MRC | Epidemiology Unit

Journee scientifique de l'Alliance sante Quebec

The Cambridge Experience

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www.british-towns.net

Clinical school and hospital

Co-located basic science
MRC Laboratory for Molecular Biology

Biomedical Campus development

Basic science

Metabolic diseases

Population Health

Cancer

Institute of Public Health

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Regional cohort study established at the outset of the Institute

- Unites epidemiology
- Enhances links to basic science
- Links to all disease-specific clinical interests
- Links to local and national health policy
- Unites epidemiology and public health in informing preventive strategies

European Prospective Investigation into Cancer and Nutrition

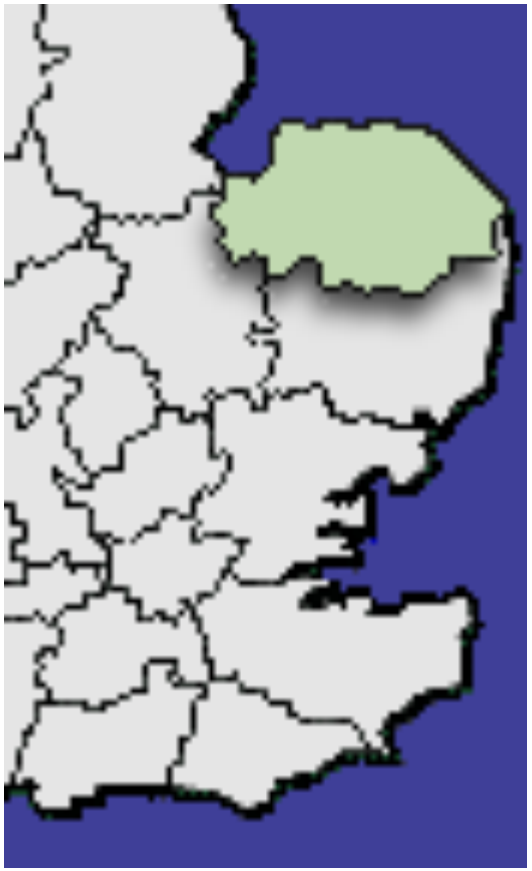
10 country collaboration

500,000 participants

investigate reasons for variations in cancer with a focus on nutrition

UK centres: Oxford
Cambridge

EPIC-Norfolk population study



Aim: to improve health through better understanding of the major determinants health in middle and later life

25,000 men and women 40-79 years from General Practice age-sex registers in Norfolk, UK

Baseline survey 1993-1997

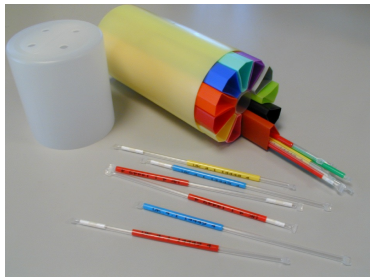
Broad consent

Extensive lifestyle and biologic information

Followed up to present: linkage with health records e.g. Mortality, Cancer Incidence, Hospital admissions, General Practice records.

EPIC-Norfolk: clinic assessments

	Year	Number	Focus
Visit 1	1993-1997	25,000	Cancer, cardiovascular disease
Visit 2	1997-2000	15,000	Bone health
Visit 3	2006-2011	8,000	Vision, physical and mental function
Visit 4	2012-2014	10,000	Body composition



Contributions of prospective cohort studies

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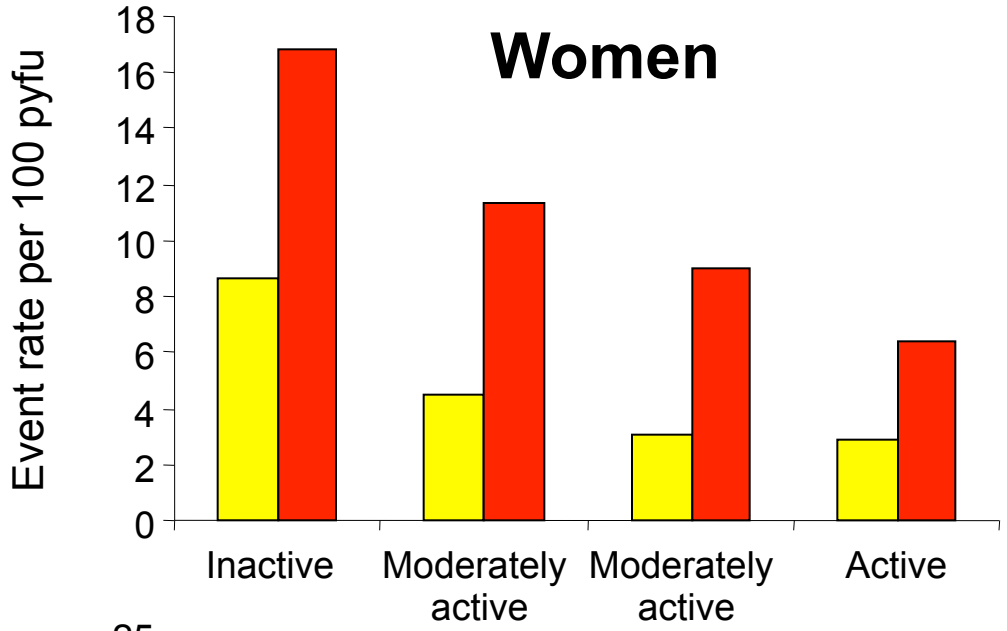
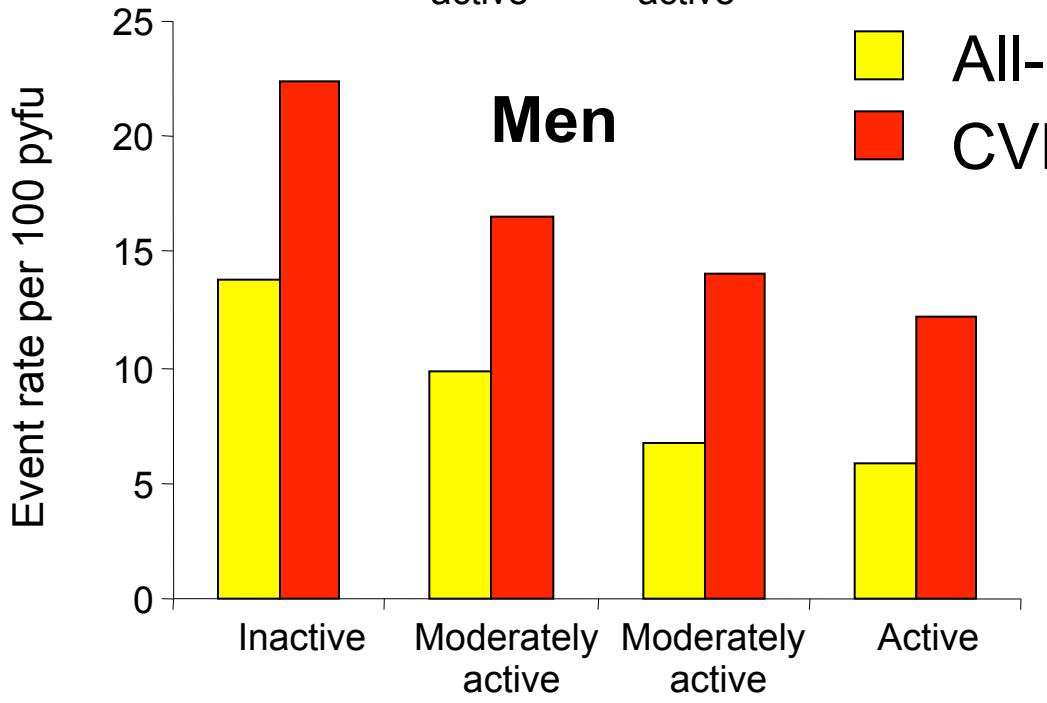




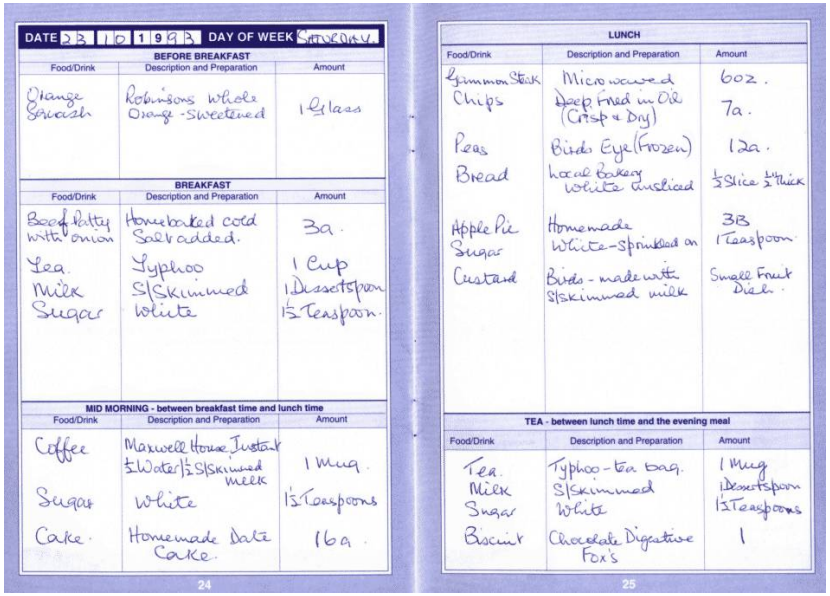
All-cause mortality

CVD incidence

Source: Khaw et al, Int J Epid 2006

More detailed investigation of exposure to disease relationships

A Prospective Study of the Association Between Quantity and Variety of Fruit and Vegetable Intake and Incident Type 2 Diabetes



DATE 23 10 1998 DAY OF WEEK Saturday

BEFORE BREAKFAST

Food/Drink	Description and Preparation	Amount
Orange Squash	Robinsons Whole Orange - Sweetened	1 Glass

BREAKFAST

Food/Drink	Description and Preparation	Amount
Beef Patty with Onion	Homebaked cold Salt added.	3a.
Tea.	Typhoo	1 Cup
Milk	S/Skimmed	1 Dessertspoon
Sugar	White	1½ Teaspoon.

MID MORNING - between breakfast time and lunch time

Food/Drink	Description and Preparation	Amount
Coffee	Maxwell House Instant ½ Water ½ S/Skimmed Milk	1 Mug.
Sugar	White	1½ Teaspoons
Cake.	Homemade Date Cake.	16a.

24

LUNCH

Food/Drink	Description and Preparation	Amount
Gammon Steak	Microwaved	6oz.
Chips	Deep Fried in Oil (Crisp & Dry)	7a.
Peas	Birds Eye (Frozen)	12a.
Bread	Local Bakery White Unsliced	½ Slice ½" Thick
Apple Pie	Homemade	3B
Sugar	White - Sprinkled on	1 Teaspoon
Custard	Birds - made with S/Skimmed milk	Small Fruit Dish.

