

Obesity and Mortality

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**Obesity is defined in terms
of adverse effects on health,
not population norms**

Index of Obesity

Body mass index (BMI)

=

**Weight (kg) divided by
Height (meters) squared**

Body Mass Index Classification

- **Obesity: BMI \geq 30**
- **Overweight: BMI \geq 25**

Measures of Obesity

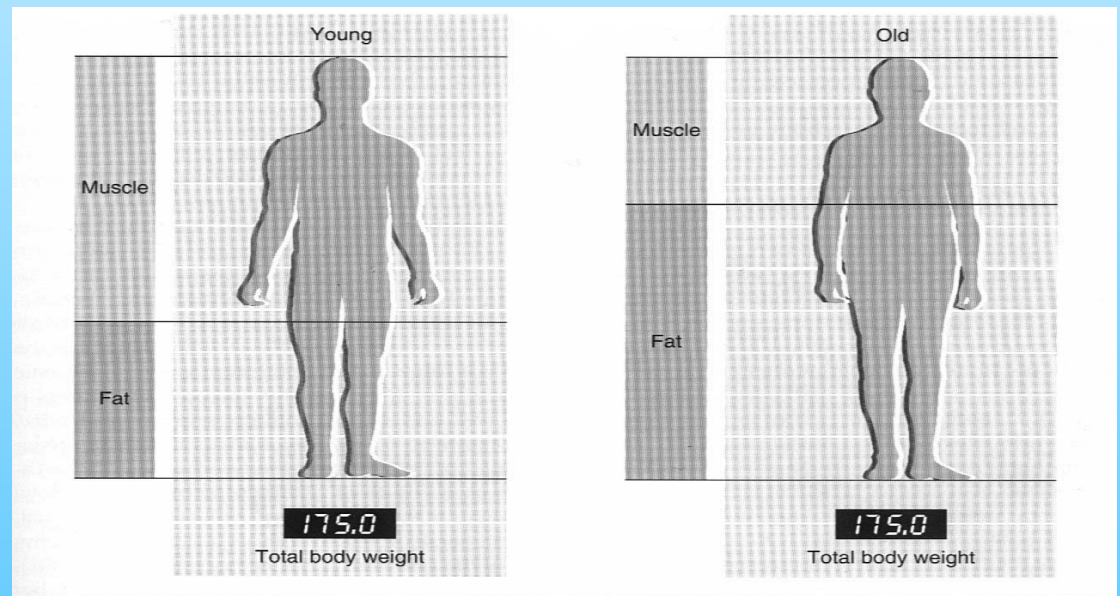
BMI is affected by body frame and muscularity, and is not specific for obesity.

Intra-abdominal (visceral) fat is the worst, most strongly correlated with disease.

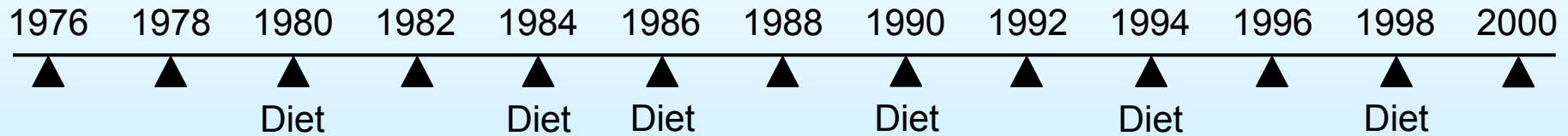
Waist circumference is recommended as the best practical measure of obesity

Waist Circumference: High Risk Classification

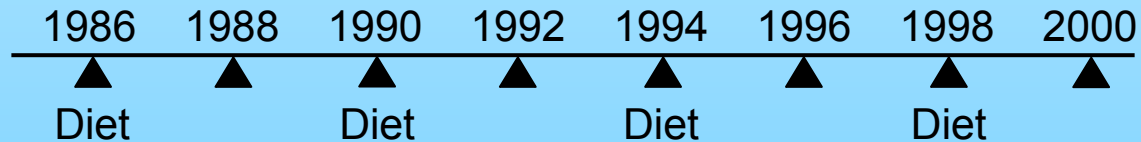
- **WOMEN**
 - **>35 inches, >85 cm**
- **MEN**
 - **>40 inches, >102 cm**



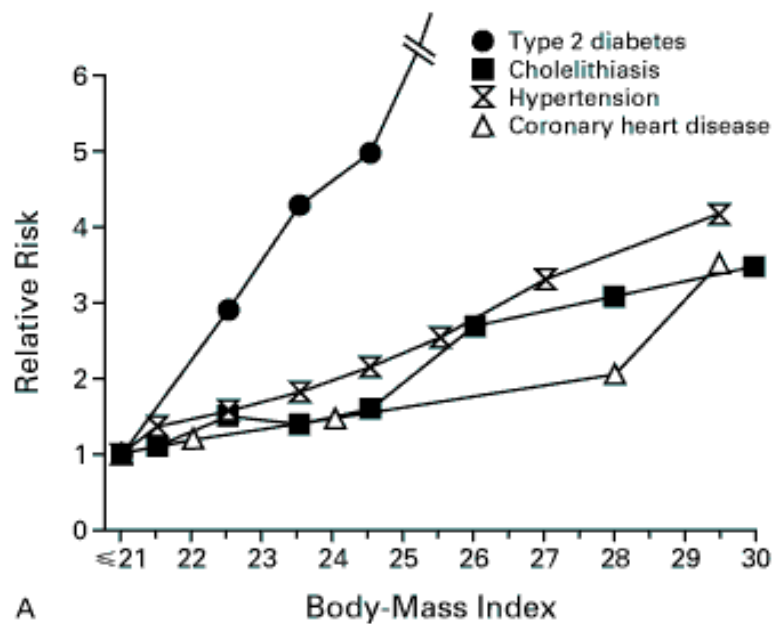
Nurses' Health Study (n=121,700)



Health Professionals Follow-up Study (n=52,000)

