Lifestyle Modification and Intervention for Cardiometabolic Patients

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Cardiometabolic Syndrome AKA

- Metabolic syndrome X
- Metabolic syndrome
- Syndrome X
- Insulin resistance syndrome
- Reavens syndrome (after Gerald Raven)
- CHAOS- Coronary artery disease, hypertension, Adult onset diabetes, Obesity, and Stroke (Australia)

What is Cardiometabolic Syndrome?

- Describes a highly complex and heterogeneous set of signs and symptoms.
- Typically characterized by clustering of three symptoms although the diagnostic criteria from different institutions are as heterogeneous and the signs themselves.

Diagnostic Criteria; Co-occurrence of any 3 of these 5.

Joint Interim statement definition of the metabolic syndrome 2009
Diagnosis if co-occurrence of 3 of the following 5.
1. Elevated waist circumference according to population and country specific definitions; 88cm for women, 102 cm men US.
2. Elevated TG ≥ 150 mg/dl or drug treatment for elevated TG
3. Reduced HDL-C < 40 mg/dl in men and < 50 mg/dl in women or drug treatment for reduced HDL-C
4. Elevated BP≥ 130 mmHg systolic BP or ≥ 85mmHg diastolic BP and/or drug treatment for hypertension
5. Elevated fasting plasma glucose ≥ 100 mg/dl or drug treatment for elevated glucose

According to the Last Joint Interim Statement definition of the metabolic syndrome 2009

History of the Syndrome

- First discussed in 1923 by Kyle, referencing HTN, gout, hyperglycemia
- G. Reaven 1988 As Syndrome X, including glucose intolerance, in TG, low HDL.
- WHO Definition 1998, DM II, Waist to hip %, microalbumin.
- NCEP ATP III clinical definition of Met Synd.

Incidence and Prevalence

- 34% of the US population qualifies as having metabolic syndrome base on a 2002-2006 National Health and Nutrition Examination Survey.

Hu G, Qiao Q, Tuomilehto J, Balkau B, Borch-Johnson K, Pyorala K. Prevalence of the metabolic syndrome and it relation to all-cause and Cardiovascular mortality in middle-aged men. Arch intern Med 2004.

Demographics

- Increased incidence with age and among certain ethnic groups
- Prevalence among specific races;

Mexican-American	31.9%
Caucasian-American	23.8%
African-American	21.6 %
Others	20.3 %

Ford, E S, Giles WH, Deitz WH, Prevalence of Metabolic Syndrome: report of the National Heart ,Lung,and Blood Institute/ADA conference on Scientific issues related to definition.Circulation 2004;109:551-556.

Early Signs and Symptoms

- Principle symptom- central obesity, adipose tissue accumulation around the trunk. Apple shape presentation.
- Other signs:
  - Hypertension
  - Impaired glucose tolerance
  - Atherogenic dyspidemia
  - Central fat accumulation
  - Insulin resistance
  - Prothrombotic/ inflammatory state

Meigs JB: Epidemiology of the metabolic syndrome, 2002. AM J Manag Care 2002;8:S283-292

How to Measure a Patients Waist

- Correct location: top of iliac crest
- Measure in a horizontal plane with a snug measuring tape, parallel to the floor
- Record the measurement at the end of normal expiration
- Absolute thresholds for increased risk vary with ethnicity, however typically:
  - Women >35 in
  - Men > 40 in

Cause and Mechanisms

- Very complex and not fully understood.
- Most likely causes include a combination of:
  - Genetics
  - Aging
  - Diet (especially a diet high in sugar)
  - Sedentary behavior/low physical activity
  - Excessive alcohol use

- Much debate is currently going on regarding whether insulin resistance or obesity it the underlying cause or if these two are just manifestations of a deeper metabolic disorder.

Proposed Mechanisms

- Central underlying pathology
  - Insulin Resistance

Versus

- Adipocyte and disorder of fat metabolism

Versus

- Molecular Chemical Vascular, Hepatic, Immunologic Mediators

Genetic Influence

- Questions remain as to the genetic basis of the syndrome, however there appears to be a strong link.
- The heritability of metabolic syndrome as defined by NCEP is approximately 30%.
- Heritability of:
- HTN 11% to 37%
- Obesity and insulin resistance 47% to 66%.
- Atherogenic Dyslipidemia 43% to 54%.

