# Obesity and cardiovascular disease

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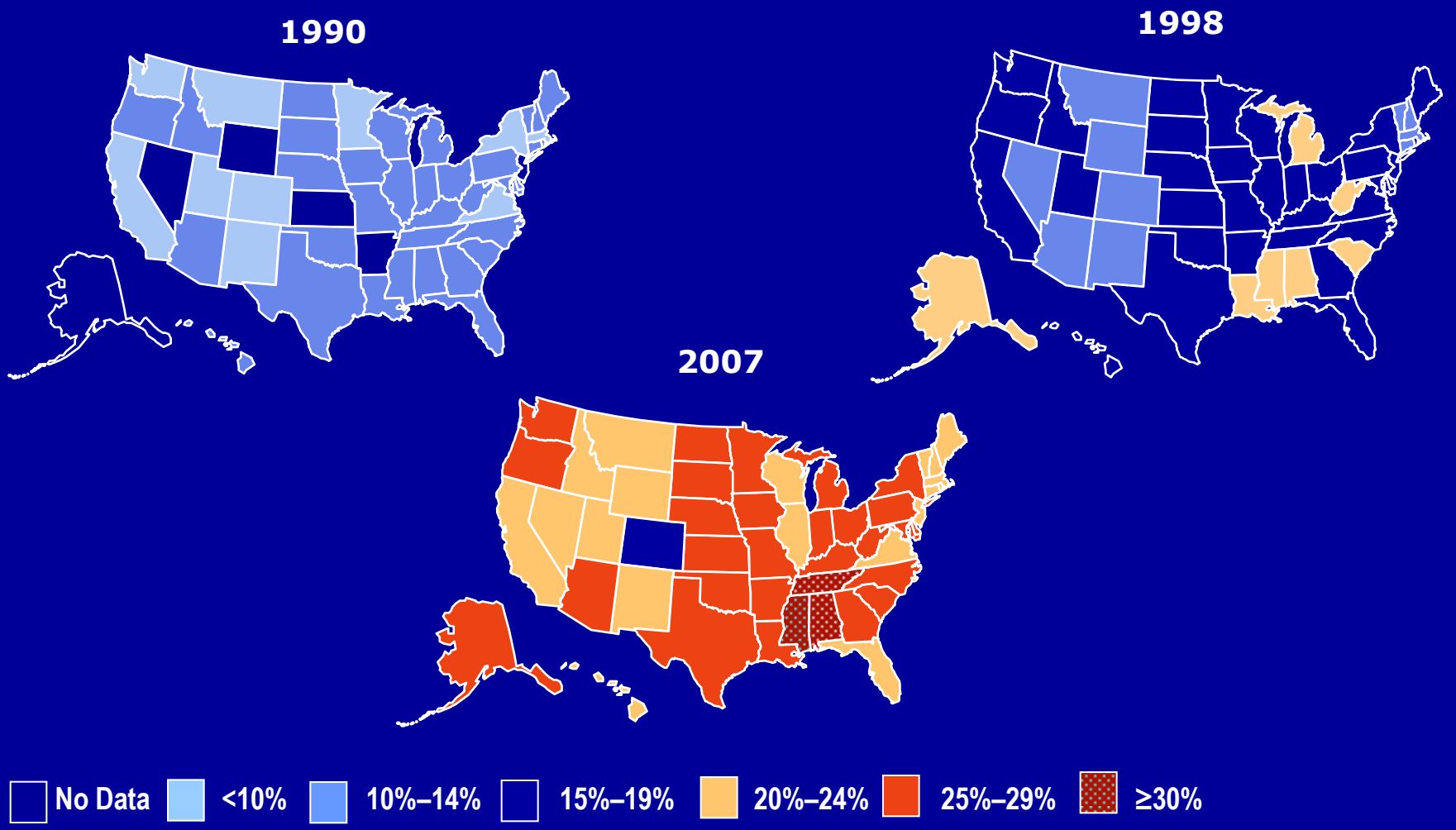
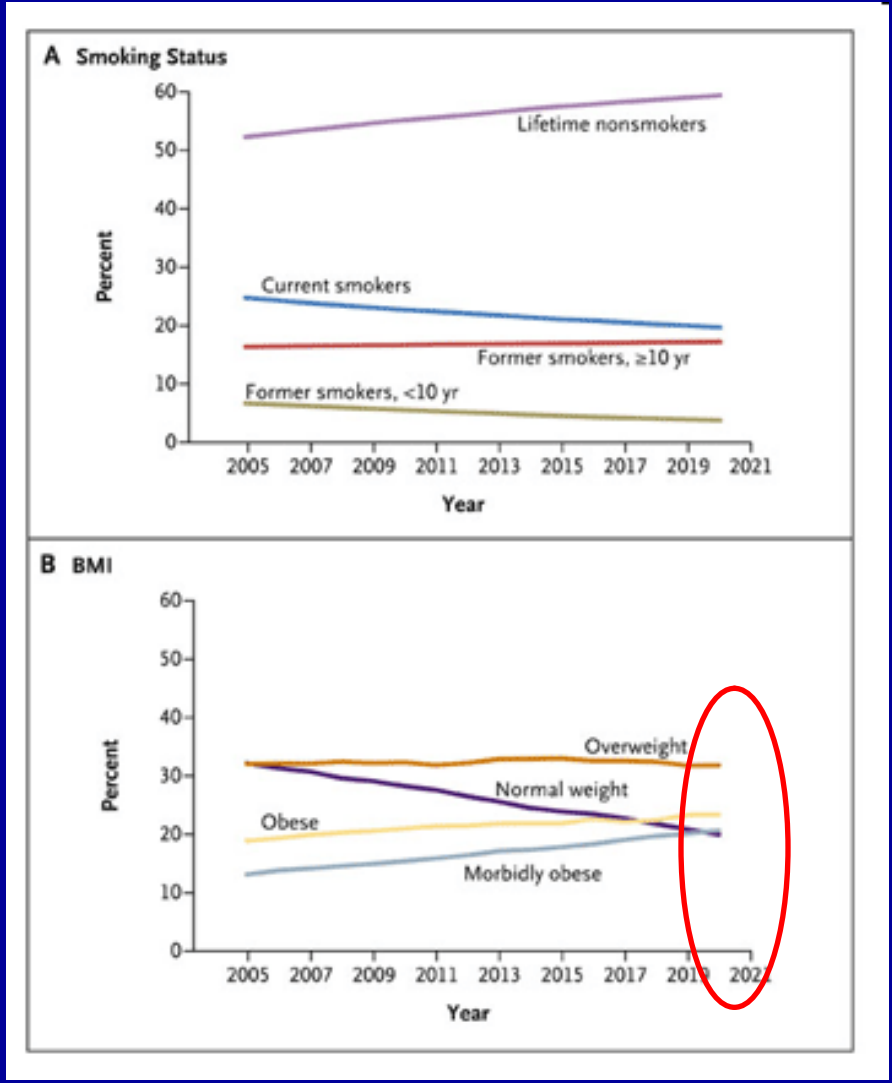
# Obesity trends in US



