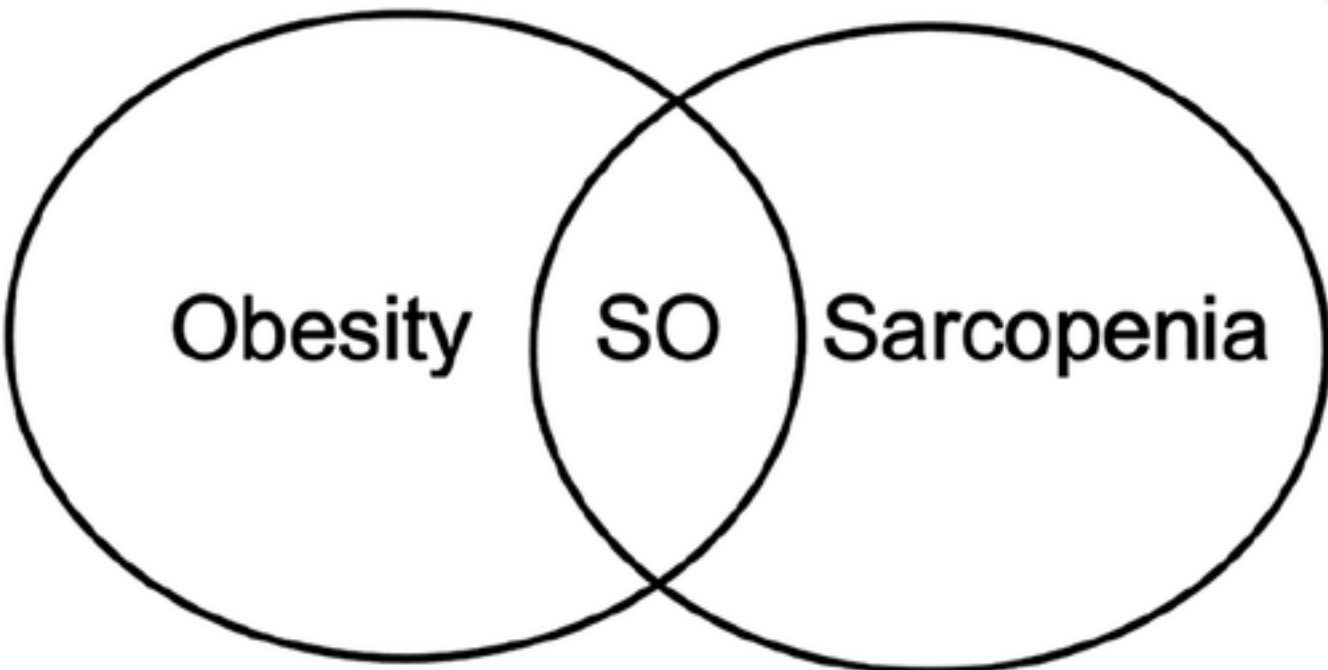# Elderly obesity and Sarcopenic obesity in Taiwan

Obesity in Seniors

Prof. Wen-Yuan Lin, M.D., M.S.,Ph.D, EMBA

Department of Family Medicine,

China Medical University and Hospital

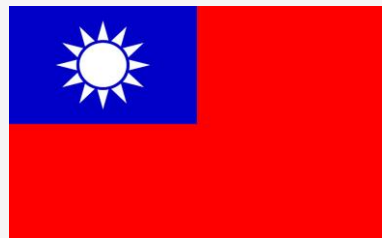**Taiwan Medical Association for The Study of Obesity**

Contents

Topic Highlights

- Definition
- Prevalence
- Obesity Guidelines in Taiwan
- Treatment

Definition of Obesity in Taiwan

Taiwan

Table 1. Comparisons of three different BMI criteria used

Classification	BMI (Global)	BMI (Asian)	BMI (Taiwan)
Underweight	15-20 kg/m²	≤18.49	
Normal weight	20-25 kg/m²	18.5-22.99	
Overweight	25-30 kg/m²	≥ 23	≥ 24
Obese grade I	30-35 kg/m²	≥ 25	≥ 27
Obese grade II	35-40 kg/m²		
Obese grade III	> 40 kg/m²		

WHO, 1998; WHO, 2000; Department of Health Taiwan, 2002
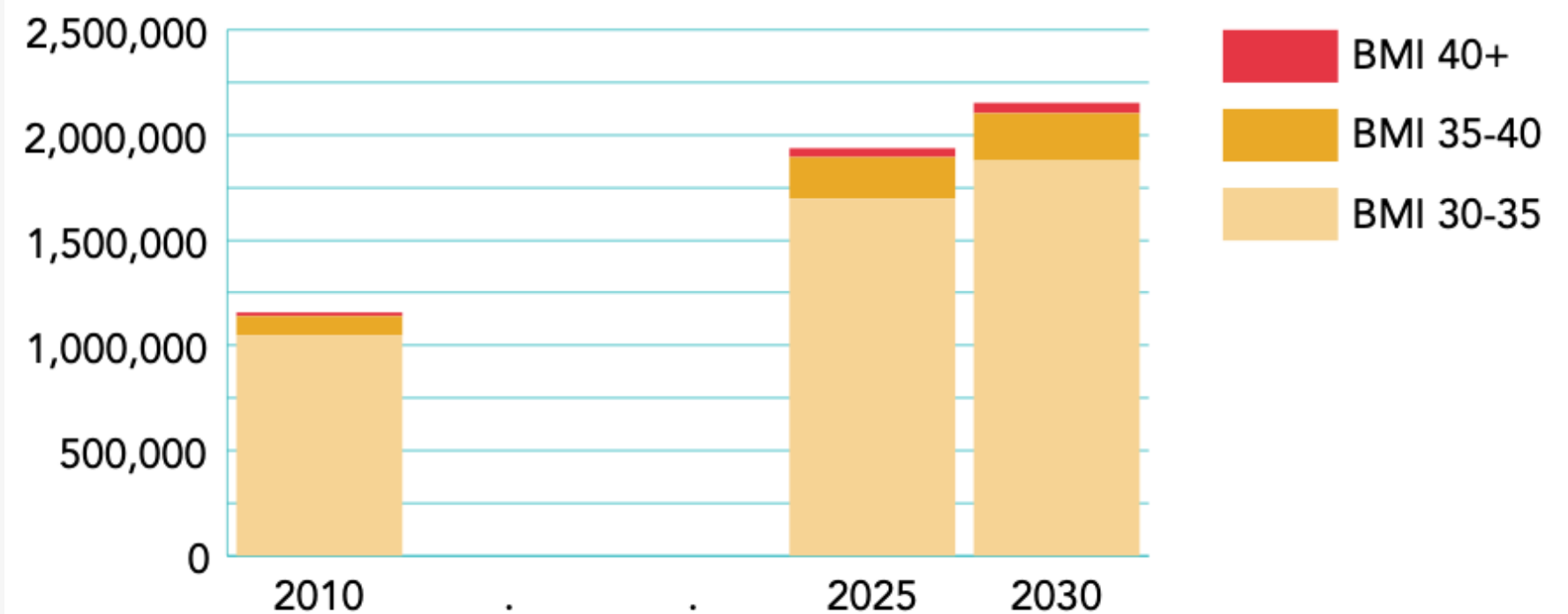
Prevalence of Obesity in Taiwan
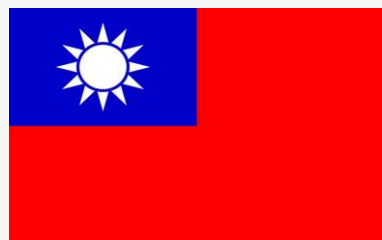
Taiwan

ADULT OBESITY IN 2030

		BMI ≥30	BMI ≥35	BMI ≥40
MEN	Prevalence (%)	10.45%	1.03%	0.24%
	Total number	1,016,502	100,262	22,887
WOMEN	Prevalence (%)	11.16%	1.71%	0.26%
	Total number	1,136,892	173,993	26,294

