What is a health trajectory?

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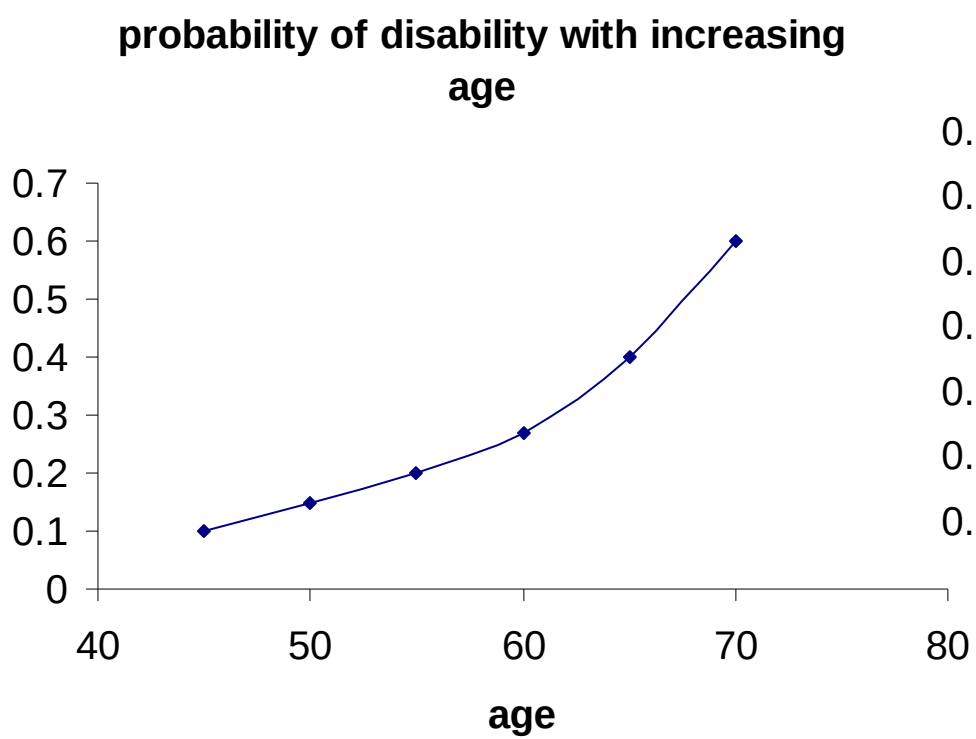
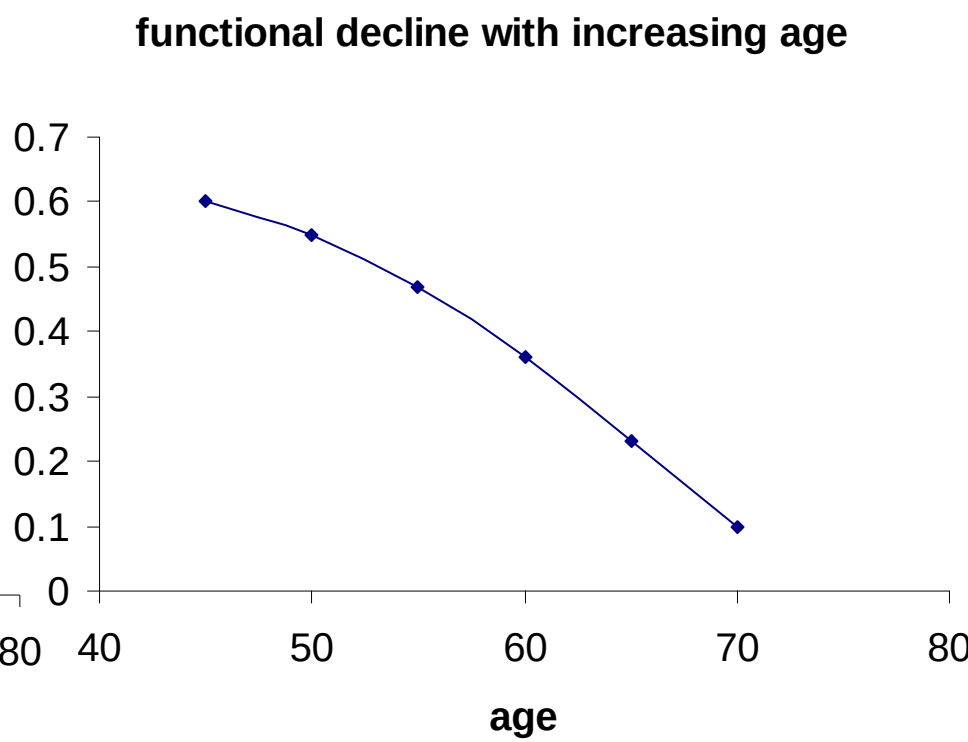
- rate of change in health per unit of time