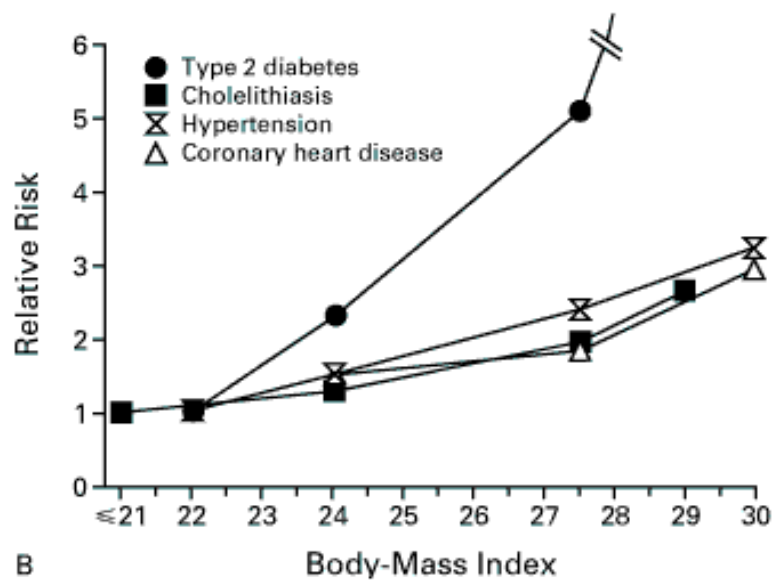


Women



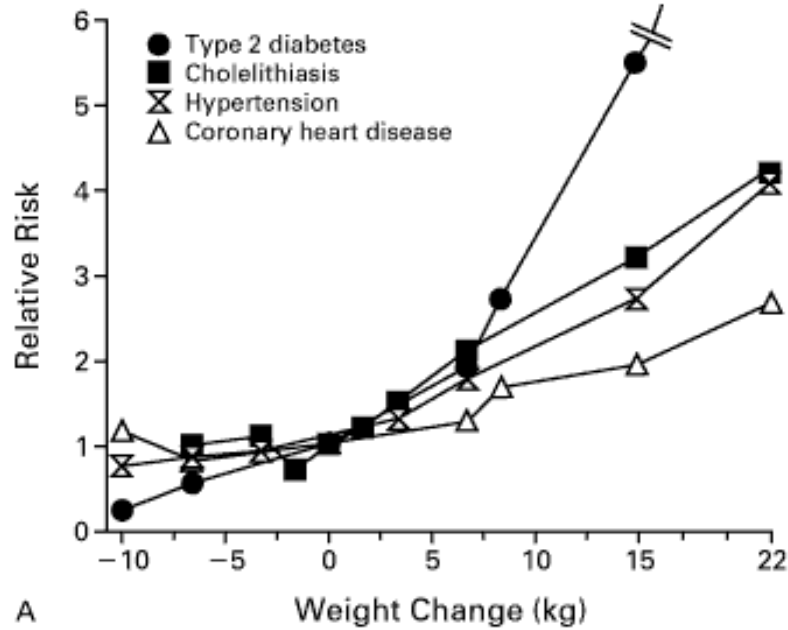
A

Men



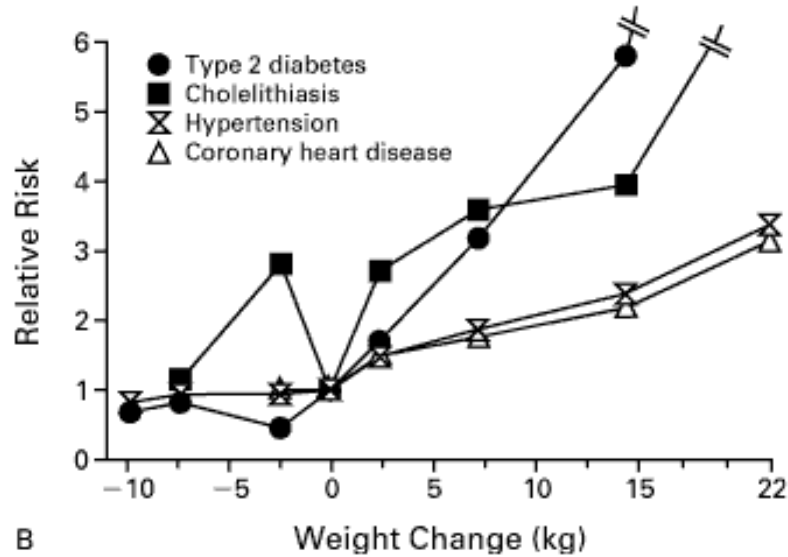
B

Women

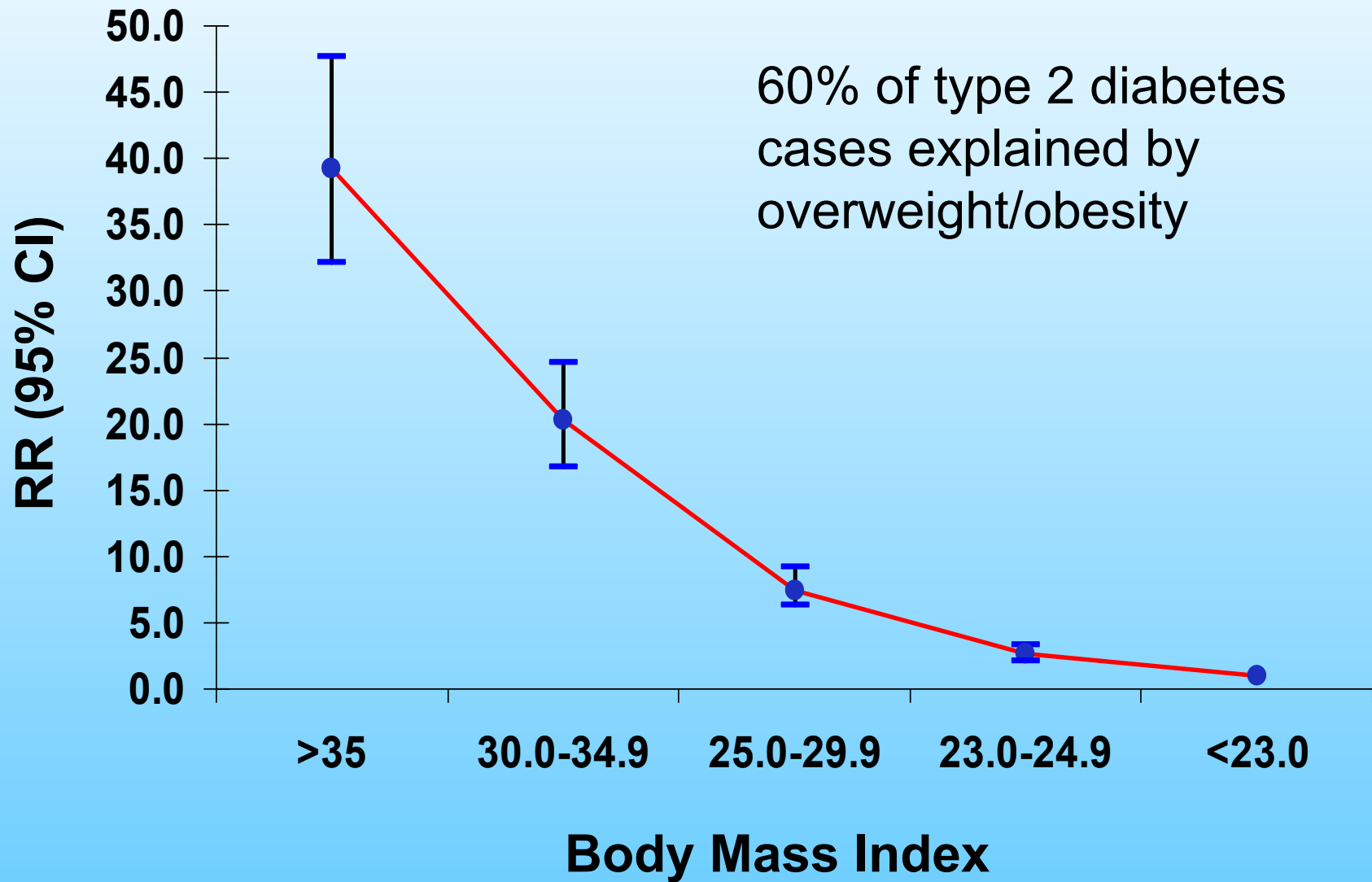


A

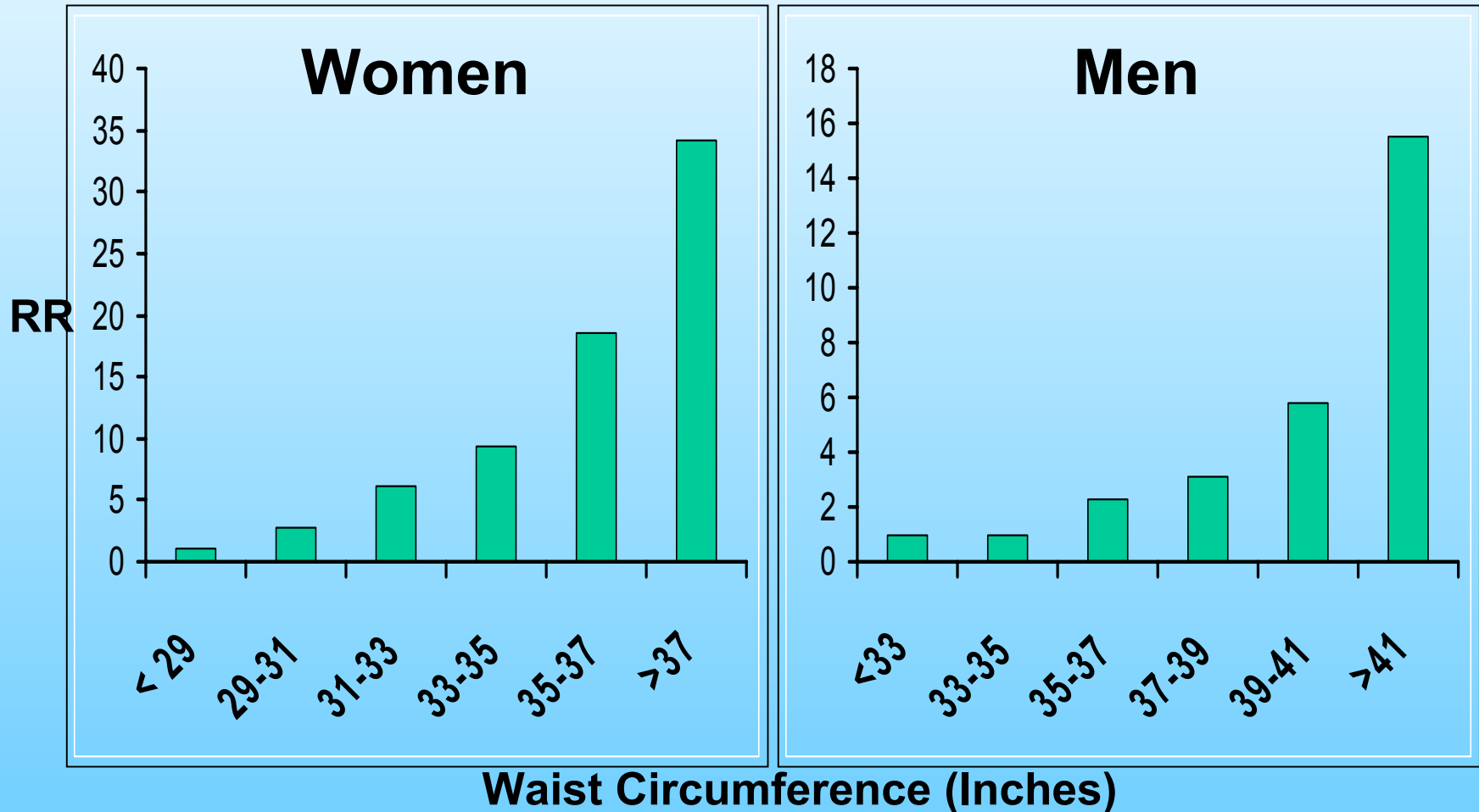
