



The Actuarial Profession

making financial sense of the future

What longevity predictors should be allowed for when valuing pension scheme liabilities?

Institute sessional meeting - September 2009

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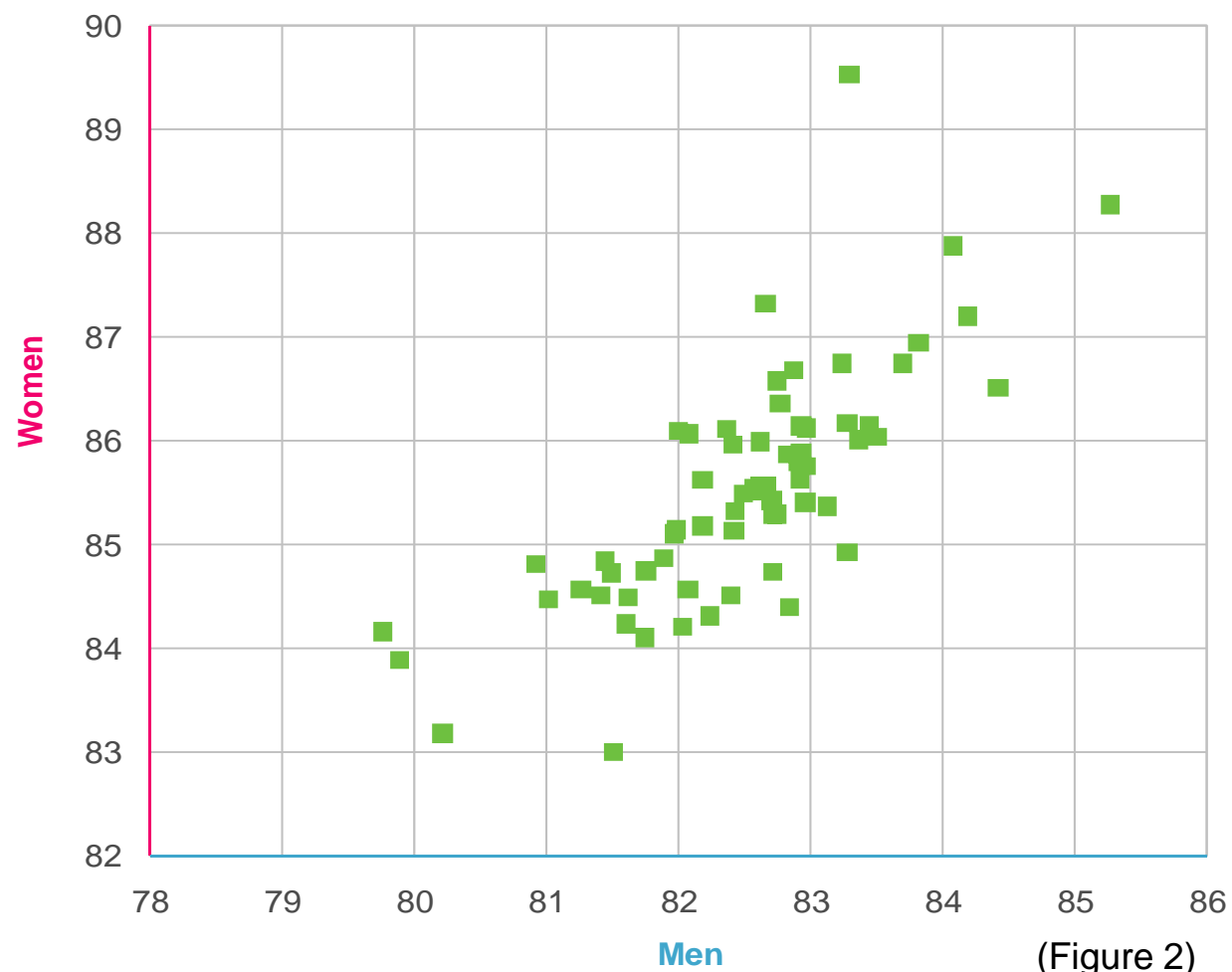
Overview

- Introduction and data description
- Methods
- Results
- Context
- Conclusion

Introduction

- Life expectancy differences found by social groups
- Baseline longevity will also differ
- Currently single or group adjusted
- Pension schemes a rich data source
- Scheme differences can be related to known mortality factors

Period life expectancy by scheme



(Figure 2)

Key questions

- Do the possible differentials manifest themselves within pension scheme data?
- Are routine pension data sufficient for investigating differentials?
- Do differentials between schemes and within schemes have common causes that can be identified?
- Are potential models robust to enable estimation of differences that are larger than the error estimates?

Data - ClubVita

- 91 schemes
 - Over one million living pensioners and dependants
 - 15+ years covered
 - National data (all regions represented)
 - Wide range of industries
-
- Last three years used here (2005-2007)

Scheme size

	Number	%
< 5000	38	(42%)
5000-9000	18	(20%)
10,000-29,999	25	(27%)
30,000 or above	10	(11%)

(Table 2)

Data available (2005-2007)

	Exposure	Deaths
Male pensioners	1,284,000	45,000
Female pensioners	1,056,000	23,500
Widows	492,000	24,000
Widowers	61,000	1,800

(Table 1)

Mortality factors (at retirement)

- Age and sex
 - Health status
 - Salary history
 - Pension amount
 - Occupation type
-
- Postcode

Lifestyle differentiation

Geo-demographic classifications (ACORN)

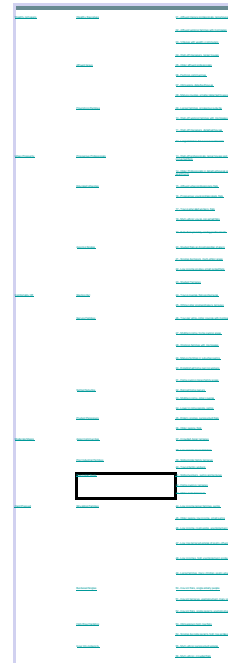
Address (Postcode)



Marketing Information:

- Using email
- Dishwashers / Tumble drier
- High credit card limits
- Coffee bars
- Lunch-time eating out
- Eating brown bread
- Buying wine
- Big weekly food bills
- Buying new cars
- Gardening
- Opera

