Follow-up of the Finnish Diabetes Prevention Study

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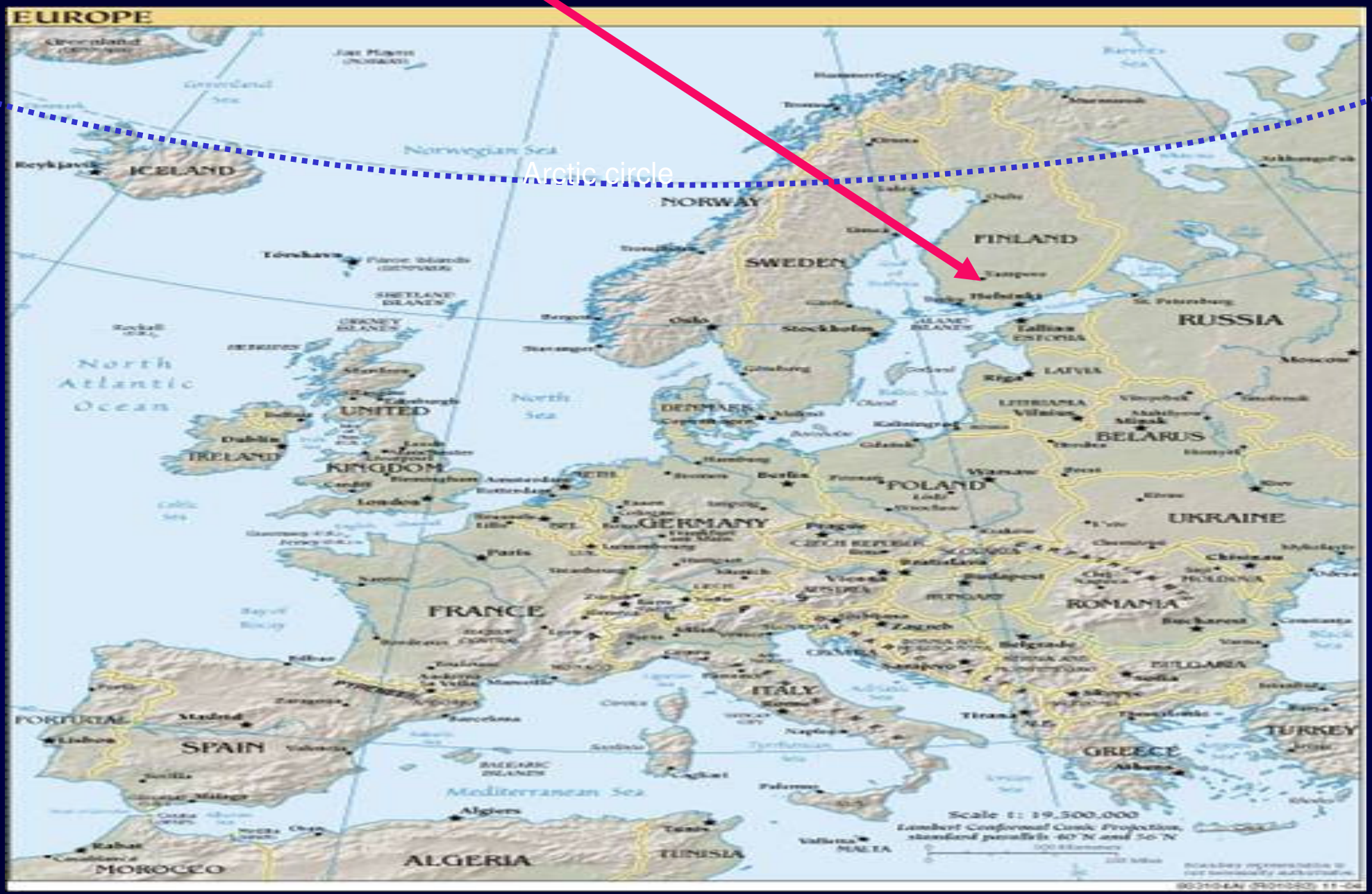

EUROPE
Arctic circle
ICELAND
NORWAY
SWEDEN
FINLAND
RUSSIA
North Atlantic Ocean
Norwegian Sea
North Sea
Baltic Sea
Mediterranean Sea
UNITED KINGDOM
IRELAND
DENMARK
LATVIA
BELARUS
POLAND
GERMANY
UKRAINE
FRANCE
ROMANIA
ITALY
SPAIN
PORTUGAL
GREECE
TURKEY
ALGERIA
TUNISIA
MOROCCO
Scale 1: 19,500,000

DPS: The Finnish Diabetes Prevention Study

The main aim:

To determine whether lifestyle intervention of overweight, middle-aged subjects with impaired glucose tolerance (IGT) will prevent or delay the development of type 2 diabetes

Study subjects:

- 522 subjects with IGT in two oral glucose tolerance tests
- Age 40–65 years
- BMI > 25 kg/m^2
- control group or intensive lifestyle intervention group

Tuomilehto et al. N Engl J Med 2001; 344:1343

DPS:Lifestyle goals

- Weight reduction > 5%
- Fat intake < 30 E%
- Saturated fat intake < 10 E%
- Fiber intake ≥ 15 g/1000 kcal
- Physical activity >30 min/day

Intervention group

- Individually tailored diet based on 3-day food diaries
- 7 dietary counselling sessions during the 1st year, every 3 months thereafter
- Free-of-charge gym

Control group

- General advice about healthy diet and exercise habits
- No individualized counselling

Lindström et al.
Diabetes Care 2003; 26: 3230-3236

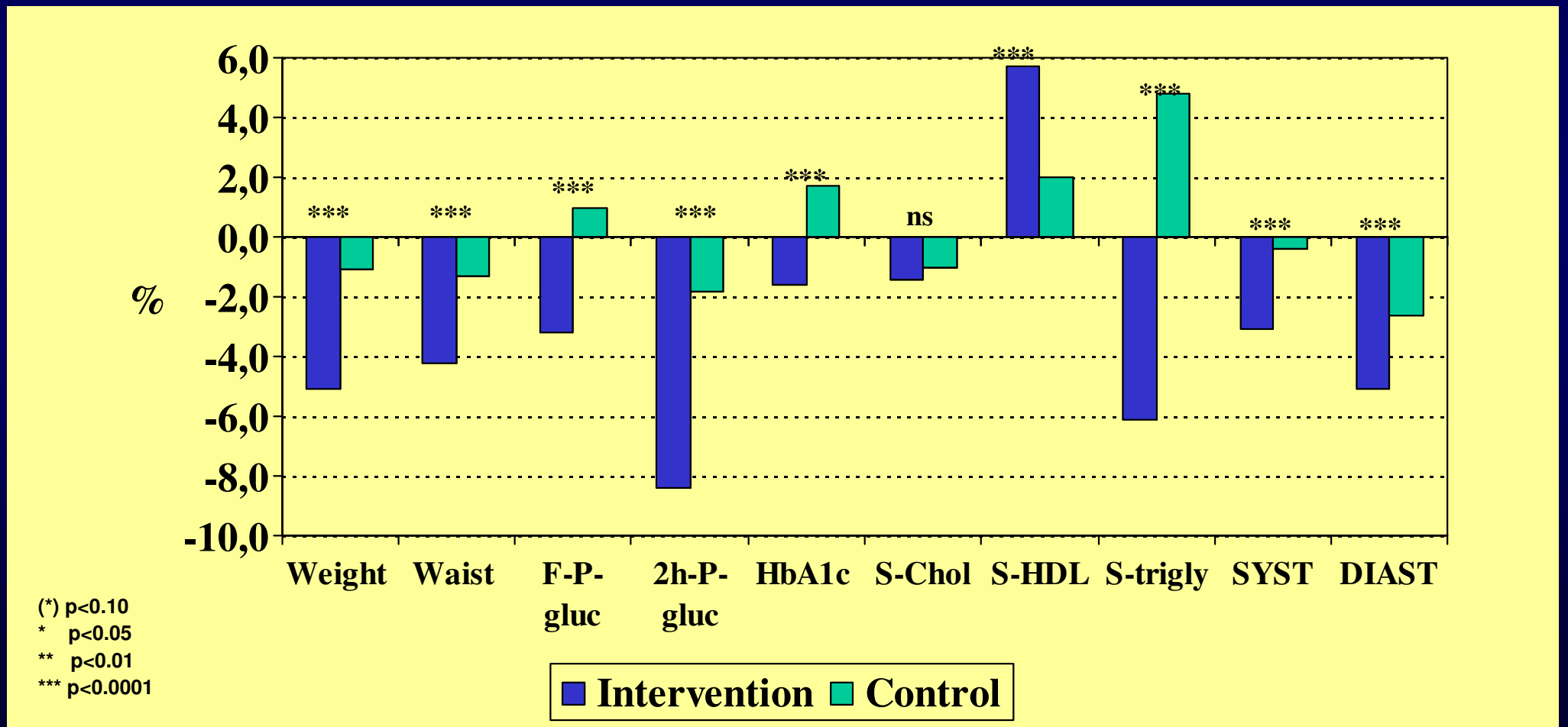
Baseline lifestyle characteristics of the DPS subjects

