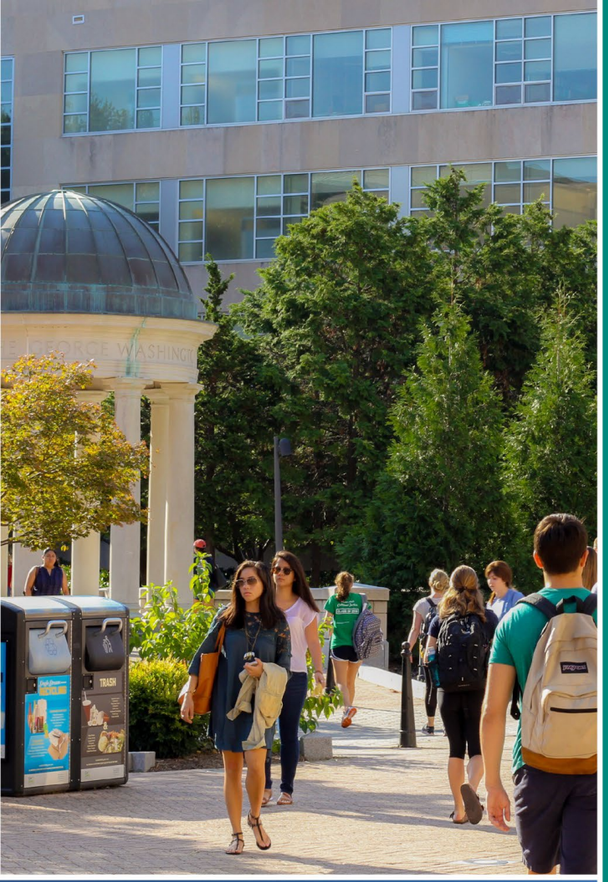

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

The Science, Strengths, and Limitations of BMI as a Measure of Obesity

William H Dietz MD, PhD
Redstone Global Center for Prevention and Wellness
George Washington University School of Public Health

Milken Institute School of Public Health
THE GEORGE WASHINGTON UNIVERSITY

Sumner M. Redstone Global Center for Prevention & Wellness

Outline

Measures of body composition
BMI in children and adolescents
BMI in adults

- Limitations in Asian populations
- Relevance of waist circumference

Edmonton Obesity Staging System
Contribution of adipose tissue to the pathophysiology of obesity
Consensus statement

Methods to Determine Body Composition

Measures of Total Body Fat

Densitometry

- Underwater weighing
- Body plethysmography

Isotope dilution

- Deuterium oxide (D_20)
- H_2O^{18}

Dual X-Ray Absorptiometry

Bioimpedance

Measures of fat distribution

Waist circumference

- Men < 40 inches (102 cm)
- Women < 35 inches (88 cm)

Waist:hip ratio

- Men $\leq$ 1
- Women $\leq$ 0.8

Dual X-ray absorptiometry

CT Scans

Rationale for Use of BMI in Children and Adolescents

Reflects increased body fat

- At BMI > 95th percentile, 75% youth have increased body fat defined as ≥ 85th %tile TBF from DEXA
- Smaller percent of youth between 85th- 95th %tiles have increased body fat, defined by DEXA

BMI > 95th %tile increases risk of disease

- 70% of children in Bogalusa have 1 CVD risk factor and 39% have 2 or more

Increased BMI associated with risk of persistent obesity

- Risk of persistence increases with age and severity

Continuity with adult criteria

- 95th %tile BMI in late adolescent corresponds to BMI = 30
- 82nd or 83rd %tiles correspond to BMI =25

