The Hertfordshire Cohort Study: novel approaches to exploring musculoskeletal functioning in later life

Shirley Simmonds & Richard Dodds
MRC Lifecourse Epidemiology Unit
University of Southampton

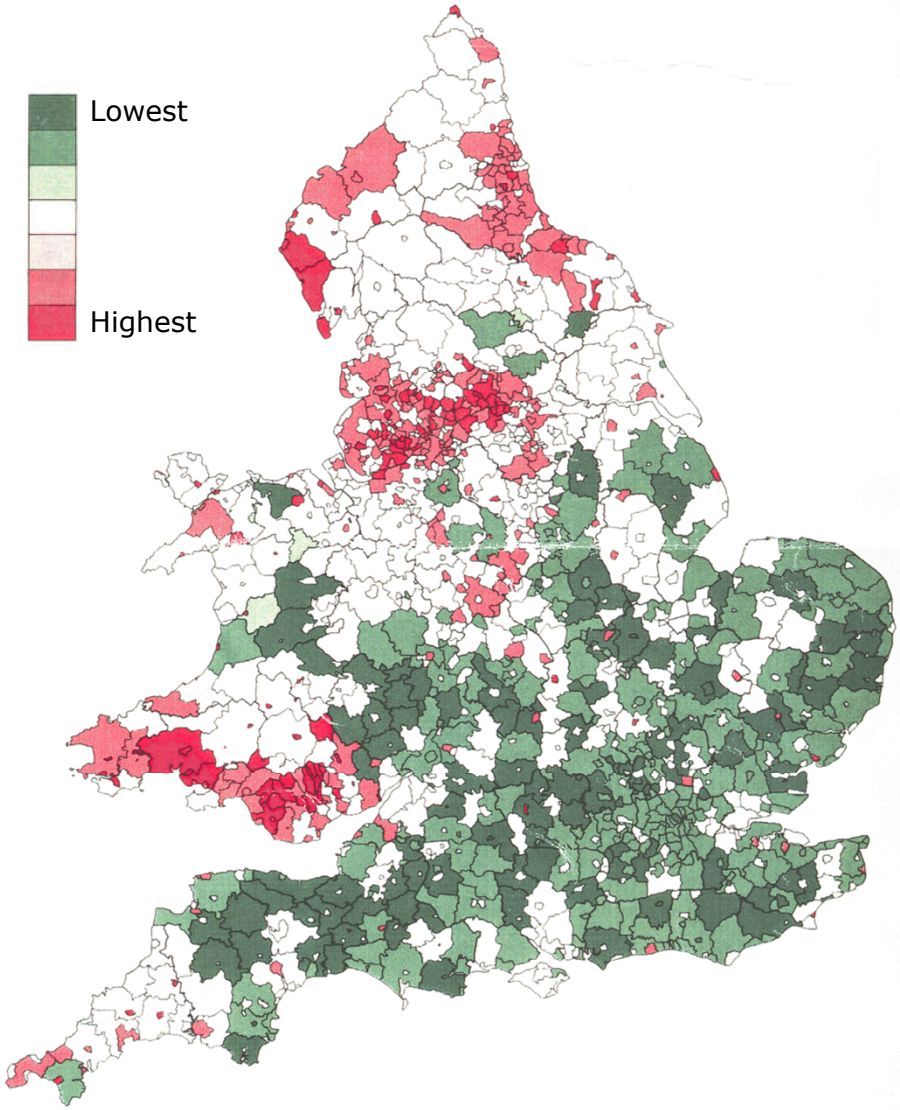
MRC Lifecourse Epidemiology Unit

University of Southampton

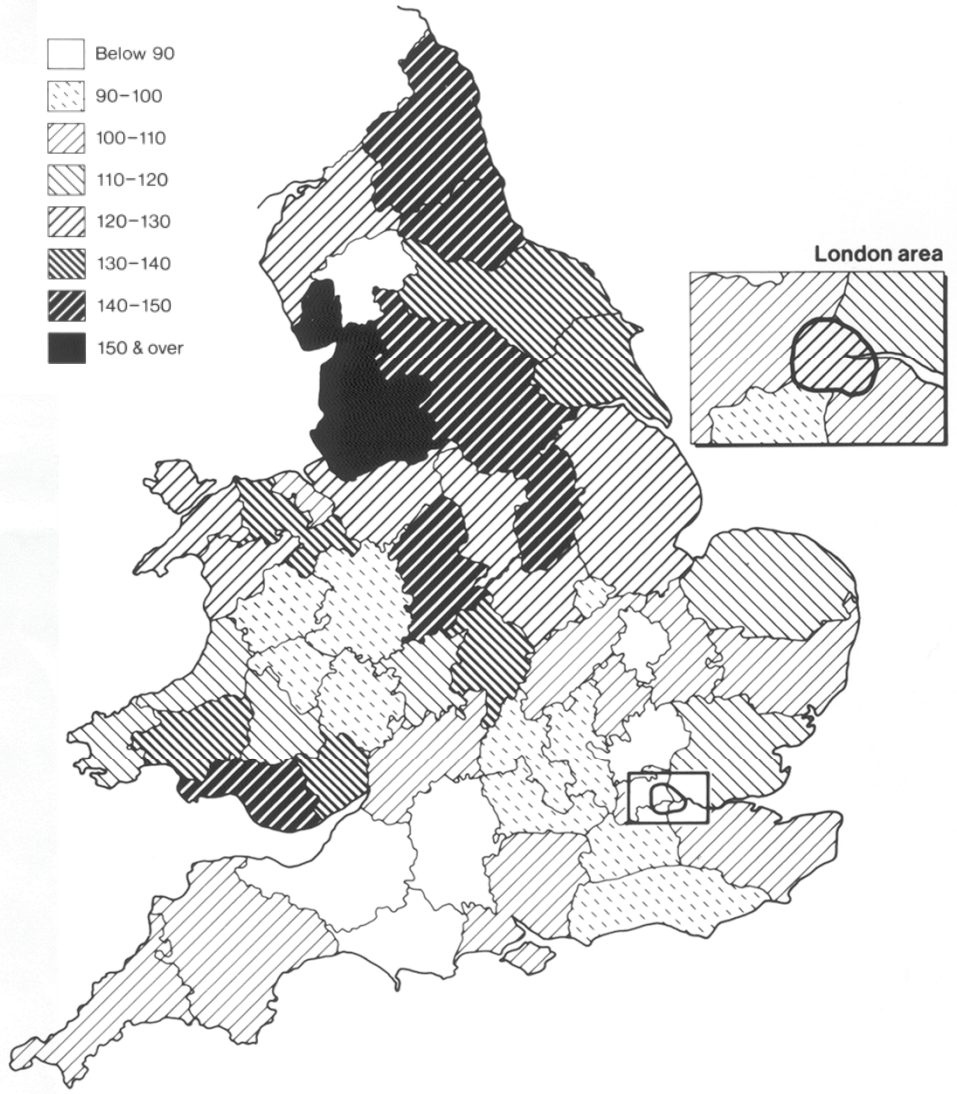
Novel approaches in the Hertfordshire Cohort Study

1. The Hertfordshire Cohort Study: the first 100 years…
2. Developmental origins of sarcopenia: initial evidence, cross-cohort work and detailed physiological studies
3. Relevance to practice & policy: linkage to routine data
4. Summary

