The Actuarial Profession
making financial sense of the future

The role lifetime lifestyle on mortality and longevity

Gita Mishra

MRC Unit for Lifelong Health and Ageing

Outline

Review on evidence of links between alcohol, smoking, physical activity, and diet with mortality risk

Clustering of health behaviours and mortality risk

Early origins of health behaviours

Benefit of a life course approach – importance of onset, duration
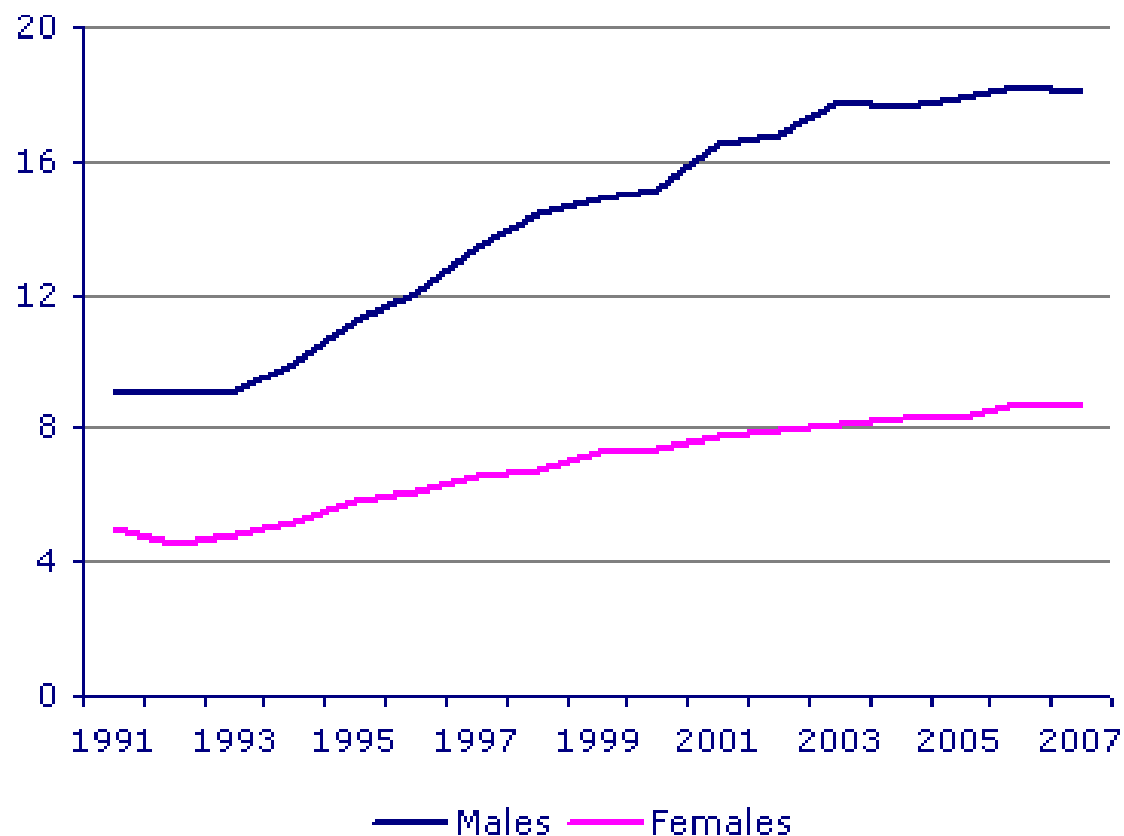
Lifestyle factors

- Around 70-80% of the deaths in developed countries are lifestyle related

  (Schneider, 2009)

- Adult behavioural risks factors, such as excessive alcohol consumption, regular tobacco use, physical inactivity, and unhealthy diet are sources of many chronic diseases
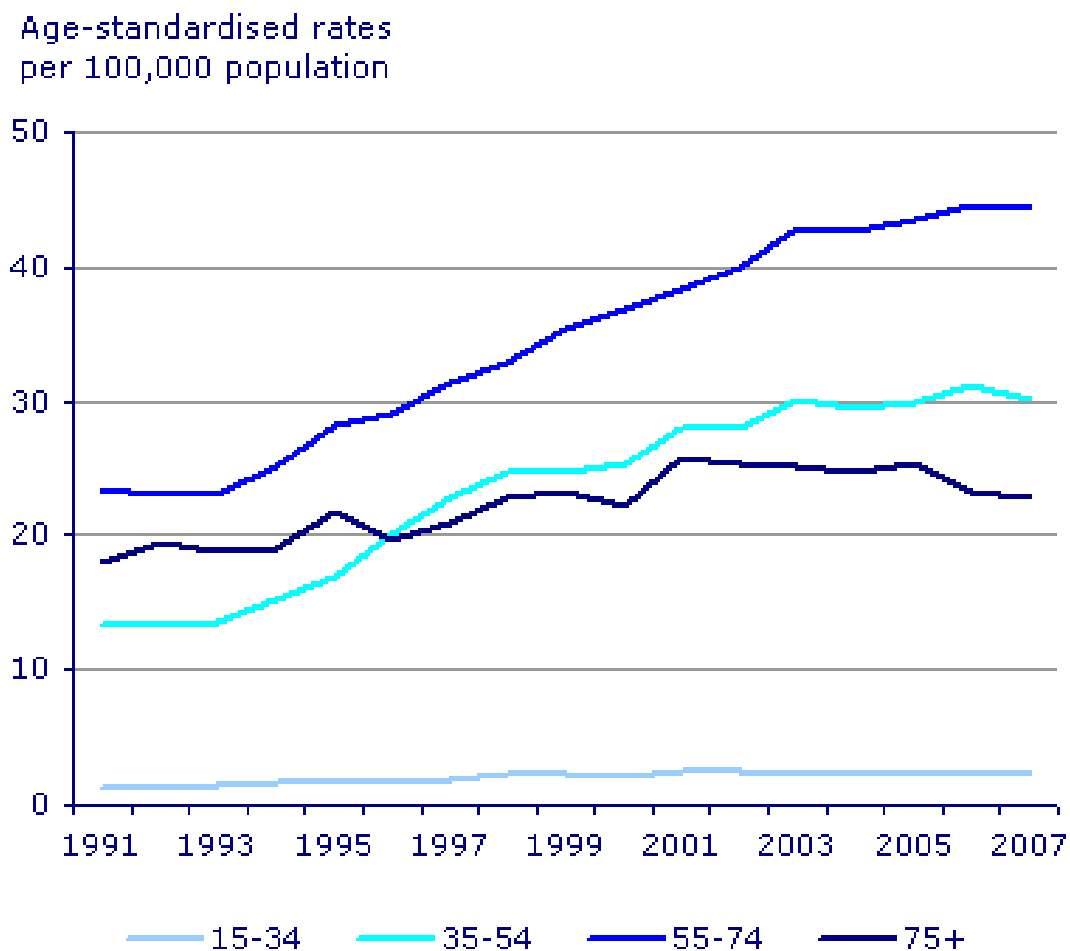
Alcohol related-death rates by sex, UK

Age-standardised rates per 100,000 population

Legend: Males, Females

The Actuarial Profession
making financial sense of the future

Male alcohol related-death rates by age, UK

The Actuarial Profession
making financial sense of the future

What is the nature of the relationship?