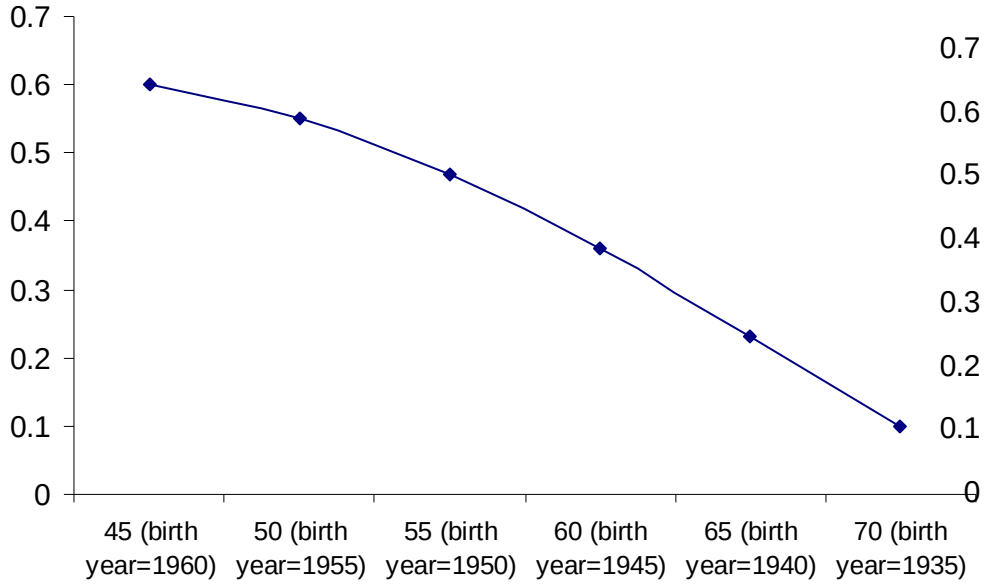
- **health transition** vs. **health trajectory**