Coronary heart disease: Men, 1968-78



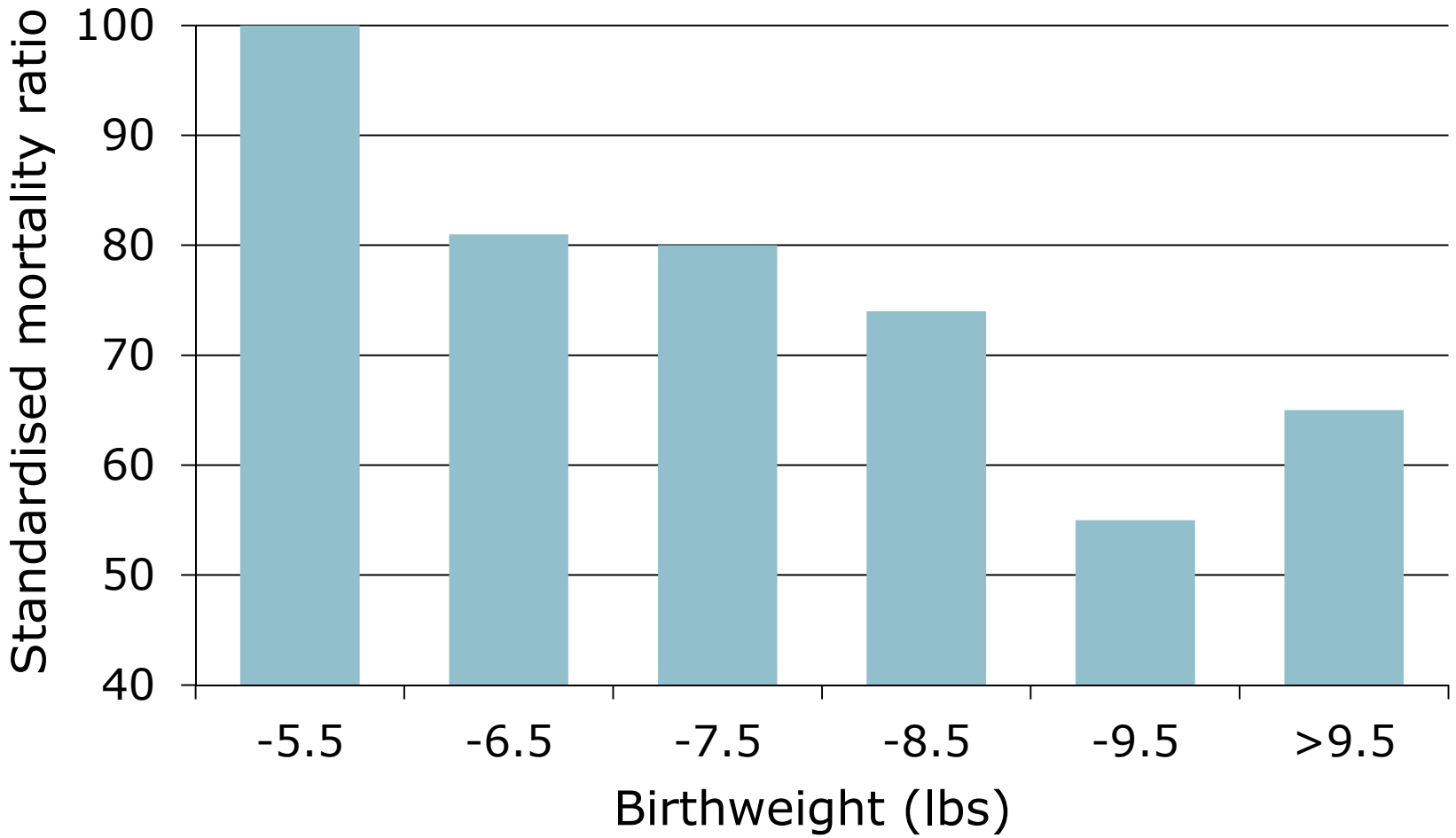
Infant mortality: rate per 1000, 1901-10



The Hertfordshire Records

Weight at Birth.	Weight 1st Year	Food.	No. of Visits.	Condition, and Remarks of Health Visitor. W	V.	D	T
8¼ lbs	24½ lbs	B.	11	4	-	-	4
Healthy & well developed.			Buckland School. Card to S.				
7 lbs	18¼ lbs	B	12	h.	4.	4.	8
moved to Bury Green Lt.			Hadham. Had measles, pneumonia.				
8	20	Bot.	11	Y.	Y.	?	4
T.B. above in left neck opened. Ant. fontanelle still open @ 3 yrs. Abdomen very large. p							
8½	22	B.B.	9	Y	Y	Y	10
Healthy & normal.			Buckland School. Card.				

Death rates from coronary heart disease among 15,726 men and women in Hertfordshire according to birth weight

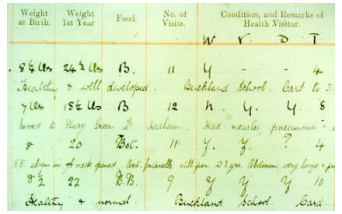


Osmond C *et al* BMJ 1993

Hertfordshire Cohort Study

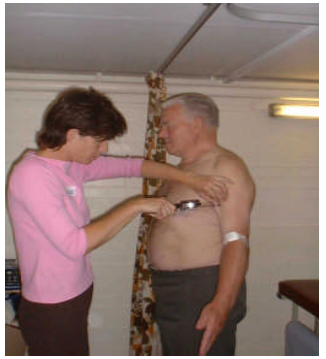
lifecourse influences on human health, ageing and disease in 2997 men and women born 1931 - 1939

Historical records Birth weight, weight at one year
Infant feeding/infections



Questionnaire
General health
SF-36
Diet (FFQ and 24 hr diary)
Physical activity

Clinic visit
CVD: blood pressure, ECG
Type 2 DM: anthropometry, OGTT
Muscle: anthropometry, strength, pQCT
Bone: DXA
Joints: Hand & knee x-rays

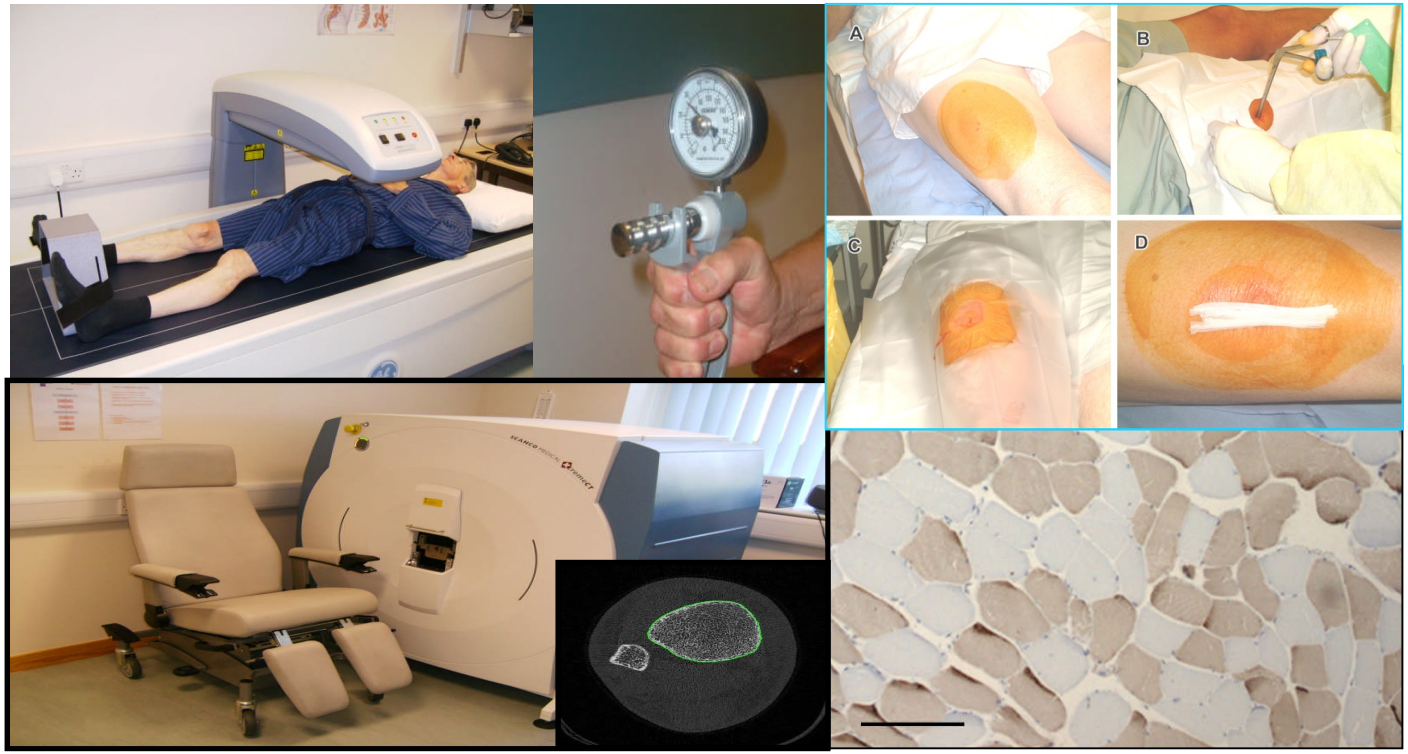


Venous blood Glucose, insulin, bone turnover, DNA

Syddall *et al* Int J Epidemiol 2005

The Hertfordshire Cohort Study: from historical to high-tech studies of musculoskeletal ageing in men and women entering their ninth decade

