



**RESEARCH CENTRE FOR  
PREVENTION AND HEALTH**

# **A new physical activity scale for measuring physical activity**

**Mette Aadahl<sup>1,2</sup>**

**Torben Jørgensen<sup>1</sup>**

*<sup>1</sup>Research Centre for Prevention and Health, Glostrup.*

*<sup>2</sup>Department of Medical Orthopaedics and Rehabilitation,  
Rigshospitalet, Copenhagen.*



# Introduction

- **We need simple, valid and reliable methods for measuring physical activity level when studying the association between physical activity and different health outcomes or when monitoring interventions aimed at increasing physical activity level.**
- **Existing methods are often expensive and complicated to administer or very crude classifications of physical activity level that yield very little information.**



# Introduction

”Physical activity comprises any body movement produced by the skeletal muscles that results in a substantial increase over the resting energy expenditure”

*(Caspersen et al, 1985)*



# Aim










- To develop and validate a physical activity scale for measuring physical activity in 24 hours of work, leisure time and sports in an average weekday.












## **Material & methods**

- Selection of specific physical activities of known absolute intensity.
- METs (metabolic equivalents)
- 1 MET = energy expenditure when resting quietly
- "Compendium of physical activities"

Ainsworth et al. MSEE 1993 & 2000

<b>A</b> 	Søvn, hvile	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>B</b> 	Fx se TV, slappe af, læse eller lytte til musik.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>C</b> 	Fx sidde ved computer eller skrivebord, sidde i møde, siddende kontorarbejde, sidde og spise.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>D</b> 	Fx stå eller slentre omkring. Vaske op, lave mad, køre bil (som fører).	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>E</b> 	Fx let rengøring, feje gulv, danse (langsomt), gå med indkøbsvogn eller barnevogn, gå ned ad trapper.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>F</b> 	Fx at cykle i moderat tempo, gå i hurtigt tempo, male og tapetsere.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>G</b> 	Fx let havearbejde, bære og stable træ, bære småting op ad trappe.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>H</b> 	Fx aerobics eller fitness-træning, hugge brænde, grave eller skovle sne.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>I</b> 	Aktiviteter som er mere anstrengende end niveau H, fx at løbe eller jogge, cykle i hurtigt tempo, fodbold, håndbold, tennis.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10

<b>A</b> 	Søvn, hvile	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>B</b> 	Fx se TV, slappe af, læse eller lytte til musik.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>C</b> 	Fx sidde ved computer eller skrivebord, sidde i møde, siddende kontorarbejde, sidde og spise.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>D</b> 	Fx stå eller slentre omkring. Vaske op, lave mad, køre bil (som fører).	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>E</b> 	Fx let rengøring, feje gulv, danse (langsomt), gå med indkøbsvogn eller barnevogn, gå ned ad trapper.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>F</b> 	Fx at cykle i moderat tempo, gå i hurtigt tempo, male og tapetsere.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>G</b> 	Fx let havearbejde, bære og stable træ, bære småting op ad trappe.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>H</b> 	Fx aerobics eller fitness-træning, hugge brænde, grave eller skovle sne.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10
<b>I</b> 	Aktiviteter som er mere anstrengende end niveau H, fx at løbe eller jogge, cykle i hurtigt tempo, fodbold, håndbold, tennis.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 15 30 45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10

**40,2**  
**METs**



## Material and Methods

- **Face and content validity** was assessed by interviews with 10 volunteer men and women from the one year follow-up of the Inter 99 study.
- **Criterion validity** was assessed against four weekdays of accelerometry (CSA 7164) and activity diary in 40 volunteer men and women, recruited through newspaper advertisement.