- Systematic review of 34 studies on men and women
  - A total of 1,015,335 subjects;
  - 94,533 deaths

- J-shaped relationship between alcohol and total mortality confirmed in adjusted studies.

- Low levels are inversely associated with total mortality.
  - 1-2 drinks /day for women
  - 2-4 drinks /day for men

- High alcohol consumption linked with increased mortality risk

Di Castelnuovo, Arch Int Med 2006
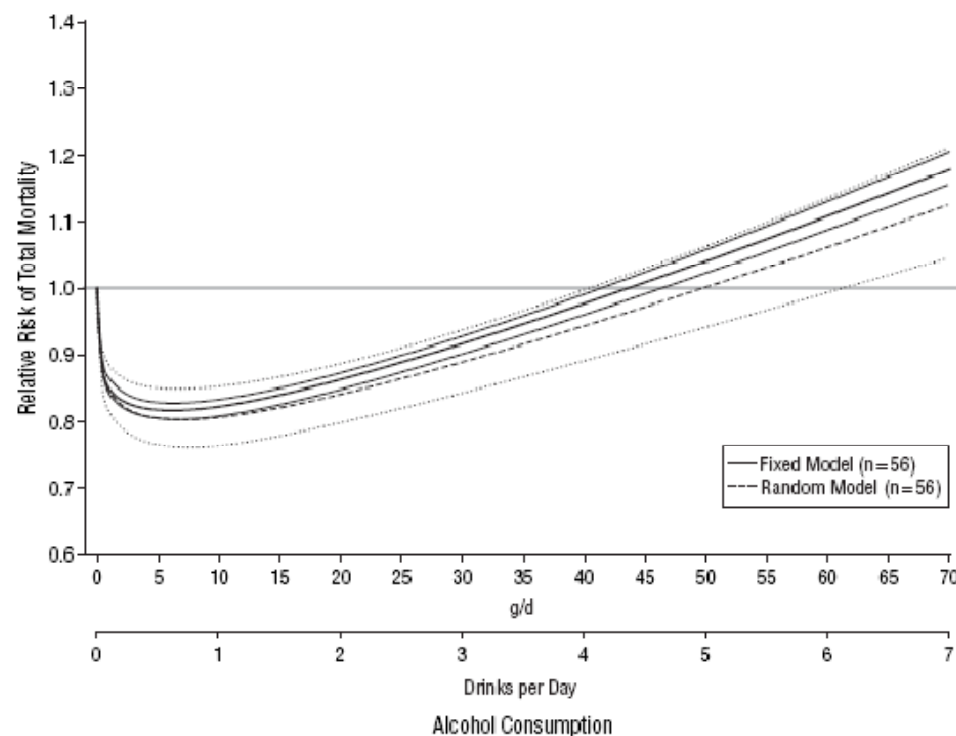
Relative risk of total mortality and alcohol intake curves (adjusted for social status)

