Case Presentation

Moderator: Sharon Liu, DO
Associate Internal Medicine Chief
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Izzy (2006)

- 51 y/o Hispanic woman with a history of diabetes and obesity.
- Her diabetes has not been well-controlled as she craves sweet candy, carbohydrates and processed foods.
- She drinks socially, on average 6 drinks a week, smokes ½ pack of cigarettes a day. She denies drug use. She has 2 tattoos, obtained in the early 1980s.
- PMH is positive for HTN, hypothyroidism and hyperlipidemia.
- BMI is 32; waist circumference is 36.5 inches.
- Works as administrative assistant for a doctor in town.
- Married and has 2 adult children.

Izzy

- Substernal burning pain for the past 6 weeks for which her PCP prescribed a PPI. Symptoms persisted despite PPI.
- Returned to PCP.
- Labs
  - CMP: LFTs were mildly elevated, otherwise normal
  - CBC normal
  - Fasting lipid panel: LDL 170, HDL 32, triglycerides 352
  - HgA1c 9.4
- BP: 140/90
- Referred to Dr. Dlabal

Cardiovascular Complications of Metabolic Syndrome

Paul W. Dlabal, M.D.

Austin, Texas

Metabolic Syndrome: Definitions of NCEP, WHO, EGIR and ACE

	NCEP	WHO	EGIR	ACE
Required	. . .	Required: Insulin in top 25%; glucose ≥6.1 mmol/L [110 mg/dL]; 2-hour glucose ≥7.8 mmol/L [140 mg/dL]	Required: Insulin in top 25%	High risk*; BMI >25 kg/m^2 or waist ≥102 cm (men) or ≥88 cm (women)
No. of abnormalities	**≥3 of:**	**And ≥2 of:**	**And ≥2 of:**	**And ≥2 of:**
Glucose	≥6.1 mmol/L [110 mg/dL]		≥6.1 mmol/L [110 mg/dL]	≥6.1 mmol/L [110 mg/dL]; 2-hour glucose ≥7.8 mmol/L [140 mg/dL]
HDL cholesterol	<1.0 mmol/L [40 mg/dL] (men); <1.3 mmol/L [50 mg/dL] (women)	<0.9 mmol/L [35 mg/dL] (men); <1.0 mmol/L [40 mg/dL] (women)	<1.0 mmol/L [40 mg/dL]	<1.0 mmol/L [40 mg/dL] (men); <1.3 mmol/L [50 mg/dL] (women)
		or	or	
Triglycerides	≥1.7 mmol/L [150 mg/dL]	≥1.7 mmol/L [150 mg/dL]	≥2.0 mmol/L [180 mg/dL]	≥1.7 mmol/L [150 mg/dL]
Obesity	Waist ≥102 cm (men) or ≥88 cm (women)	Waist/hip ratio >0.9 (men) or >0.85 (women); BMI ≥30 kg/m^2	Waist ≥94 cm (men) or ≥80 cm (women)	
Hypertension	≥130/85 mm Hg	≥140/90 mm Hg	≥140/90 mm Hg	≥130/85 mm Hg

*For the ACE definition, high risk of being insulin resistant is indicated by the presence of at least 1 of the following: diagnosis of CVD, hypertension, polycystic ovary syndrome, nonalcoholic fatty liver disease, or acanthosis nigricans; family history of type 2 diabetes, hypertension, or CVD; history of gestational diabetes or glucose intolerance; nonwhite ethnicity; sedentary lifestyle; BMI ≥25 kg/m^2 or waist circumference ≥94 cm for men and ≥80 cm for women; and age>40 years.

JACC Vol. 59, No. 7 2012 - February 14, 2012; 665-72

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TABLE 2. Baseline Characteristics in 615 Men and 749 Women Without Diabetes or Prevalent CVD, According to the Presence of the NCEP Metabolic Syndrome Definition

	Women		Men	
Characteristic	NCEP	No NCEP	NCEP	No NCEP
No.	193	556	117	498
Age, y	62.8±7.6	60.3±7.2	62.2±7.1	60.4±7.1
Current smoking, %	35	26	34	35
Former smoker, %	20	24	50	46
Systolic blood pressure, mm Hg	146.4±20.4	129.1±18.9	146.1±18.0	131.9±18.6
Diastolic blood pressure, mm Hg	84.8±10.7	79.4±9.9	87.3±9.1	82.5±10.0
Antihypertensive medication use, %	26.4	10.4	21	6.2
Total cholesterol, mmol/L	7.14±1.18	6.69±1.12	6.55±1.09	6.28±1.09
LDL cholesterol, mmol/L	4.98±1.12	4.57±1.06	4.52±1.02	4.41±1.01
Triglycerides, mmol/L	2.13±0.77	1.18±0.43	2.28±1.03	1.39±0.63
HDL cholesterol, mmol/L	1.20±0.26	1.59±0.34	1.00±0.24	1.26±0.31
Fasting glucose, mmol/L	5.63±0.58	5.22±0.47	5.86±0.59	5.42±0.45
Fasting insulin, pmol/L	102.7±54.6	74.1±38.4	103.2±45.8	84.4±62.1
BMI, kg/m^2	29.0±3.3	25.6±3.2	28.0±3.0	25.3±2.5
Waist circumference, cm	93±8	83±9	102±9	92±8
Waist-to-hip ratio	0.89±0.06	0.82±0.06	0.99±0.06	0.93±0.06
Framingham CHD risk score	9.7±6.4	4.3±3.9	21.3±7.0	15.1±7.1

Data are mean±SD or percentage of subjects.

Circulation. 2005;112:666-673

Prevalence of Individual MetS Abnormalities

TABLE 1. Prevalence of Individual MetS Abnormalities Among US Adults by Disease Category

Disease	Subjects, n	Weighted No. of Subjects, millions (%)	Disease Condition Categories*				
			Impaired Glucose Tolerance†	Low HDL-C‡	High Triglycerides§	Elevated Blood Pressure‖	Obesity¶
All groups	6255	63.9 (100)	9.0	46.9	21.8	54.8	20.1
No MetS, diabetes, or CVD	2878	34.6 (54.2)	4.6	25.4	9.6	31.5	3.5
MetS (all)	1698	16.6 (26.0)	18.5	85.0	48.2	90.5	56.2
MetS (no diabetes)	1178	12.3 (19.2)	21.0	92.6	52.6	94.9	63.9
Diabetes	520	4.3 (6.8)	100.0#	63.4	35.9	78.0	34.2
CVD (all)	1679	12.6 (19.8)	8.6	59.3	23.3	77.1	20.7
Pre-existing CVD	1398	10.7 (16.9)	8.6	57.3	20.4	74.8	17.8
Diabetes and CVD	281	1.9 (2.9)	100.0#	70.9	40.1	90.0	37.4

Circulation. 2004;110:1245-1250

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Metabolic Syndrome: Definitions/Hazard Ratios/Risk

TABLE 5. Metabolic Syndrome Definitions and Hazard Ratios of Risk of Fatal and Nonfatal CVD, With Adjustment for Other CVD Factors and for 10-Year Framingham Risk*

Adjusted for:	NCEP	WHO	EGIR	ACE
Men				
Age	1.91 (1.31–2.79)	1.45 (1.02–2.05)	1.49 (1.01–2.21)	1.30 (0.92–1.83)
Age, LDL cholesterol, current smoking	1.88 (1.28–2.76)	1.48 (1.04–2.12)	1.69 (1.13–2.54)	1.16 (0.82–1.65)
10-Year Framingham risk category	1.64 (1.11–2.44)	1.44 (1.01–2.04)	1.48 (0.99–2.19)	1.06 (0.74–1.53)
Women				
Age	1.68 (1.11–2.55)	1.31 (0.85–2.00)	1.34 (0.87–2.14)	1.84 (1.22–2.78)
Age, LDL cholesterol, current smoking	1.44 (0.95–2.19)	1.32 (0.86–2.01)	1.33 (0.84–2.11)	1.52 (1.01–2.30)
10-Year Framingham risk category	1.17 (0.73–1.87)	1.31 (0.85–2.02)	1.21 (0.75–1.95)	1.31 (0.81–2.10)

Data are age-adjusted hazard ratios (95% CI).

*Framingham risk score and metabolic syndrome definitions both include information on HDL cholesterol and hypertension. There was considerable variation in the presence of the metabolic syndrome over 10-year Framingham risk categories, and the models that included both variables did not become unstable, as might be indicated by large changes in the estimate.

Circulation. 2005;112:666-673

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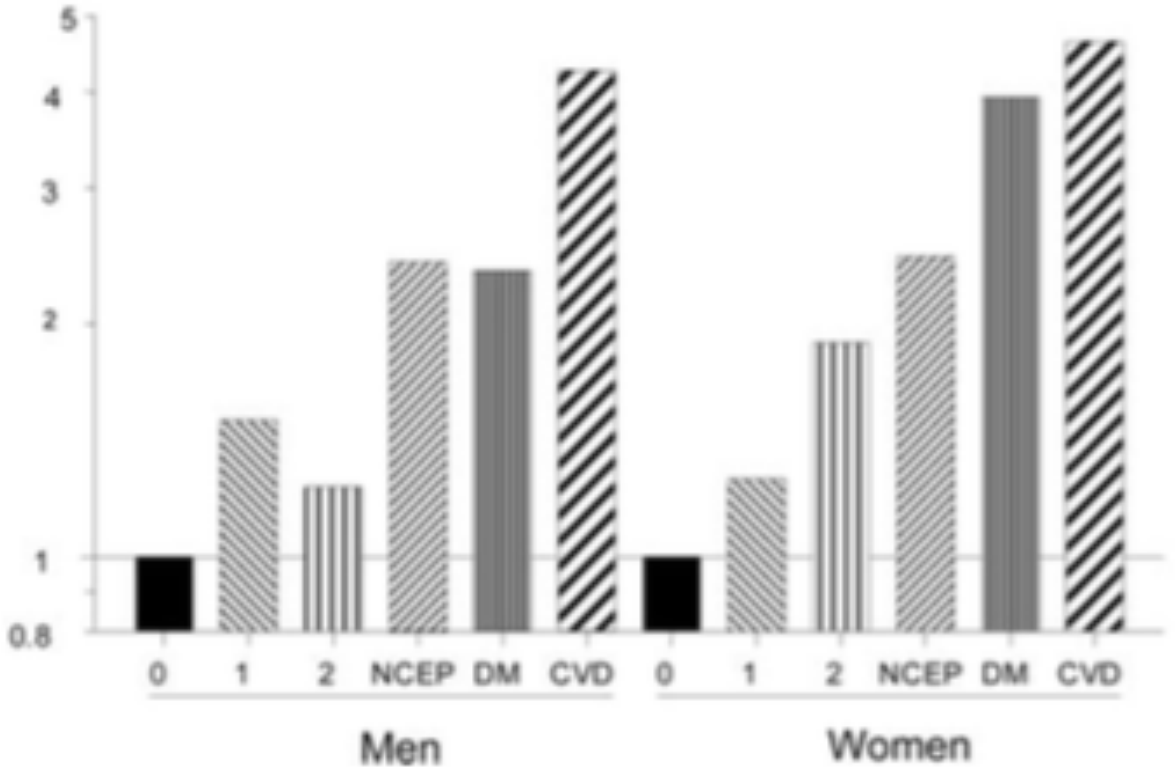
Number of Metabolic Syndrome Abnormalities by NCEP

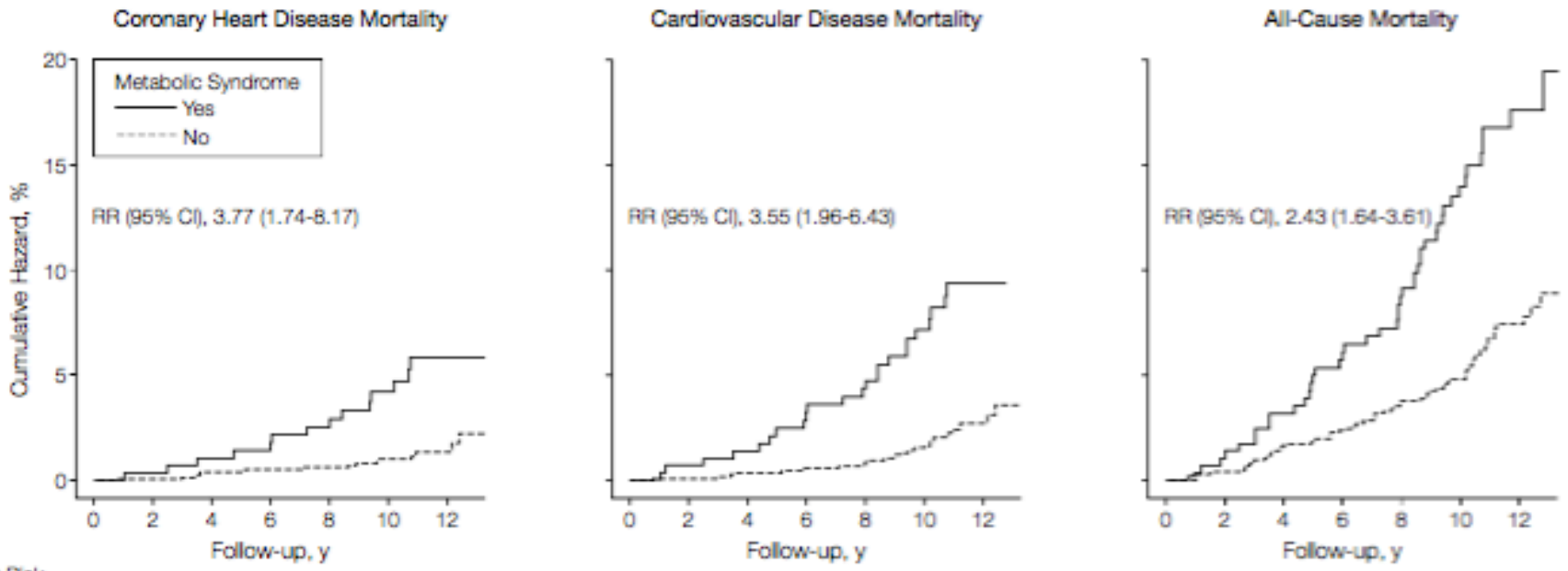


Number of metabolic syndrome abnormalities by NCEP definition, diabetes, and prevalent CVD and hazard ratios of 10-year risk of fatal and nonfatal CVD. Bars show age-adjusted hazard ratios for 0 (reference category), 1, 2, and ≥3 metabolic syndrome abnormalities by NCEP definition, baseline diabetes (DM), and baseline prevalent CVD status.