Body Fat vs BMI in 6-11 yo Children

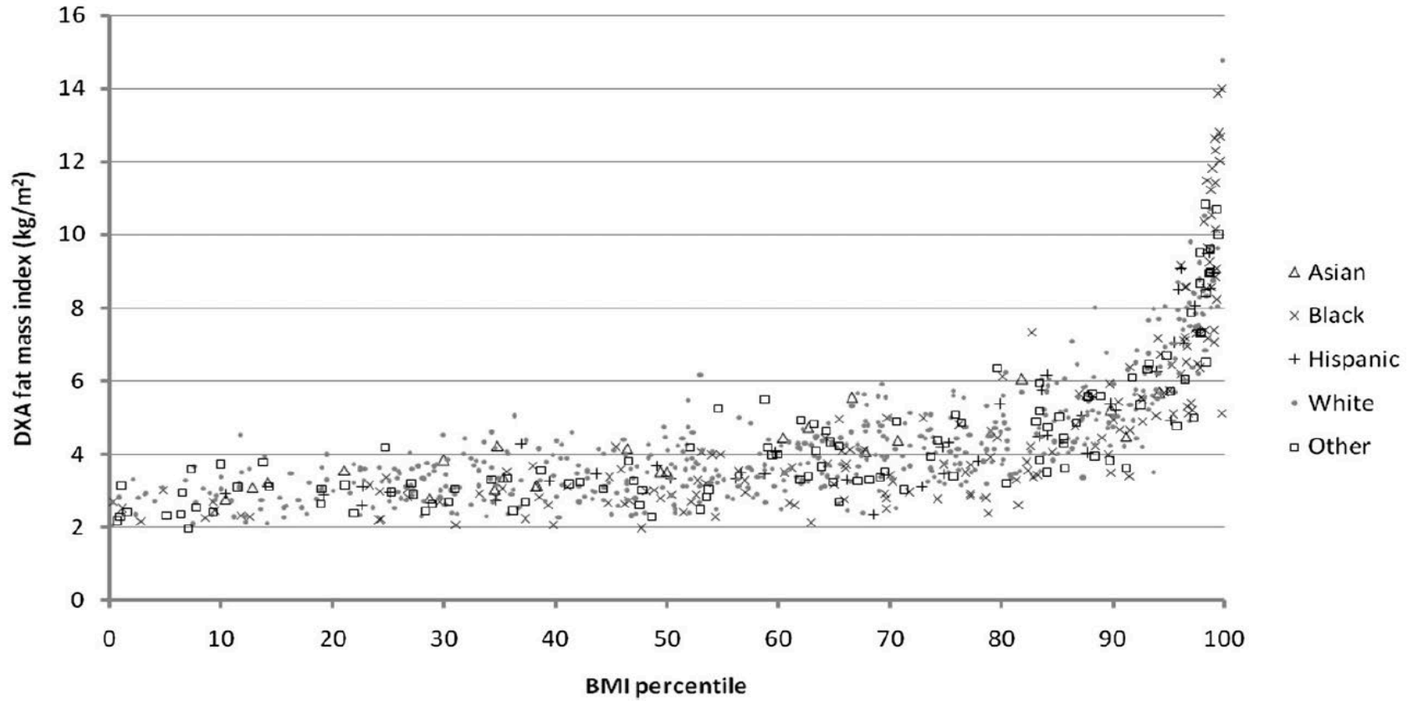

Figure 1 Age- and sex-specific BMI percentile in relation to DXA fat mass index at 6.5-10.9 years, by race/ethnicity. Data from 875 participants in Project Viva. BMI percentiles based on CDC growth charts [20].

Boeke CE et al. BMC Pediatrics 2013;13:99

Correlations of Anthropometric Measures with Body Fat Measured by DEXA in 1110 6-11 yo Children

DEXA TBF	Correlation	BMI	Correlation
BMI	0.83		
Sum of skinfolds	0.90	Sum of skinfolds	0.79
Waist circumference	0.79	Waist circumference	0.86
Bioimpedance	0.87	Bioimpedance	0.88

