



METABOLIC SYNDROME RISK DIFFERENTIATED BY SEX IN KOREAN ADULTS

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Metabolic syndrome (MetS)

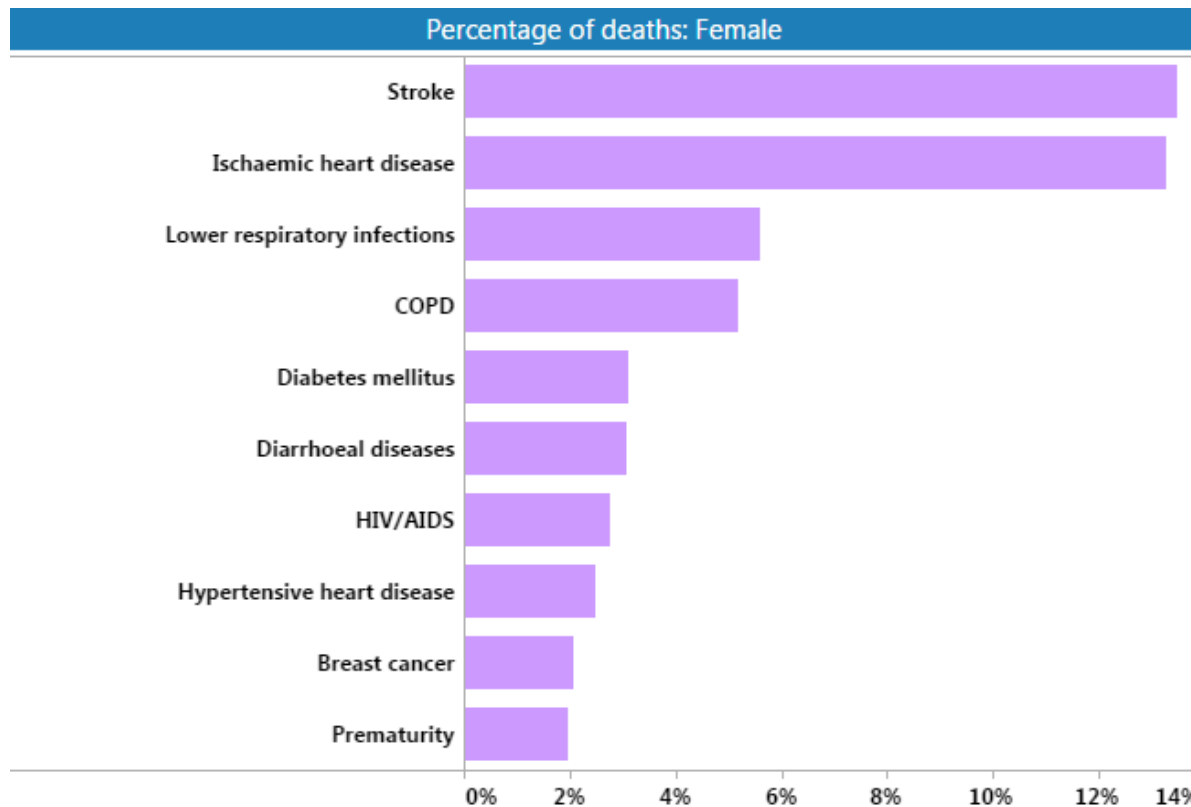
“Insulin Resistance Syndrome”, “Syndrome X”

“a group of signs and symptoms that occur together and characterize a particular abnormality or condition” [Syndrome]

“a condition that impairs normal functioning typically manifested by distinguished signs and symptoms” [Disease]

