

Prevalence of the Metabolic Syndrome & its association with Incident Coronary Heart Disease in the ARIC Cohort

Application of the definition recommended by the National Cholesterol and Education Program's (NCEP) Adult Treatment Panel III

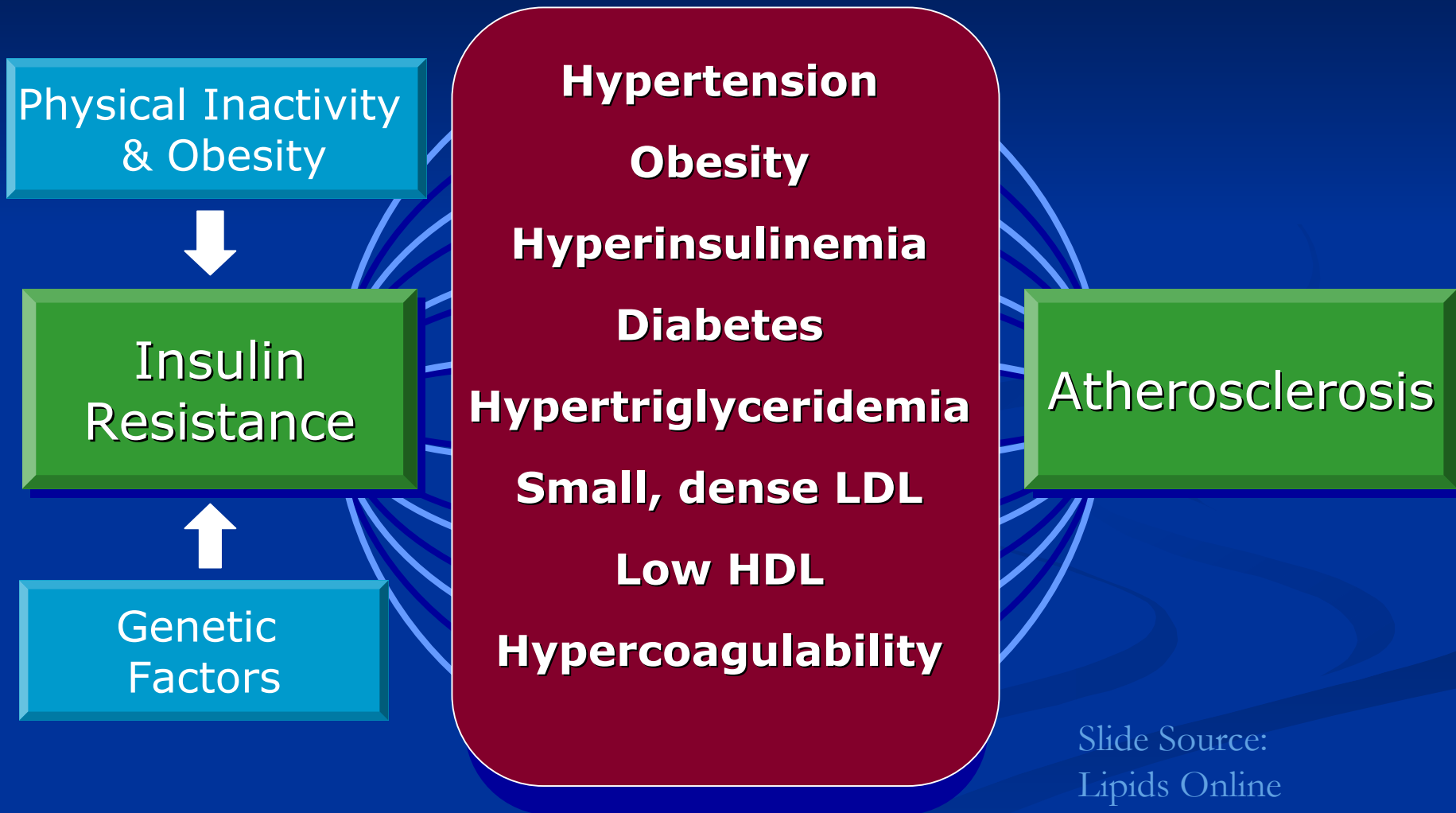
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Concept of the Metabolic Syndrome