NUMBER OF ADULTS WITH OBESITY

Legend: BMI 40+, BMI 35-40, BMI 30-35

CHILD OBESITY IN 2030

Age	5–9	10–19
Prevalence (%)	24.03%	17.20%
Total number	246,081	356,218

Prevalence of Obesity in Taiwan
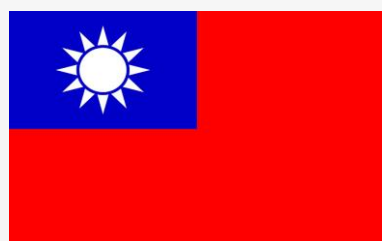
Taiwan

ANNUAL INCREASE IN CHILD OBESITY 2010–2030
4.4%
VERY HIGH

ANNUAL INCREASE IN ADULT OBESITY 2010–2030
2.6%
HIGH

ADULTS WITH OBESITY BY 2030
10.8%
MEDIUM

PREMATURE DEATHS FROM NCDS AS % OF ALL NCD DEATHS
NA

GLOBAL PREPAREDNESS RANKING
NA

World Obesity Atlas 2022
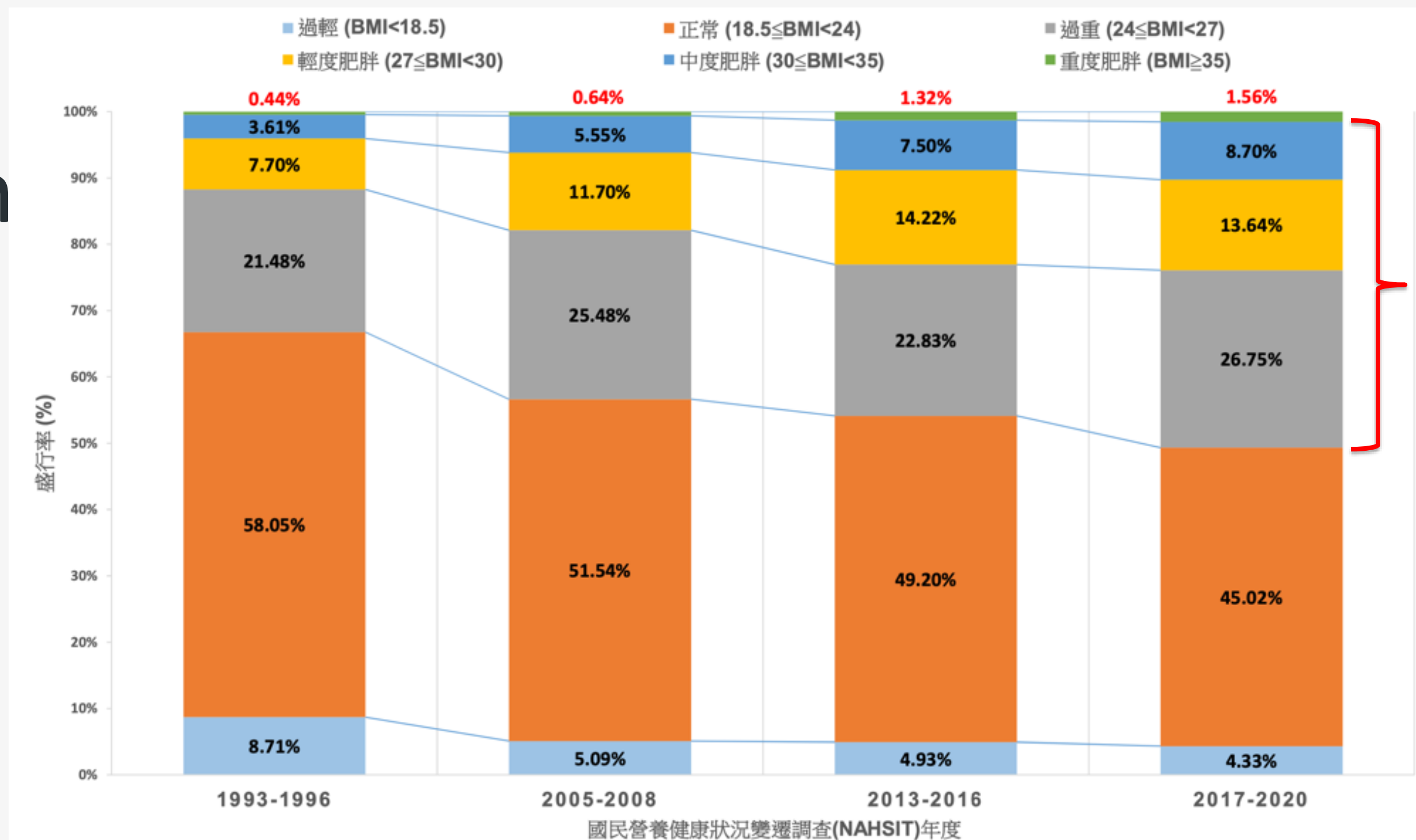
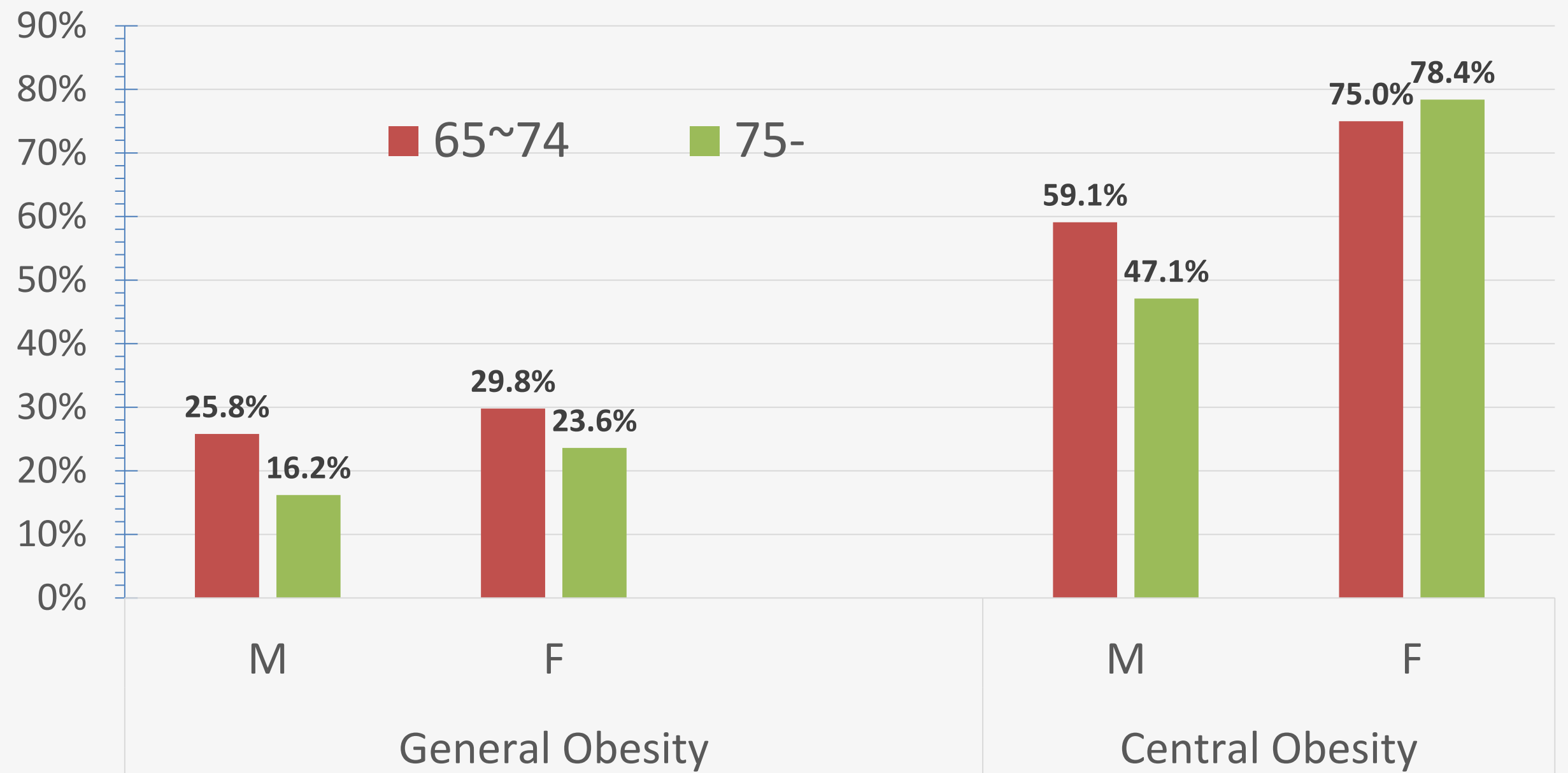# Prevalence of Obesity in Taiwan
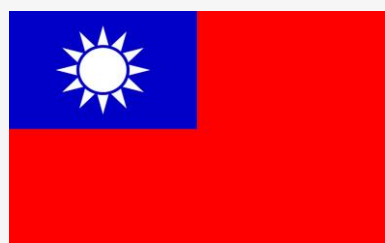
Taiwan

*Overweight / Obese prevalence: 50.7%

Nutrition and Health Survey in Taiwan, NAHSIT (NAHSIT), 2022

Prevalence of Elderly Obesity in Taiwan

Elderly Obesity in Taiwan

Nutrition and Health Survey in Taiwan, NAHSIT (NAHSIT), 2017-2022

Prevalence of Elderly Obesity in Taiwan

*Elderly Obese prevalence: 29.7% in male and 24.8% in female

Table 3a. Male overweight and obesity prevalence by age groups using two national surveys

Survey By Year				2001 NHIS		2017 NHIS		
Age group	Sample size	Overweight(%)	Obesity(%)		Age group	Sample size	Overweight(%)	Obesity(%)
20-44	4,275	21.2	15.3		18-39	3,244	26.1	24.5
45-64	2,379	33.2	18.8		40-64	3,699	33.4	27.6
65+	1,028	22.8	10.9		65+	1,444	29.7	17.2
Total	7,682	25.1	15.7		Total	8,387	29.9	24.9

Table 3b. Female overweight and obesity prevalence by age groups using two national surveys

Survey by year				2001 NHIS		2017 NHIS		
Age group	Sample size	Overweight(%)	Obesity(%)		Age group	Sample size	Overweight(%)	Obesity(%)
20-44	4,188	10.6	7.6		18-39	2,938	14.3	14.3
45-64	2,342	22.9	14.2		40-64	3,707	24.0	17.3
65+	822	18.4	13.8		65+	1,541	24.8	21.0
Total	7,352	15.8	10.7		Total	8,186	20.4	16.7

National Health Interview Surveys, NHIS , 2001, 2017

OBESITY AND MORTALITY RISK

American Cancer Society Study of 750,000 Men and Women
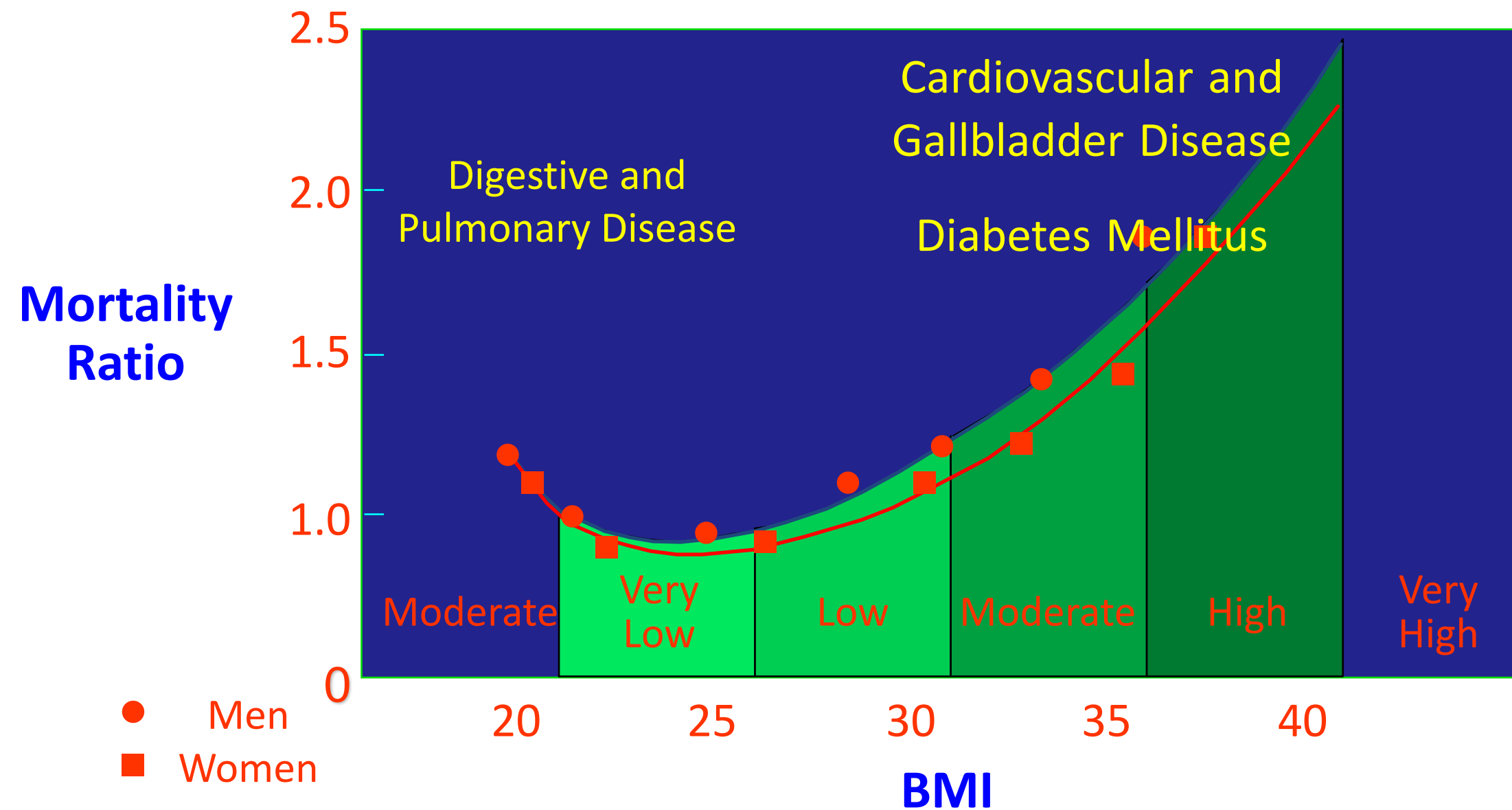
Association between Body-Mass Index and Risk of Death in More Than 1 Million Asians
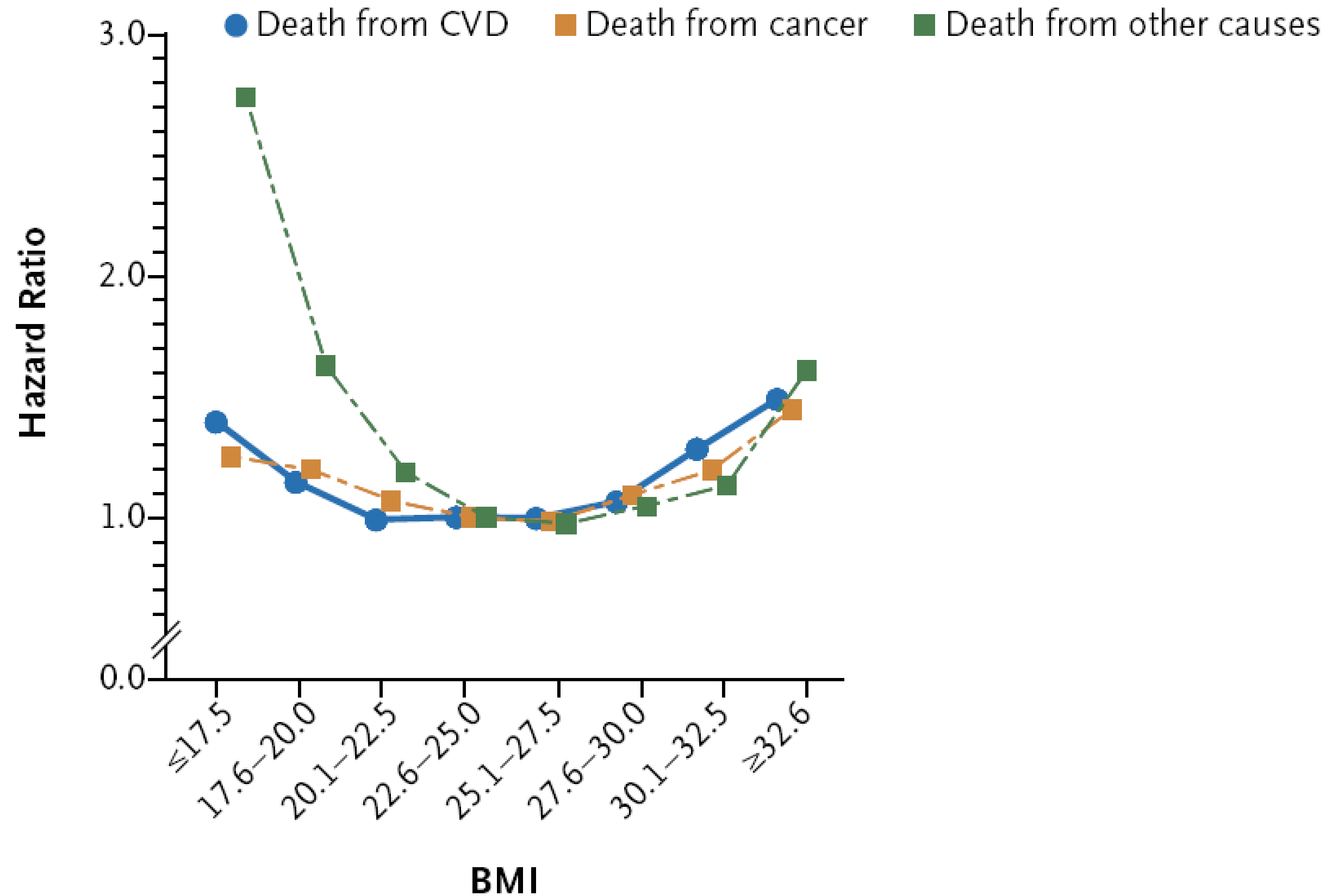
A East Asians