Circulation. 2005;112:666-673

Unadjusted Kaplan-Meier Hazard Curves

Figure. Unadjusted Kaplan-Meier Hazard Curves



RR indicates relative risk; CI, confidence interval. Curves for men with vs without the metabolic syndrome based on factor analysis (men in the highest quarter of the distribution of the metabolic syndrome factor were considered to have the metabolic syndrome). Median follow-up (range) for survivors was 11.6 (9.1-13.7) years. Relative risks were determined by age-adjusted Cox proportional hazards regression analysis.

JAMA December 4, 2002 – Vol 288, No. 21 (Reprinted)

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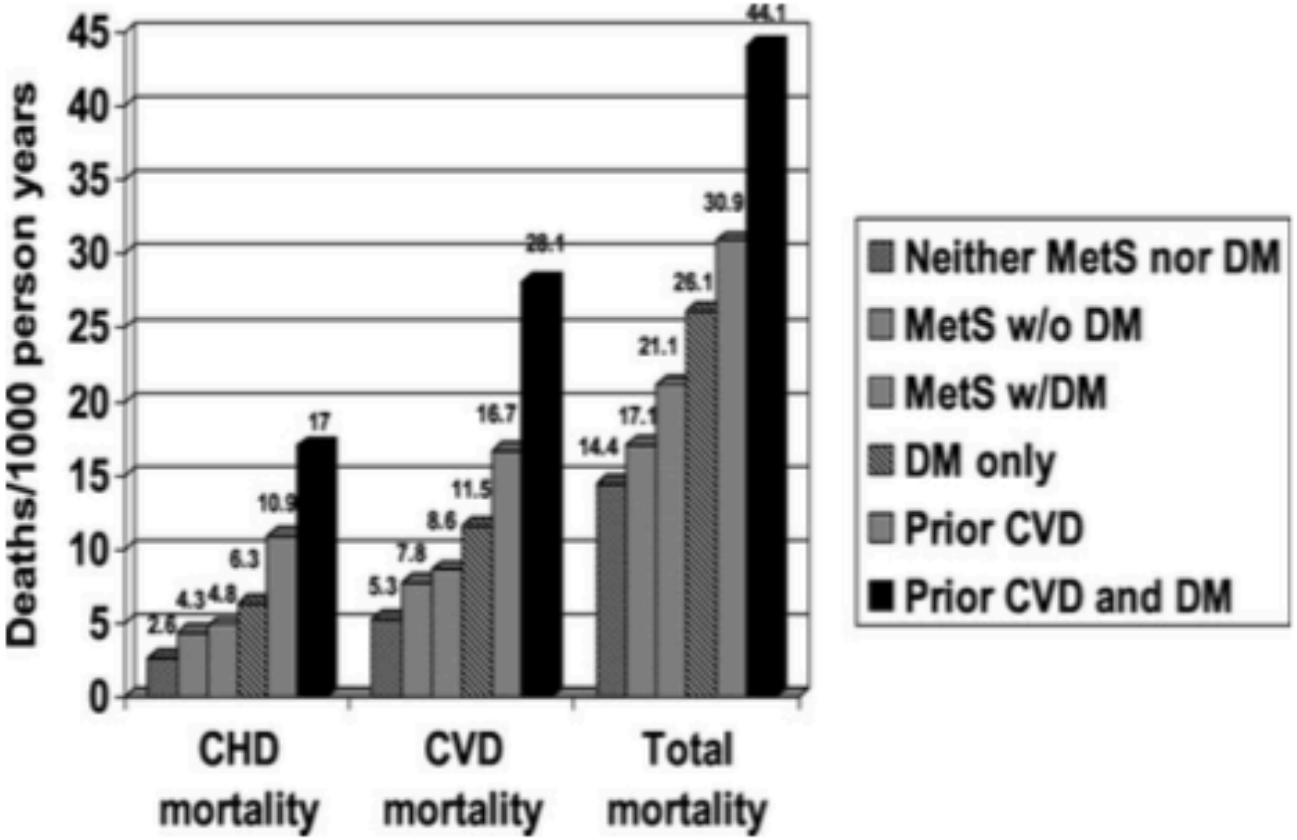
Age and Gender Adjusted CHD, CVD, and Total Mortality Rates



Age- and gender-adjusted CHD, CVD, and total mortality rates in US adults with MetS with and without diabetes and pre-existing CVD in the NHANES II Follow-Up Study (n=6255; mean follow-up, 13.3 years). DM indicates diabetes mellitus.

Circulation. 2004;110:1245-1250

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Metabolic Syndrome and Age-adjusted Risk

TABLE 3. Metabolic Syndrome and Age-Adjusted Risk for Outcomes for Framingham Offspring at 8-Year Follow-Up

Event	No. of Metabolic Syndrome Risk Factors	Men, RR (95% CI)	Women, RR (95% CI)
CVD	0	Referent	Referent
	1 or 2	1.48 (0.69–3.16)	3.39 (1.31–8.81)
	≥3	3.99 (1.89–8.41)	5.95 (2.20–16.11)
Hard CHD	0	Referent	Referent
	1 or 2	0.98 (0.36–2.67)	3.77 (0.45–31.28)
	≥3	2.55 (0.96–6.79)	7.21 (0.81–64.37)
Total CHD	0	Referent	Referent
	1 or 2	1.24 (0.54–2.83)	3.29 (0.95–11.34)
	≥3	3.01 (1.33–6.83)	3.96 (1.02–15.38)
T2DM	0	Referent	Referent
	1 or 2	4.16 (0.98–17.64)	6.10 (1.85–20.10)
	≥3	23.83 (5.80–98.01)	29.69 (9.10–96.85)

MI indicates myocardial infarction.

Circulation. 2005;112:3066-3072

Metabolic Syndrome/Age Adjusted Risk

TABLE 2. Metabolic Syndrome* and Age-Adjusted Risk for Outcomes for Framingham Offspring at 8-Year Follow-Up

Event	No. of Events/Nonevents, Metabolic Syndrome Absent	No. of Events/Nonevents, Metabolic Syndrome Present	RR (95% CI)	Age-Adjusted Statistical Significance	PAR, %
Men					
CVD	53/1081	63/352	2.88 (1.99–4.16)	<0.0001	33.7
Hard CHD (MI or CHD death only)	23/1111	25/390	2.58 (1.46–4.57)	0.0011	29.9
Total CHD	38/1096	40/375	2.54 (1.62–3.98)	<0.0001	29.4
T2DM	28/1106	71/344	6.92 (4.47–10.81)	<0.0001	61.5
Women					
CVD	37/1442	21/274	2.25 (1.31–3.88)	0.0034	15.8
Hard CHD (MI or CHD death only)	8/1471	5/290	2.50 (0.80–7.79)	0.1151	18.4
Total CHD	21/1458	8/287	1.54 (0.68–3.53)	0.3038	7.5
T2DM	33/1446	46/249	6.90 (4.35–10.94)	<0.0001	46.9

*Defined as the presence of >3 of the 5 metabolic risk factors.
All analyses are age-adjusted.

Circulation. 2005;112:666-673

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Four-year Kaplan-Meier Plots of Survival

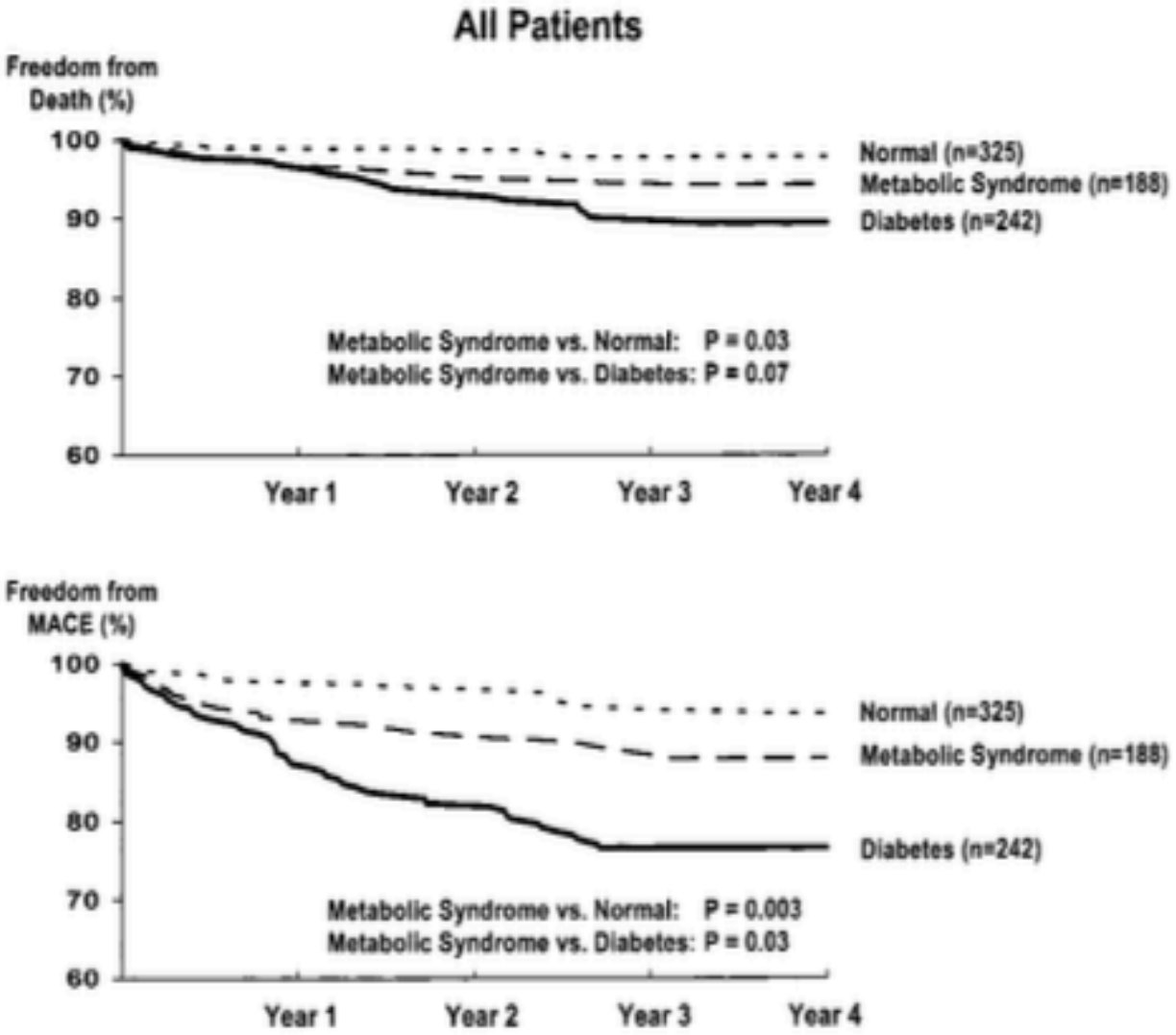

Figure 2. Four-year Kaplan-Meier plots of survival (top) and rates of freedom from MACE (death, nonfatal myocardial infarction, stroke, or congestive heart failure; bottom) by metabolic status at study entry.

Circulation. 2004;109:714-721

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Women Without Significant CAD

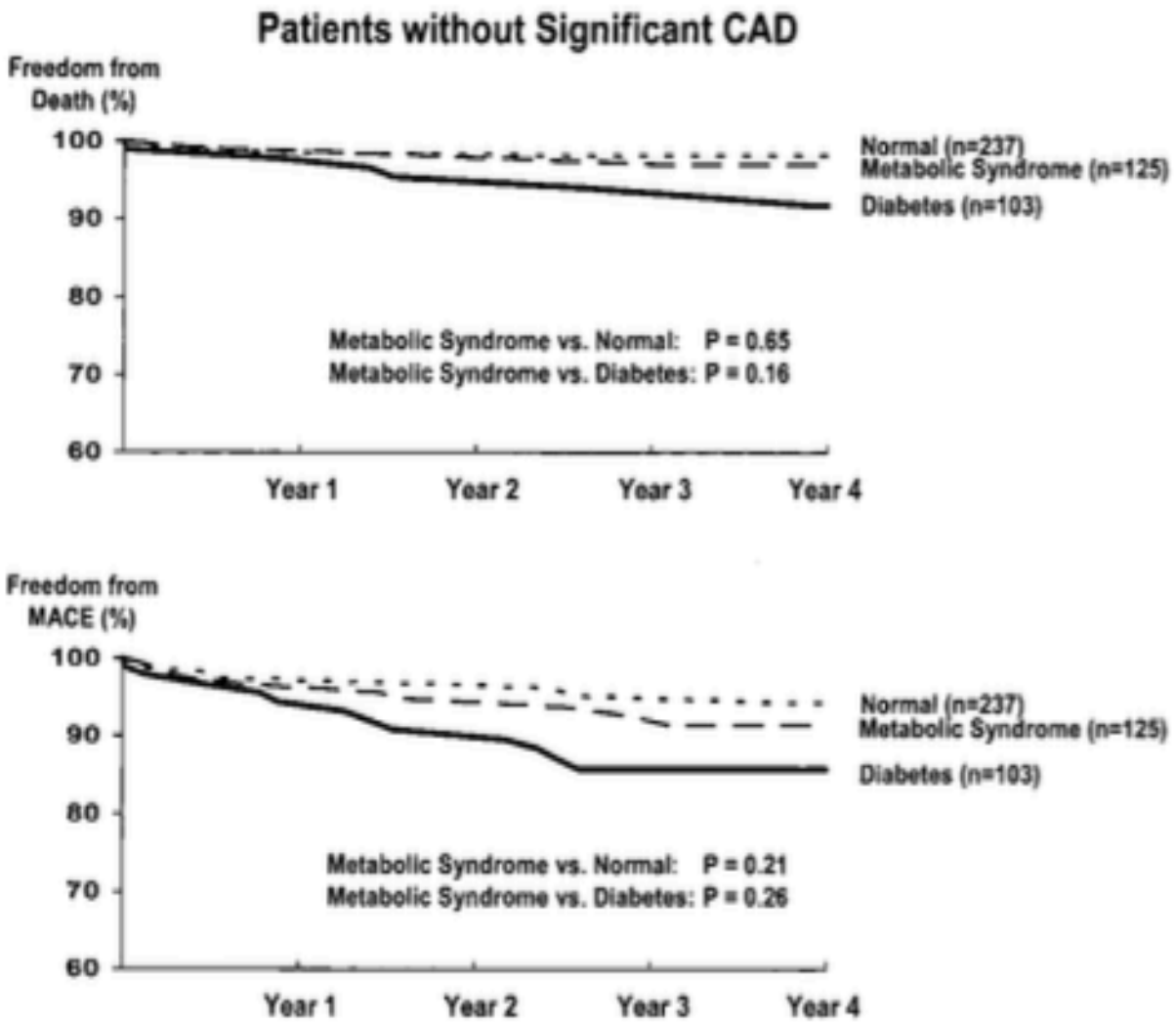

Figure 4. Among women without significant angiographic CAD at study entry (no lesion ≥50% stenosis), 4-year plots of survival (top) and freedom from MACE (death, nonfatal myocardial infarction, stroke, or congestive heart failure) rates (bottom) by metabolic status at study entry.