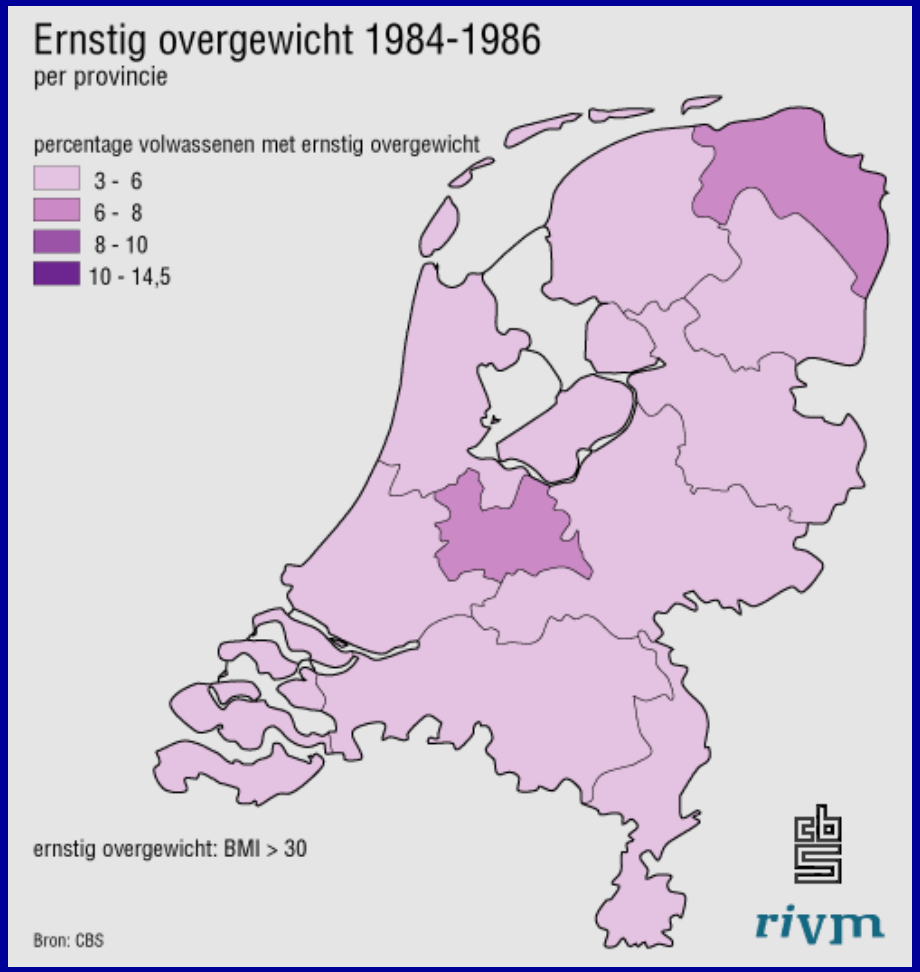
# Forecasted Trends, 2005-2020




**45% expected to be obese by 2020**

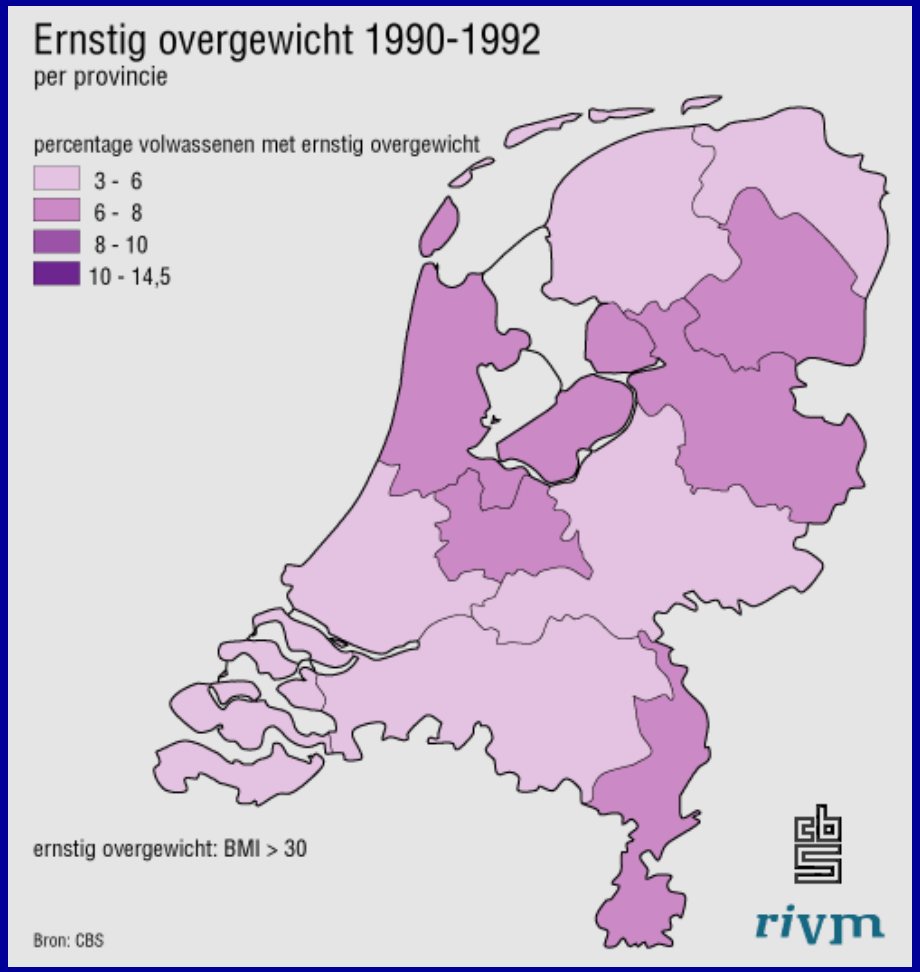
*Stewart et al. New Eng J Med 2009;361:2252-60*