Di Castelnuovo, Arch Int Med 2006
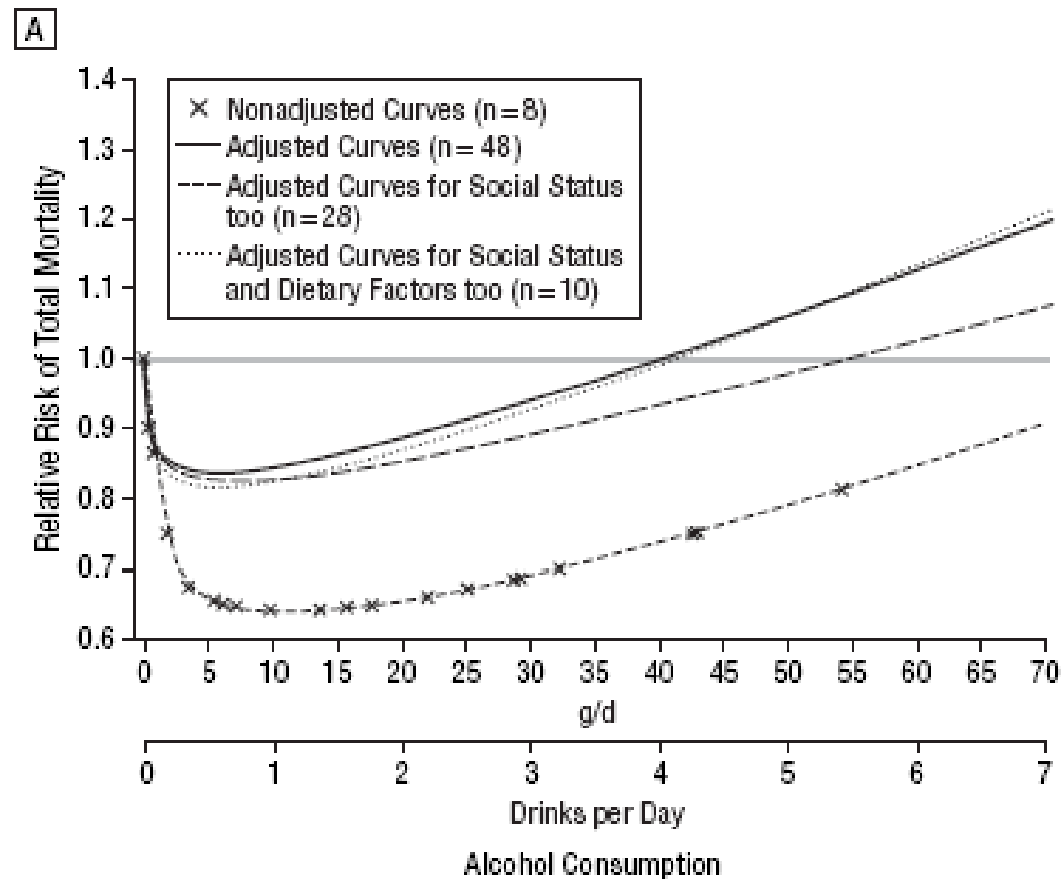
Relative risk of total mortality and alcohol intake curves by sex
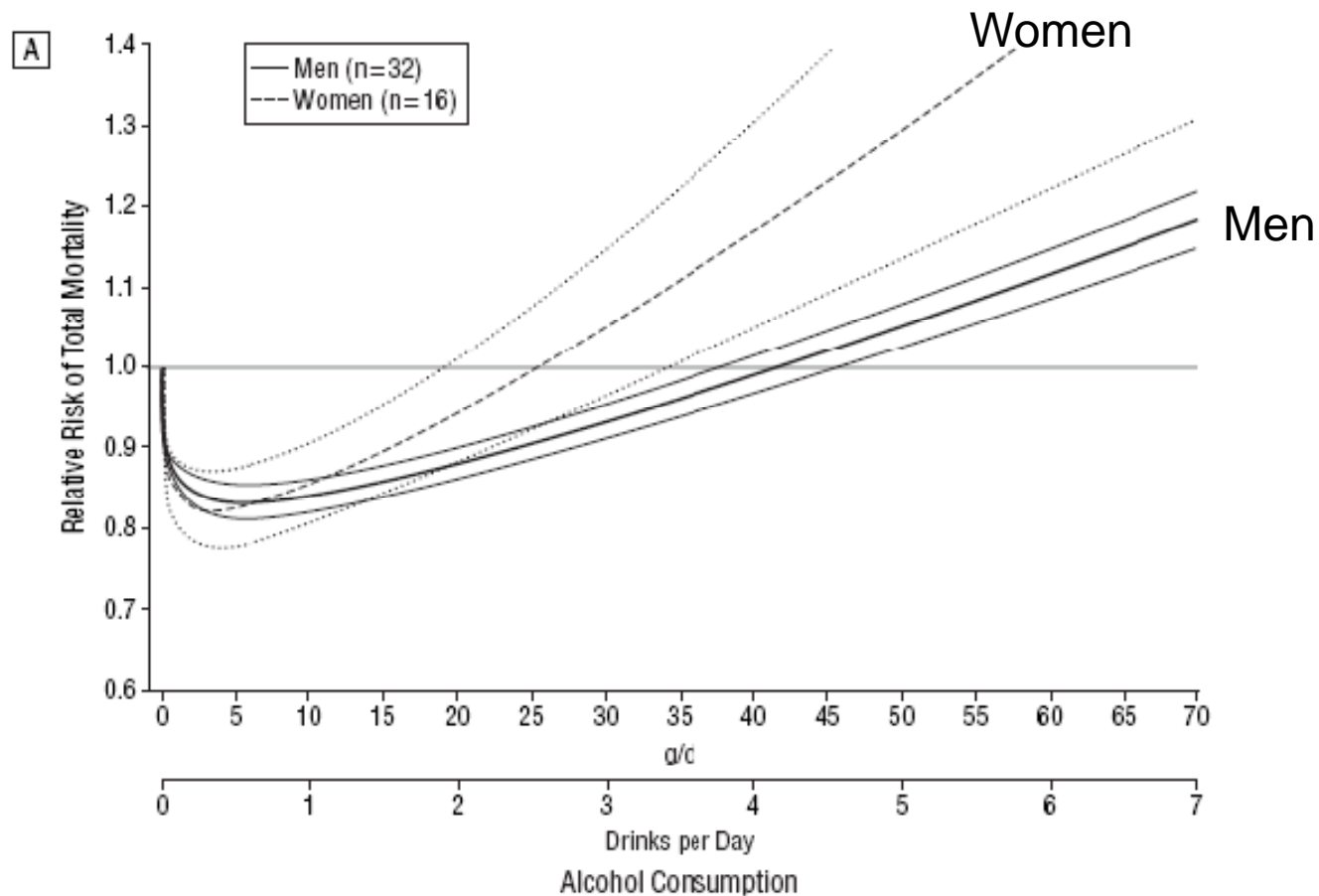
Di Castelnuovo, Arch Int Med 2006

Does the J-shaped relationship exist across all age groups?

- Using published systematic reviews & population data

- A direct dose-response relation exists in women aged 16-54 and in men aged 16-34.

- At older ages the relationship is U shaped.
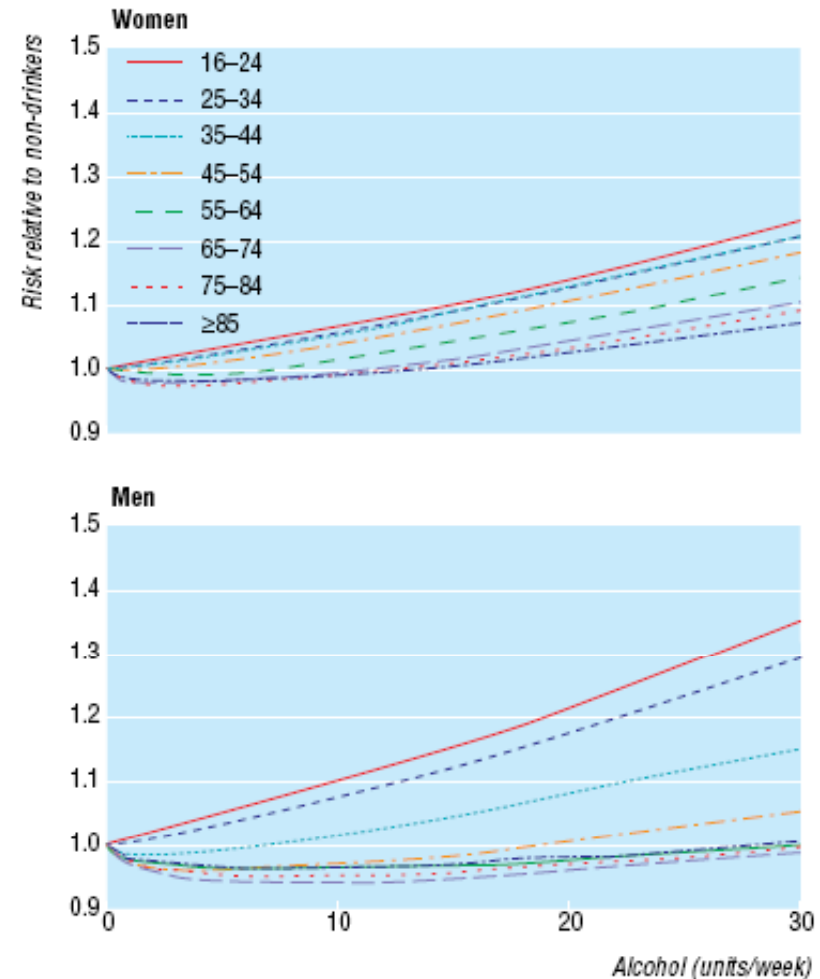
White, BMJ 2002

Alcohol Consumption: summary

- Moved from general relationship between alcohol consumption to a more detailed understanding

- J shaped relationship (with low consumption associated with lower mortality risk)
  - remains after adjusting for social status,
  - different for men and women
  - by age group.