Men



B

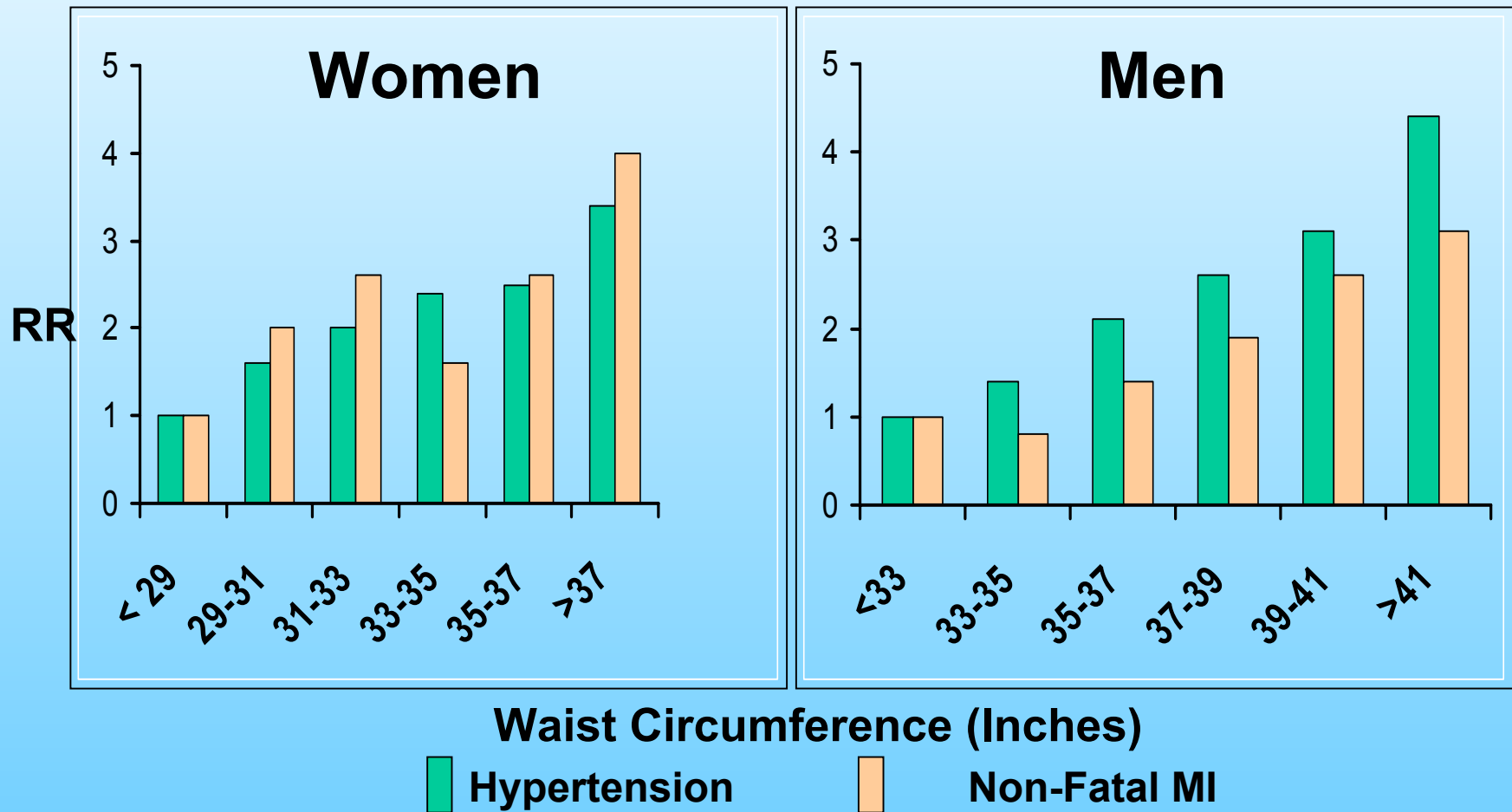


Waist Circumference and Diabetes

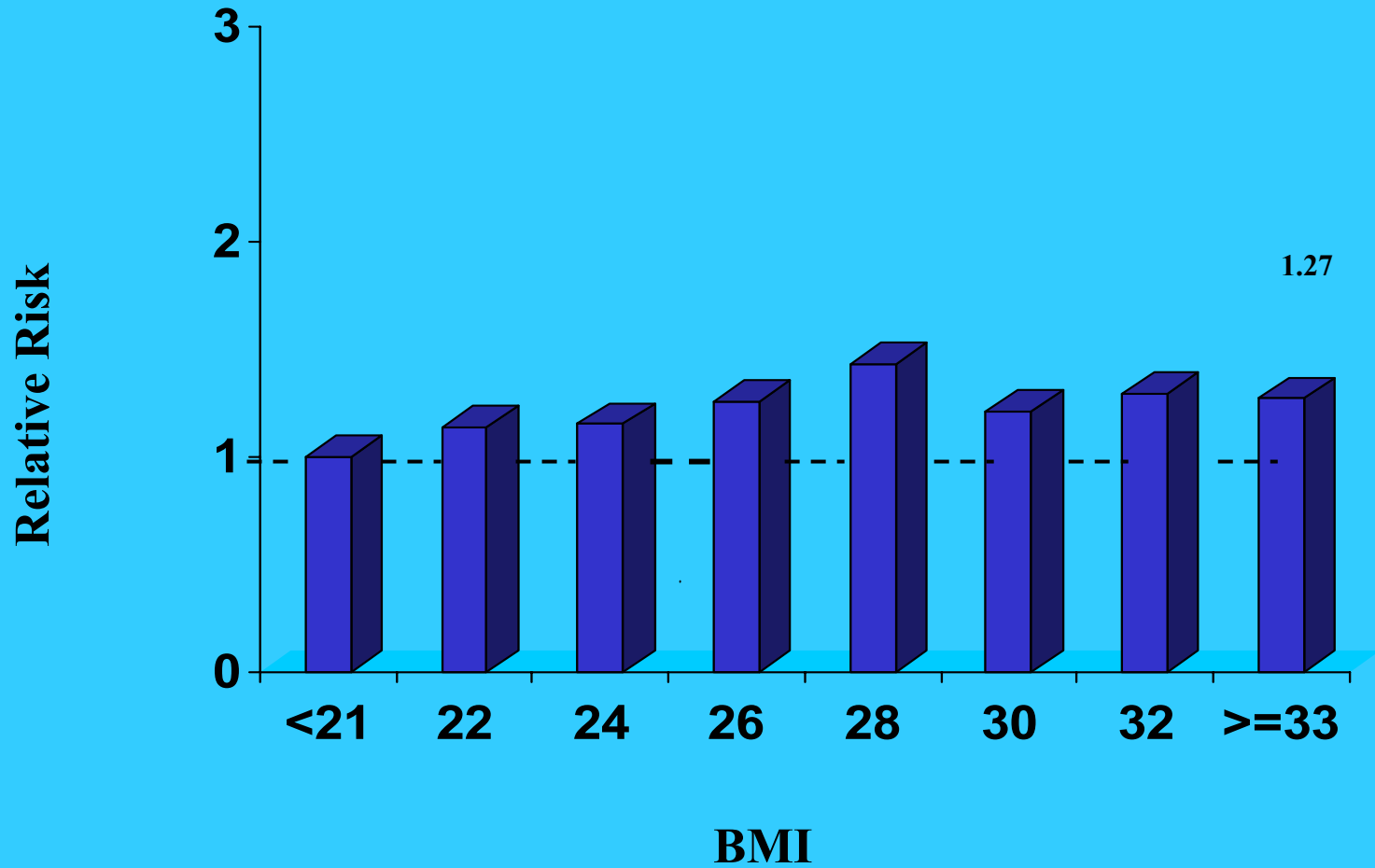


Compiled from Nurses Health Study (women);
Health Professional Followup Study (men)