# Obesity in The Netherlands




*CBS/ RIVM*

# Obesity in The Netherlands

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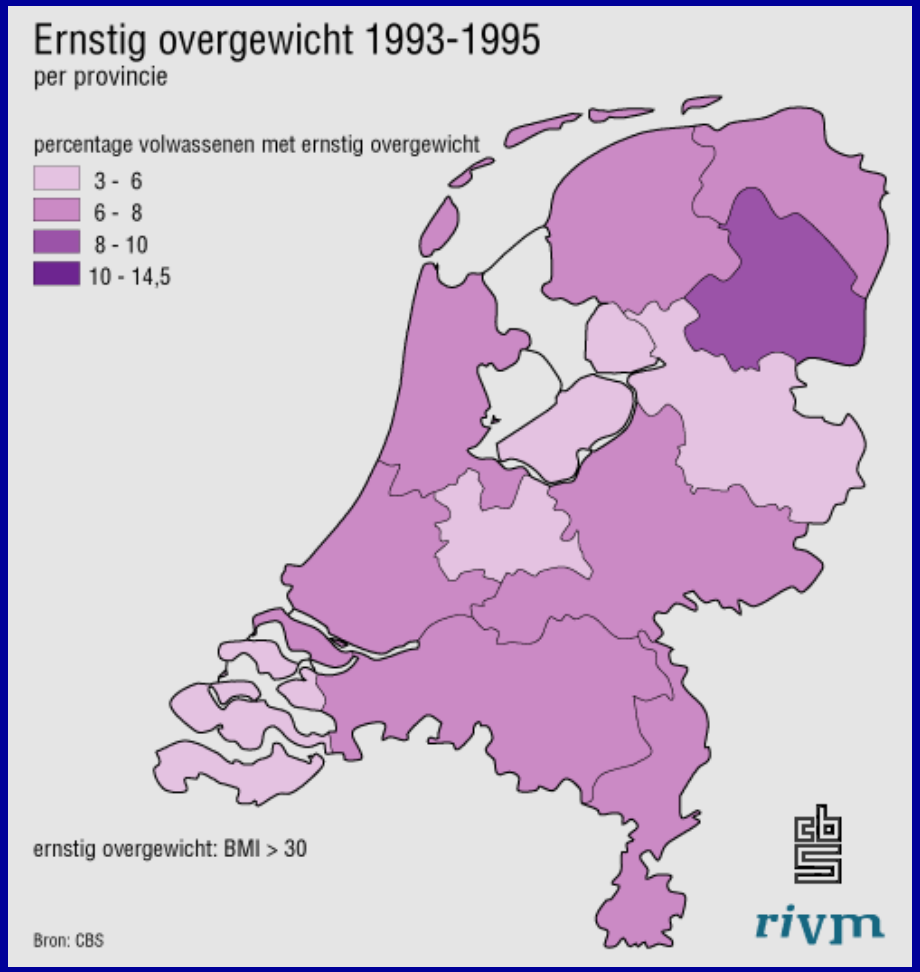
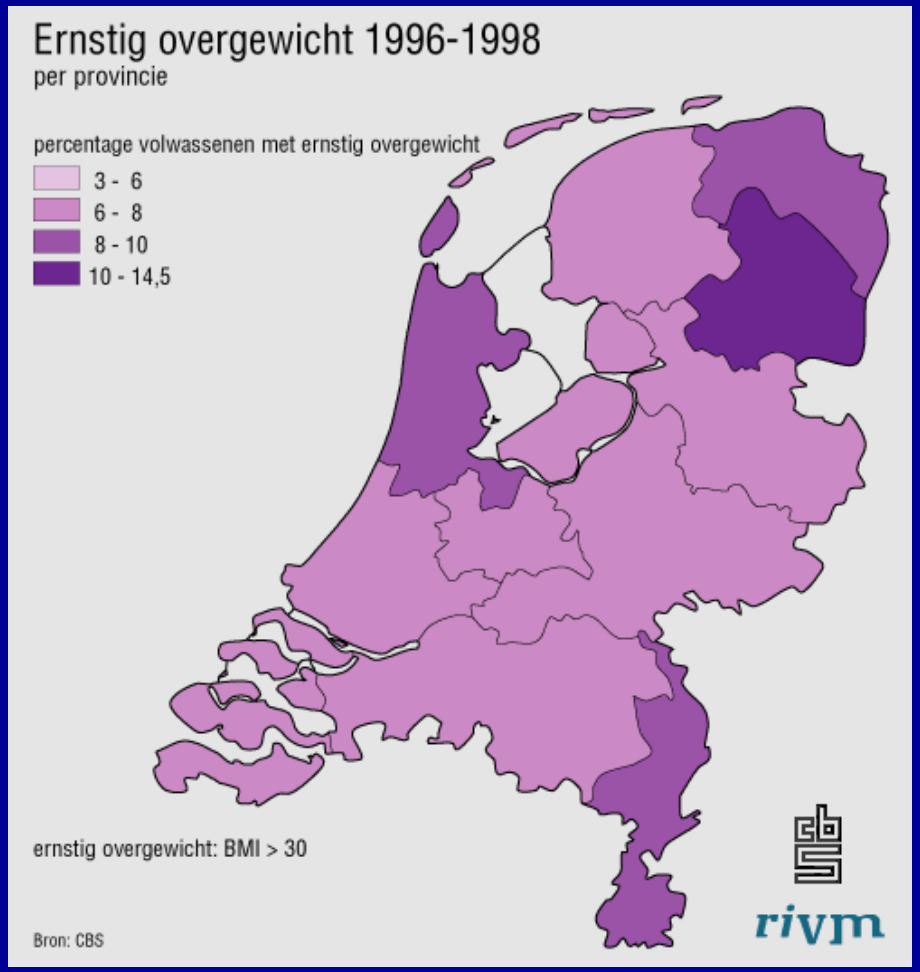
# Obesity in The Netherlands