Circulation. 2004;109:714-721

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Women With Significant CAD

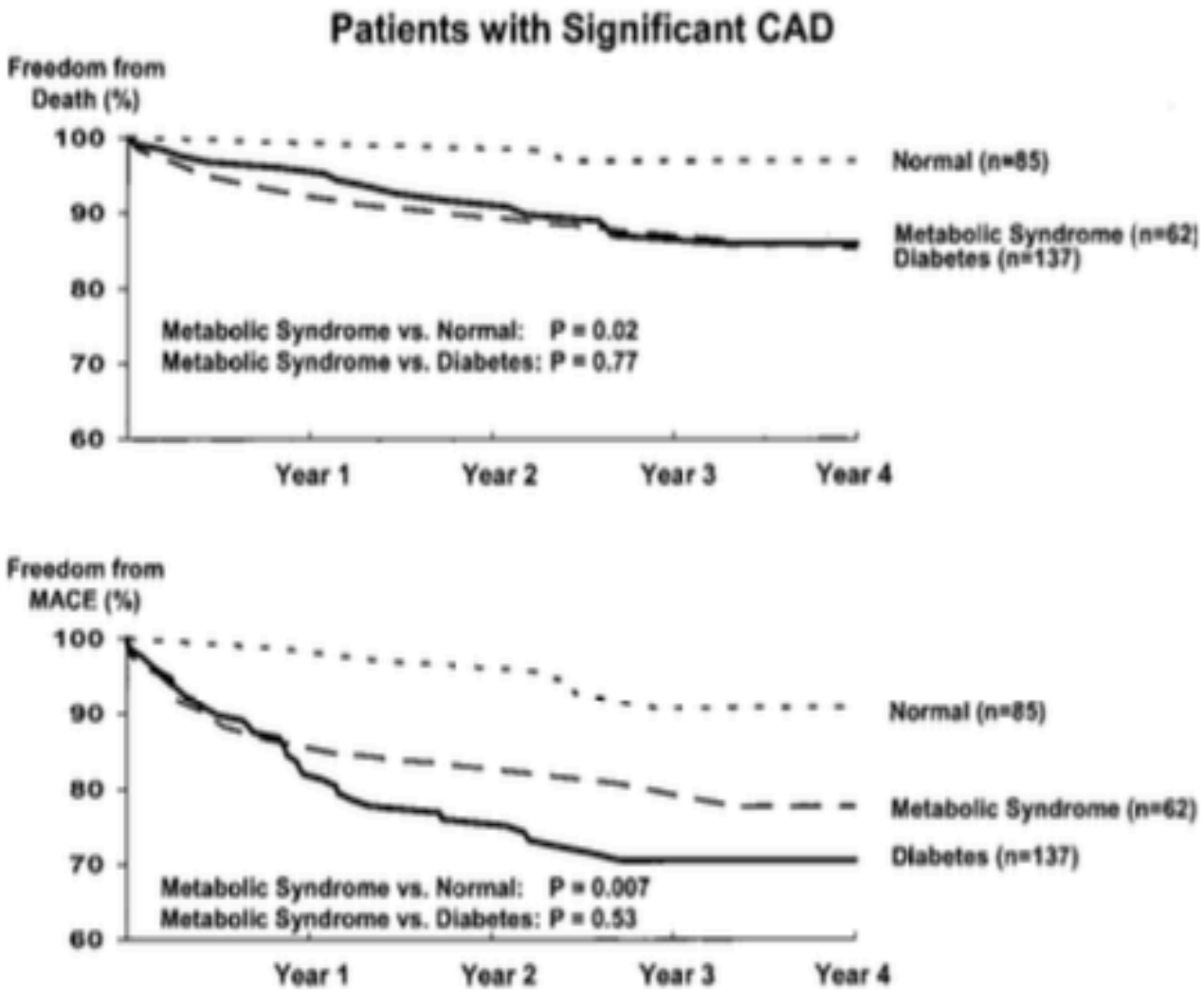

Figure 3. Among women with significant angiographic CAD at study entry (≥1 lesion ≥50% stenosis), 4-year plots of survival (top) and freedom from MACE (death, nonfatal myocardial infarction, stroke, or congestive heart failure; bottom) by metabolic status at study entry.

Circulation. 2004;109:714-721

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Incidence Rate of Major CV Events

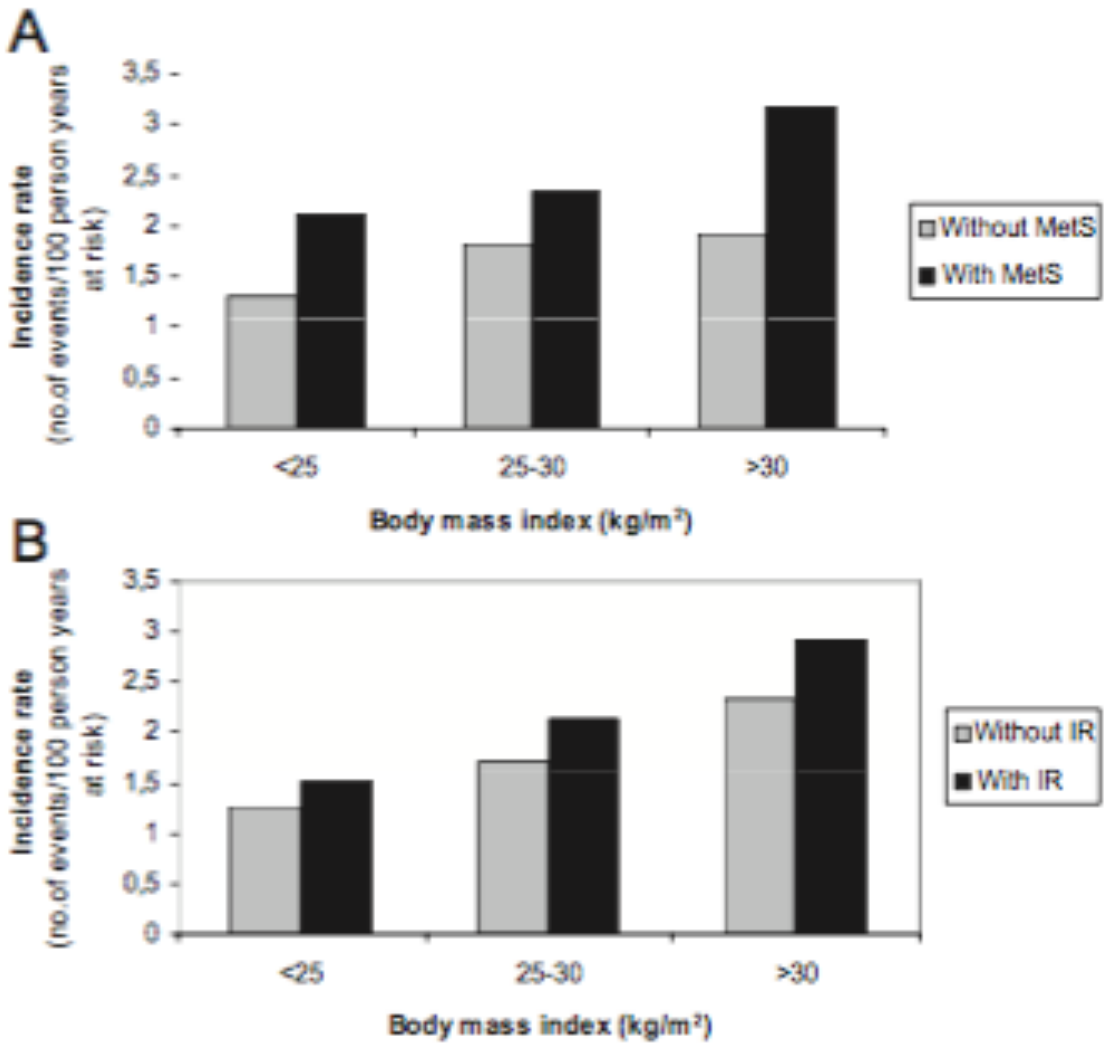

Figure 1. Incidence rates of major cardiovascular events in different combinations of BMI and MetS (A) and different combinations of BMI and IR (B).

Circulation. 2010; 121; 230-236; originally published December 28, 2009

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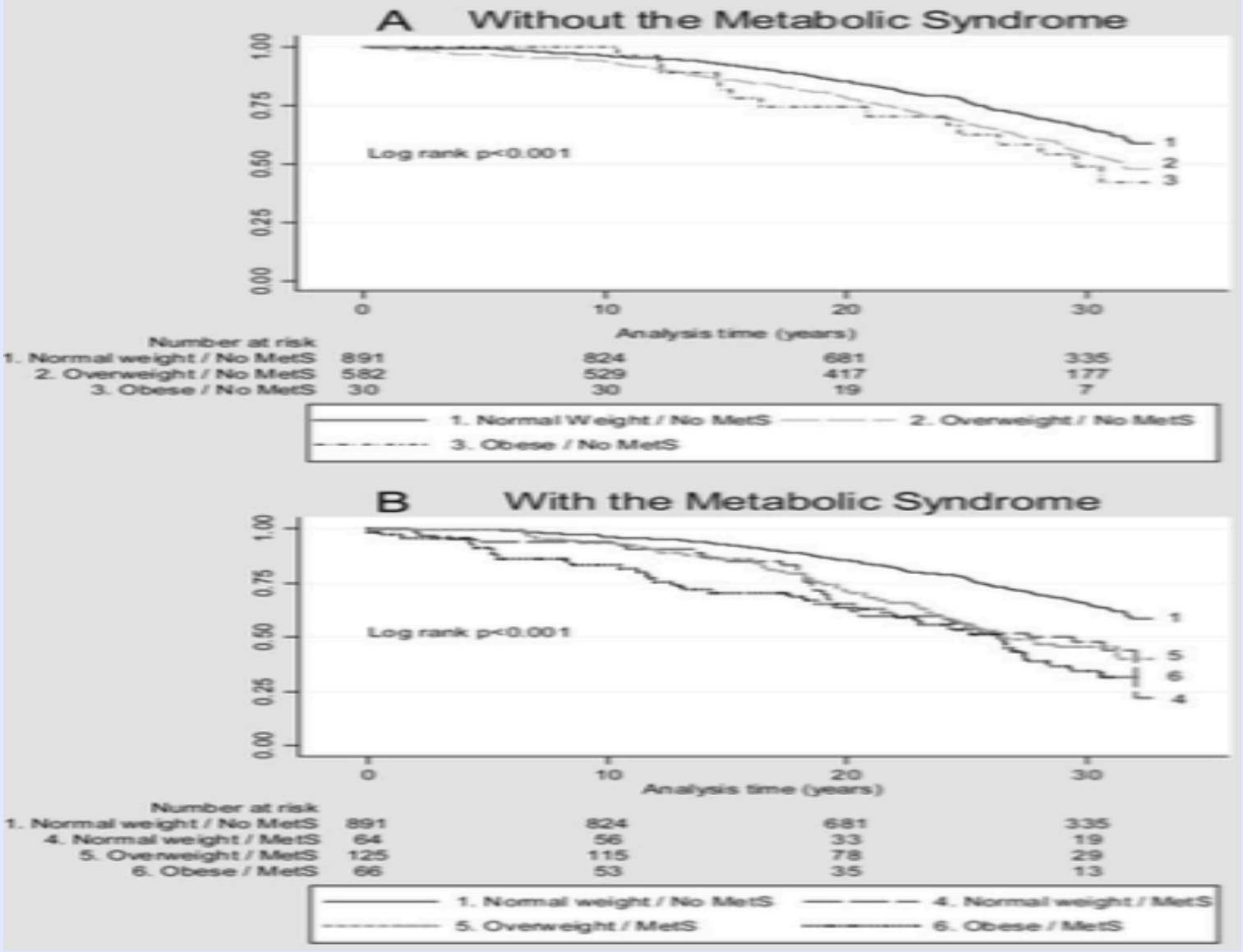
Risks in Overweight or Obese Patients: With/Without Metabolic Syndrome



Circulation. 2010; 121; 230-236; originally published December 28, 2009R

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IS THERE HOPE?