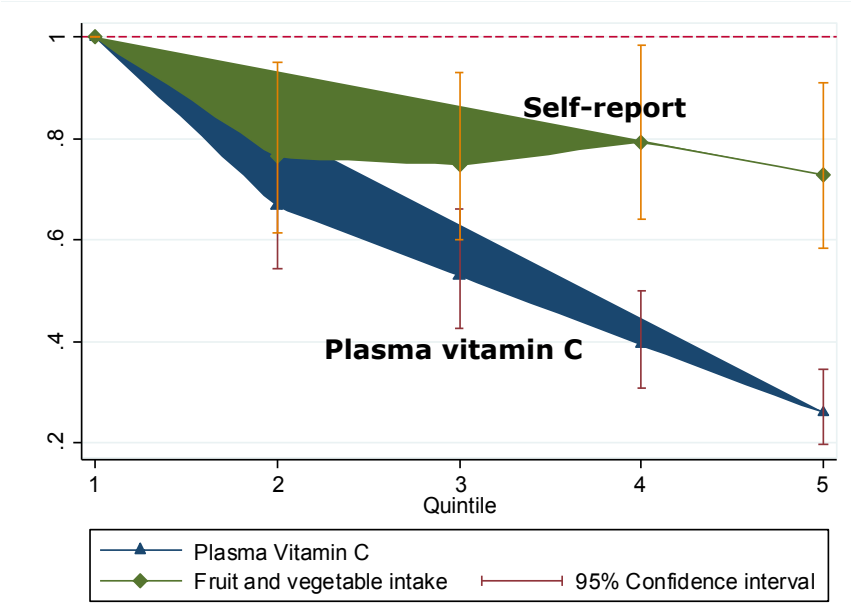
TEA - between lunch time and the evening meal

Food/Drink	Description and Preparation	Amount
Tea.	Typhoo - tea bag.	1 Mug
Milk	S/Skimmed	1 Dessertspoon
Sugar	White	1½ Teaspoons
Biscuit	Chocolate Digestive Fox's	1

25

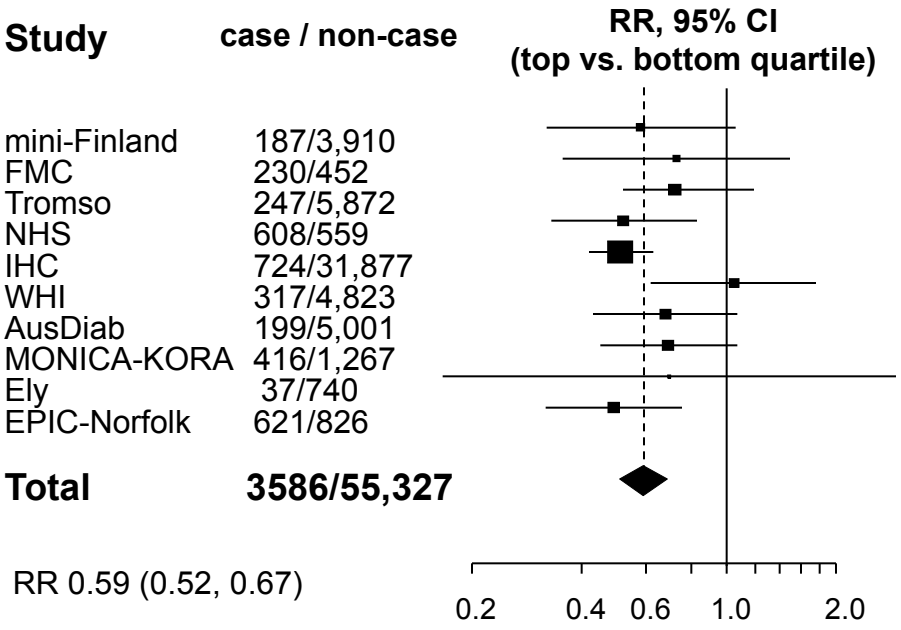
More detailed investigation of exposure to disease relationships – nutritional biomarkers

Vitamin C



Source: Harding et al, Arch Int Med 2008

25(OH) vitamin D



Source: Forouhi et al, Diabetologia 2012

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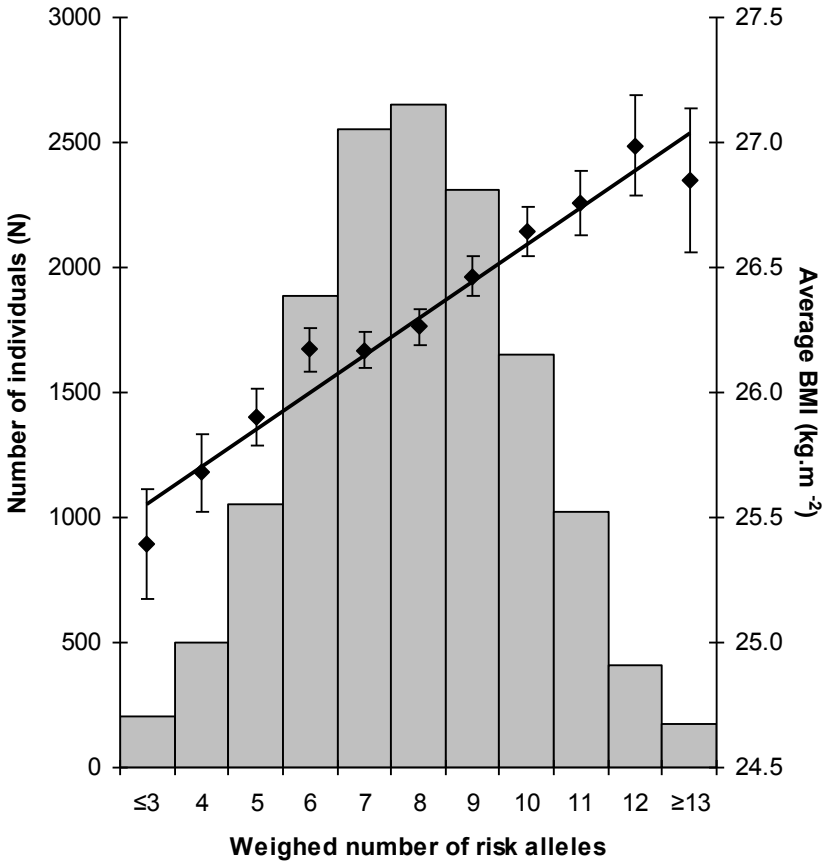
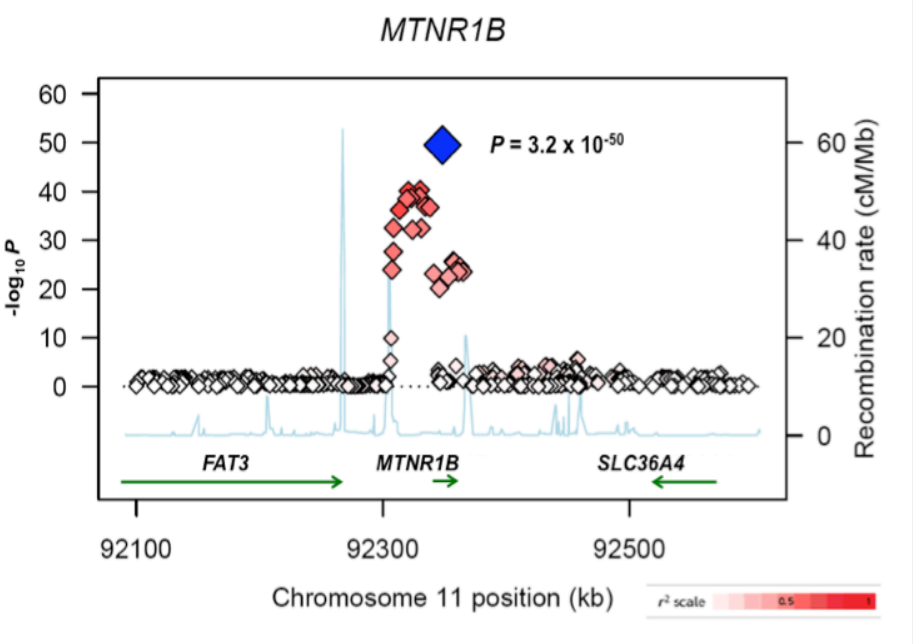
Combined effect of 8 genetic variants on BMI

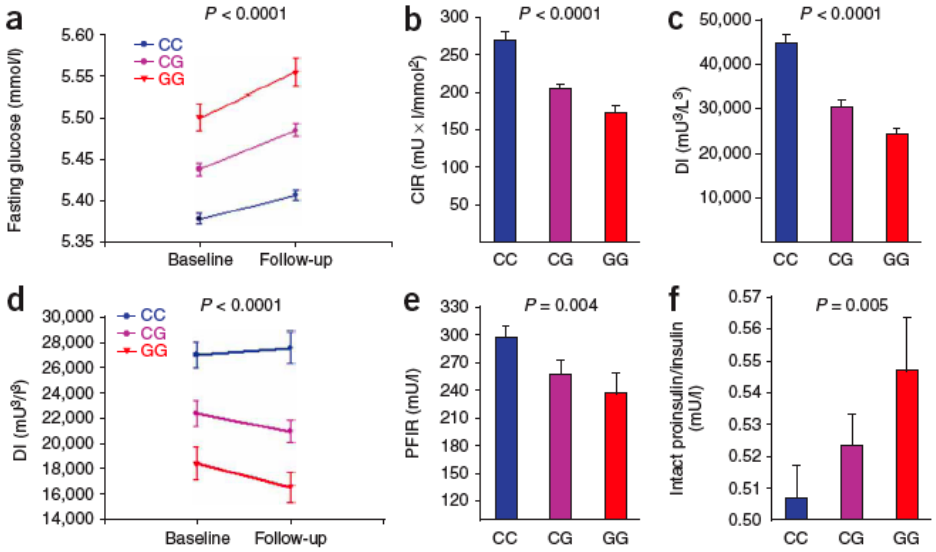


1.5 kg.m^{-2} or 3.7-4.7 kg

Source: Willer et al. Nature Genetics 2009

Genetic associations with intermediate pathways can identify new pathways to type 2 diabetes



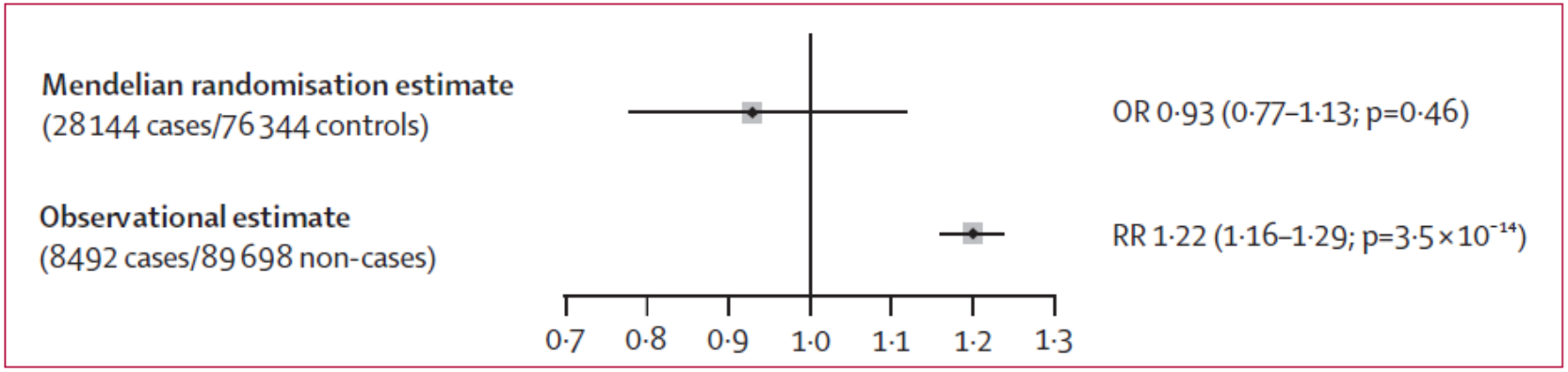


Source: Prokopenko et al. Nature Genetics 2008

Discovery of genetic loci may aid in testing the causal inference of associations