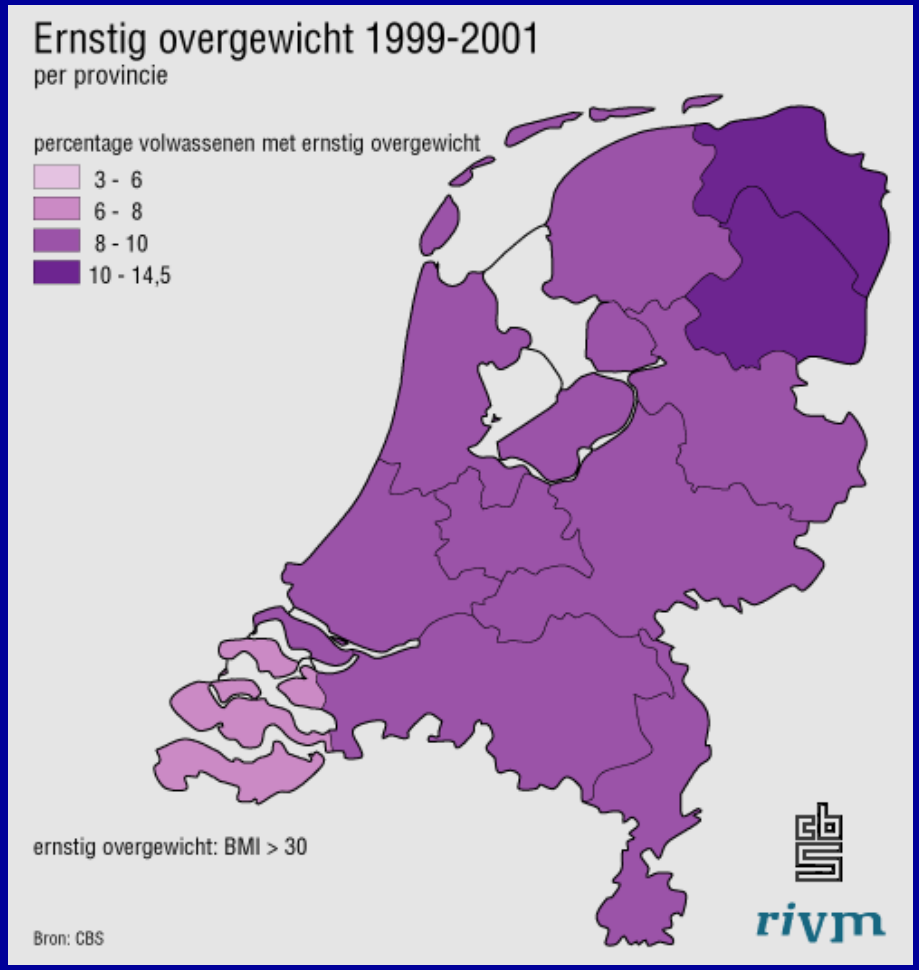

*CBS/ RIVM*

# Obesity in The Netherlands




*CBS/ RIVM*

# Obesity in The Netherlands



# How to define obesity?

- Body Mass Index (BMI) = weight/ heigth$^2$
  - Obesity: BMI≥30

- Waist Circumference (WC)
  - Men: 102 cm
  - Women: 88 cm

# Body Mass Index

| | Body Mass index, $kg/m^2$ |
|---|---|
| <18.5 | Underweight |
| 18.5-24.9 | Healthy weight |
| 25.0-29.9 | Overweight |
| ≥30 | Obese |

*WHO criteria*

# ESC guidelines secondary prevention

## Managing total CVD risk: BODY WEIGHT

- Increasing body weight is associated with increased total and CVD mortality and morbidity, mediated in part through increases in blood pressure and blood cholesterol, reduced HDL cholesterol, and an increased likelihood of diabetes.
- Weight reduction is recommended for obese people (BMI ≥30 kg/m$^2$) and should be considered for those who are overweight (BMI ≥25 and <30 kg/m$^2$).
- Men with a waist circumference of 94—102 cm and women with a waist circumference of 80—88 cm are advised not to increase their weight. Men above 102 cm and women above 88 cm are advised to lose weight.
- Restriction of total calorie intake and regular physical exercise are the cornerstones of weight control. It is likely that improvements in central fat metabolism occur with exercise even before weight reduction occurs.

# ESC guidelines secondary prevention

**Table 3** Impact of increasing body weight on risk factors, morbidity, and mortality

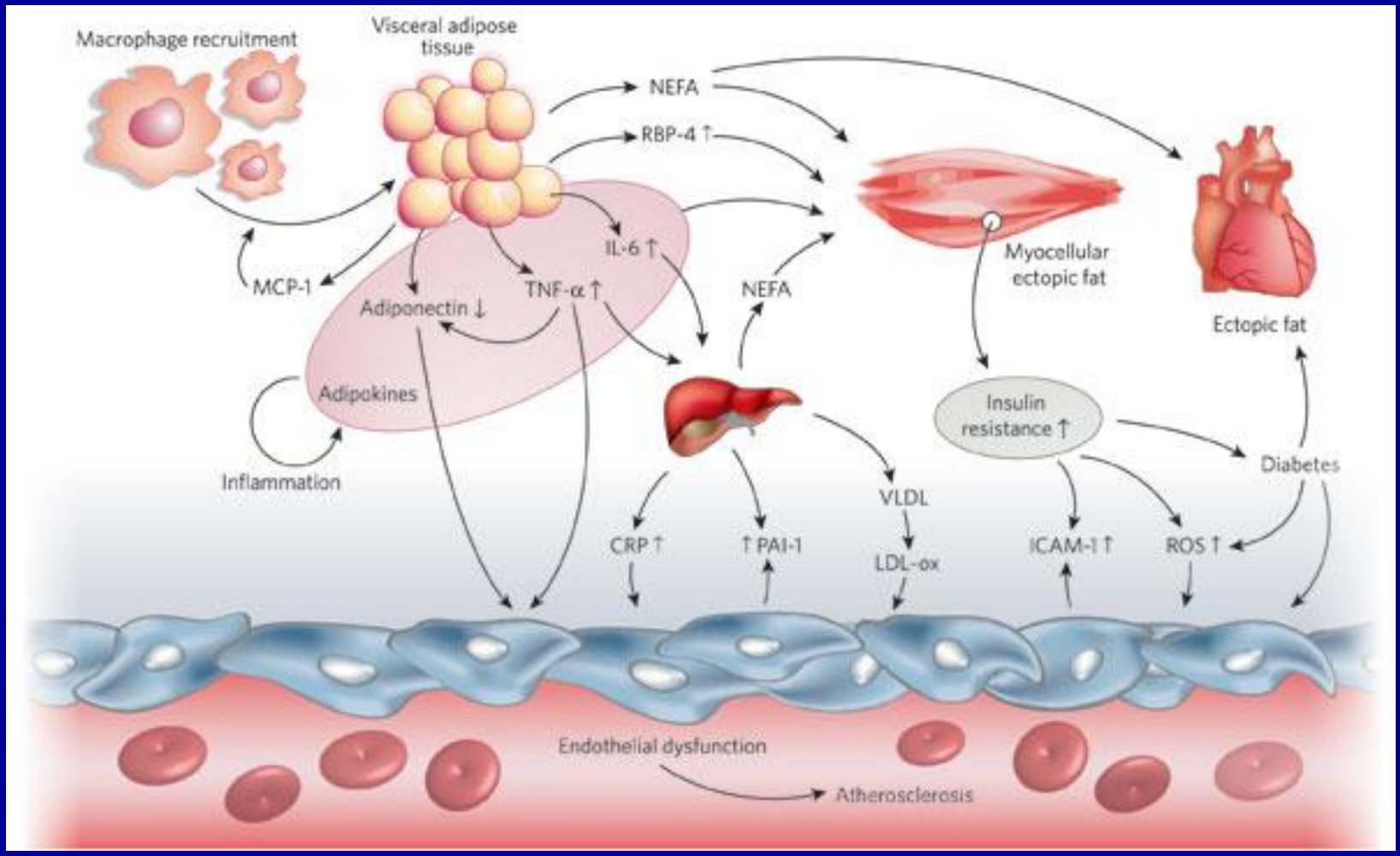
| Risk factors | Morbidity | Mortality |
|---|---|---|
| Raised BP | Type 2 diabetes | Increased total and cardiovascular mortality |
| Raised total and LDL cholesterol | Insulin resistance | |
| Reduced HDL cholesterol | Coronary heart disease | |
| Increased waist circumference | Stroke | |
| Sleep apnoea | Osteoarthritis (knee) | |
| Obesity hypoventilation syndrome | Cancer | |
| Physical inactivity | Low back pain due to obesity | |
| | Breathlessness | |
| | Polycystic ovary syndrome | |
| | Infertility | |
| | Cholelithiasis | |
| | Asthma (exacerbation) | |
| | Venous thromboembolic pulmonary embolism | |
| | Inflammation | |
| | Autonomic nervous system dysfunction | |