- The problem consists of **MODIFIABLE** risk factors for CAD/CHD/CV Mortality

- The solution is to MODIFY these risks:
  - Weight Loss
  - Increased Cardiorespiratory Fitness
  - Direct Intervention

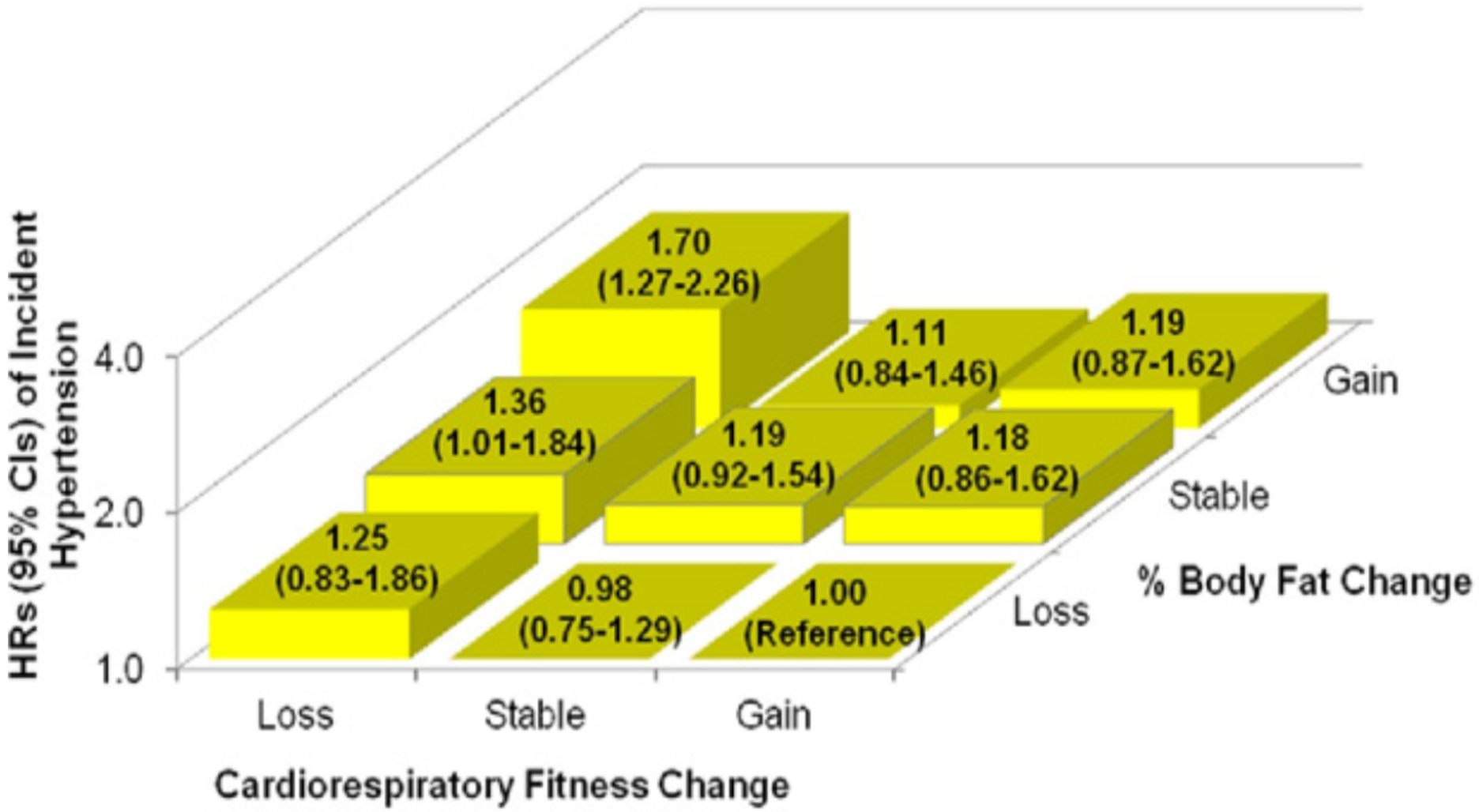
Correlations Between Changes in Fitness or Fatness

	Fitness Change		Fatness Change			
			% Body Fat Change		BMI Change	
CVD Risk Factor Components	r*	p Value	r*	p Value	r*	p Value
Unadjusted						
Systolic blood pressure change	-0.08	<0.001	0.10	<0.001	0.14	<0.001
Diastolic blood pressure change	-0.05	0.003	0.06	0.002	0.09	<0.001
Waist circumference change	-0.21	<0.001	0.35	<0.001	0.38	<0.001
Fasting glucose change	0.01	0.43	0.05	0.006	0.10	<0.001
Triglycerides change	-0.15	<0.001	0.16	<0.001	0.23	<0.001
HDL cholesterol change	0.11	<0.001	-0.12	<0.001	-0.11	<0.001
Total cholesterol change	-0.12	<0.001	0.21	<0.001	0.22	<0.001
Adjusted for age, sex, and % body fat change for fitness change or maximal MET change for fatness change						
Systolic blood pressure change	-0.05	0.006	0.07	<0.001	0.12	<0.001
Diastolic blood pressure change	-0.04	0.045	0.04	0.04	0.07	<0.001
Waist circumference change	-0.14	<0.001	0.37	<0.001	0.42	<0.001
Fasting glucose change	0.03	0.08	0.06	0.002	0.10	<0.001
Triglycerides change	-0.10	<0.001	0.12	<0.001	0.19	<0.001
HDL cholesterol change	0.08	<0.001	-0.09	<0.001	-0.08	<0.001
Total cholesterol change	-0.05	0.008	0.17	<0.001	0.18	<0.001

*Values are Pearson correlation coefficients in the unadjusted model and Pearson partial correlation coefficients in the adjusted model.
CVD = cardiovascular disease; HDL = high-density lipoprotein; other abbreviations as in Table 2.

JACC Vol. 59, No. 7 2012 - February 14, 2012; 665-72

HRs of Incident Cardiovascular Disease Risk (1)



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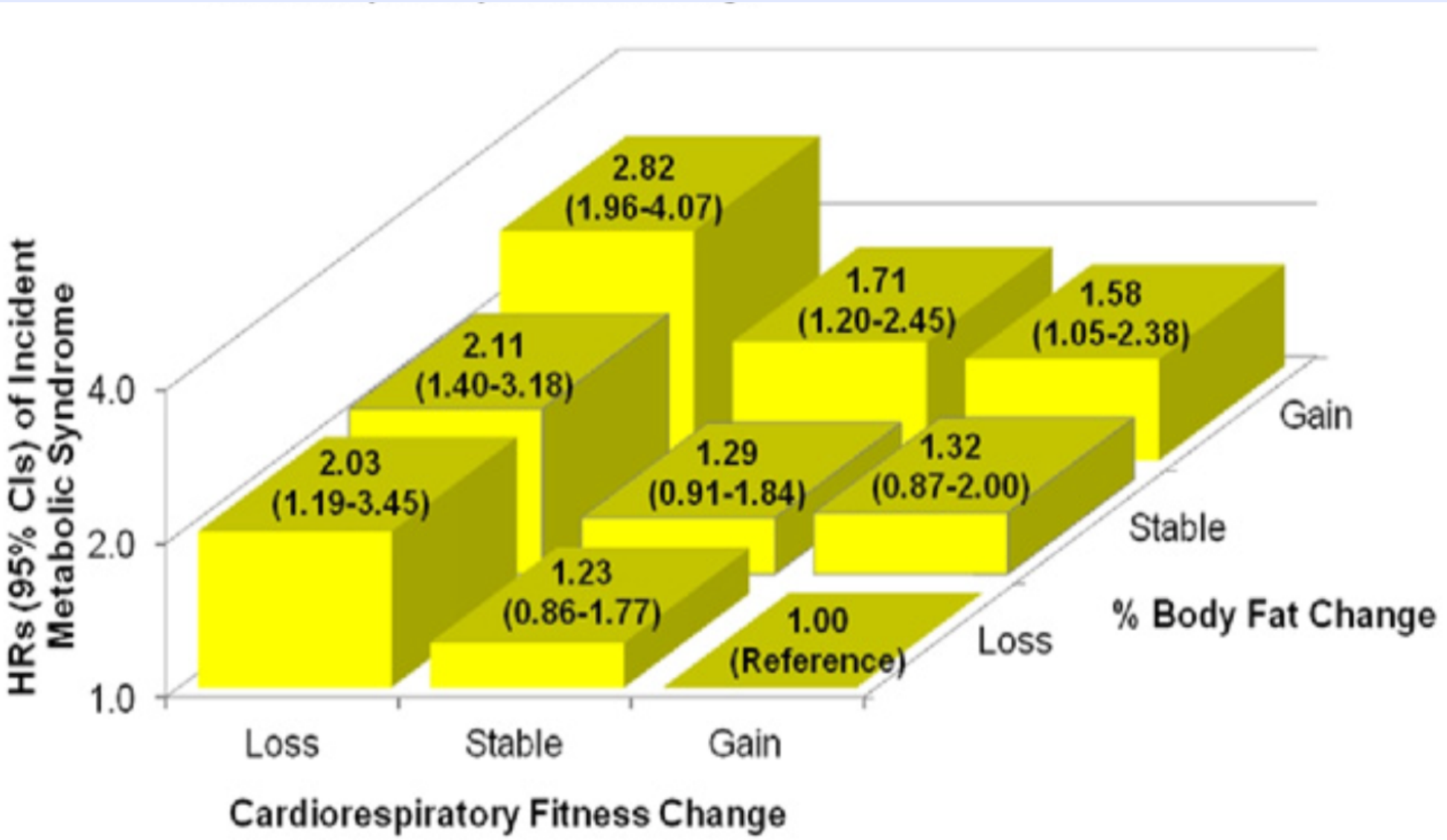
HRs of Incident Cardiovascular Disease Risk (2)



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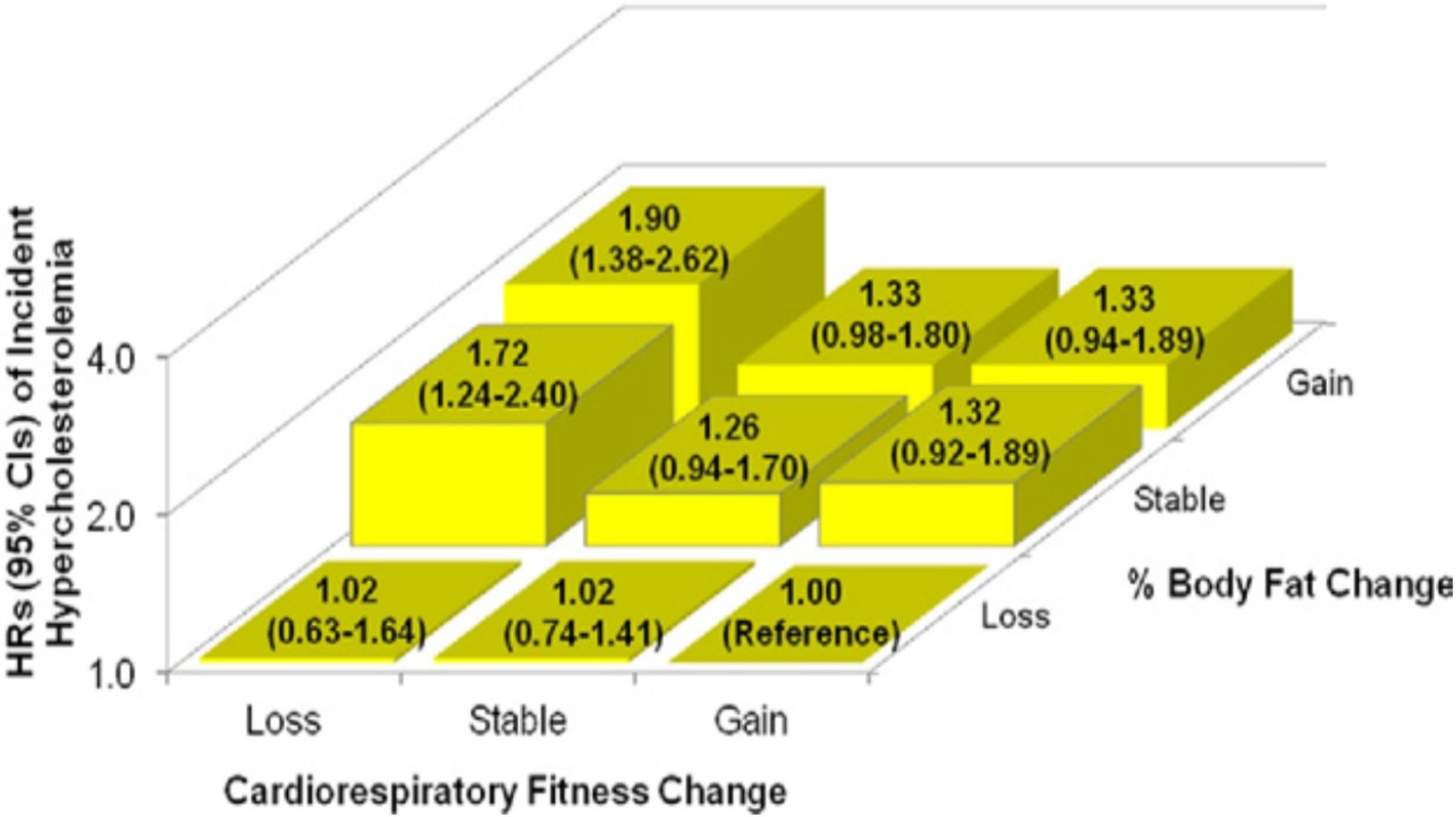
HRs of Incident Cardiovascular Disease Risk (3)



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Summary

- The prevalence of metabolic syndrome in the US and other industrialized countries is substantial, and contributes greatly to the burden of CVD.
  - Affects: Up to 25% of the US population.
  - CV Risk: Increases up to 2 fold.
  - Diabetes & MetS increase the risk up to 4 fold.
  - CV & MetS syndrome increase the risk more than 4 fold.
  - Improvement in fitness & fatness confers expected benefit.

Back to Dr. Liu

Izzy

- A cardiac stress test was ordered and it was positive. She underwent a left cardiac cath and was found to have 1 vessel disease, this was stented.
- Treatment plan
  - Started on Plavix
- Her substernal pain resolved and she felt much better.
- Labs: LDL 145, HDL 35, TG 230
- Ultrasound was ordered since LFTs remained elevated.
- Dr. Dlabal, how will you manage her hyperlipidemia?

Lipid Management in Metabolic Syndrome

Paul W. Dlabal, M.D.

Austin, Texas

Metabolic Syndrome: Constellation of Reversible Risk Factors for CAD

- Reduced HDL
- Elevated TG
- Elevated BP and FBS
- Weight gain

Criteria for Clinical Diagnosis

Table 11 Criteria for Clinical Diagnosis of the Metabolic Syndrome

Measure	Categorical Cut Points
Elevated Waist Circumference[a]	≥ 102 cm in males≥ 88 cm in females
Elevated triglycerides(drug treatment for elevated triglycerides is an alternate indicator[b])	≥ 150 mg/dL (1.7 mmol/L)
Reduced HDL-C(drug treatment for reduced HDL-C is an alternate indicator[b])	< 40 mg/dL (1.0 mmol/L) in males< 50 mg/dL (1.3 mmol/L) in females
Elevated blood pressure(antihypertensive drug treatment in a patient with a history of hypertension is an alternate indicator	Systolic ≥ 130 and/or diastolic ≥ 85 mm Hg
Elevated fasting glucose[c](drug treatment of elevated glucose is an alternate indicator)	≥ 100 mg/dl

Grundy "Risk Assessment" NCBI Bookshelf, 2015

Secondary Causes of Hyperlipidemia Most Commonly Encountered

Secondary Cause	Elevated LDL-C	Elevated Triglycerides
Diet	Saturated or *trans* fats, weight gain, anorexia nervosa	Weight gain, very-low-fat diets, high intake of refined carbohydrates, excessive alcohol intake
Drugs	Diuretics, cyclosporine, glucocorticoids, amiodarone	Oral estrogens, glucocorticoids, bile acid sequestrants, protease inhibitors, retinoic acid, anabolic steroids, sirolimus, raloxifene, tamoxifen, beta blockers (not carvedilol), thiazides
Diseases	Biliary obstruction, nephrotic syndrome	Nephrotic syndrome, chronic renal failure, lipodystrophies
Disorders and altered states of metabolism	Hypothyroidism, obesity, pregnancy*	Diabetes (poorly controlled), hypothyroidism, obesity; pregnancy*

Adapted with permission from Stone et al (80).

*Cholesterol and triglycerides rise progressively throughout pregnancy (80); treatment with statins, niacin, and ezetimibe are contraindicated during pregnancy and lactation.