		Recommendation
Dietary carbohydrates (E%)	43 ± 7	50 - 60
Dietary protein (E%)	18 ± 3	10-20
Dietary total fat (E%)	37 ± 7	< 30
Dietary saturated fat (E%)	17 ± 4	< 10
Dietary fibre (g / 1000 kcal)	12 ± 4	≥ 15
Physical activity (h/week)		
- total	5.7	
- moderate or vigorous	2.7	> 4

Leisure time physical activity at baseline and at year 1 in the intervention (I) and control (C) groups

	Baseline		Year 1	
	I	C	I	C
	%	%	%	%
None	34	32	14	30
Light	56	58	60	57
Moderate or heavy	10	10	26	13
p-value	0.892		0.001	

Changes (%) in clinical and metabolic parameters from baseline to year 1

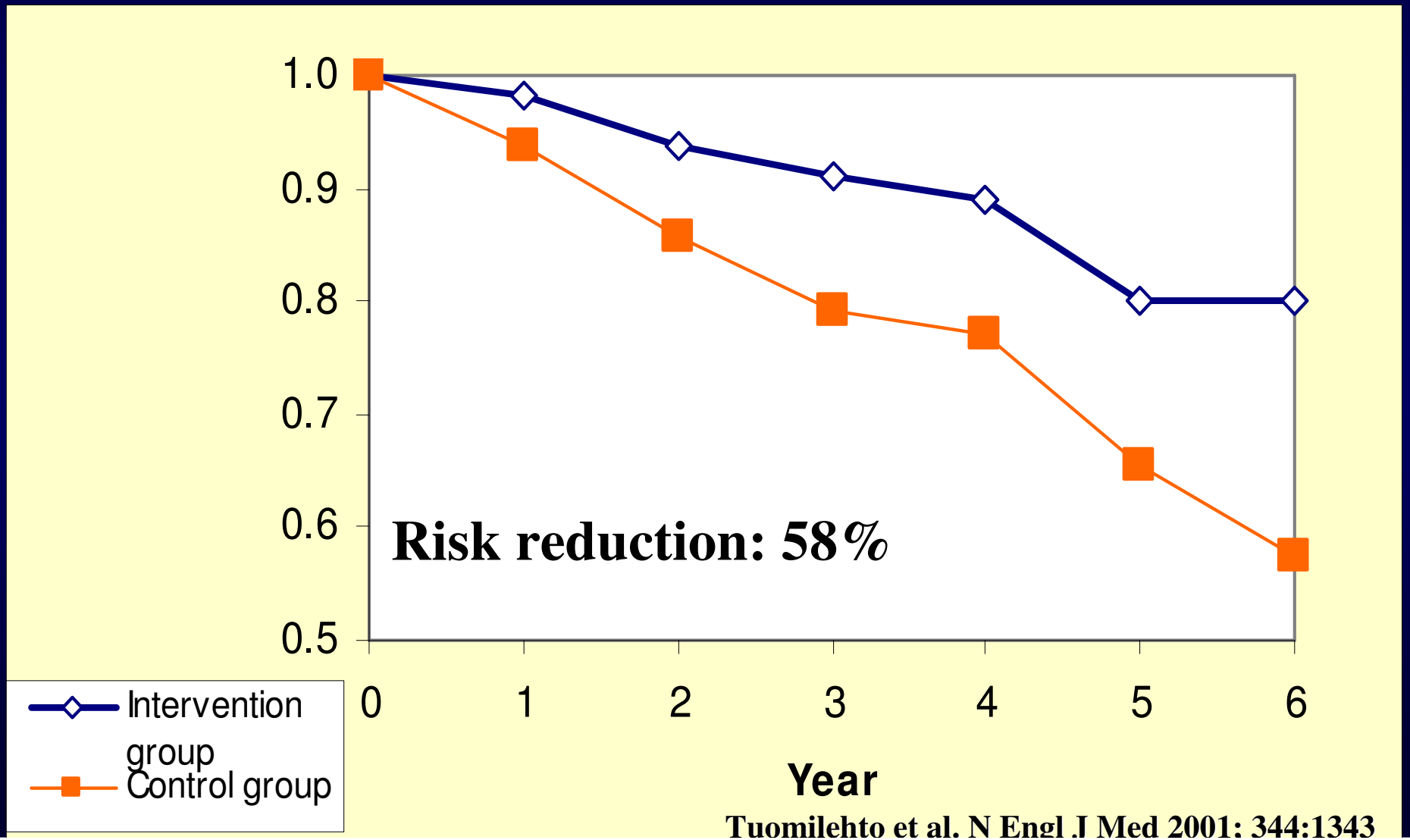


(*) p<0.10
* p<0.05
** p<0.01
*** p<0.0001

DPS - Interim analysis of end-points

- The first participants were raqndomised in 1993.
- The study was estimated to last for 6 years.
- 160 cases of diabetes was expected to occur.
- An interim analysis by randomization group was planned when 80 cases of diabetes had been accumulated.
- The analysis was carried out by an independent statistician .
- The median follow-up time at the time of the interim analysis was 3.2 years (range 1-6 years)

Development of diabetes during the lifestyle intervention in the intervention and control groups - DPS