# Obesity – Cardiovascular disease

- Development and progression of coronary artery disease
- Associated with cardiovascular risk factors as diabetes, dyslipidemia and hypertension

- Elevated cardiovascular morbidity and mortality (stroke, myocardial infarction, cardiovascular death)

# Pathofysiology




*Van Gaal et al. Nature 2006;444:875-80*

# Pathofysiology

- Indirect: increased prevalence of diabetes, hypertension and dyslipidemia

- Direct: adipose tissue is an active endocrine organ:

  Increased levels of cytokines + inflammatory markers → endothelial dysfunction → atherosclerosis

# Metabolic Syndrome

## The Metabolic Syndrome

- The term 'metabolic syndrome' refers to the combination of several factors that tend to cluster together- central obesity, hypertension, low HDL cholesterol, raised triglycerides, and raised blood sugar- to increase risk of diabetes and CVD.
- This implies that, if one component is identified, a systematic search for the others is indicated, together with an active approach to managing all of these risk factors.
- Physical activity and weight control can radically reduce the risk of developing diabetes in those with the metabolic syndrome.

# Metabolic Syndrome

| Risk Factor | Defining level men | Defining level women |
|---|---|---|
| Abdominal obesity | >102 cm | >88 cm |
| Triglycerides | ≥150 mg/dl | ≥150 mg/dl |
| HDL cholesterol | <40 mg/dl | <50 mg/dl |
| Blood pressure | ≥130/ ≥80 mmHg | ≥130/ ≥80 mmHg |
| Fasting glucose | ≥110 mg/dl | ≥110 mg/dl |

→ 1.5-3 fold increase in risk of CHD and stroke

*ATP III guidelines*

# Bodyfat distribution

Intra-abdominal or Visceral type

(android or “apple shaped”)

Lower body or external type

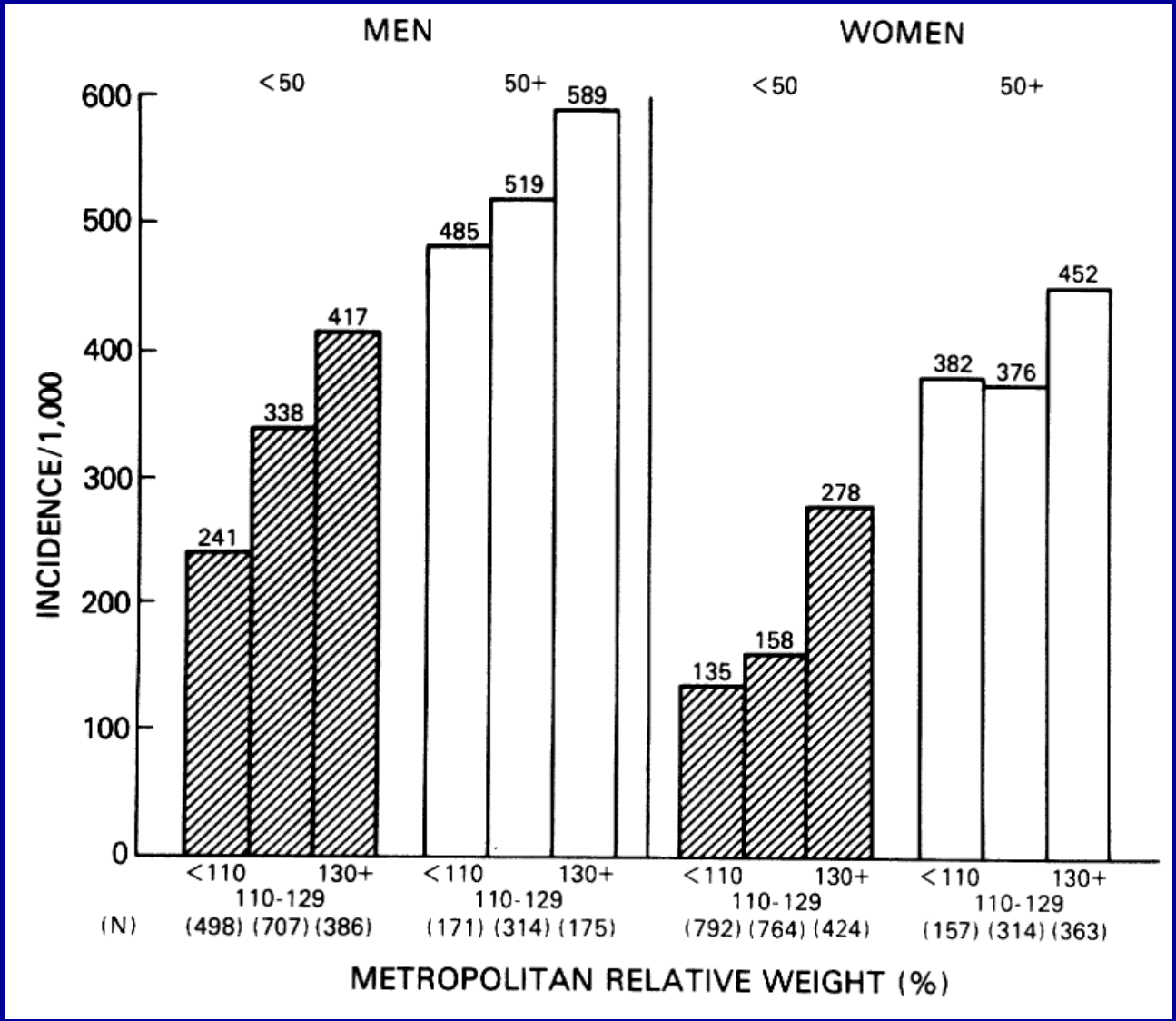
(gynoid or “pear shaped”)