- Reavan (1988): "Syndrome X"
- Alternative terms
 - "Insulin Resistance Syndrome"
 - "Multiple Metabolic Syndrome"
 - "Cardiovascular Dismetabolic Syndrome"
 - "Metabolic Syndrome"

Insulin Resistance and Atherosclerosis



Metabolic Syndrome: Limitations of Multiple Definitions

- Wide range of prevalence estimates could result from different definitions or from real variation among populations studied
- Difficult to compare across populations or over time

Definition of the Metabolic Syndrome Proposed by NCEP

Three or More of the Following

- **High Fasting Glucose*** (≥ 110 mg/dl, ≥ 6.1 mmol/L), *or diabetes medications*
- **Elevated Blood Pressure** ($\geq 130/85$ mm Hg), *or hypertension medications*
- **Elevated Triglycerides** (> 150 mg/dl, > 1.7 mmol/L)
- **Low HDL-C** (Men < 40 , Women < 50 mg/dl, Men < 1.0 mmol/L, Women < 1.3 mmol/L)
- **Central Obesity** (waist circ. Men > 102 , women > 88 cm)

NCEP definition in Clinical Practice

- Consensus-derived definition
- Components collected during routine clinical examination
- Unknown
 - Prevalence - who will be identified for primary prevention efforts?
 - What is the strength of the association between this definition and incident CHD?

ARIC Cohort

- ARIC: longitudinal study of atherosclerosis and CHD.
- 4 U.S. communities:
 - Jackson, MS
 - Washington Co., MD
 - 8 suburbs of Minneapolis, MN
 - Forsyth Co., NC
 - Age 45-64 at baseline visit (1987-1989)
- CHD ascertainment complete through 1998