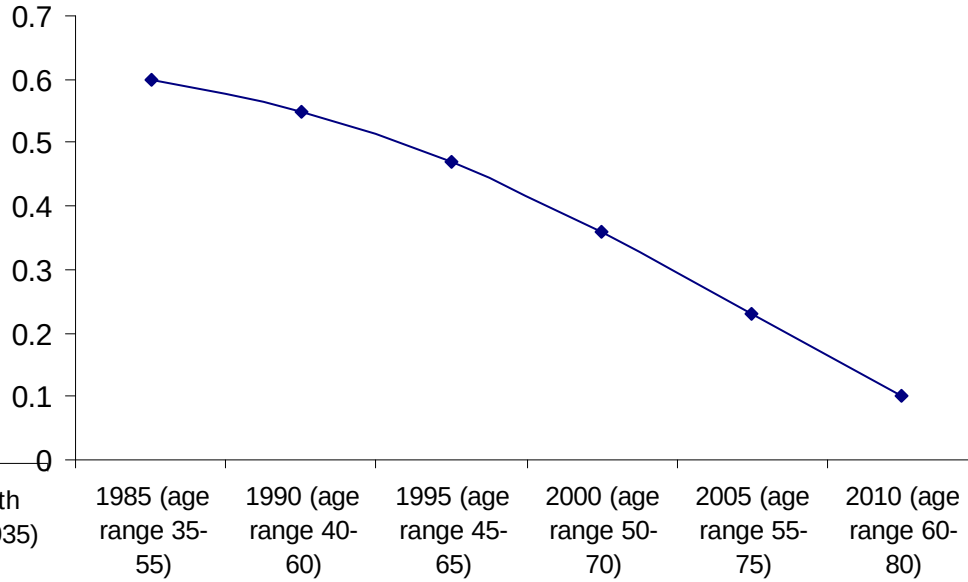


Age, period and cohort effects- 1

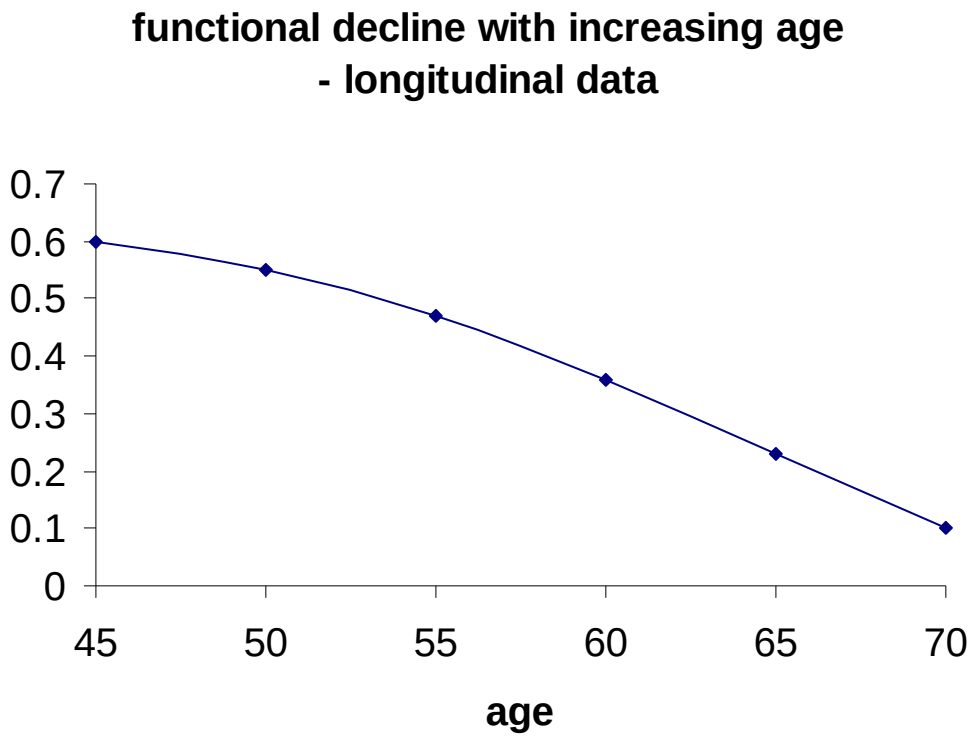
functional decline with increasing age - cross sectional data



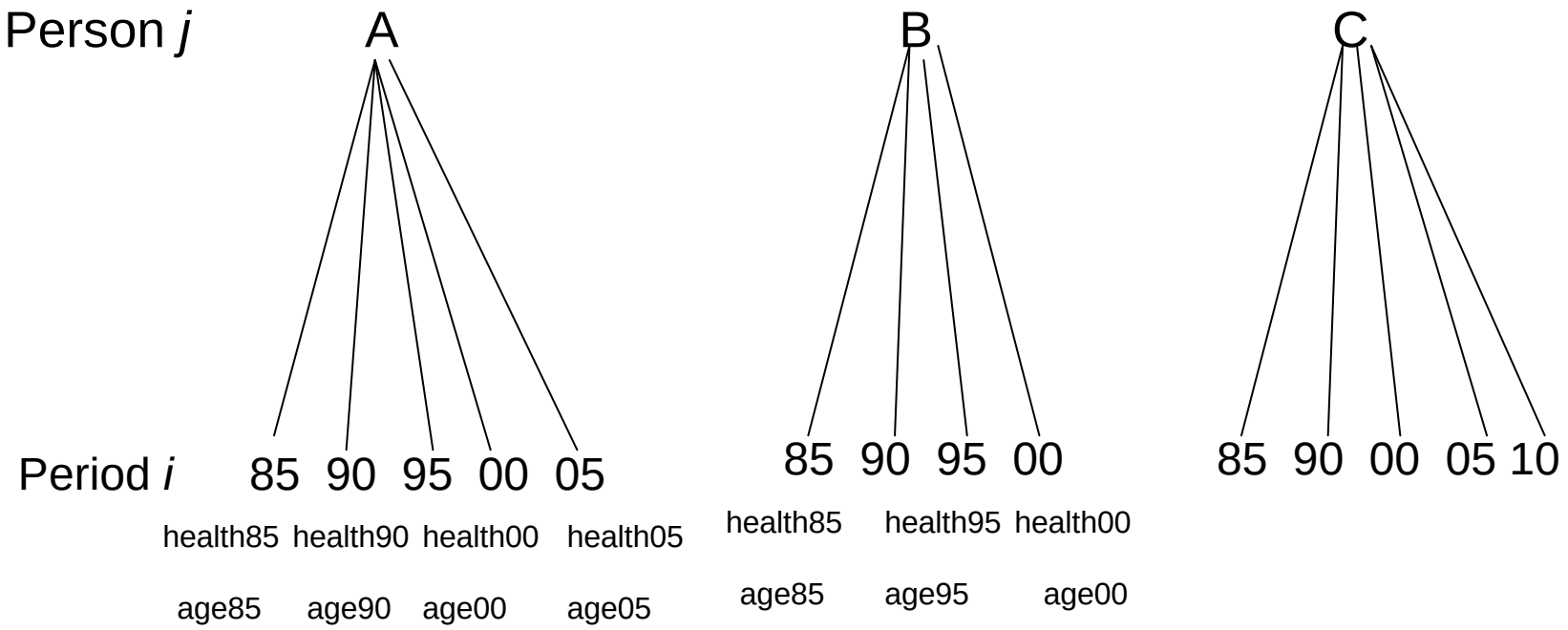
functional decline by time period - longitudinal data