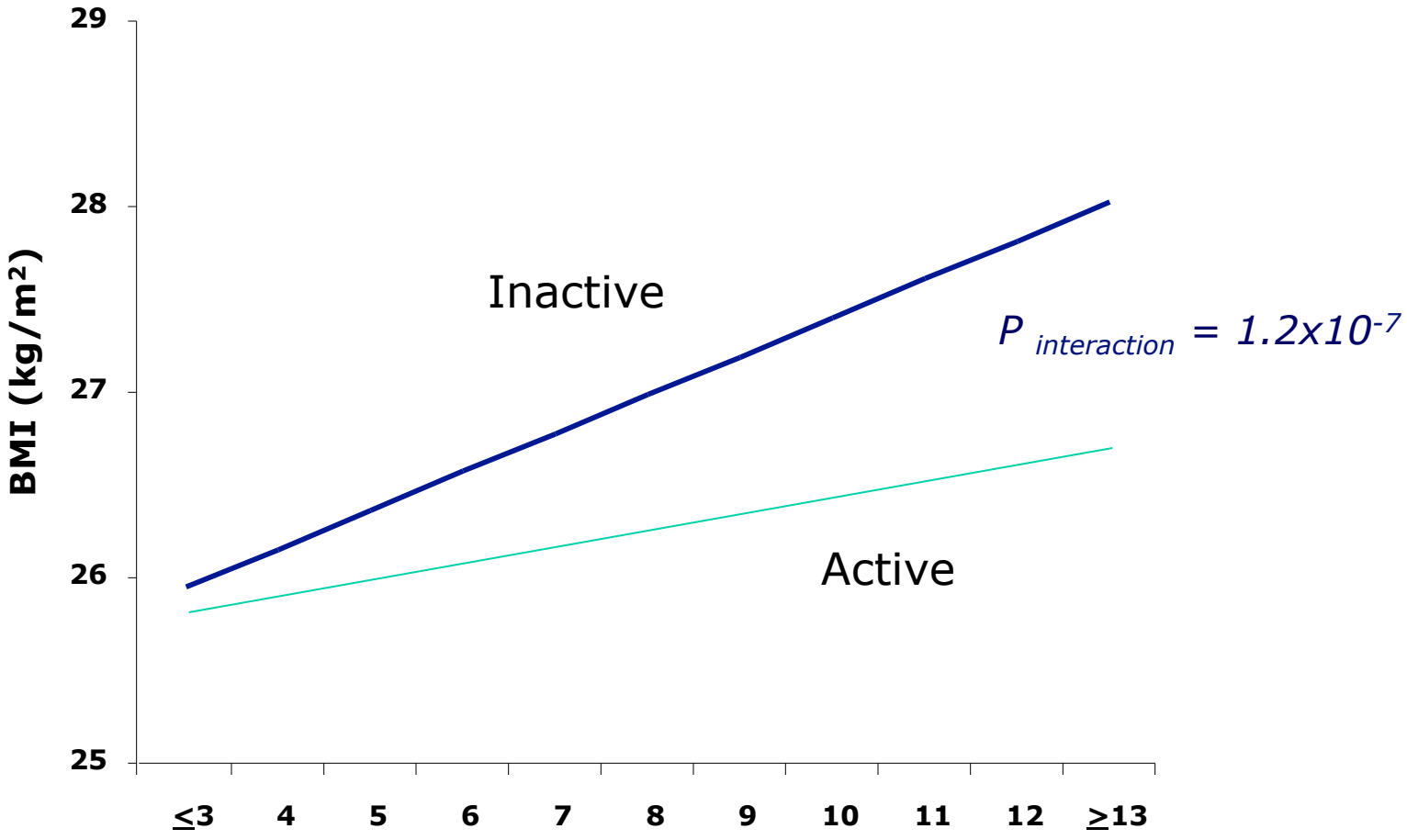
Association between circulating 25-hydroxyvitamin D and incident type 2 diabetes: a mendelian randomisation study

Zheng Ye, Stephen J Sharp, Stephen Burgess, Robert A Scott, Fumiaki Imamura, InterAct Consortium, Claudia Langenberg, Nicholas J Wareham, Nita G Forouhi



Source: Ye et al, Lancet Diabetes Endo 2014

Gene-lifestyle interplay



Source: Li et al. PLoS Medicine 2010

The EPIC-InterAct Study

- EPIC-Europe - 455,680 individuals at baseline

- EPIC-Norfolk

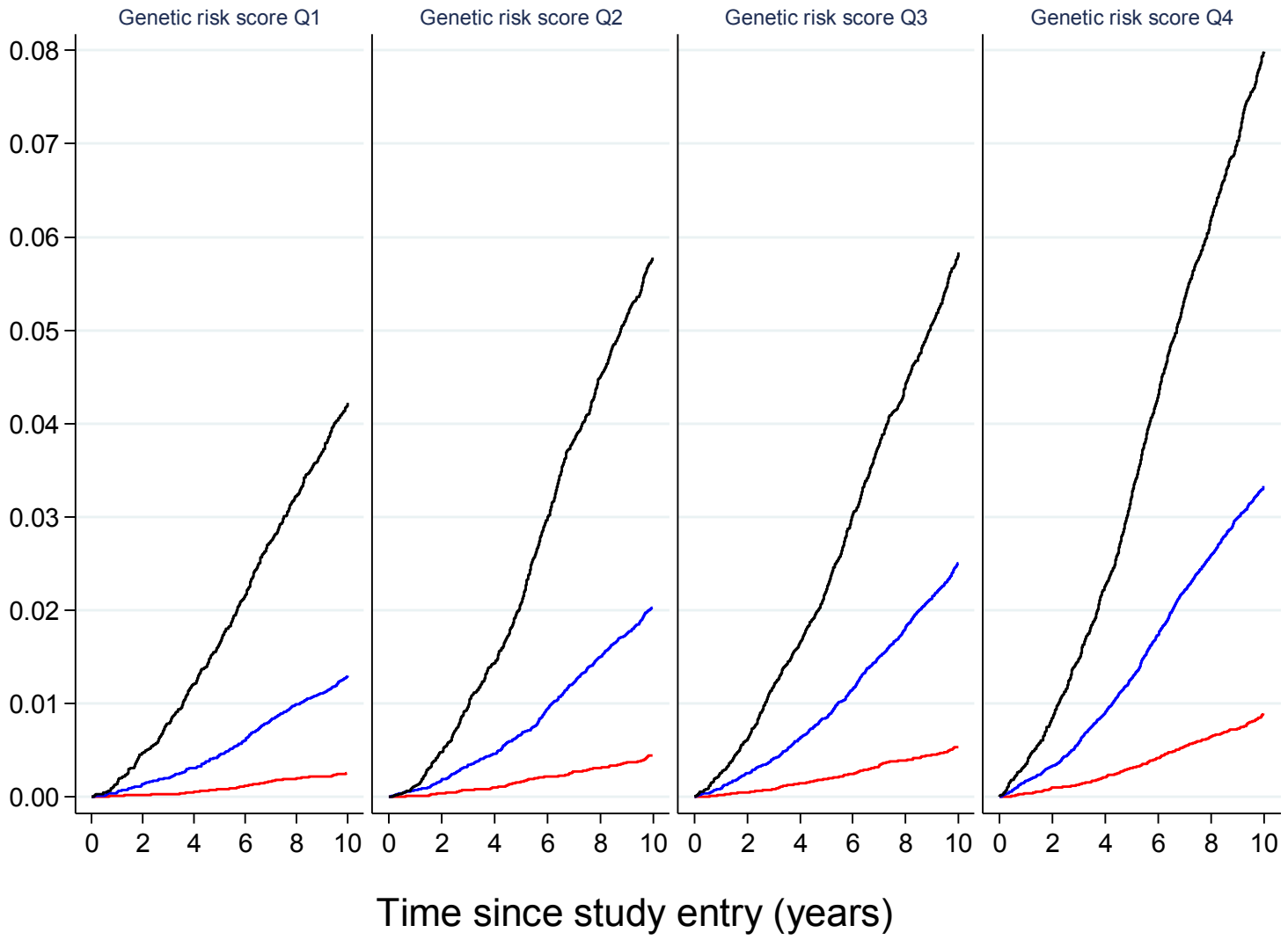
- Stored blood
- Data on diet/physical activity
- Exposure heterogeneity

- Long follow-up
  - 4 million person years
  - 12,403 incident cases of T2D

- Nested case-cohort study within EPIC Europe

Source: Langenberg C et al, Diabetologia 2011

Incidence of diabetes by BMI and GRS



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Source: Langenberg et al, PLoS Med 2014

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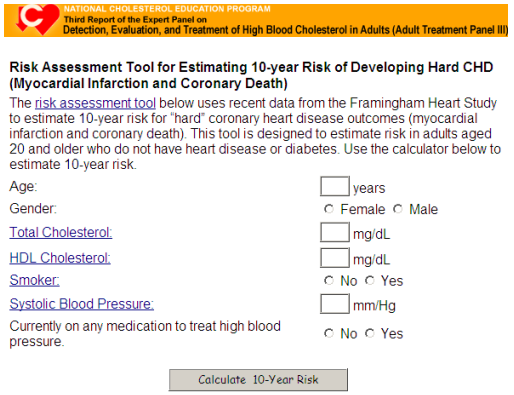
Pragmatic risk prediction

- Ranking individuals in order to target therapy at those at greatest risk
- Provision of prognostic information or estimation of the likely absolute benefit from intervention
- Motivation to change behaviour



NATIONAL CHOLESTEROL EDUCATION PROGRAM
Third Report of the Expert Panel on
Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)

Risk Assessment Tool for Estimating 10-year Risk of Developing Hard CHD (Myocardial Infarction and Coronary Death)

The risk assessment tool below uses recent data from the Framingham Heart Study to estimate 10-year risk for "hard" coronary heart disease outcomes (myocardial infarction and coronary death). This tool is designed to estimate risk in adults aged 20 and older who do not have heart disease or diabetes. Use the calculator below to estimate 10-year risk.