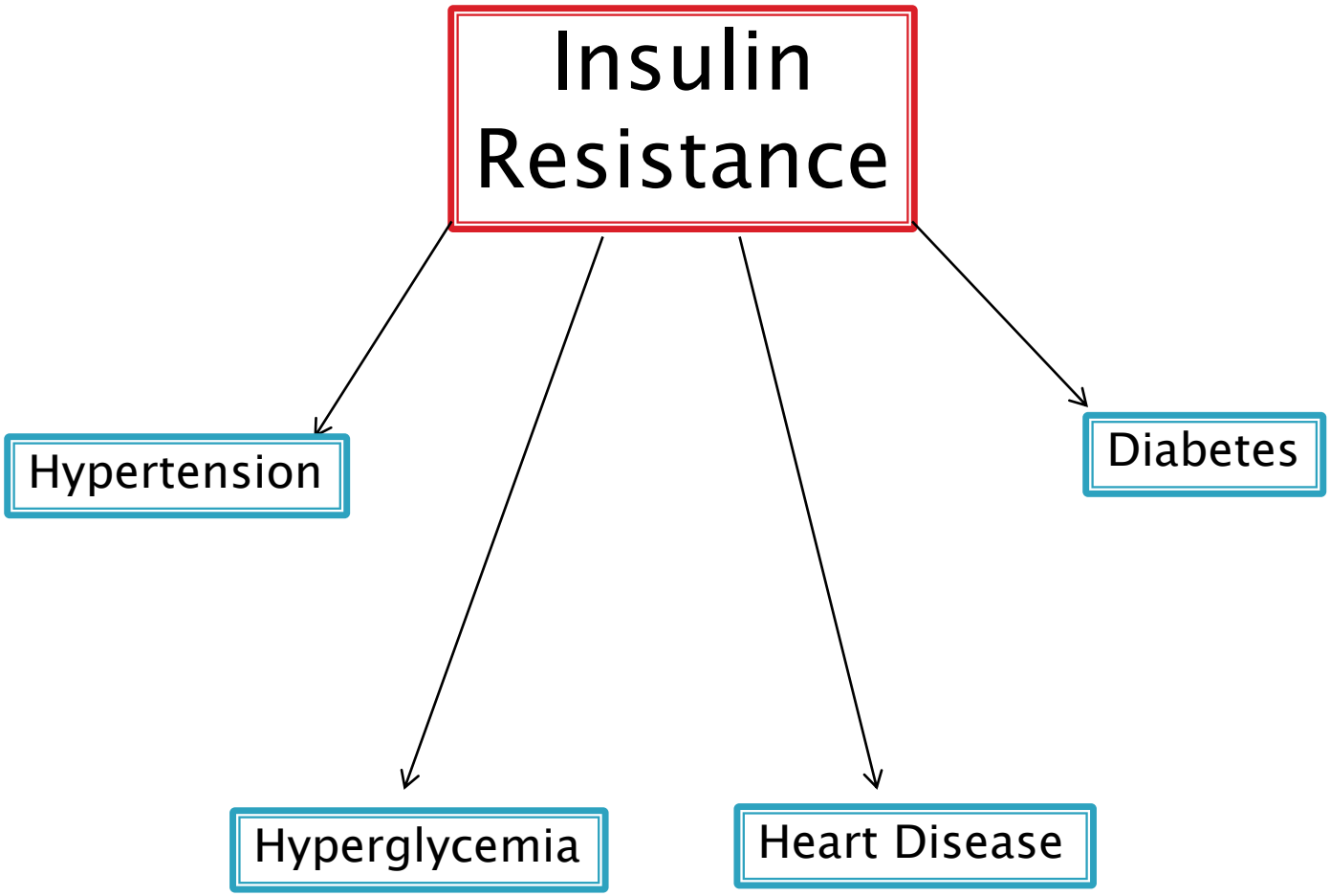
Karaja, A.T., Hunt, S.C., Pankow, J.S., Myers, R.H., Heiss, G.,Lewis, C.E., Rao, D., and Province, M.A. 2005a. An Evaluation of Metabolic Syndrome in Hypergen Study. Nurt.metab (Lond), 2:2.