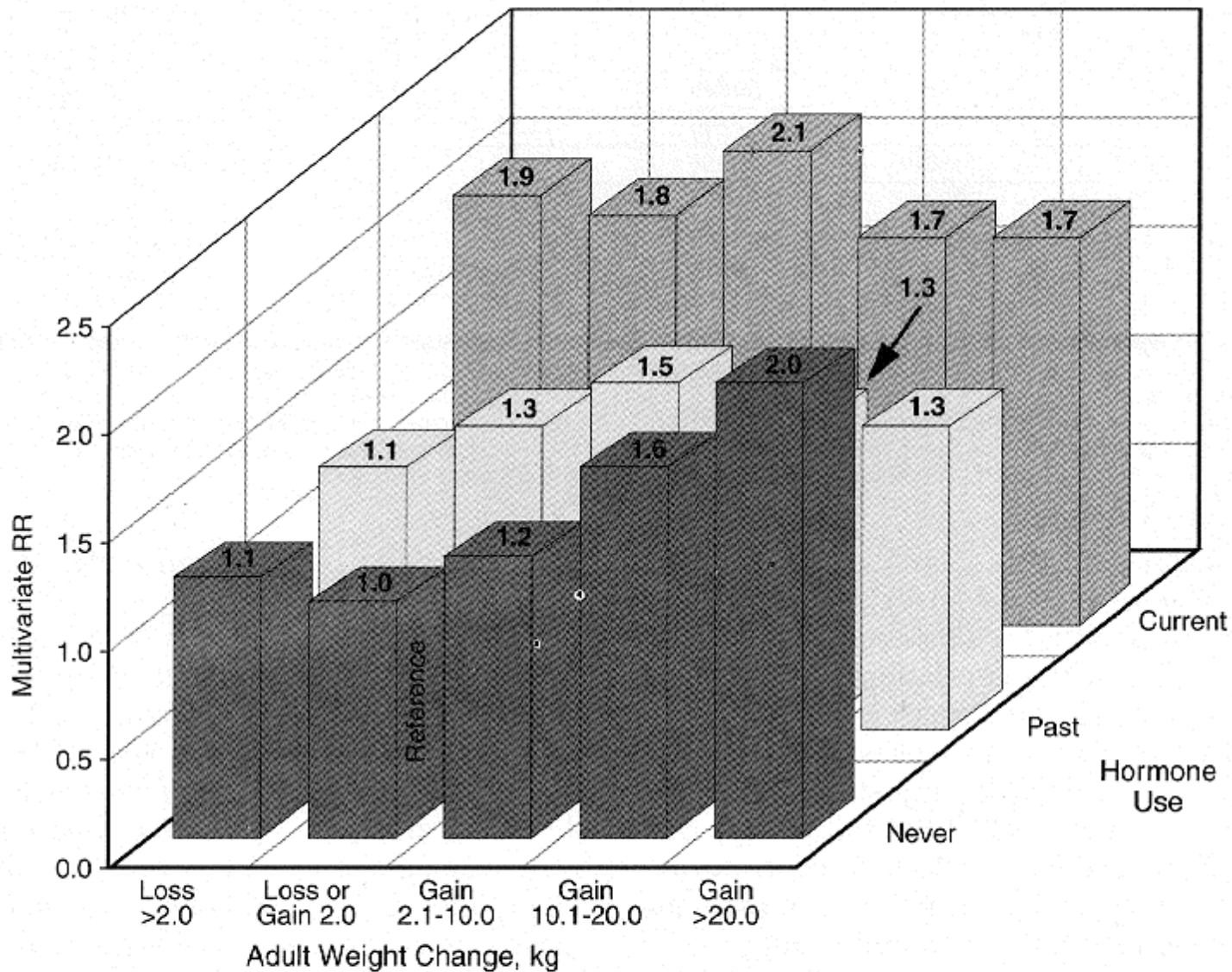
Waist Circumference, Non-Fatal MI and Hypertension



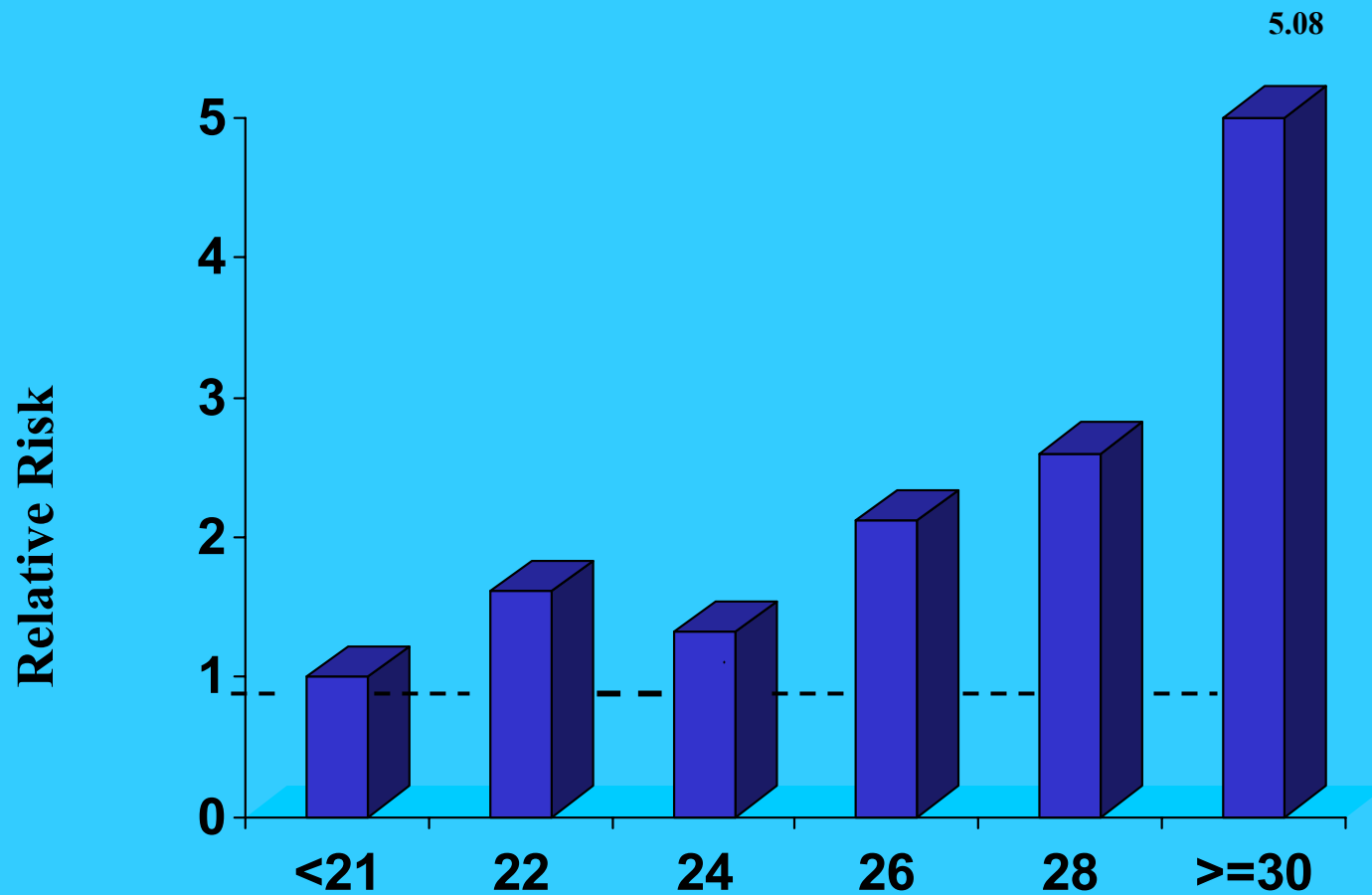
Compiled from Nurses Health Study (women);
Health Professional Followup Study (men)



Postmenopausal Breast Cancer
Pooling Project of Diet and Cancer
(van den Brandt, 2000)



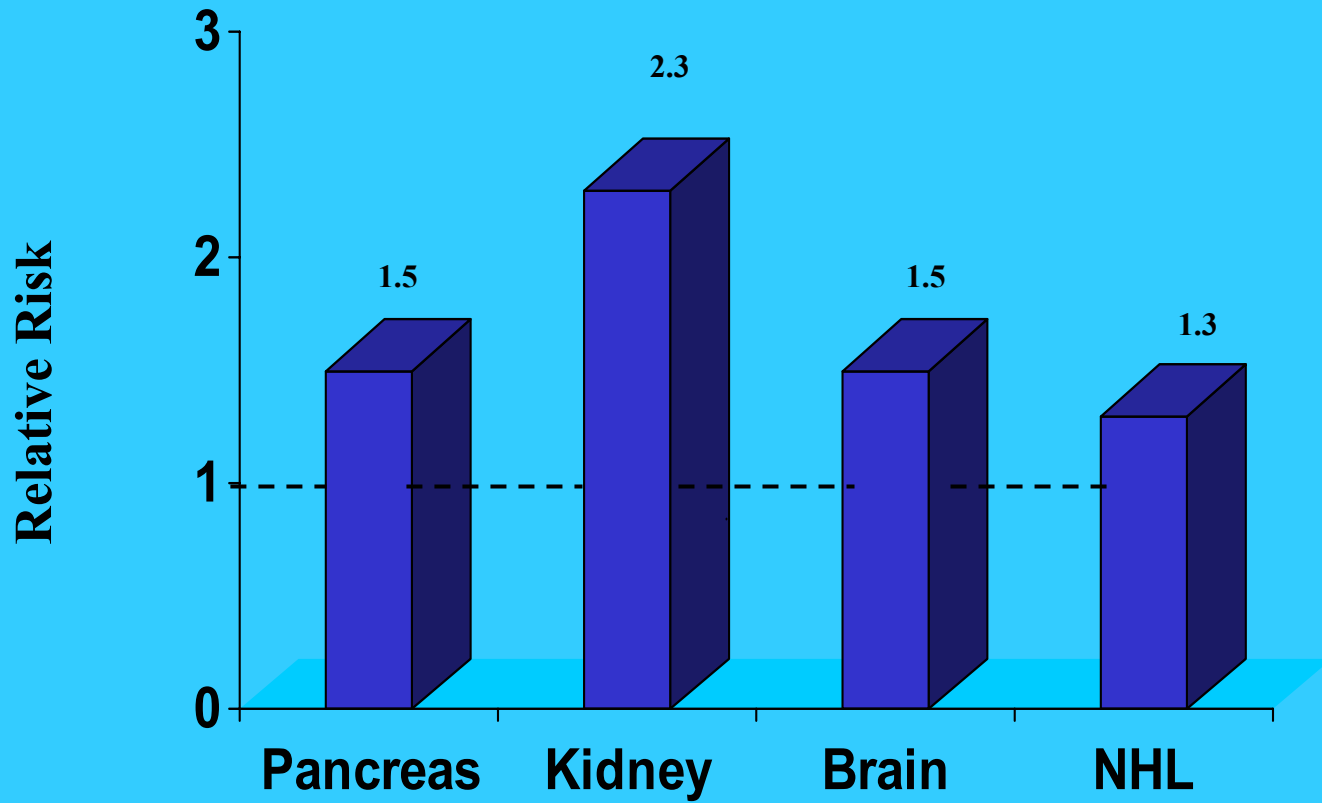
Relative risk (RR) of breast cancer by adult weight change and hormone use among postmenopausal women. Relative risk was adjusted for age, height, history of benign breast diseases, family history of breast cancer, age at menarche, parity, age at first birth, age at menopause, and body mass index at age 18 years.