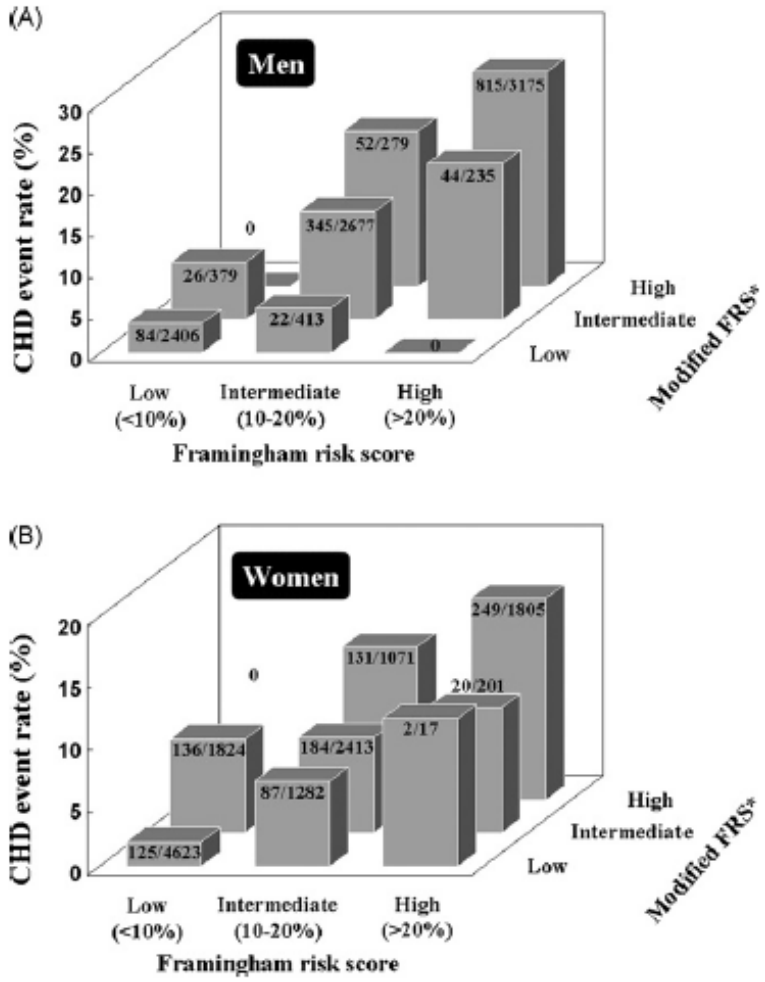
Age:	☐ years
Gender:	○ Female ○ Male
Total Cholesterol:	☐ mg/dL
HDL Cholesterol:	☐ mg/dL
Smoker:	○ No ○ Yes
Systolic Blood Pressure:	☐ mm/Hg
Currently on any medication to treat high blood pressure.	○ No ○ Yes

Calculate 10-Year Risk

Source: Chamnan et al, Diabetologia 2009

Value of local data for risk prediction

- More contemporary
- Framingham over-estimates risk
- Not a problem for ranking but is an issue for quantification of absolute risk
- More relevant to local population
- Can include modifiable factors that may aid with motivation to change



Source: Arsenault et al, Atherosclerosis 2009

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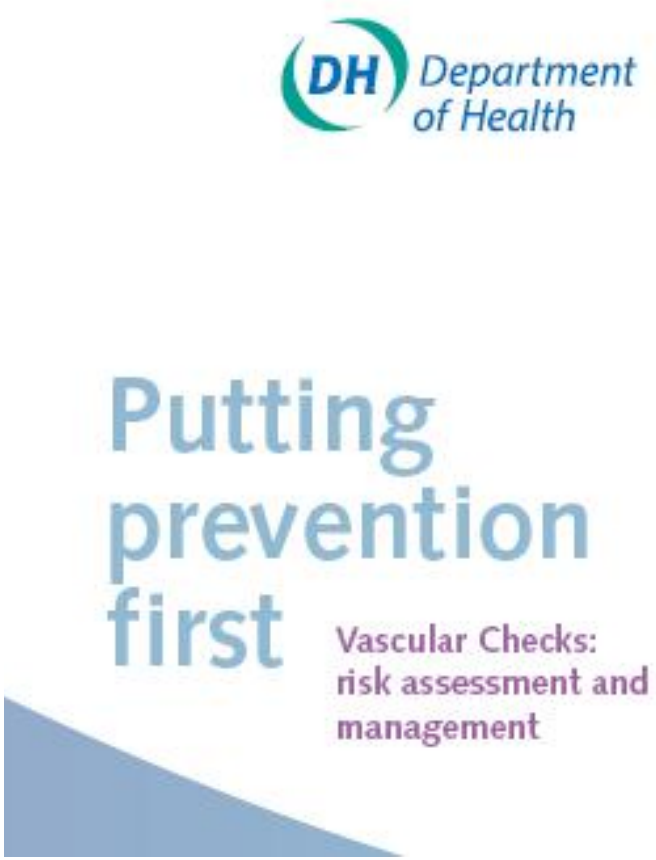
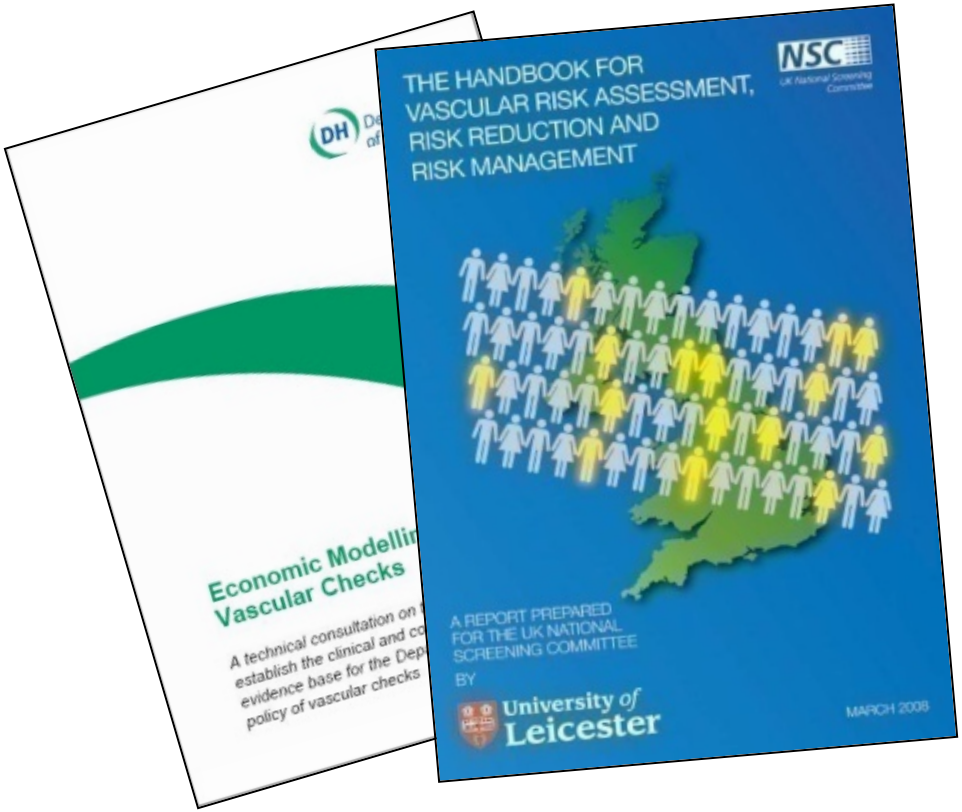
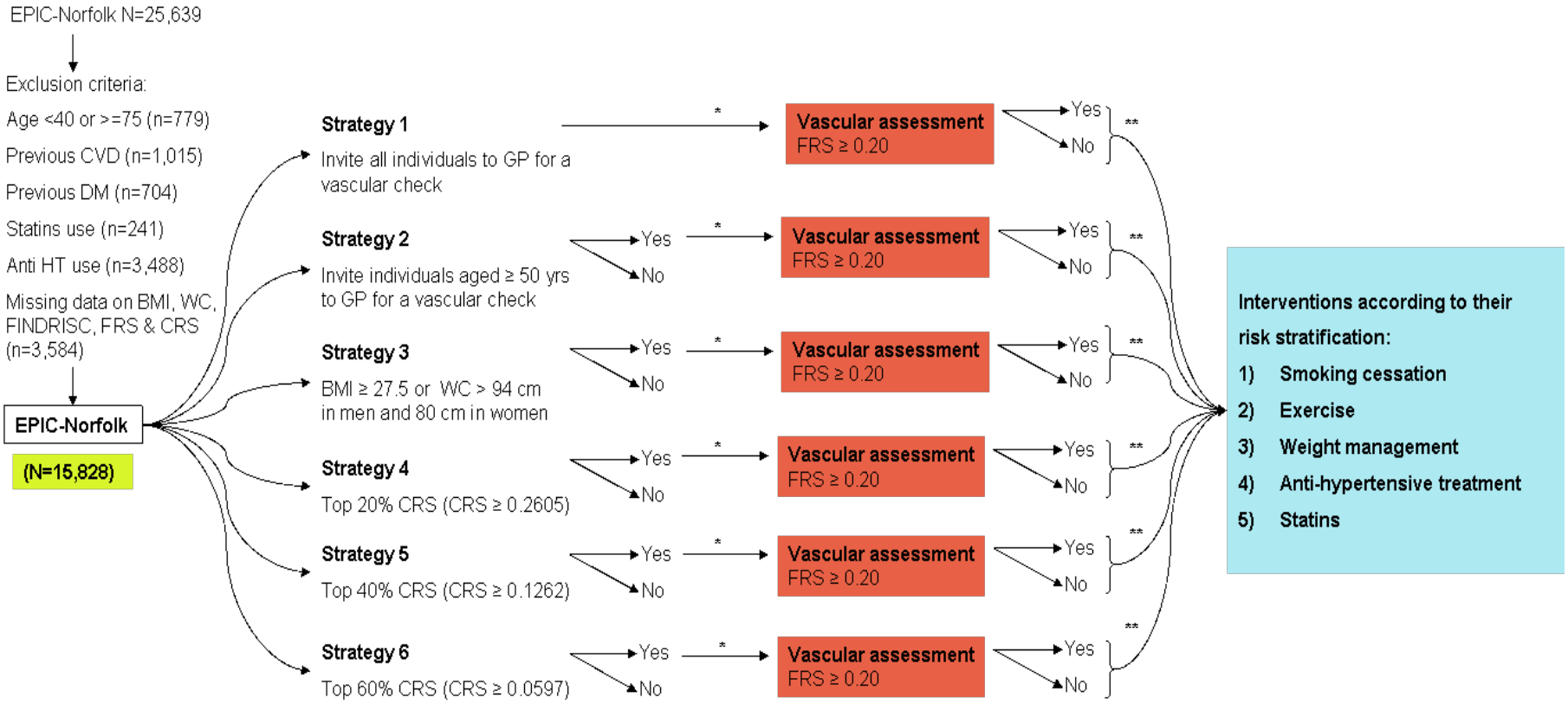
Estimation of potential impacts of interventions – UK health checks