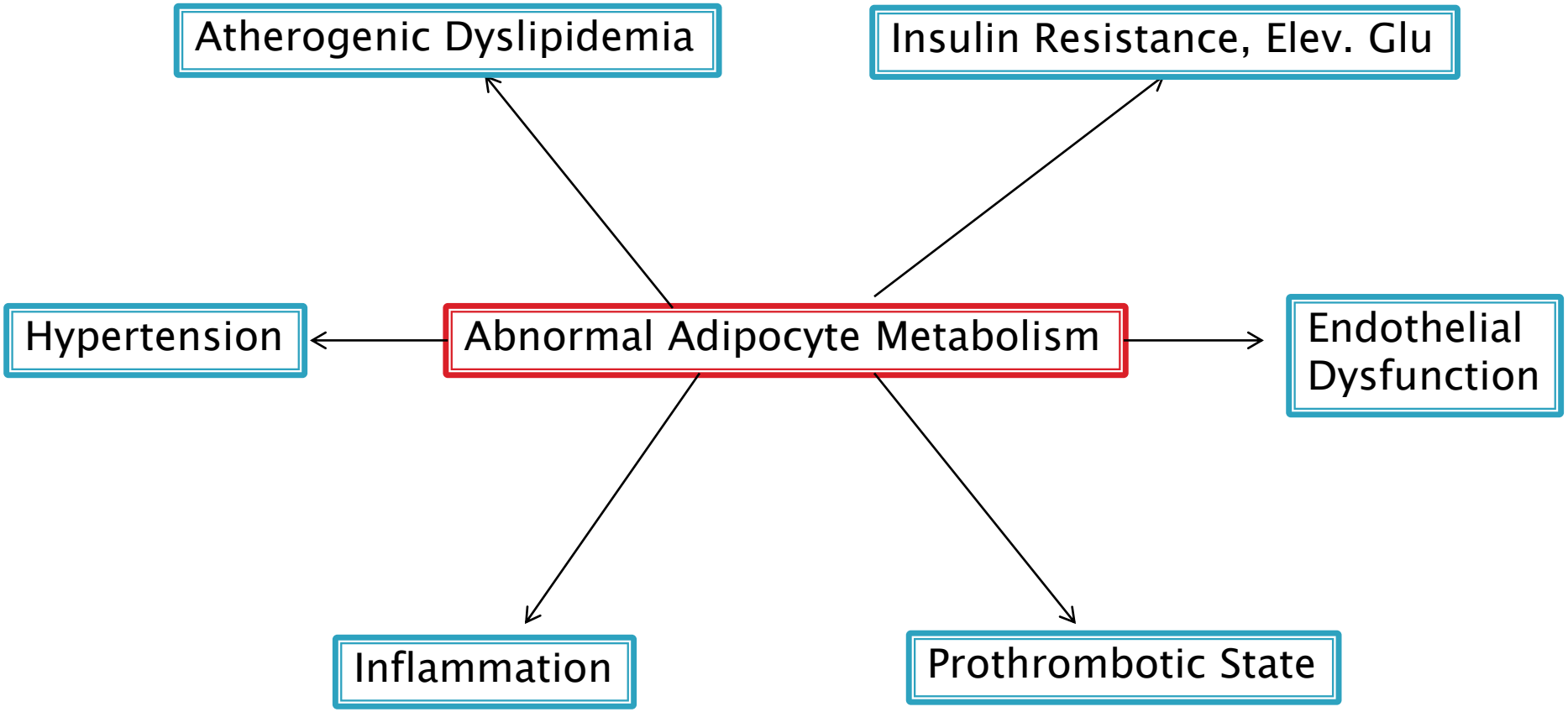
The "Thrifty Gene" Hypothesis

- Proposed by geneticist James V. Neel 1962
- Theorized that certain genetic elements among ethnic groups predisposed them to storing body fat more efficiently
- In the days of feast or famine this was advantageous
- In the days of fast, high calorie food, it is certainly not.
  - Could play a large role in predisposing individuals to metabolic syndrome.