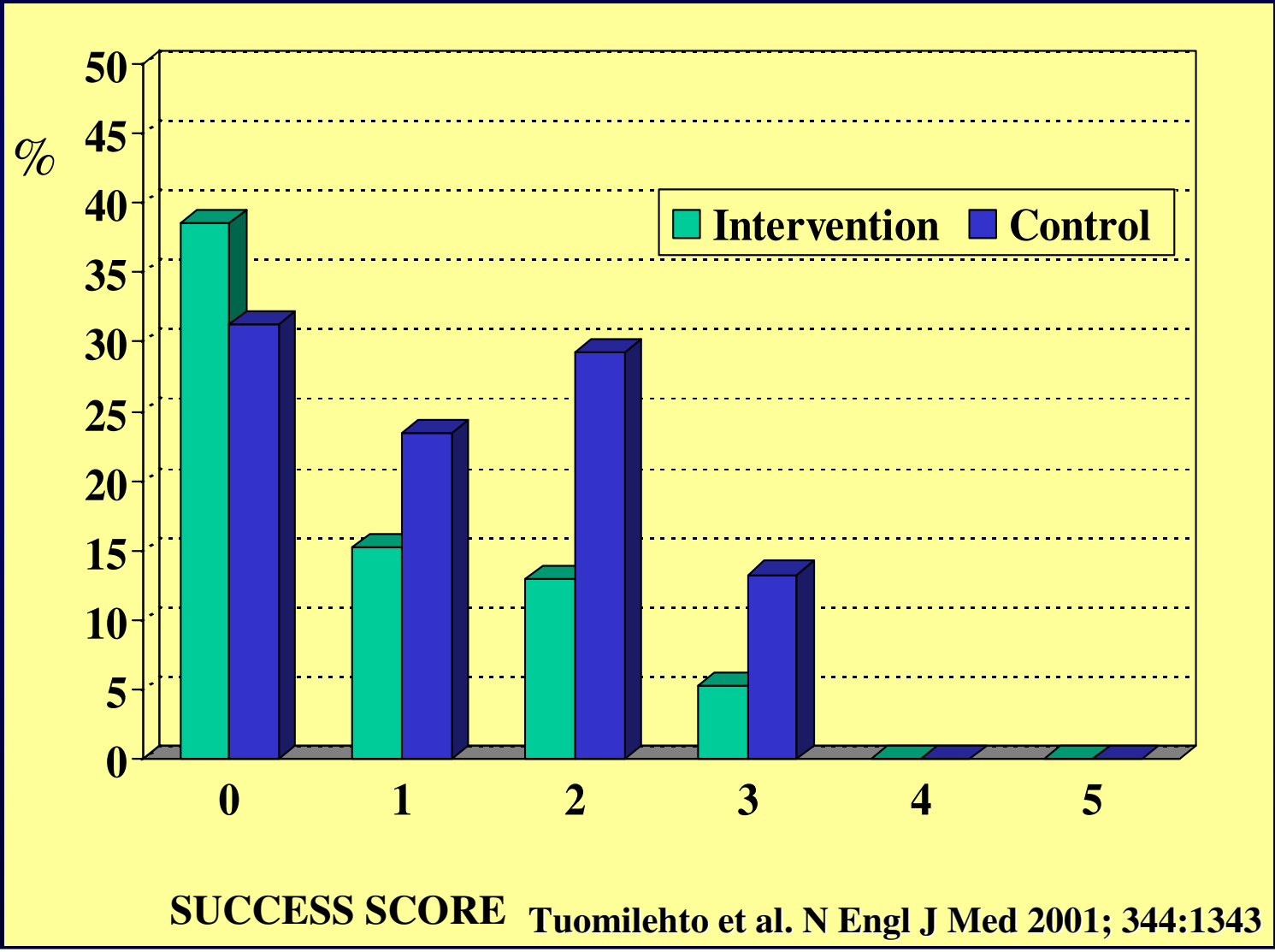


Tuomilehto et al. N Engl J Med 2001; 344:1343

Reduction in diabetes risk when achieving the specific lifestyle target - DPS

TARGET	ALL SUBJECTS Odds Ratio (95% CI)	Risk reduction (%)
Weight loss >5%	0.34 (0.12-0.50)	66 %
Total Fat < 30E%	0.47 (0.28-0.81)	53 %
Saturated Fat < 10 E%	0.46 (0.16-0.81)	54 %
Fiber > 15 g/1000 kcal	0.29 (0.12-0.69)	71 %
Exercise >4h/week	0.38 (0.23-0.64)	62 %

Proportion of subjects becoming diabetic by success in achieving the intervention targets at one-year examination - DPS



Tuomilehto et al. N Engl J Med 2001; 344:1343

DPS FOLLOW-UP STUDY: THE MAIN AIM

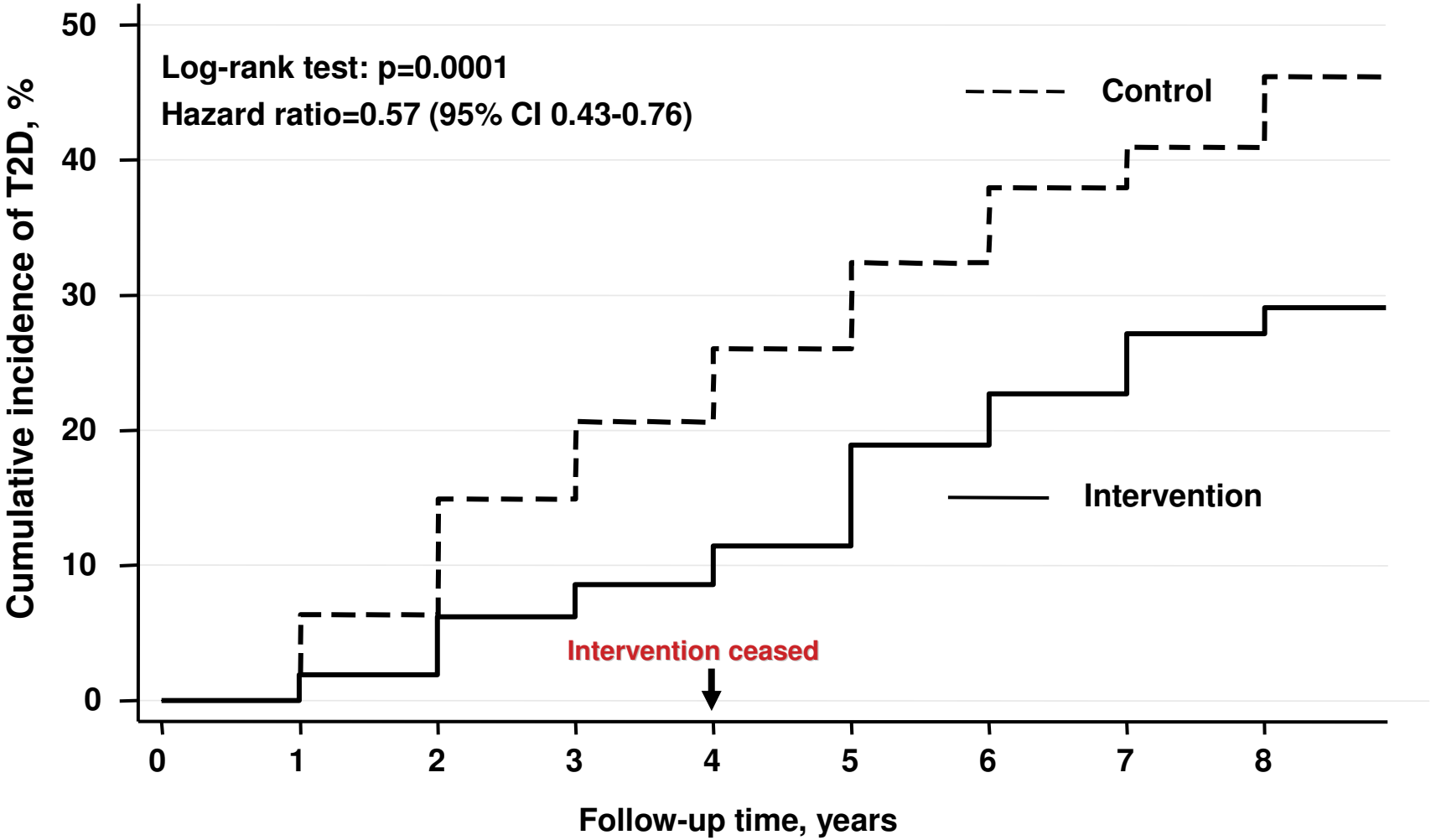
1. To determine whether lifestyle guidance of overweight, middle-aged subjects with impaired glucose tolerance (IGT) will

prevent or delay

the development of type 2 diabetes in long run.