Smoking

- The adverse health consequences of tobacco smoking have been known for over 50 years

- In the UK, it is estimated that each year
    - 114,000 die from smoking attributable causes,
    - about a fifth of all deaths.

Smoking: prevalence of cigarette smoking by sex:1974-2008

The Actuarial Profession
making financial sense of the future
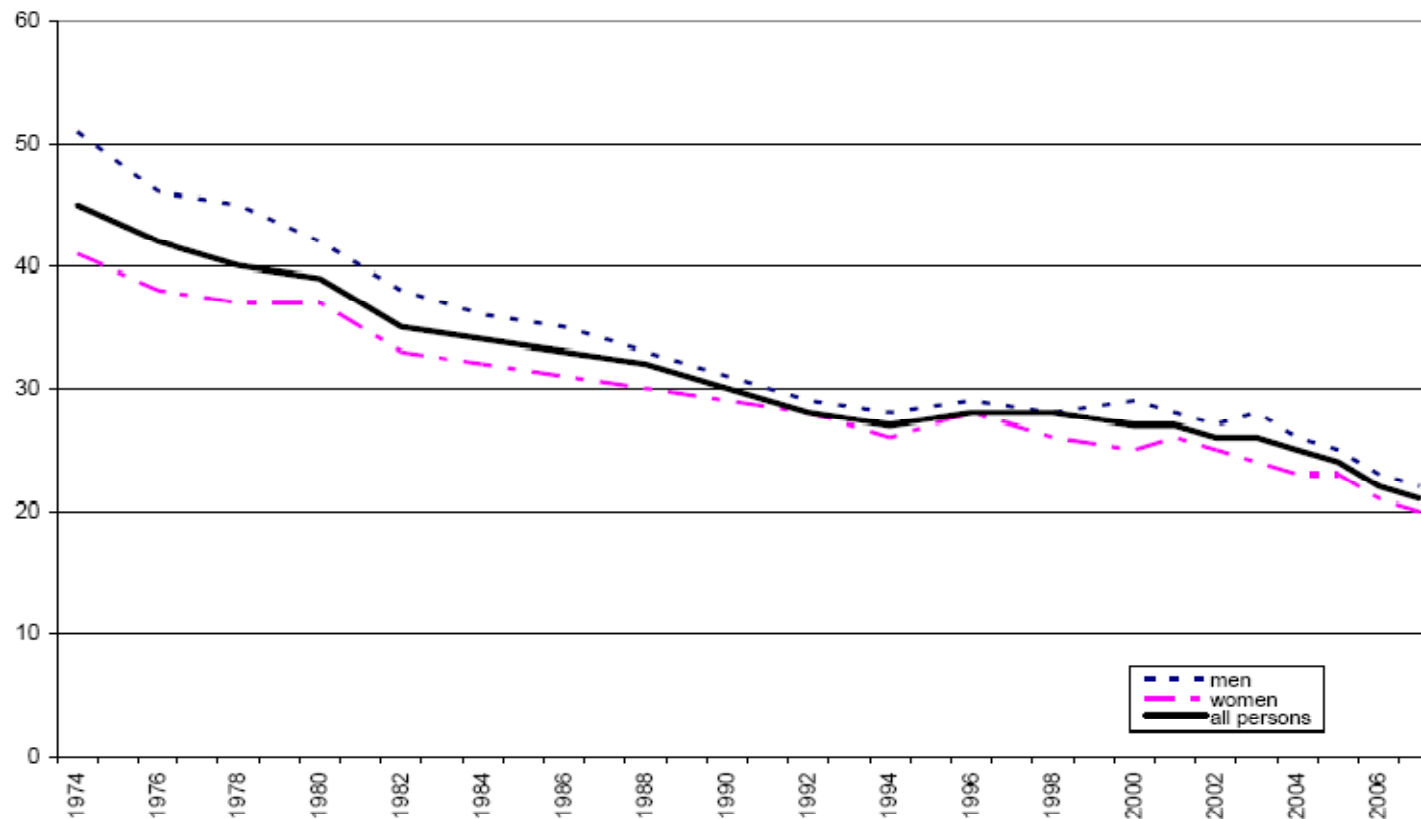
The prevalence of cigarette smoking in England by social class: 1992-2008