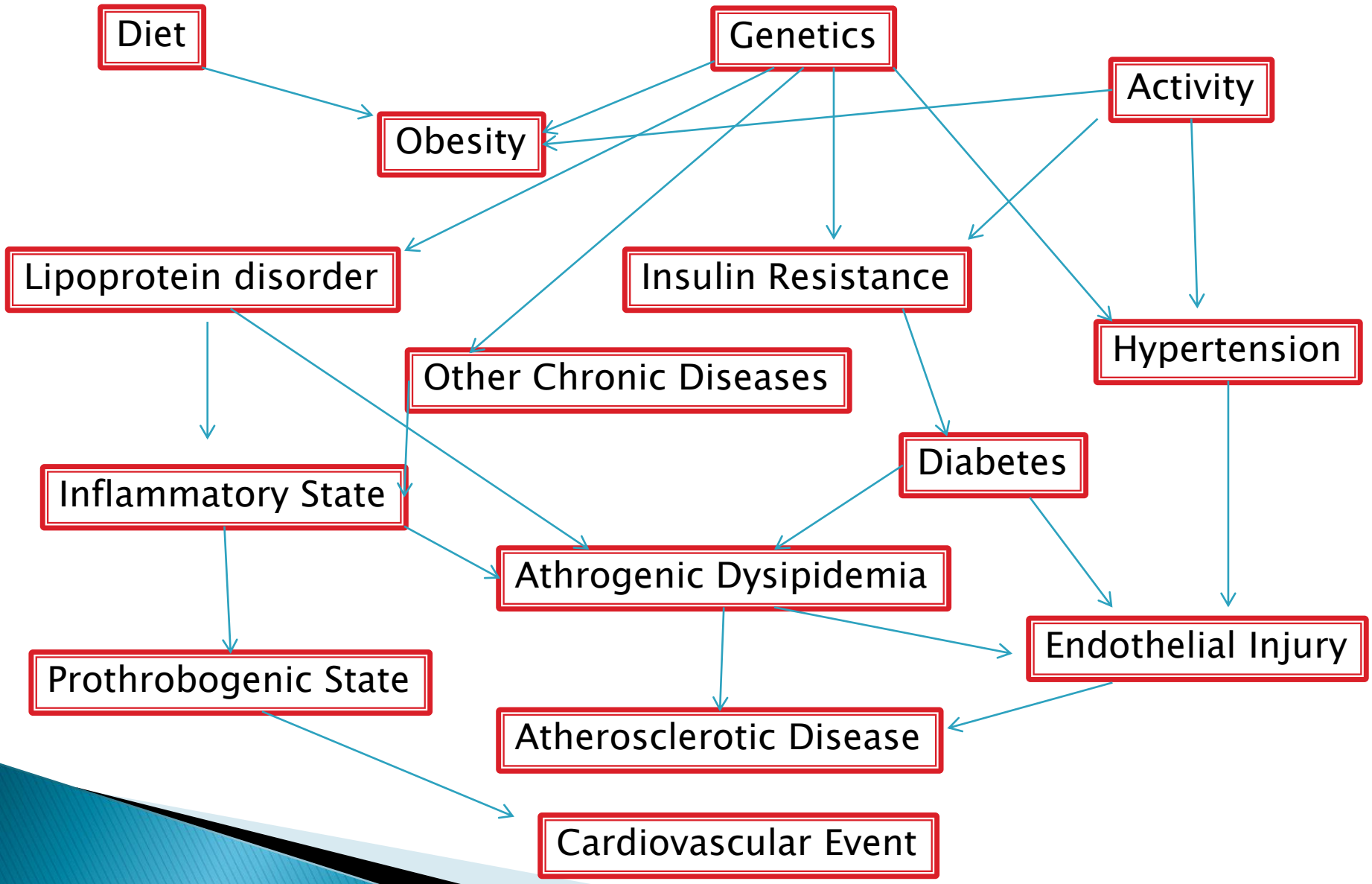
Atherogenic Dyslipidemia

- Increased small dense low density lipoproteins (LDL) particles.
- Decreased high density lipoprotein (HDL) particles.
- Increased triglycerides.


Insulin Resistance
Hypertension
Diabetes
Hyperglycemia
Heart Disease


Atherogenic Dyslipidemia
Insulin Resistance, Elev. Glu
Hypertension
Abnormal Adipocyte Metabolism
Endothelial Dysfunction
Inflammation
Prothrombotic State

Component Conditions Independent/Related



Why should we care? It's a matter of life and death!

Table 3. Relative Risk of Death From CHD, CVD, and Any Cause During the 11-Year Follow-up*