BMI and all-cause mortality in Taiwan
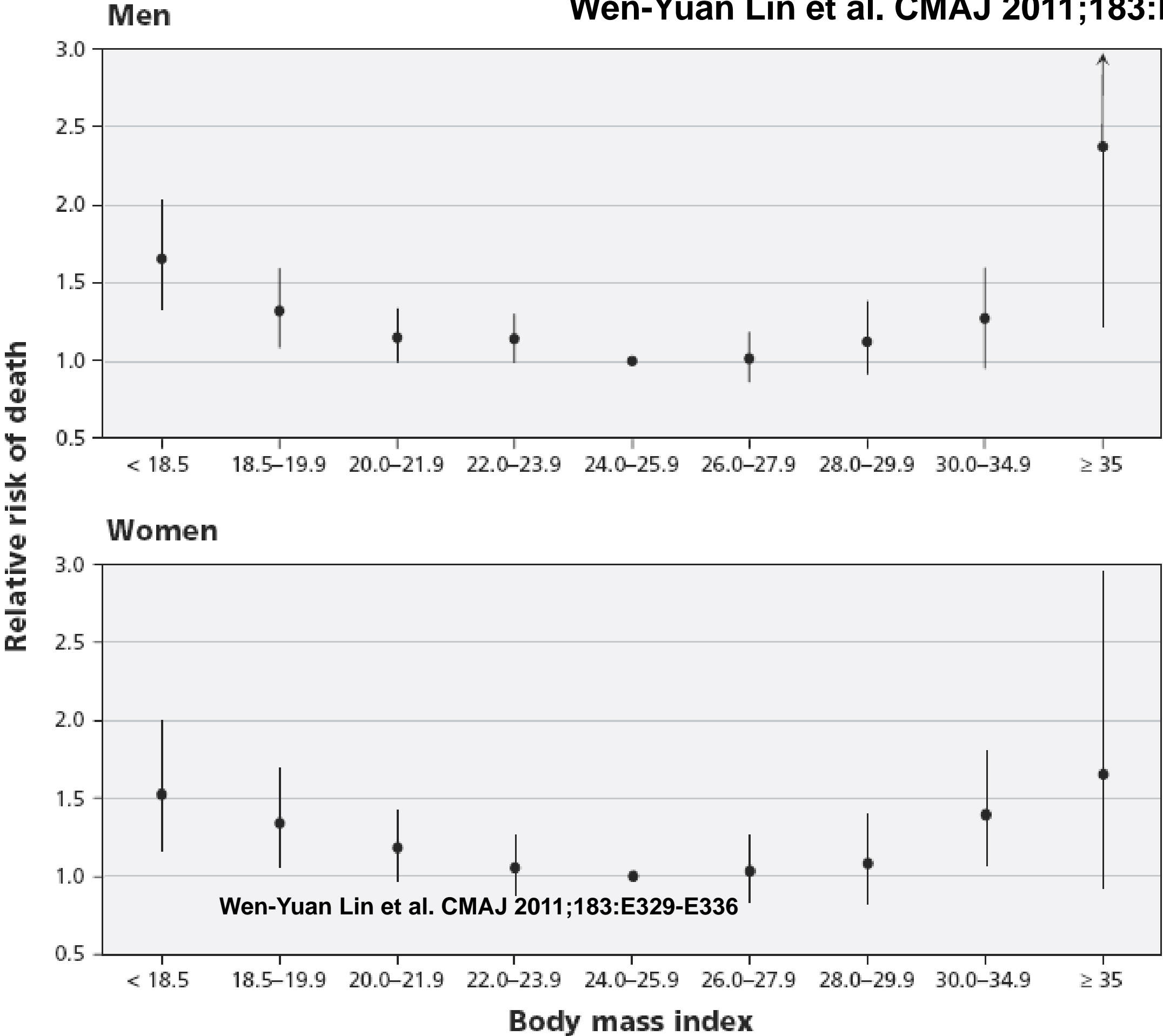
BMI and all-cause mortality in Taiwan
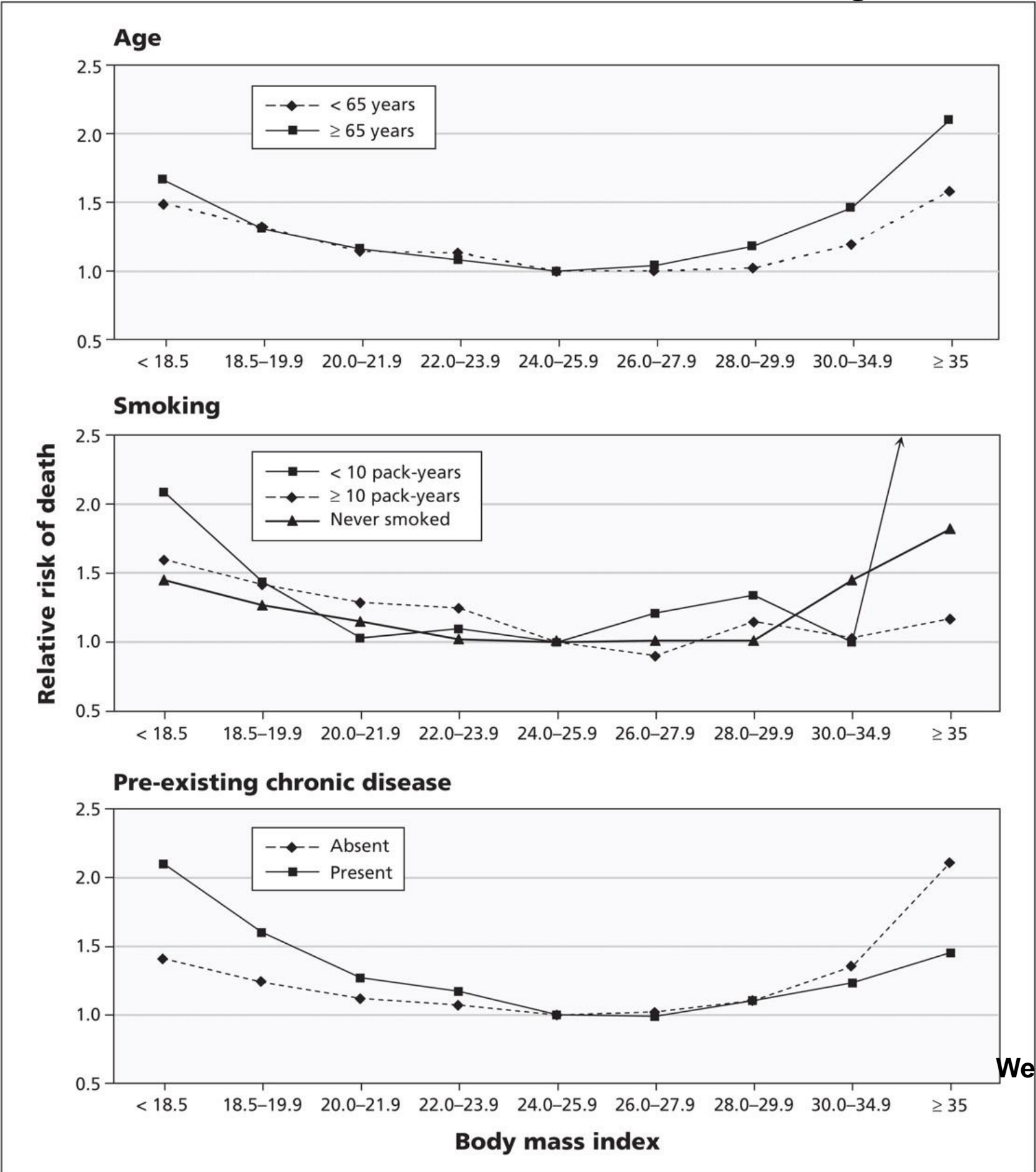
The Obesity Paradox-weighting the benefit
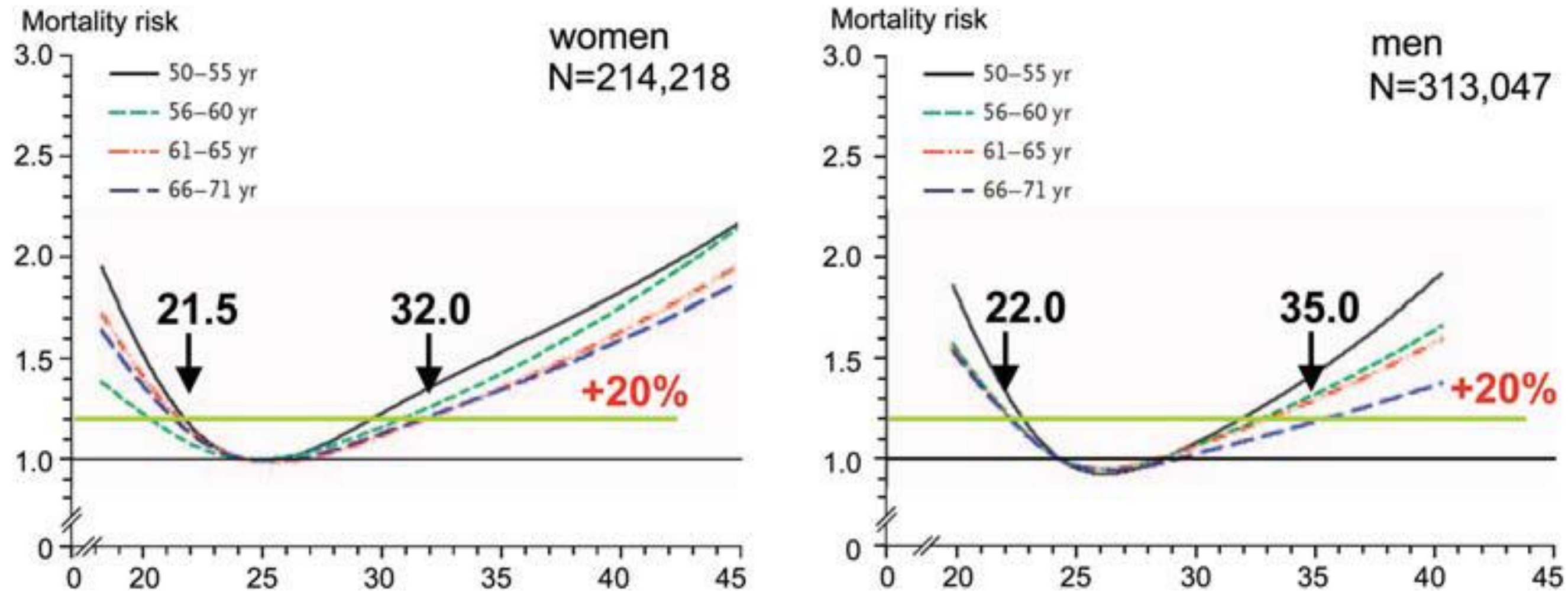
Association of BMI and mortality risk in age subgroups in men and women. The green line indicates a 20% increased risk of death, showing a similar risk for men aged over 66 years with a BMI of 22 kg/m2 and with a BMI 35 of kg/m2. Adapted from Adams et al.