## **Material and Methods**

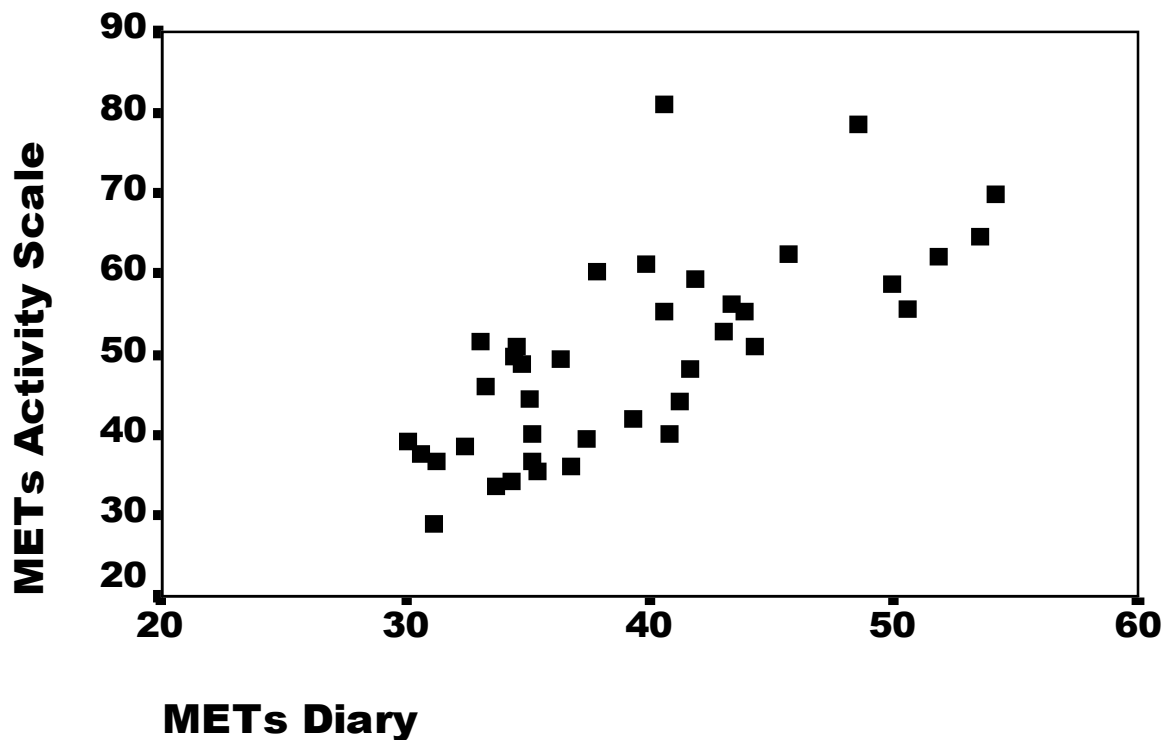
- The activity scale was applied in the 3 year follow-up of the Inter 99 study: the first 619 consecutive men and women.
- The Inter 99 study is a population-based intervention study of 13.016 men and women between 30 and 60 years of age, randomly selected from Copenhagen County and invited for risk assessment for ischaemic heart disease by PRECARD®