Causes of death

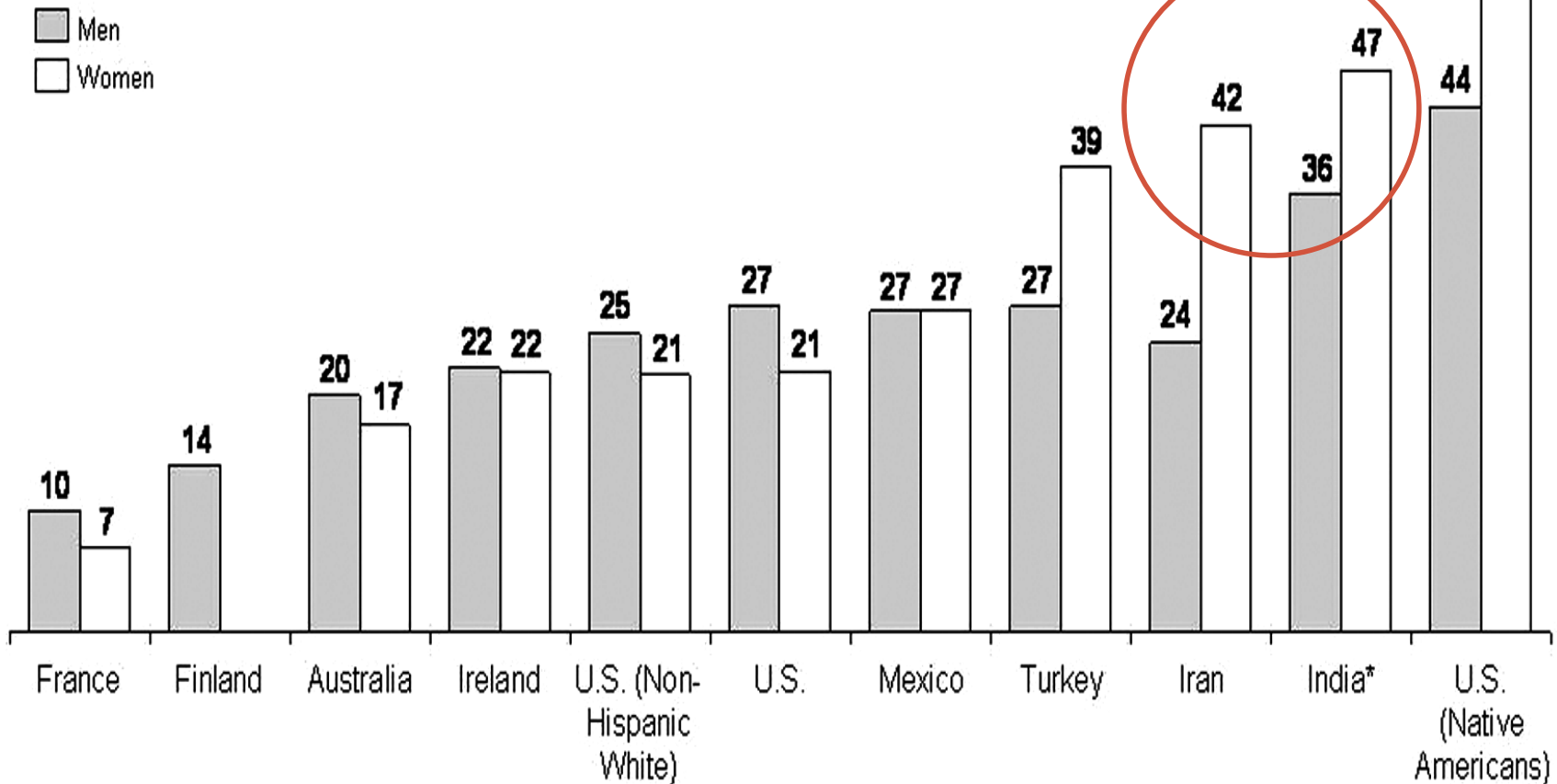
- In 2012, 17.5 million deaths caused by CVD and 1.5 million deaths caused by diabetes
- 1/3 of all female deaths due to CVD and stroke