BMI

Endometrial Cancer

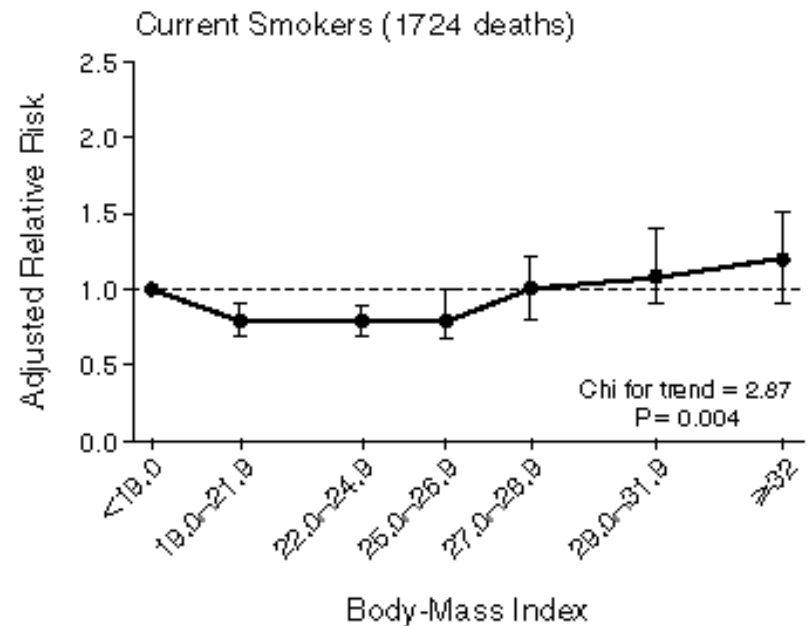
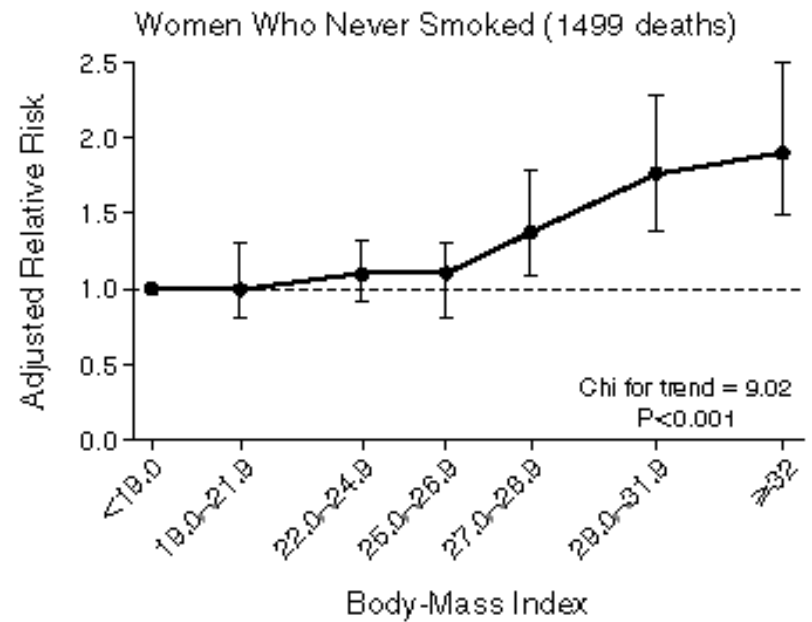
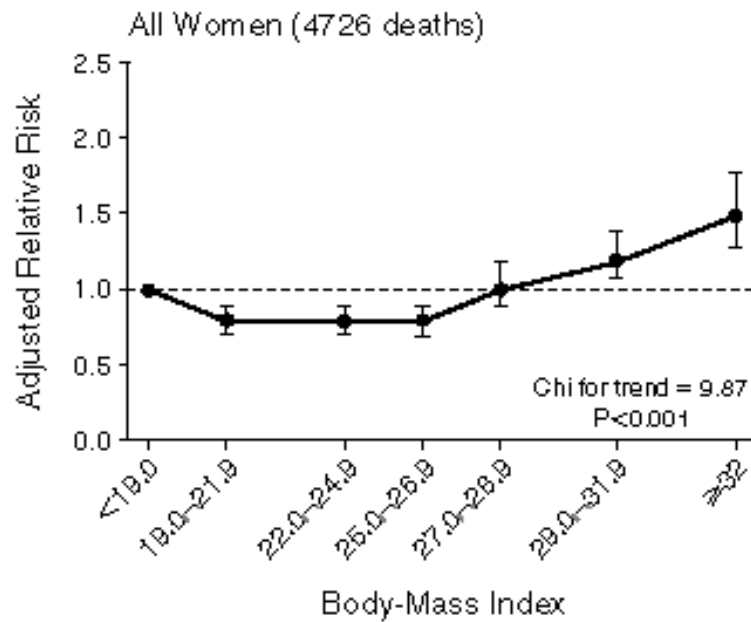
Nurses' Health Study



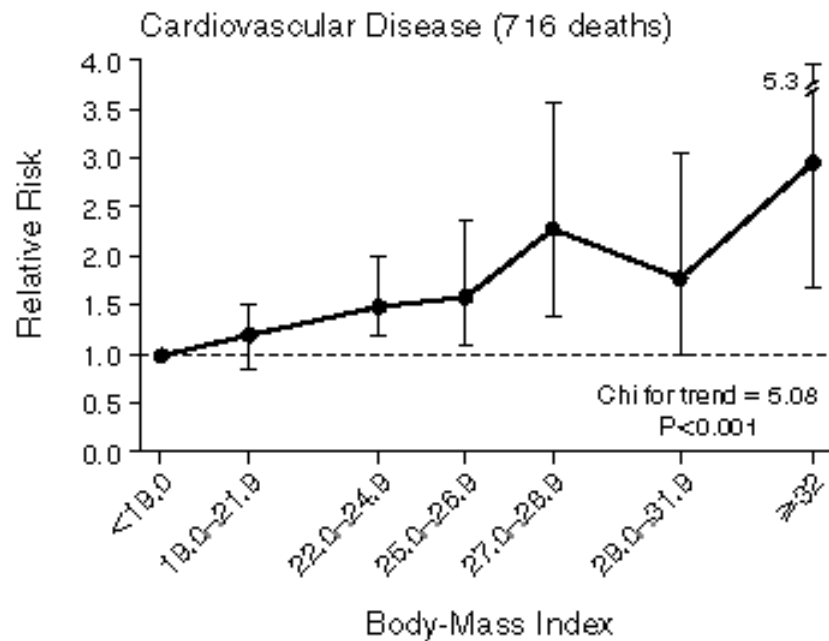
OBESITY
(Wolk, 2001)