57 lifestyle types

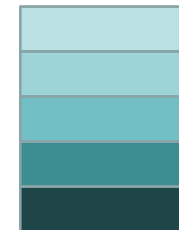


Rank by mortality

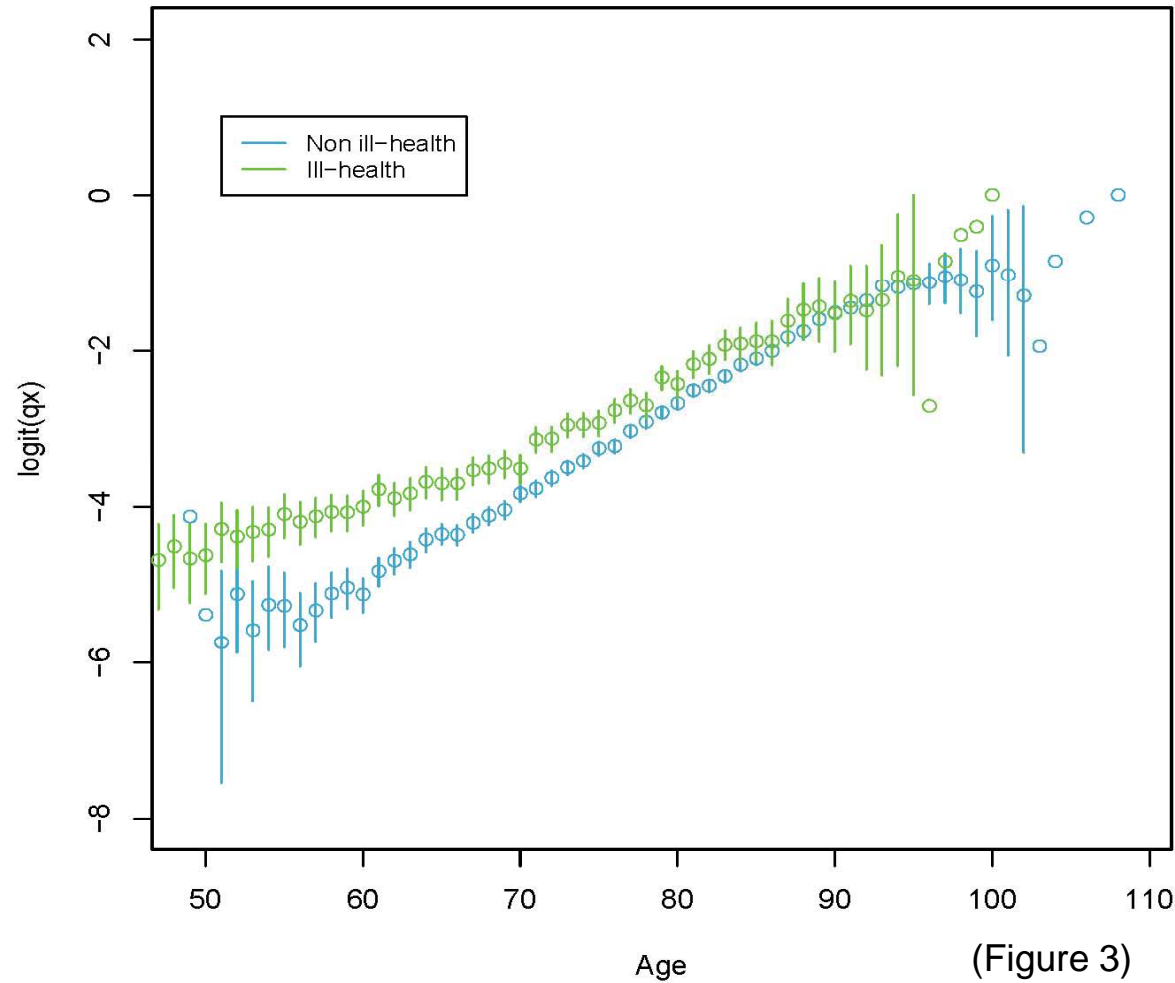


Clustering methods

5 longevity groups



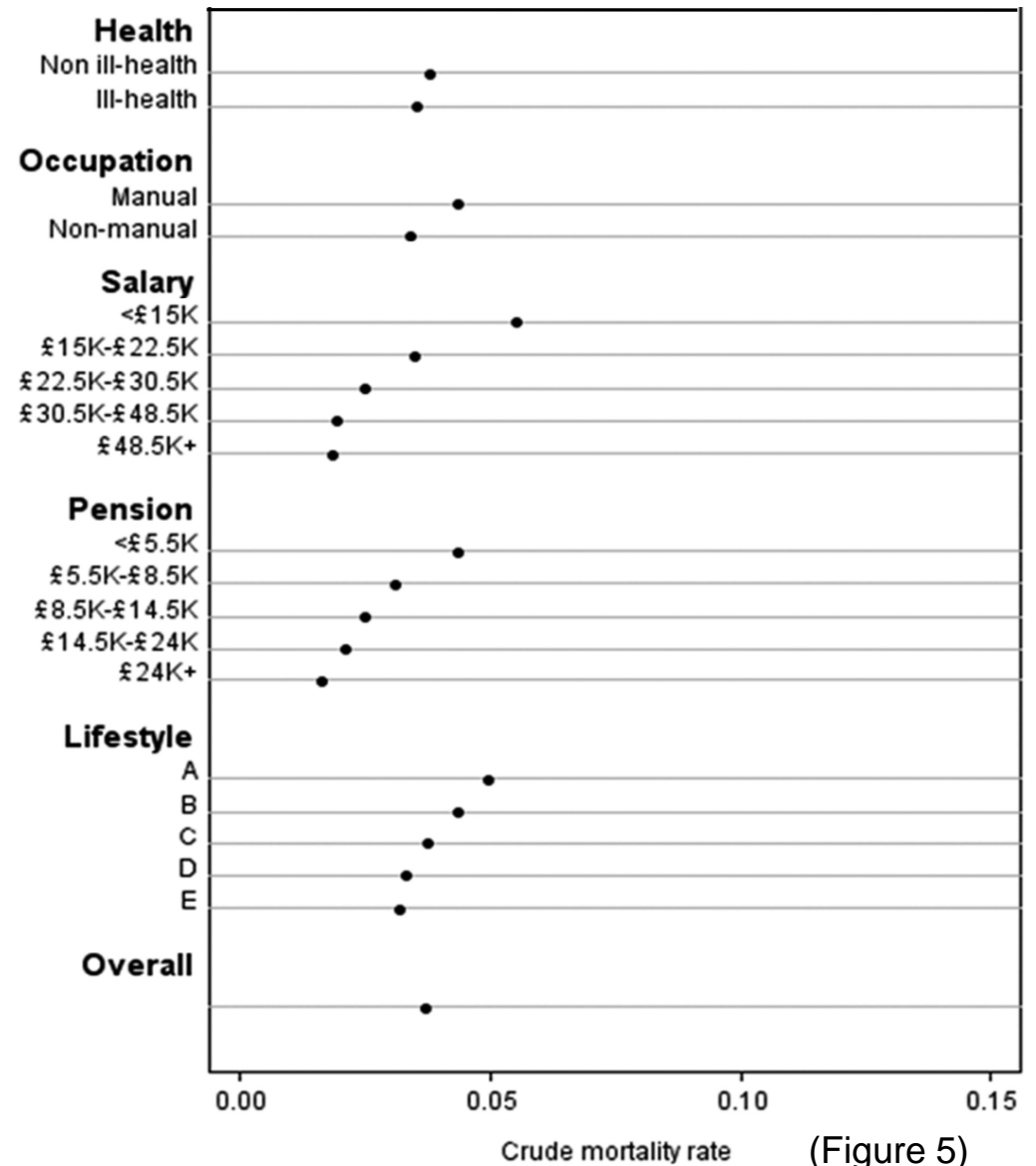
Differential mortality



Differential mortality

Higher mortality

- Ill health
- Manual
- Low salary
- Low pension
- Lifestyle group



Possible statistical methods

- Generalised linear model

 - Model death (yes/no)

 - Logistic transformation

- Survival modelling

 - Time to event (death)