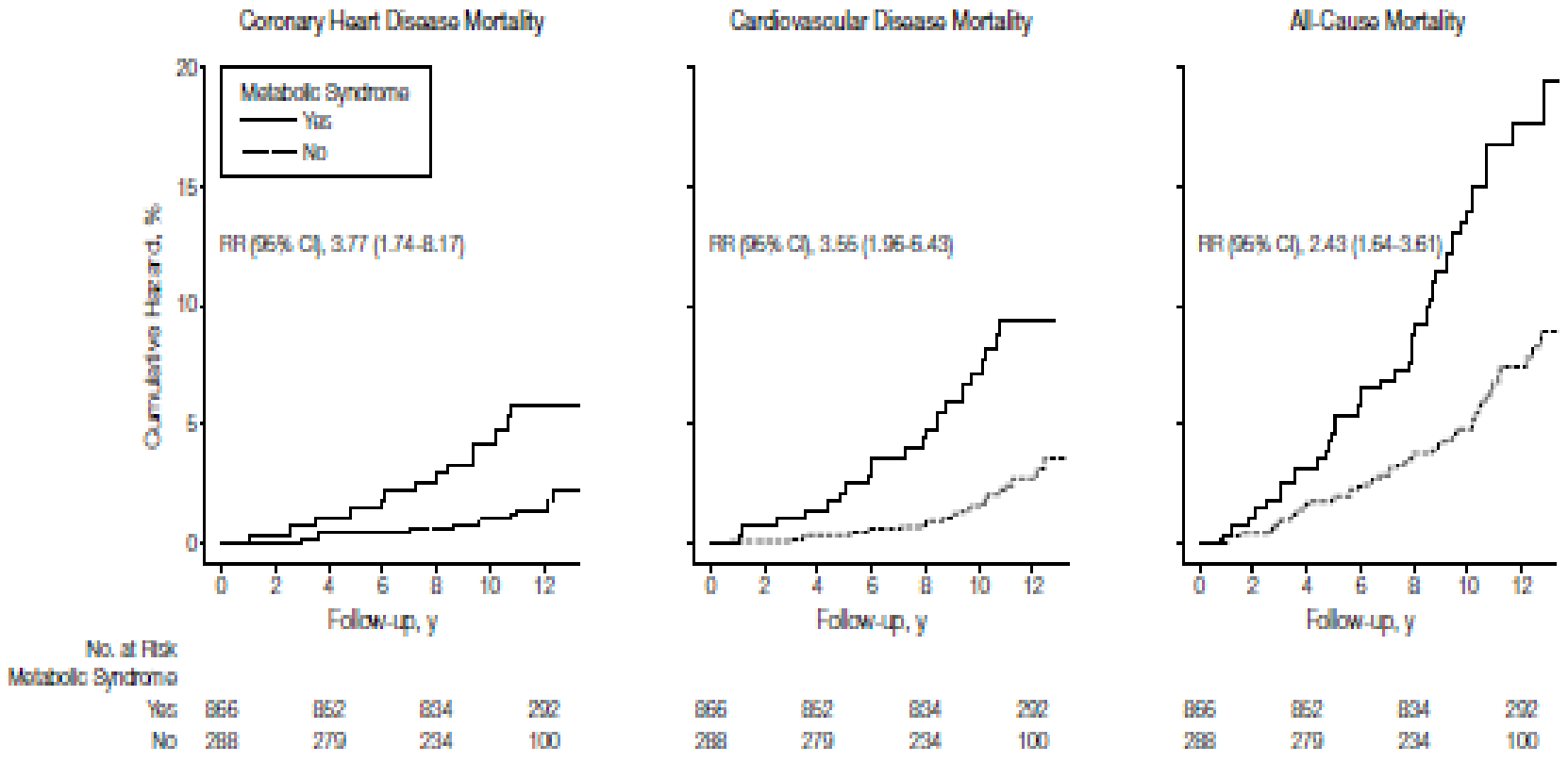
	Metabolic Syndrome, Relative Risk (95% Confidence Interval)			
Models†	NCEP Definition With Waist Girth >102 cm	NCEP Definition With Waist Girth >94 cm	WHO Definition With Waist-Hip Ratio >0.90 or BMI ≥30	WHO Definition With Waist Girth ≥94 cm
Cohort, No. (%)	106 (8.8)	169 (14.0)	172 (14.2)	161 (13.4)
CHD mortality				
1	3.40 (1.37-8.43)	2.39 (0.99-5.56)	2.72 (1.19-6.22)	2.96 (1.30-6.76)
2	4.16 (1.60-10.8)	2.90 (1.17-7.15)	2.87 (1.22-6.78)	3.30 (1.41-7.74)
3	4.26 (1.62-11.2)	3.04 (1.21-7.62)	3.32 (1.36-8.11)	4.15 (1.65-10.5)
CVD mortality				
1	2.08 (0.93-4.65)	1.62 (0.78-3.35)	2.53 (1.33-4.80)	2.76 (1.45-5.24)
2	2.52 (1.10-5.78)	1.92 (0.91-4.07)	2.63 (1.37-5.05)	2.96 (1.54-5.68)
3	2.27 (0.96-5.36)	1.85 (0.86-4.00)	2.83 (1.43-5.59)	2.91 (1.41-6.00)
All-cause mortality				
1	1.67 (0.95-2.92)	1.48 (0.91-2.40)	1.87 (1.19-2.92)	2.05 (1.31-3.21)
2	2.02 (1.14-3.59)	1.66 (1.00-2.75)	1.87 (1.18-2.96)	2.11 (1.33-3.33)
3	1.67 (0.91-3.08)	1.52 (0.89-2.58)	1.77 (1.09-2.88)	1.82 (1.08-3.07)