Age, period and cohort effects- 2



2 level multilevel model



Wide format Data….

Person	health85	health90	health95	health00	age85	age90	age95	age00
A	60	58	57	55	45	50	55	60
B	53	54	52	49	60	65	70	75
C	50	46	42	35	59	64	69	74

…transposed to long format Data

Person	Period	Health	Age
A	85	60	45
A	90	58	50
A	95	57	55
A	00	55	60
B	85	53	60
B	90	54	65
B	95	52	70
B	00	49	75
C	85	50	59
C	90	46	64
C	95	42	69
C	00	35	74

Random coefficients multilevel model= Growth Curve Model

$$\text{function}_{ij} \sim \text{N}(XB,\ \Omega)$$

$$\text{function}_{ij} = \beta_{0ij}\text{cons} + \beta_{1j}\text{age\_c}_{ij}$$

$$\beta_{0ij} = 65.070(0.327) + u_{0j} + e_{0ij}$$

$$\beta_{1j} = -0.263(0.006) + u_{1j}$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \end{bmatrix} \sim \text{N}(0,\ \Omega_u) \ :\ \Omega_u = \begin{bmatrix} 151.400(14.330) & \\ -3.042(0.261) & 0.072(0.005) \end{bmatrix}$$

$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0,\ \Omega_e) \ :\ \Omega_e = \begin{bmatrix} 28.692(0.280) \end{bmatrix}$$

*-2*loglikelihood(IGLS Deviance)* = 234793.700(35092 of 51541 cases in use)

Random slopes multilevel model= Growth Curve Model adjusted for period effects

$$\text{function}_{ij} \sim \text{N}(XB,\ \Omega)$$

$$\text{function}_{ij} = \beta_{0ij}\text{cons} + \beta_{1j}\text{age\_c}_{ij} + 0.026(0.116)\text{period\_2}_{ij} + \text{-}0.130(0.143)\text{period\_3}_{ij} + \text{-}1.031(0.167)\text{period\_4}_{ij} + \text{-}0.403(0.197)\text{period\_5}_{ij}$$