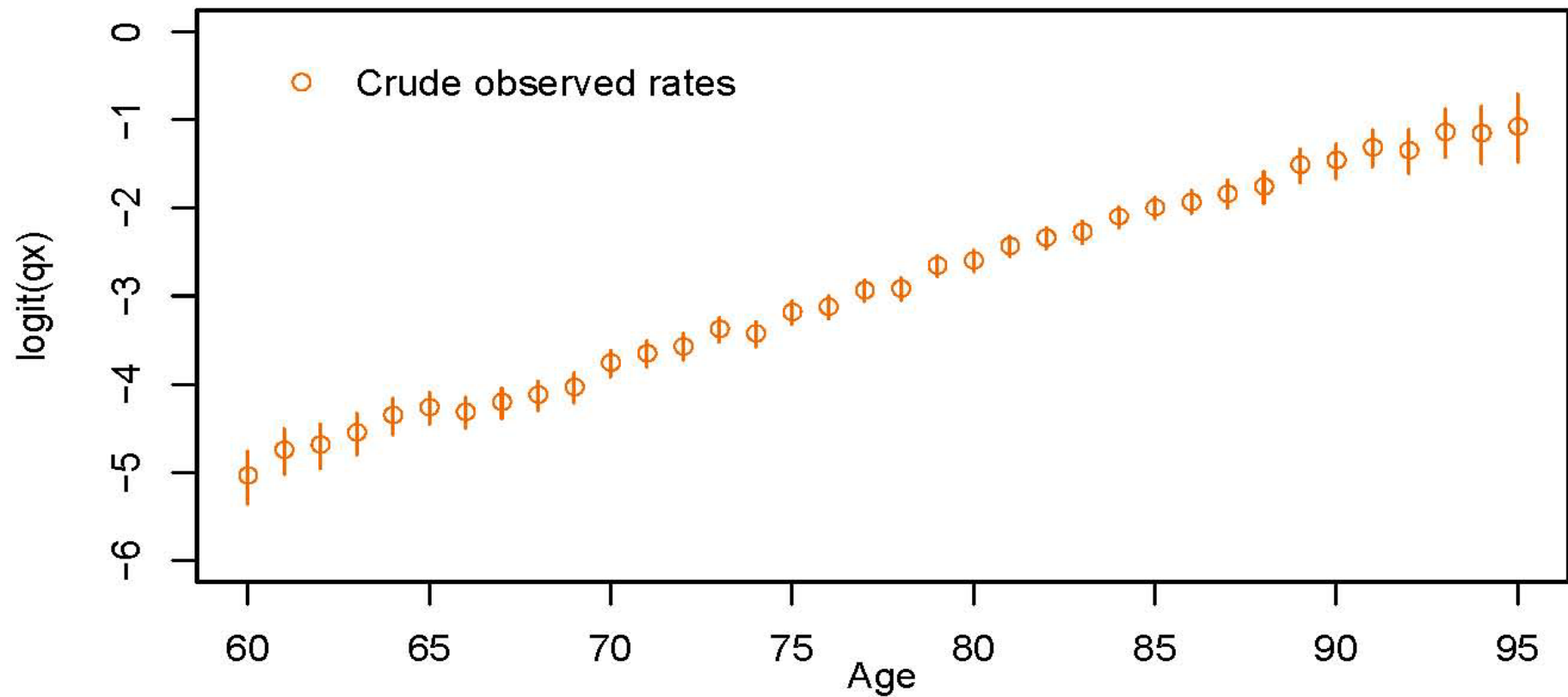
 - Non-parametric or parametric

Continuous or grouped covariates

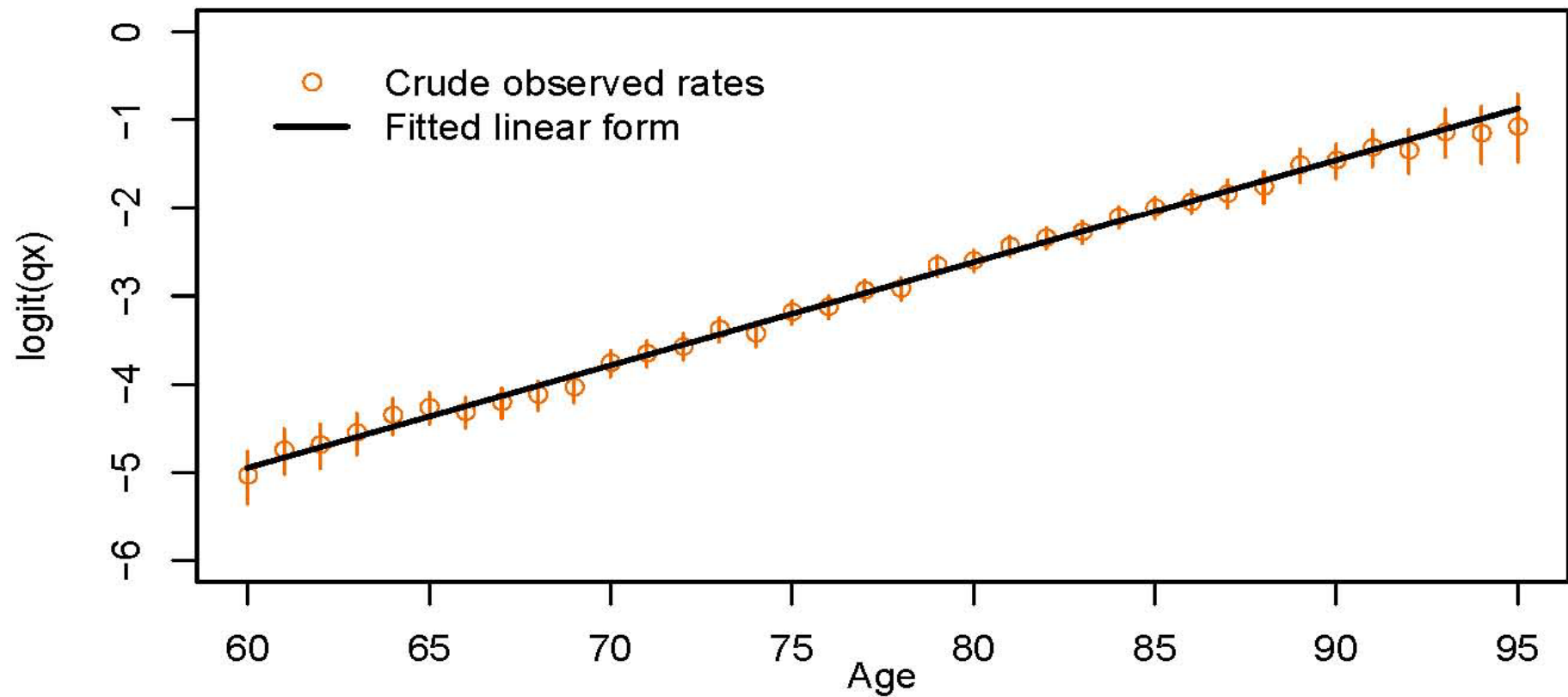
Analysis method

- Relate deaths to potential mortality factors
- Using last three years of data
- Age in all models
- Sex and health status modelled separately
- Factors added sequentially