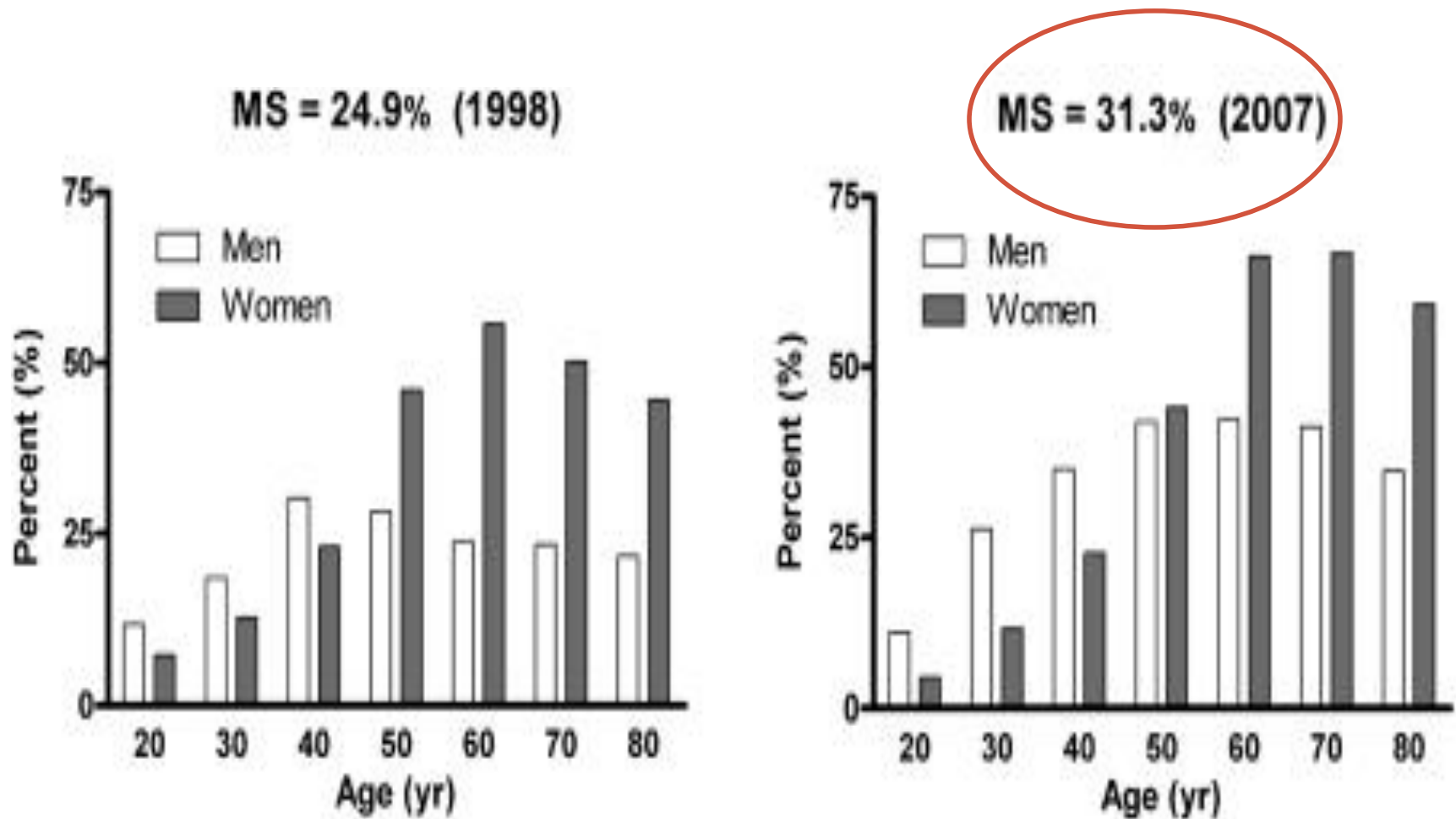
Prevalence of MetS

Prevalence of the Metabolic Syndrome According to the ATPIII Definition

Bars Illustrate Prevalence %



Prevalence of MetS in Korean adults



Diagnostic Criteria: NCEP ATPIII

Individuals must have 3 or more of the following:

Elevated waist circumference (WC)

- **> 102 cm in men, > 88 cm in women**
- **≥ 90cm in men, ≥ 80 cm in women (Asian; IDF)**

Elevated triglycerides (TG)

- **≥ 150 mg/dL**

Low HDL-cholesterol (HDLC)

- **< 40 mg/dL in men, < 50 mg/dL in women**

Elevated blood pressure (BP)

- **≥ 130/85 mmHg; ≥ 140/90 mmHg (WHO)**

Elevated fasting blood glucose (FBG)

- **≥ 100 mg/dL**

Study Questions

**The risk of MetS differentiated by sex
in Korean adults?**

HOW?

WHY?