The Actuarial Profession
making financial sense of the future
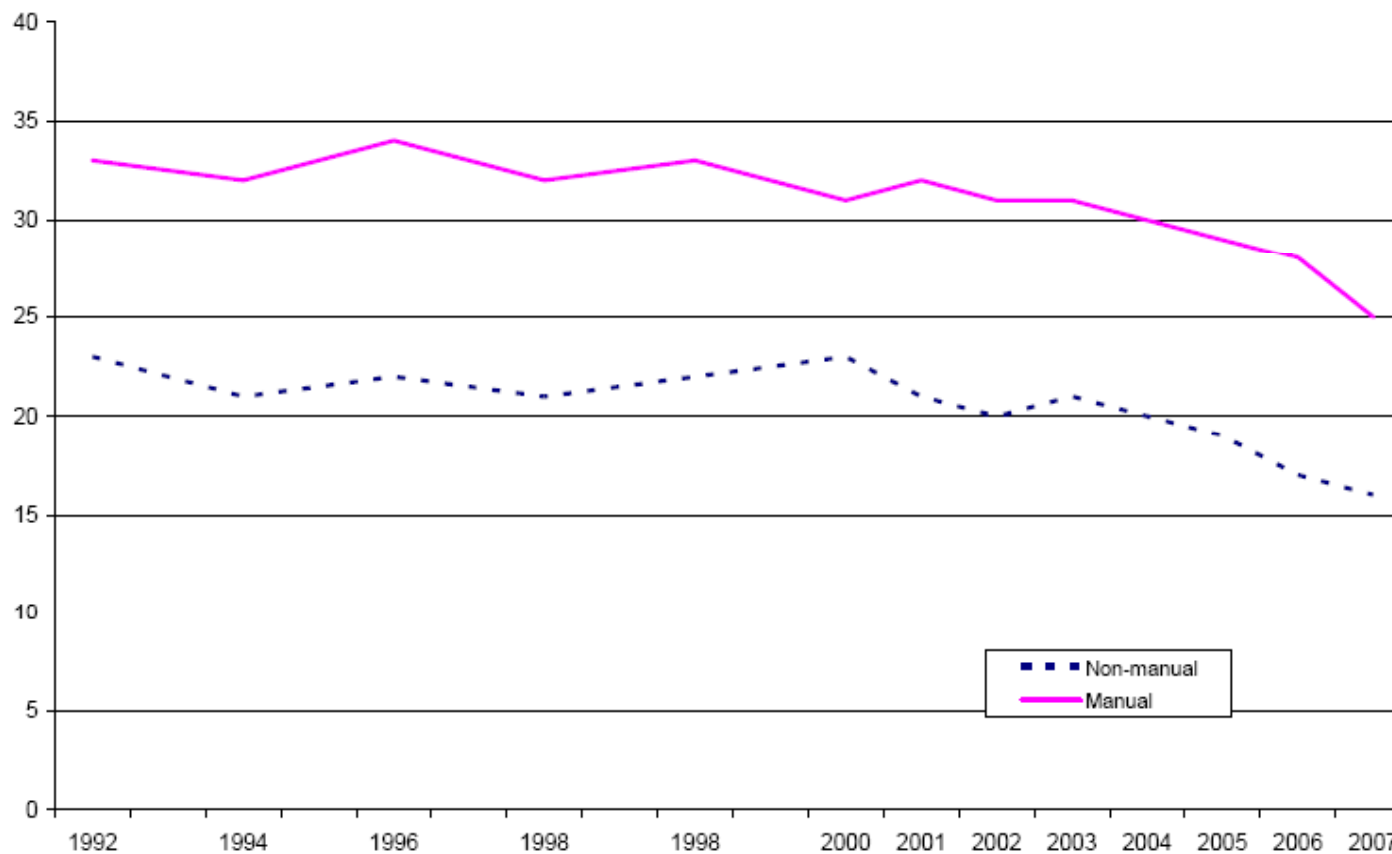
How strong is the relationship?

- Doll et al. (2004) key study of male doctors:
    - prolonged cigarette smoking from early adult life tripled age-specific mortality rates
    - but cessation at age 50 years halved the hazard,
    - cessation at age 30 years avoided almost all of it.

The Actuarial Profession
making financial sense of the future

Hazard ratios for all-cause mortality in the MRC 1946 British birth cohort members by the smoking trajectories and current smoking status (N=3286)

Smoking trajectories

	HR (95% CI) for all-cause mortality
Never smoker (921)	1
Predominantly non-smoker (1076)	1.30 (0.86, 1.99)
Predominantly smoker (692)	1.61 (1.03, 2.50)
Lifelong smoker (587)	3.21 (2.14, 4.79)

Most recent smoking status

Never-smoker (921)	1
Former smoker (1114)	1.28 (0.84, 1.95)
Current smoker (1251)	2.39 (1.64, 3.48)

Never smoker — Predominantly non-smoker
Predominantly smoker — Lifelong smoker

Clenell et al, JECH 08
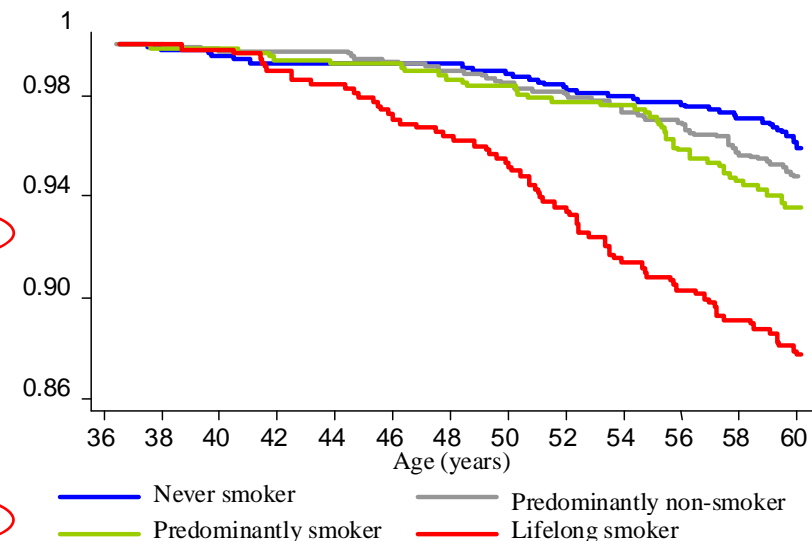
Smoking: summary

- Mortality risk due to smoking are well-established

- But only relatively recently has the role of smoking trajectory been highlighted:
    - impact of lifelong smoking
    - reduction in risk with cessation at different ages
    - role of when smoking behaviour started.

Physical Activity

- Data from the US suggest that physical inactivity is the fourth largest contributor to deaths (*Danaie, PLosMed 09*).

- One third reduction in all-cause mortality among the active compared with the least active participants.

- This magnitude of reduction was similar for both men and women (*Oguma, B J Sports Med 02*).