Estimation of potential impacts of interventions on public health by modelling



Source: Chamnan et al BMJ 2010;340:c1693

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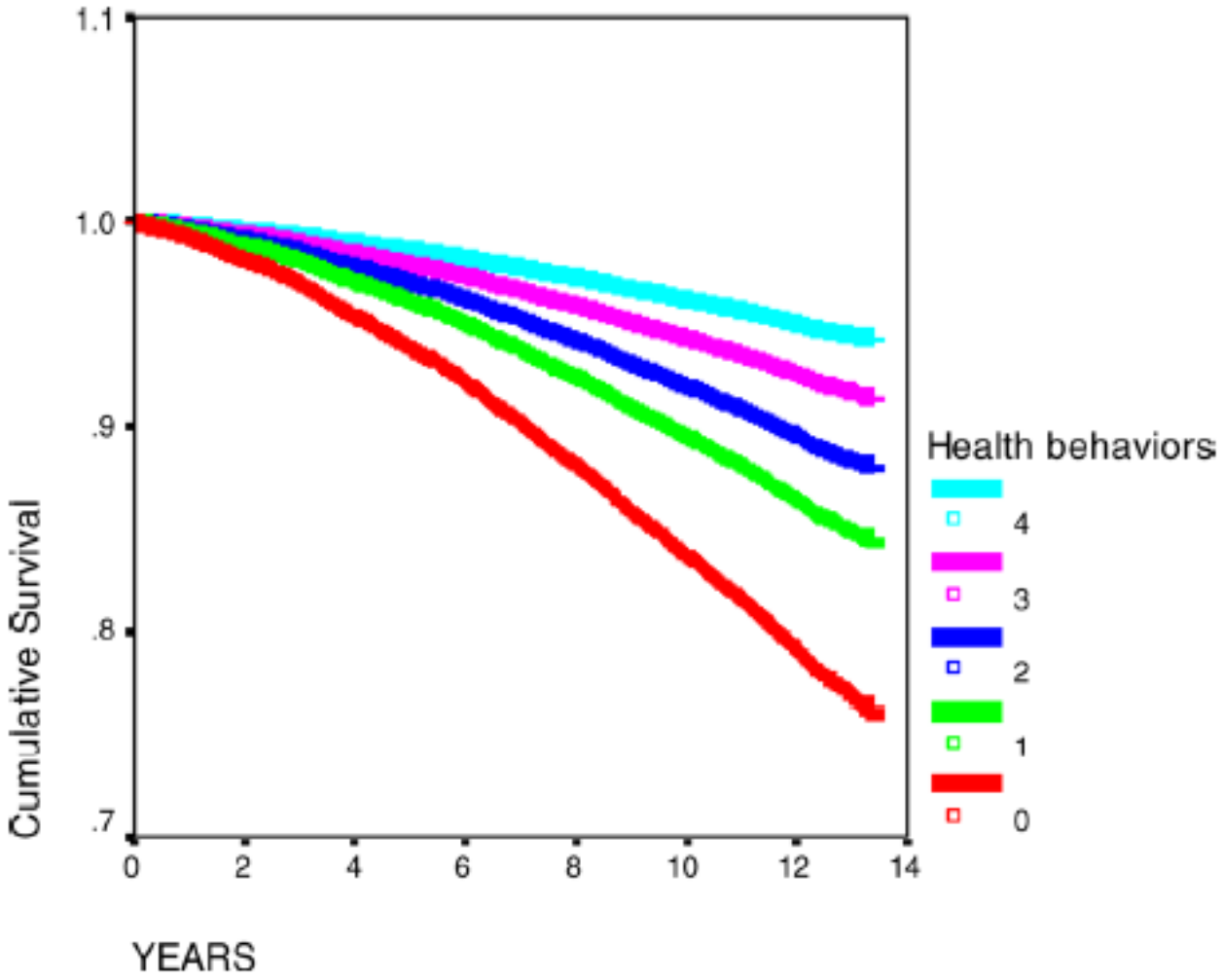
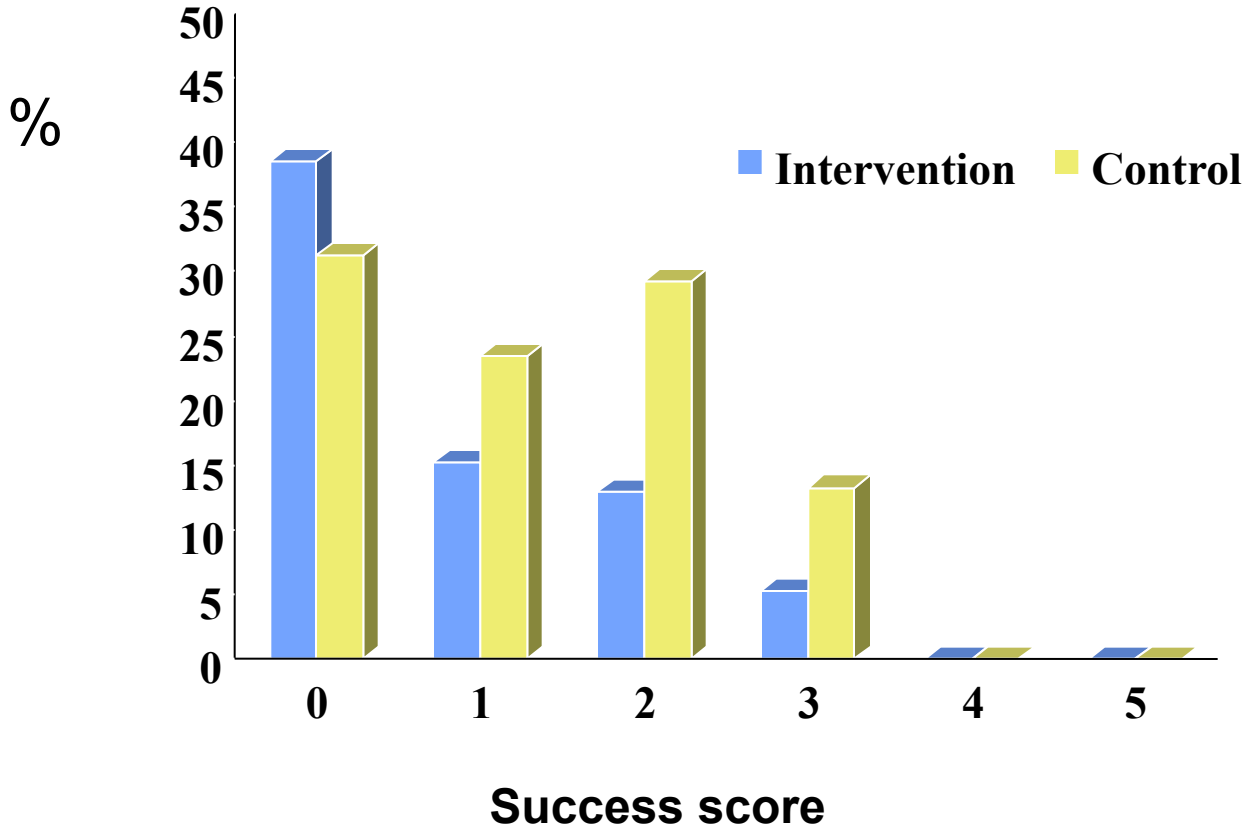
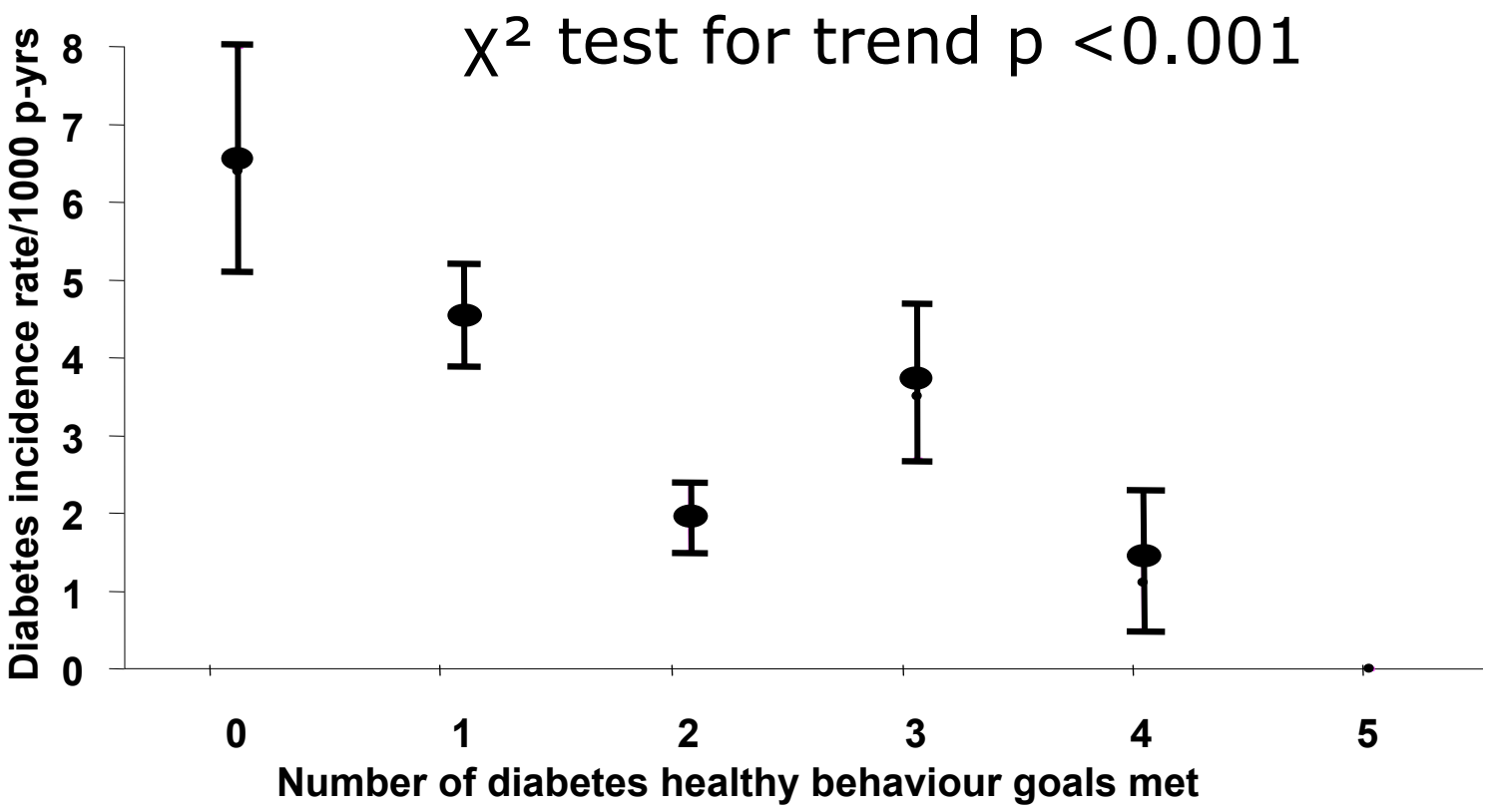
Combined impact of health behaviours on mortality risk



Percentage progression to diabetes by successful achievement of intervention targets in the Finnish Diabetes Prevention Trial



Rate of developing diabetes according to the number of diabetes healthy behaviour goals met



Source: Simmons et al, Diabetologia 2006

Comparison of risk groups

Risk factors	Number	Cases	Inc/ 1000pyrs	PAF (%)	NNT (58%)	NNT (20%)
Sedentary	14227 (58%)	284 (69%)	4.21	27	410	1188
Sedentary, family history, >55yrs	818 (3%)	31 (8%)	8.03	4	215	623
Obese (BMI), family history, >55yrs	246 (1%)	25 (6%)	21.6	5	80	233
Sedentary, obese (BMI + WC), family history, >55yrs	86 (0.4%)	12 (3%)	32.6	3	53	153

Source: Harding A, et al Prev Med 2006

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- transport policy
- foot/cycle paths