What is Obesity Paradox?

- Obese people with chronic disease have a better chance of survival than normal-weight individuals do.

Survival Rate of Chronic Heart Failure Patients
©2007 HowStuffWorks

BMI less than 24.3
BMI 24.4-34.1
BMI greater than 34.2

Survival Percentage

Years following first diagnosis of CHF
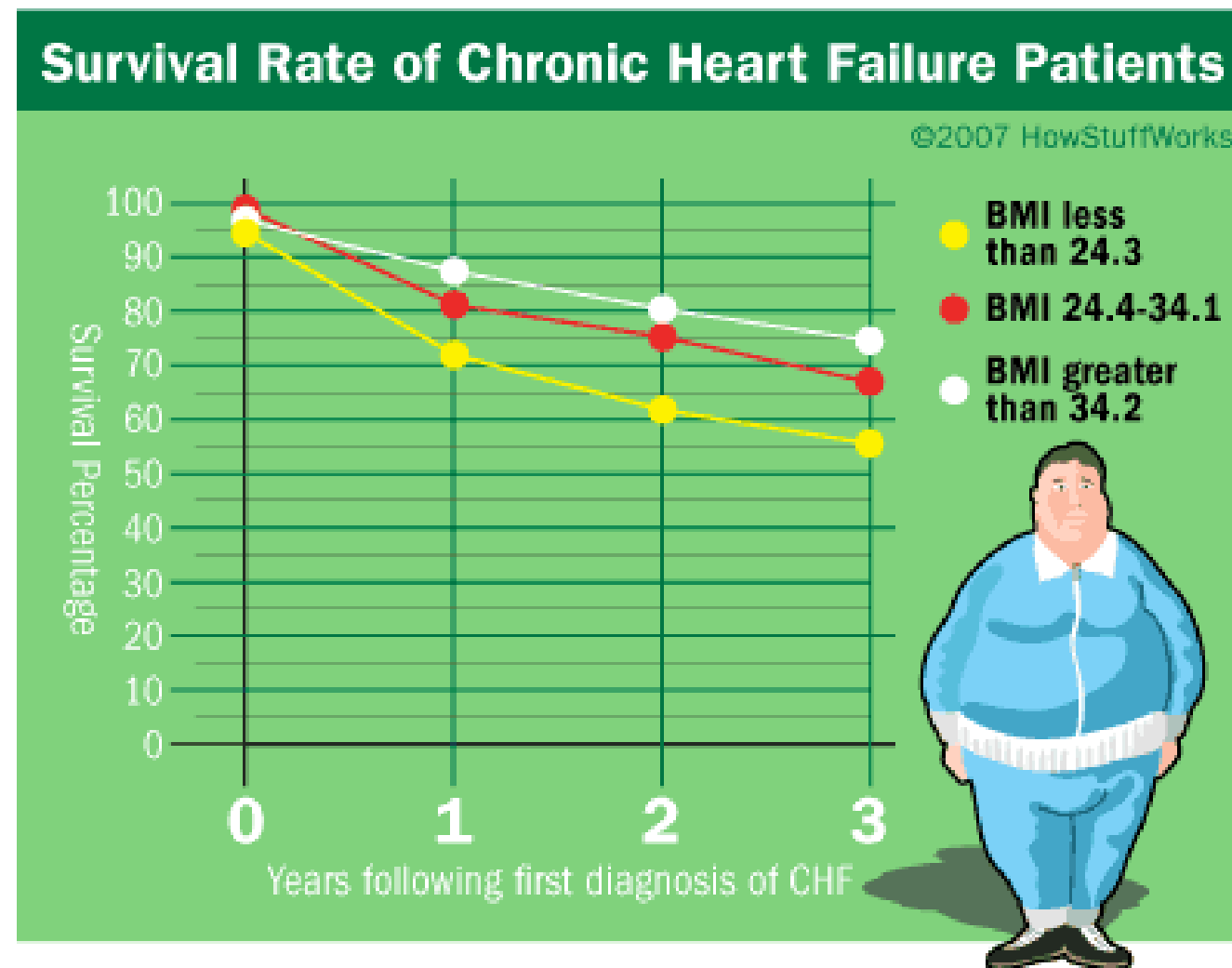
Common situations with Obesity Paradox

- Chronic/Acute heart failure

- Coronary artery disease

- Hypertension

- Dialysis patients

- Acute myocardial infarction

- Veteran patients

- Elderly

- Others

Obesity Guidelines

Evidence-based Guideline on Adult / Children Obesity Prevention and Management

2013 **2018** **2023**

▲ 1st edition
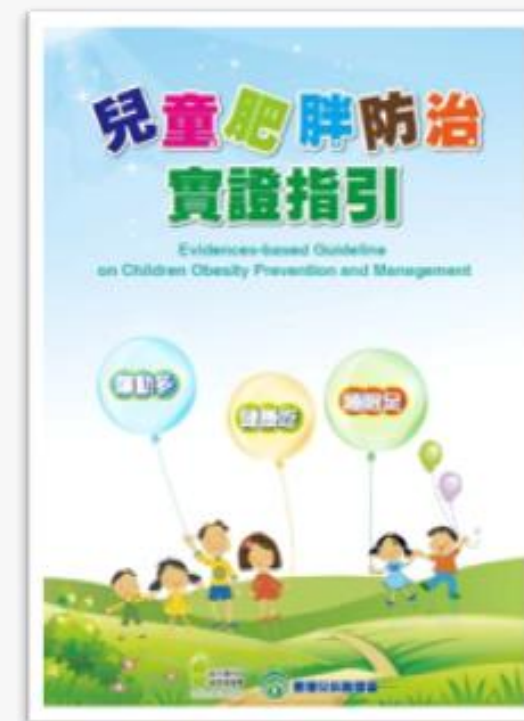
▲ 2nd edition

▲ 3rd edition

Clinical Practice Guideline of Obesity
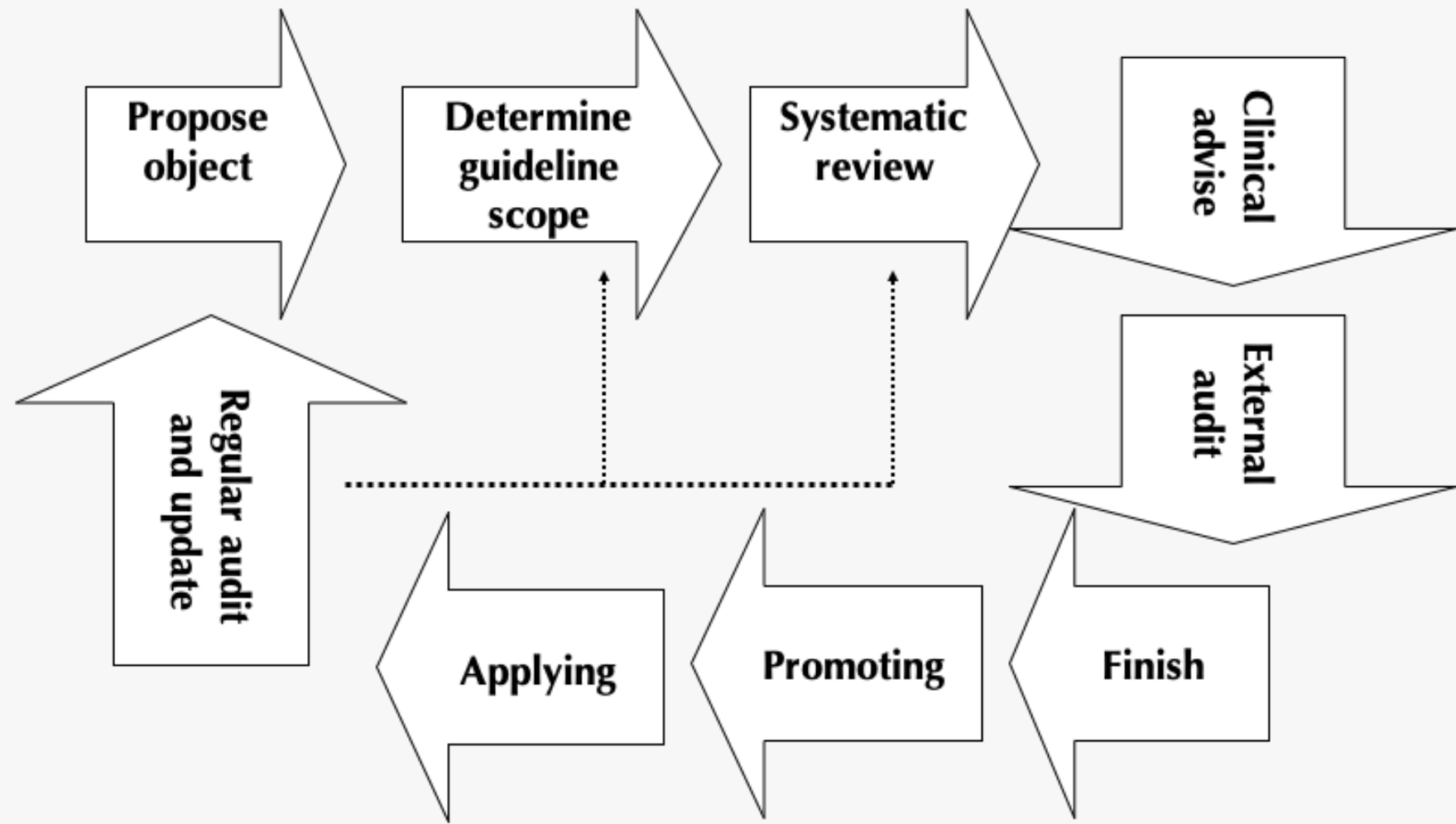
Clinical Practice Guideline of Obesity

BMI **Condition** **Decision and Do**

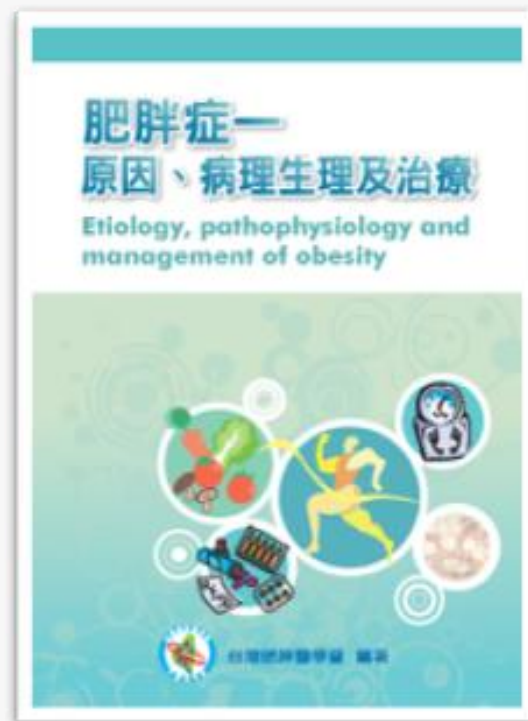| BMI	Condition	Decision and Do
<18.5 Underweight	Nutrition	**0** Improve nutrition、medical assessment
18.5~24 Normal		**1** Maintain healthy body weight* Regular waist and BMI measurement
24~27 Overweight		**2** Diet control/. Exercise/Lifestyle modification#/Regular waist and BMI measurement every week
27~35 Class 1 Obesity	Comorbidities or more than one CV risk factor — **No**	**3** Psychological intervention
	— **Yes**	**4** Anti-obesity medication
35~40 Class 2 Obesity	— **No**	
	— **Yes**	**5** Bariatric surgery
≧40 Class 3 Obesity		