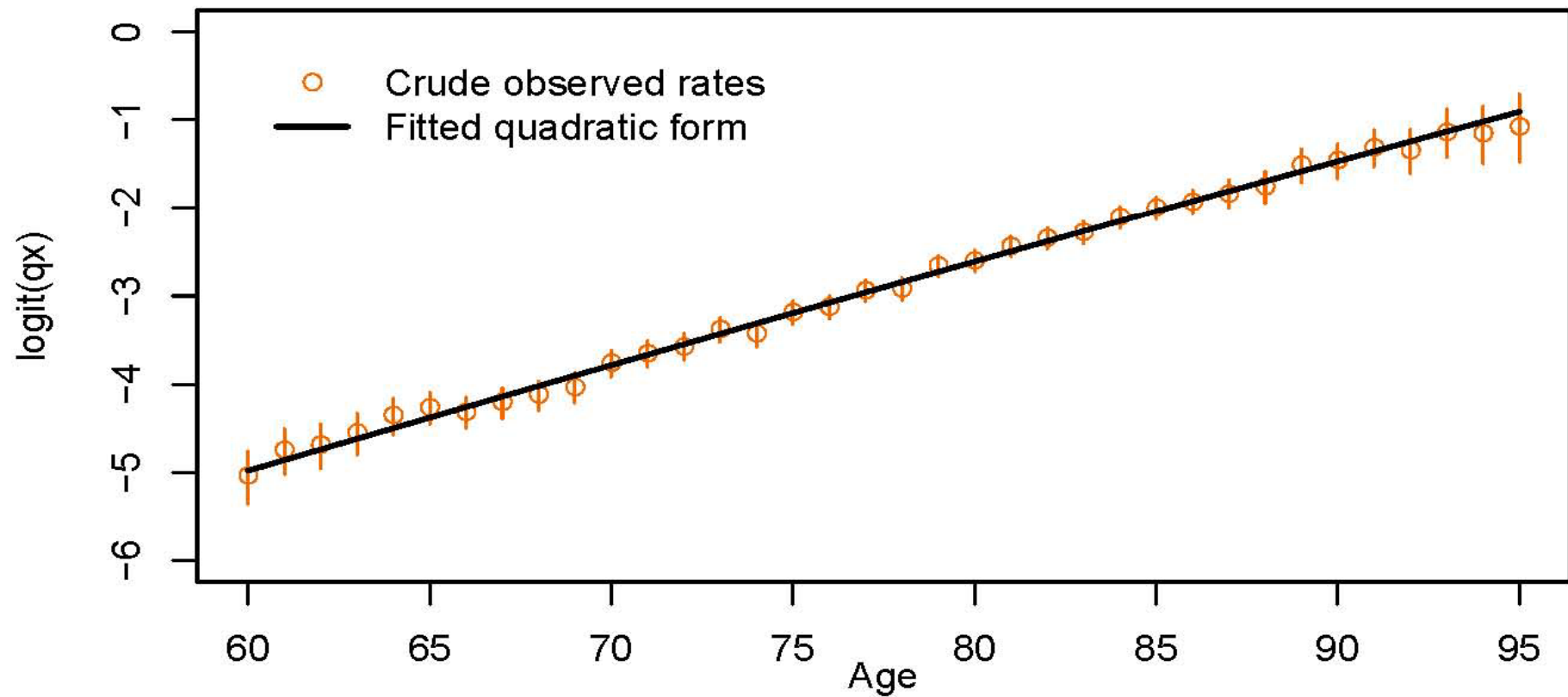
Relationship with age



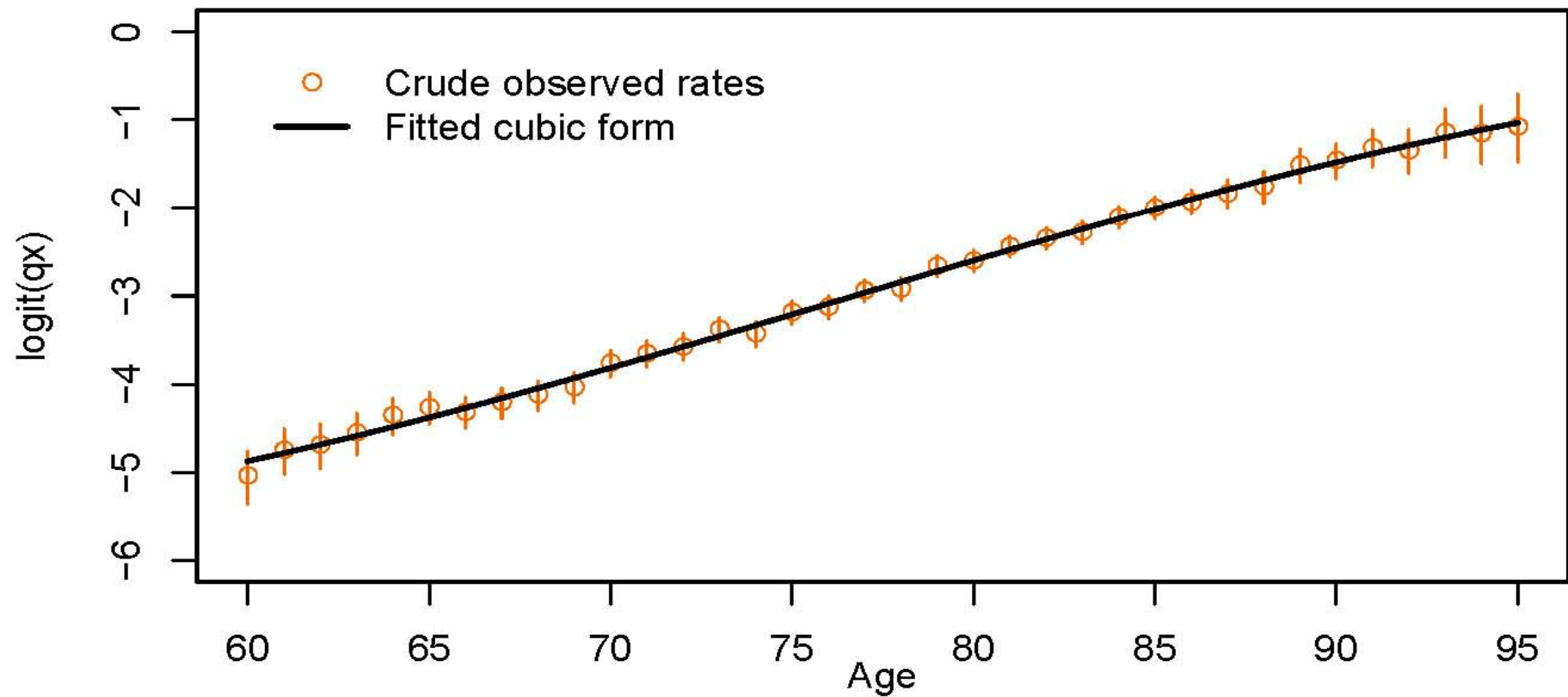
Relationship with age



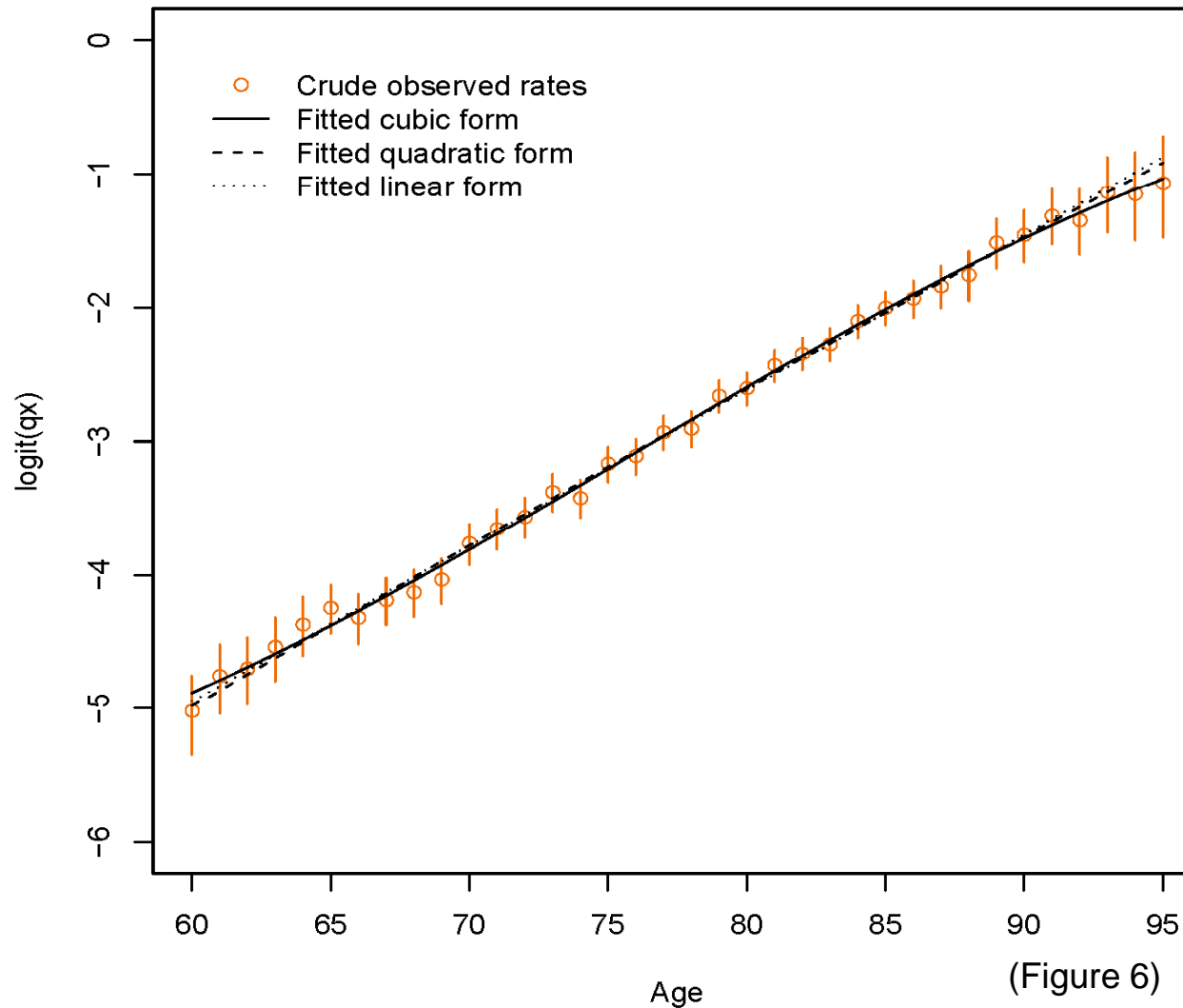
Relationship with age