# BMI and cardiovascular disease risk

| | | Disease Risk Relative to Normal Weight and Waist Circumference | |
|---|---|---|---|
| | Body Mass index, $kg/m^2$ | Men, ≤102 cm<br>Women, ≤88 cm | Men, >102 cm<br>Women, >88 cm |
| <18.5 | Underweight | - | - |
| 18.5-24.9 | Healthy weight | - | - |
| 25.0-29.9 | Overweight | Increased | High |
| 30.0-34.9 | Obesity, class I | High | Very high |
| 35.0-39.9 | Obesity, class II | Very high | Very high |
| ≥40 | Obesity, class III | Extremely high | Extremely high |

From the Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report: National Institutes of Health

# Incidence of cardiovascular disease

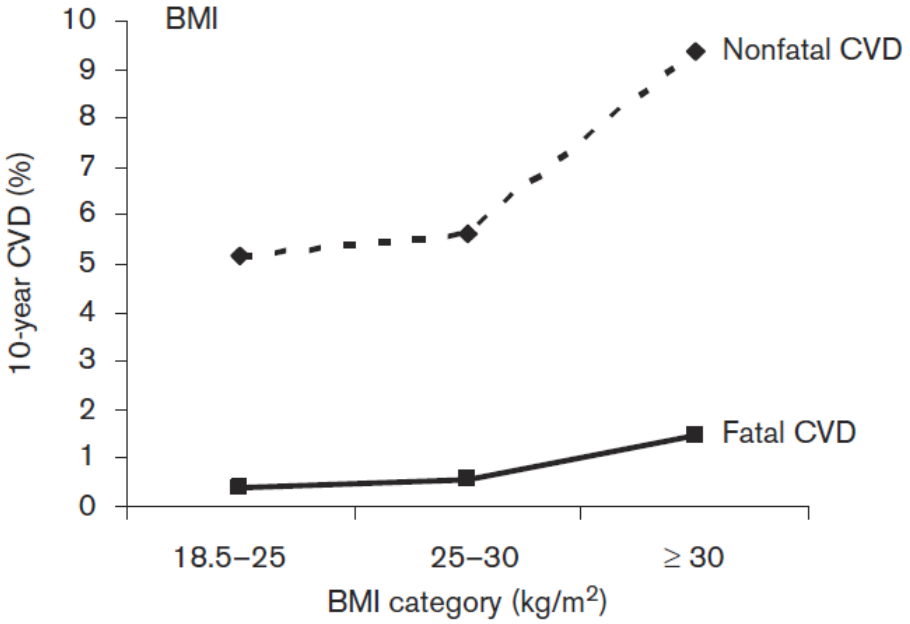


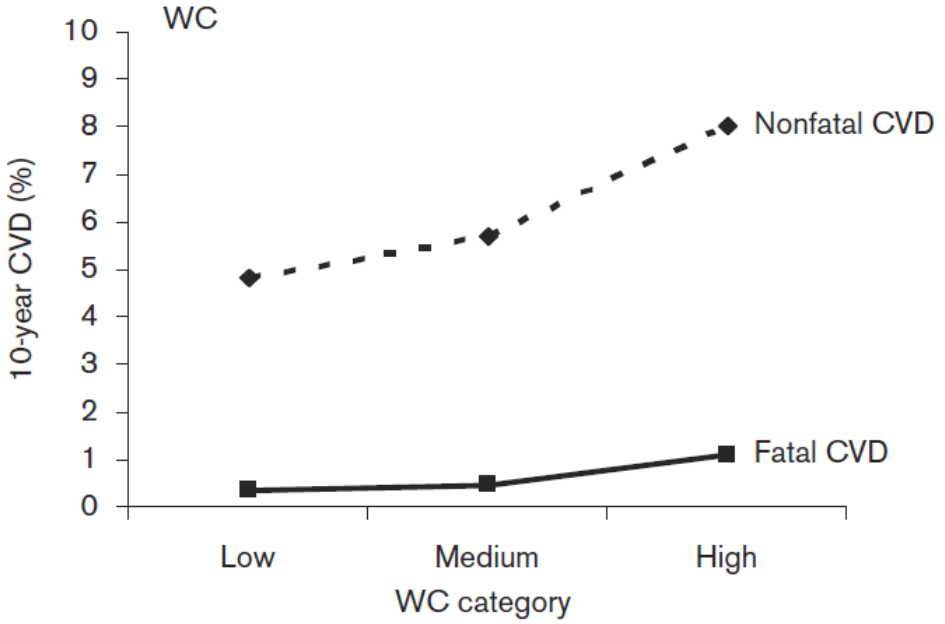

Metropolitan Relative Weight=(actual/desirable weight)*100