Boeke CE et al. BMC Pediatrics 2-13; 13:99

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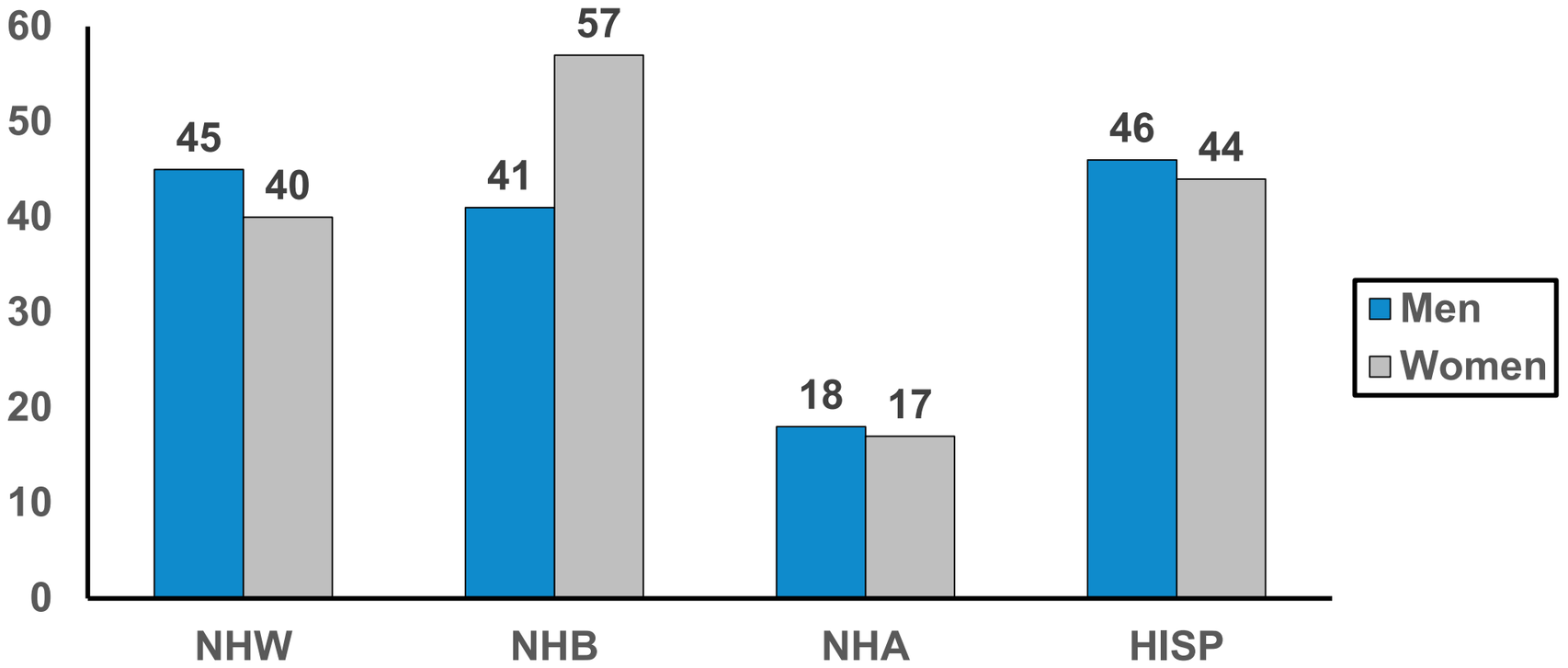
Rationale for the Use of BMI in Adults

- Adult weight increases proportionally to height squared (not a linear function of height)
- BMI is a stature independent measure of weight independent of height
- Reasonable correlation with fat mass (r= 0.70)
- Applicable across most ethnicities and the life cycle although correlations may differ
- Lowest mortality across the distribution used to define “healthy” not “normal” weight

What BMI is Not

- It is associated with body fat but it is not a direct measure of body fat
- It does not assess concomitant presence of comorbid conditions, disease risks, or functionality
- Its association with risk is inconsistent and varies with age, sex, and ethnicity
- It does not assess risks related to body fat distribution
- It is not a diagnostic measure of obesity