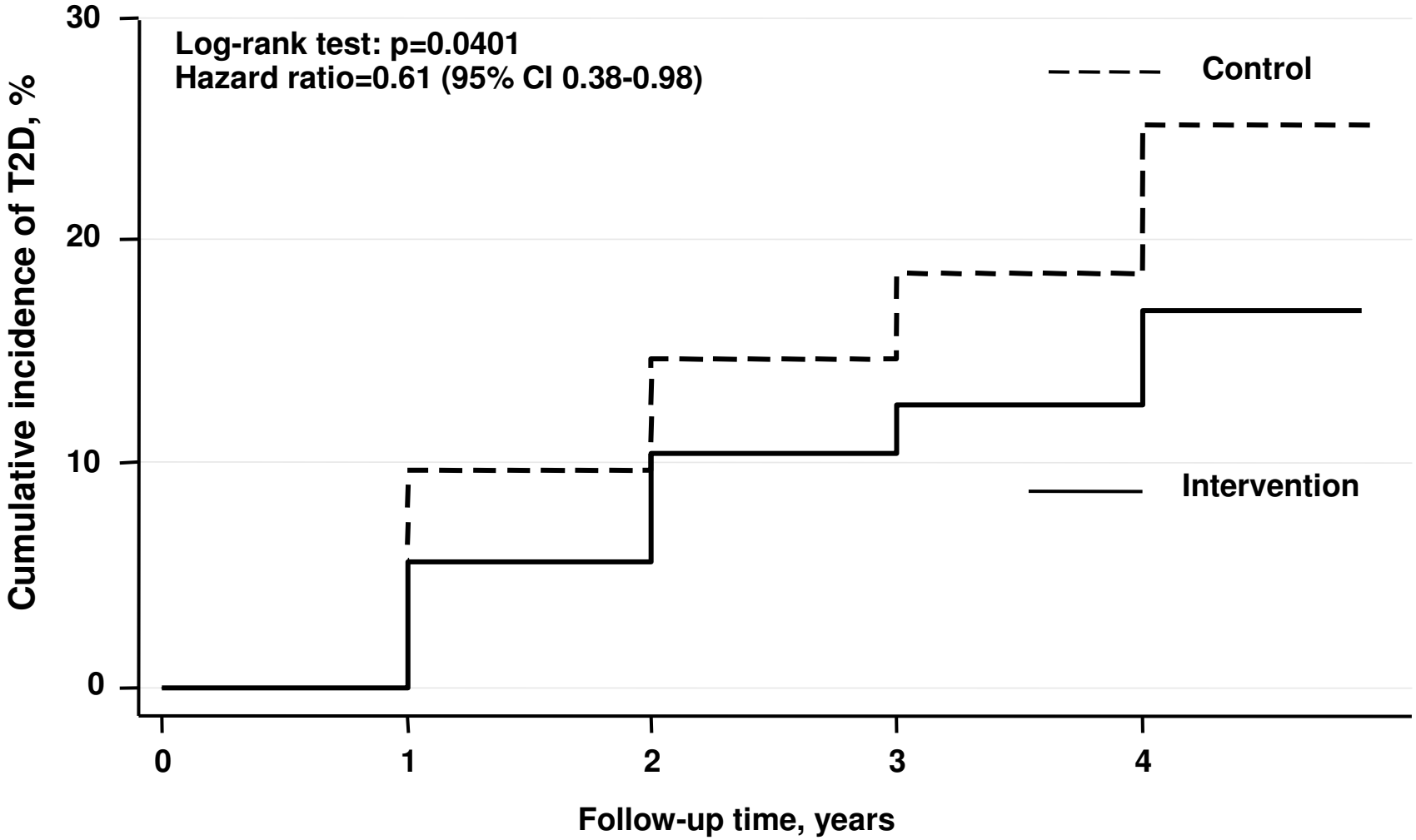
2. To determine the incidence of cardiovascular events and other complications of hyperglycaemia.

DPS: Diabetes incidence by the randomization group during the total extended follow-up period



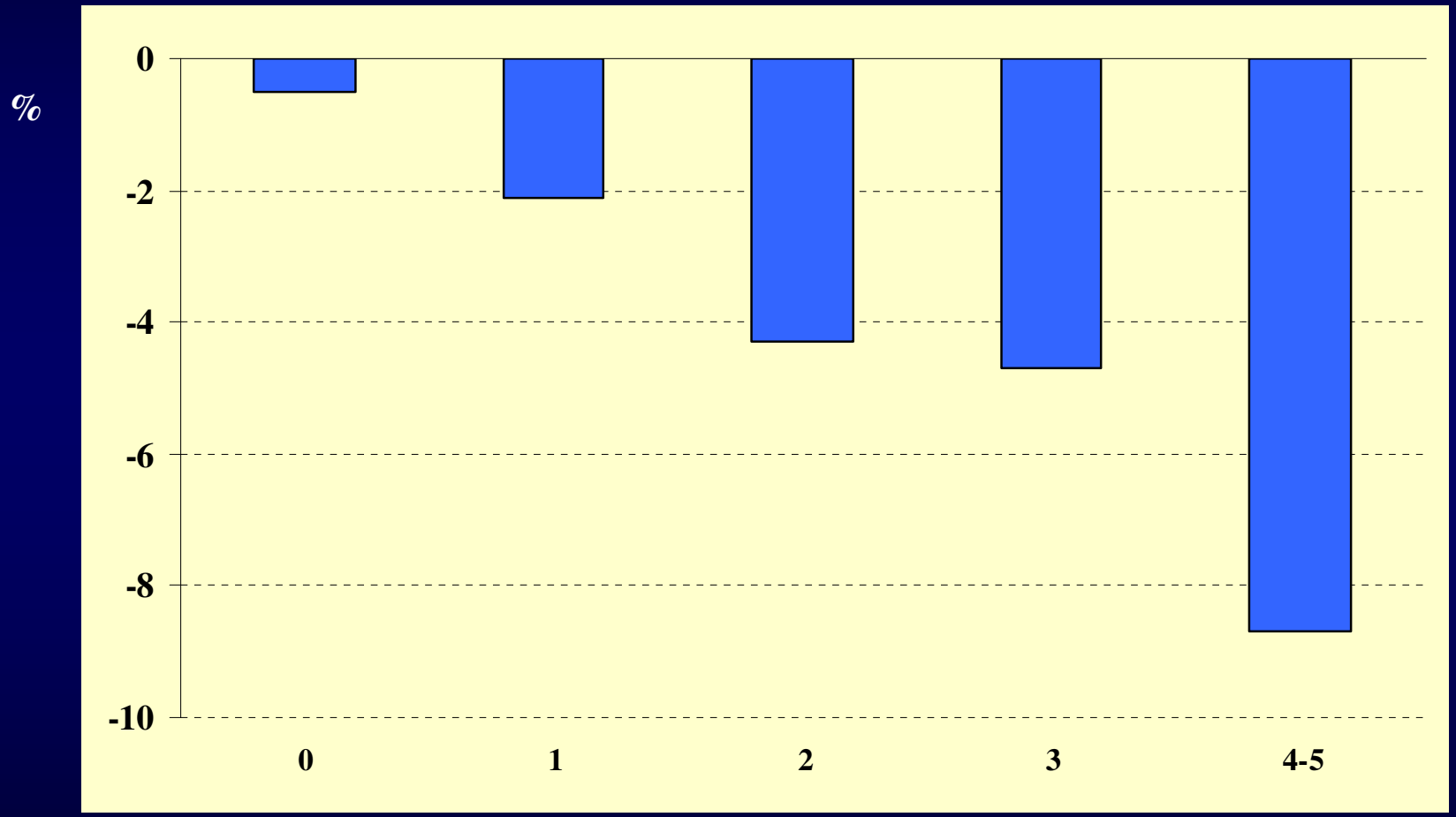
Lindström et. al. *Lancet* 2006;368:1673-79

DPS : Diabetes incidence by the randomisation group during the post-intervention follow-up period