- school characteristics
- workplace layout

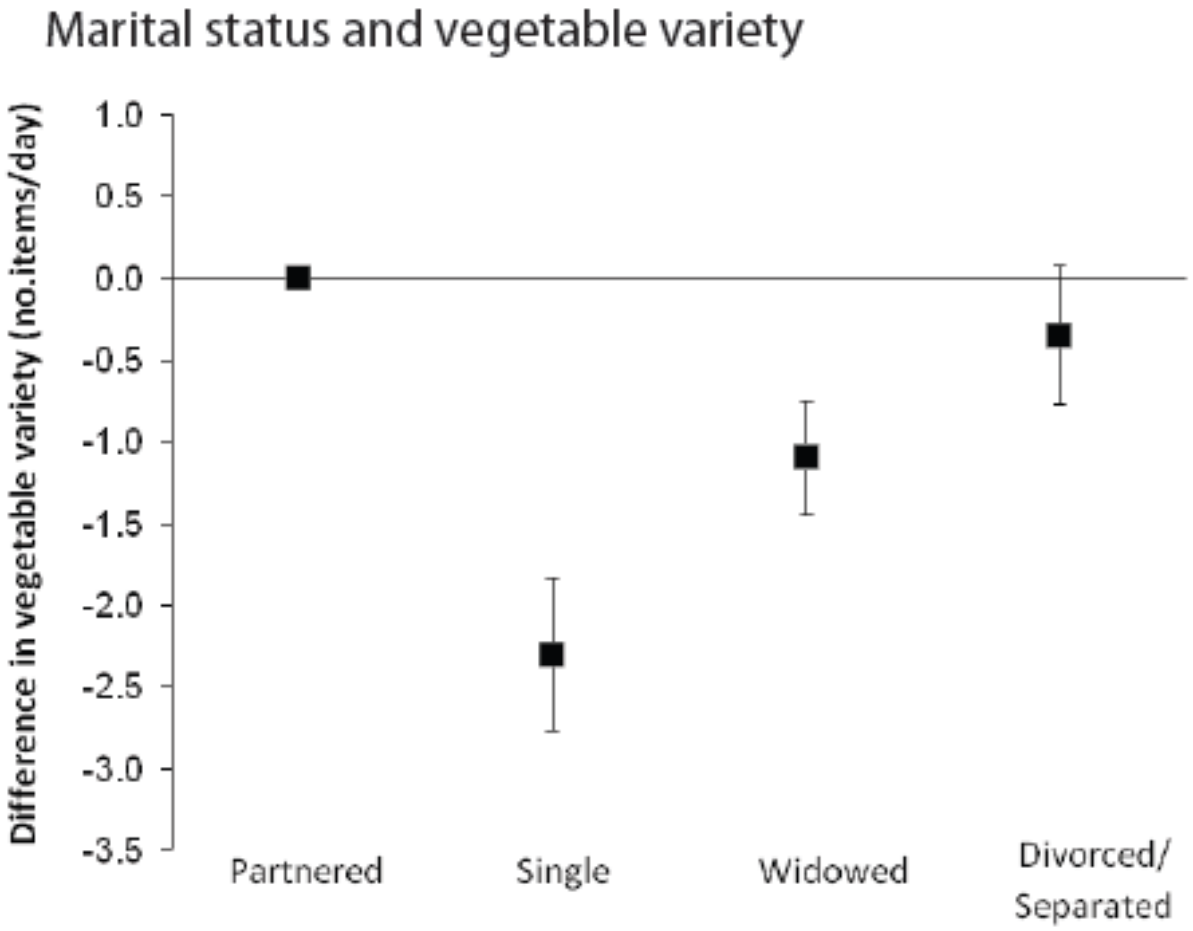
- family activity levels

- attitudes
- preference

Collective

Individual

Consumption of a diet rich in variety is influenced by social factors



EPIC-Norfolk results are contributing to evidence briefings for policy makers

Multiple social ties and healthy eating in older people

Findings from the EPIC-Norfolk study

CEDAR
Centre for Diet and Activity Research
A UKCRC Public Health Research Centre of Excellence

www.cedar.iph.cam.ac.uk

Evidence Brief, October 2013

Fully referenced and linked at
www.cedar.iph.cam.ac.uk/resources/evidence

Supporting an ageing population is a key health challenge for the twenty-first century. Around half of those over seventy-five now live alone, and social isolation can affect their health. New research from CEDAR is adding to understanding about the influence of multiple social relationships on healthy eating.

Healthy ageing: a public health priority

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Financial hardship and cost of healthy eating

Financial hardships, diet & obesity

Findings from the Whitehall II and EPIC-Norfolk studies

CEDAR
Centre for Diet and Activity Research
A UKCRC Public Health Research Centre of Excellence

www.cedar.iph.cam.ac.uk

Evidence Brief 8, November 2014

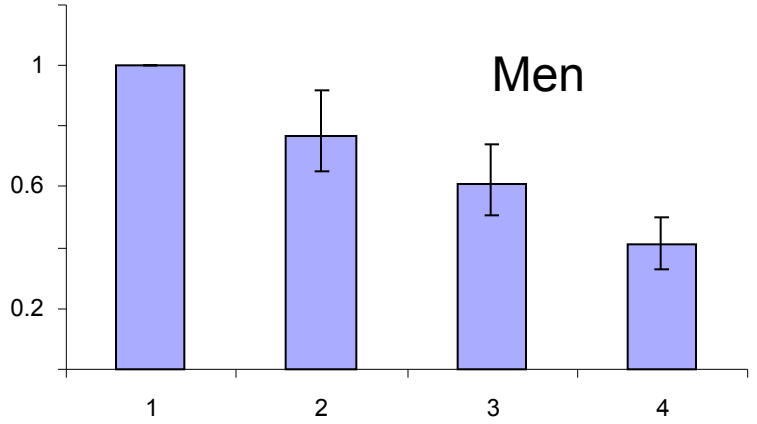
Fully referenced and linked at
www.cedar.iph.cam.ac.uk/resources/evidence

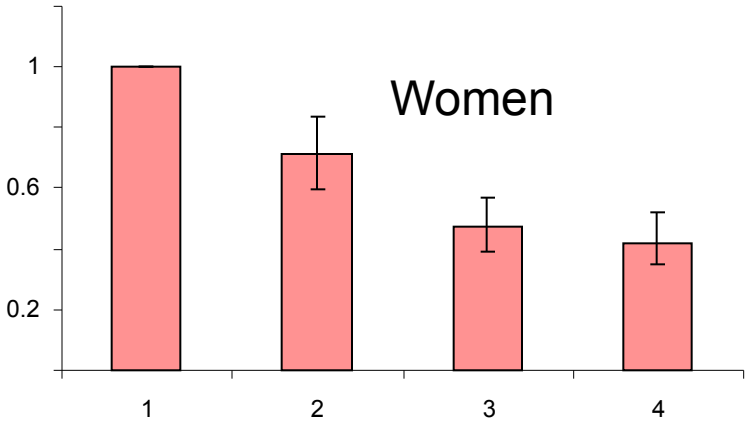
New research from CEDAR is showing that, beyond conventional indicators of socioeconomic status, financial hardship at all levels of society can affect people's diet, health and weight. With financial uncertainty affecting people in different ways, what does this mean for strategies to promote healthy weight?

Source: Conklin et al, BMC Public Health 2013

Source: Jones et al, PLoS One 2014

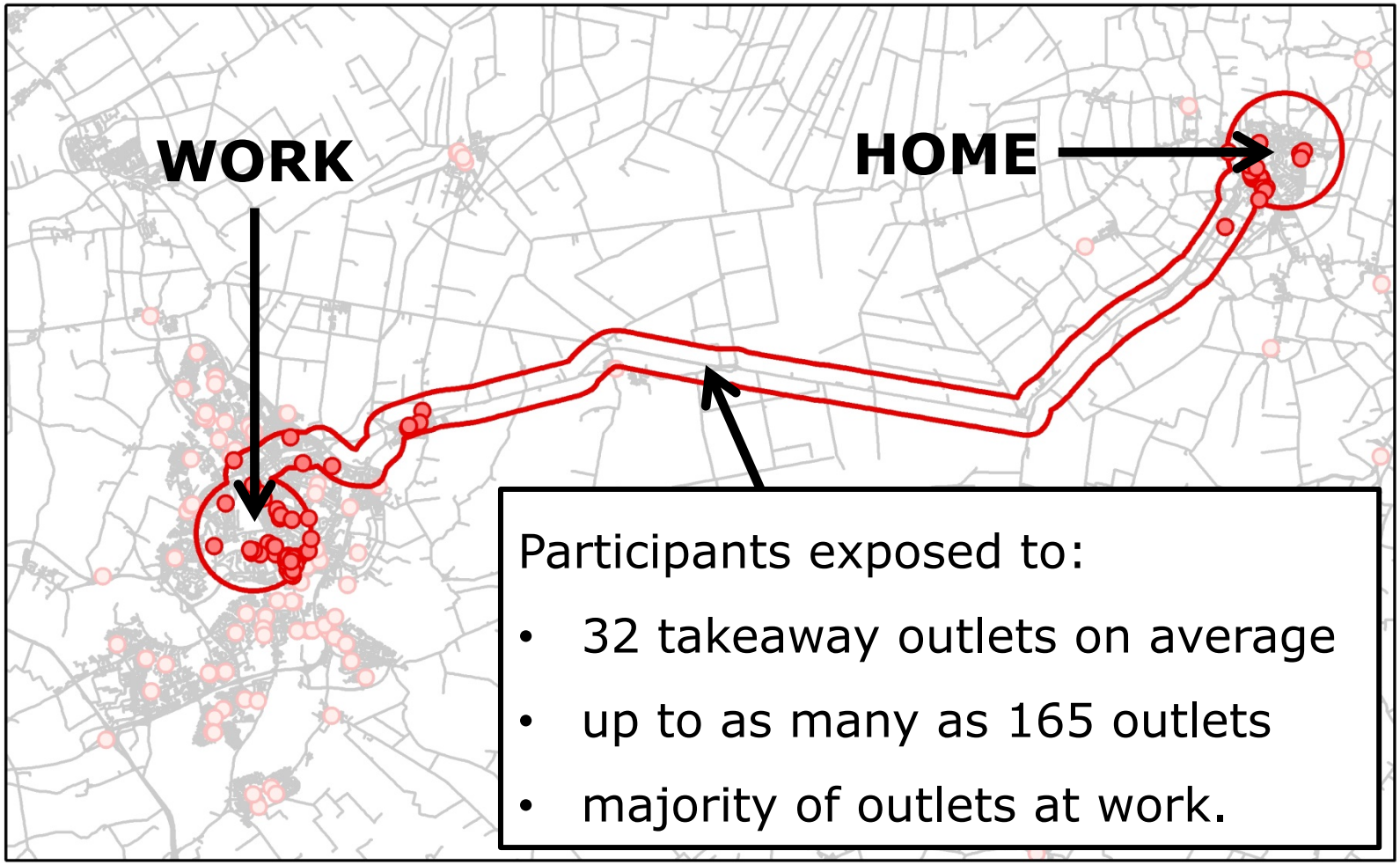
Cycling is influenced by factors beyond our individual control