+1
+1~2
+1~3
+1~4

Assess every 3-6 months
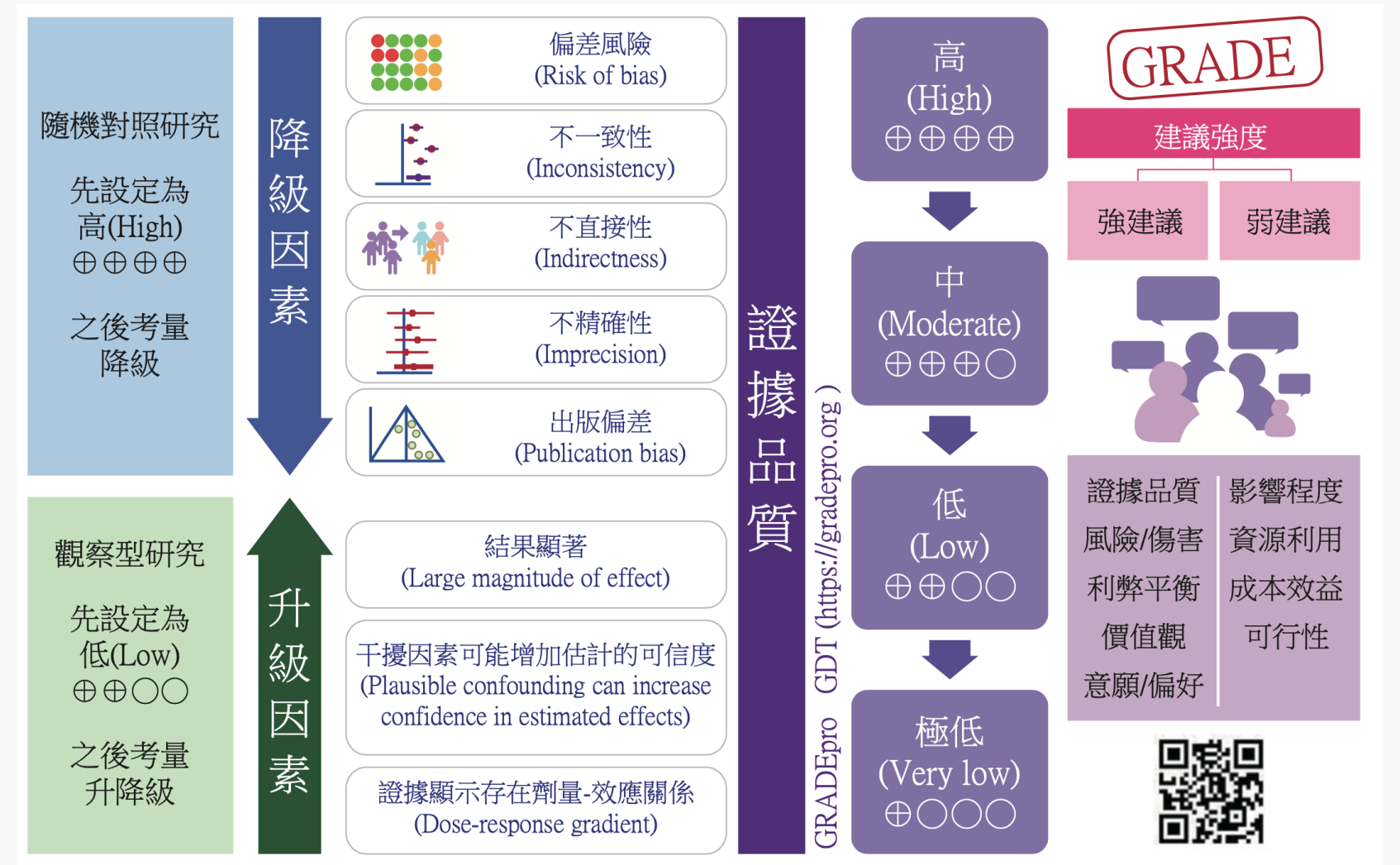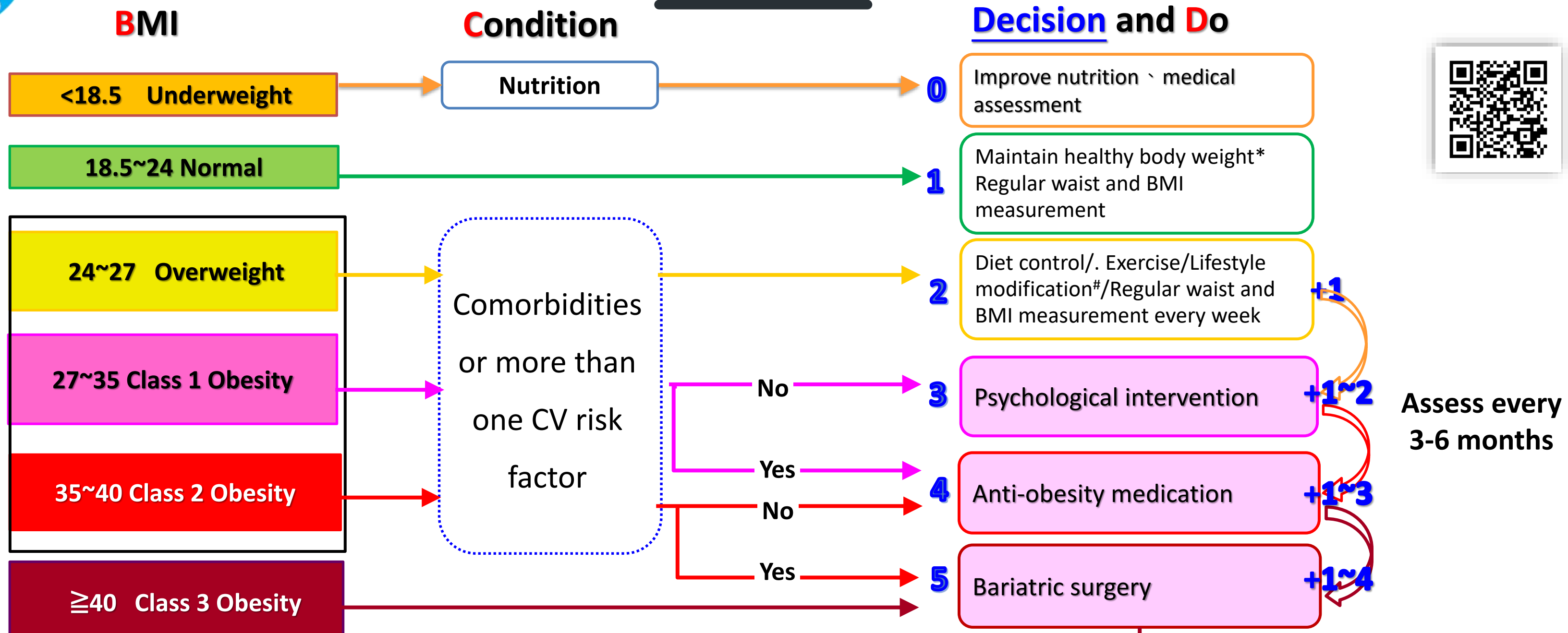
Comorbidities
1. Hypertension
2. Dyslipidemia
3. Type 2 diabetes
4. Cardiovascular diseases
5. Sleep apnea

Cardiovascular risk factors
1. Cigarette smoking
2. High blood pressure(SBP≥130mmHg or DBP≥85mmHg)
3. Low HDL-C(Men<40mg/dL, Women<50mg/dL)
4. High triglyceride≥ 150 mg/dL
5. Impaired fasting glucose or impaired glucose tolerance
6. Family history of early onset of CV disease (Men < 55 y/o, women < 65y/o)
7. Age: Men≥45y/o, Women≥55 y/o or menopause

#Lifestyle modification
Healthy diet, regular exercise, smoking cessation, avoid excessive alcohol drinking, etc.

Indication for bariatric surgery: BMI is 2.5 kg/m^2 lower in Taiwan

Elderly Obesity Guideline

Recommendation	COR	LOE
It is recommended to use a combination of body mass index BMI, waist circumference, and other indicators to assess obesity in older adults. (COR: strong. LOE: moderate)	I	B
Interventions for obesity in older adults should be based on a comprehensive assessment of factors such as body composition (e.g., muscle mass), functional status (e.g., walking speed), obesity-related health conditions, and other relevant factors.	I	B
Diet and exercise interventions plans for weight loss can be helpful in controlling chronic metabolic diseases such as hypertension, diabetes, and hyperlipidemia in older adults. (COR: strong. LOE: moderate)	I	B
Diet and exercise interventions for weight loss can also be helpful for older adults with obesity-related degenerative joint diseases such as osteoarthritis. (COR: strong. LOE: moderate)	I	B

Elderly Obesity Guideline

Recommendation	COR	LOE
It is recommended to use lifestyle interventions, including dietary control and exercise, for weight loss in older adults. (COR: strong. LOE: moderate)	I	B
Weight loss in older adults can be effectively achieved and metabolic risks reduced through simple dietary control, while adding exercise intervention can help to reduce muscle loss and improve functionality. (COR: strong. LOE: moderate)	I	B
Resistance training alone can reduce fat tissue, improve muscle strength and functional ability, but it may not result in weight loss. (COR: weak. LOE: high)	II	A
When combined with aerobic exercise and strength training, dietary interventions for weight loss can effectively improve functionality and reduce lean tissue loss in obese older adults. (COR: strong. LOE: moderate)	I	B

Elderly Obesity Guideline

Recommendation	COR	LOE
Older adults taking orlistat do not have any specific risks, but the decision to use this weight loss medication should consider whether the potential health benefits of weight loss outweigh any potential risks in older patients. (COR: weak. LOE: moderate)	II	B
There is not enough research on using liraglutide for weight loss in older adults, but based on limited analysis, it seems to work as well as it does in younger people. However, older adults may experience more gastrointestinal side effects when taking this medication. (COR: weak. LOE: moderate)	II	B
Weight loss surgery carries higher risks for older adults, so careful evaluation of the risks and benefits of surgery is necessary. (COR: weak. LOE: moderate)	II	B

Sarcopenic Obesity

- Obesity is defined as abnormal or extensive fat accumulation that negatively affects health.
- Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal muscle and strength with a risk of adverse outcome such as physical disability, poor quality of life and death.
- **Sarcopenic obesity** was defined as a combination of excess body fat and reduced muscle mass and/or strength with aging.
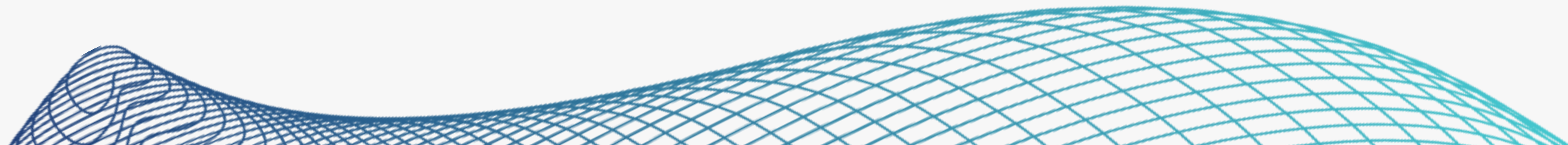
Potential mechanisms of age-related sarcopenia and sarcopenic obesity.

| Mitochondrial dysfunction | Altered satelite cell number and their dysfunction | Altered proteostasis |
| Neuromuscular changens | Discurbed muscle – adipose tissue crosstalk | Decrease in number of motor units |

SARCOPENIA/SARCOPENIC OBESITY

Change in hormon levels		Sedentary lifestyle
Insulin resistance, visceral obesity		Malnutrition
		Immunosenescence

| Myosteatosis/ Lipotoxicity | Oxidative stress | Dysbiosis | Low grade inflammation |

AGEING

?