Photoessay describing the history of the Hertfordshire Cohort Study over nearly hundred years, from instigation of the system that provided the historical records, to the modern-day high-tech measurement systems enabling detailed musculoskeletal characterisation

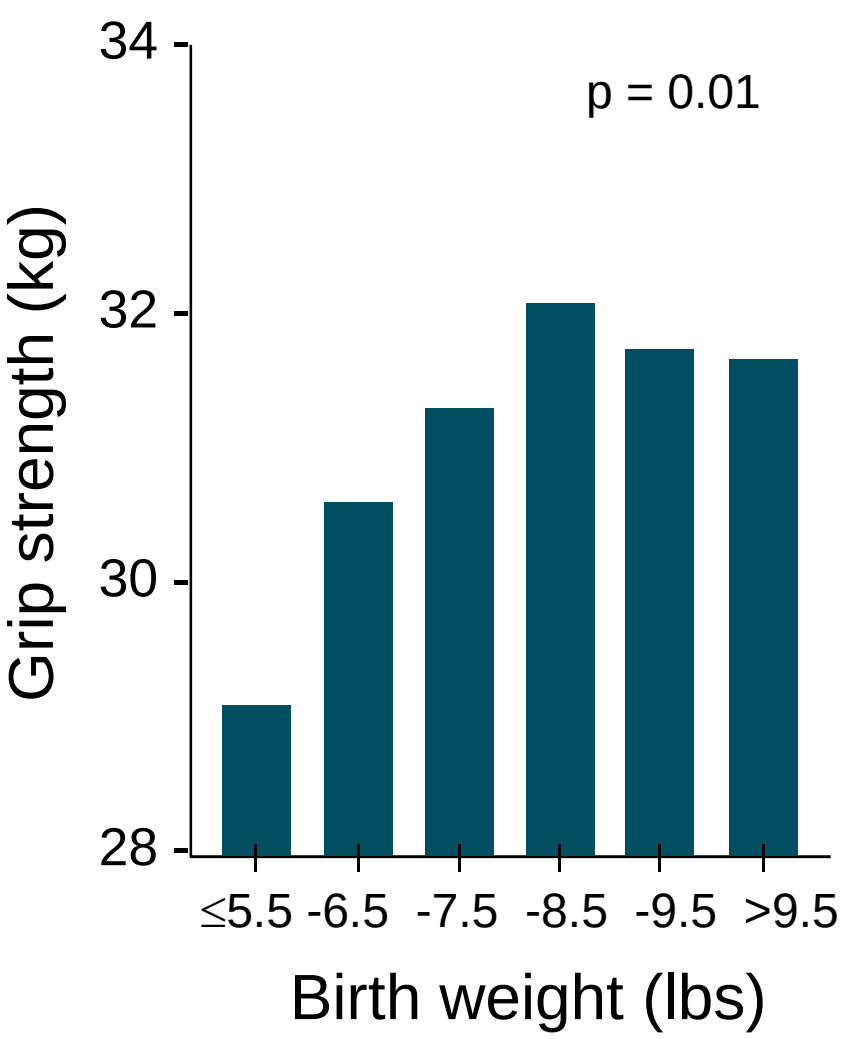


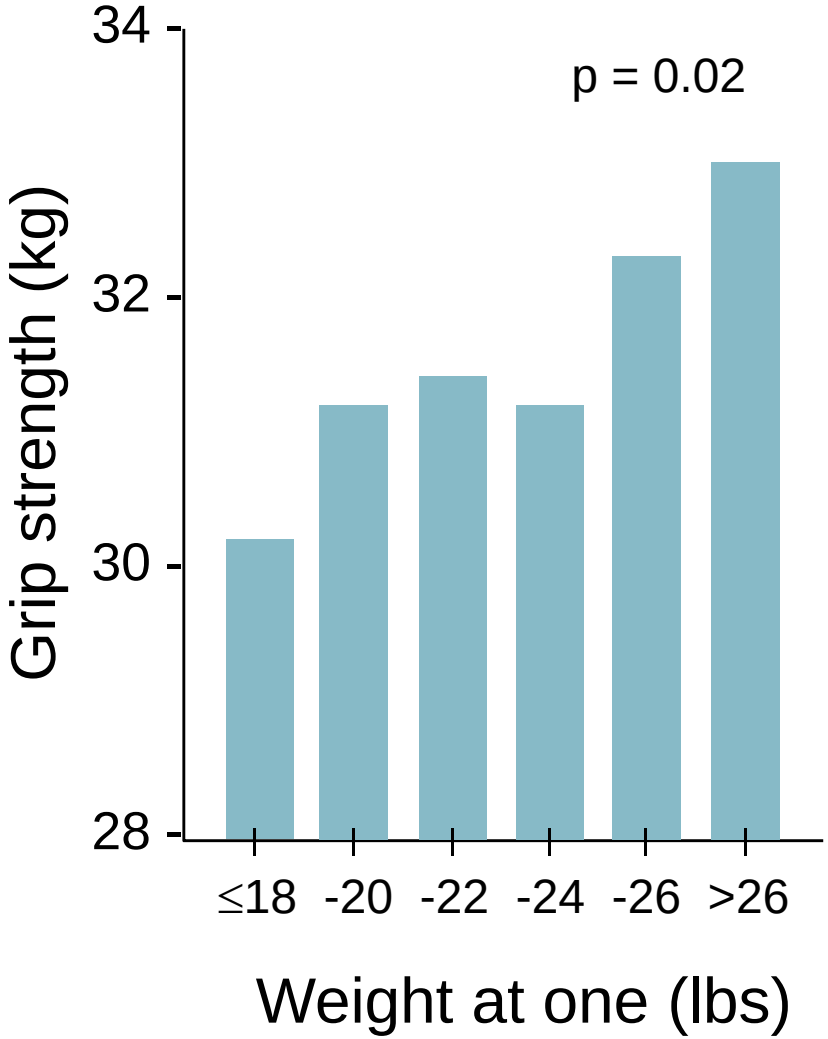
Denison H *et al* Int J Epidemiol 2012

Early growth and muscle strength

- Muscle strength is important for health in older age, as evidenced by studies showing associations between weak grip and
  - Greater dependency of activities of daily living
  - Greater morbidity including type 2 diabetes mellitus
  - Higher all-cause mortality rates
- Findings from Hertfordshire highlighted the potential relevance of growth in early life for successful ageing

Are rates of ageing determined in utero? Findings from the Hertfordshire Ageing Study