# Results

Correlation Activity Scale and Diary

$r=0.74$



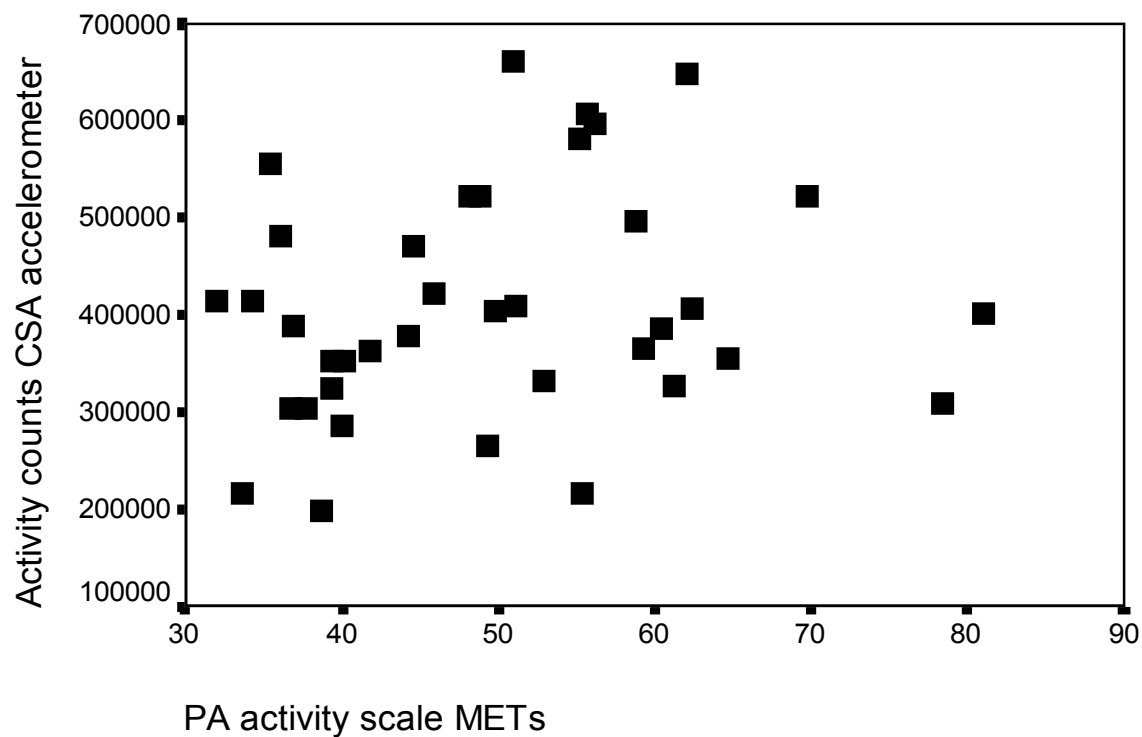
**N=39**



# Results

Correlation accelerometer and PA scale

$r = 0.20$



**N=39**



# Results

## Three year follow-up "Inter 99"

**N=619**

<b>Biological Variables</b>	<b>Men (n=297)</b>	<b>Women (n=322)</b>
<b>BMI</b> mean/SD	<b>28.0</b> (4.5)	<b>27.8</b> (6.4)
<b>Waist</b> mean/SD	<b>96 cm</b> (11.7)	<b>86 cm</b> (14.5)
<b>Systolic BP</b> mean/SD	<b>133</b> (17)	<b>129</b> (17)
<b>Diastolic BP</b> mean/SD	<b>86</b> (12)	<b>82</b> (11)
<b>Cholesterol</b> mean/SD	<b>5.7</b> (1.1)	<b>5.7</b> (1.1)
<b>HDL</b> mean/SD	<b>1.3</b> (0.4)	<b>1.6</b> (0.4)
<b>LDL</b> mean/SD	<b>3.6</b> (1.0)	<b>3.5</b> (1.0)