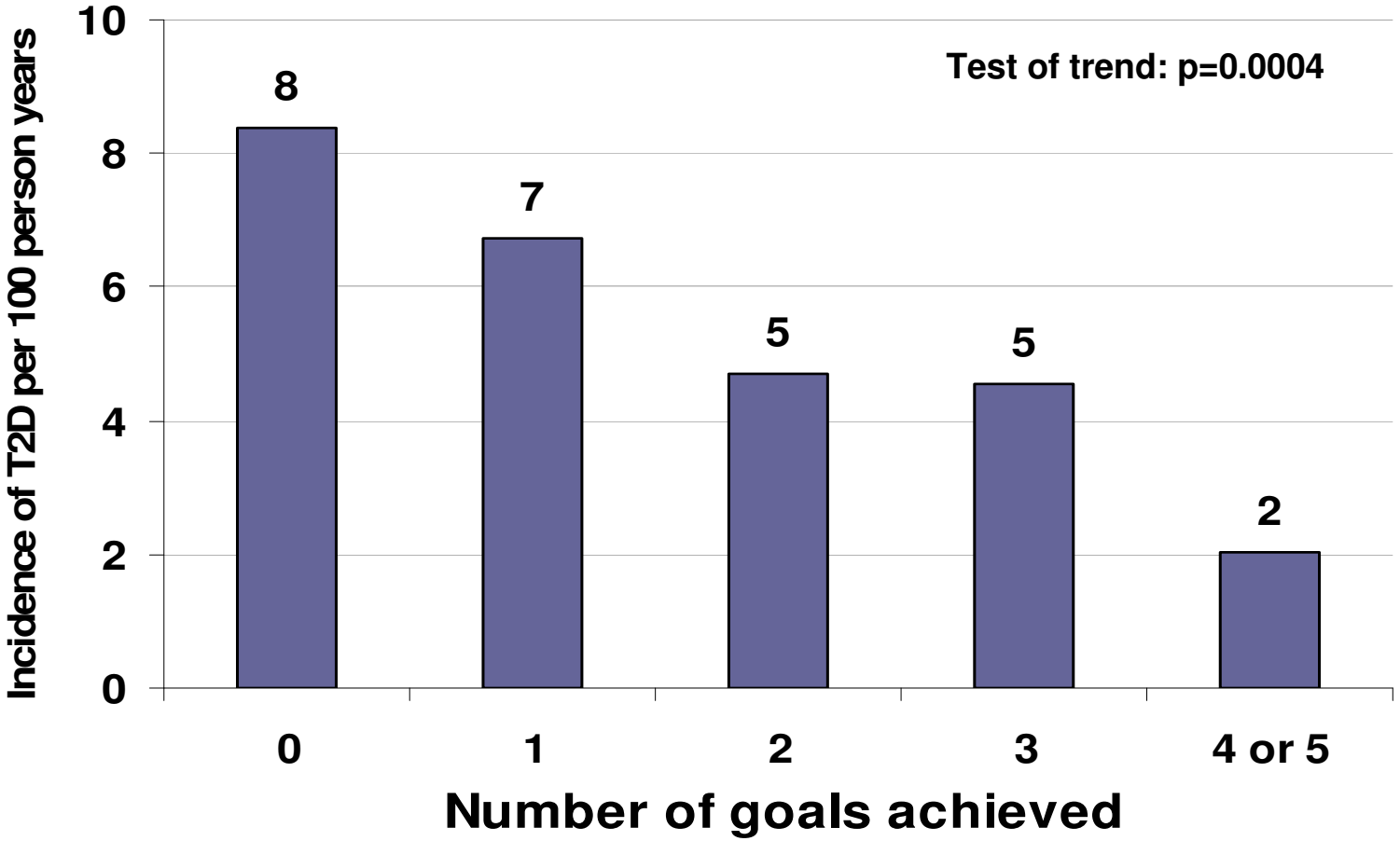
Lindström et. al. *Lancet* 2006;368:1673-79

Weight reduction (%) from baseline by success score (number of intervention goals achieved) at year 3 -DPS



Lancet 2006:368;1673-79

DPS study: Diabetes incidence by success score (number of intervention goals achieved) at year 3



Lindström et. al. *Lancet* 2006

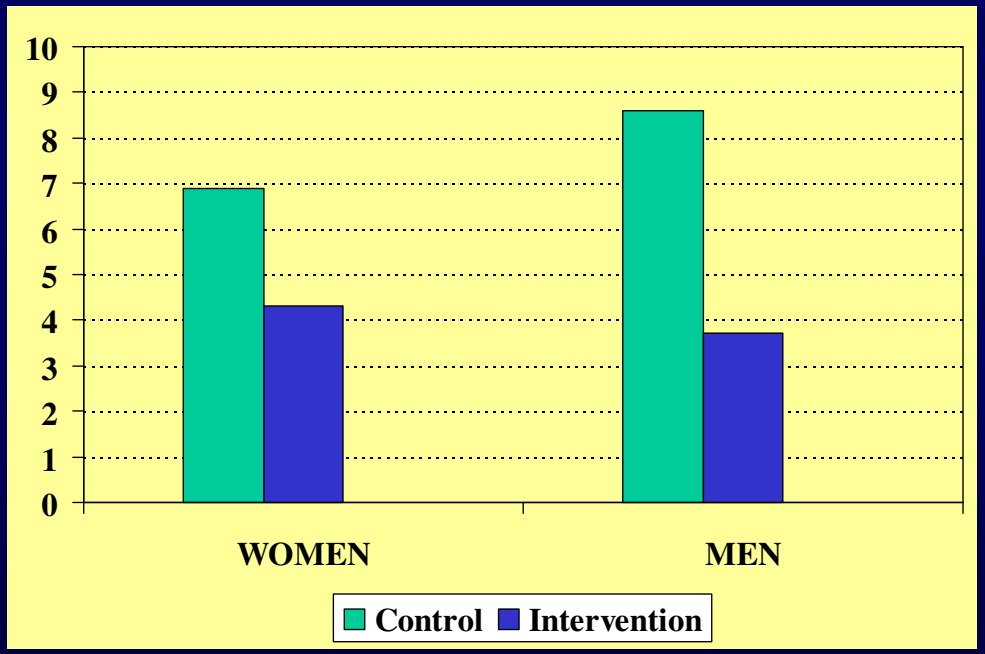
DPS study: Proportion (%) of persons achieving predefined intervention goals

Number of Goals Control	3-year F-U Intervention	3-year F-U Control	1st post-intervention F-U* Intervention	1st post-intervention F-U* Control
0	10	27	7	14
1	31	41	32	40
2	24	22	24	25
3	21	5	19	14
4-5	14	6	18	7
P-value	<0.0001		0.0042	

* excluding diabetics during intervention period.