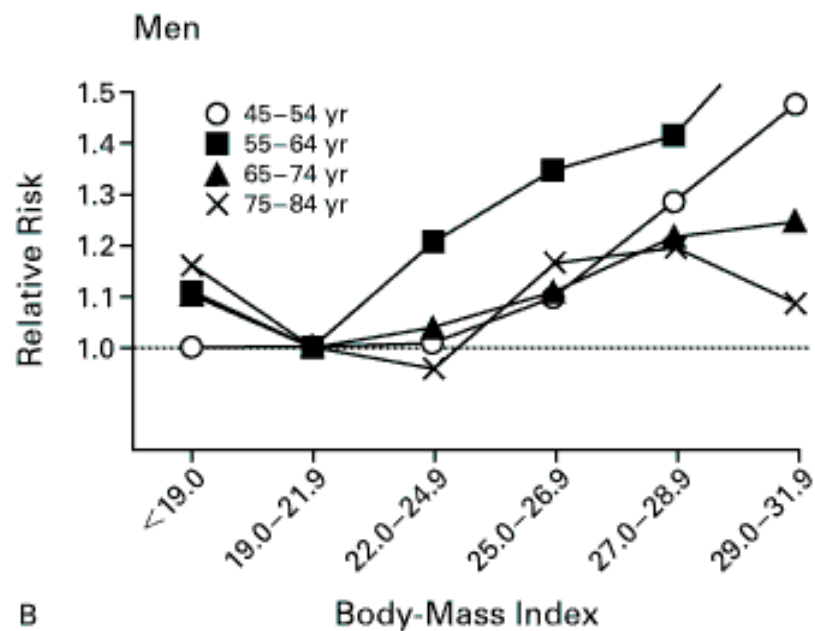
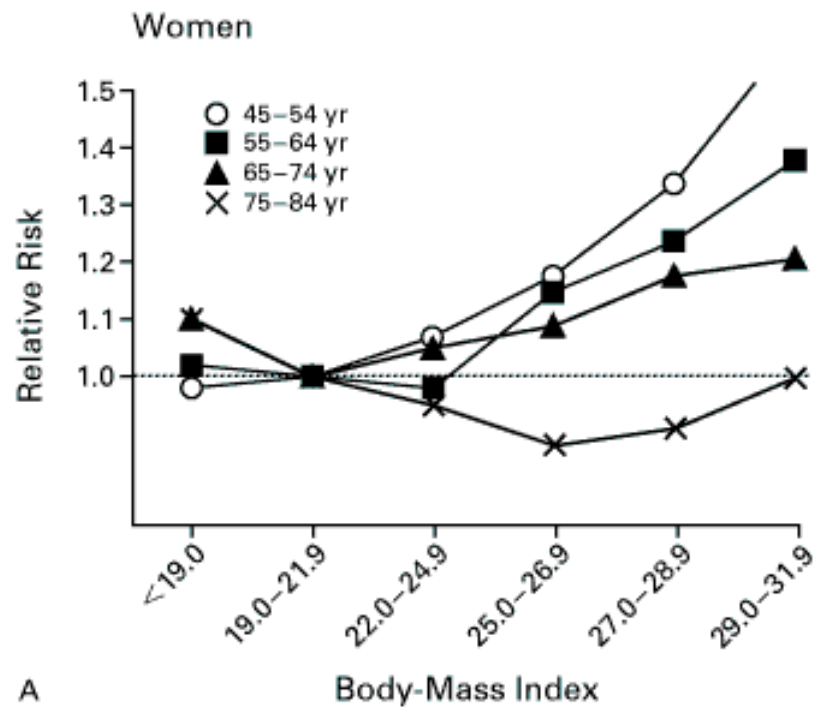
Obesity and Mortality

- **Confounding by weight loss due to pre-clinical conditions and chronic illness (respiratory disease)**
- **Confounding by smoking**
- **Over-control for biological intermediate endpoints**
- **BMI is not the best measure of obesity among older people**