LDL-C indicates low-density lipoprotein cholesterol.

AHA

Paradigm for Subtyping MetS

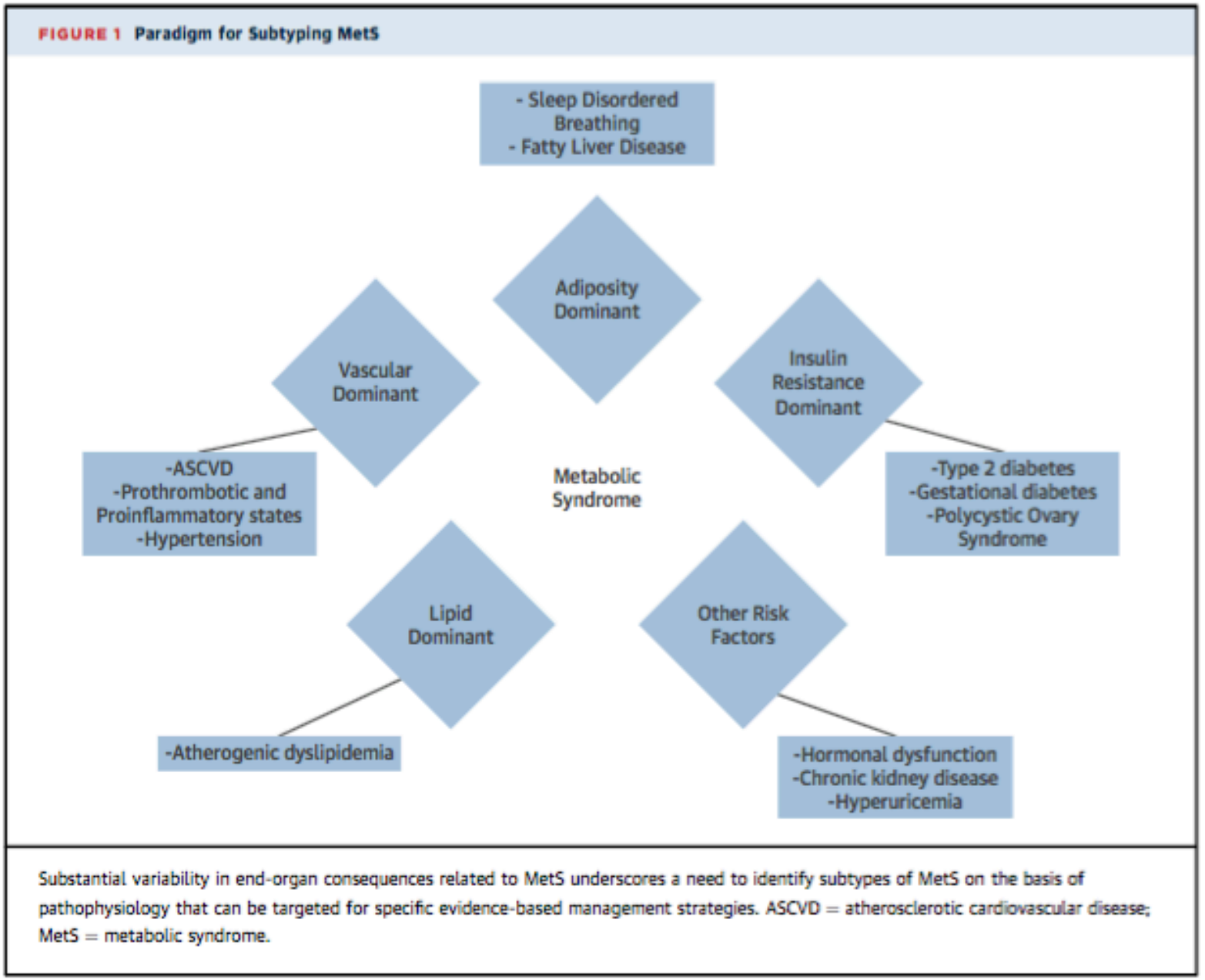


FIGURE 1 Paradigm for Subtyping MetS

Substantial variability in end-organ consequences related to MetS underscores a need to identify subtypes of MetS on the basis of pathophysiology that can be targeted for specific evidence-based management strategies. ASCVD = atherosclerotic cardiovascular disease; MetS = metabolic syndrome.

JACC VOL. 66, NO. 9, 2015 SEPTEMBER 1, 2015:1050–67

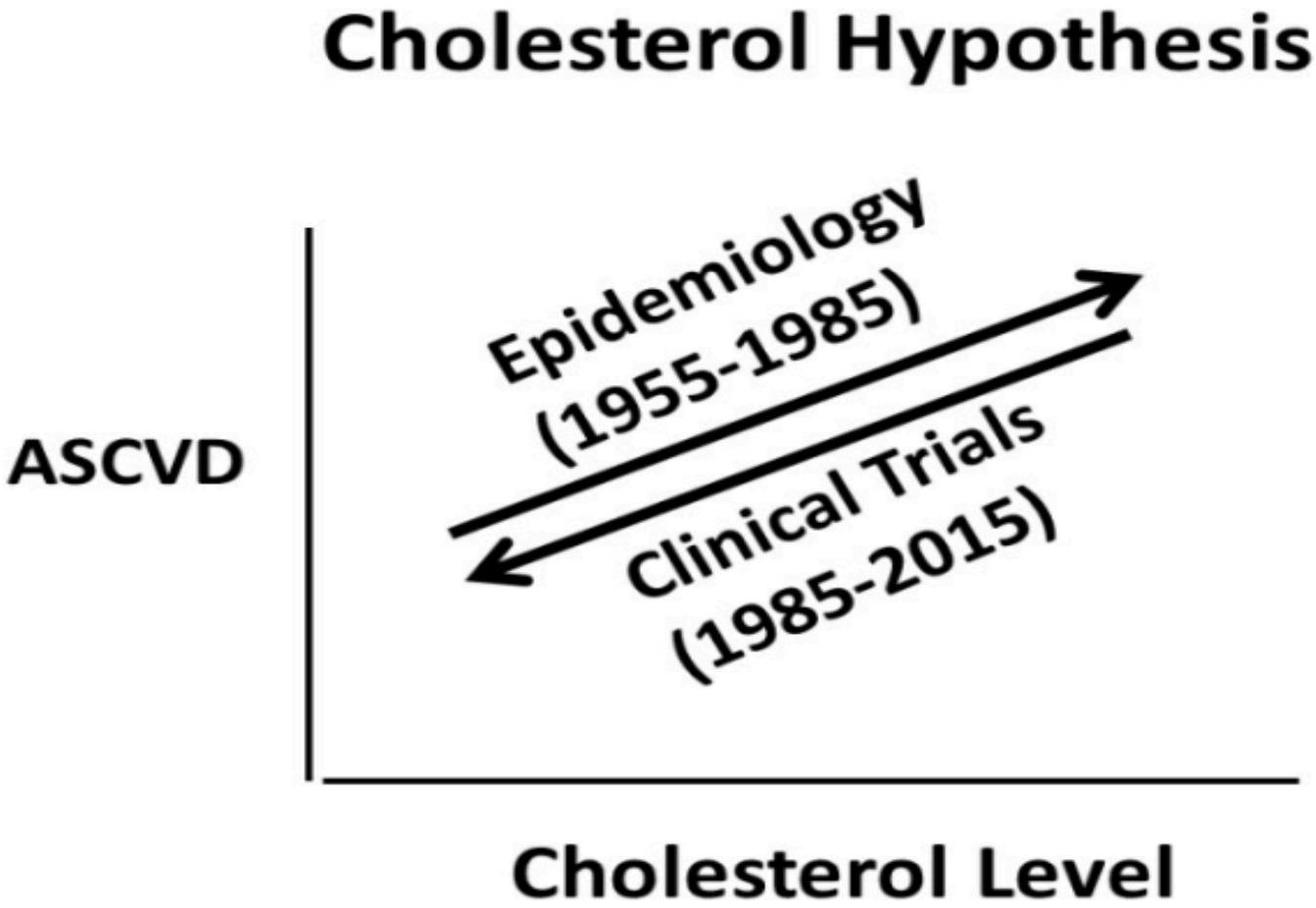
PRACTICE GUIDELINE

2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults☆

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Endorsed by the American Academy of Physician Assistants, American Association of Cardiovascular and Pulmonary Rehabilitation, American Pharmacists Association, American Society for Preventive Cardiology, Association of Black Cardiologists, Preventive Cardiovascular Nurses Association, and WomenHeart: The National Coalition for Women With Heart Disease

Step-by-step Process of Review of Evidence in the Guideline



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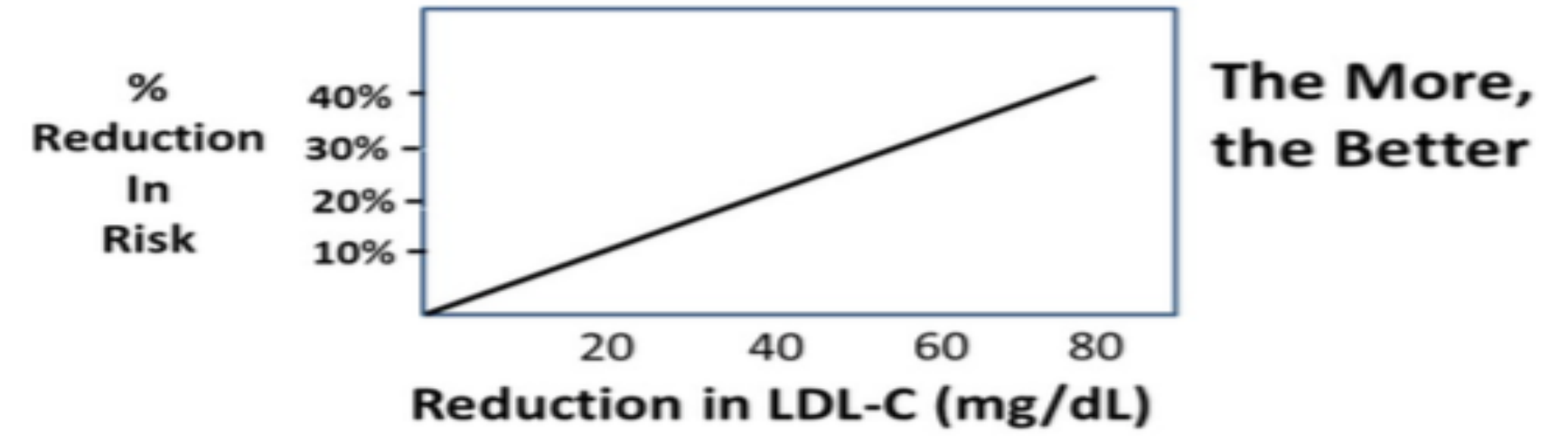
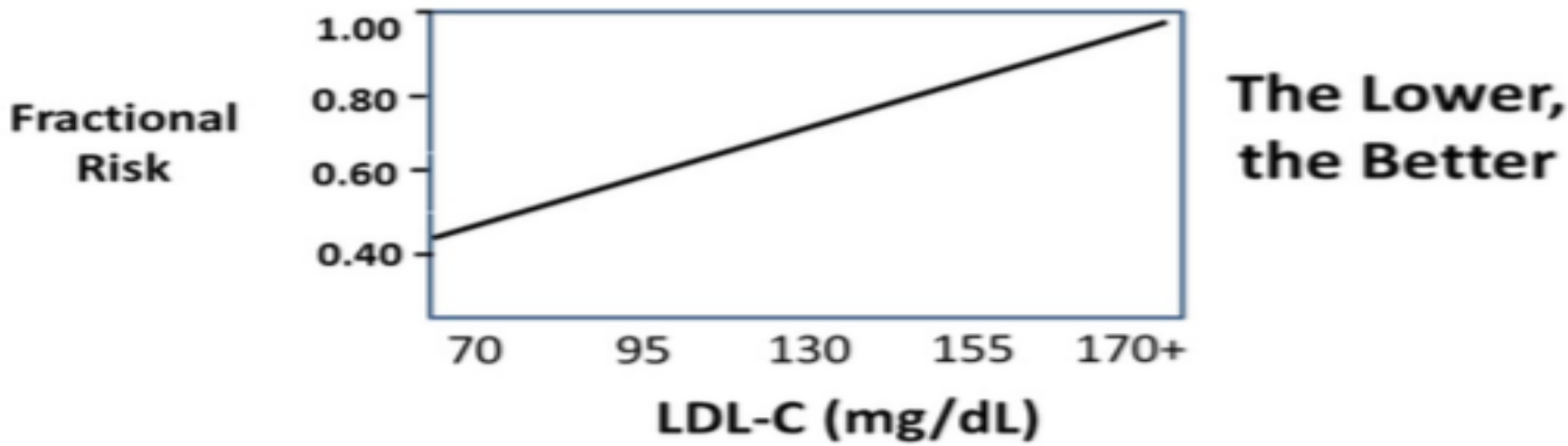
Cholesterol-ASCVD Relationship: Two Types of Meta-Analysis





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Summary of Statin Initiation Recommendations