Lindström et. al. *Lancet* 2006

DPS: Diabetes in the Intervention vs. Control group by sex

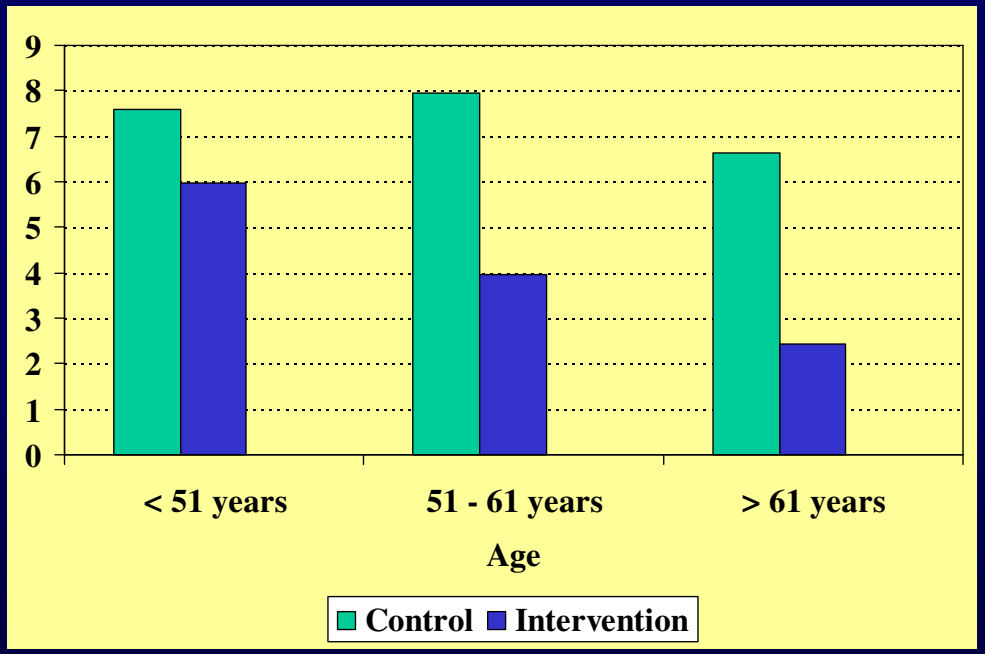


Incidence rate per 100 person-years

Hazard ratio

Lindström et al. Diabetes Care 2008

DPS: Diabetes in the Intervention vs. Control group by age



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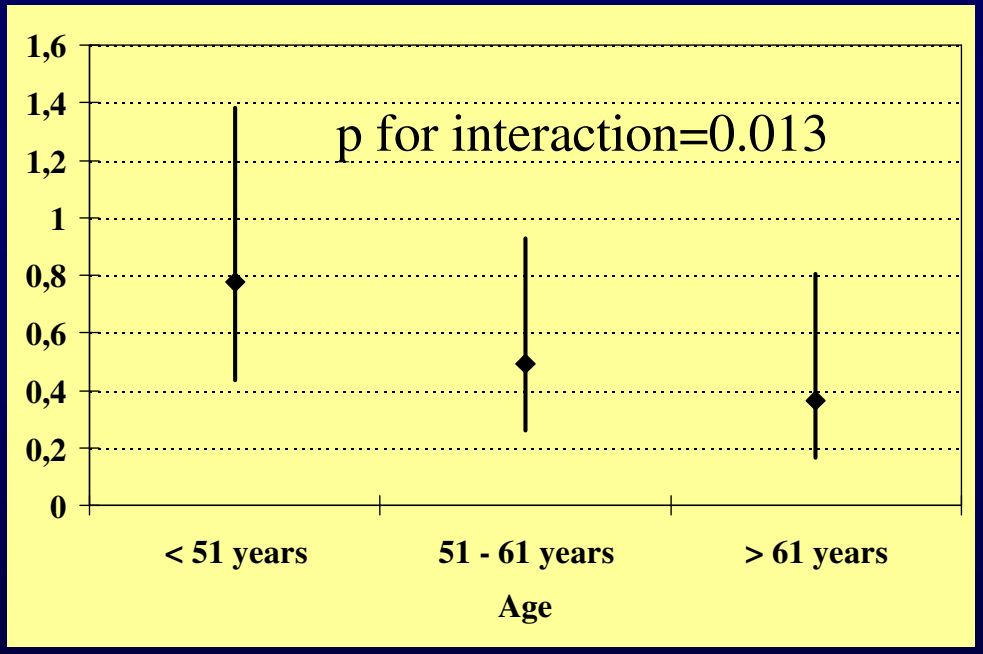
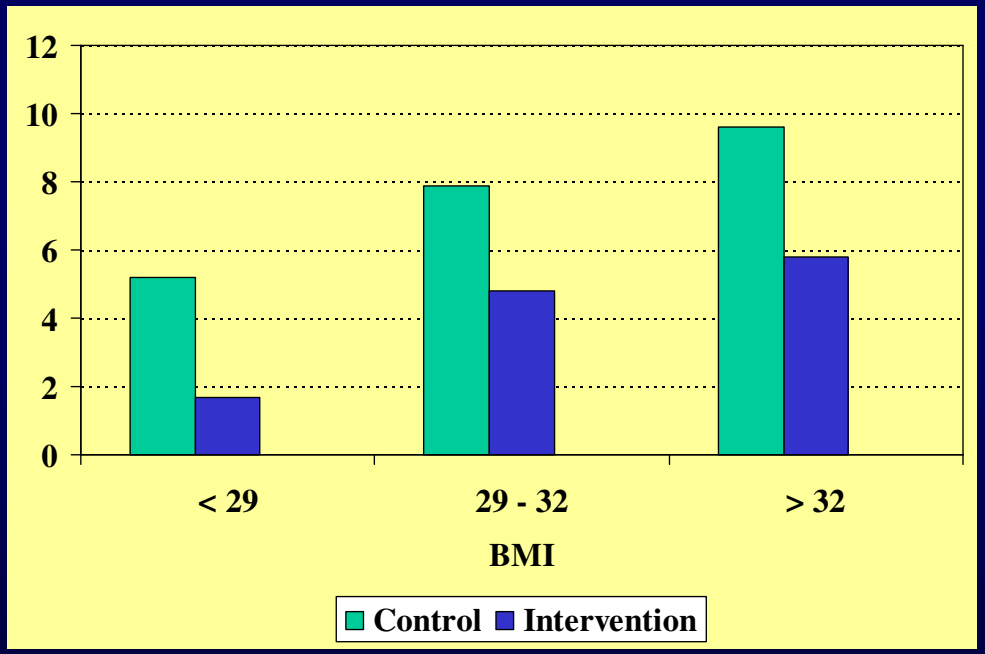


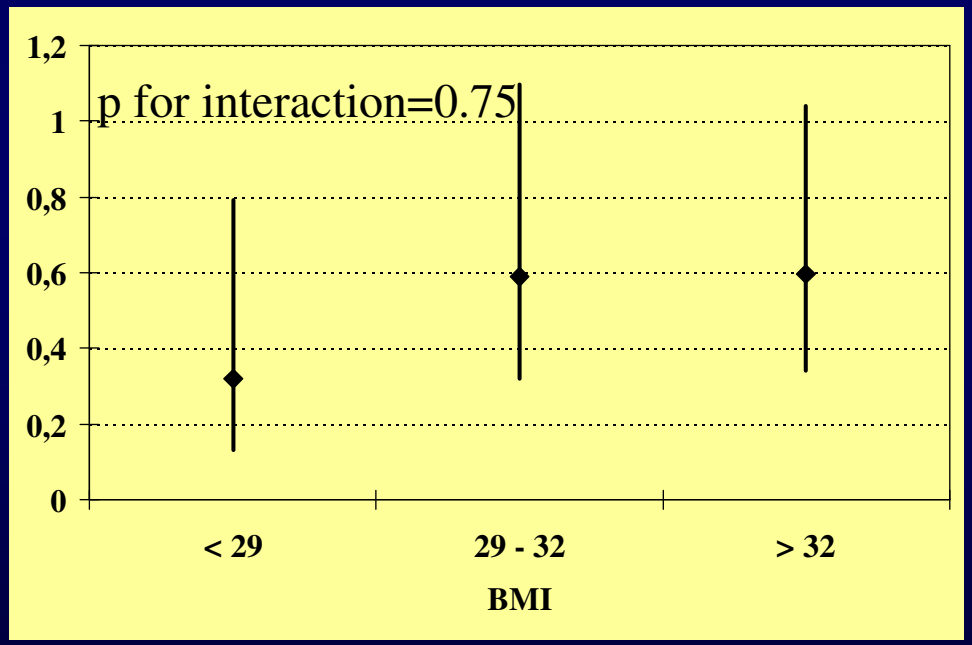
Hazard ratio

Lindström et al. Diabetes Care 2008

DPS: Diabetes in the Intervention vs. Control group by baseline BMI



Incidence rate per 100 person-years



Hazard ratio

Lindström et al. Diabetes Care 2008

People at risk of type 2 diabetes –

How to find them?

FINnish Diabetes RIsk SCore

FINDRISC

n=509
Score range 1-24 p

Median score among the DPS participants: 13
men:12, women:14

Lindström et al.
Diabetes Care 2003; 26: 725-731

Finnish Diabetes Association

TYPE 2 DIABETES RISK ASSESSMENT FORM

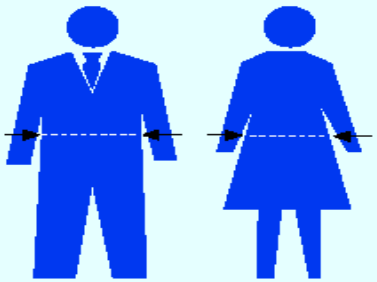
Circle the right alternative and add up your points.