WEIGHT GAIN

Leptin resistance

Muscle weakness
↓ Endurance capacity
↑ Fatigability
Muscle wasting

↓ Lipid oxidation

↓ Adiponectin
↑ Leptin
↑ TNF-alpha
↑ IL-6
↑ MCP-1

Inflammation

↑ Inflammation
↑ Fatty infiltration

↑ **Total/abdominal fat**

↓ **Physical activity**

↓ Energy expenditure

↑ Insulin resistance

Macrophage recruitment

Mauro Zamboni, Gloria Mazzali, Francesco Fantin, Andrea Rossi, Vincenzo Di Francesco. Sarcopenic obesity: A new category of obesity in the elderly,Nutrition, Metabolism and Cardiovascular Diseases. 2008: 18(5); 388-395

Body composition changes with age and the interplay between sarcopenia and obesity.
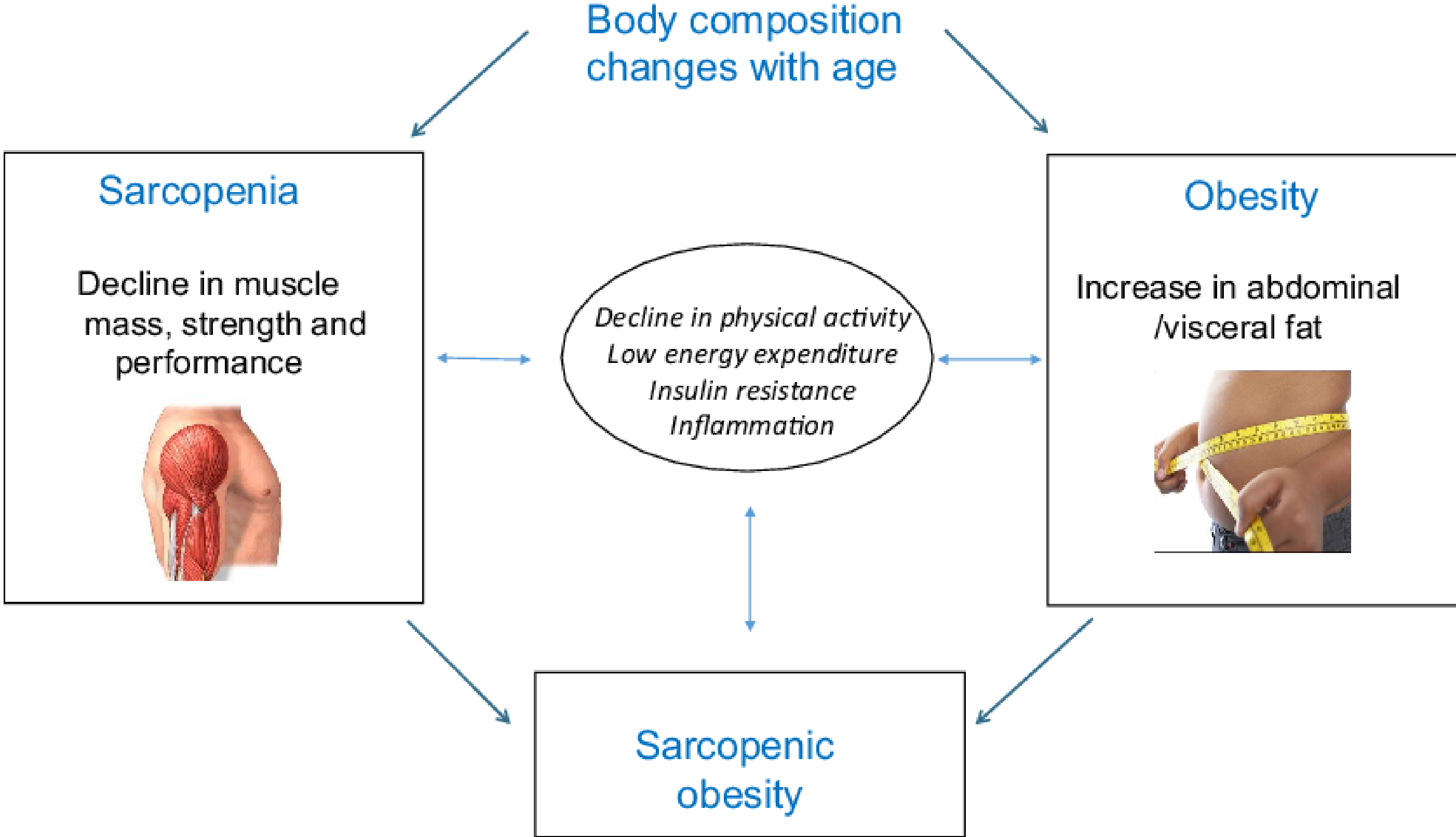
Body composition changes with age

Sarcopenia

Decline in muscle mass, strength and performance

Decline in physical activity
Low energy expenditure
Insulin resistance
Inflammation

Obesity

Increase in abdominal /visceral fat

Sarcopenic obesity

Atkins, J., & Wannamathee, S. (2020). Sarcopenic obesity in ageing: Cardiovascular outcomes and mortality. *British Journal of Nutrition, 124*(10), 1102-1113. doi:10.1017/S0007114520002172

Definition of Sarcopenic Obesity

- Obesity: defined using high BMI or high WC (waist circumference) or high body fat%
- Sarcopenia:

EWGSOP2 criteria

Low muscle strength
By handgrip	
< 27 kg for men	
< 16 kg for women	
By chair stand test:	
> 15s for five rises	

+

Low muscle mass
ASM	ASM/height^2
< 20 kg for men	or < 7.0 Kg/m^2
< 15 kg for women	or < 5.5 Kg/m^2

FOR SEVERITY

Physical performance
One of the following criteria:
- Gait speed: ≤ 0.8 m/s
- SPPB: ≤ 8 point score
- TUG: ≥ 20s
- 400m walk test: ≥ 6min /NC

SDOC criteria

Low Muscle strength
Muscle weakness: by handgrip
< 35.5 kg in men
< 20 kg in women

+

Low usual gait speed
Slowness:
< 0.8 m/s

AWGS criteria

Low muscle mass
ASM/height^2 by DXA and BIA
< 7.0 Kg/m^2 for men
< 5.4 Kg/m^2 (by DXA) < 5.7 Kg/m^2 (by BIA) for women

+

Reduced Muscle strength
By handgrip
< 28 kg for men
< 18 kg for women

OR

Physical performance
One of the following criteria:
- 6-meter walk < 1.0 m/s
- 5-time chair stand test ≥ 12s
- SPPB ≤ 9

FOR SEVERITY — The presence of all three criteria: severe sarcopenia

Methods for measuring sarcopenia and obesity

Sarcopenia			Obesity	
Muscle mass	Muscle strength	Muscle performance	Fat mass	Adipose tissue
Anthropometry, for example, calf circumference, MAMC Bioimpedance analysis Computerised tomography Dual-energy X-ray absorptiometry MRI	Grip strength Chair stand test Knee flexion/extension	Gait speed Timed-up-and-go test Short physical performance battery	Anthropometry, for example, BMI, skinfold thickness, WC, WHR Bioimpedance analysis Dual-energy X-ray absorptiometry	Computerised tomography MRI

Atkins, J., & Wannamathee, S. (2020). Sarcopenic obesity in ageing: Cardiovascular outcomes and mortality. *British Journal of Nutrition, 124*(10), 1102-1113. doi:10.1017/S0007114520002172

Physical activity and sarcopenic obesity: definition, assessment, prevalence and mechanism
Duck-chul Lee, Robin P Shook, Clemens Drenowatz, and Steven N Blair
Future Science OA 2016 2:3

SARCOPENIC OBESITY: UNDERSTANDING ASSESSMENT AND DEVELOPING DIAGNOSTIC CRITERIA

Sarcopenic Obesity has:

- strong negative clinical impacts,

- may lead to disabilities,

- drives complications, and

- negatively affects health and survival.

Diagnostic algorithm of Sarcopenia, Asian Working Group for Sarcopenia (AWGS) Criteria

Diagnostic Algorithm of Sarcopenia (AWGS)

Hand-grip strength (HS)	Usual gait speed (GS)
Cut-off value	Cut-off value
・Male: 26kg	・0.8m/s
・Female: 18kg	

Low HS and/or low GS

No low HS and No low GS

Muscle mass (SMI)

Cut-off value (BIA)
・Male: $7.0 kg/m^2$
・Female: $5.7 kg/m^2$

low SMI

Normal SMI

Sarcopenia
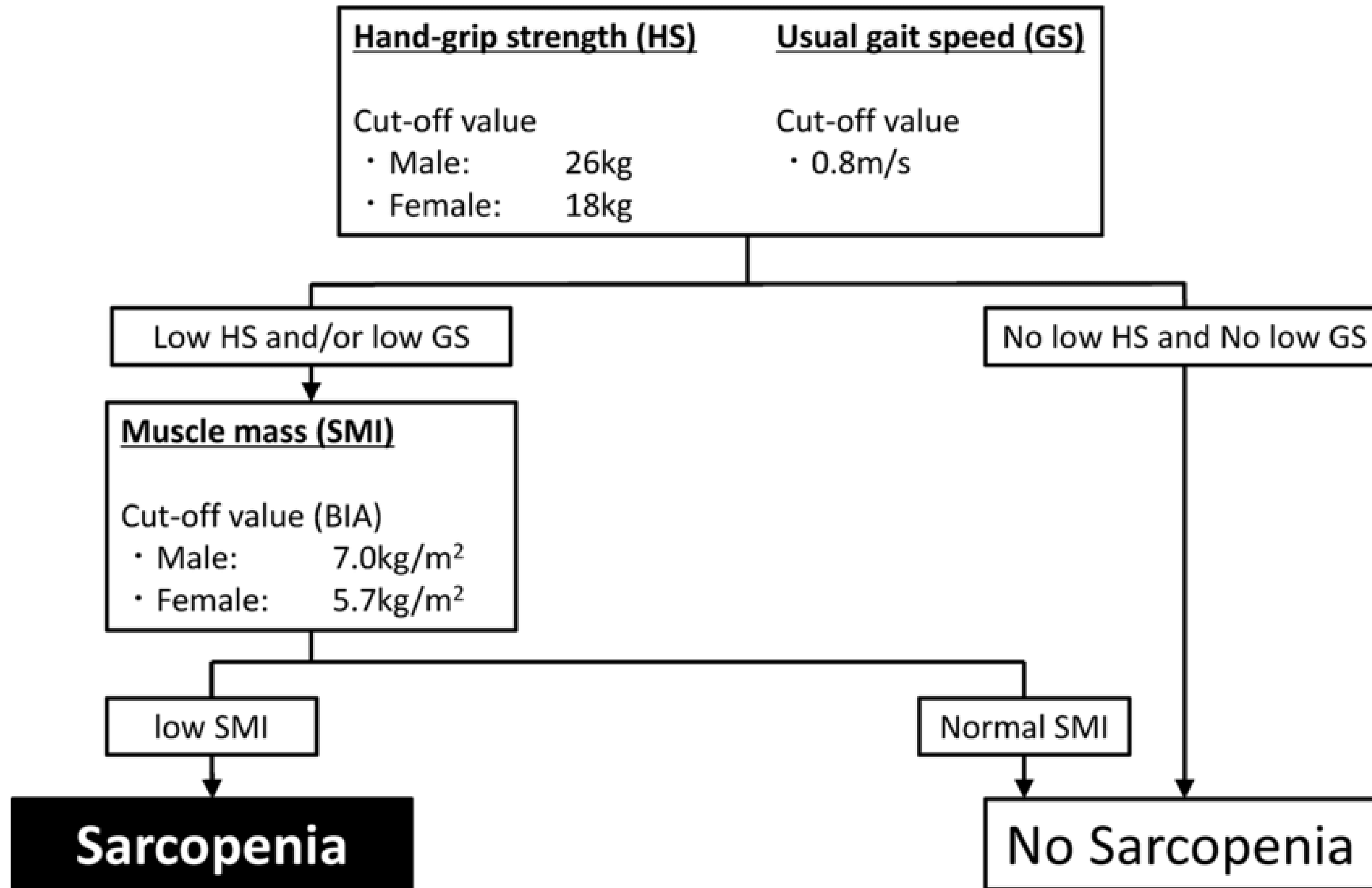
No Sarcopenia

The Prevalence of Sarcopenic Obesity in TEHS (Taichung Elderly Health Study)

Definition	Criteria	M	F
Baumgartner's Definition	sarcopenia as appendicular skeletal muscle index below -2SD of the sex-specific mean of a younger reference group. Percentage body fat greater than the median (>26% in men and >36% in women) using DXA was defined as obesity.	4.1%	1.0%
Jassen's Definition	sarcopenia as skeletal mass index below -2SD of younger adult values	0.4%	5.1%
Davison's Definition	those in the upper two quintiles of body fat and in the lower three of muscle mass	24.0%	25.6%

The Prevalence of Sarcopenic Obesity in Taiwan

Table 2 Sarcopenia (low muscle mass) and obesity (fat percentage) cutoff points based on population distribution.