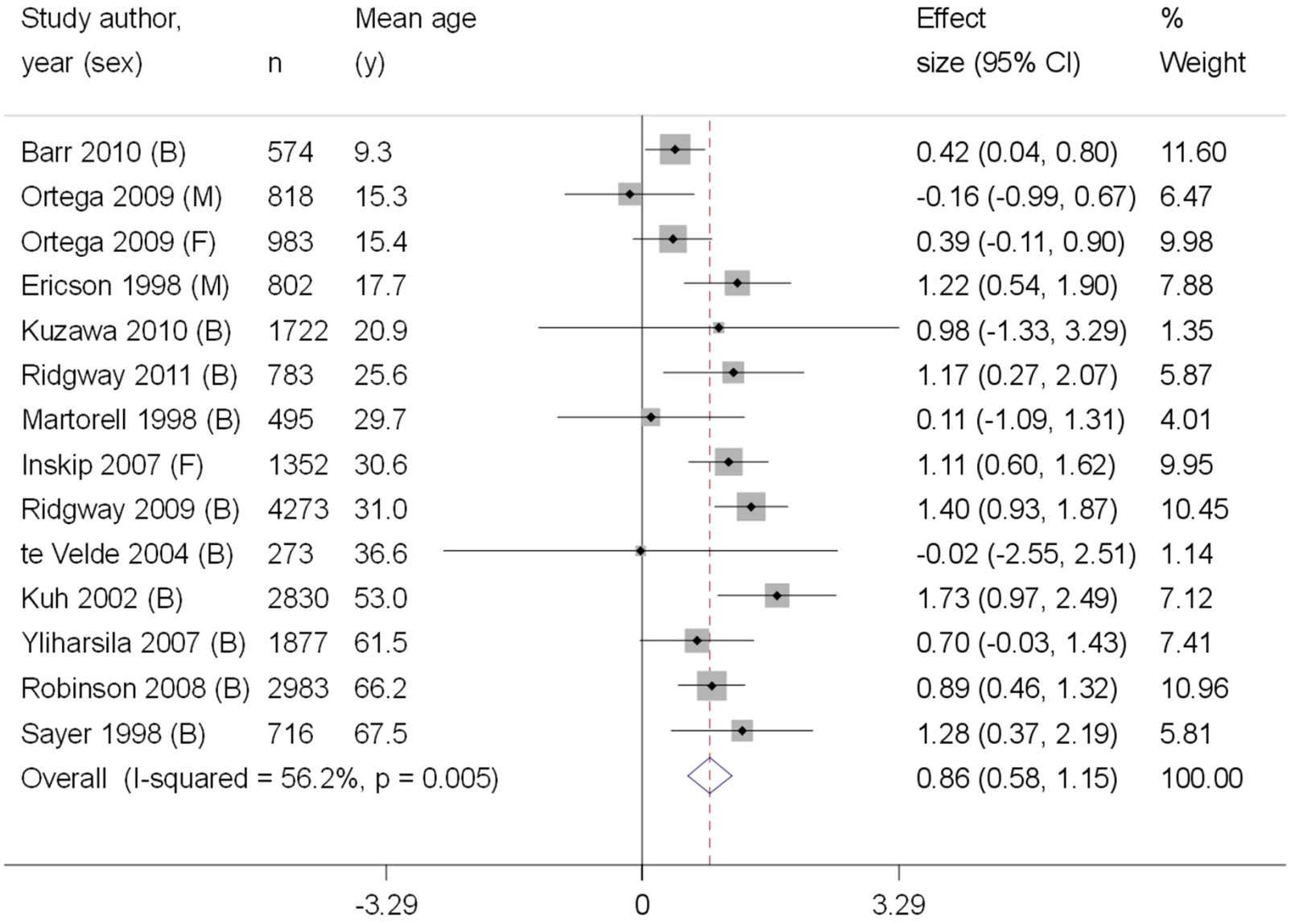


Sayer AA *et al* Age Ageing 1998

Birth weight and muscle strength: a systematic review and meta-analysis

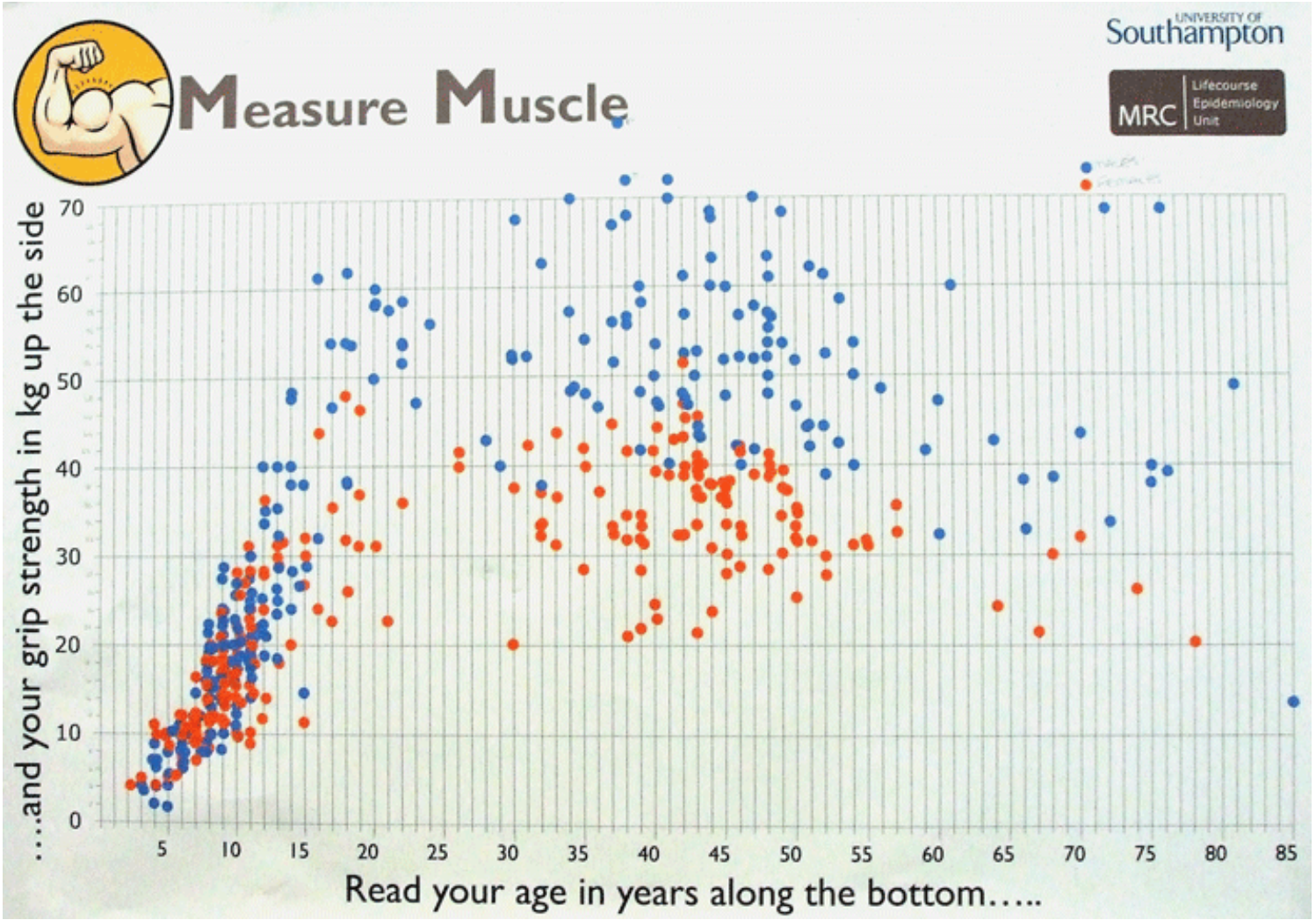
- We screened 10 365 abstracts and 19 articles met inclusion criteria
- 15 studies used grip as a single measure of strength
- 17 studies found that higher birth weight was associated with greater strength
- Meta-analysis (13 studies, 20 481 participants, mean ages 9.3 to 67.5) showed a 0.86 kg (95% CI 0.58, 1.15) increase in muscle strength per additional kilogram of birth weight, after adjustment for age, height and gender.

Dodds R, Denison H et al. Journal Nutrition, Health and Ageing 2012;16(7):609-15



Dodds R, Denison H et al. Journal Nutrition, Health and Ageing 2012;16(7):609-15

University of Southampton: example of public engagement activity



Research Training Fellowship - objectives

1. To describe a trajectory of the population mean of life course grip strength from childhood to old age, by combining longitudinal data from several UK cohorts