$$\beta_{0ij} = 63.174(0.602) + u_{0j} + e_{0ij}$$

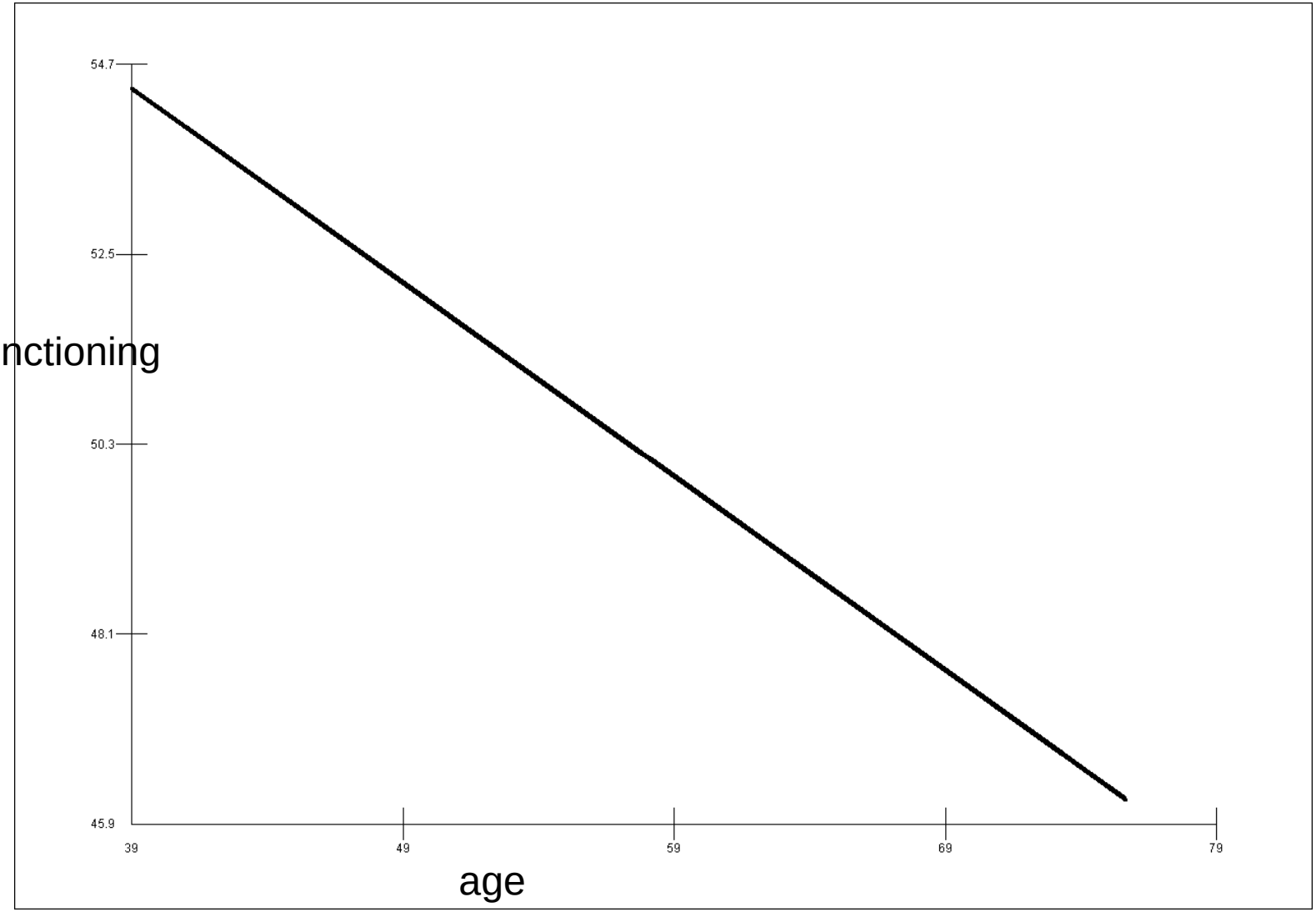
$$\beta_{1j} = \text{-}0.225(0.012) + u_{1j}$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \end{bmatrix} \sim \text{N}(0,\ \Omega_u) \ :\ \Omega_u = \begin{bmatrix} 154.674(14.307) & \\ \text{-}3.114(0.261) & 0.074(0.005) \end{bmatrix}$$