Reference group defined	Criteria			Criteria		
	A	B	C	A	B	C
	Fat percentage (%) cut-offs			Corresponding prevalence (%)		
Male	31.41	30.16	30.64	16.7	23.1	20
Female	39.17	41.43	43.25	42.5	28.6	20
	ASMI (kg/m^2) cut-offs			Corresponding prevalence (%)		
Male	6.76	7.36	7.09	11.3	28.7	20
Female	5.28	5.74	5.70	8.1	23.5	20

Abbreviations: SD, standard deviation; ASMI, appendicular skeletal muscle mass index.

The thresholds of ASMI and fat percentage based on sex-specific two standard deviations from mean of young reference group (criteria A), the value set at one SD from the mean value of ASMI and fat percentage of this pooled elderly population with a BMI of 24.0—25.9 (criteria B), and the value at 20th percentile of this pooled elderly population (criteria C).

Chang C-I, et al. The impacts of sarcopenia and obesity on physical performance in the elderly. Obes Res Clin Pract (2014), http://dx.doi.org/10.1016/j.orcp.2014.08.003

Health Outcome of Sarcopenic Obesity
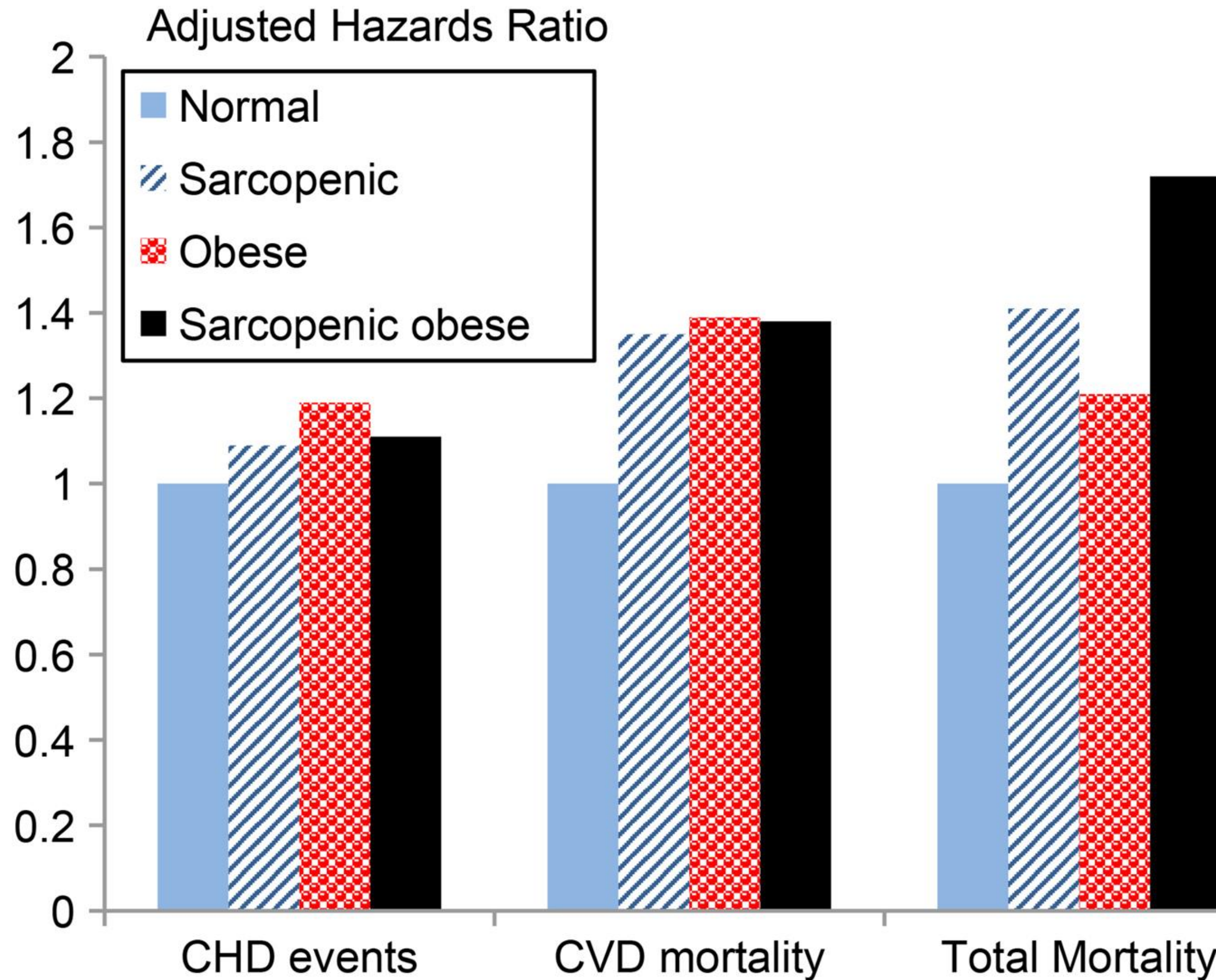
Mortality among adults with sarcopenic obesity

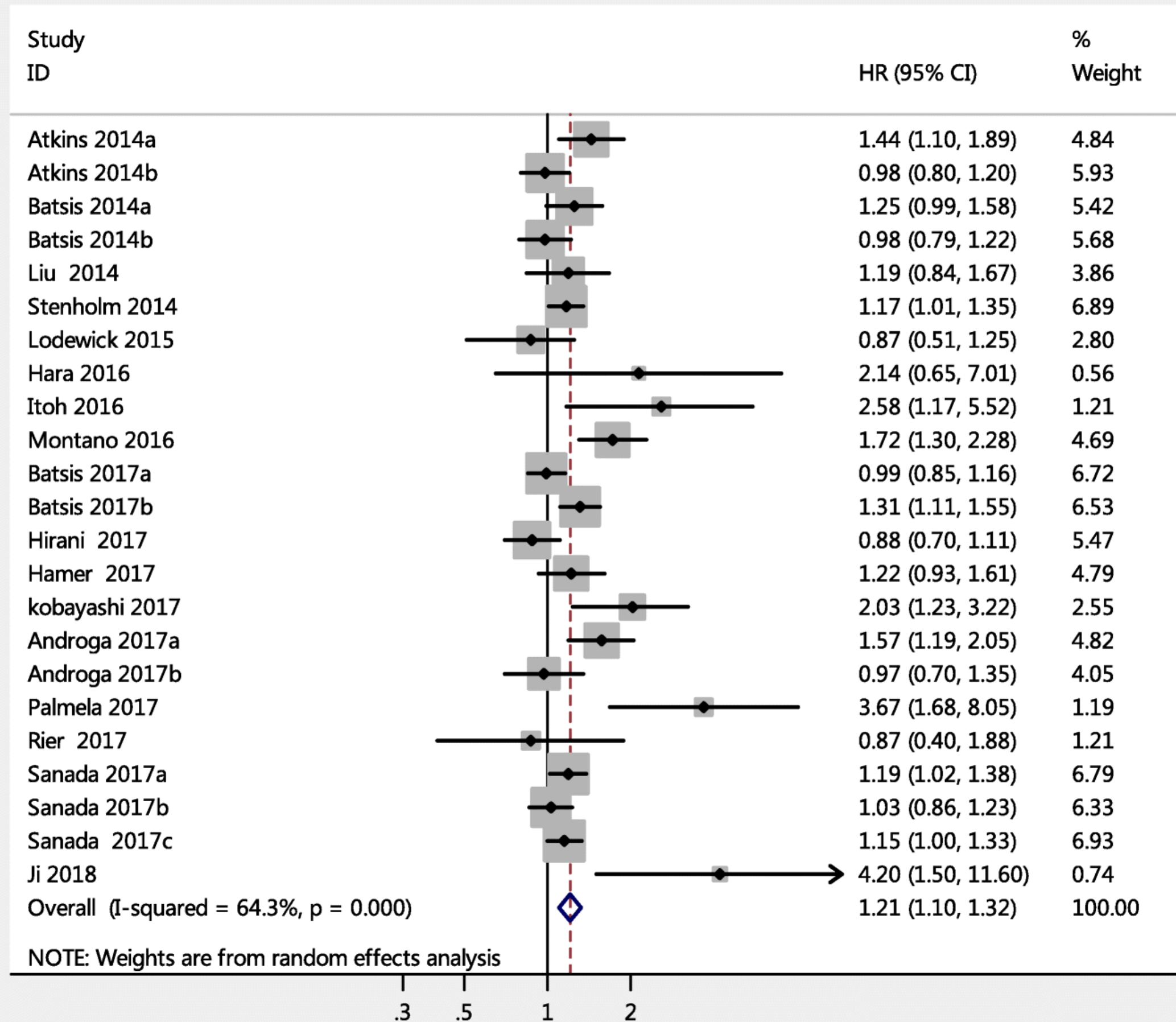| Study ID	HR (95% CI)	% Weight
Atkins 2014a	1.44 (1.10, 1.89)	4.84
Atkins 2014b	0.98 (0.80, 1.20)	5.93
Batsis 2014a	1.25 (0.99, 1.58)	5.42
Batsis 2014b	0.98 (0.79, 1.22)	5.68
Liu 2014	1.19 (0.84, 1.67)	3.86
Stenholm 2014	1.17 (1.01, 1.35)	6.89
Lodewick 2015	0.87 (0.51, 1.25)	2.80
Hara 2016	2.14 (0.65, 7.01)	0.56
Itoh 2016	2.58 (1.17, 5.52)	1.21
Montano 2016	1.72 (1.30, 2.28)	4.69
Batsis 2017a	0.99 (0.85, 1.16)	6.72
Batsis 2017b	1.31 (1.11, 1.55)	6.53
Hirani 2017	0.88 (0.70, 1.11)	5.47
Hamer 2017	1.22 (0.93, 1.61)	4.79
kobayashi 2017	2.03 (1.23, 3.22)	2.55
Androga 2017a	1.57 (1.19, 2.05)	4.82
Androga 2017b	0.97 (0.70, 1.35)	4.05
Palmela 2017	3.67 (1.68, 8.05)	1.19
Rier 2017	0.87 (0.40, 1.88)	1.21
Sanada 2017a	1.19 (1.02, 1.38)	6.79
Sanada 2017b	1.03 (0.86, 1.23)	6.33
Sanada 2017c	1.15 (1.00, 1.33)	6.93
Ji 2018	4.20 (1.50, 11.60)	0.74
Overall (I-squared = 64.3%, p = 0.000)	1.21 (1.10, 1.32)	100.00

NOTE: Weights are from random effects analysis

Zhang, X., Xie, X., Dou, Q. *et al.* Association of sarcopenic obesity with the risk of all-cause mortality among adults over a broad range of different settings: a updated meta-analysis. *BMC Geriatr* **19**, 183 (2019). https://doi.org/10.1186/s12877-019-1195-y

Health consequence of Sarcopenia, Obesity, and SO in Taiwan

Table 3 Characteristics among subjects stratified by body composition based on fat proportion and ASMI data derived from the health young adults and the pooled elderly population.