2. To compare the influence of physical activity on grip strength at different ages across the life course

3. To explore the relationship between physical activity and subsequent grip strength trajectory

MRC Lifecourse Epidemiology Unit

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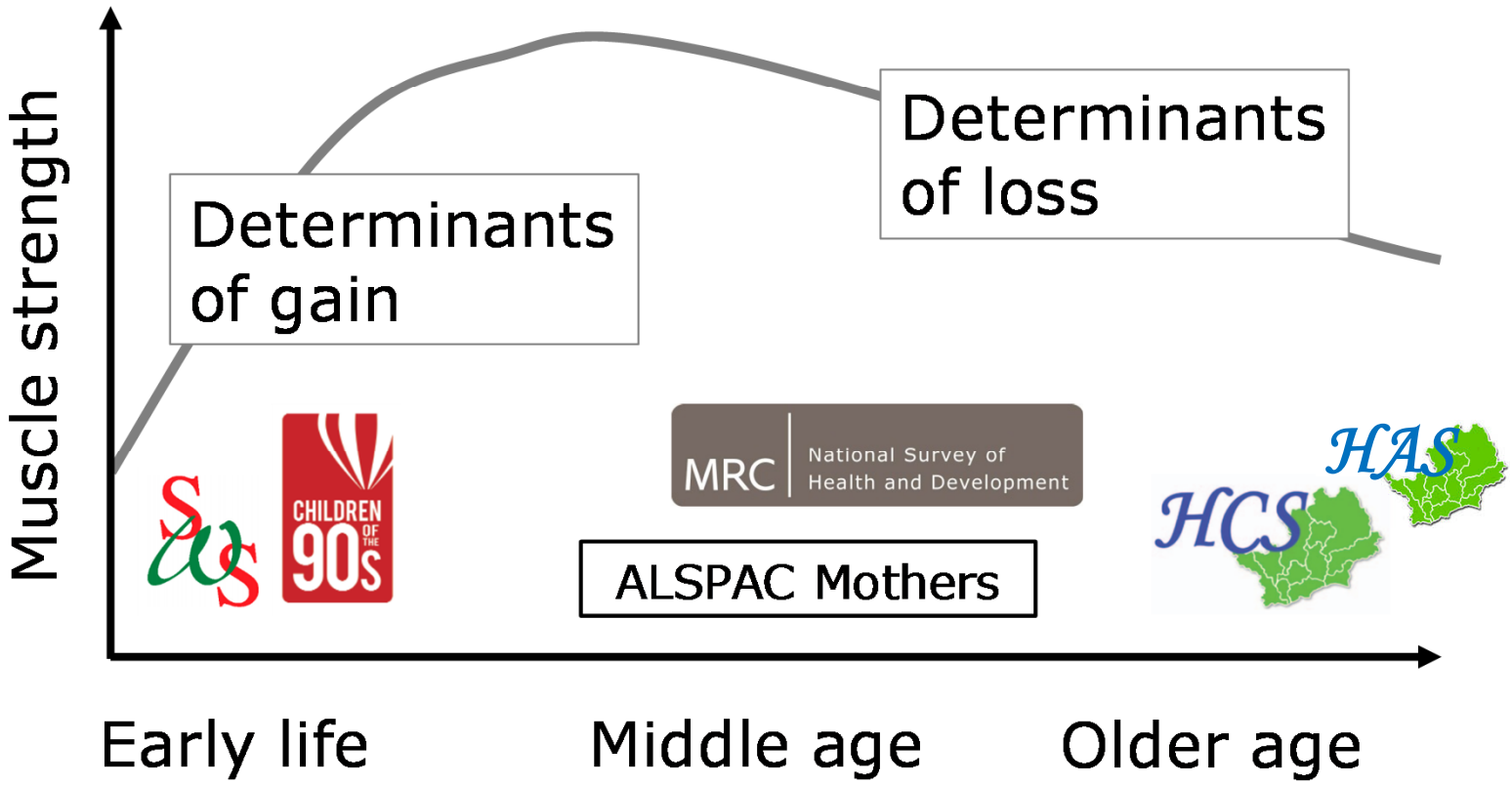
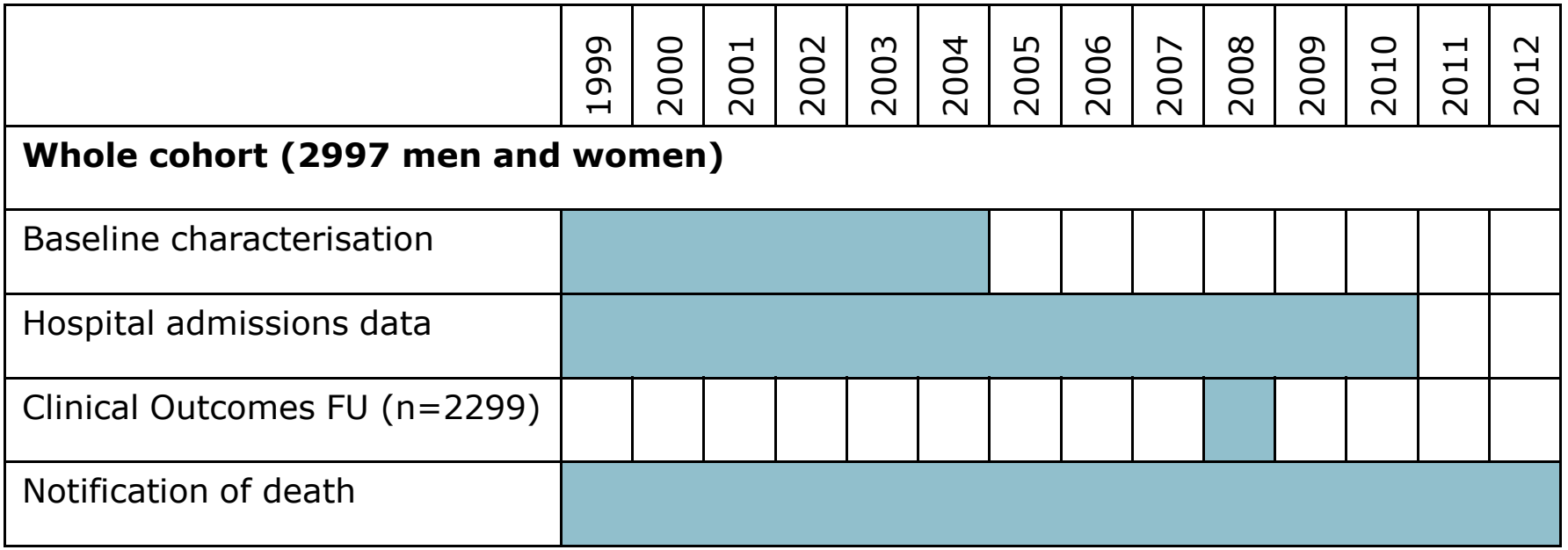
Supported by wellcome trust

Research Training Fellowship - overview



HCS: Cohort-wide and detailed sub-cohort studies



Examples of detailed sub-cohort studies

Musculoskeletal follow-up

Hertfordshire Sarcopenia Study

Hertfordshire Bone Study

Hertfordshire Physical Activity Trial

GH/IGF axis and BMD

Biochemical markers of osteoarthritis

HPA activity

Personality questionnaire

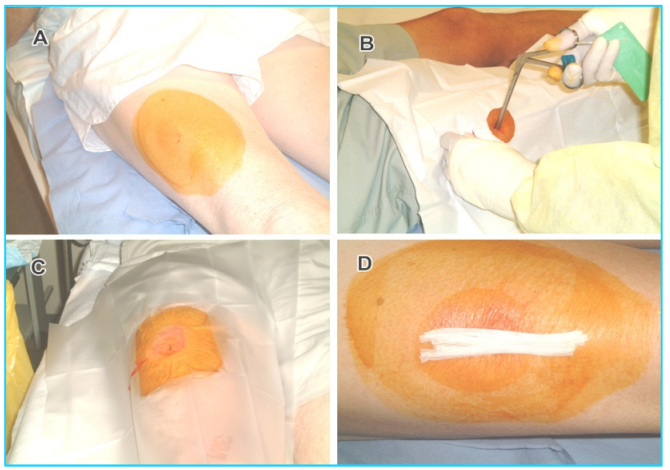
Hertfordshire Sarcopenia Study: investigation of cellular and molecular mechanisms

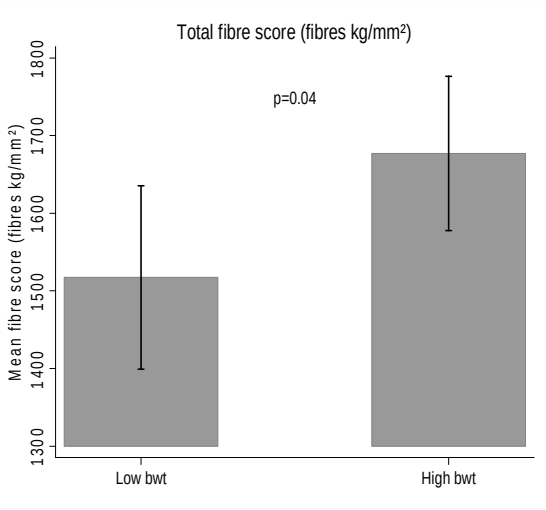
- Muscle tissue successfully collected and processed for 105 men aged 64 – 73 years with lower and higher birth weight

- Muscle biopsy was feasible, acceptable & efficient in context of a major epidemiological study

- Trends found for reduced fibre density & significantly reduced total fibre score in low birth weight men