Relationship with age



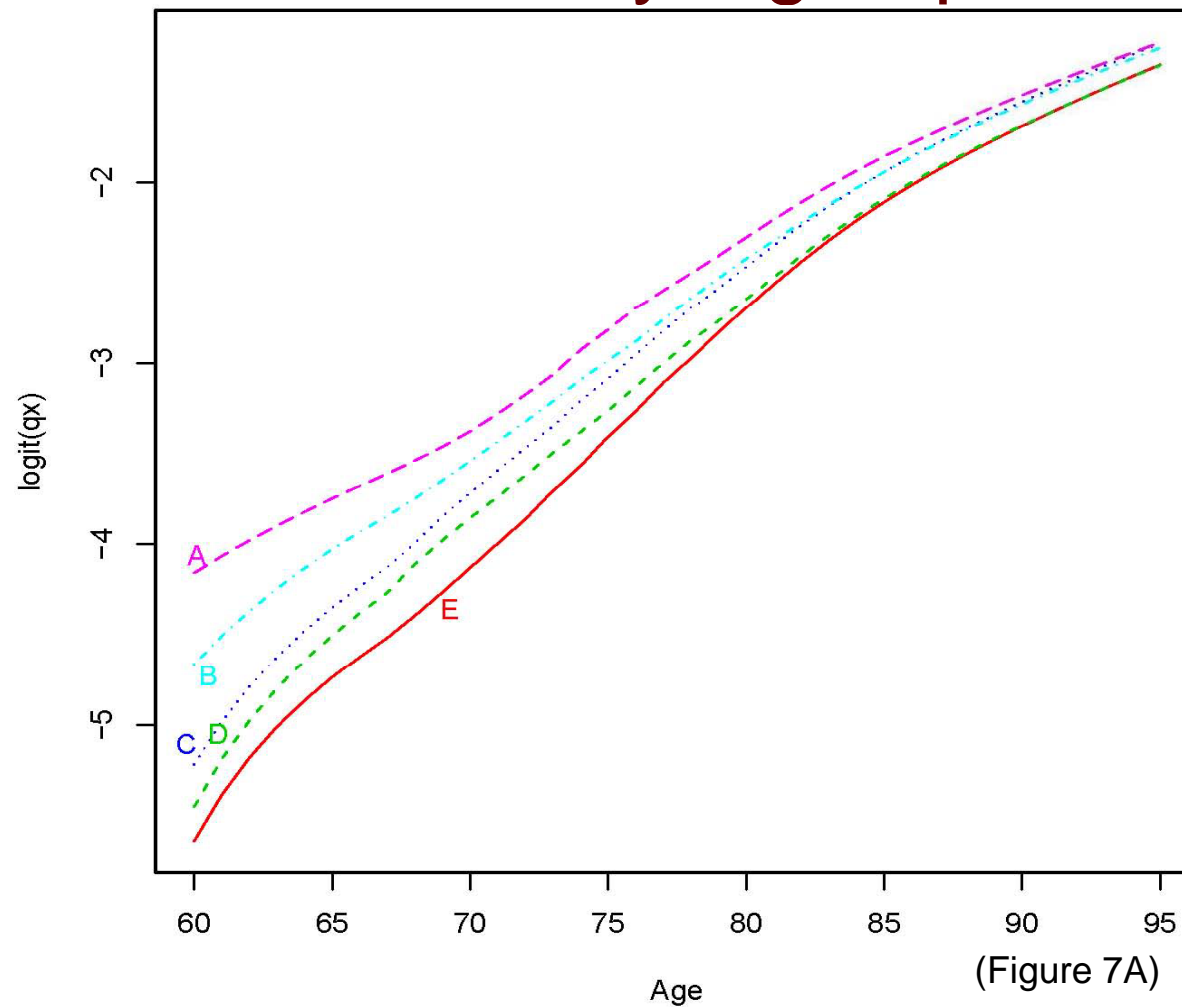
Relationship with age



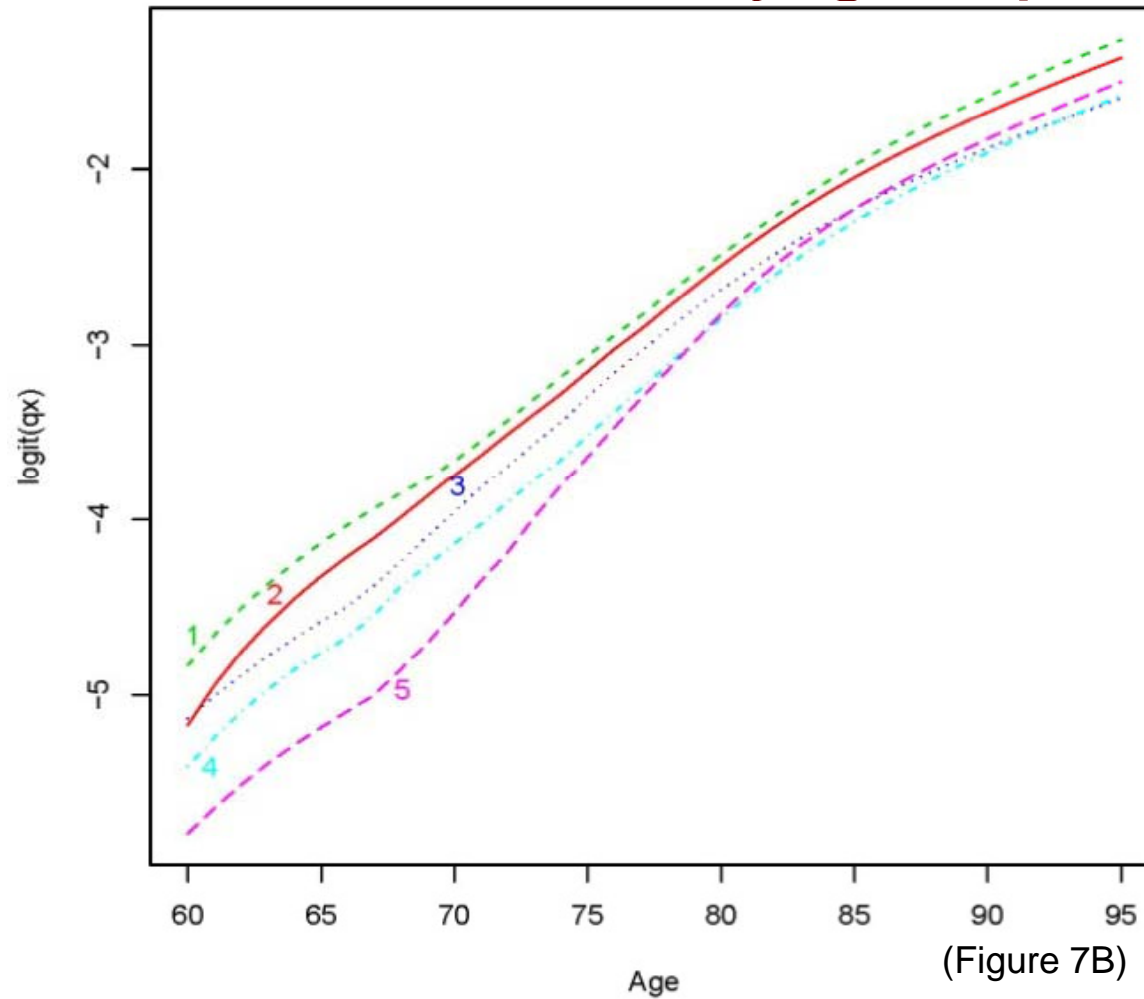
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Modelled rates – lifestyle groups