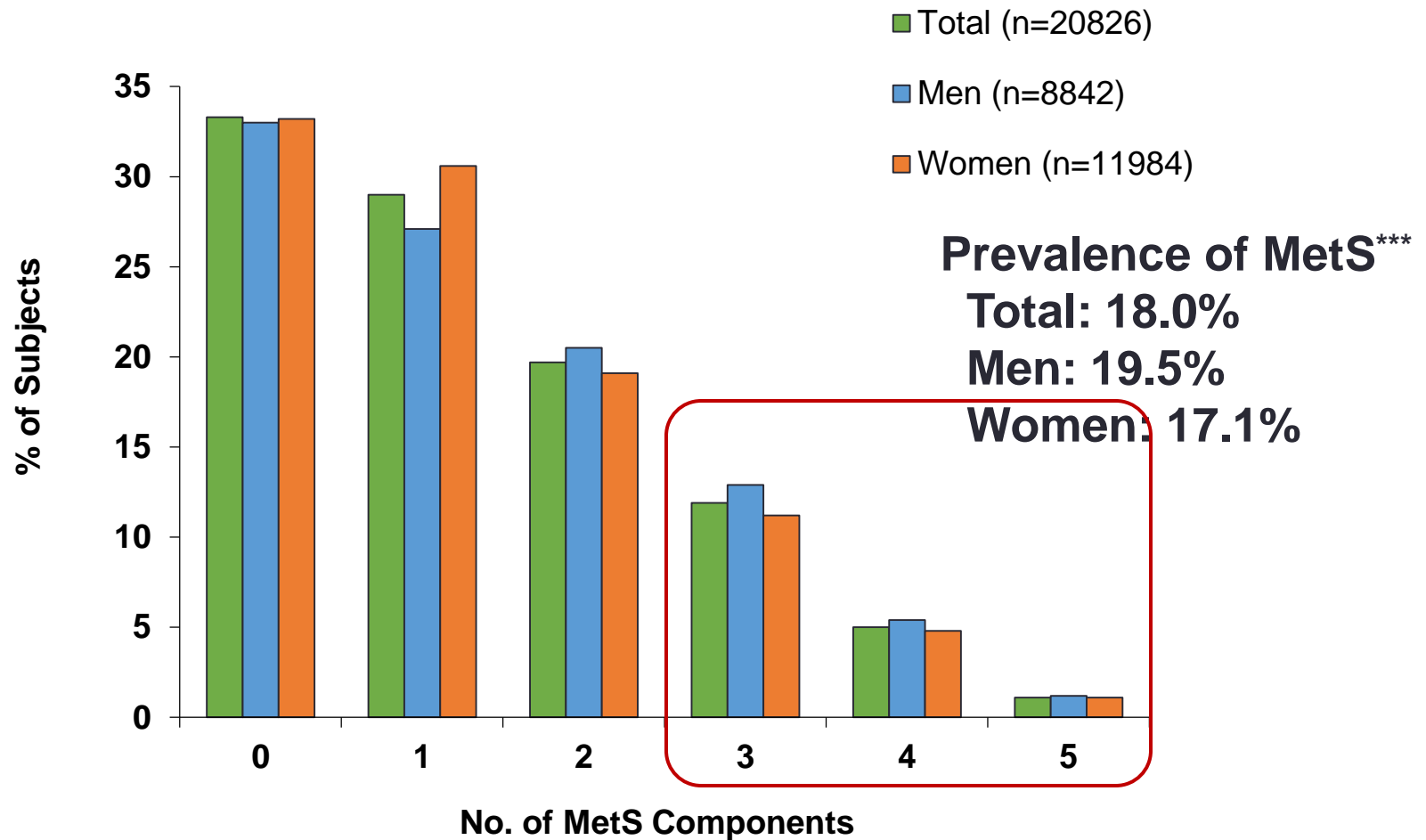
Data & Subjects

- The nationally representative sample data from the Korea National Health and Nutrition Examination Survey for 2008–2012
- A total of 20,826 adults (8,842 men and 11,984 women) aged 19+ years with no diagnosed diabetes, hypertension, or dyslipidemia