Obesity Prevalence Among Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian, and Hispanic Men and Women 2017-2018



Hales CM et al. NCHS Data Brief # 360, February 2020

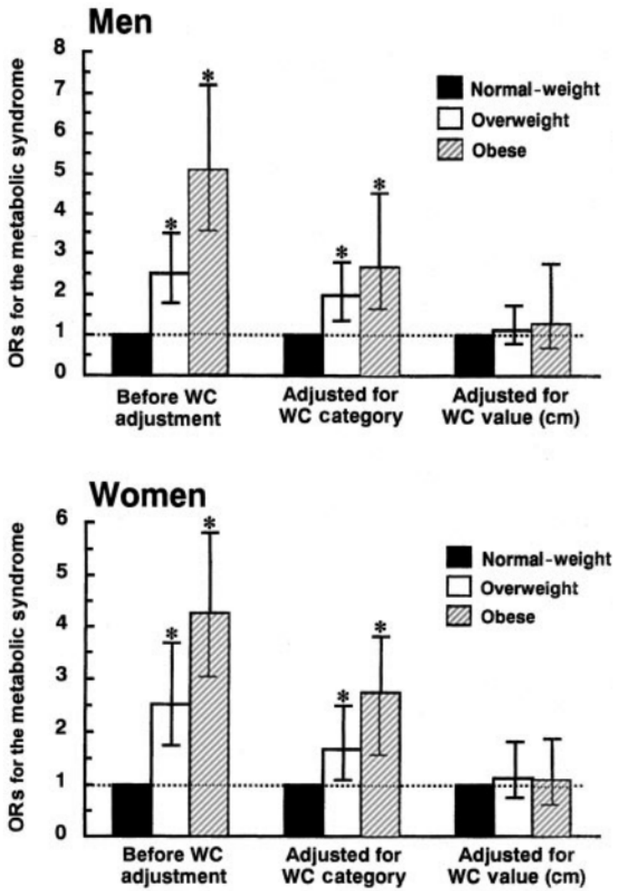
BMI Cutpoints for Asian Populations

BMI in 7 Asian Populations Corresponding to 25% and 30% TBF Determined by DEXA

	U.S.	Asian	Recommended
Overweight: BMI @ 25% TBF	25	22-25	23.0
Obesity: BMI @ 30% TBF	30	27-30	27.5