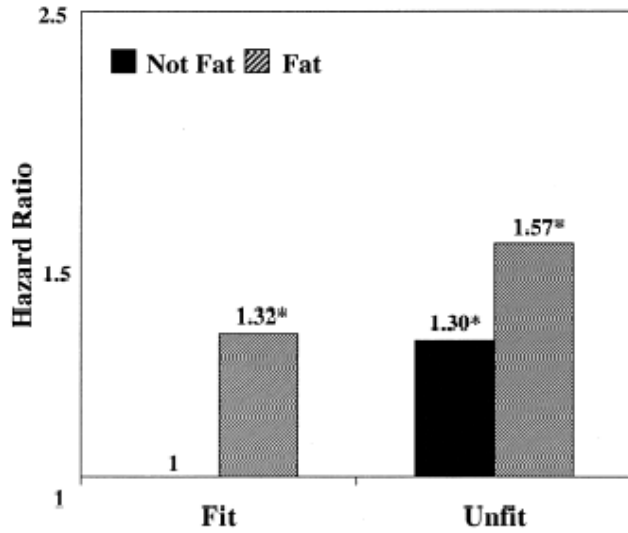


BMI at age 18 and mortality

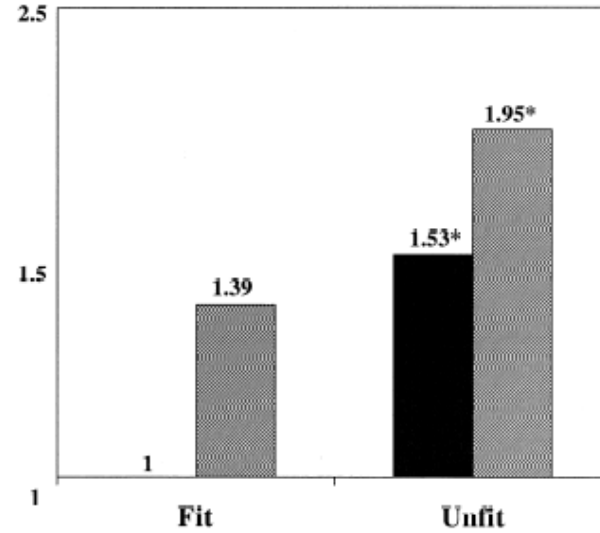




All-Cause Mortality

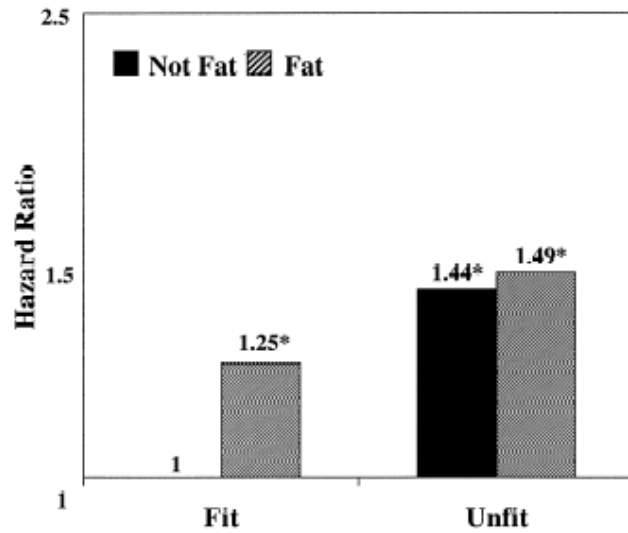


Cardiovascular Disease Mortality

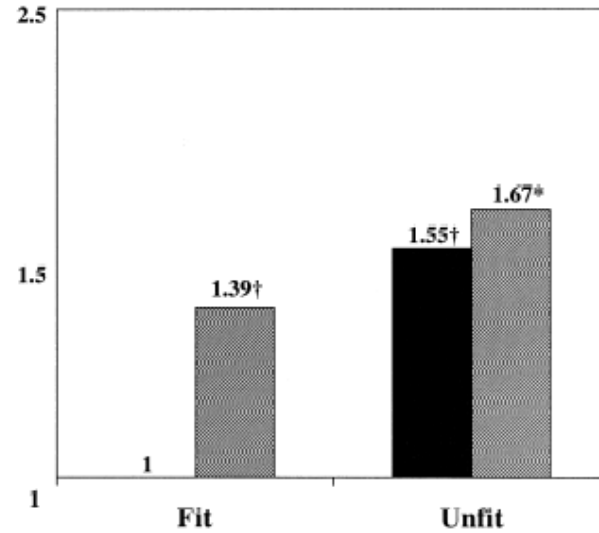


Women

All-Cause Mortality

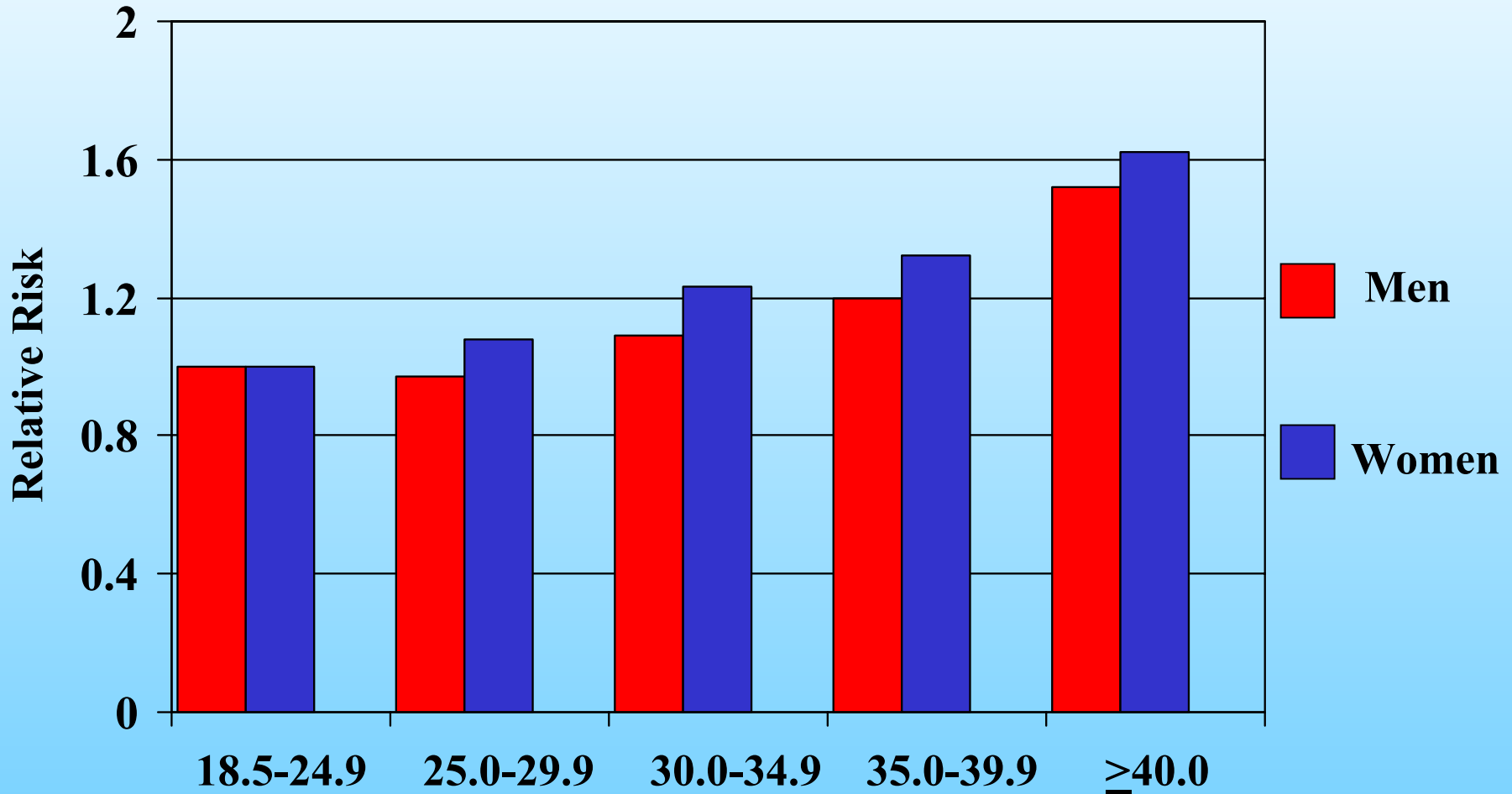


Cardiovascular Disease Mortality



Men

p for trend = 0.001 for men
p for trend = <0.001 for women



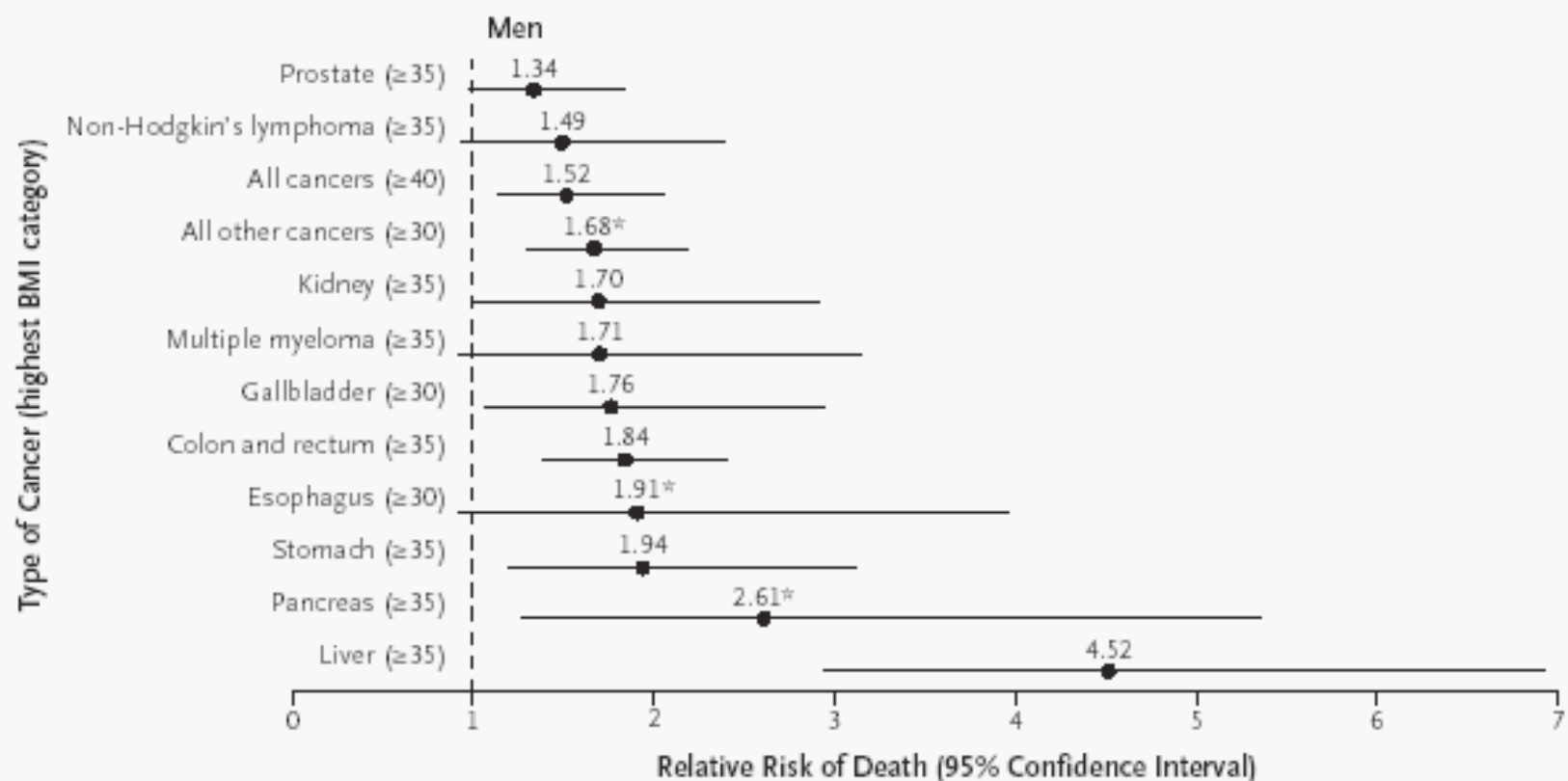


Figure 1. Summary of Mortality from Cancer According to Body-Mass Index for U.S. Men in the Cancer Prevention Study II, 1982 through 1998.

For each relative risk, the comparison was between men in the highest body-mass-index (BMI) category (indicated in parentheses) and men in the reference category (body-mass index, 18.5 to 24.9). Asterisks indicate relative risks for men who never smoked. Results of the linear test for trend were significant ($P \leq 0.05$) for all cancer sites.