Diagnosis of MetS

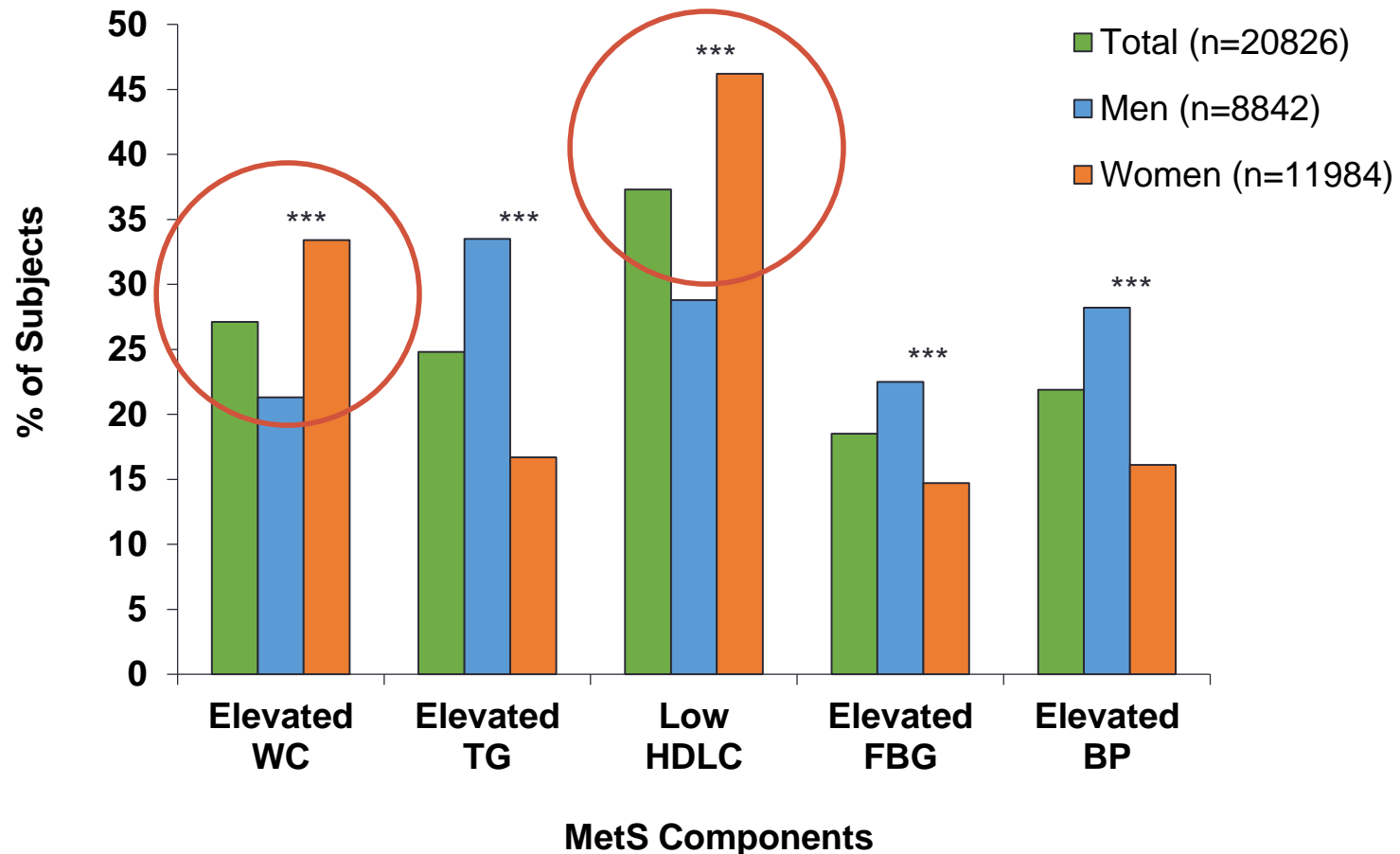
- By the criteria of the National Cholesterol Education Program Adult Treatment Panel III
- The presence of ≥ 3 of the components

Age-standardized prevalence of MetS by sex



The chi-square was used to test differences in prevalence of MetS by sex (**p<0.001).