WHO Expert Consultation Lancet 2004;362:157

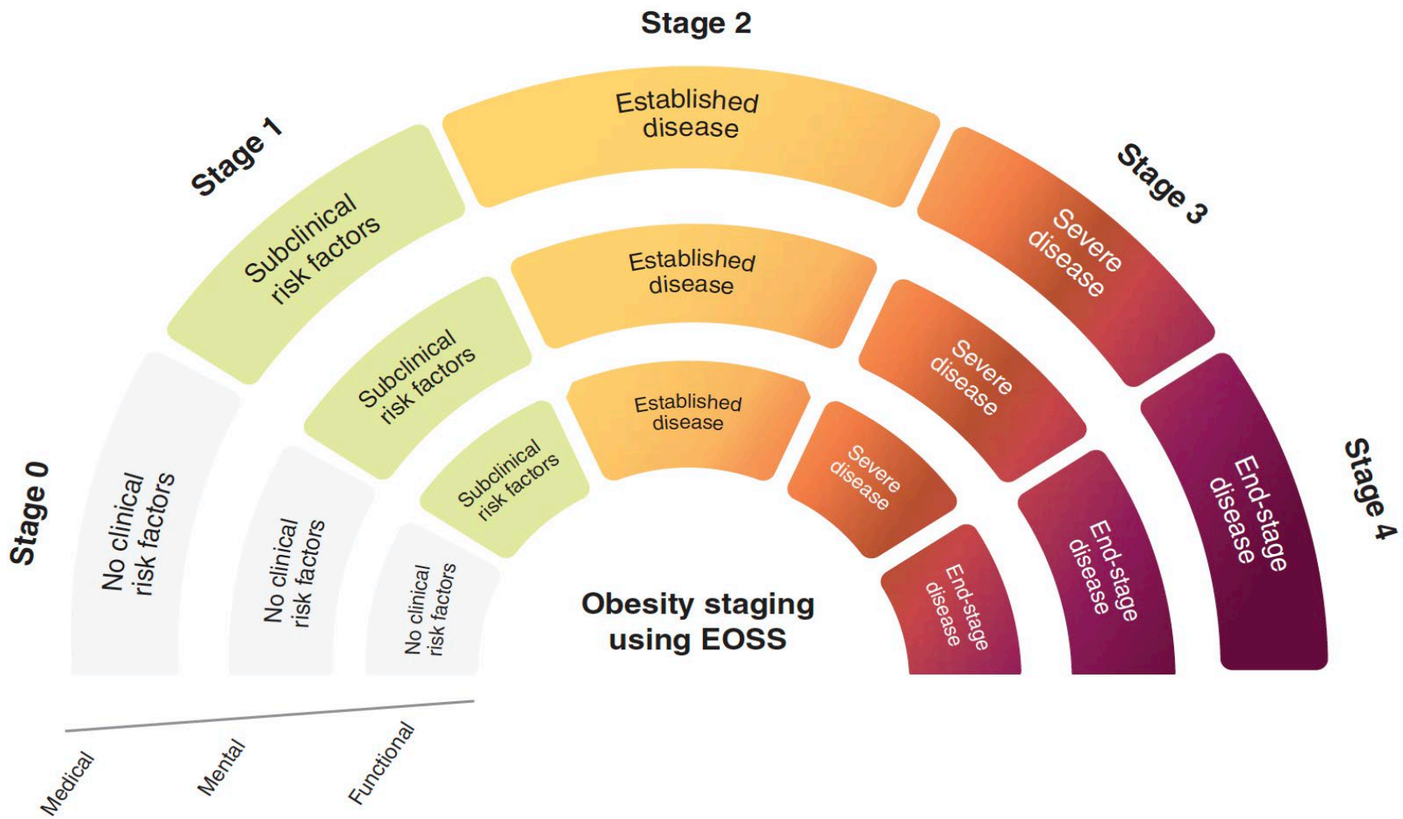
Waist Circumference vs BMI on Metabolic Syndrome Risk



Sample comprised almost 15,000 men and women with BMI 18.5-34.9. All those with BMI ≥35 had high WC values and were excluded. In this sample "BMI coupled with WC does not predict an increase in obesity related health risk than does BMI alone when the 2 values are examined on a continuous scale." Increased waist measures were ≥35" (88cm) in women and ≥40" (102 cm) in men