1. Age
0 p. Under 45 years
2 p. 45–54 years
3 p. 55–64 years
4 p. Over 64 years

2. Body-mass index
(See reverse of form)
0 p. Lower than 25 kg/m²
1 p. 25–30 kg/m²
3 p. Higher than 30 kg/m²

3. Waist circumference measured below the ribs (usually at the level of the navel)

	MEN	WOMEN
0 p.	Less than 94 cm	Less than 80 cm
3 p.	94–102 cm	80–88 cm
4 p.	More than 102 cm	More than 88 cm



4. Do you usually have daily at least 30 minutes of physical activity at work and/or during leisure time (including normal daily activity)?
0 p. Yes
2 p. No

5. How often do you eat vegetables, fruit or berries?
0 p. Every day
1 p. Not every day

6. Have you ever taken antihypertensive medication regularly?
0 p. No
2 p. Yes

7. Have you ever been found to have high blood glucose (eg in a health examination, during an illness, during pregnancy)?
0 p. No
5 p. Yes

8. Have any of the members of your immediate family or other relatives been diagnosed with diabetes (type 1 or type 2)?
0 p. No
3 p. Yes: grandparent, aunt, uncle or first cousin (but no own parent, brother, sister or child)
5 p. Yes: parent, brother, sister or own child

Total Risk Score
The risk of developing type 2 diabetes within 10 years is

Lower than 7	Low: estimated 1 in 100 will develop disease
7–11	Slightly elevated: estimated 1 in 25 will develop disease
12–14	Moderate: estimated 1 in 6 will develop disease
15–20	High: estimated 1 in 3 will develop disease
Higher than 20	Very high: estimated 1 in 2 will develop disease

Please turn over

Finnish Diabetes Association

ISK ASSESSMENT FORM

your points.

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cm

cm

d/or

daily

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Test designed by Professor Jaakko Tuomilehto, Department of Public Health, Univ

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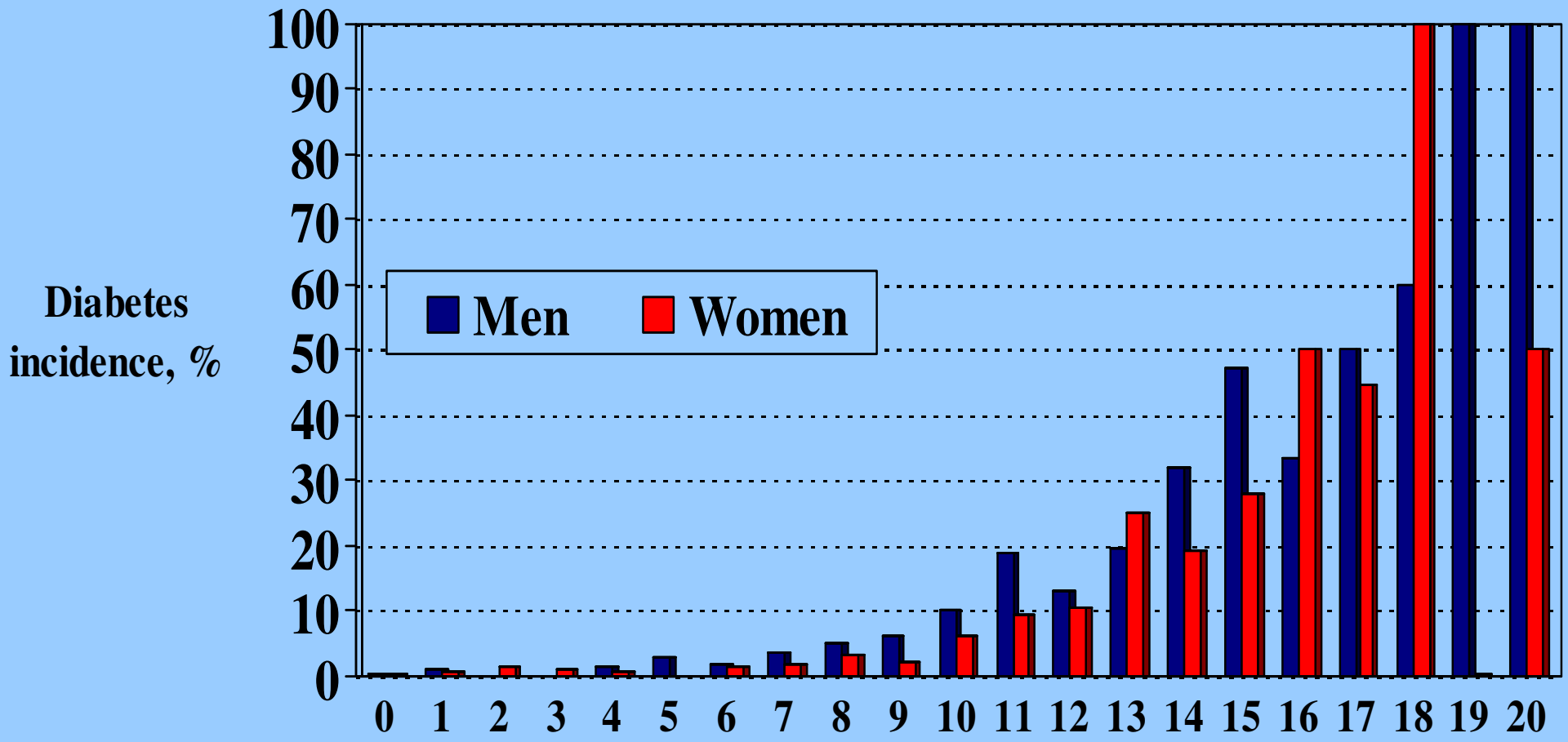
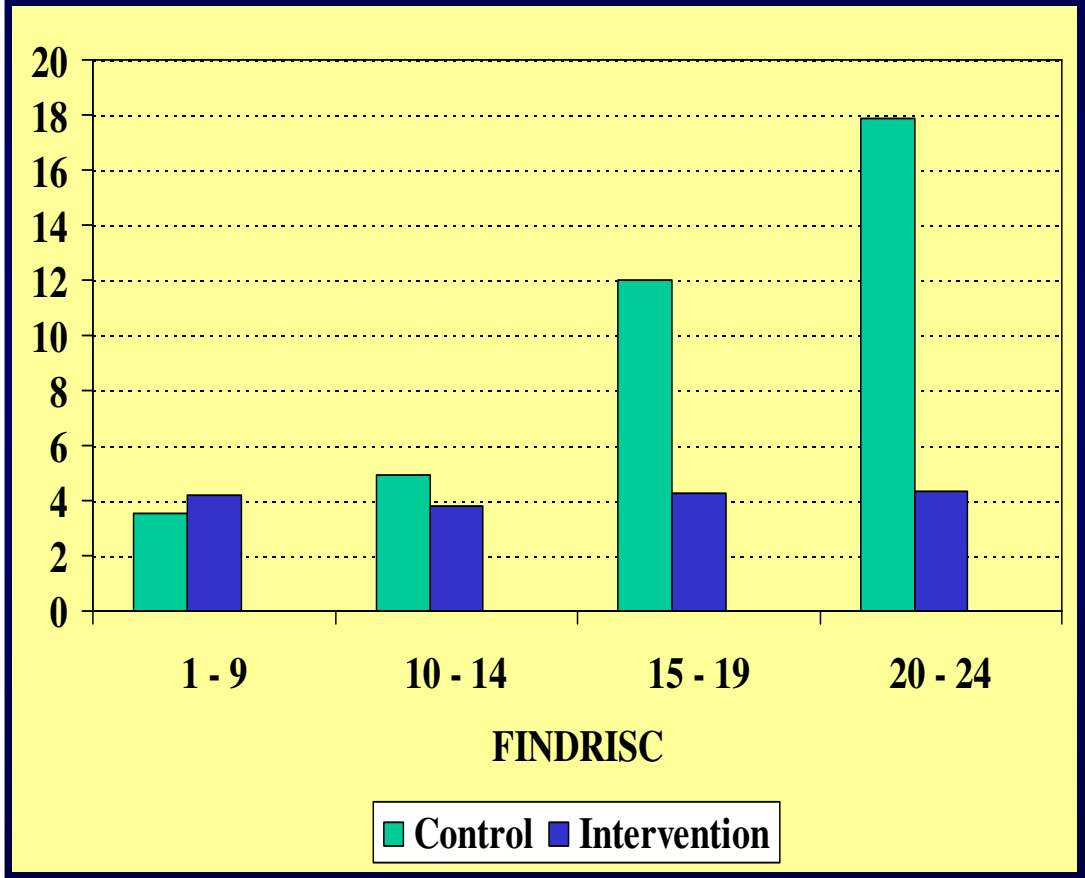
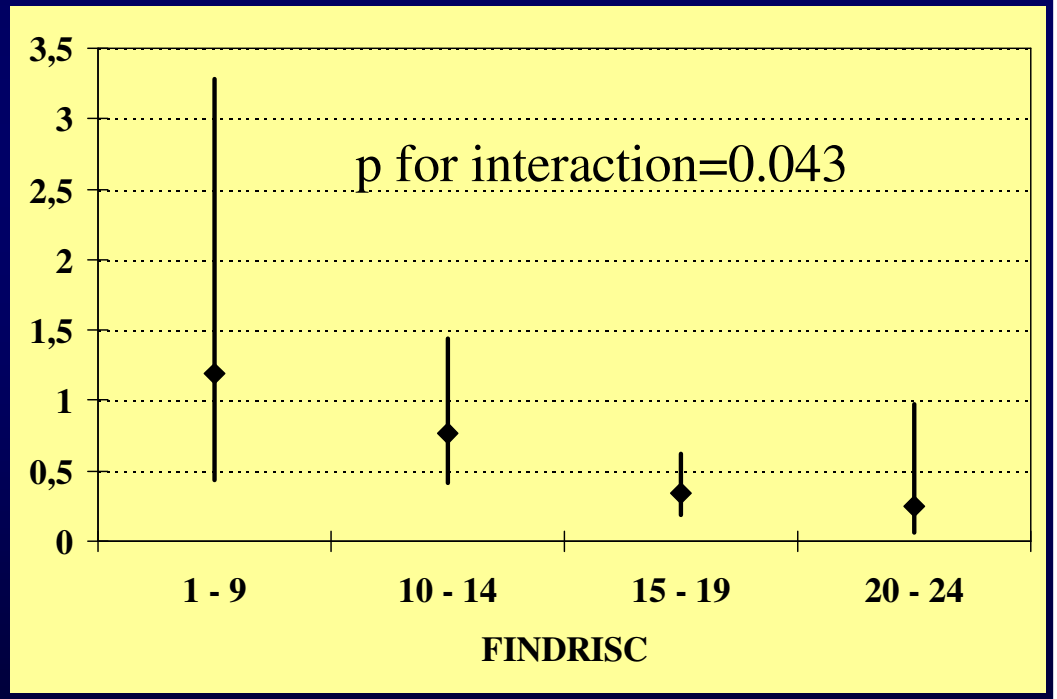
Diabetes incidence during 10-year follow-up by baseline FINDRISC value