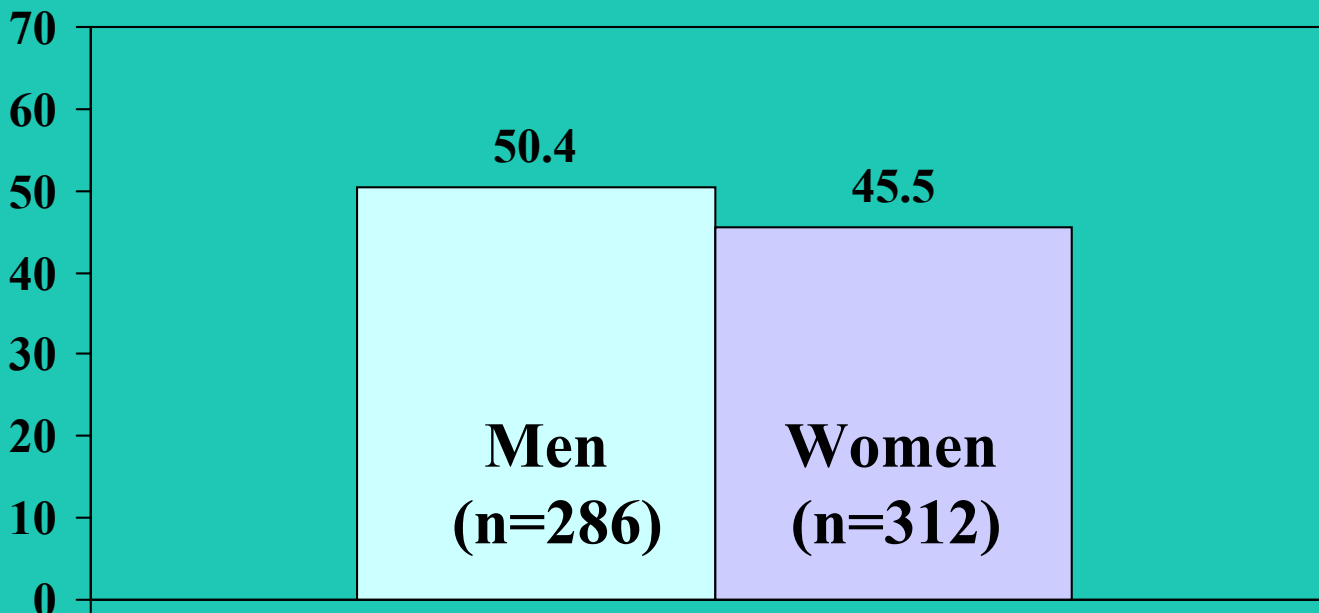
# Results

## Physical activity level

Mean 24 hour MET-time

**P=0.000**

**METs**





# Statistical analysis

## Linear regression models

- **Independent variables**

- 24-hour MET-time  
(as linear variable)
- Sex/Age/Smoking  
status

- **Outcome variables**

- Cholesterol (Total/HDL)
- Blood pressure  
(Systolic/diastolic)
- Body mass index
- Waist circumference



# Results

Dependent variable: Total cholesterol /HDL

<b>Variables</b>	<b>Parameter estimates</b> $\beta$	<b>P-value</b>
<b>Total MET-time</b>	0,002585 (Total)	0,498
<b>Total MET-time</b>	0,003346 (HDL)	0,027

Adjusted for sex, age and current smoking status.