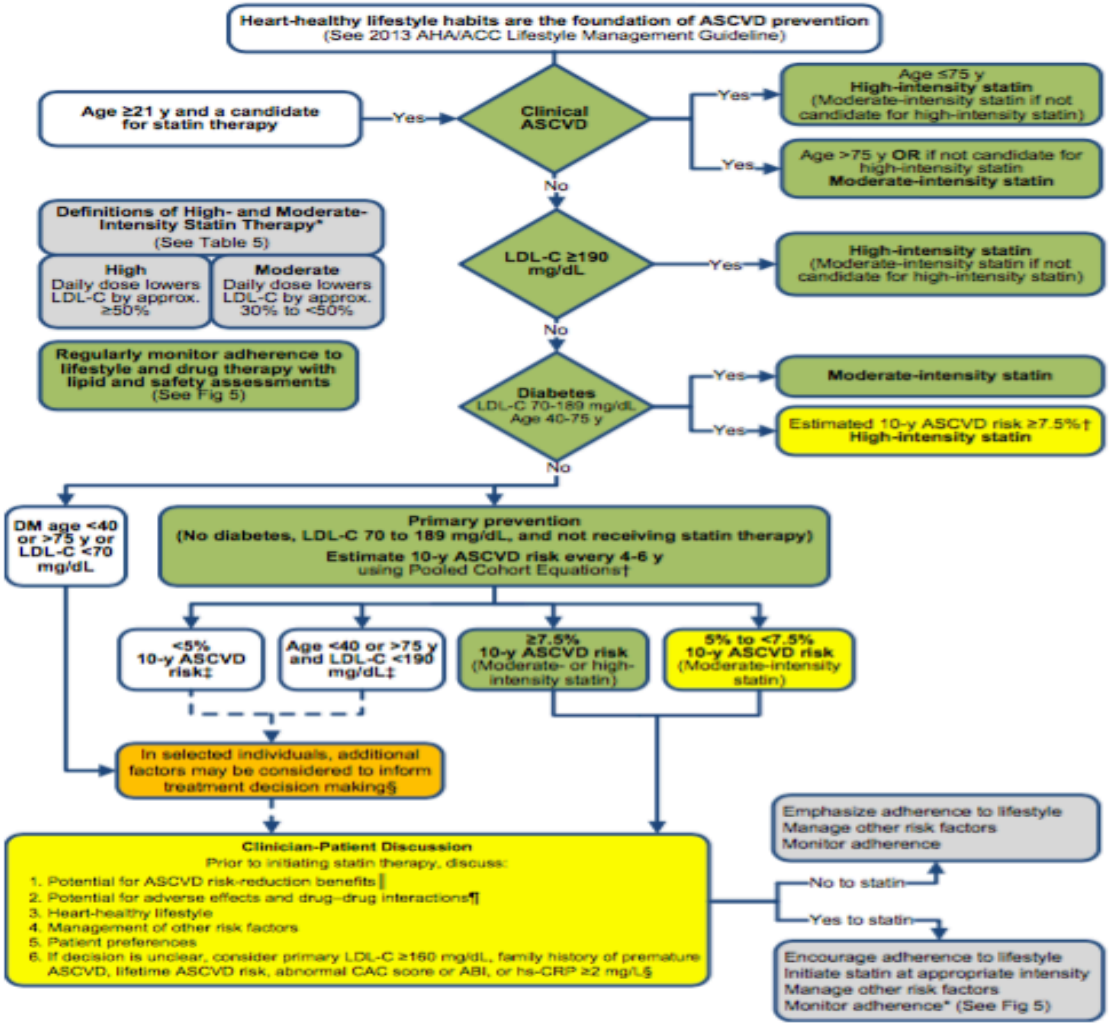

Figure 2. Summary of Statin Initiation Recommendations for the Treatment of Blood Cholesterol to Reduce ASCVD Risk in Adults (See Figures 3, 4, and 5 for More Detailed Management Information)

Professional Heart.org, AHA

Four Treatment Benefit Groups

- ASCVD
- LDL>190 mg/dL
- Diabetes
- LDL<190 mg/dL with 10-year risk >5%

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Definition of Treatment Intensity

Drug	Low-Intensity	Moderate-Intensity	High Intensity
	20-25% ê LDL-C	30-45%ê LDL-C	≥45%ê LDL-C
Lovastatin	10 mg	40 mg	
Pravastatin	10 mg	40 mg	
Simvastatin	10 mg	20 mg	
Fluvastatin	40 mg	80 mg	
Pitavastatin		2-4 mg	
Atorvastatin	5 mg	10 mg	80
Rosuvastatin		5 mg	20
Ezetimide	10 mg	10 mg + Simvastatin	10 mg + Simvastatin 40 mg (or other

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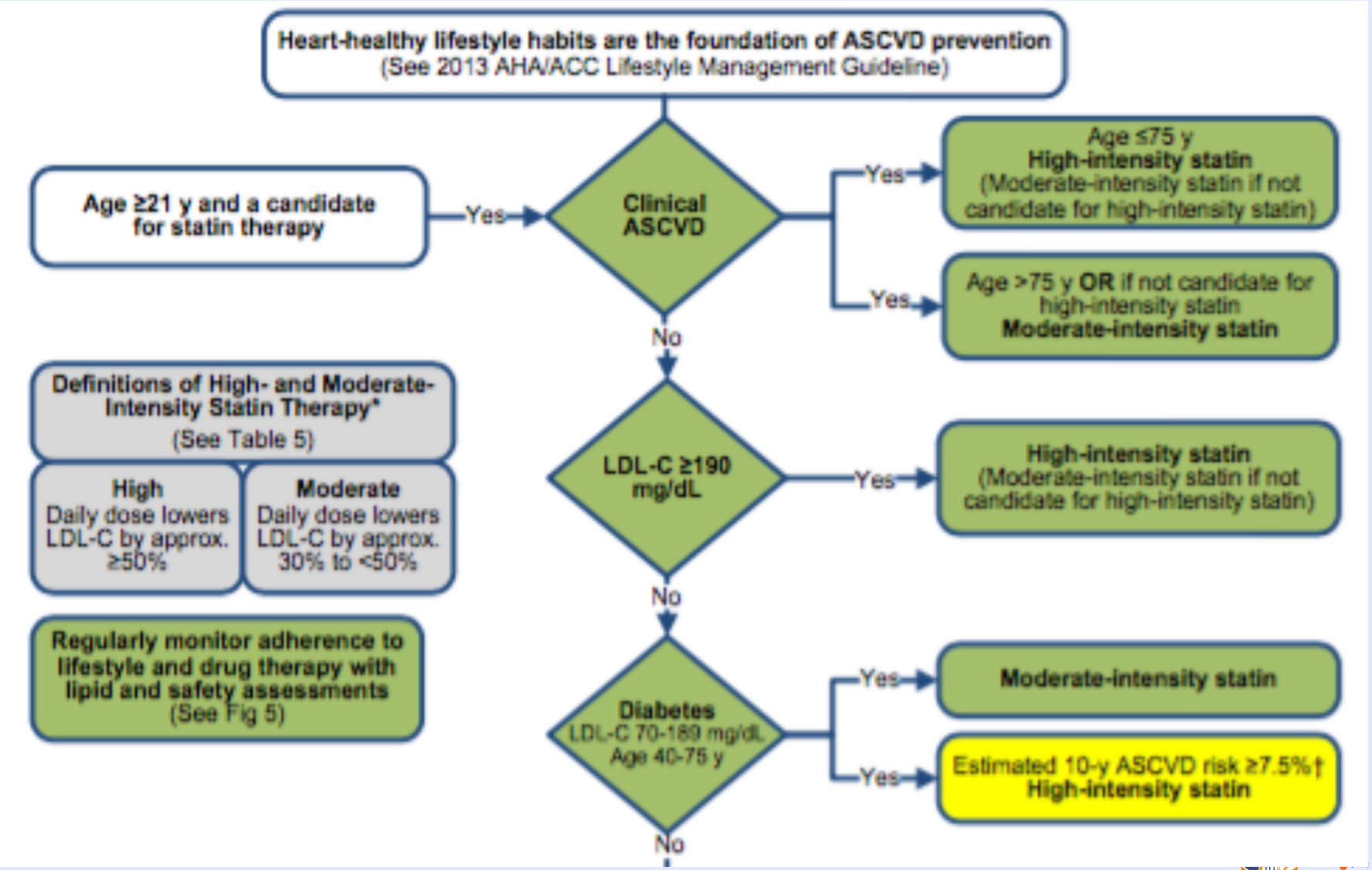
Step-by-step Process of Review of Evidence in the Guideline



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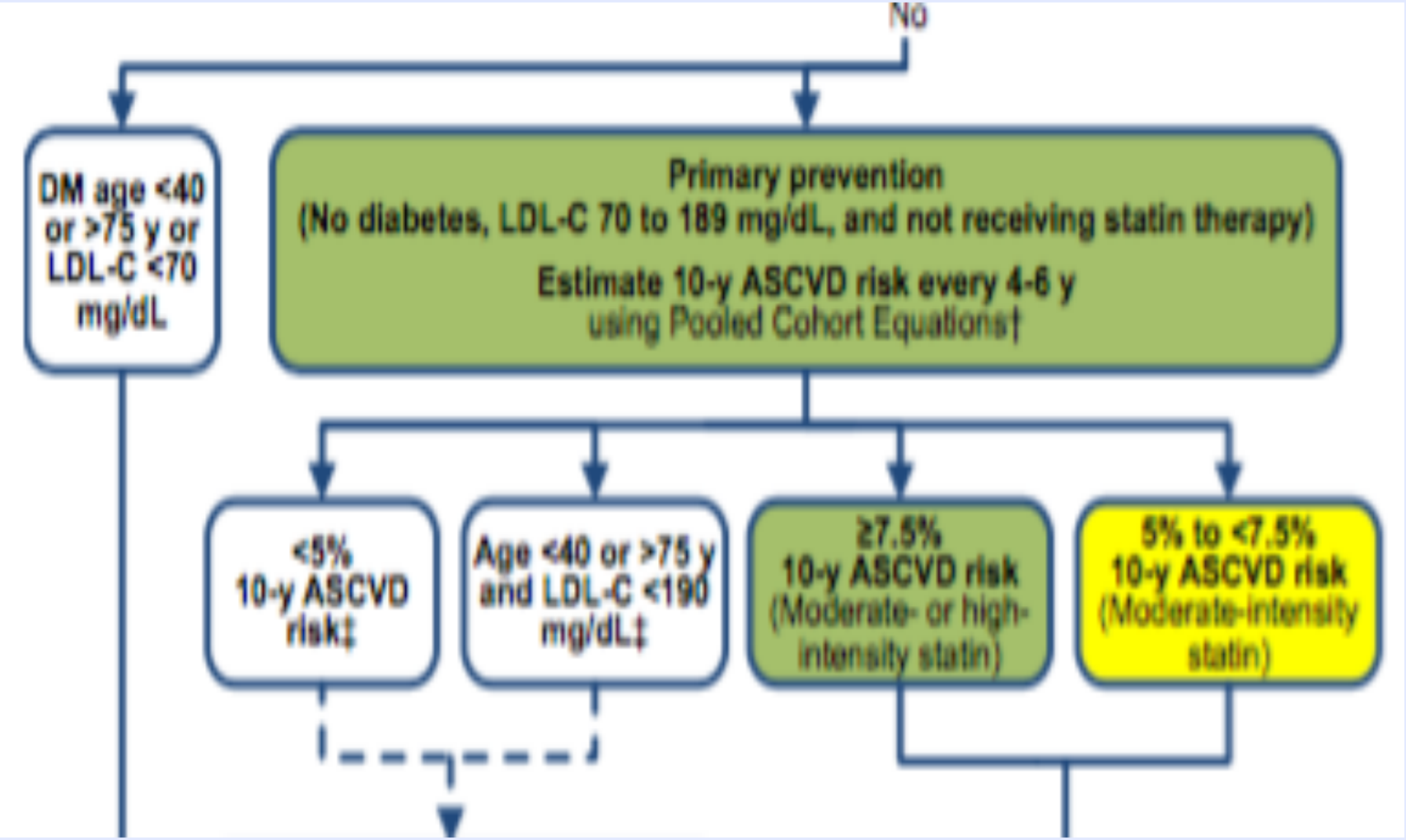
Step-by-step Process of Review of Evidence in the Guideline



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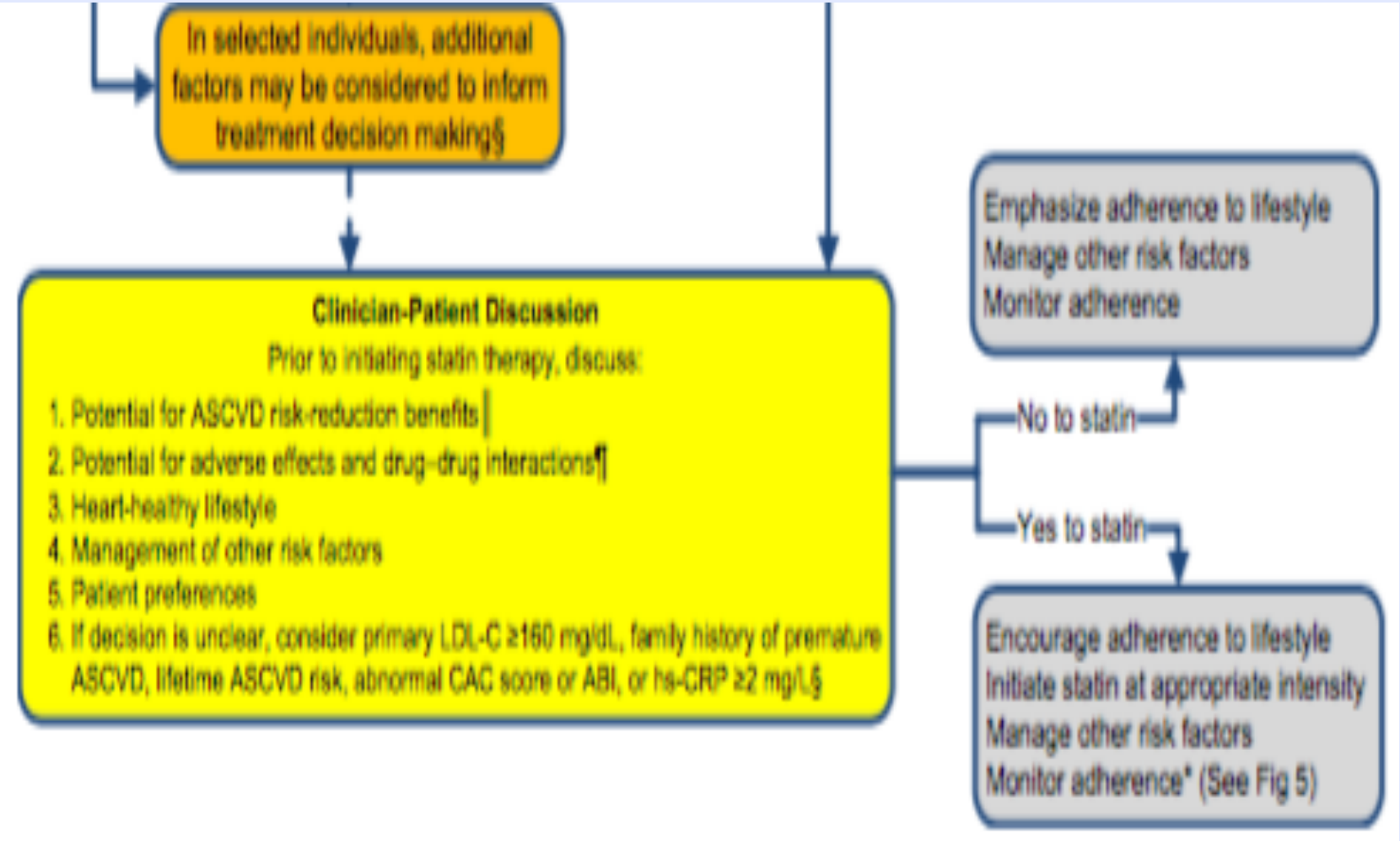
Step-by-step Process of Review of Evidence in the Guideline