Physical inactivity and disease-specific mortality – results from meta-analyses
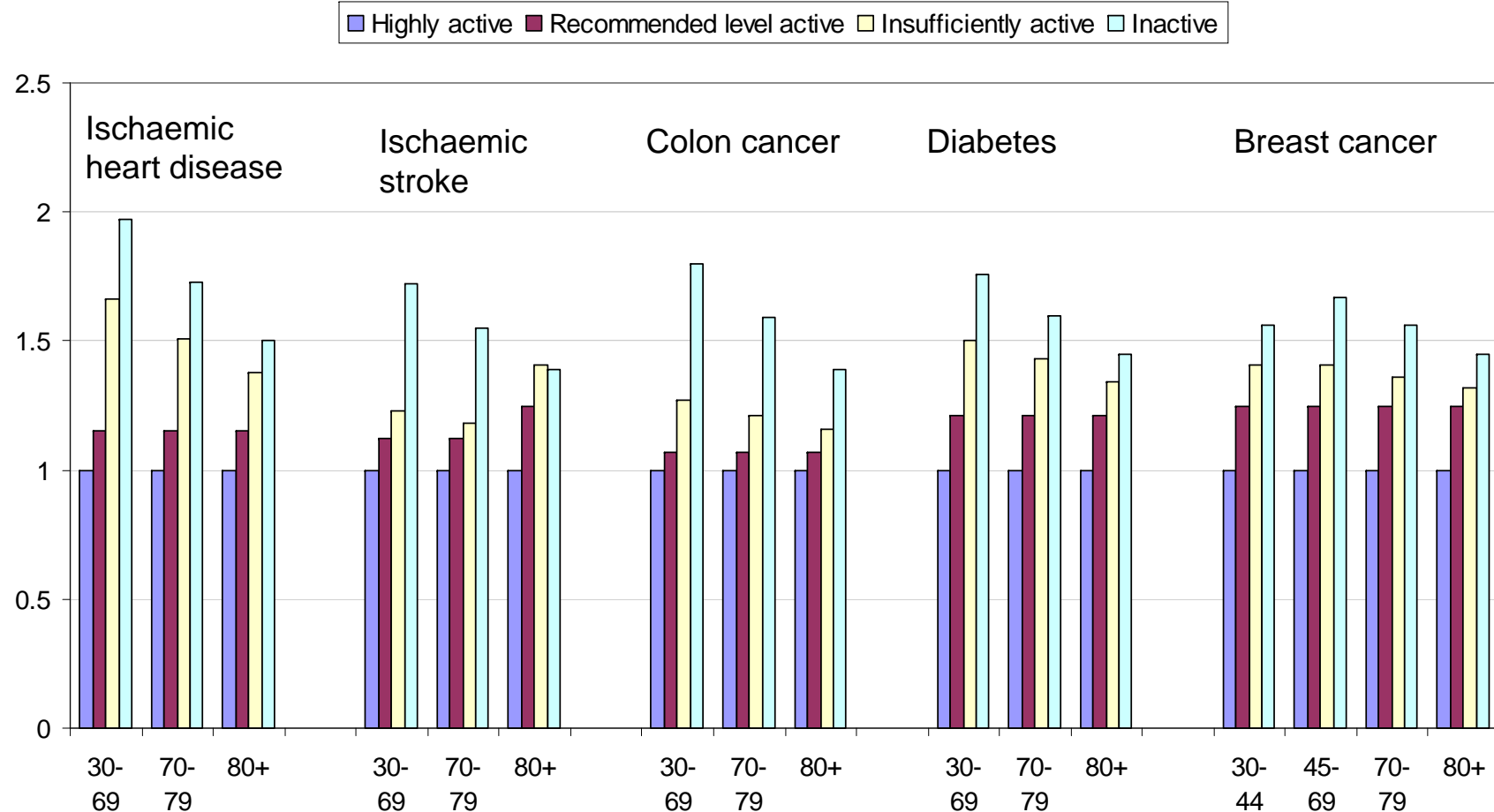
Danaei et al Plos Med 2009

Walking and all-cause mortality by sex

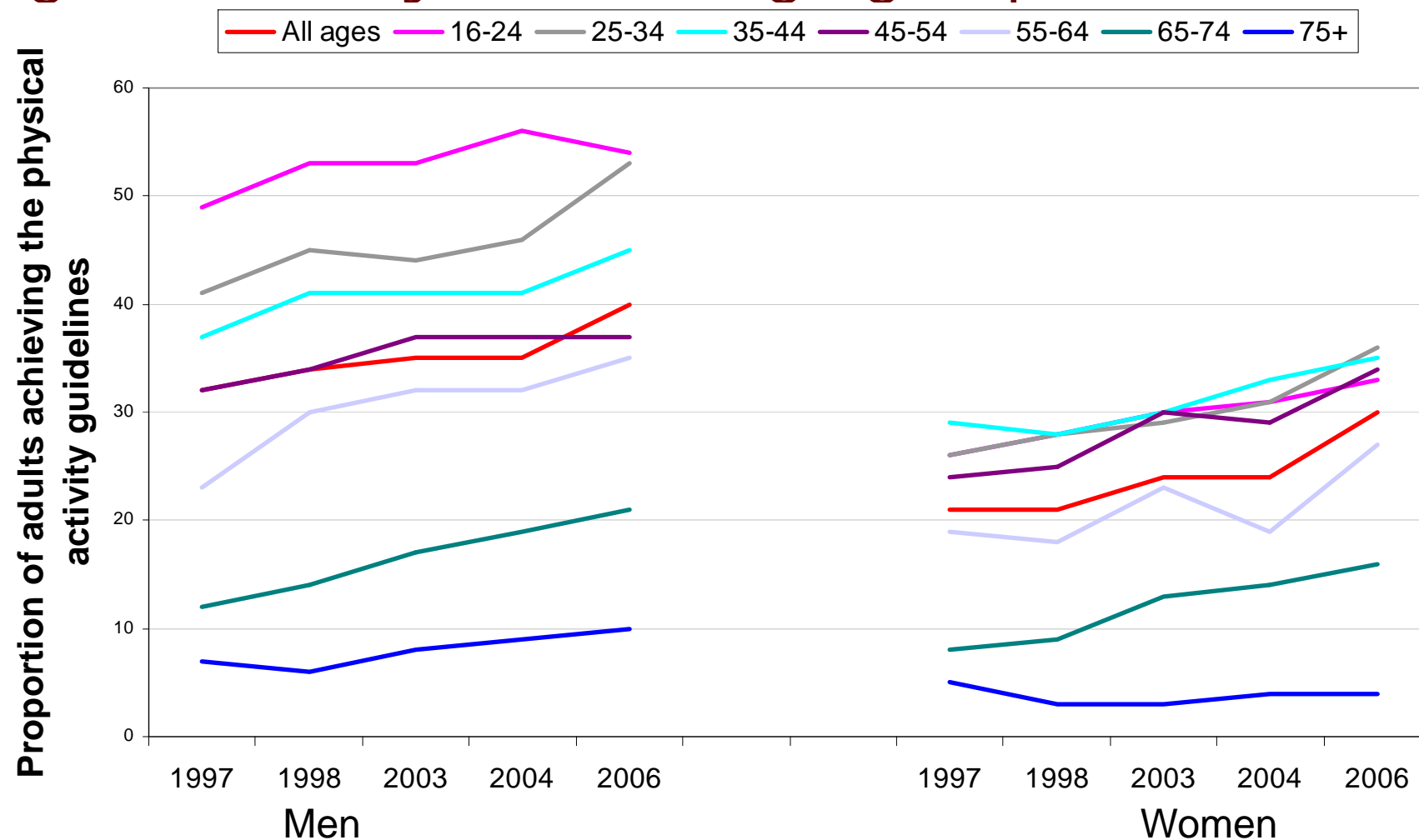|	Authors (year)	Exposure	Sample size	Hazard ratio (95% CI)	
Male					
1	Wannamethee et al (1998)[11]	Walking > 1 hour/day	4311	0.62	(0.37 to 1.05)
2	Hakim et al (1998)[12]	Walking > 3.2 km/day	707	0.55	(0.37 to 0.83)
3	Bijnen et al (1998)[13]	Walking > 1 hour/week	802	0.71	(0.58 to 0.88)
4	Davey Smith et al (2000)[19]	Brisk walking	6702	0.55	(0.48 to 0.63)
5	Fujita et al (2004)[24]	Walking > 1 hour/day	20 004	0.92	(0.80 to 1.06)
6a	Schnohr et al (2007)[26]	Walking > 2 hours/day	3204	0.89	(0.69 to 1.14)
6b	Schnohr et al (2007)[26]	Brisk walking	3204	0.43	(0.32 to 0.59)
	Subtotal		38 934	0.66	(0.53 to 0.83)
Female					
1	Gregg et al (2003)[23]	Walking > 898 kcal/week	9518	0.71	(0.62 to 0.82)
2	Fujita et al (2004)[24]	Walking > 1 hour/day	21 159	0.72	(0.59 to 0.89)
3a	Schnohr et al (2007)[26]	Walking > 2 hours/day	4104	0.81	(0.59 to 1.10)
3b	Schnohr et al (2007)[26]	Brisk walking	4104	0.48	(0.35 to 0.66)
4	Matthew et al (2007)[27]	Walking > 10 MET-hours/day	67 143	0.86	(0.71 to 1.05)
	Subtotal		106 028	0.72	(0.62 to 0.84)
Male and female					
1	LaCroix et al (1996)[10]	Walking > 4 hours/week	1645	0.73	(0.48 to 1.10)
2	Stessman et al (2000)[18]	Walking > 4 hours/week	456	0.14	(0.04 to 0.50)
	Total		147 063	0.68	(0.59 to 0.78)
	Test for heterogeneity			$\chi^2(13) = 31.35$, p < 0.001	
	Test for overall effect			$\chi^2(1) = 57.86$, p < 0.001	