ARIC Baseline Characteristics

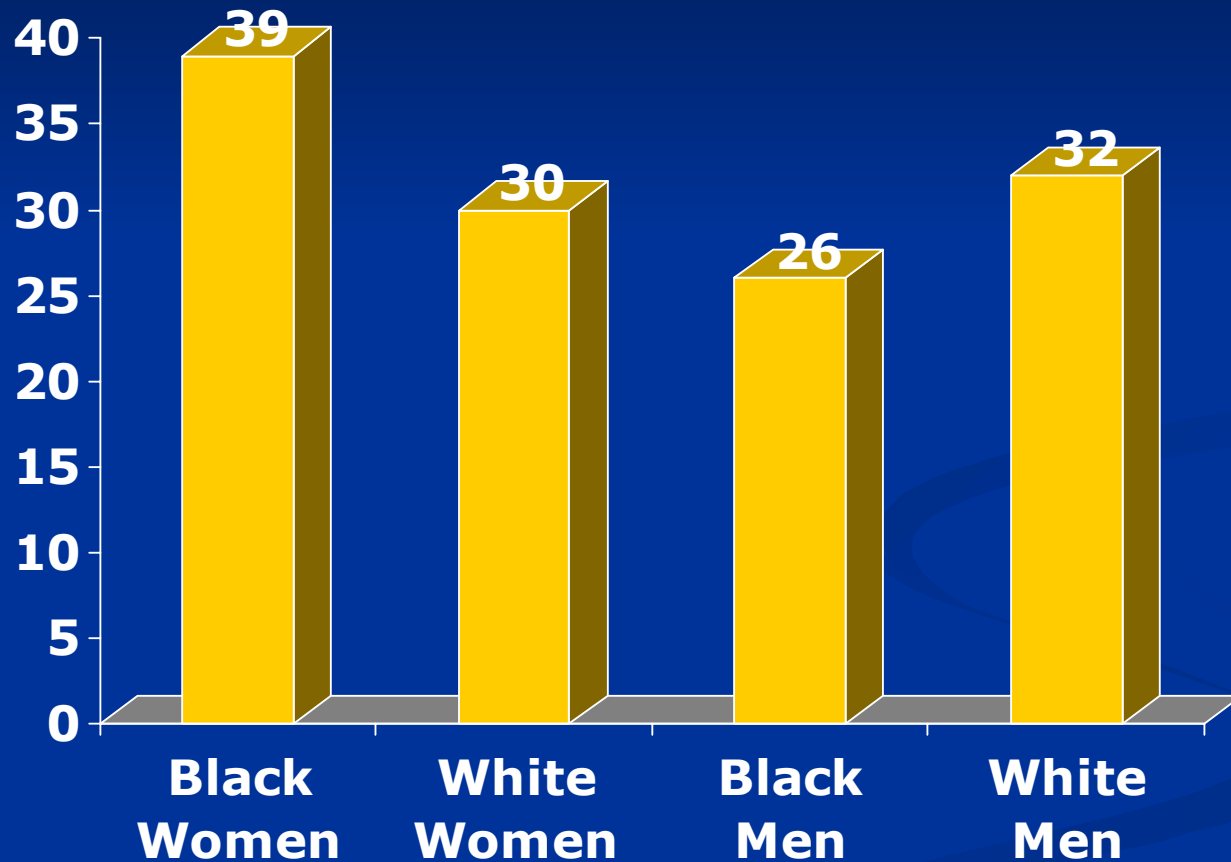
	Women (n=8,201)	Men (6,670)
Age (yrs)	54 (5.7)	55 (5.8)
Black	28%	21%
Prior CHD	2%	8%
HDL-C (mg/dl)	58 (17.2)	44 (13.9)
Triglycerides (mg/gl)	123 (79.5)	141 (96.8)
Fasting Glucose (mg/dl)	106 (36.3)	108 (31.8)
Systolic BP (mm Hg)	120 (19.3)	122 (17.8)
Diastolic BP (mm Hg)	72 (11.0)	75 (11.2)
Waist Circumference (cm)	95 (15.6)	99 (11.0)
LDL (mg/dl)	136 (40.8)	140 (37.0)

Values are mean (sd) or percentage

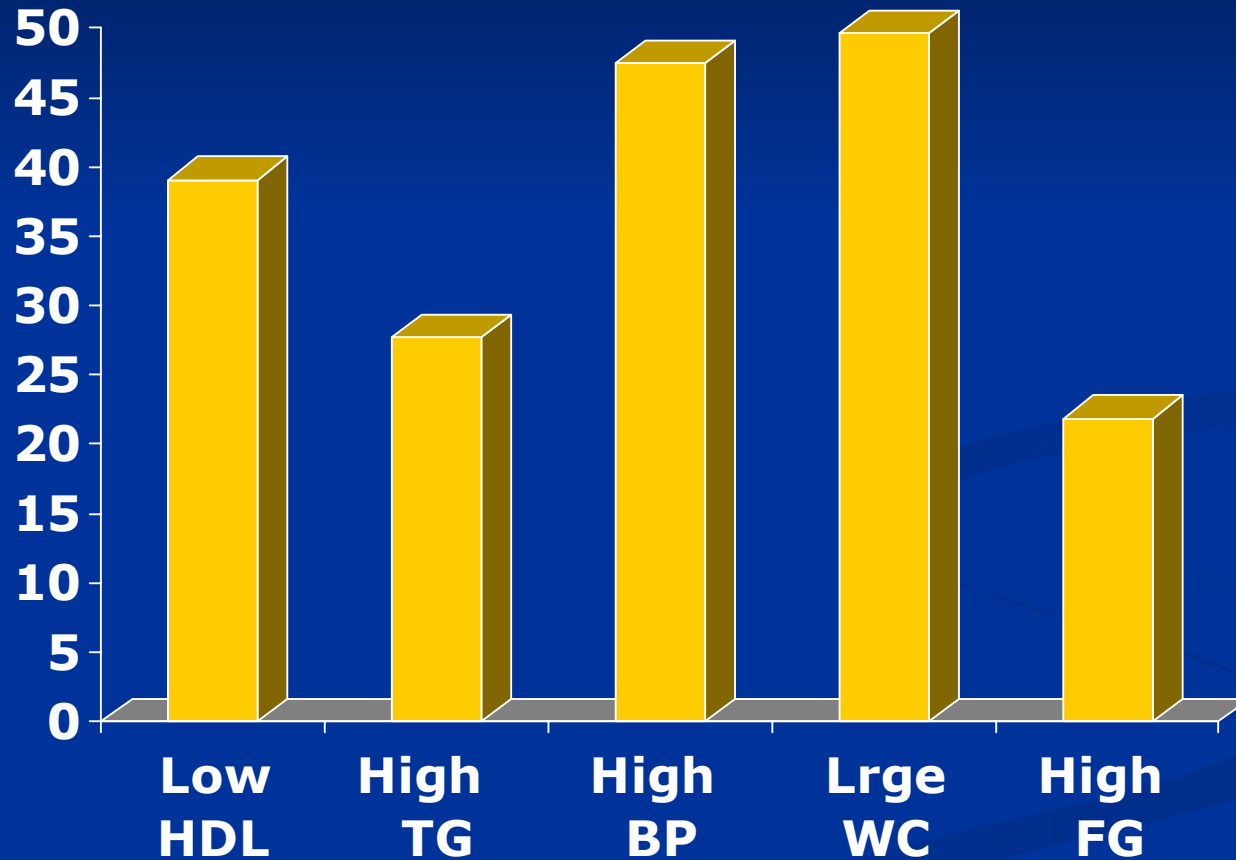
Distribution of Components of the Metabolic Syndrome