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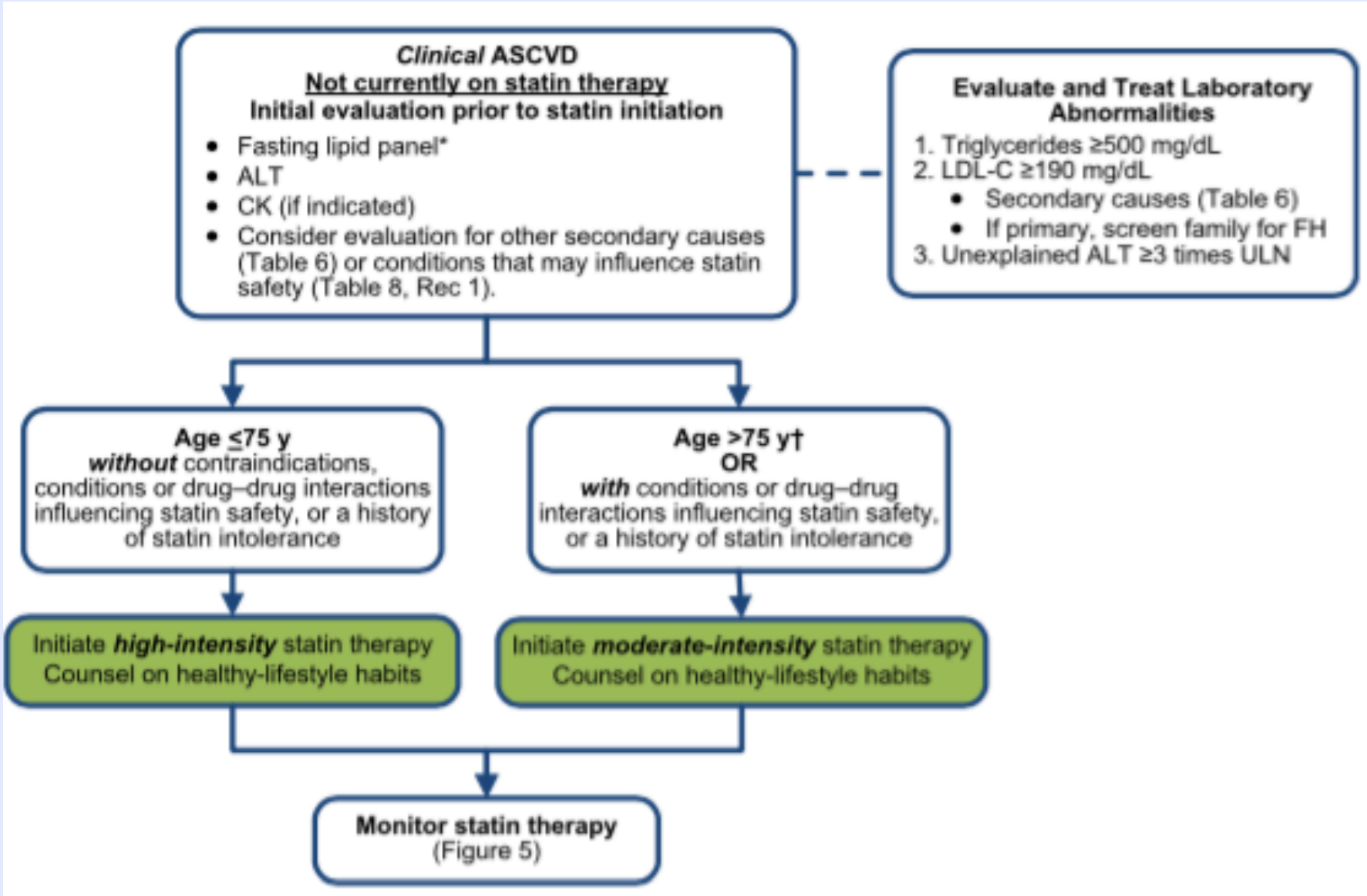
Initiating Statins in Individuals with Clinical ASCVD



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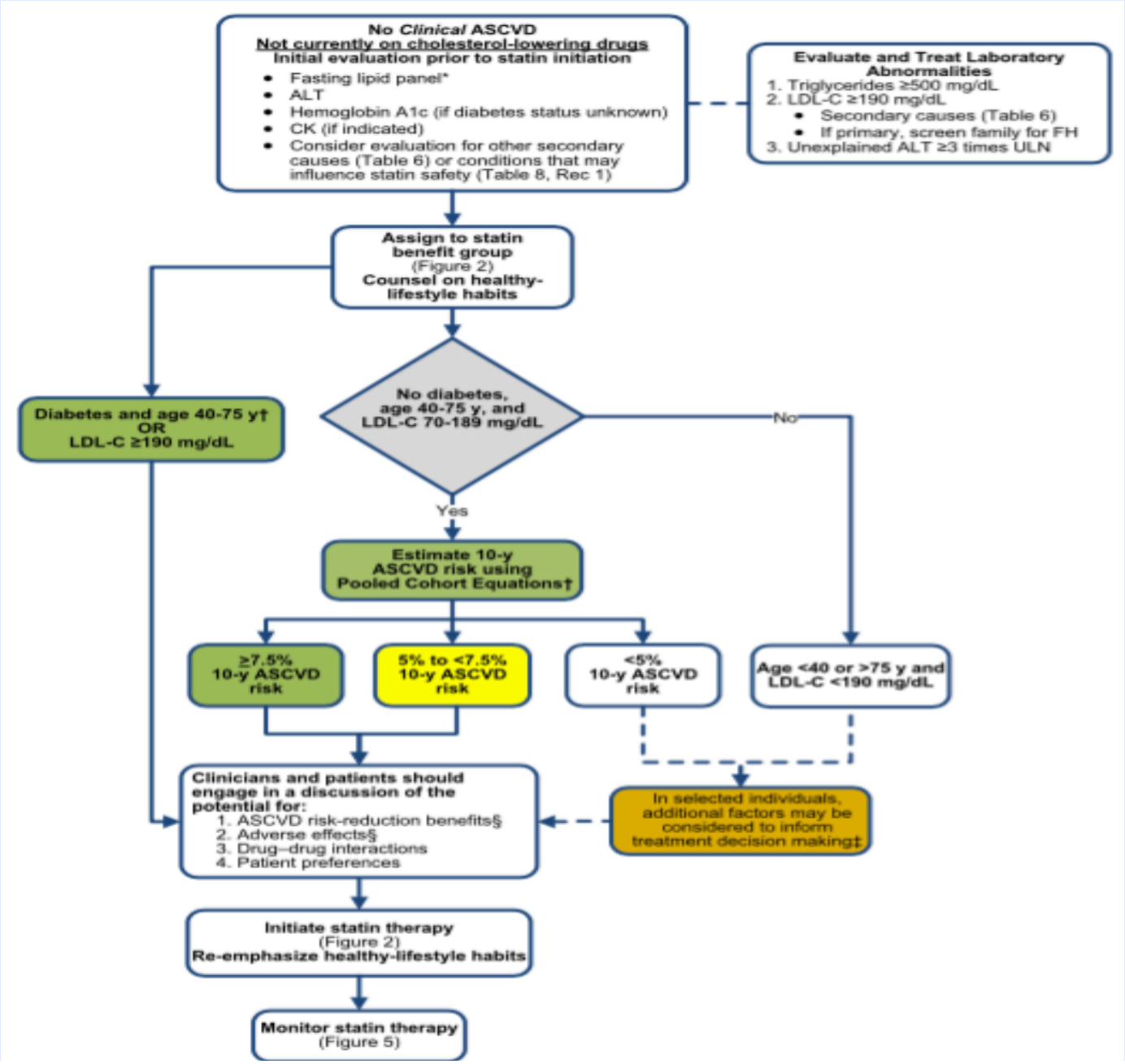
Initiating Statins in Individuals Without Clinical ASCVD



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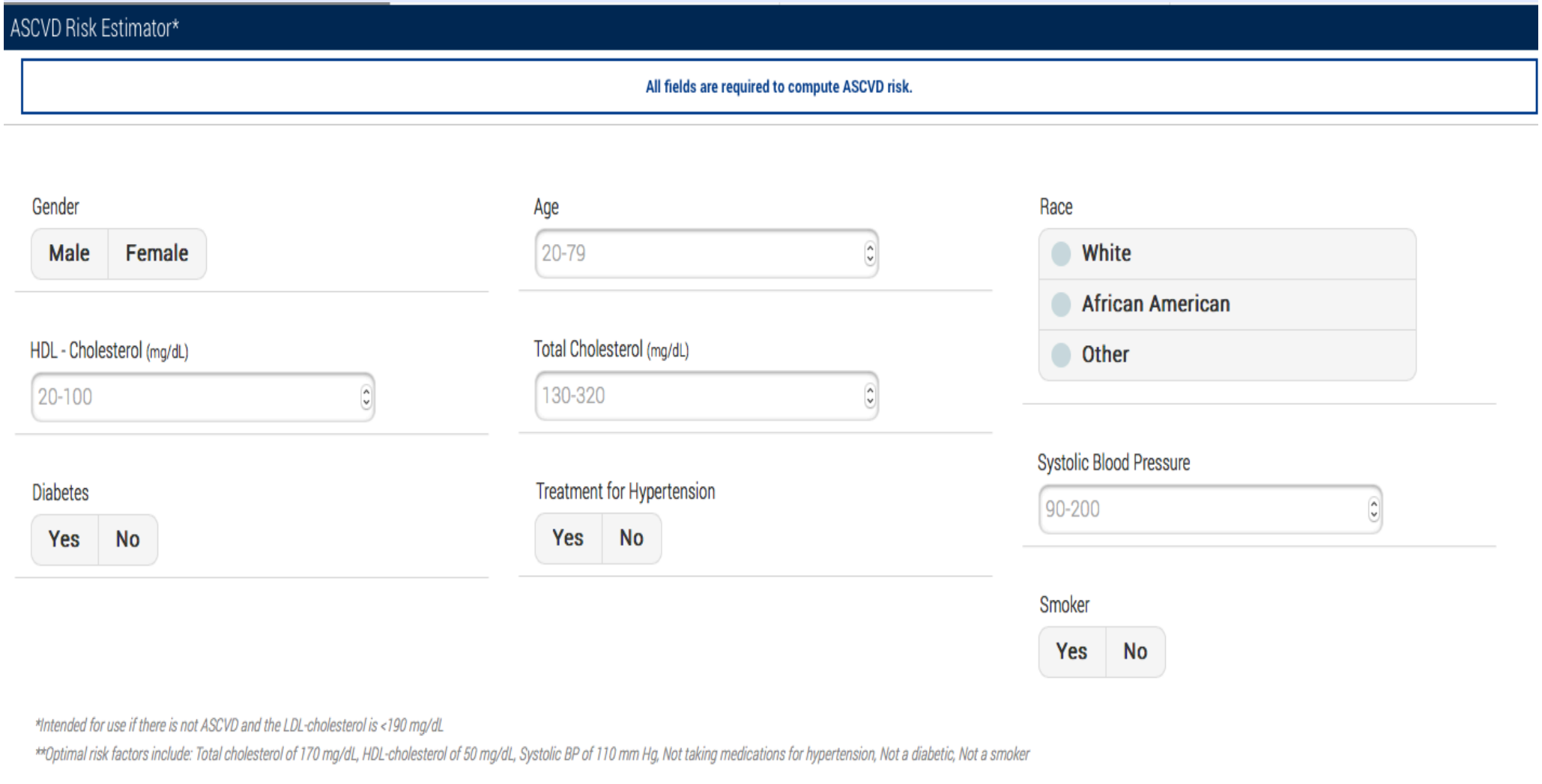
Risk Calculators

- http://my.americanheart.org/cvriskcalculator
- http://www.cardiosource.org/en/Science-And-Quality/Practice-Guidelines-and-Quality-Standards/2013-Prevention-Guideline-Tools.aspx
- http://tools.acc.org/ASCVD-Risk-Estimator/

ASCVD Risk Estimator



ACC and AHA 2014

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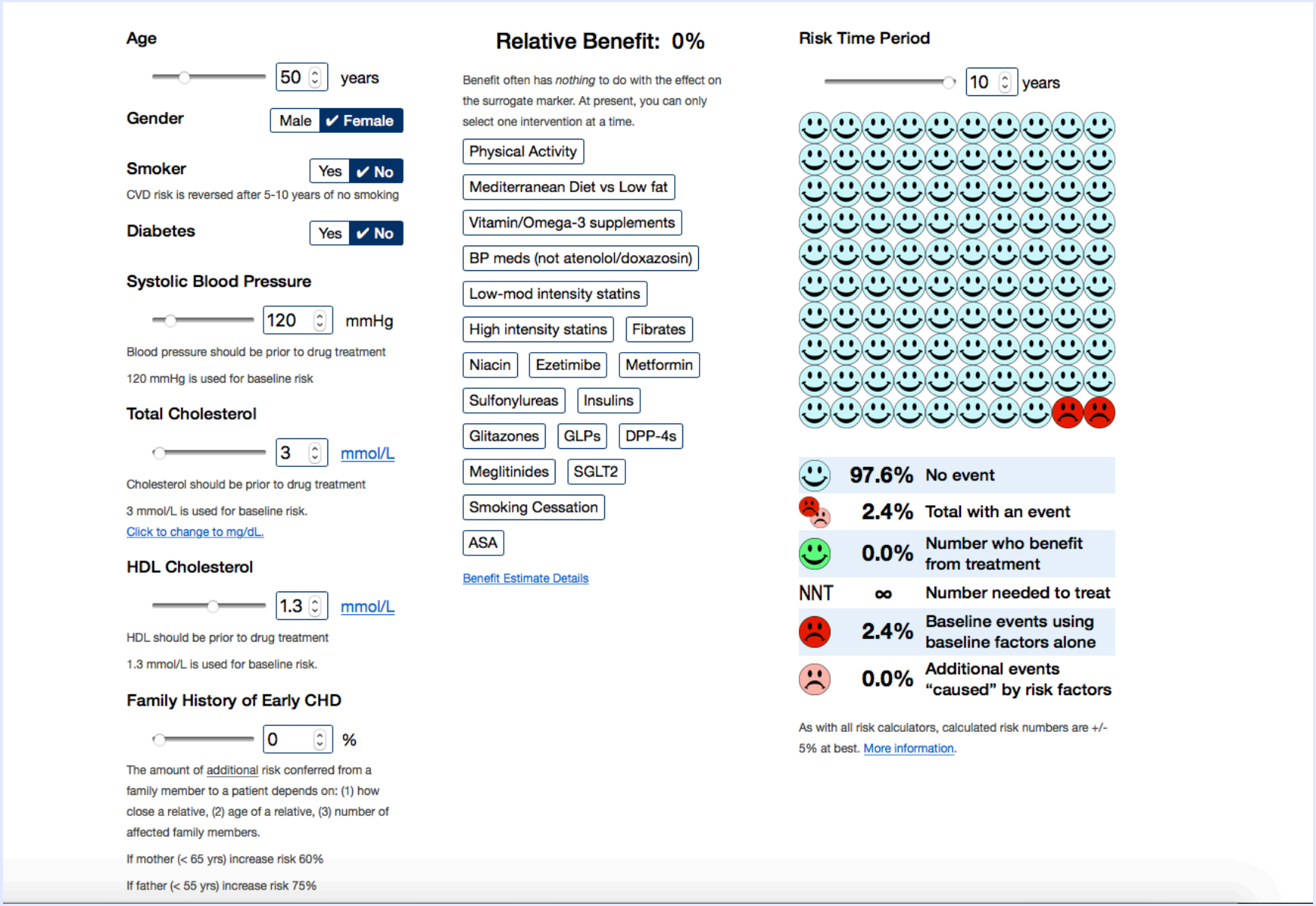
The Absolute CVD Risk/Benefit Calculator