Age-standardized prevalence of MetS components by sex

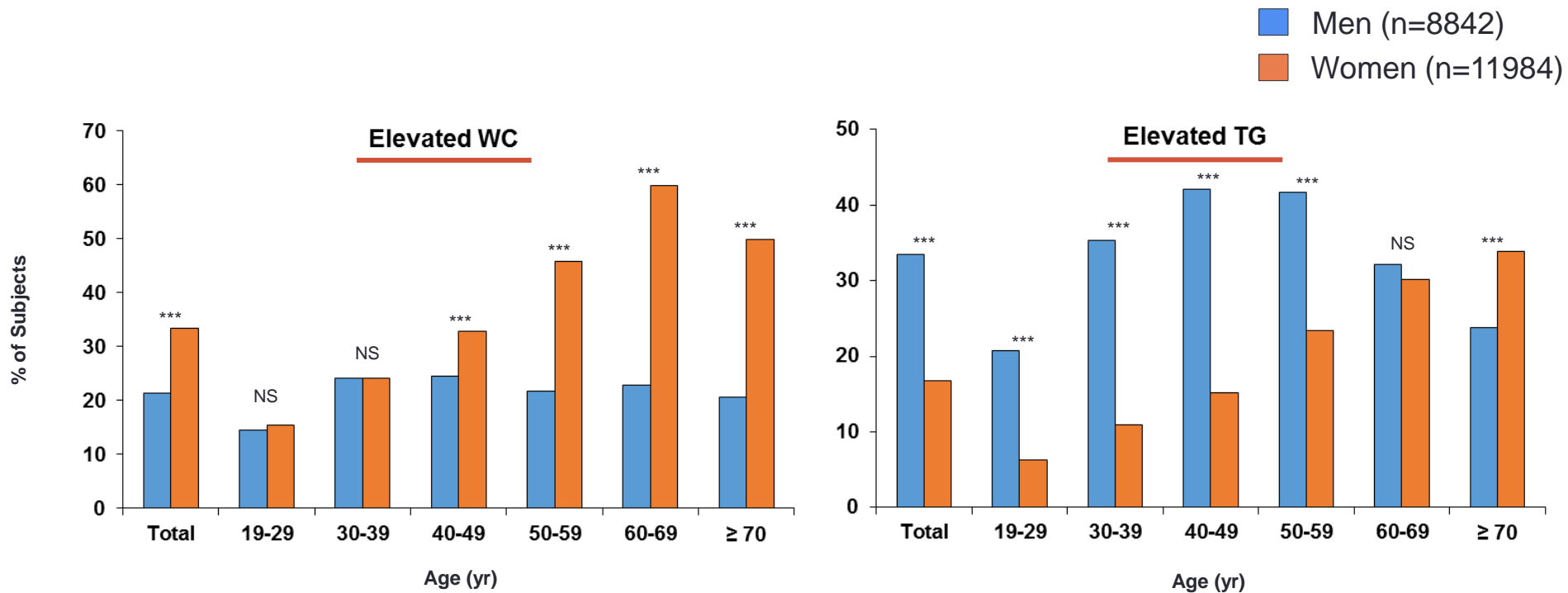


The chi-square was used to test differences in prevalence of MetS components by sex (**p<0.001).

Combinations of MetS components among subjects with MetS by sex

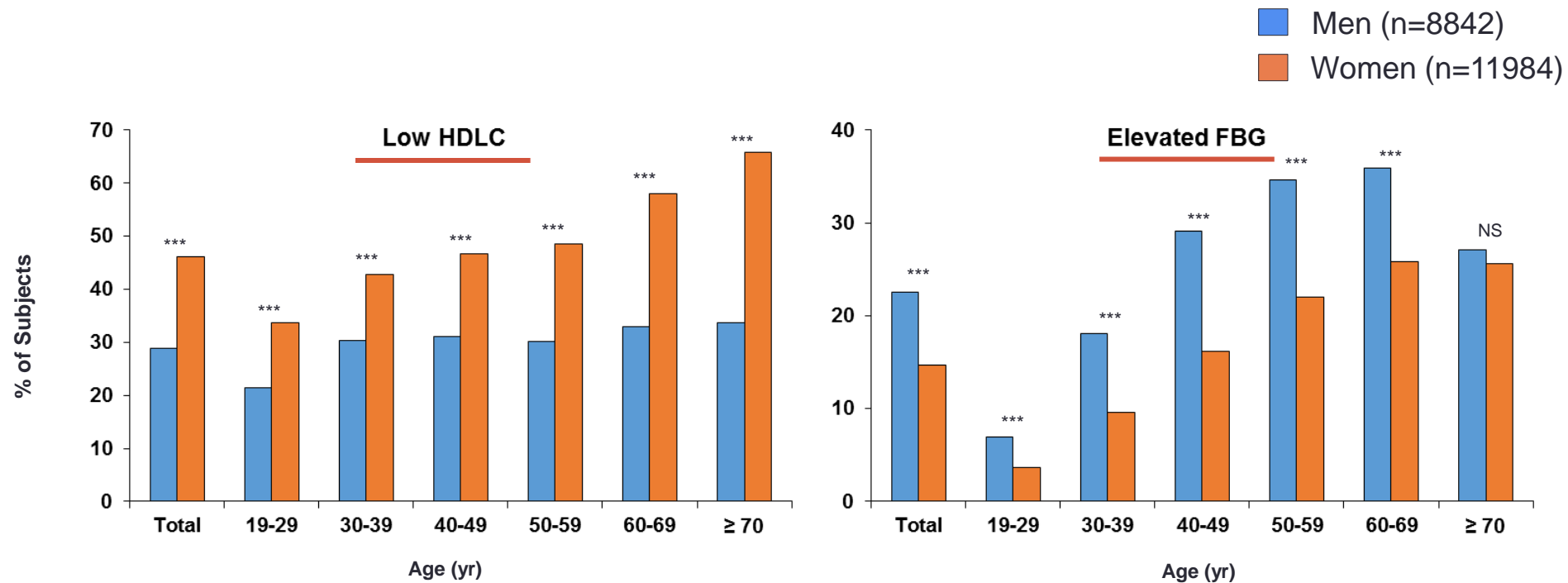
		Combinations of MetS components					Men (n=1772)	Women (n=1943)	
		Elevated WC	Elevated TG	Low HDLC	Elevated FBG	Elevated BP	% (SE)	% (SE)	
No. of MetS components	3	X	X	X			13.2 (1.0)	23.5 (1.2)	
		X	X		X		5.0 (0.6)	2.3 (0.4)	
		X	X			X	8.4 (0.8)	2.4 (0.5)	
		X		X	X		3.0 (0.4)	12.0 (0.9)	
		X		X		X	2.7 (0.5)	10.5 (0.8)	
		X			X	X	4.9 (0.6)	4.8 (0.6)	
			X	X	X		8.3 (0.8)	3.8 (0.5)	
			X	X		X	9.9 (0.9)	4.1 (0.5)	
			X		X	X	8.8 (0.9)	0.9 (0.2)	
					X	X	X	2.0 (0.4)	2.5 (0.4)
		4	X	X	X	X		6.3 (0.7)	9.1 (0.8)
			X	X	X		X	7.0 (0.7)	8.8 (0.8)
X	X			X	X	6.3 (0.7)	2.0 (0.4)		
X			X	X	X	2.0 (0.4)	5.4 (0.6)		
	X		X	X	X	6.3 (0.7)	1.6 (0.3)		
5	X	X	X	X	X	6.0 (0.7)	6.3 (0.7)		