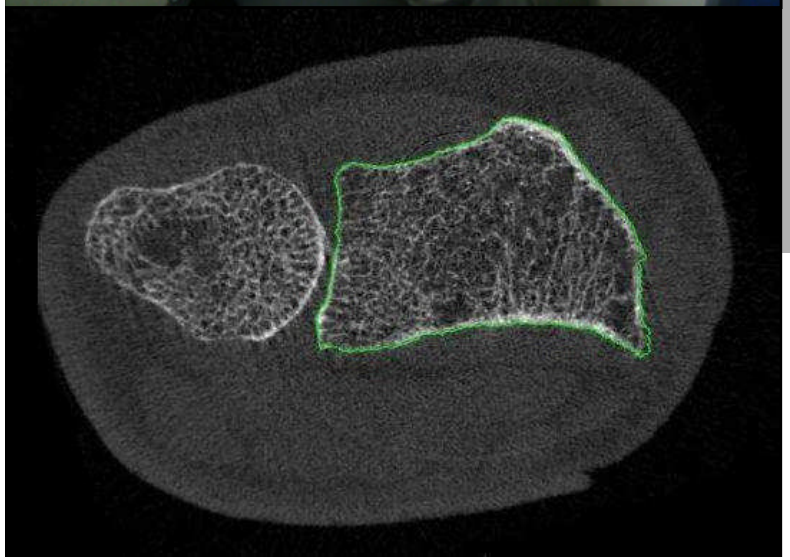
- Gene expression & epigenetic studies

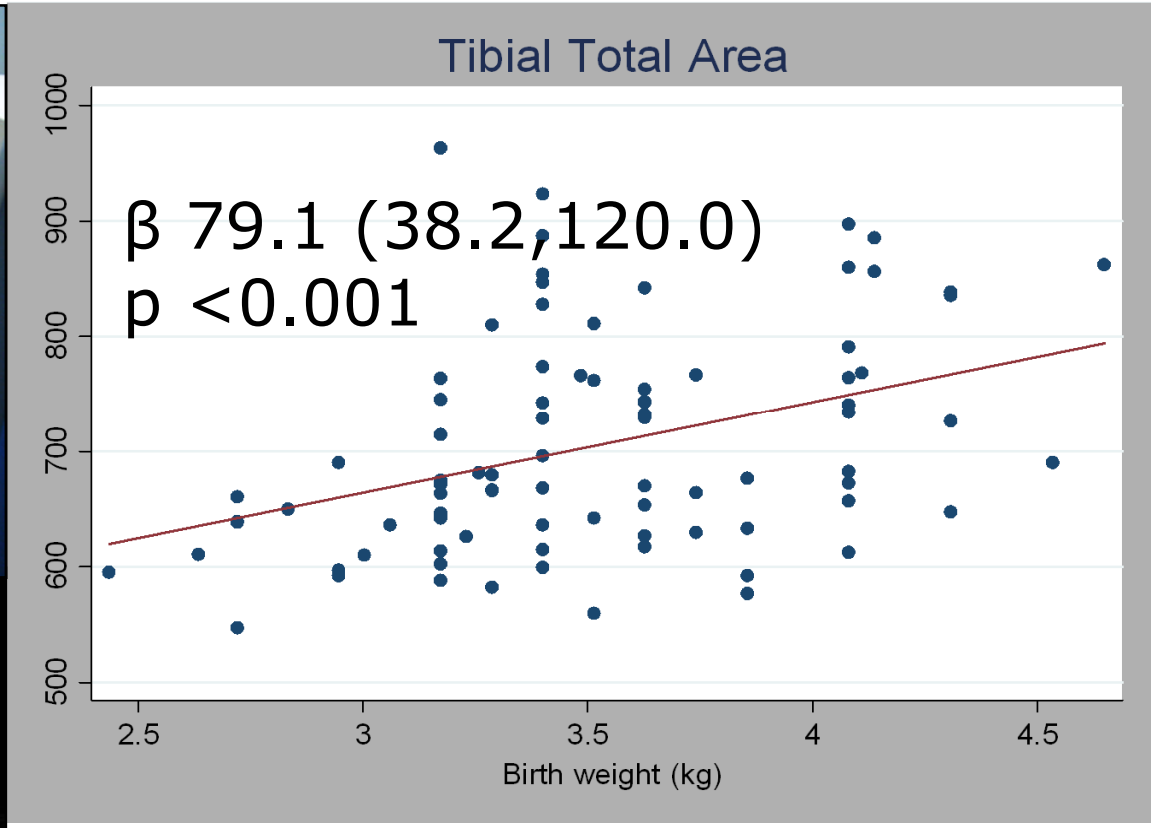




Patel H *et al* J Nutr Health Aging 2011

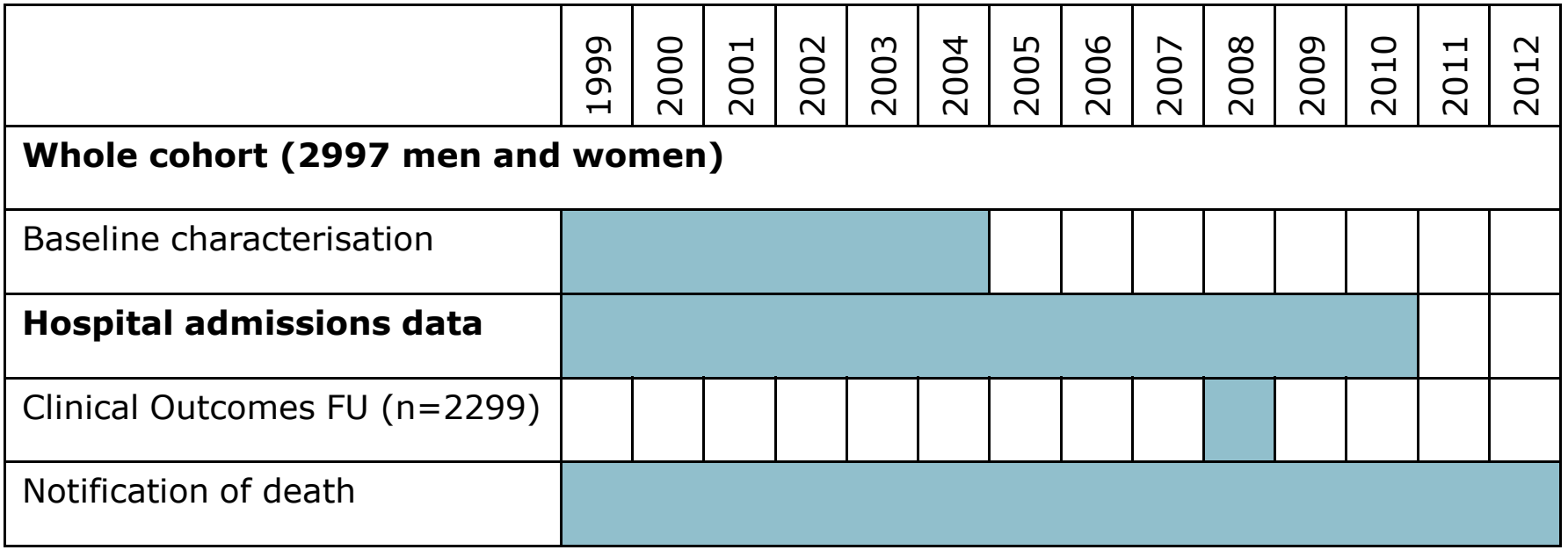
Association between the birth weight and tibial total area in Hertfordshire women





Positive relationship between birth weight and tibial total area in women

HCS: Cohort-wide and detailed sub-cohort studies



Examples of detailed sub-cohort studies

Musculoskeletal follow-up

Hertfordshire Sarcopenia Study

Hertfordshire Bone Study

Hertfordshire Physical Activity Trial

GH/IGF axis and BMD

Biochemical markers of osteoarthritis

HPA activity

Personality questionnaire

Methods

- Signed consent was obtained from participants at baseline to access their medical records in the future

- Hospital Episode Statistics data for HCS participants were obtained (www.hesonline.nhs.uk)

- Data were condensed, cleaned and checked

- 2997 HCS men and women experienced a total of 8741 admissions from their baseline to 31/03/10