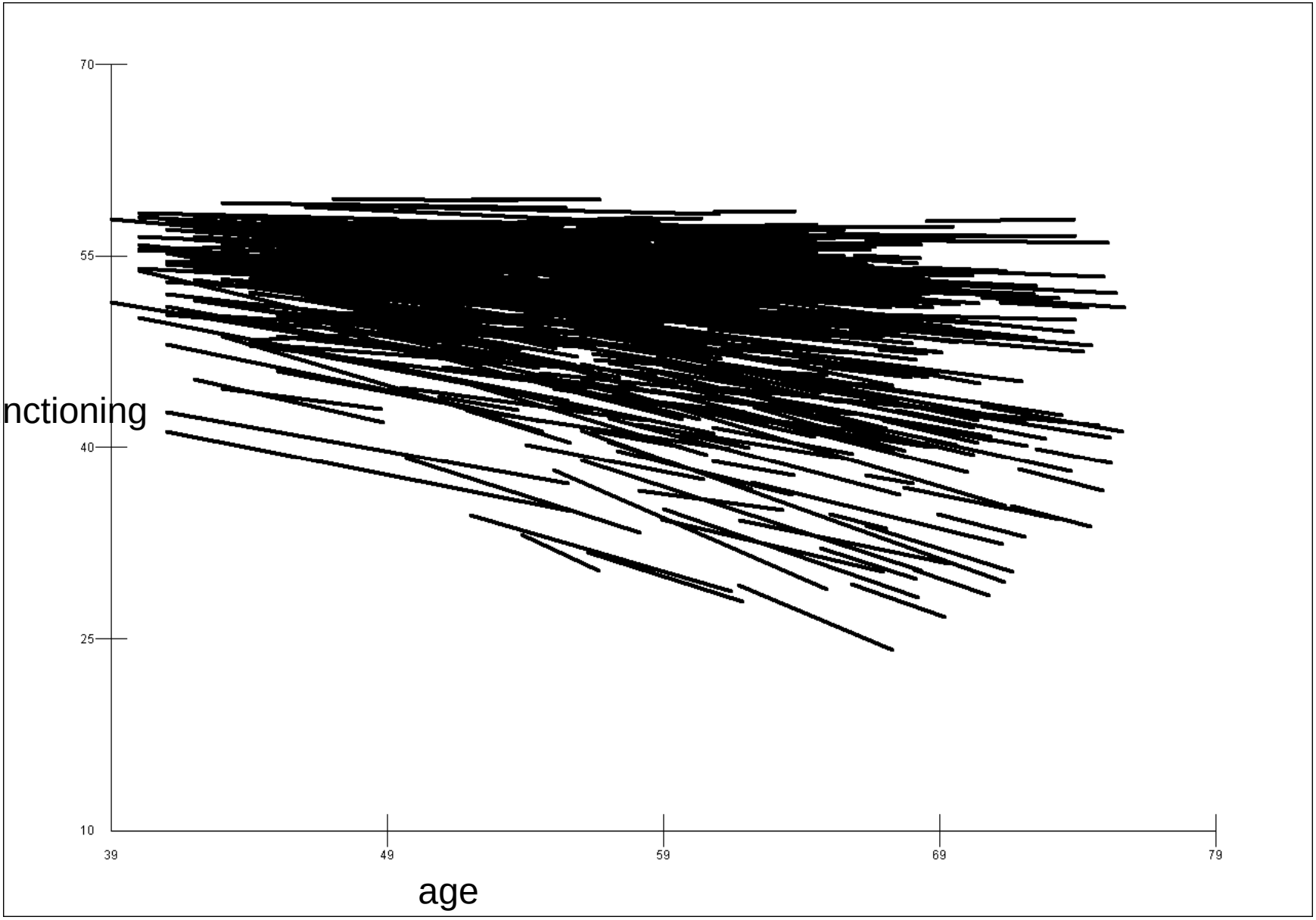
$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0,\ \Omega_e) \ :\ \Omega_e = \begin{bmatrix} 28.518(0.279) \end{bmatrix}$$

*-2*loglikelihood(IGLS Deviance)* = 234675.700(35092 of 51541 cases in use)

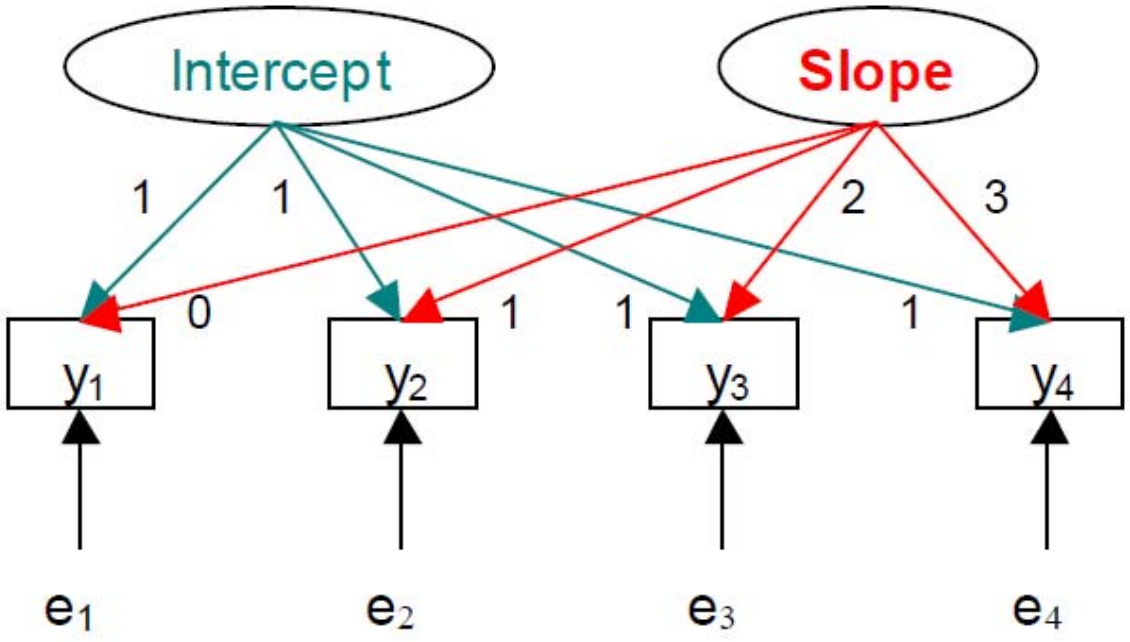
Predicted functional trajectory from Growth Curve Model