Age-specific prevalence of MetS and its components by sex (1)



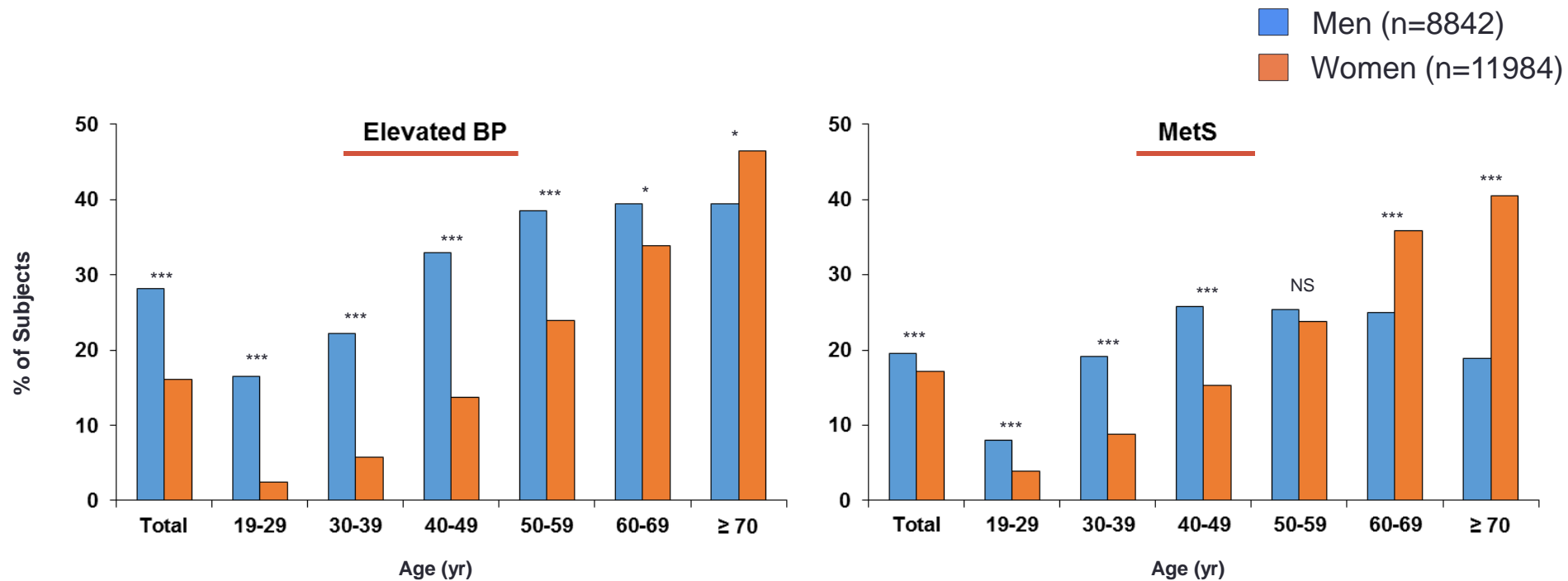
The chi-square was used to test differences in prevalence of metabolic syndrome and its components between men and women by age groups (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Age-specific prevalence of MetS and its components by sex (2)



The chi-square was used to test differences in prevalence of metabolic syndrome and its components between men and women by age groups (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