Jenssen I, Katzmarzyk PT et al. Am J Clin Nutr 2004; 379

Edmonton Obesity Staging System



Swaleh R et al. Canad Med Assn J Open 2021; 9: E1141

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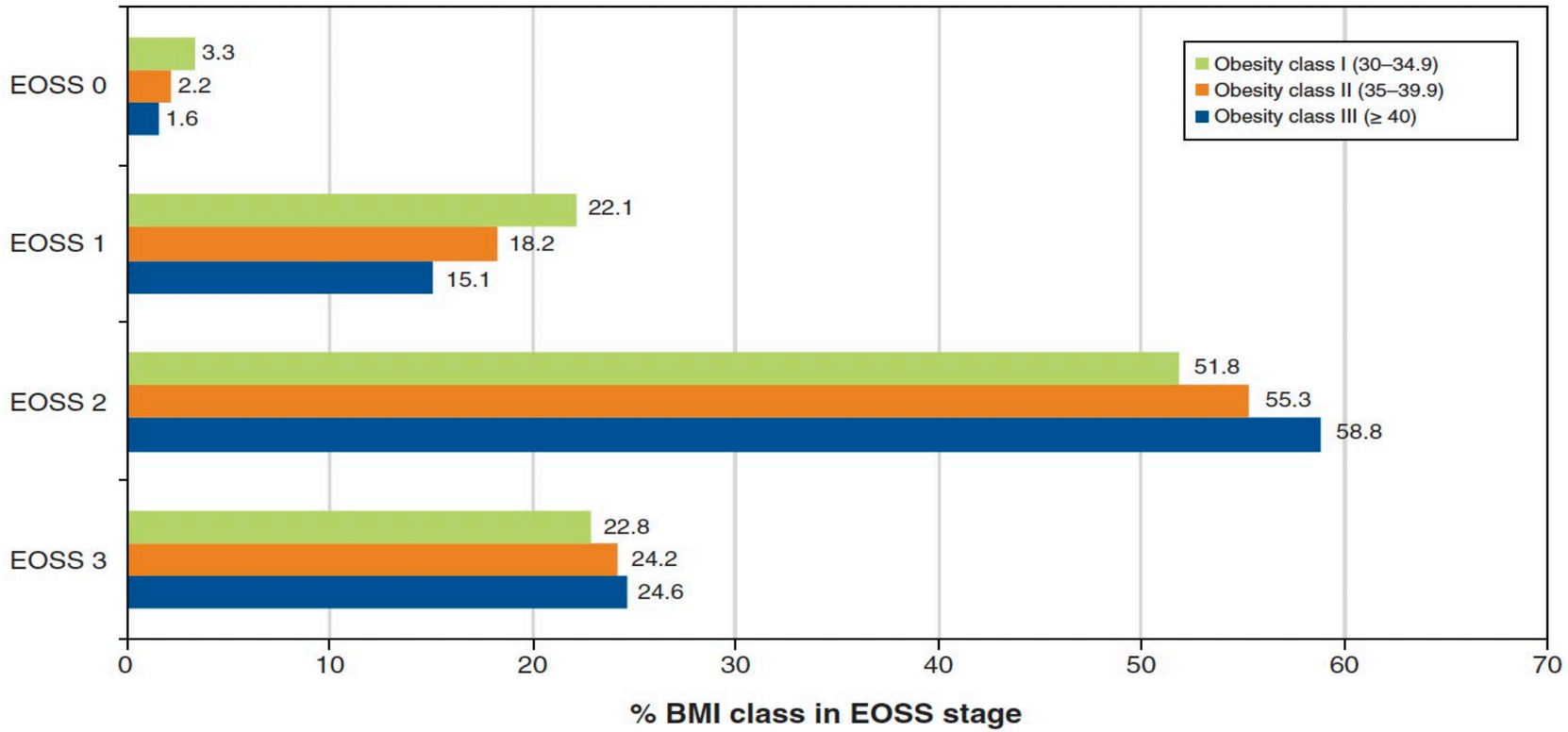
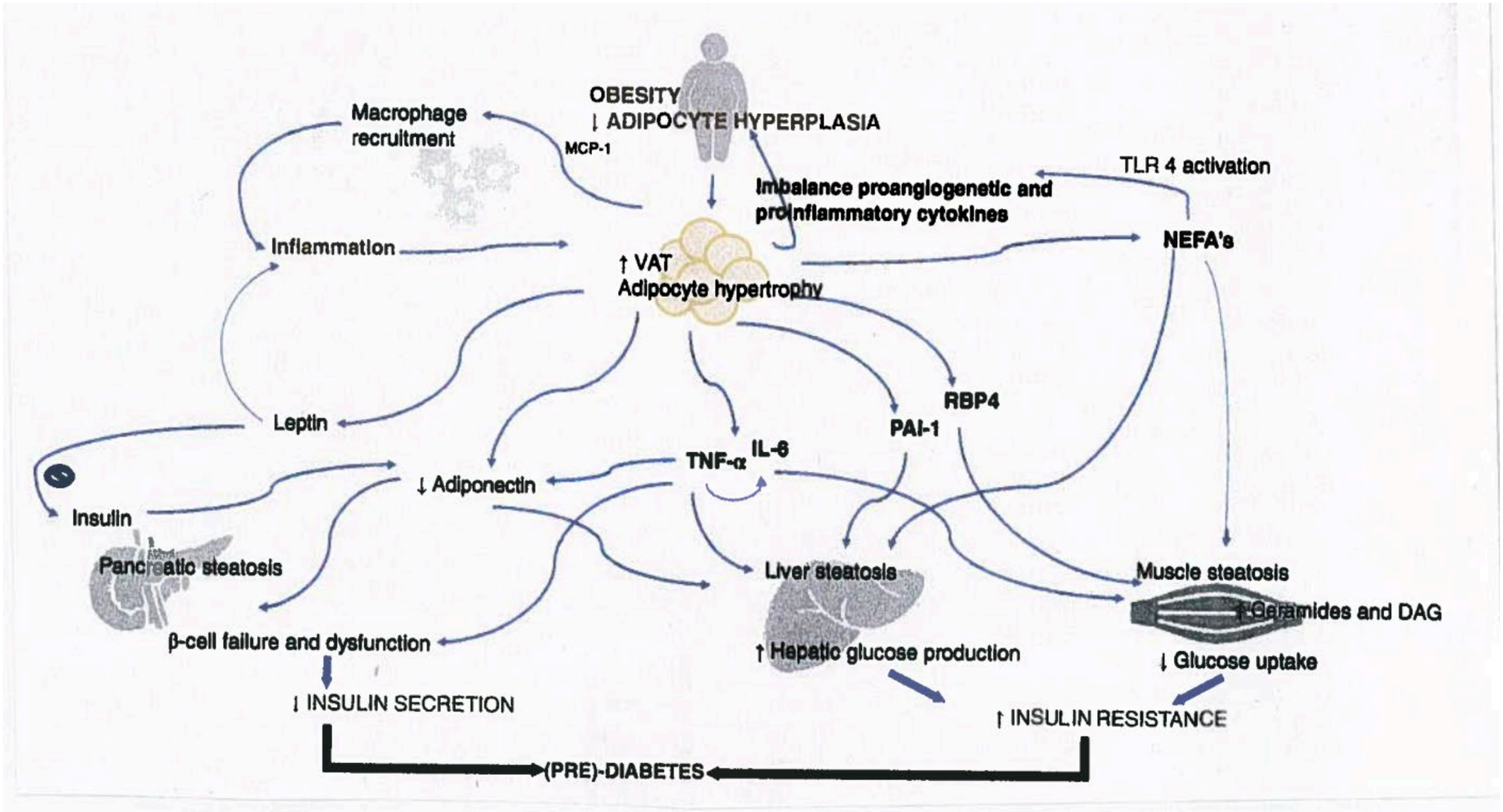


Swaleh R et al. Canad Med Assn J Open 2021; 9: E1141

The Contribution of Adipose Tissue to the Pathophysiology of Obesity



Consensus Statement from 6 Obesity Groups (AND, STOP, TOS, OMA, ASMBS, OAC)

Obesity is a highly prevalent chronic disease characterized by excessive fat accumulation or distribution that presents a risk to health and requires lifelong care. Virtually every system in the body is affected by obesity. Other major chronic diseases associated with obesity include diabetes, heart disease, and cancer.

The body mass index (weight in kg/height in meters^2) is used to screen for obesity, but it does not displace clinical judgement. BMI is not a measure of body fat. Social determinants, race, ethnicity, and age may modify the risk associated with a given BMI.

Bias and stigmatization directed at people with obesity contributes to poor health and impairs treatment.

Every person with obesity should have access to evidence-based treatment.

Is the use of the term “obesity” in and of itself stigmatizing?

If so, how do we talk about obesity if we can’t talk about obesity?