Predicted functional trajectories for each individual from Random Slope Growth Curve Model



Growth Curve Model- latent variable formulation



2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

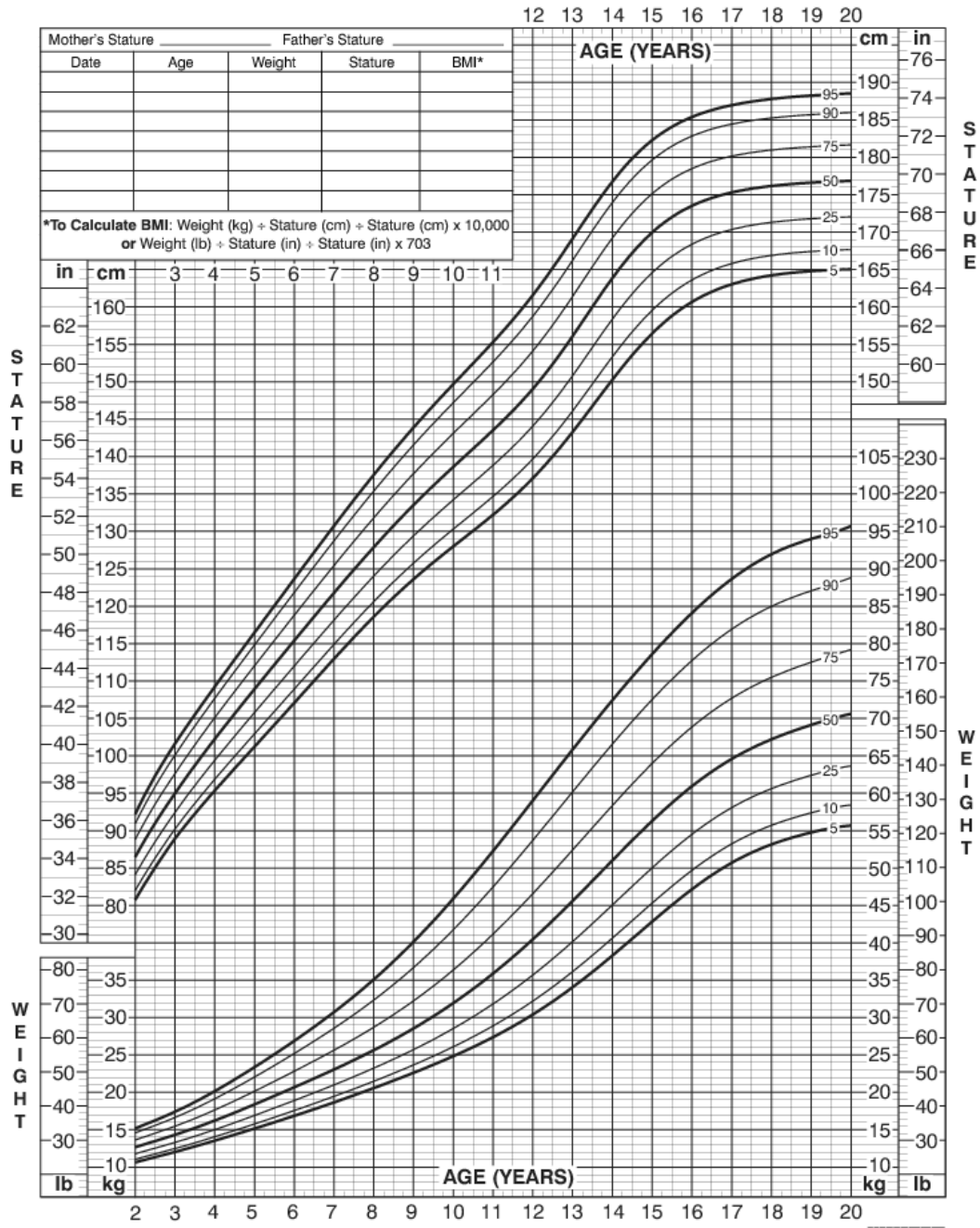
NAME _____

RECORD # _____

Mother's Stature _____ Father's Stature _____

Date	Age	Weight	Stature	BMI*

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Child-to-Adult Body Mass Index and Height Trajectories: A Comparison of 2 British Birth Cohorts

