolescents

- Total Cholesterol < 170 mg/dl (or 15% decline from baseline)
- Triglyceride < 100 mg/dl
- LDL Cholesterol 130 mg/dl (or 15% decline from baseline)
- HDL Cholesterol > 35 mg/dl

McCindle B et al. Drug Therapy of High-Risk Lipid Abnormalities in Children and Adolescents. Scientific statement of the AHA *Circulation* 2007



Nick Downes

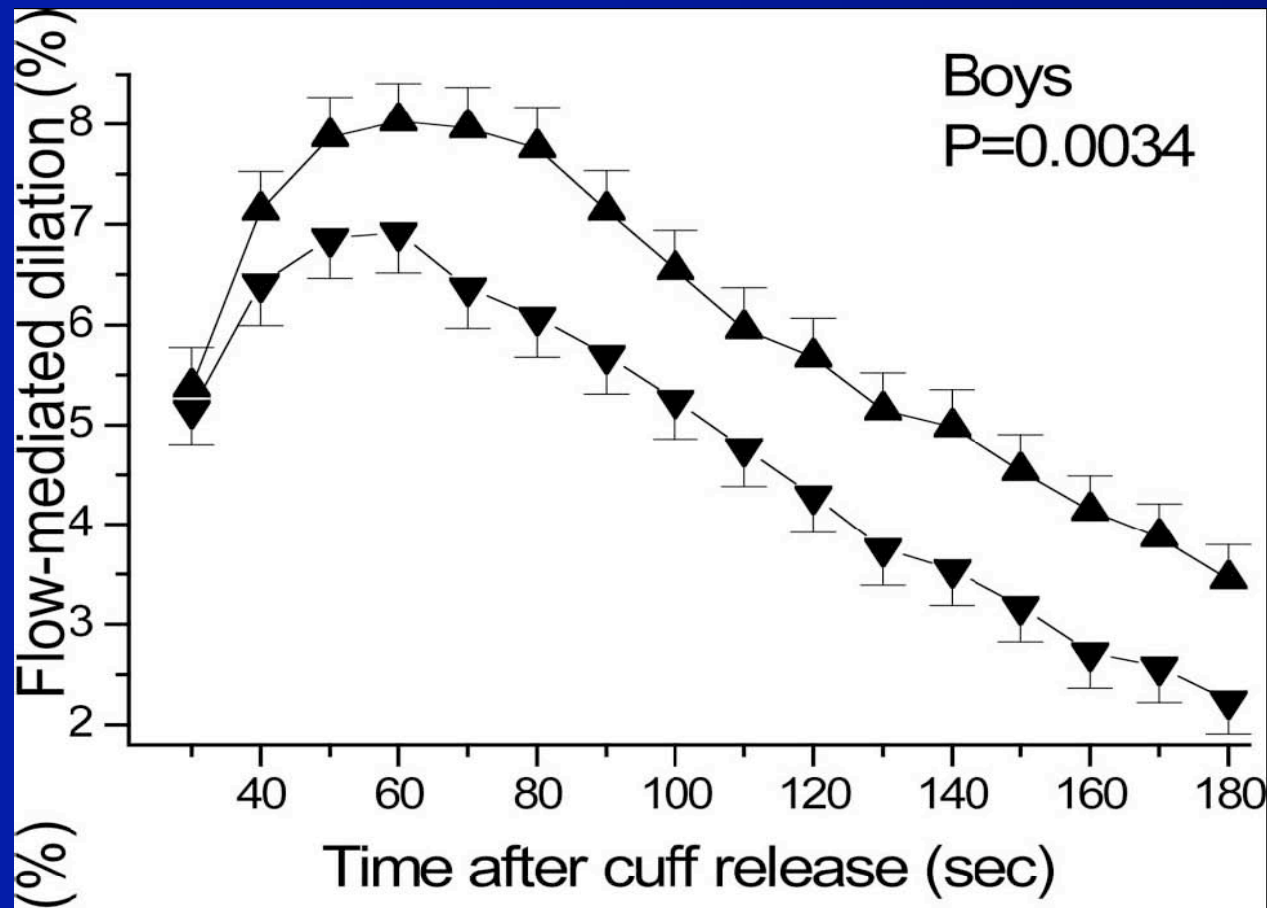
*"When I was your age, I had to walk six feet, change the channel by hand and then walk the six feet back."*

# Criteria for Pharmacotherapy of Hyperlipidemias

- Age > 10
  - + LDL cholesterol > 190 mg/dl (>99th percentile)
  - + Strong Family History of severe premature atherosclerosis
  - + Failure to respond to supervised dietary management in a reasonable time period
- OR Xanthomas

McCindle B et al. Drug Therapy of High-Risk Lipid Abnormalities in Children and Adolescents. Scientific statement of the AHA *Circulation* 2007

# Does pediatric primary prevention work?



# Alex G's management

- In light of his family history the first evaluation should be a fasting lipid profile. (question 1 , ans 2)
- His diagnosis is FH, therefore his probability of a premature heart attack or stroke is 80% if untreated. Since half of first heart attacks are fatal his chance of sudden death is then 40%. (question 2, ans 2)
- After sufficient trial of TLC, with RD supervision if his LDL remains above target of 130mg/dl, then he will be started on a statin. (question 3, ans 3)

# Conclusions I

- Atherosclerosis is the most prevalent cause of morbidity and mortality in the U.S.
- The risk factors associated with premature lesions are highly prevalent in children and adolescents.
- Health plans and providers have a key role to play in prevention.

# Conclusions II

- Dietary and physical activity therapeutic lifestyle change (TLC) are still the cornerstone of therapy for adolescents with hyperlipidemia.
- For selected high risk adolescents (~10%) the addition of pharmacotherapy is indicated.
- Statins, recently FDA approved for adolescents, are now first line monotherapy.