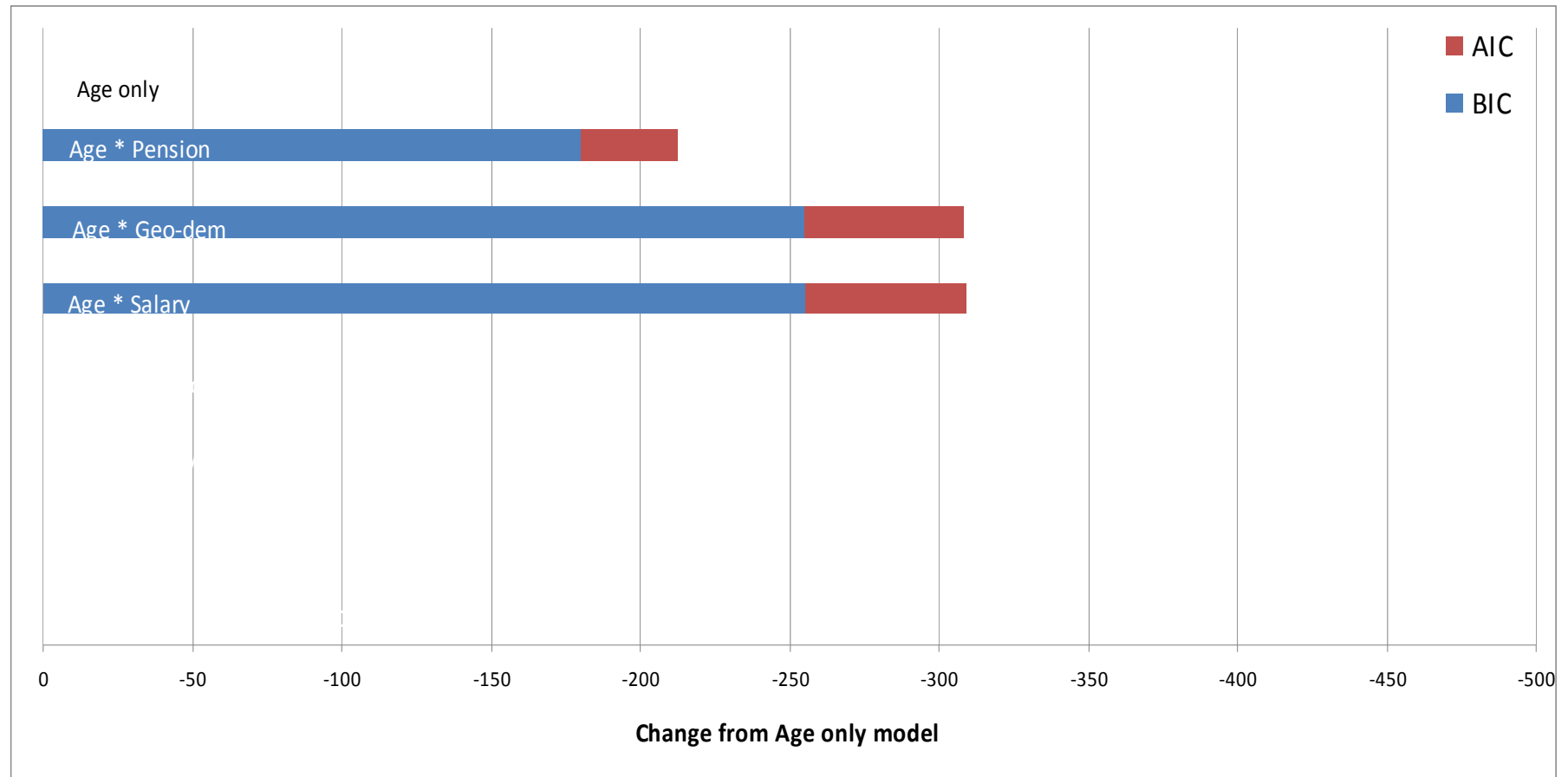
Modelled rates – salary groups



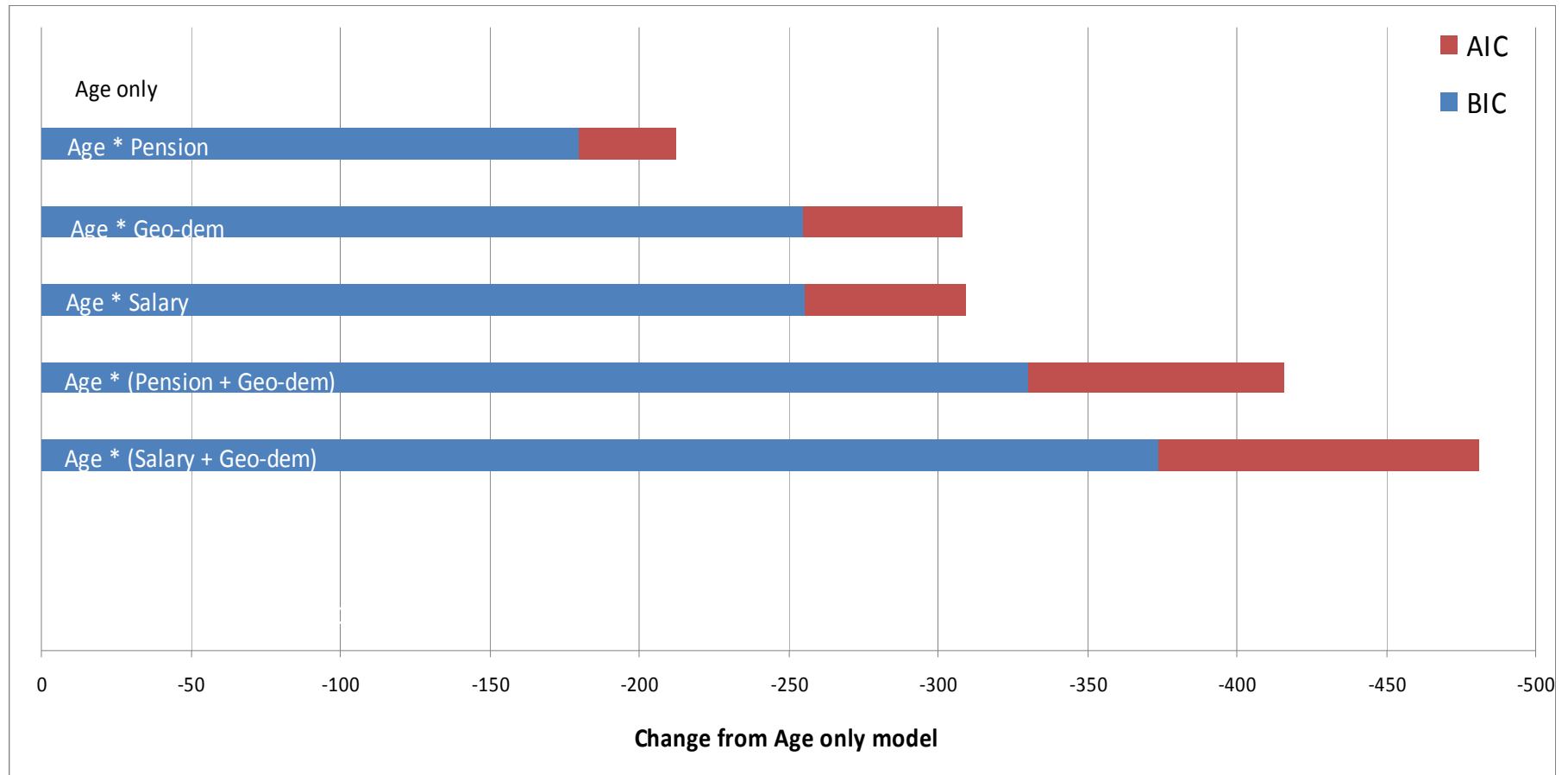
Model choice

- Factors related
- Model choice – simplest needed
- Two methods
 - Akaike's Information Criterion (AIC)
 - Bayesian Information Criterion (BIC)
- Both use log-likelihood and penalise the number of parameters
- BIC penalises number of parameters more

Factor effects

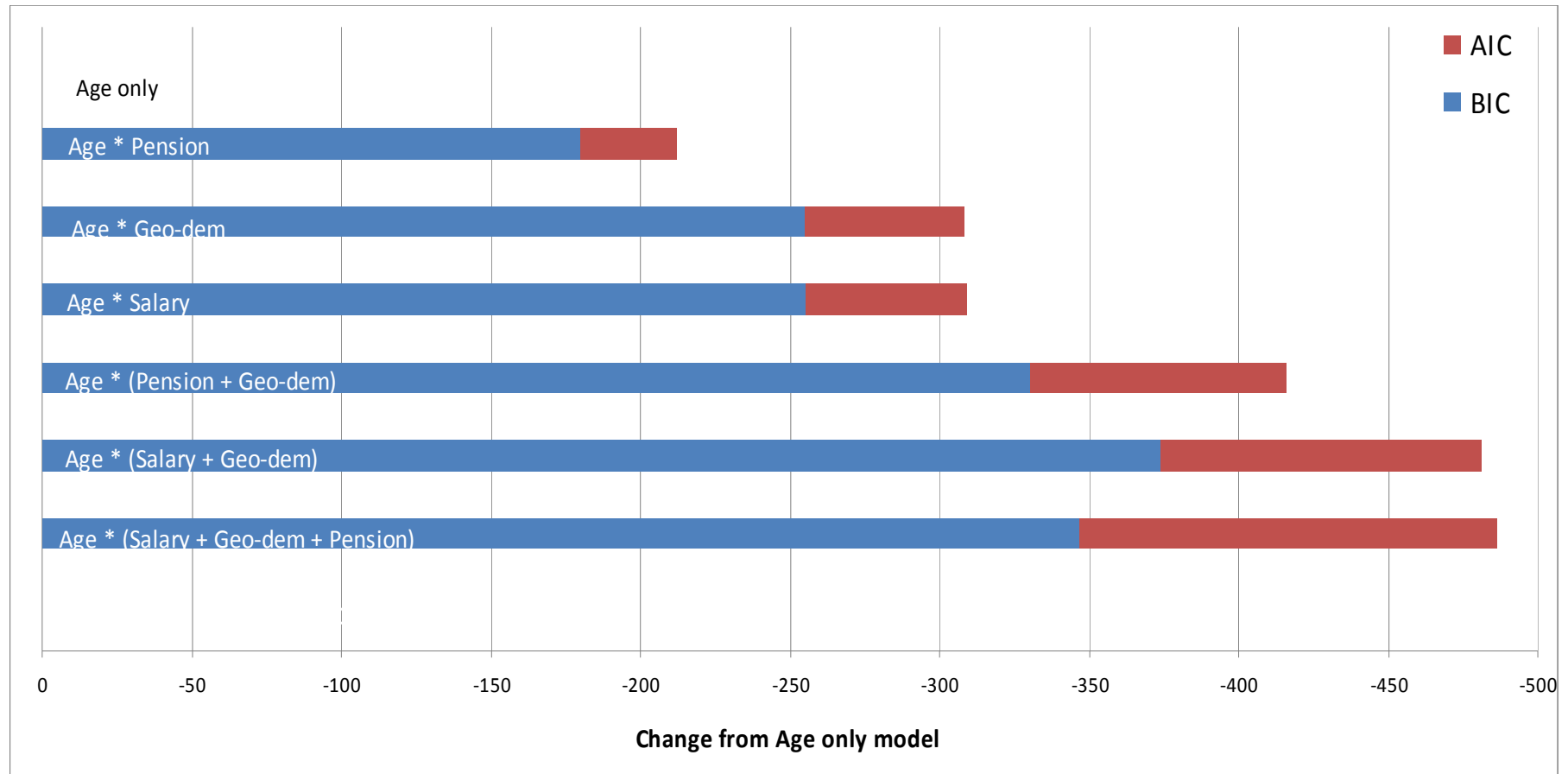


Factor effects



(Figure 8)