*Hubert et al. Circulation 1983;67:968-977*

# BMI/ WC - cardiovascular disease

- 20.500 Dutch men/ women aged 20-65

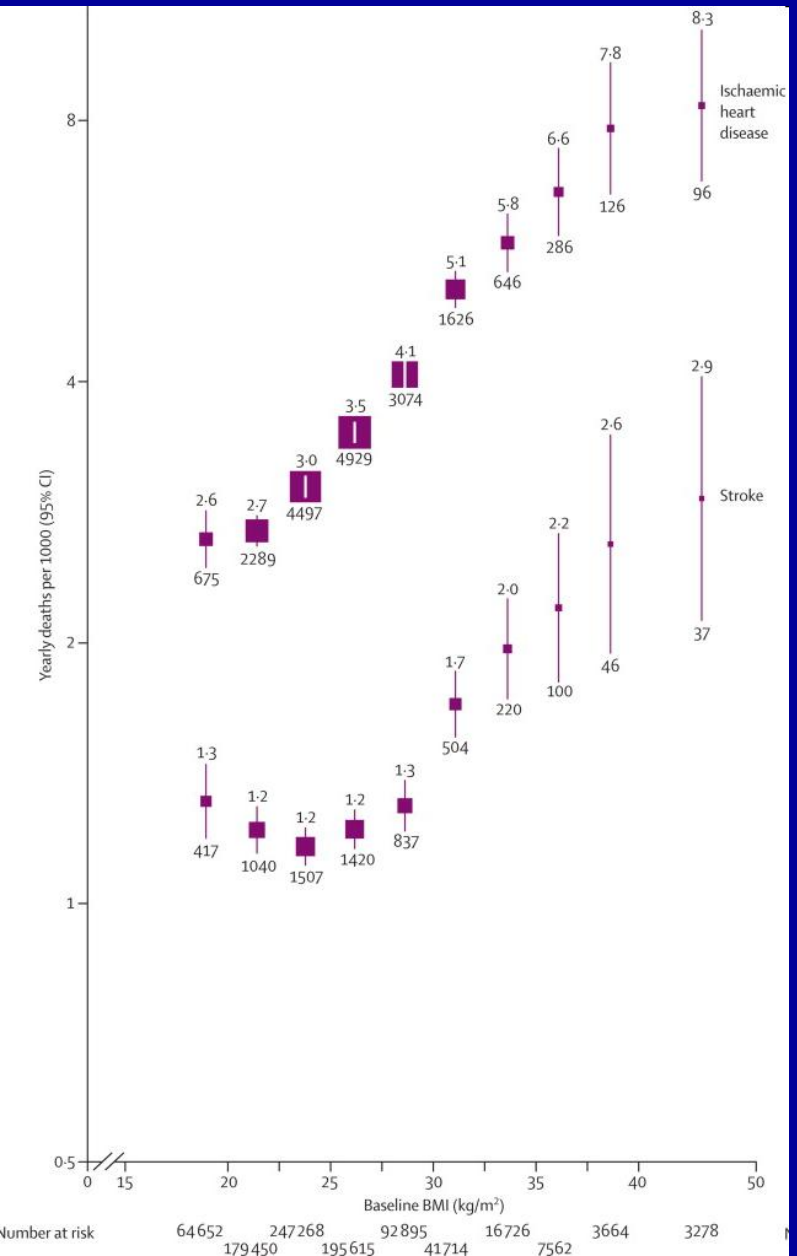



→ 35% of fatal and 15% of nonfatal CVD cases could be attributed to overweight and obesity

*Van Dis et al. Eur J Cardiovasc Prev Rehabil 2009;16:729-34*

# BMI - cardiovascular mortality




- Collaborative analyses of 57 prospective studies
- 894.576 participants

- Strong positive relation between BMI and mortality from ischemic heart disease

*Prospective Study Collab. Lancet 2009;373:1083-96*

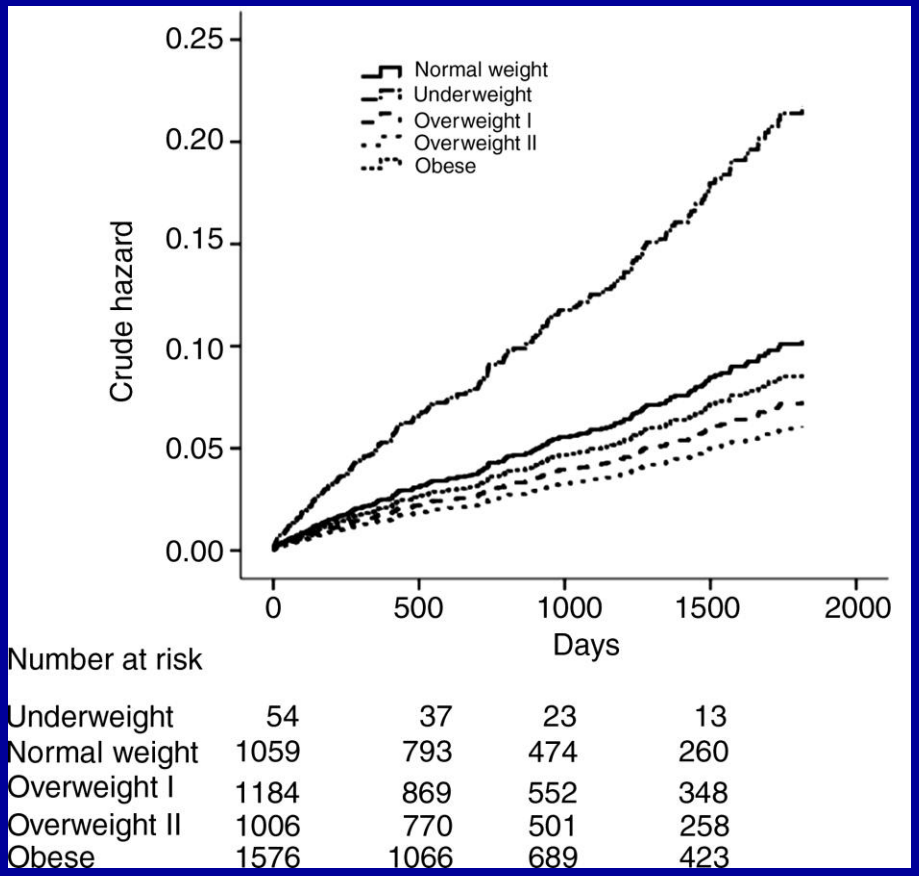
# Patients with established cardiovascular disease

- Obesity appears to be protective against an adverse prognosis

- Obesity paradox?