Reference group: lowest walking group

Hamer & Chida Br J Sports Med 2008

Trends achieving the physical activity guidelines by sex and age group

Legend: All ages — 16-24 — 25-34 — 35-44 — 45-54 — 55-64 — 65-74 — 75+

Proportion of adults achieving the physical activity guidelines

Men: 1997, 1998, 2003, 2004, 2006

Women: 1997, 1998, 2003, 2004, 2006

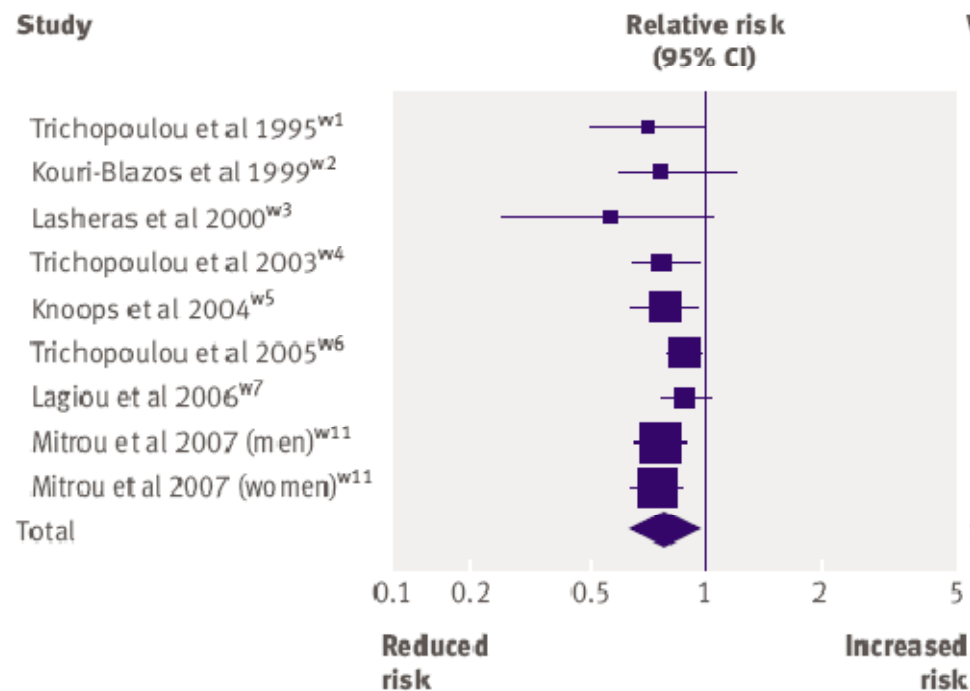# Physical Activity: summary

- **Strong inverse dose response relationship between physical activity and mortality**
    - but more research needed on the type, timing, and duration of physical activity
    - greater understanding in how to increase the proportion of those meeting guidelines

Fruit and vegetables intake and mortality

- The global burden of disease attributable to suboptimal intake of fruit and vegetable has been estimated at:
    - 31% for ischaemic heart disease,
    - 19% for ischaemic stroke,
    - 19% for stomach cancer, and
    - 12% for lung cancer

- Widely adopted 5 a day guideline:
    - eating at least 5 portions of a variety of fruit and vegetables (total 400g)

- In the UK, men have average daily intake of 2.7 portions, women 2.9 portions (NDNS)

Department of Health. 2000. The NHS Plan. London: Department of Health.