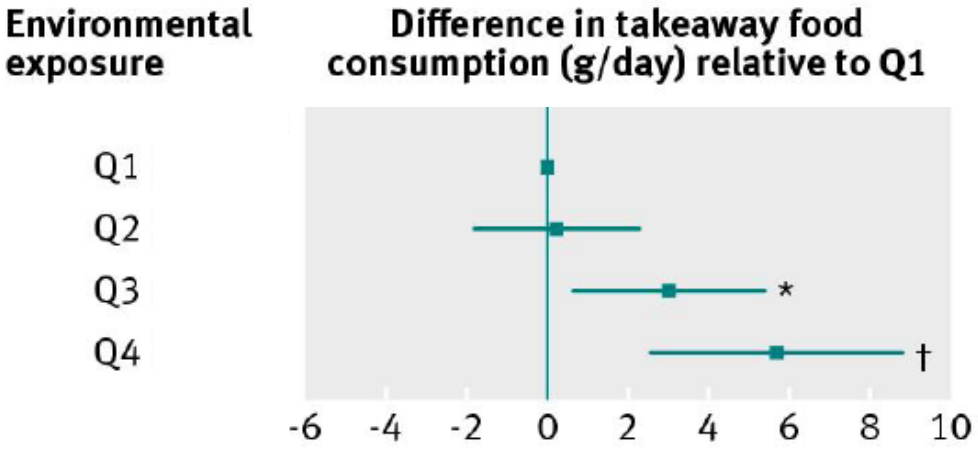


Road traffic

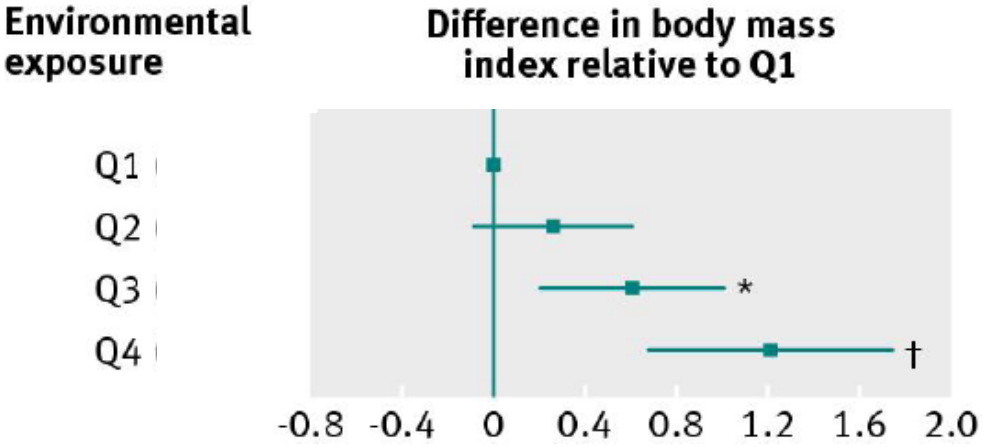
Non-home takeaway food exposure



Evidence for environmental effects



+5.7 grams



+1.2 units

Source: Burgoine *et al* BMJ 2014

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Evaluating the impact of interventions

- Alternative cohort designs recruited on attendance at health care – e.g GPRD in the UK
- Useful for investigation of some forms of question
- Limited by confounding particularly confounding by indication
- Limited utility in investigating disease aetiology unless assessment of risk factors is universal and standardised
- Randomised designs ?

Evaluating ways of communicating information about health behaviours, risk factors and disease risk.

Simple

Feedback on your physical activity level

What is physical activity?
Physical activity involves moving your body and using enough energy to make you breathe more deeply than usual and feel warmer.

This includes everyday activities such as walking, housework, gardening, playing with children, washing the car, climbing stairs, dancing, and all types of exercise and sports.

What are the health benefits?
As well as helping to control weight, it has been shown that increased physical activity reduces your risk of diseases such as cancer, heart disease, diabetes and stroke. It is also thought to help ease stress, anxiety and depression.

The government recommends at least 30 minutes of moderate physical activity (e.g. brisk walking) at least five days per week. However, more is always better, and even very small increases in your level can make a difference to health.

How has my physical activity been measured?
In this study, your overall physical activity level (PAL) has been calculated from your heart rate and movement during the week you wore the Actiheart monitor.

My physical activity level (PAL)
During the week you wore the monitor, your PAL was recorded as: **1.63**

We have provided a reference table for you below:

Data from many different studies have been used to give the following reference values for physical activity levels. These values are based on energy requirements and as such are only rough estimates.

PAL value	Description
Less than 1.2	*Bed rested. Most likely when in care of others*
1.2 – 1.55	*Low activity level: Sedentary lifestyle*
1.55 - 1.71	*Medium activity level: Occasionally active. Typical office work*
1.71 – 1.95	*High activity level: Some manual work and/or regular exercise*
Greater than 1.95	*Very high activity level: A fair amount of manual work or exercise training*

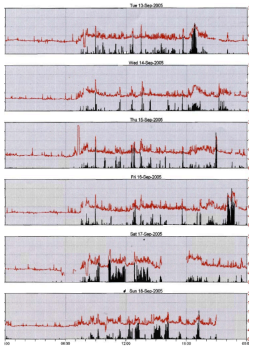
Reference values for PAL (FAO/WHO/UNU 1985)

Visual

Your personal physical activity printout

Please find below a personal printout of your daily heart rate and movement. These were recorded for each day that you wore your Actiheart monitor.

The red trace shows your heart rate and the black blocks show measurement of movement. The date for each record is also displayed. Some people find it interesting to recall certain activities they did that day, and match them up with peaks or troughs in their heart rate or movement.

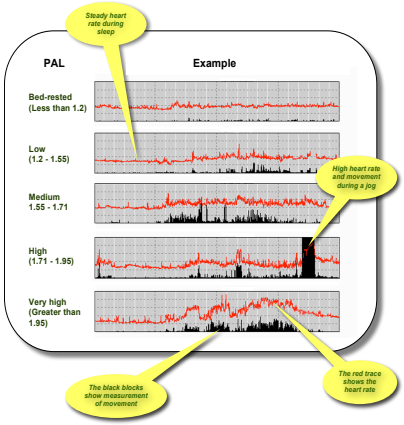


Examples from other volunteers

The examples below show printouts of each level of physical activity described in the reference table (page 1).

The examples are taken from a selection of volunteers. Each separate graph represents a single day of measurement, and is taken from a different person to show a heart rate and movement pattern typical of that activity level.

You might find it useful to compare your personal daily graphs to these examples. Higher levels of physical activity are indicated by a high or varied heart rate or more black areas.



Contextualized

How can I increase my physical activity level (PAL score)?

Examples of what you can do to raise your physical activity level are shown in the table below. This tells you how much time you need to spend doing any one of these types of activities in a day to increase your daily PAL score by either 0.1 or 0.2 points:

Activity	*0.1 PAL points*	*0.2 PAL points*
Moderate housework	***35 minutes***	***1 ¼ hours***
Brisk walking	***30 minutes***	***1 hour***
Leisurely cycling	***20 minutes***	***40 minutes***
Light jogging	***15 minutes***	***30 minutes***

Jenny's experience

When Jenny received her feedback, the results showed that she had a physical activity level (PAL) of 1.4. She was surprised to find that this indicates a low level of activity. Being a busy parent who was often exhausted by the end of the day, she considered herself to be fairly active, and was disappointed about her result.

Understanding the result

When she thought more carefully about the main things that kept her busy, however, she realised that they didn't involve much body movement or change in her heart rate or breathing. She noted down her daily activities for a week, and found that her typical day would be spent working at her desk in the office, driving the kids about, catching up on paperwork at home, making important phone calls, and organising her schedule. Although she was tired, she realised that it was often from having so much to think about, rather than from any physical activity.

Setting goals

Jenny decided that she would like to increase her level of physical activity in stages. Her first goal was to move from a low to a medium level, which meant increasing her PAL from 1.4 to at least 1.55. After some thought, she decided to set her target PAL at 1.6, which she felt was a manageable level.

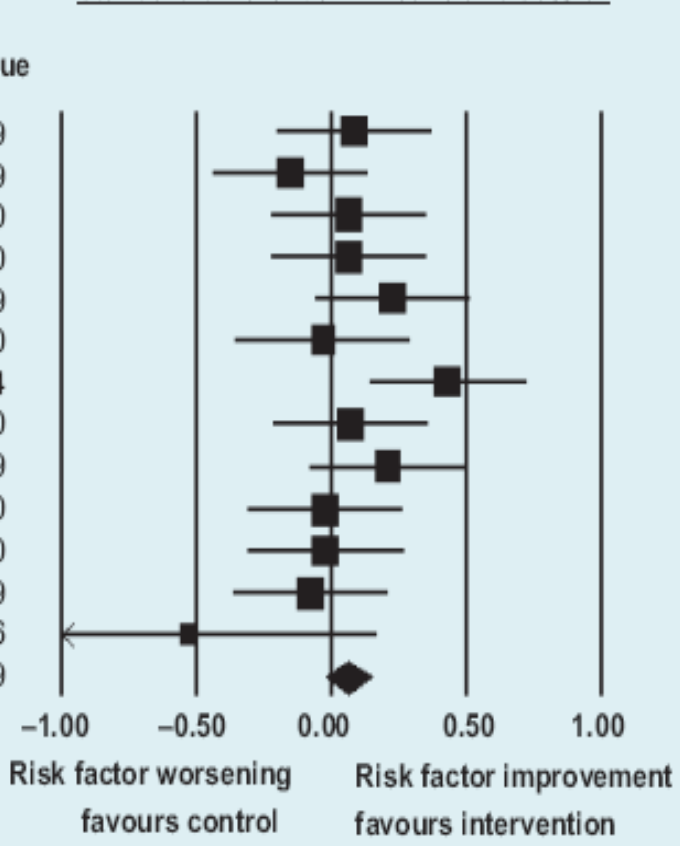
Making changes

From the table, she chose an activity that she felt she could build into her daily routine, which in her case was walking. To reach her target of 1.6, she needed to increase her score by 0.2 points. According to the reference table, this was equivalent to an hour of brisk walking a day. As Jenny's office was roughly a half-hour walk from her home, she decided to start walking to work and back instead of driving. She built this up gradually, and kept a record in her calender of what she was doing and how she was getting on. During the first week, she only walked on Tuesday and Thursday. By the fourth week, she was walking to work four or five days a week, and feeling much better.

Source: PLoS One 2013;8:e75398

Impact on cardiovascular risk factors

Variable name	Standard difference in means	SE	Variance	Lower limit	Upper limit	Z-Value	P-Value
	Statistics for each variable						
Total counts	0.086	0.147	0.022	–0.202	0.374	0.584	0.559
10-year CVD risk	–0.155	0.146	0.021	–0.441	0.132	–1.060	0.289
Weight	0.065	0.147	0.022	–0.224	0.353	0.441	0.660
Body fat percentage	0.063	0.147	0.022	–0.226	0.351	0.427	0.670
Systolic blood pressure	0.224	0.148	0.022	–0.065	0.513	1.516	0.129
Alcohol intake	–0.033	0.166	0.027	–0.358	0.291	–0.202	0.840
LDL	0.429	0.149	0.022	0.137	0.720	2.882	0.004
Triglycerides	0.071	0.147	0.022	–0.217	0.359	0.482	0.630
Fructosamine	0.207	0.147	0.022	–0.082	0.496	1.407	0.159
Fasting glucose	–0.024	0.147	0.022	–0.312	0.264	–0.164	0.870
2-h glucose	–0.022	0.147	0.022	–0.310	0.266	–0.151	0.880
Vitamin C	–0.079	0.147	0.022	–0.368	0.209	–0.540	0.589
Smokers cotinine	–0.530	0.356	0.126	–1.227	0.168	–1.489	0.136
Overall effect	–0.061	0.043	0.002	–0.022	0.145	1.442	0.149