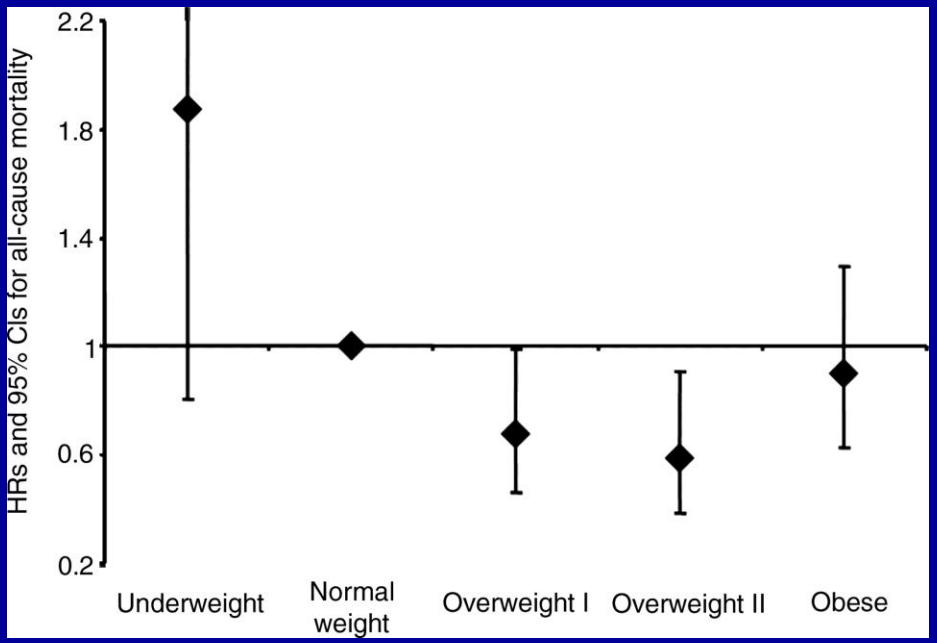
# PCI patients

- 4880 patients undergoing PCI 1997-2006




Number at risk

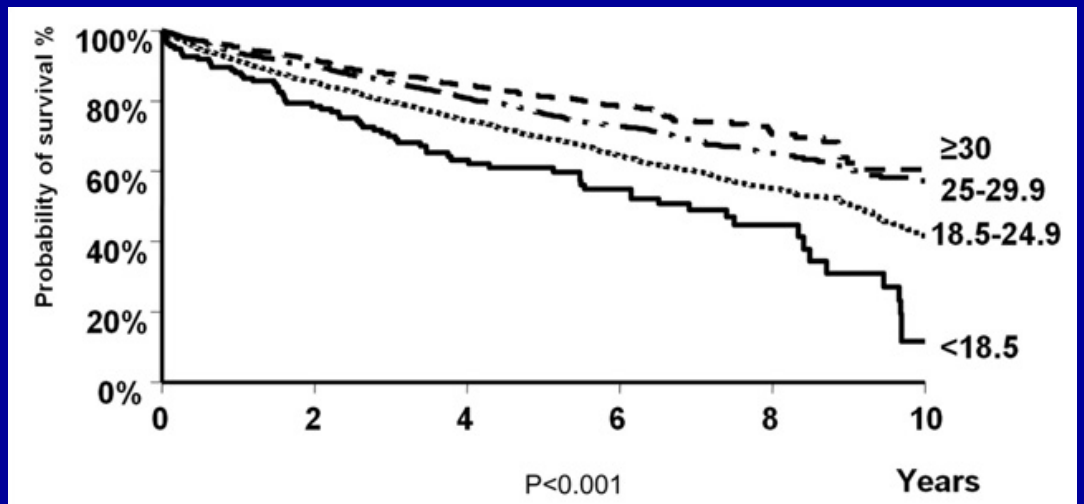
| | | | | |
|---|---|---|---|---|
| Underweight | 54 | 37 | 23 | 13 |
| Normal weight | 1059 | 793 | 474 | 260 |
| Overweight I | 1184 | 869 | 552 | 348 |
| Overweight II | 1006 | 770 | 501 | 258 |
| Obese | 1576 | 1066 | 689 | 423 |



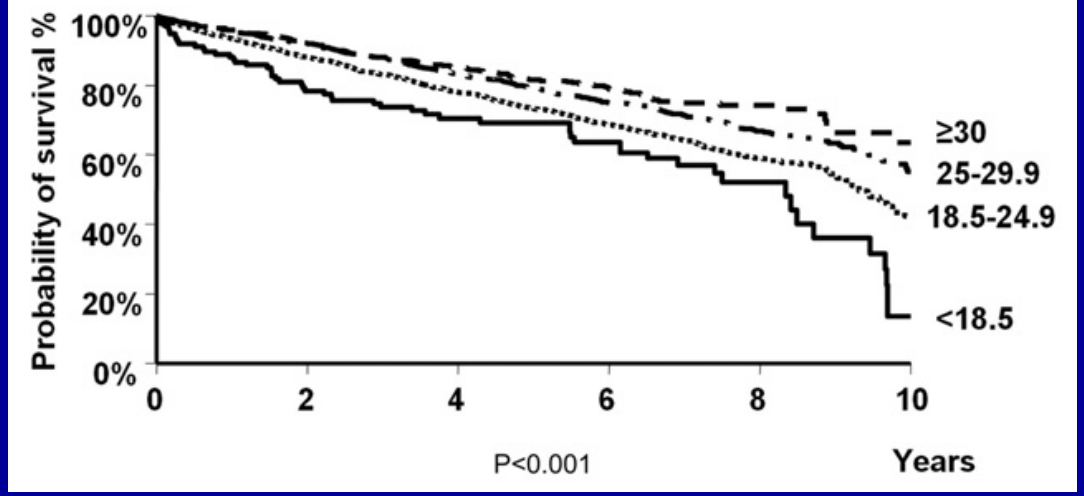

*Hastie C E et al. Eur Heart J 2010;31:222-226*

# Coronary artery disease patients

- 5950 patients with known or suspected CAD
- EMC 1993-2005




All cause mortality




Cardiac death

*Galal, Poldermans et al. AJC 2007;99:1485-1490*

# Conclusion

- Obesity epidemic risk factor
- Major association with metabolic syndrome, cardiovascular disease and mortality
- ESC guidelines stress importance obesity
- Obesity paradox?