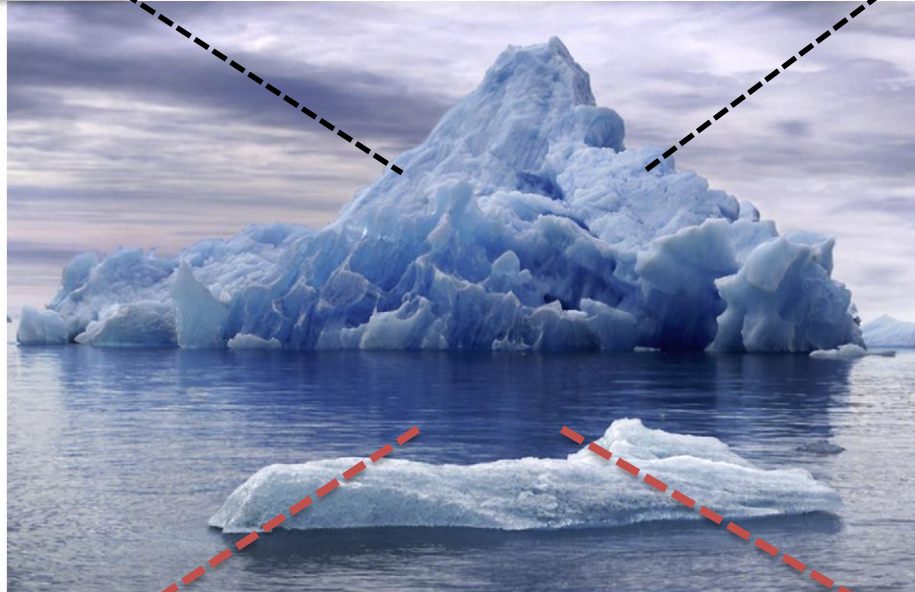
Age-specific prevalence of MetS and its components by sex (3)



The chi-square was used to test differences in prevalence of metabolic syndrome and its components between men and women by age groups (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

**Dyslipidemia
Hypertension**

**Diabetes
Abdominal Obesity**



**Insulin resistance
Inflammation
Prothrombotic state
Endothelial dysfunction
Cardiovascular disease**

**Polycystic ovary disease
Sleep apnea
Non-alcoholic fatty liver disease
Cancer
Hyperuricemia & gout**

**Genetics, Aging
Obesity and inactivity
Medications
PCOS
Atherosclerosis
Dyslipidemia
Hypertension
IUGR**

Risk factors of MetS

- Gender related behaviors



Alcohol



Physical inactivity



Tobacco



Unhealthy diet

Carbohydrate Intake and Refined-Grain Consumption Are Associated with Metabolic Syndrome in the Korean Adult Population

^{SUJ} **Dietary patterns based on carbohydrate nutrition are associated with the risk for diabetes and dyslipidemia**

High intake of whole grains and beans pattern is inversely associated with insulin resistance in healthy Korean adult population

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Basis of diagnostic criteria

Low HDLC

- Men < 40 mg/dL, Women < 50 mg/dL

- Associated with insulin resistance or hyperinsulinemia
- Based on insulin resistant men in US and hypertensive men and women in Sweden and Finland
- **Men < 43 mg/dL, Women < 48 mg/dL for Korean adults (Moon et al. 2015)**

Elevated WC

- Men > 102 cm, Women > 88 cm (in Caucasians)
- Men ≥ 90cm, Women ≥ 80 cm (in Asian; IDF)

- Associated with cardiovascular risk factors
- Based on South Asian population
- **Men ≥ 90cm, Women ≥ 85 cm for Korean adults (Lee et al. 2007)**

Different effect of MetS on chronic diseases

- In several studies of meta-analysis, MetS was a stronger predictor for CVD morbidity and mortality in women

			Total	Men	Women
Hu G et al. (2004)	Cohort studies	CVD death		2.26 (1.61–3.17)	2.78 (1.57–4.94)
Galassi A et al. (2006)	Cohort studies	CVD events	1.61 (1.42–1.83)	1.57 (1.41–1.75)	2.10 (1.79–2.45)
Gami AS et al. (2007)	Cohort studies	CVD events & death	1.78 (1.58–2.00)	1.98	2.63
Hui WS et al. (2010)	Cohort studies	All cause death	1.46 (1.35–1.57)	1.44 (1.32–1.58)	1.51 (1.37–1.66)

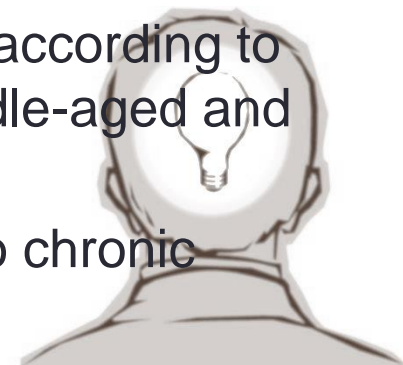
Conclusions & Implications

**The risk of MetS differentiated by sex
in Korean adults**

HOW

WHY

- Reestablish the sex-specific diagnostic criteria of MetS
- Investigate MetS pathogenesis based on sex and gender related risk factors
- Develop preventive and therapeutic strategies of MetS according to specific sex and age group, especially focusing on middle-aged and elderly women
- Identify different effect of MetS on further progression to chronic diseases by sex



감사합니다 Natick

Grazie Danke Ευχαριστίες Dalu

Thank You Köszönöm

Спасибо Dank Gracias

谢谢 Merci Seé
ありがとう

Obrigado