DELIVERY
2.3d

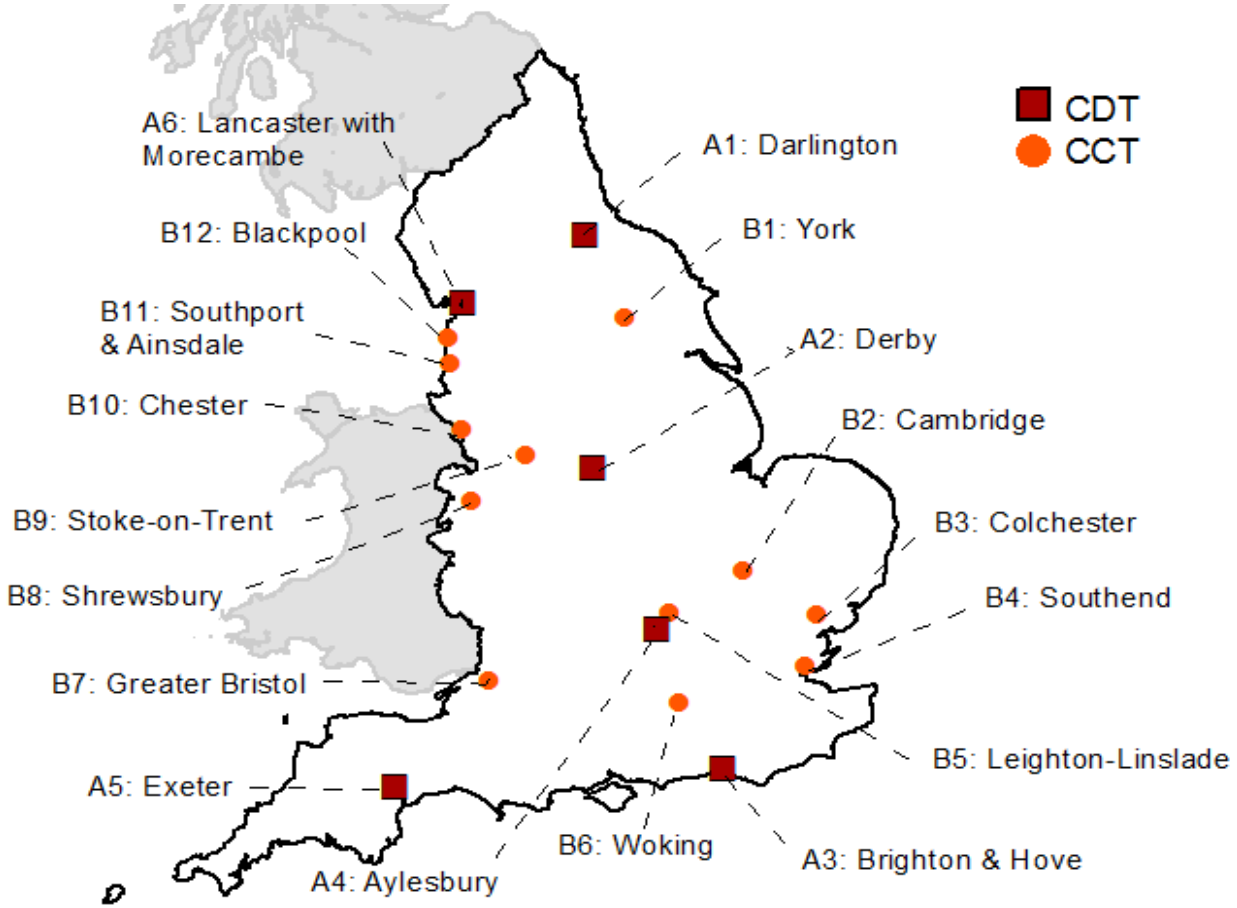

SOTORVET
5A Husum Torv

Using natural experiments to evaluate population health interventions:

guidance for producers and users of evidence

Craig et al., MRC 2011; Craig et al., *J Epidemiol Community Health* 2012

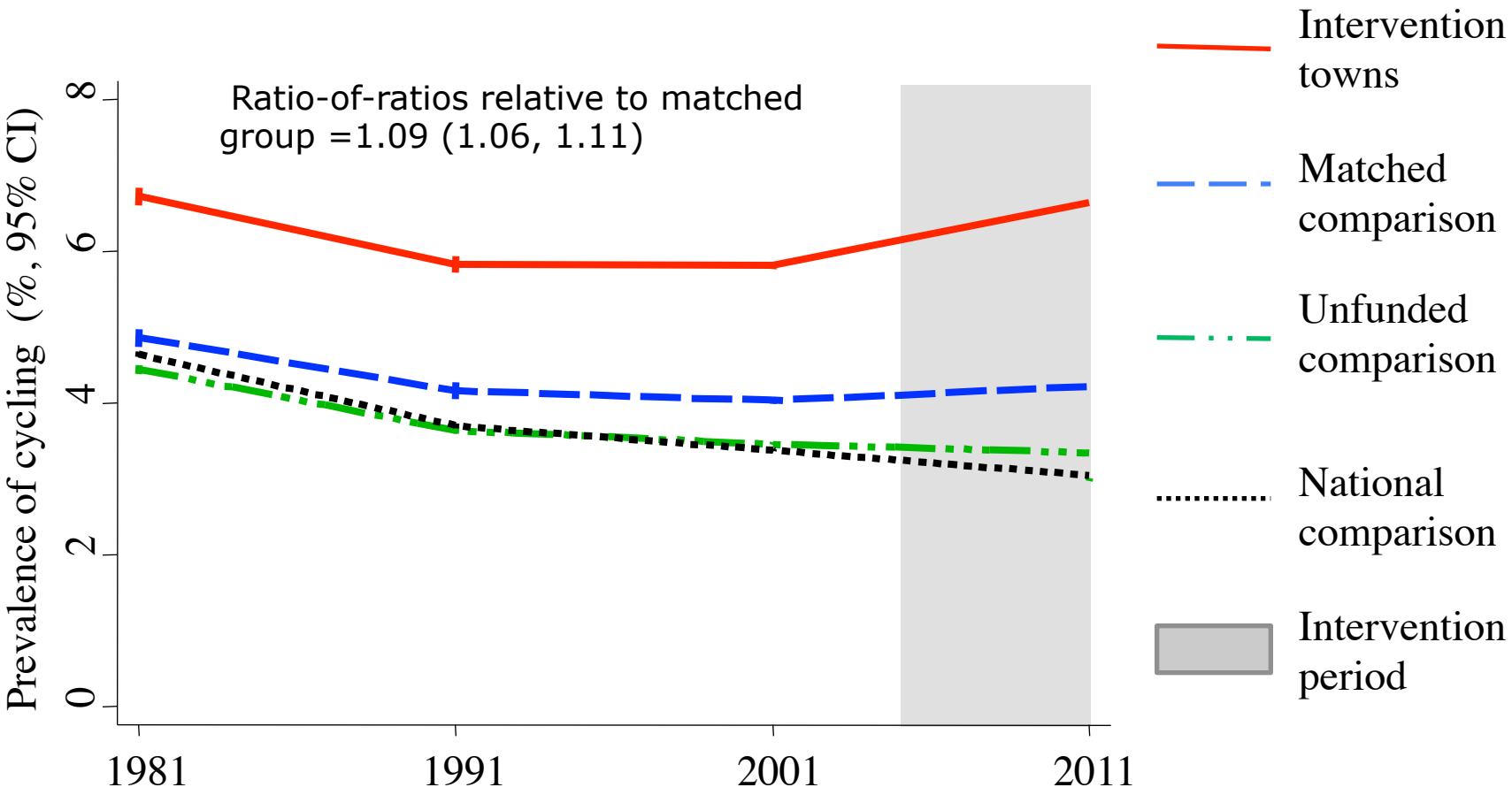
A natural experimental study of investment in cycling infrastructure



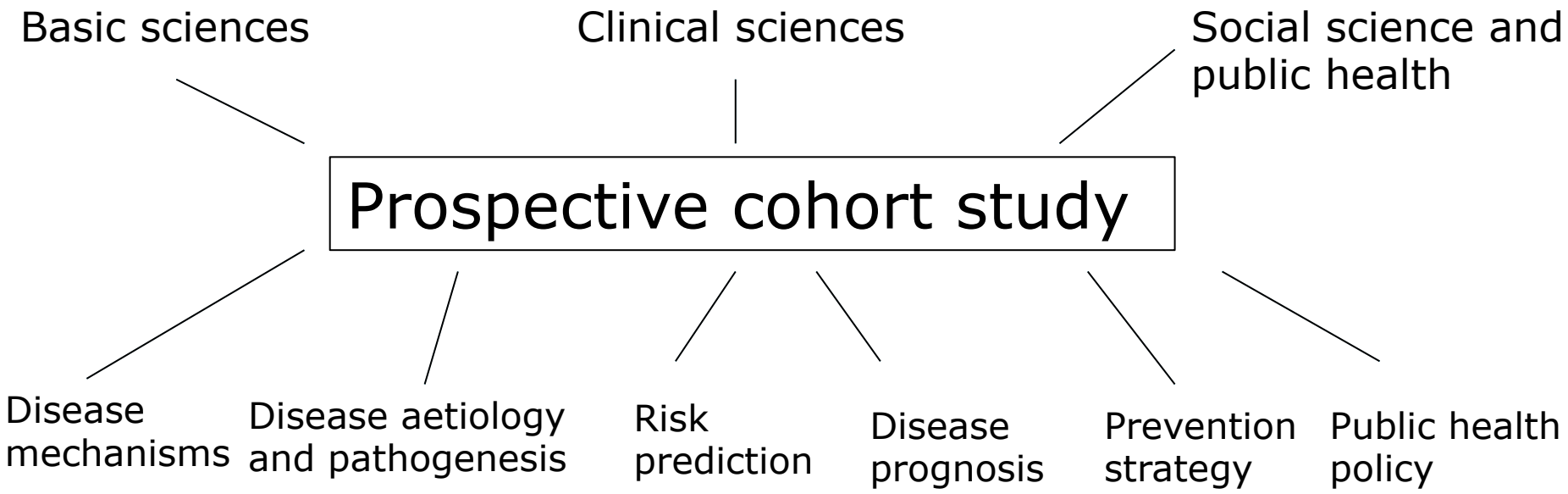
CDT = 'Cycling Demonstration Towns', funded 2005-2011
CCT = 'Cycling Cities and Towns', funded 2008-2011

Source: Goodman et al., Soc Sci Med 2013

Changes in prevalence of cycling



Source: Goodman et al., Soc Sci Med 2013


Basic sciences
Clinical sciences
Social science and public health
Prospective cohort study
Disease mechanisms
Disease aetiology and pathogenesis
Risk prediction
Disease prognosis
Prevention strategy
Public health policy

Challenges of establishing new cohorts

- The challenge of size and level of detail
- The challenge of being scientifically inclusive
- The challenge of delivery of scientific outputs over a mixed time horizon
- The challenge of the requirement for elapsed time
- Thinking about the scientific and health challenges of tomorrow whilst using today's assessment of risk factors
- The ethical, legal and social challenges of "broad consent" and the protection of the utility of the cohort for the future, for uses that can't be predicted now
- Engaging the participants

The participants

- Priority setting
- Defining research outcomes
- Selecting research methods
- Patient recruitment
- Interpretation of findings
- Dissemination of results

Thanks

Simon Griffin
Ulf Ekelund
Soren Brage
Ken Ong
David Ogilvie
Esther van Sluijs
Rebecca Simmons
Ruth Loos
Nita Forouhi
Claudia Langenberg
Robert Scott

Paul Franks
Cathy Elks
Rupert Jakes
Anne-Helen Harding
Tricia Peters

Andrew Cooper

Stefanie Odermatt

Stephen Sharp
Jian'an Luan
Jing-Hua Zhao

Rachel Curran
Rebecca Stratford
Matt Sims
Adam Dickinson
Iain Morrison
James Sylvester
Oliver Francis

Nick Day

Kay-Tee Khaw

Sheila Bingham