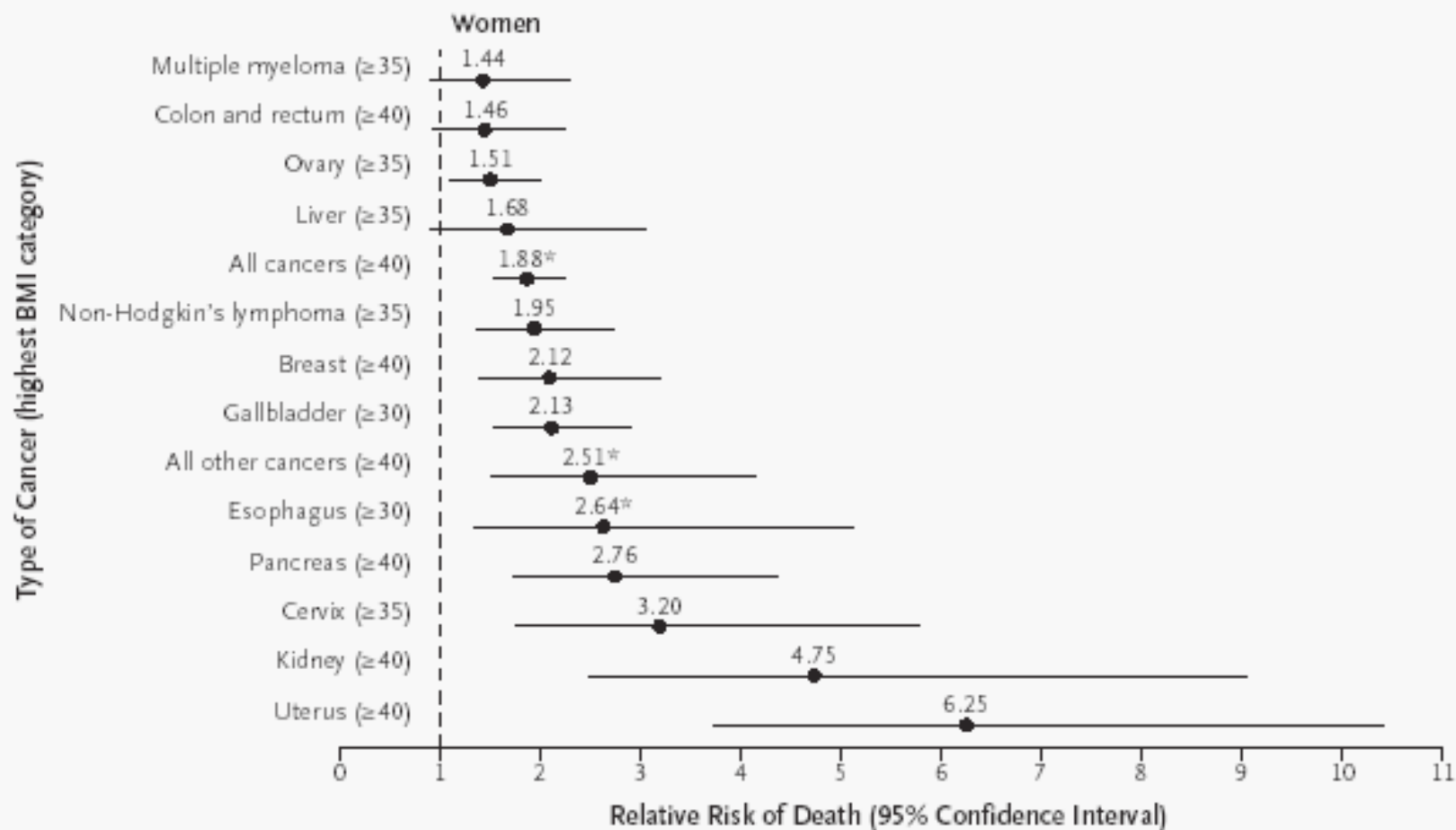
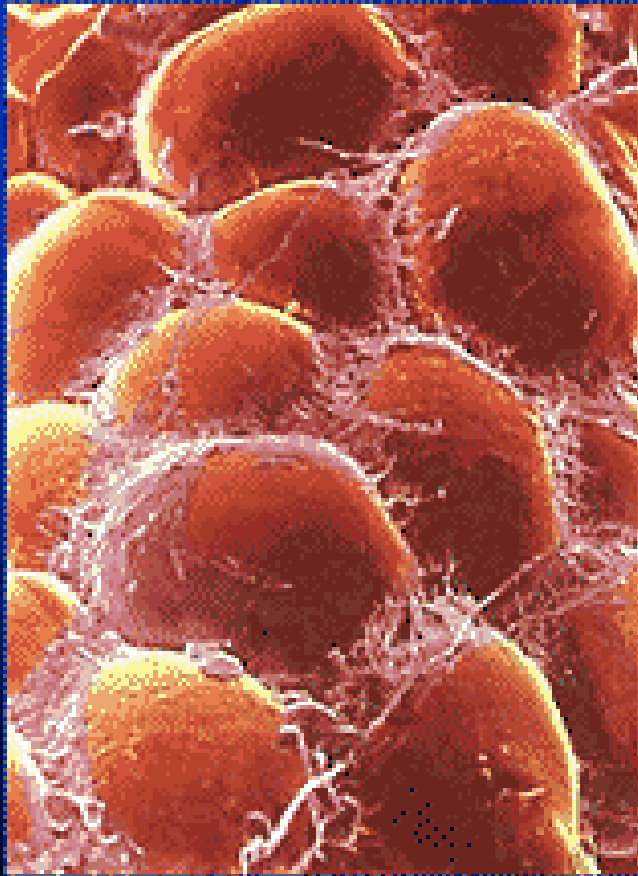


Figure 2. Summary of Mortality from Cancer According to Body-Mass Index for U.S. Women in the Cancer Prevention Study II, 1982 through 1998.

For each relative risk, the comparison was between women in the highest body-mass-index (BMI) category (indicated in parentheses) and women in the reference category (body-mass index, 18.5 to 24.9). Asterisks indicate relative risks for women who never smoked. Results of the linear test for trend were significant ($P \leq 0.05$) for all cancer sites.



Adipose tissue

Estrogen

Cytokines:

TNF-alpha

Interleukin 6

'Adipokines'

Resistin

Adiponectin

Prothrombotic mediators:

PAI-1

Current Guidelines:

If not already overweight or obese:

- maintain a BMI between 18.5 and 25
- Minimize weight gain during adulthood

If already overweight or obese:

- avoid further weight gain
- aim for a 5 to 10% sustainable weight loss

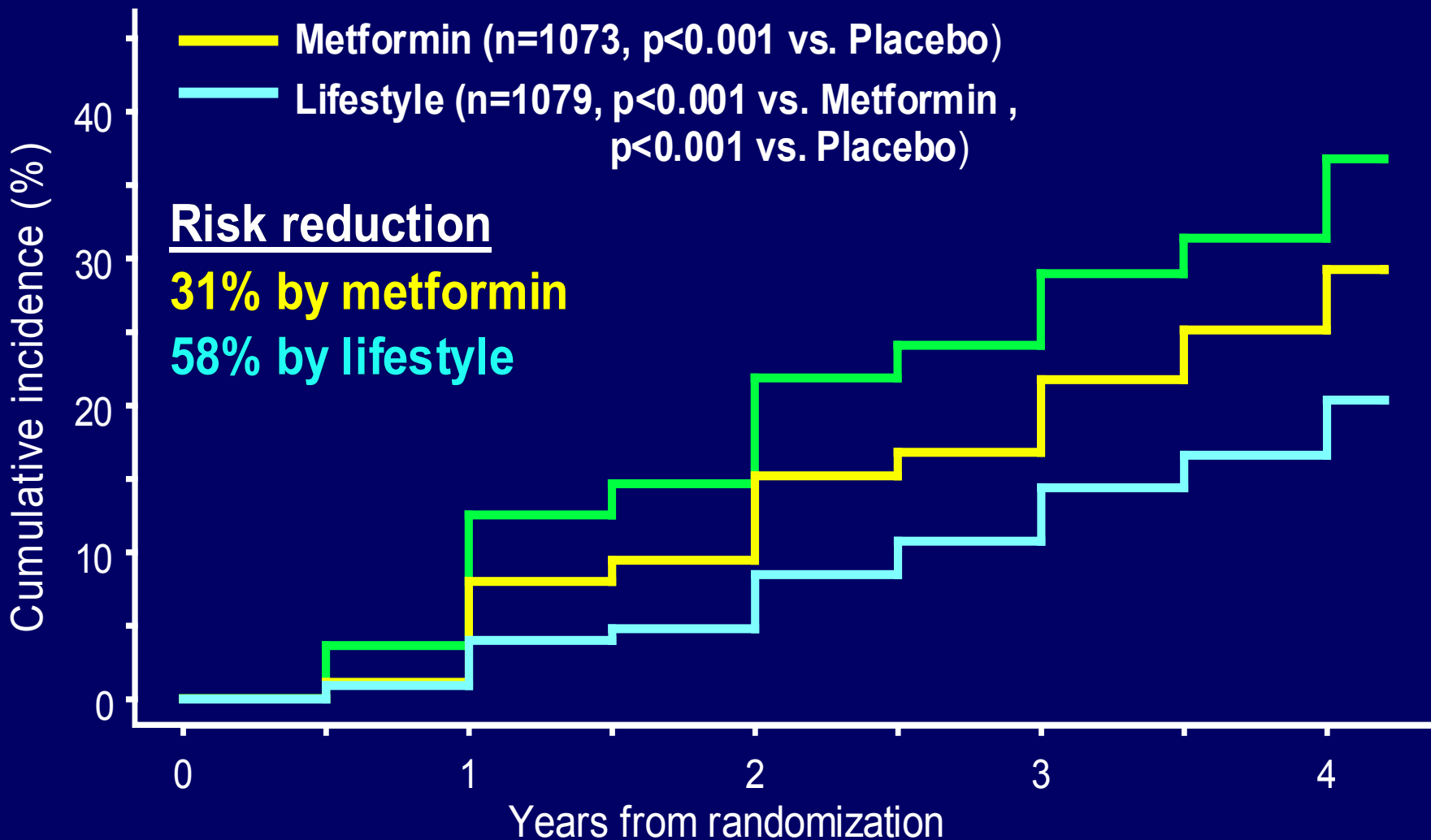
Incidence of Diabetes

- Placebo (n=1082)
- Metformin (n=1073, $p < 0.001$ vs. Placebo)
- Lifestyle (n=1079, $p < 0.001$ vs. Metformin, $p < 0.001$ vs. Placebo)

Risk reduction

31% by metformin

58% by lifestyle



CONCLUSIONS

- **The evidence on health consequences of obesity is overwhelming.**
- **Although optimal BMI is yet to be defined, obesity is clearly associated with increased mortality.**
- **Being fit does not reverse the increased risk associated with obesity.**
- **Public health measures are urgently needed to curb the obesity epidemic.**