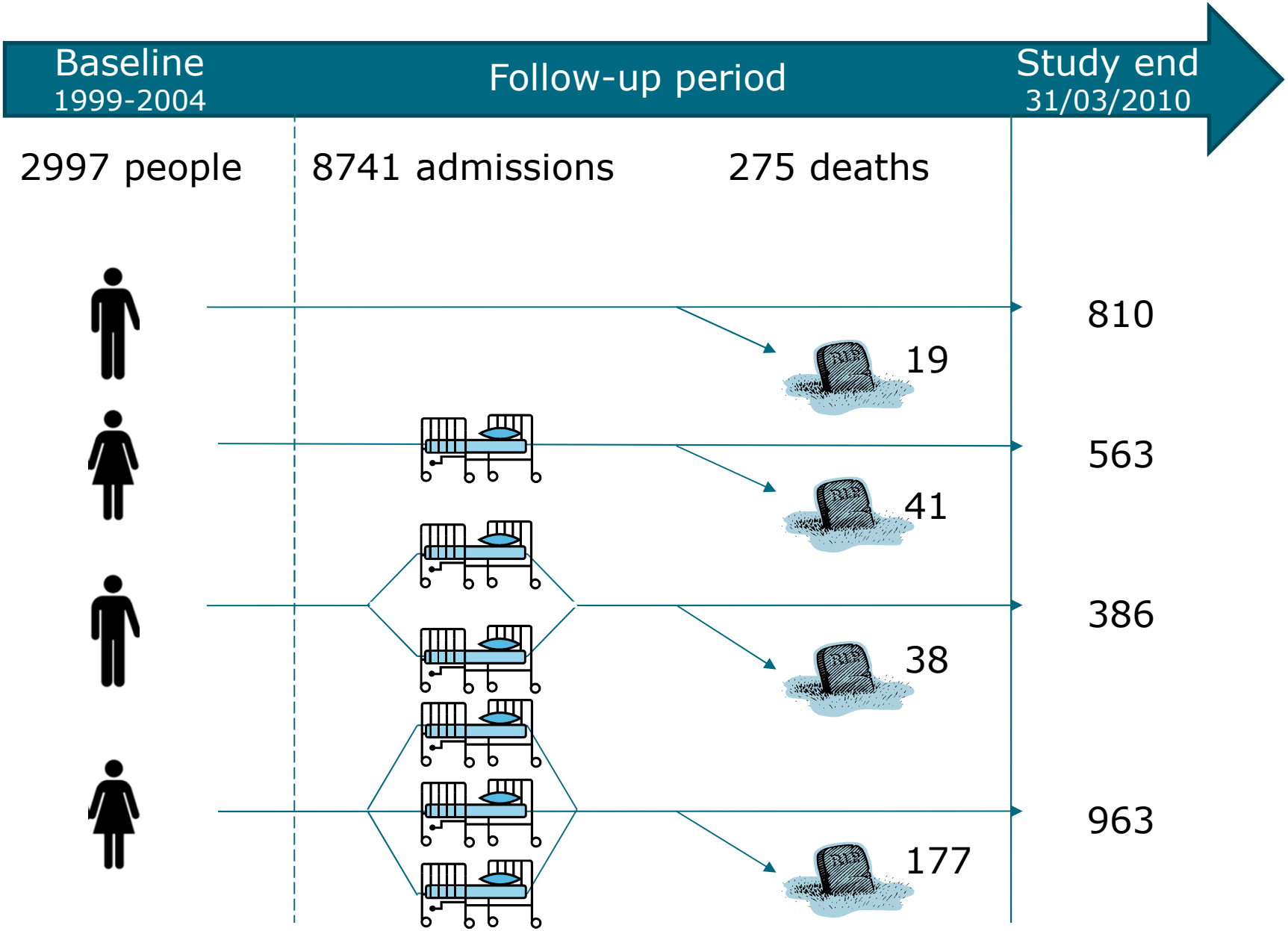
Hospital Episode Statistics: supplied data

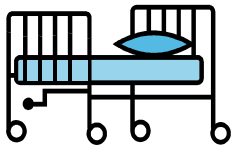
For 8741 admissions:

- ★Where admitted from?
- ★Elective/Emergency
- ★Diagnoses (ICD10)
- ★Procedures (OPCS-4)
- ★Duration of stay
- ★Where discharged to?

We can consider these records at the admissions or the individual level

Study overview





Characteristics of 8741 admissions

Patient gender	n	%
Male	5183	59
Female	3558	41
Where admitted from?		
Other hospital	126	1
Temporary residence	14	-
Usual residence	8593	98
Elective/emergency		
Elective	6504	74
Emergency	2213	25
Transfer	24	1

Duration of stay (days)	n	%
Day case	5057	58
2	938	11
3	492	6
4	350	4
5+	1904	21
(max 141)		
Where discharged to?		
Usual residence	8518	97
Died	127	1
Temporary residence	19	-

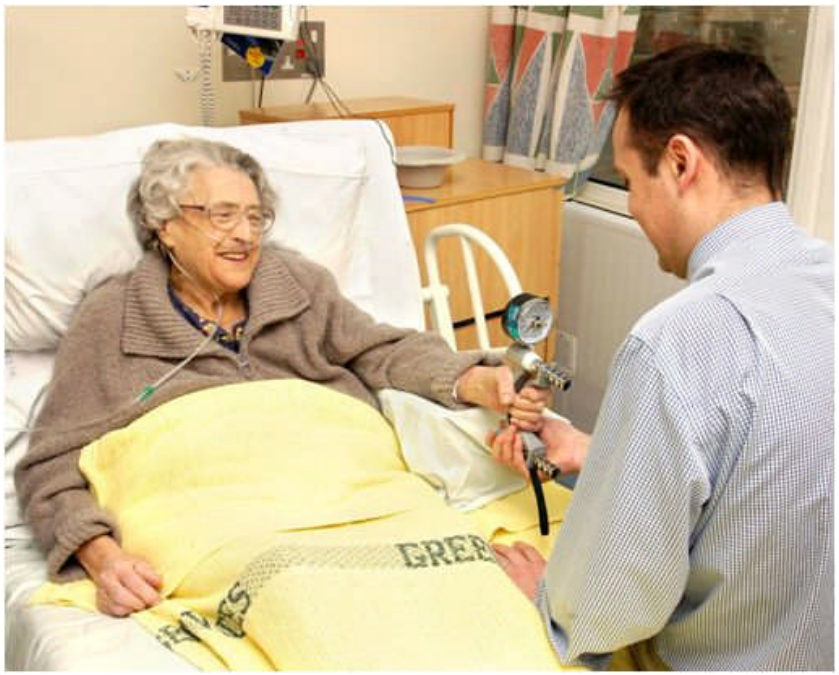
Admissions among 2997 individuals

Among everyone:

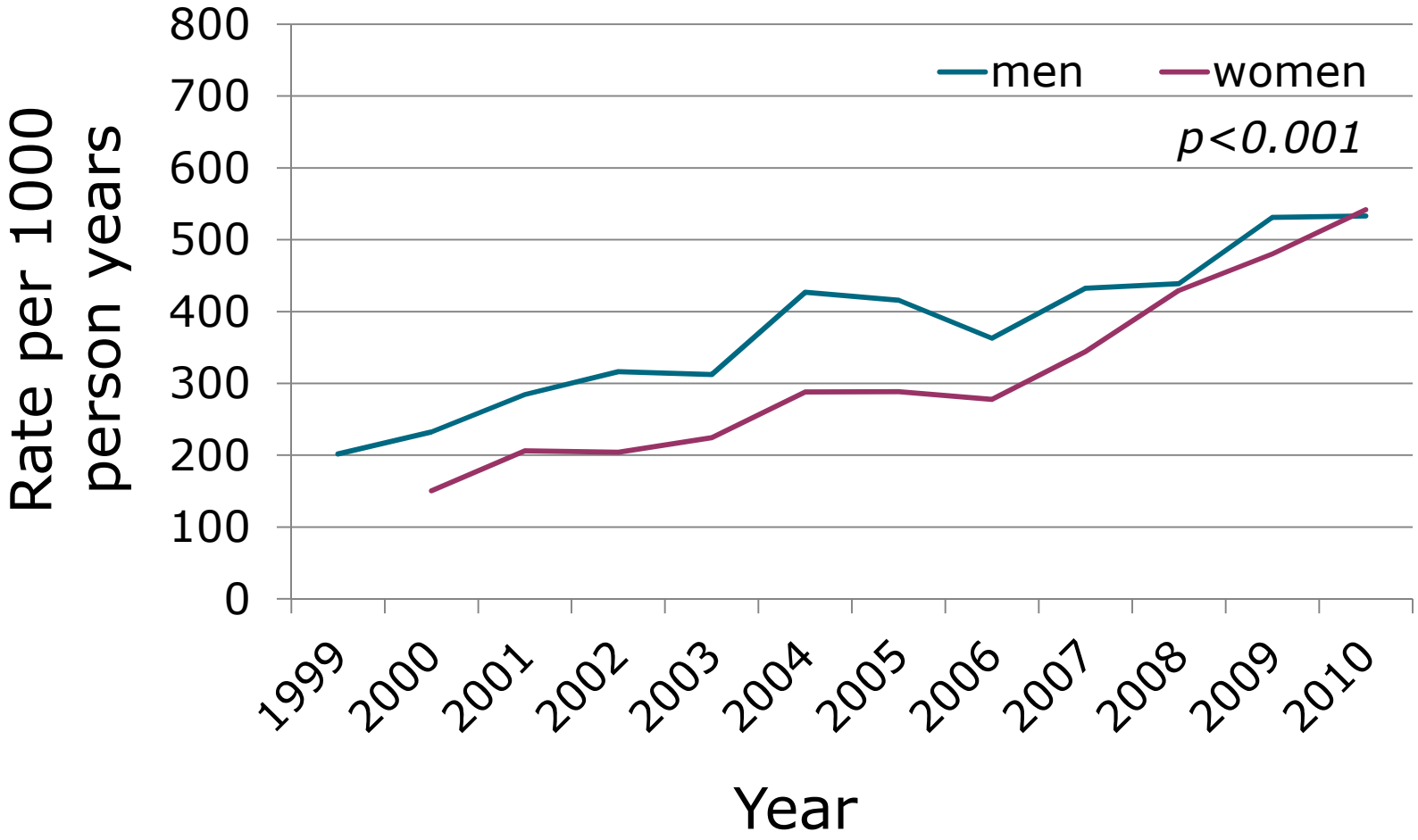
Ever admitted		
	n	%
Yes	2168	72
Number of admissions/person		
0	829	28
1	606	20
2	424	14
3+ (max 56)	1138	38
Emergency admissions		
Ever	1051	35
Never	1946	65
Overnight admissions		
Ever	1520	51
Never	1477	49