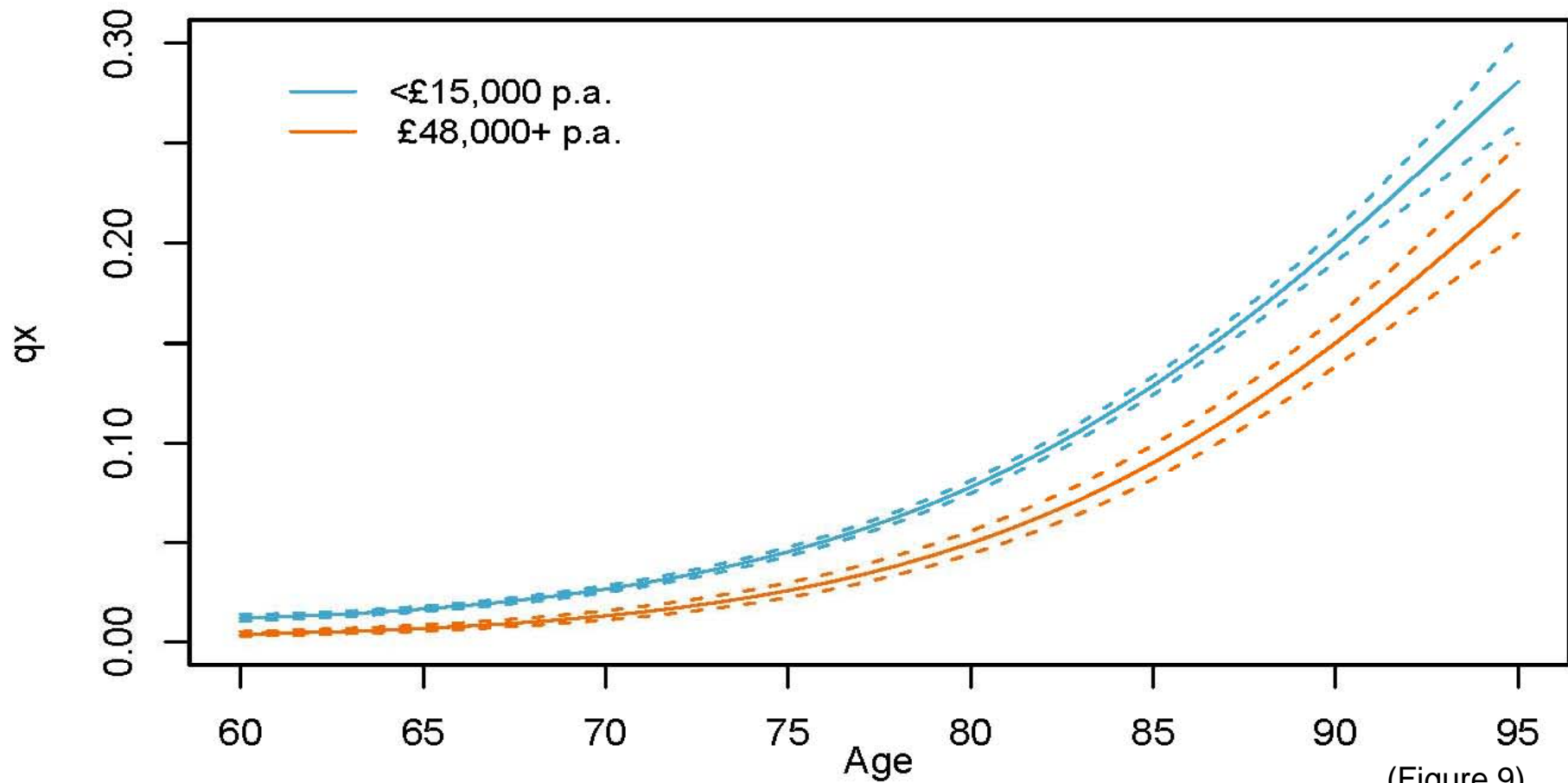
Factor effects



Final factors – Model in men, good health

- Sex and ill-health separate models
- Age – up to cubic terms
- Lifestyle group
- Salary group

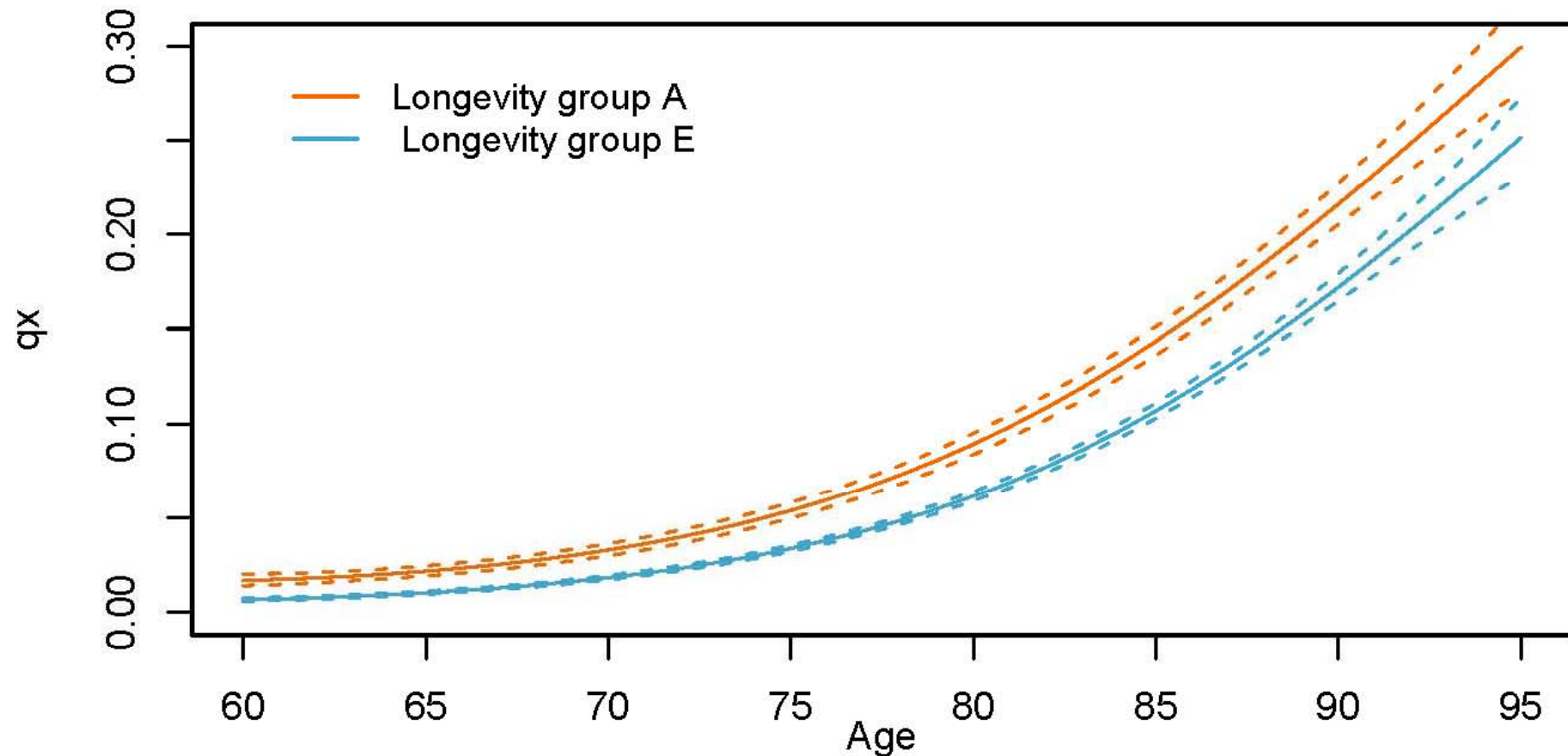
Salary effect Given lifestyle group



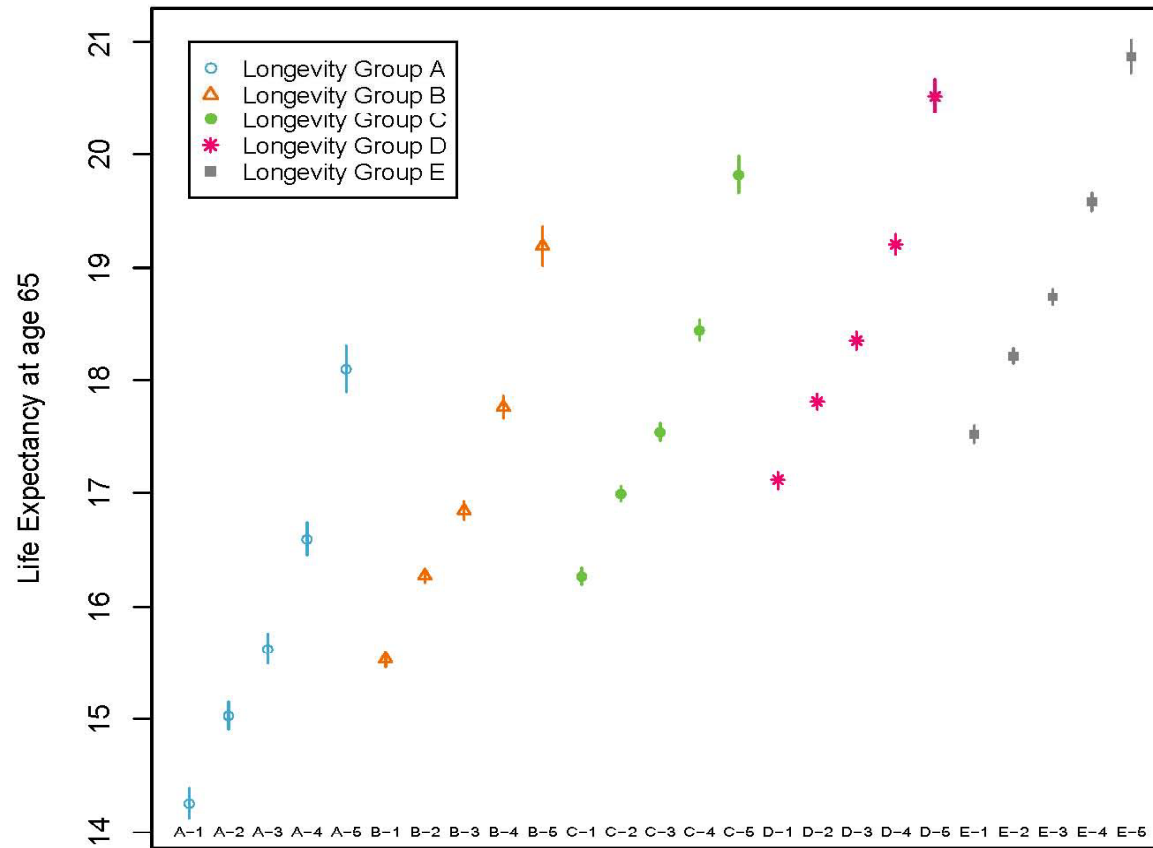
(Figure 9)