*CHD indicates coronary heart disease; CVD, cardiovascular disease; NCEP, National Cholesterol Education Program; WHO, World Health Organization; and BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters).

†Model 1: age-adjusted. Model 2: adjusted for age, examination year, low-density lipoprotein (LDL) cholesterol, smoking (cigarettes/d), family history of CHD. Model 3: adjusted for age, examination year, LDL cholesterol, smoking (cigarettes/d), family history of CHD, fibrinogen levels, white blood cell levels, alcohol consumption (g/wk), and socioeconomic status.

Hannah-Maaria Lakka, MD, PhD; David E Laasonen MD, MPH; Timo A Lakka et al. The Meabolic Syndrome and Total and Cardiovascular Disease Mortality in Middle-aged Men. JAMA. 2002;288(21)

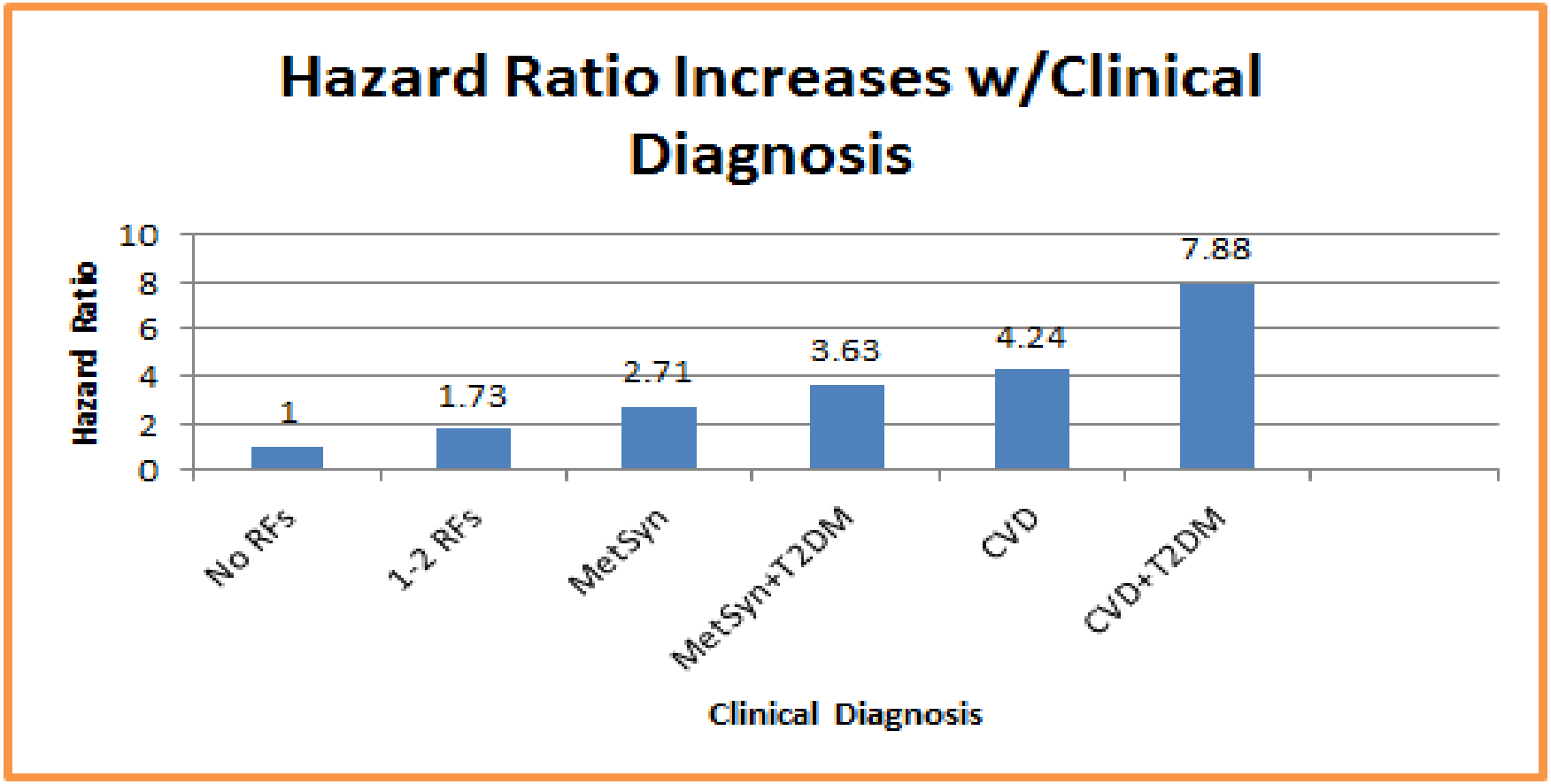
Metabolic syndrome increases all cause death rate:



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.

Maria-Lakka, Laksonnen, Lakka et. al. The Metabolic Syndrome and Total Cardiovascular Disease Mortality in Middle Aged Men. JAMA. 2002; 288(21):2709-2716

Cardiovascular Mortality Risk



- Malik,S, et. Circulation. 2004;110:1245-1250

Risk Factors

- Age: Disease risk increases with age. 10% prevalence in a 20 year olds and 40% prevalence in 60 year olds.
- Race: Disproportionately affects blacks and Mexican-American populations.
- BMI/Obesity: BMI of greater than 25 and abdominal obesity increases risk.
- Diabetes History: Type two diabetes increases the syndrome risk.

Prevention

- Relatively easy to prevent yet highly difficult to treat once diagnosed.
- Increased physical activity. AHA recommends 30 minutes of daily exercise.
- Healthy diet

- However, there seems to be a high underlying genetic factor so despite a healthier lifestyle some may still get this disease.

Disease Management

- Lifestyle modifications:
  - Management is based on control of the contributing cluster of factors
  - It is recommended that immediate lifestyle modification is implemented for best results.
  - Does not appear that the effects are completely reversible once the syndrome is manifest, but can be managed to decrease risk.

Specific Recommendations Vary

- Weight loss goals:
  - Patient should try to loose 7-10% of baseline weight in the first 6-12 months.
    - One proposed intervention is to reduce caloric intake to 500-1000 calories per day. Diet modification should include reducing saturated fat intake as well as increasing fruits and vegetable in the diet.
    - Others are less restrictive but demonstrate benefit.

Grundy SM, Hansen B, Smith SC, et al. Clinical management of metabolic syndrome: report of the American Heart Association/National Heart, Lung, and Blood Institute/American Diabetes Association conference on scientific issues related to management. *Circulation.* 2004;109:551-556.

Grundy SM, Cleeman JI, Daniels SR, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. *Circulation.* 2005;112:2735-2752.

Overall Lifestyle Modification Goals

- Weight loss to individual goal
- Regular exercise
- Low saturated trans fat in diet
- DISCONTINUATION OF SMOKING
- Alcohol consumption in moderation
- Reversal of dyslipidemia
  - LDL less than 100 mg/dl; for medium risk patients less than 130 mg/dl
  - Low risk patients less than 160mg/dl

Lifestyle Modification

- As determined by Grave, lifestyle modifications founded on behavioral therapy is the most important strategy and is highly effective in managing the syndrome.
- Effective lifestyle modification is characterized by integrating therapies that address diet and exercise goals as well as integrate behavioral and cognitive elements.
  - Largest barrier to care: helping patients maintain lifestyle changes in the long term
    - Counseling and support is effective in maintaining long term interventions.

Riccardo Dalle Grave, Simona Calugi, Elena Centis, Rebecca Marzocchi, Marwan El Ghoch, Giulio Marchesini. Lifestyle Modification in the Management of the Metabolic Syndrome: Achievements and Challenges. Diabetes Metab Syndr Obes. 2010; 3: 373–385. Published online 2010 November 2. doi: 10.2147/DMSOTT.S13860

PMCID: PMC3047997

Keys to Success

- When treating metabolic syndrome it is important to work with your patient to provide advice and encouragement; it is essential to emphasize a collaborative approach.
- Many patients are overwhelmed at the concept of such drastic lifestyle modifications and need support systems or are highly likely to fail.
- Success results from support, encouragement and being goal oriented.

Summarized from:

Miller WR, Rollnick S. Motivational Interviewing. 2nd ed. New York, NY: Guilford Press; 2002.