DPS: Diabetes in the Intervention vs. Control group by baseline FINDRISC value



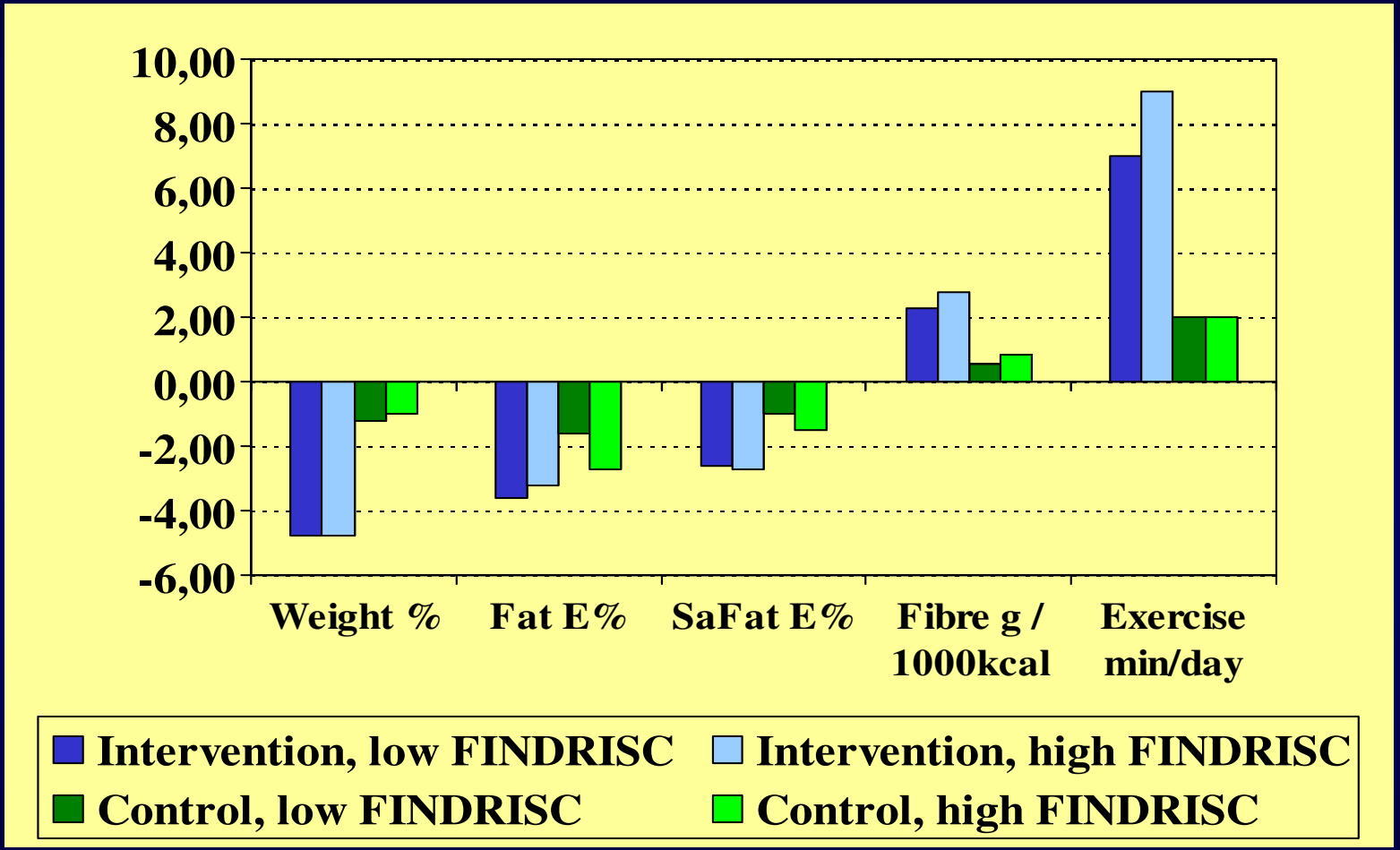
Incidence rate per 100 person-years



Hazard ratio

Lindström et al. Diabetes Care 2008

1-year lifestyle changes in the Intervention and Control groups by FINDRISC



p for interaction (FINDRISC*group) ns for all

The Finnish Diabetes Prevention Study Group

HELSINKI	National Public Health Institute, Diabetes and Genetic Epidemiology Unit
	Jaakko Tuomilehto, Johan Eriksson, Jaana Lindström, Markku Peltonen, Timo Valle, Paula Nyholm, Jouko Sundvall
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	Matti Uusitupa, Anne Louheranta, Martti Hakumäki, Kaija Kettunen, Timo Lakka
TAMPERE	Finnish Diabetes Association and National Public Health Institute
	Pirjo Ilanne-Parikka, Virpi Salminen, Arja Putila, Hilkka Kaisto, Pirjo Lehto
TURKU	Social Insurance Institution, Research and Development Center
	Helena Hämäläinen, Merja Rastas, Sirkka Aunola, Anja Ilmanen
OULU	University of Oulu, Department of Public Health and General Practice; Oulu Deaconess Institute, Department of Sports Medicine
	Sirkka Keinänen-Kiukaanniemi, Marjo Mannelin, Mauri Laakso, Pirjo Härkönen