Among 2168 with ≥ 1 admission:

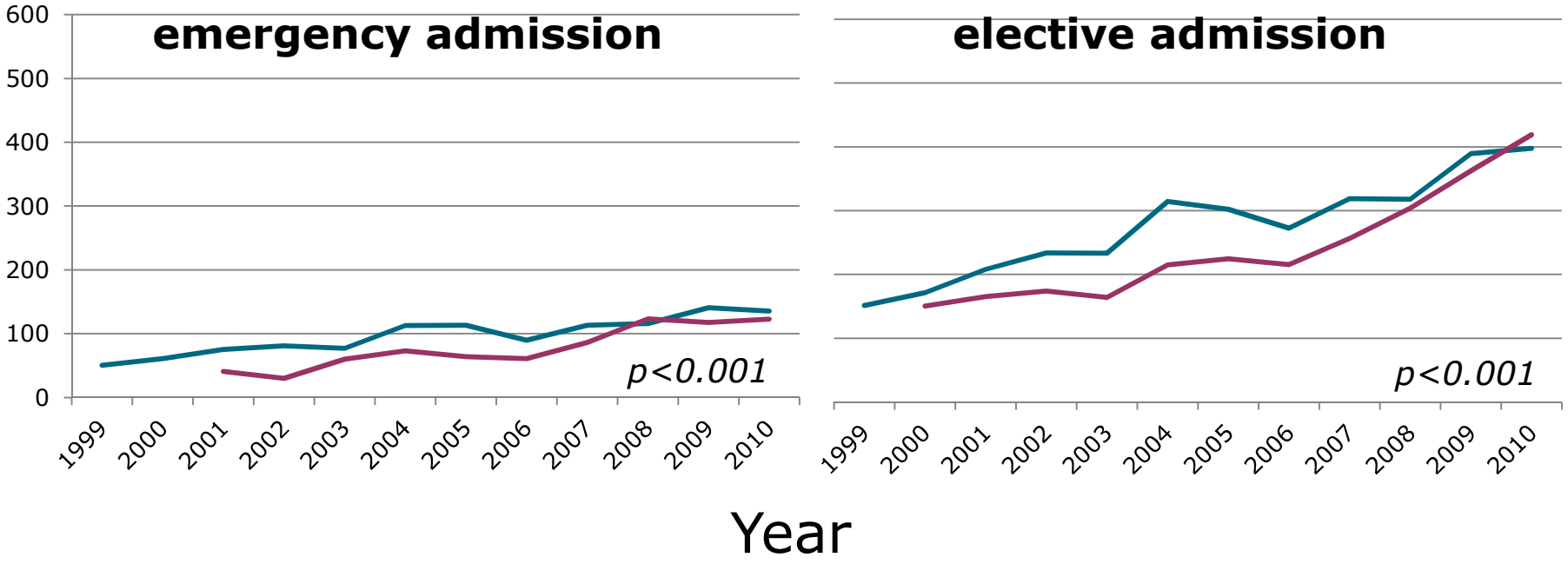
Time to first admission (years)			
Percentiles	25th	50th	75th
	1.1	2.6	4.9
Total time in hospital (days)			
	2	7	19



Time trends in admission



Time trends in admission
(Rate per 1000 person years)



Characteristics of 275 deaths

Relative to HES status	
With no admission	19
Discharged dead	127
Died after admission	129

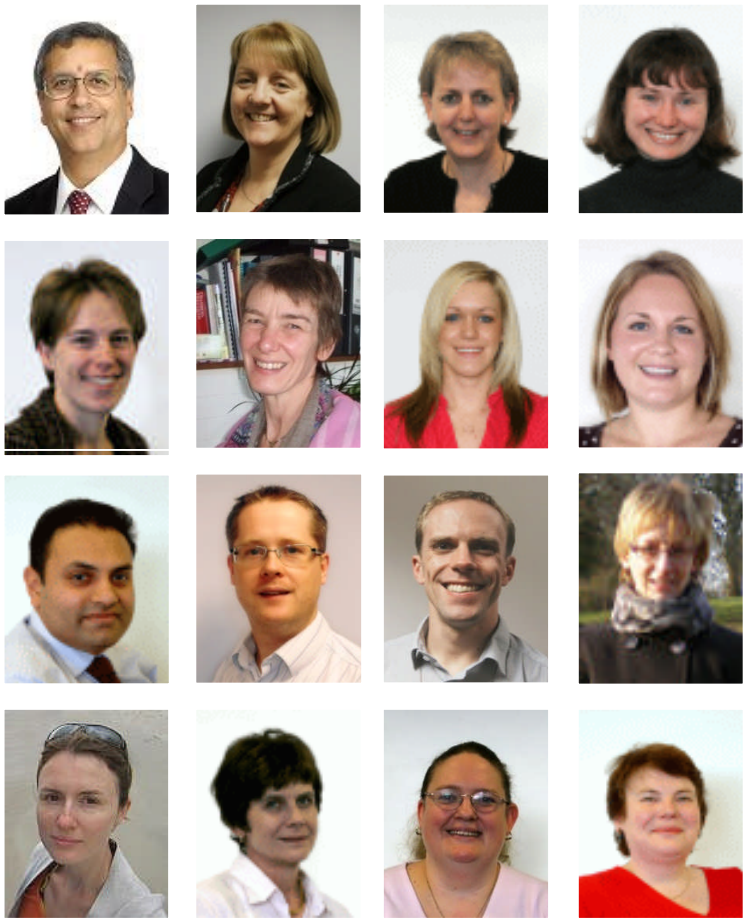
Crude death rates by number of admissions		
	n	%
0	19	2
1	41	7
2	38	9
3+	177	16

Commonest underlying causes			
	M	F	Σ
Ca Lung	22	15	37
MI	16	4	20
IHD	15	4	19
Ca Pancreas	10	3	13
Ca Prostate	11	-	11
Carcinomatosis	7	3	10
COPD	7	2	9
Ca Breast	-	8	8
Ca Bladder	8	-	8
Ca Oesophagus	5	1	6

Conclusions

- Single cohorts like the Hertfordshire Cohort Study are powerful resources for research
  - Examine life course (particularly early growth) influences on a range of age-related disease
  - Novel approaches include sub-studies focused on understanding biological mechanisms and linkage to routine data with policy relevance
- Major contributors to cross-cohort collaborations including HALCyon

Acknowledgements



MRC Lifecourse Epidemiology Unit
Ageing and Health

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Medicine for Older People

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NHS National Institute for Health Research

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Any questions?

- sjs@mrc.soton.ac.uk
- rd@mrc.soton.ac.uk