Wilson GT, Schlam TR. The transtheoretical model and motivational interviewing in the treatment of eating and weight disorders. Clin Psychol Rev. 2004;24(3):361–378.

Success and Achievements

- Reduction in body mass is generally described as the principle goal in interventional management of metabolic syndrome.
  - Weight loss results in improving the clinical measures of the disease including lipid profile, blood glucose and blood pressure.
- Clinical Data
  - Two year study comprising of 41 obese adults
    - All underwent lifestyle modification interventions including exercise and weight loss
    - Results: after two years , 66% of patients who lost 10 percent of weight no longer met diagnostic criteria for metabolic syndrome

Muzio F, Mondazzi L, Sommariva D, Branchi A. Long-term effects of low-calorie diet on the metabolic syndrome in obese nondiabetic patients. Diabetes Care. 2005;28(6):1485–1486.

Noted Barriers to Successful Treatment

Often environmental/education based

-Lack of understanding of the disease and its implications by both patients and providers

-Reduced of access to healthy foods and overconsumption of unhealthy options

-Limited time in the day to exercise appropriately as well as no access to exercise facilities

-Stigma as perceived by the patient

More Clinical Results

- US Diabetes Prevention Program
- 3000 patients with impaired glucose tolerance
- Intervention group consisted of diet modification or metformin therapy (850 mg, 3x daily). Control group was prescribed placebo.
- After 3.2 years 38% of lifestyle cohort, 23% of metformin only, and 18% in control groups no longer met metabolic syndrome diagnostic measures.

Orchard TJ, Temprosa M, Goldberg R, et al. The effect of metformin and intensive lifestyle intervention on the metabolic syndrome: the Diabetes Prevention Program randomized trial. Ann Intern Med. 2005;142(8):611–619.

Supportive Evidence

- If 1 % reduction in HbA1c is achieved, risk reduction of the following can be expected:

- 21% for any diabetes related end point
- 37% microvascular complication
- 14% MI

- Stratton IM, et al. BMJ. 2000; 321:405-412

Do Not Wait to Implement Lifestyle Modification Intervention!!

It has been shown numerous times that lifestyle modification is highly beneficial in patients that have only one or two of the diagnostic criteria and have not yet received a metabolic syndrome diagnosis.

Practical and Sustainable Modifications

- Long term adherence is key!
- Dietary Recommendation:
  - 1000-1200 Kcal/day overweight women
  - 1200-1600 Kcal/day overweight men
  - Should comprise >55% calories from carbs, <30% for lipids (specifically 7-10% from sat fat), ~15% from proteins
  - Calories can be increased if exercise is increased
  - Goal: calorie deficit of 500-1000 Kcal per day resulting in 0.5-1.0 kg/week
- Physical Exercise Recommendation
  - Moderate to vigorous exercise 60 min a day, at least 5 days a week
  - Walking is often a favorite of patients and is effective
  - Exercise should result in a caloric debt of 400 Kcal per day producing weight loss and preserving muscle tone
  - Note all diet and exercise modification should be monitored and managed by a physician

Marzocchi, Marwan El Ghoch, Giulio Marchesini. Lifestyle modification in the management of the metabolic syndrome: achievements and challenges 2010; 3: 373–385. Published online 2010 November 2. doi: 10.2147/DMSOTT.S13860 PMCID: PMC3047997

Lifestyle Modification Failure:

- Metabolic syndrome is uncommon in the absence of obesity and inactivity.
- Not all obese, inactive patients develop Metabolic syndrome.

This would support a genetic predisposition.

When genetics overcome lifestyle efforts in some patients, a pharmacologic response will be indicated. Standard interventions apply.

Conclusions:

- Much remains to be discovered about this condition
  - Various mechanisms have been proposed
  - There appear to be strong genetic predispositions for some patients
- Treatment is currently focused on treating underlying factors
- Lifestyle modification is effective
  - Weight loss largely through diet modification
  - Smoking cessation
  - Alcohol moderation
  - Moderate exercise

Recognition of the Syndrome

- This condition has been debated and studied intensely since 1988 when Reaven published his original paper and into the early 20th century. There are thousands of papers , reviews, re-evaluation papers, and at one time even a journal dedicated to the subject.

- There is no ICD 9 or 10 code for this condition!

Summary

Metabolic syndrome is a state associated with dramatic increased risk in cardiovascular morbidity and mortality; nearly 4 times the risk.

Prevention appears to be easier than treatment, identification is the key.

Lifestyle modification positively impacts prevention and treatment.

Thank You