Characteristics (continuous)	Total (N=2629)	Criteria A					Criteria B				
		Group 1 (N=1641)	Group 2 (N=203)	Group 3 (N=734)	Group 4 (N=51)	P-value[a]	Group 1 (N=1396)	Group 2 (N=552)	Group 3 (N=547)	Group 4 (N=134)	P-value[a]
	Mean±SD	Mean±SD					Mean±SD				
Age	74.6±6.3	74.2±6.2	77.4±7.3[d]	74.3±6.1[g]	78.2±6.4[f,i]	<0.001	74.0±6.0	75.8±6.8[d]	74.2±6.1[g]	77.4±6.6[f,h,i]	<0.001
BMI (kg/m^2)	24.57±3.62	23.59±2.54	19.67±2.09[d]	28.19±3.00[e,g]	23.19±1.93[h,i]	<0.001	24.12±2.44	21.04±2.17[d]	29.18±2.79[e,g]	24.94±1.83[f,h,i]	<0.001
ASMI (kg/m^2)	7.14±1.27	7.40±1.25	5.84±0.71[d]	7.04±1.14[e,g]	5.39±0.76[f,i]	<0.001	7.51±1.22	6.12±0.82[d]	7.49±1.16[g]	6.10±0.85[f,i]	<0.001
Fat proportion (%)	31.68±9.04	27.83±6.74	25.31±7.62[d]	41.42±5.29[e,g]	41.14±4.90[f,h]	<0.001	29.00±7.36	27.70±8.30[d]	40.67±6.79[e,g]	39.48±6.02[f,h]	<0.001
Chronic disease number[b]	2 (0, 7)	1 (0, 6)	1 (0, 7)	2 (0, 5)[e,g]	1 (0, 5)[i]	<0.001[c]	1 (0, 6)	1 (0, 7)	2 (0, 6)[e,g]	2 (0, 5)[h]	<0.001[c]
Grip strength (kg)	25.30±9.02	27.02±9.09	24.08±8.88[d]	22.21±7.89[e,g]	19.07±6.82[f,h]	<0.001	26.21±9.17	24.65±8.70[d]	24.49±8.78[e]	21.74±8.22[f,h,i]	<0.001
Gait speed (m/s)	0.87±0.29	0.91±0.28	0.79±0.27[d]	0.81±0.28[e]	0.69±0.27[f,i]	<0.001	0.90±0.28	0.86±0.28[d]	0.83±0.29[e]	0.76±0.28[f,h,i]	<0.001
Timed up and go test (s)	10.91±6.61	10.59±6.05	10.96±8.89	11.41±6.74	11.77±7.52	0.031	11.31±6.58	9.75±6.34[d]	11.17±6.71[g]	11.44±7.04[h]	<0.001

Characteristics (continuous)	Total (N=2629)	Criteria C				
		Group 1 (N=1646)	Group 2 (N=457)	Group 3 (N=458)	Group 4 (N=68)	P-value[a]
	Mean±SD	Mean±SD				
Age	74.6±6.3	74.0±6.1	76.1±6.9[d]	74.4±6.1[g]	78.2±6.8[f,h,i]	<0.001
BMI (kg/m^2)	24.57±3.62	24.20±2.54	20.92±2.24[d]	29.48±2.92[e,g]	24.82±1.83[h,i]	<0.001
ASMI (kg/m^2)	7.14±1.27	7.42±1.19	5.90±0.74[d]	7.55±1.19[g]	6.04±0.80[f,i]	<0.001
Fat proportion (%)	31.68±9.04	29.53±7.80	28.98±8.67	40.91±7.05[e,g]	39.94±6.66[f,h]	<0.001
Chronic disease number[b]	2 (0, 7)	1 (0, 6)	1 (0, 7)	2 (0, 6)[e,g]	2 (0, 5)[f,h]	<0.001[c]
Grip strength (kg)	25.30±9.02	26.05±9.08	23.60±8.65[d]	24.77±8.80[e]	22.05±8.97[f]	<0.001
Gait speed (m/s)	0.87±0.29	0.90±0.28	0.82±0.27[d]	0.82±0.30[e]	0.71±0.30[f,h,i]	<0.001
Timed up and go test (s)	10.91±6.61	11.06±6.40	9.97±6.63[d]	11.18±6.85[g]	12.49±8.16[h]	<0.001

G1:Normal; G2: Sarcopenia; G3:Obesity; G4:SO

Chang C-I, et al. The impacts of sarcopenia and obesity on physical performance in the elderly. Obes Res Clin Pract (2014), http://dx.doi.org/10.1016/j.orcp.2014.08.003

Health consequence of Sarcopenia, Obesity, and SO in Taiwan

Table 3 (*Continued*)

Characteristics (categorical)	Total	Criteria A					Criteria B				
	N (%)	Group 1	Group 2	Group 3	Group 4	P-value[a]	Group 1	Group 2	Group 3	Group 4	P-value[a]
		N (%)					N (%)				
Gender						<0.001					<0.001
Female	1342 (51.0)	700 (42.7)	72 (35.5)	533 (72.6)	37 (72.5)		712 (51.0)	246 (44.6)	314 (57.4)	70 (52.2)	
Education						0.009					<0.001
(Primary education or lower)	1399 (53.8)	870 (53.5)	89 (44.3)	414 (57.3)	24 (49.0)		804 (58.1)	239 (43.7)	303 (56.2)	51 (39.5)	
Fall experience						<0.001					<0.001
Yes	523 (20.9)	282 (17.8)	52 (26.3)	172 (26.0)	17 (33.3)		236 (17.4)	120 (22.8)	120 (24.5)	47 (37.6)	

Characteristics (categorical)	Total	Criteria C				
	N (%)	Group 1	Group 2	Group 3	Group 4	P-value[a]
		N (%)				
Gender						0.907
Female	1342 (51.0)	838 (50.9)	236 (51.6)	236 (51.5)	32 (47.1)	
Education						<0.001
(Primary education or lower)	1399 (53.8)	931 (57.0)	192 (42.6)	250 (55.4)	24 (36.9)	
Fall experience						0.001
Yes	523 (20.9)	285 (17.9)	112 (25.6)	103 (25.8)	23 (33.8)	

Abbreviations: ASMI, appendicular skeletal muscle mass index; BMI, body mass index; Group 1, normal; group 2, sarcopenia, non-obesity; group 3, obesity, non sarcopenia; group 4, sarcopenic obesity. The thresholds of ASMI and fat percentage based on sex-specific two standard deviations from mean of young reference group (criteria A), the value set at one SD from the mean value of ASMI and fat percentage of the pooled elderly population with a BMI of 24.0—25.9 (criteria B), and the value at 20th percentile of this pooled elderly population (criteria C).

Data are shown as mean ± standard deviation (SD) or number (percentage) except [b]median (minimum, maximum).

[a] P-Value after comparing the differences among 4 groups by one-way analysis of variance (ANOVA) test or χ^2 test except [c]Kruskal—Wallis test.

[d] Significant difference between group 1 (normal)/group 2 (sarcopenia, non-obesity).

[e] Significant difference between group 1 (normal)/group 3 (obesity, non sarcopenia).

[f] Significant difference between group 1 (normal)/group 4 (sarcopenic obesity).

[g] Significant difference between group 2 (sarcopenia, non-obesity)/group 3 (obesity, non sarcopenia).

[h] Significant difference between group 2 (sarcopenia, non-obesity)/group 4 (sarcopenic obesity).

[i] Significant difference between group 3 (obesity, non sarcopenia)/group 4 (sarcopenic obesity).
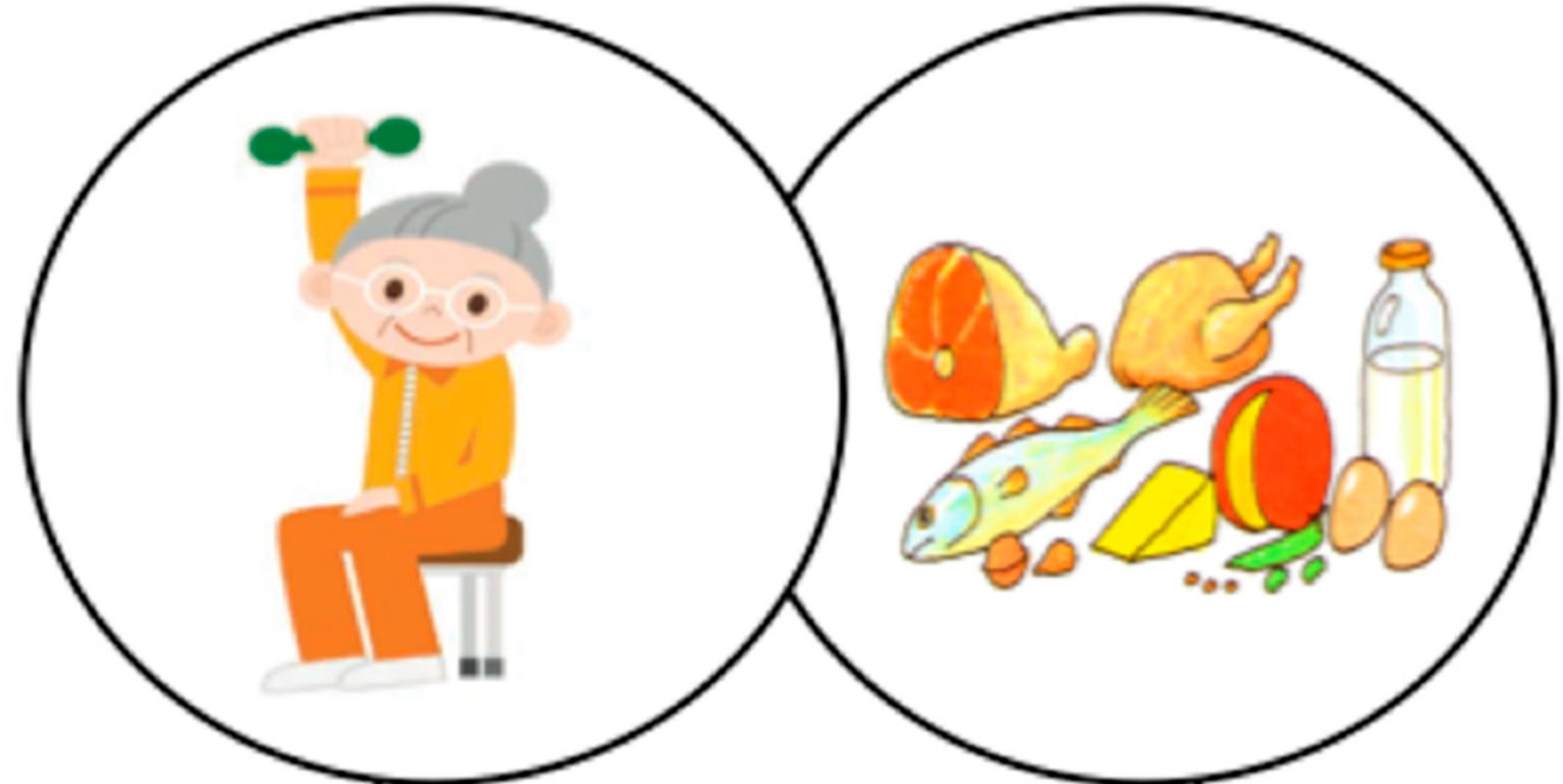
G1:Normal; G2: Sarcopenia; G3:Obesity; G4:SO

Chang C-I, et al. The impacts of sarcopenia and obesity on physical performance in the elderly. Obes Res Clin Pract (2014), http://dx.doi.org/10.1016/j.orcp.2014.08.003

Treatment of Sarcopenic Obesity

EXERCISE
- Resistance training
- Sustained resistance training

HYPOCALORIC DIET
- Normal-to-high protein intake (0.8 -1.2 g/kg/day)

DRUGS
- Vitamin D
- Hormone Replacement Therapy (HRT)?
- Phytoestrogens?

Petroni ML, Caletti MT, Dalle Grave R, Bazzocchi A, Aparisi Gómez MP, Marchesini G. Prevention and Treatment of Sarcopenic Obesity in Women. *Nutrients*. 2019; 11(6):1302. https://doi.org/10.3390/nu11061302

In Summary,

Both Sarcopenia and Obesity impact the QOL and morbidity/mortality among the elderly.

Sarcopenic Obesity may synergically increased the risk of health outcome in the elderly.

Need more evidences for the treatment of sarcopenic obesity.