Number of Components	Percentage (n=14,871)
≥ 1	81.4%
≥ 2	55.2%
≥ 3	31.4%
≥ 4	13.8%
=5	4.0%

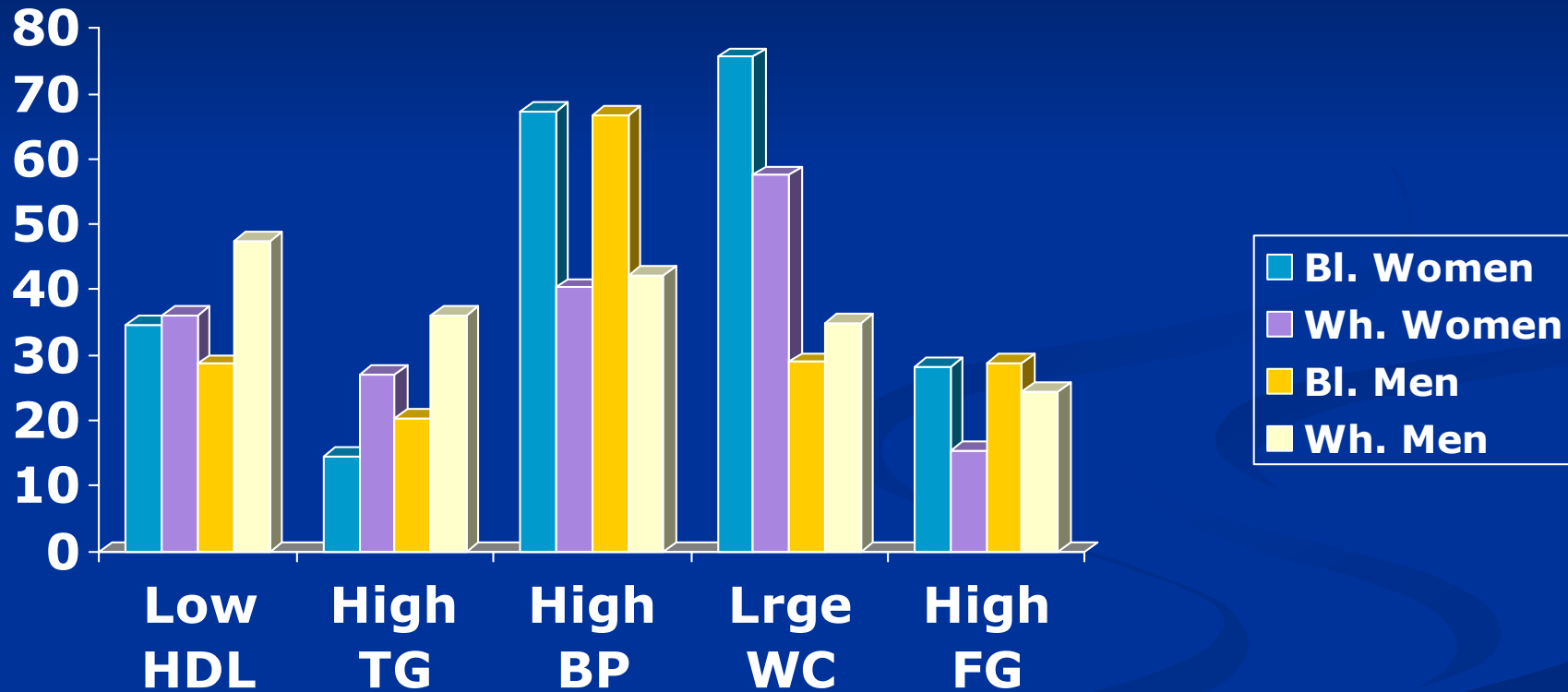
Prevalence of the Metabolic Syndrome, ARIC Baseline Visit