# Results

Dependent variable: Systolic/diastolic BP

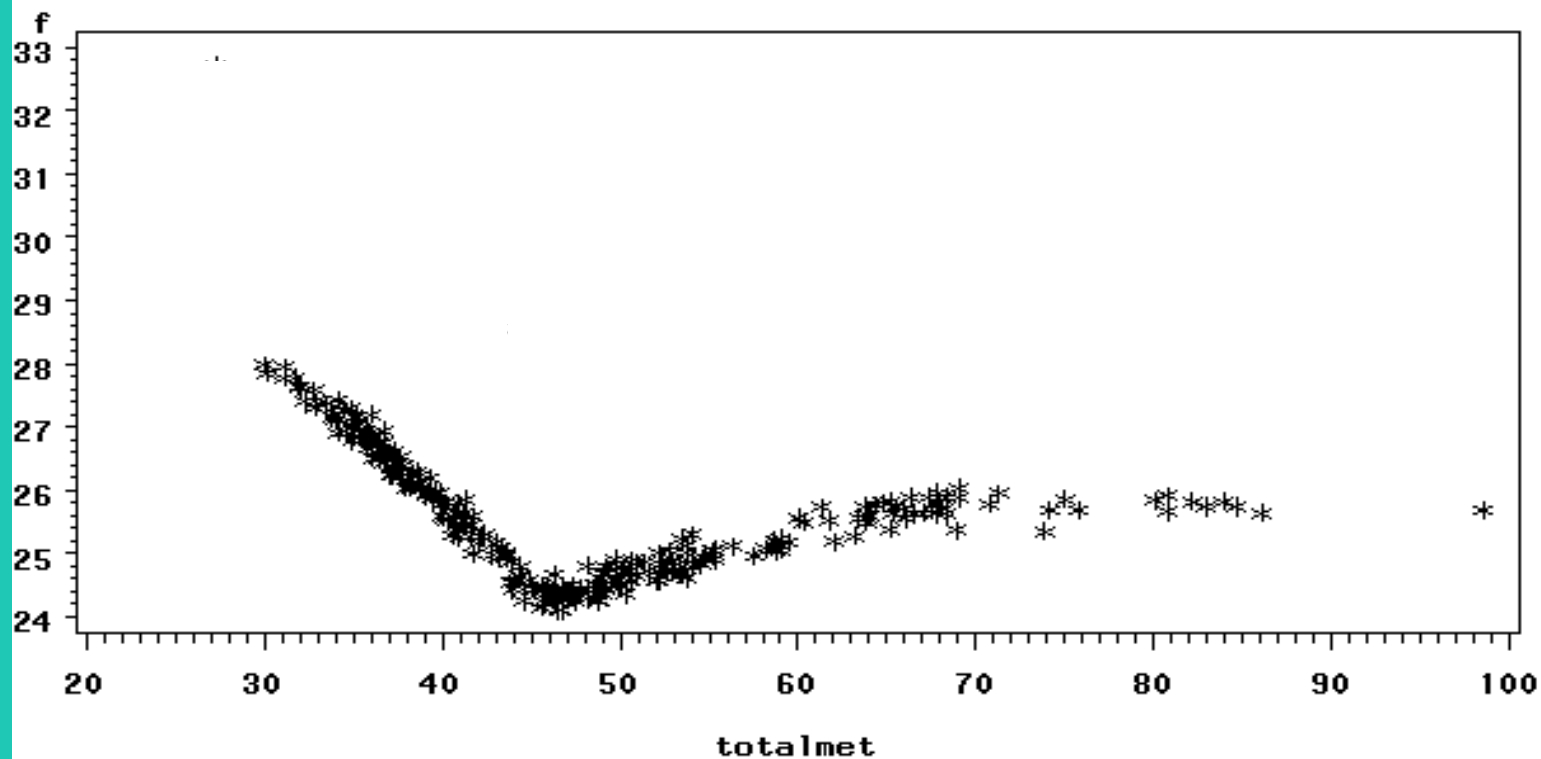
<b>Variables</b>	<b>Parameter estimates <math>\beta</math></b>	<b>P-value</b>
<b>Total MET-time</b>	0,01190 (systolic)	0,832
<b>Total MET-time</b>	-0,03067 (diastolic)	0,407

Adjusted for sex, age and current smoking status.