The Actuarial Profession
making financial sense of the future

Mediterranean diet and mortality

Risk of all-cause mortality associated with 2 points increase in adherence score

Sofi et al BMJ 08

Combinations of health behaviours and mortality risk

- From a UK prospective cohort study adherence to all four health behaviours:
  1) Current non-smoking
  2) Physically active
  3) Moderate alcohol consumption
  4) Plasma C >50nmol/l
- Resulted in:
  - a four fold decrease in mortality risk cf with those who adhered to none
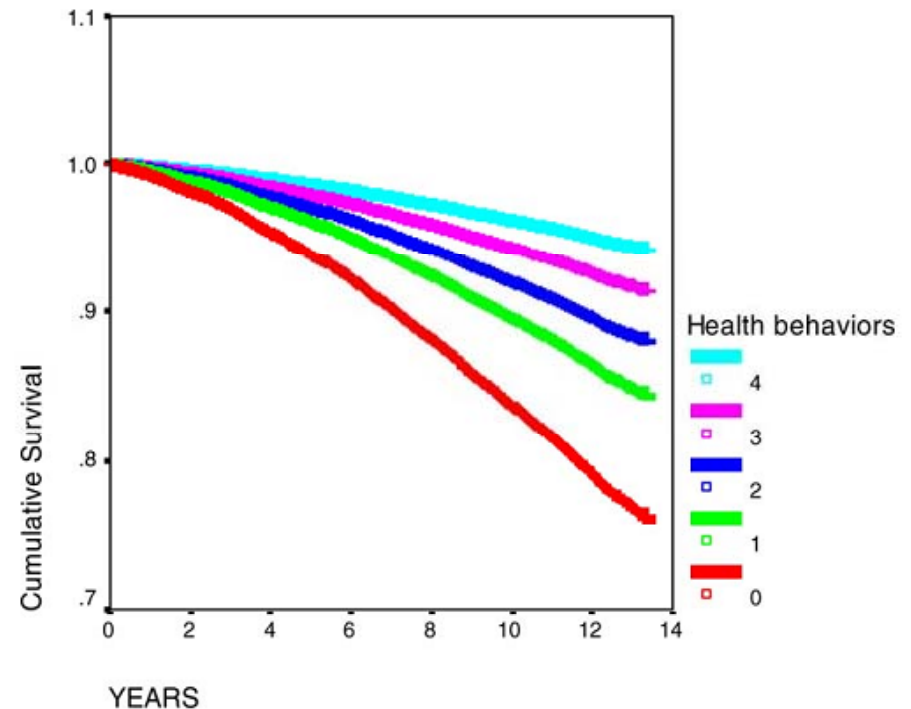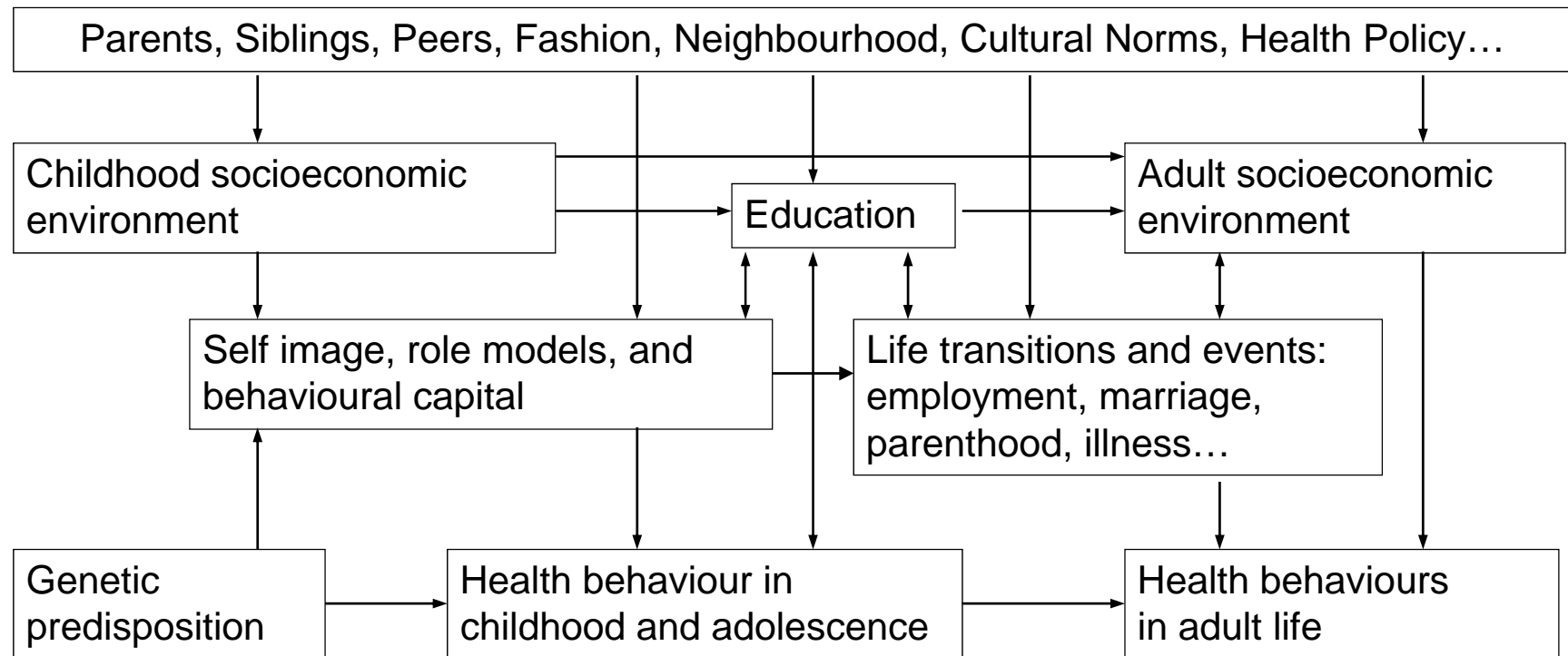 - a survival comparable to someone who was 14 years younger in age.

Figure 1. Survival Function According to Number of Health Behaviours in Men and Women Aged 45–79 Years without Known Cardiovascular Disease or Cancer, Adjusted for Age, Sex, Body Mass Index and Social Class, EPIC-Norfolk 1993–2006

doi:10.1371/journal.pmed.0050012.g001

Khaw et al PLOSMed 2008

Early life origins of lifestyle

- Growing up in disadvantaged socioeconomic environment is associated with the initiation and maintenance of some adverse health behaviours

- For example: the critical role of initiation of smoking before 18 yrs on lifelong smoking habits
  - Smoking by parents, siblings, and especially friends was associated with a higher risk not only of starting smoking but also of developing a daily habit.

  - Starting smoking was also associated with stress or a lack of self-confidence.

Developmental life course framework

Parents, Siblings, Peers, Fashion, Neighbourhood, Cultural Norms, Health Policy…

Childhood socioeconomic environment

Education

Adult socioeconomic environment

Self image, role models, and behavioural capital

Life transitions and events: employment, marriage, parenthood, illness…

Genetic predisposition

Health behaviour in childhood and adolescence

Health behaviours in adult life

What will a life course perspective add?

- Tracking participants from early childhood through adult life allows researchers to investigate:
    - when each health related behaviour arises
    - role of the duration of a health behaviour
    - under which social and environmental circumstances
    - and how one health behaviour clusters with others

To better tailor effective intervention policies.

Future research: Family based study & cross cohort comparison

- Family based studies to disentangle genetic and environmental effects of health behaviours on mortality risk.

- Cross-cohort comparisons provide a way to add value to the research on health behaviours from numerous existing life course studies

- If applied to studies from different cohorts/countries:
  - either provide immediate cross-validation of research findings
  - or establish which determinants vary according to factors such as country of residence, ethnicity, age, and cohort.

- Healthy Ageing across the Life Course (HALYCON) collaborative research program (www.halcyon.co.uk).

Thank you!