Prevalence of Individual Components, ARIC Baseline Visit



Prevalence of Individual Components, ARIC Baseline Visit



Metabolic Syndrome and Incident CHD

- Proportional hazards regression, separate models for men and women
- Incident CHD: CHD death, MI
- 13,046 participants (CHD-free at baseline, no missing data on covariates)
- Mean follow-up time 9.7 yrs
- 614 CHD events

Metabolic Syndrome and Incident CHD

Model	Hazard Ratio, 95% CI	
	Men, n=5,686	Women, n=7,360
Crude	1.87 (1.53-2.28)	3.32 (2.52-4.37)
Adjusted for age, race*ctr	1.82 (1.49-2.21)	2.79 (2.11-3.70)
Adjusted [†]	1.84 (1.51-2.25)	2.40 (1.81-3.20)

[†] Models contains age, race*ctr, smoking, education, income, LDL.

Metabolic Syndrome and Incident CHD among non-Diabetics

Model	Hazard Ratio, 95% CI	
	Men, n=5,142	Women, n=6,605
Crude	1.50 (1.18-1.89)	2.46 (1.77-3.40)
Adjusted for age, race*ctr	1.48 (1.16-1.87)	2.14 (1.54-2.97)
Adjusted [†]	1.49 (1.18-1.90)	1.80 (1.29-2.52)

[†] Models contains age, race*ctr, smoking, education, income, LDL.

Note: 11,747 participants, 9.8 yrs follow-up, 463 CHD events

Summary

- Overall prevalence 31%
- Prevalence differs across subpopulations within ARIC
- Strong association between the syndrome and incident CHD, true for non-diabetics as well.
- Stronger association in women than men

Limitations

- ARIC not designed to be representative of U.S. population
- Prevalence data are not current, data from 1987-1989
- Although not specified by NCEP, analysis did not assess whether specific combinations of the syndrome's components modify the risk of ICHD

Strengths

- Application of a new, potentially widely-used definition of the metabolic syndrome in an ethnically diverse cohort
- Estimates of prevalence may be useful to understand extent of disease burden, future health costs & utilization, likely therapeutic courses of treatment
- Prospective analysis provides important new information regarding the strength of the association between the syndrome and incident CHD and a possible gender difference.

Implications

- NCEP definition: widespread adoption is likely
 - Part of clinical management guidelines
 - Components are readily available, easy to interpret
 - Evidence-based?
- Application to primary prevention
 - 47 million in the U.S. with the syndrome
 - Which patients benefit from treatment?
 - Which types of treatment?

Discussion