# Results

Linear spline: Body mass index





# Results

Dependent variable: Body mass index

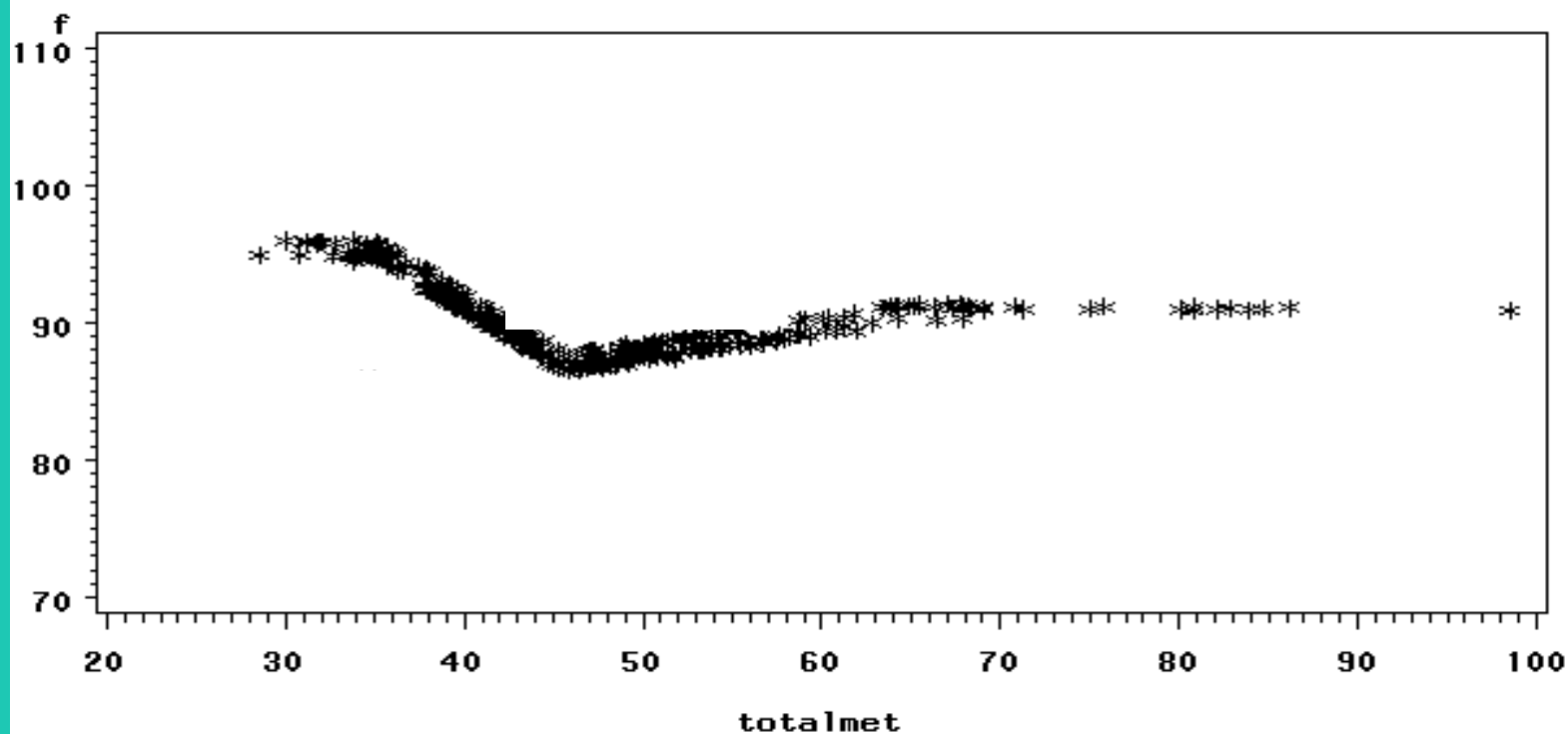
<b>Variables</b>	<b>Parameter estimates</b> $\beta$	<b>P-value</b>
<b>Total MET&lt;45</b> (N=287)	-0,288	0,001
<b>Total MET<math>\geq</math>45</b> (N=311)	0,002732	0,351

Adjusted for sex, age and current smoking status.



# Results

## Linear spline: Waist circumference





# Results

Dependent variable: Waist Circumference

<b>Variables</b>	<b>Parameter estimates</b> $\beta$	<b>P-value</b>
<b>Total MET &lt; 45</b> (N=287)	-0,830	0,000
<b>Total MET <math>\geq</math> 45</b> (N=311)	0,008287	0,266

Adjusted for sex, age and current smoking status.



## Conclusion

- The new physical activity scale appears to be a simple and valid alternative to measuring physical activity by diary.
- Further research into test-retest reliability, seasonal variation and validity should be carried out.



## Conclusion

- Selected "risk" population
- Physical activity level positively associated with HDL, inversely associated with BMI and waist circumference in sedentary to moderately active adult men and women (up to 45 METs).
- Findings should be tested in larger population sample.

*Thank you!*