AHA 2014

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Criteria for Clinical Diagnosis by CAC

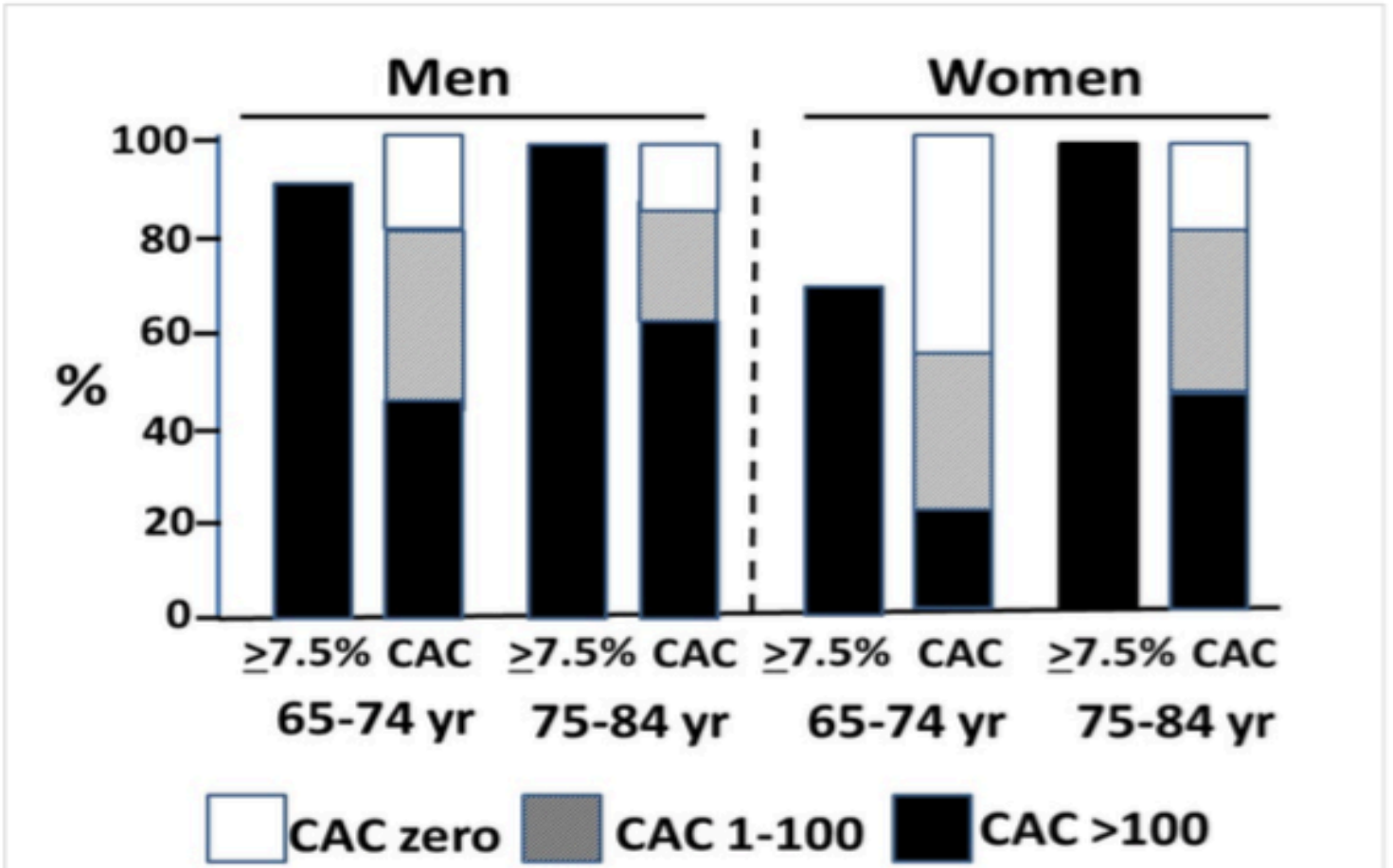

Figure 4

Comparison of the portion of the older populations (men and women) eligible for cholesterol-lowering drugs by ACC/AHA guidelines (10-year risk for ASCVD ≥ 7.5%) (31) and by coronary artery calcium (CAC) (CAC score >100 Agatston units) (91). The discrepancy is greater for women than for men.

Grundy "Risk Assessment" NCBI Bookshelf, 2015

Cholesterol Lowering Drugs

	Mechanism of Action	Effects on Plasma Lipids	LDL-C lowering	
Statins	Inhibit HMG CoA reductaseRaise LDL receptor activity	Reduce LDL and VLDLMinimal effect on HDL	30-55% depending on dose	MyalgiaCognitivedysfunctionRaises plasma glucose
Bile acid sequestrants	Impairs reabsorption of bile acidsRaise LDL receptor activity	Reduces LDLRaises VLDLMinimal effect on HDL	15-25%, depending on dose	ConstipationGI distressRaiseTriglycerides
Ezetimibe	Impairs absorption of cholesterolRaises LDL receptor activity	Reduces LDLReduces VLDLMinimal effect on HDL	15-25%	Rare
Niacin	Reduces hepatic secretion of VLDL	Reduces VLDLReduces LDLRaises HDL	5-20%	Flushing, rash, raise plasma glucose, hepatic dysfunction, others
Fibrates	Reduces secretion of VLDLEnhances degradation of VLDL	Reduces VLDL(lowers TG 25-35%) Small effect on LDLRaises HDL	5-15%	Myopathy (in combination with statins)GallstonesUncommonly various others
MTP inhibitors	Reduces hepatic secretion of VLDL	Reduces VLDL and LDL	50+%	Fatty liver
Mipomersen (RNA antisense)	Reduces hepatic secretion of VLDL	Reduces VLDL and LDL	50+%	Fatty liver
CETP inhibitors	Blocks transfer of cholesterol from HDL to VLDL&LDL	Raises HDLLowers LDL	20-30%	Under study
PCSK9 inhibitors	Blocks effects of PCSK9 to destroy LDL	Lowers LDL	45-60%	Under study

Grundy "Risk Assessment" NCBI Bookshelf, 2015

Patient 1

TEST	RESULTS OUT-OF-RANGE	RESULTS WITHIN RANGE	UNITS	EXPECTED RANGE
NMR LIPO SUBSET WITH LIPID CALC				
HDL-P, TOTAL	24.8		UMOL/L	>=30.5
LARGE VLDL-P		1.0	NMOL/L	<=2.7
SMALL LDL-P	1471		NMOL/L	<=527
LARGE HDL-P	<1.3		UMOL/L	>=4.8
VLDL SIZE		41.1	NM	<=46.6
LDL SIZE	19.7		NM	>=20.5
HDL SIZE	8.1		NM	>=9.2
INSULIN RESIST SCORE	50		SCORE	<=45
LDL PARTICLE (P) CONC	1817		NMOL/L	<1000
LDL CHOLESTEROL		116		
HDL CHOLESTEROL		35		
TRIGLYCERIDES		137		
TOTAL CHOLESTEROL		178		

LIPOPROTEIN PANEL INTERPRETATION:

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Patient 1

LIPOPROTEIN PANEL INTERPRETATION:

LDL PARTICLE CONCENTRATION (NMOL/L) RISK

OPTIMAL	NEAR OPTIMAL	BORDERLINE	HIGH	VERY HIGH
<1000	1000-1299	1300-1599	1600-2000	>2000

SMALL LDL PARTICLE CONCENTRATION (NMOL/L) RISK

LOW	MODERATE	BORDERLINE	HIGH
<117	117-526	527-839	>839

LDL SIZE (NM)

PATTERN A (LARGE LDL)	PATTERN B (SMALL LDL)
20.6-23.0	18.0-20.5

LDL-CALCULATED (MG/DL) RISK

OPTIMAL	BORDERLINE	HIGH
<100	130-159	160-189

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Secondary Causes of Hypertriglyceridemia

Conditions	Drugs	Genetic conditions
Hypothyroidism	Alcohol	Lipoprotein lipase deficiency
Uncontrolled Diabetes	Estrogens	Apolipoprotein CII deficiency
Obesity	Beta blockers	Apolipoprotein AV deficiency
Chronic renal failure	Tamoxifen/Raloxifene	GPIHBP1 deficiency
Nephrotic syndrome	Glucocorticoids	
Pregnancy	Atypical anti-psychotics	
HIV	Cyclosporine	
Cushing's syndrome	Protease inhibitors	
Lipodystrophy		
Inflammatory disease – rheumatoid arthritis, lupus, psoriasis, etc		

Tamrock "Risk Assessment for TG" NCBI 2000

Cholesterol Lowering Drugs/Also Good for TG

	Mechanism of Action	Effects on Plasma Lipids	LDL-C lowering	
Statins	Inhibit HMG CoA reductaseRaise LDL receptor activity	Reduce LDL and VLDLMinimal effect on HDL	30-55% depending on dose	MyalgiaCognitivedysfunctionRaises plasma glucose
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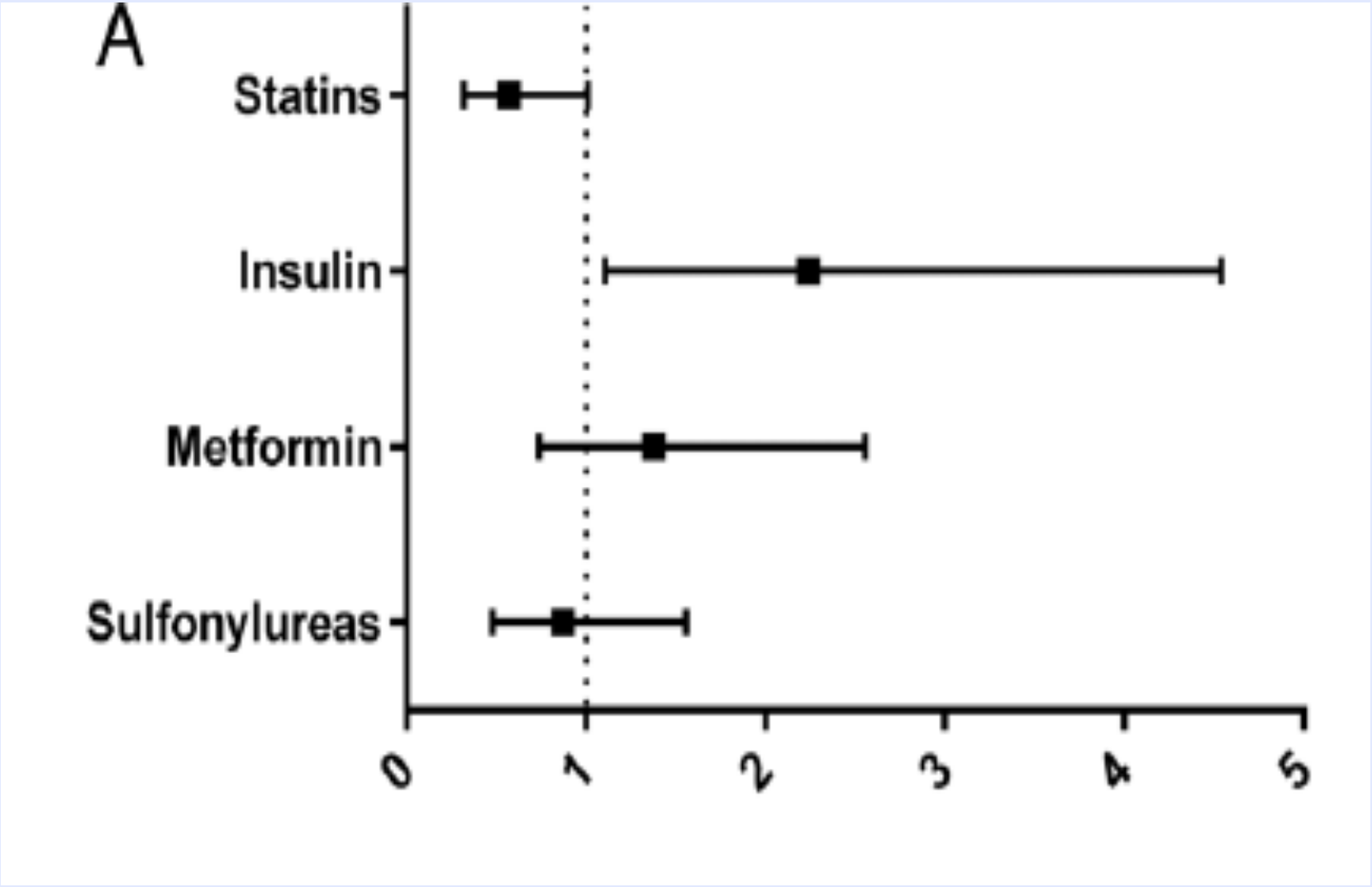
Grundy "Risk Assessment" NCBI Bookshelf, 2015

Statin Rx vs Liver Damage in NASH



Nascimbeni F et al., BMJ Open Gastro 2016:3:e000075. doi: 10.1136/bmjgast-2015-000075

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Summary: Treatment of Hyperlipidemia is Complex!

- After Dx, then diet and lifestyle change.
- Assess risk group and need for Rx as well as intensity of Rx.
- Since MetS doubles CV risk over any baseline, initiate statin therapy where indicated.
- Monitor results for necessity to augment Rx.
- Assess TG level, Dx and need for Rx.
- Where necessary, obtain lipid particle size and number to optimize Rx.

Izzy

- Started on Lipitor.
- She was given a strict low cholesterol diet to follow.
  - Since she cut back on eating fatty foods, she started eating more sweets.
- Labs: HgA1c 10.5
- She was then referred to Dr. Musi.