Lifestyle group

Given salary amount



Life expectancies by groups



(Figure 10)

Longevity groups: A:lower – E:upper; Salary Bands: 1:low – 5:high

Summary of key factors

Strata	Recommended factors to use (if available)	Range of fitted life expectancies (e_{65})
Male, normal health retirees	Age, geo-demographics ('lifestyle'), salary	14.3 - 21.3
Male, ill health retirees		12.4 - 17.7
Female, normal health retirees	Age, geo-demographics ('lifestyle'), pension	18.6 - 22.5
Female, ill health retirees		16.2 - 19.0
Widowers	Age, geo-demographics ('lifestyle')	12.7 - 17.6
Widows	Age, geo-demographics ('lifestyle'), pension	16.5 - 21.8

(Table 12)

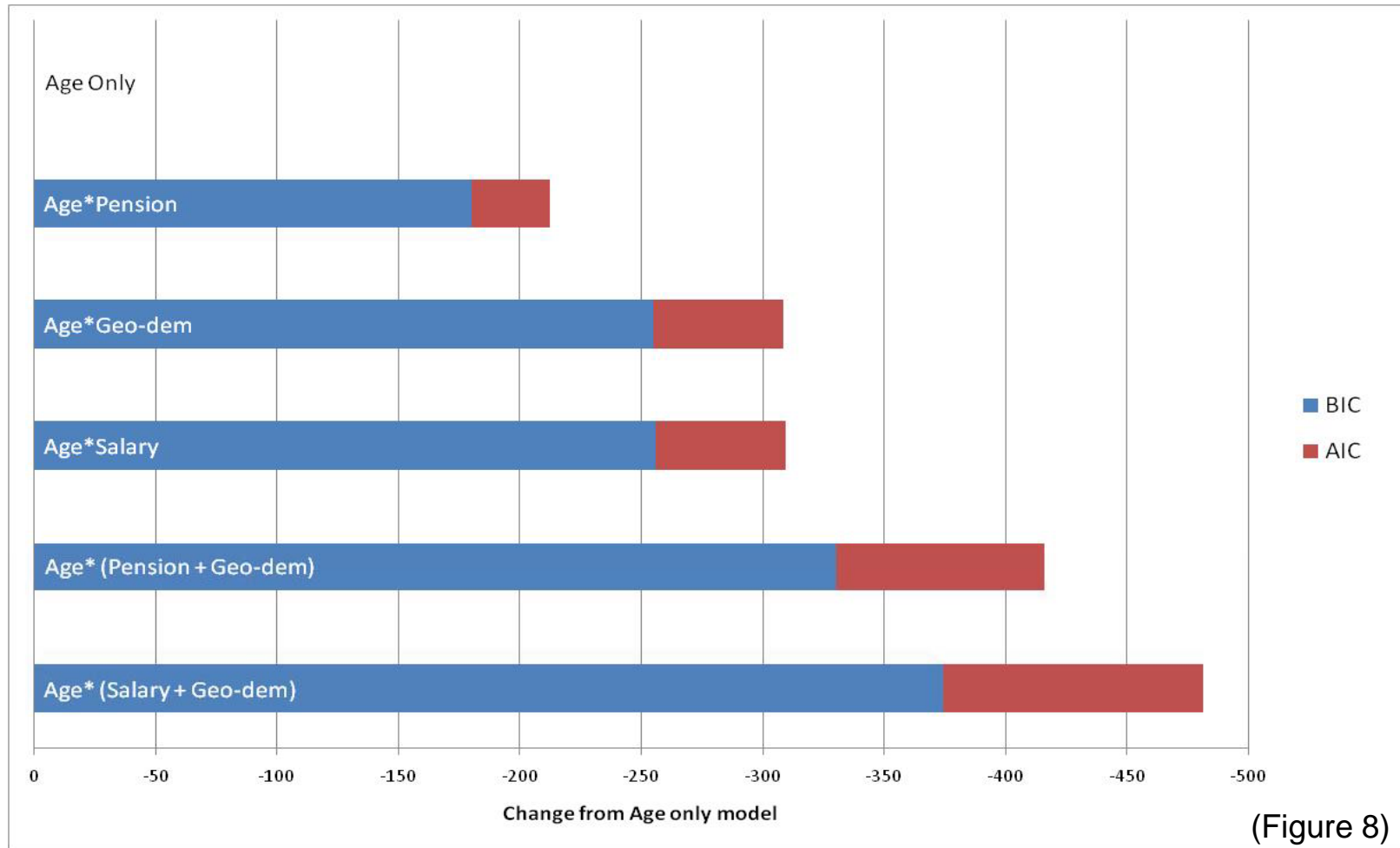
Applying the analysis in practice

Meet John

- Pensioner
- Retired 31 March 1995...
- ...from active service...
- ...and **not** on grounds of ill health
- Current pension of £3,500 p.a.
- Salary at retirement of £18,000...
- ...which is £25,600 in 'current' terms
- Lives in postcode CV8 2AD

Use **salary & lifestyle** for male **normal health** q_x values

Factor effects (reprise)



Applying the analysis in practice

Meet John

- Pensioner
- Retired 31 March 1995...
- ...from active service...
- ...and **not** on grounds of ill health
- Current pension of £3,500 p.a.

- Lives in postcode CV8 2AD

pension

Use ~~salary~~ & **lifestyle** for male **normal health** q_x values

Meet Jane

- Active member
- Salary £24,000 p.a.
- 5 years service
- Accrued a pension of £2k p.a.
- Lives in postcode HA9 6RE

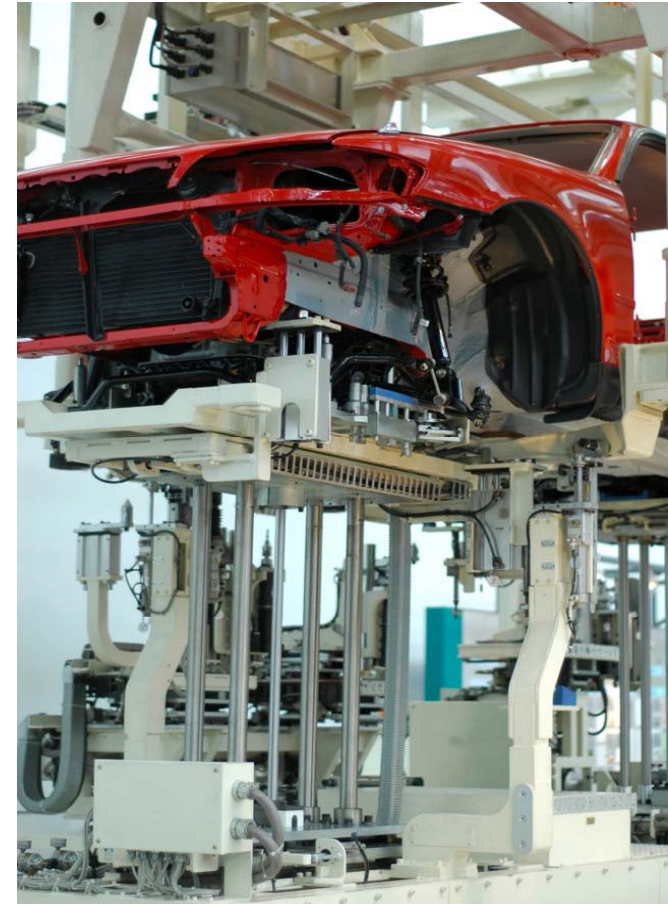
Use **salary (£24k) & lifestyle** based female q_x values



A changing world



- Experience investigations tell you a lot about current pensioners....
- ...but what about future pensioners?
- How do the characteristics of the current workforce compare to historic workforce?

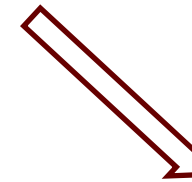


Some practical considerations

	5 salary bands
5 'lifestyle' groups	25 tables



- ✓ More transparent to clients
- ✓ Precision - Captures differences within population
- ✓ Emerging cashflows / LDI
- ✓ Longevity risk management



- ? More complexity?
- ? Computation time?
- ? Administration:
 - Transfer values?
 - Commutation factors?

Consider a bottom-up approach to an aggregate assumption?

What longevity predictors should be allowed for when valuing pension scheme liabilities?

- Wide variety of baseline longevity between schemes
- Pension scheme records are a valuable resource:
 - Retirement health
 - Gender
 - Affluence (salary often better than pension)
 - Lifestyle (via full postcode and geo-demographic propensities)
- Can simplify factors into key groups
 - Differences between groups large compared to uncertainties
- Approach can be applied to:
 - Any size scheme
 - *Future* pensioners as well as current pensioners
- **What are your views?...**



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