Leah Li, Rebecca Hardy, Diana Kuh, Rossella Lo Conte, and Chris Power

Am J Epidemiol 2008;168:1008–1015

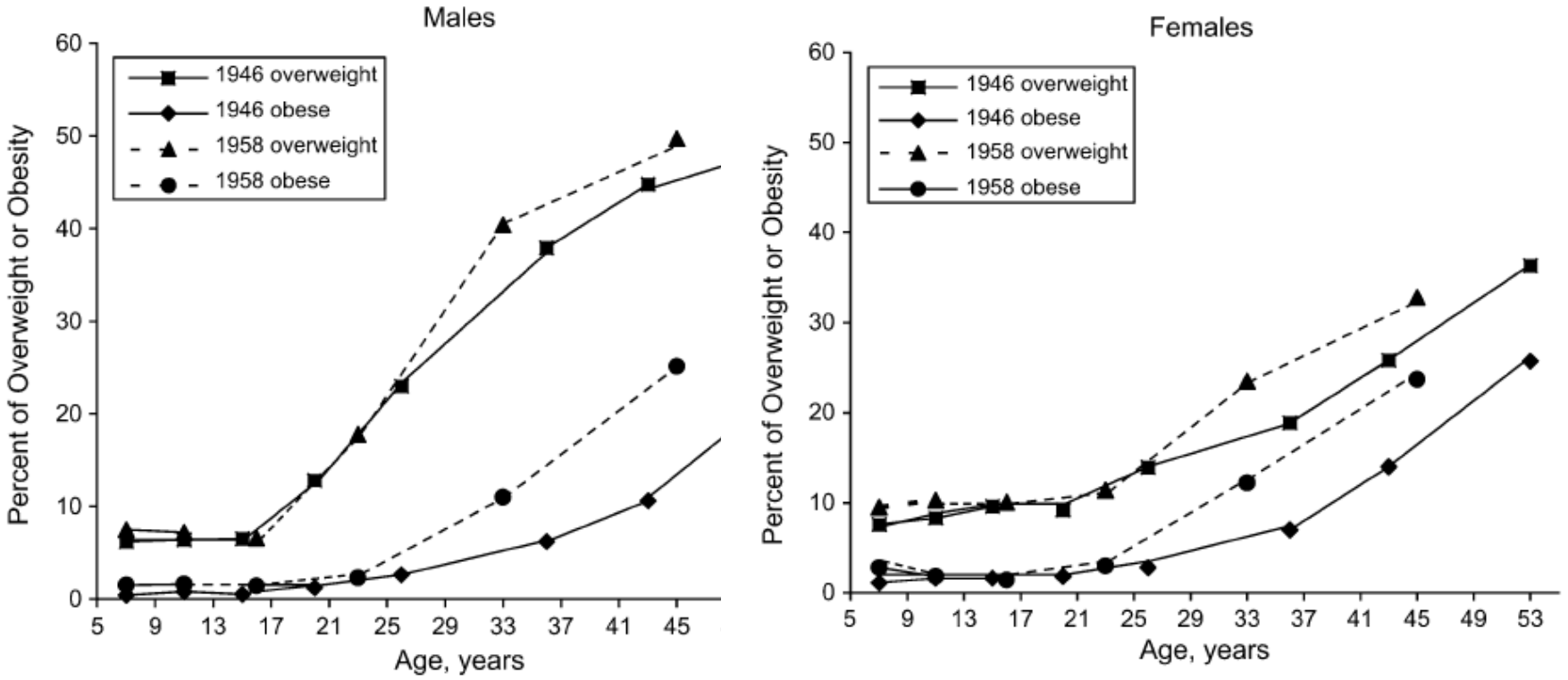


Figure 3. Observed prevalence of overweight and obesity for the 1946 and 1958 British cohorts.

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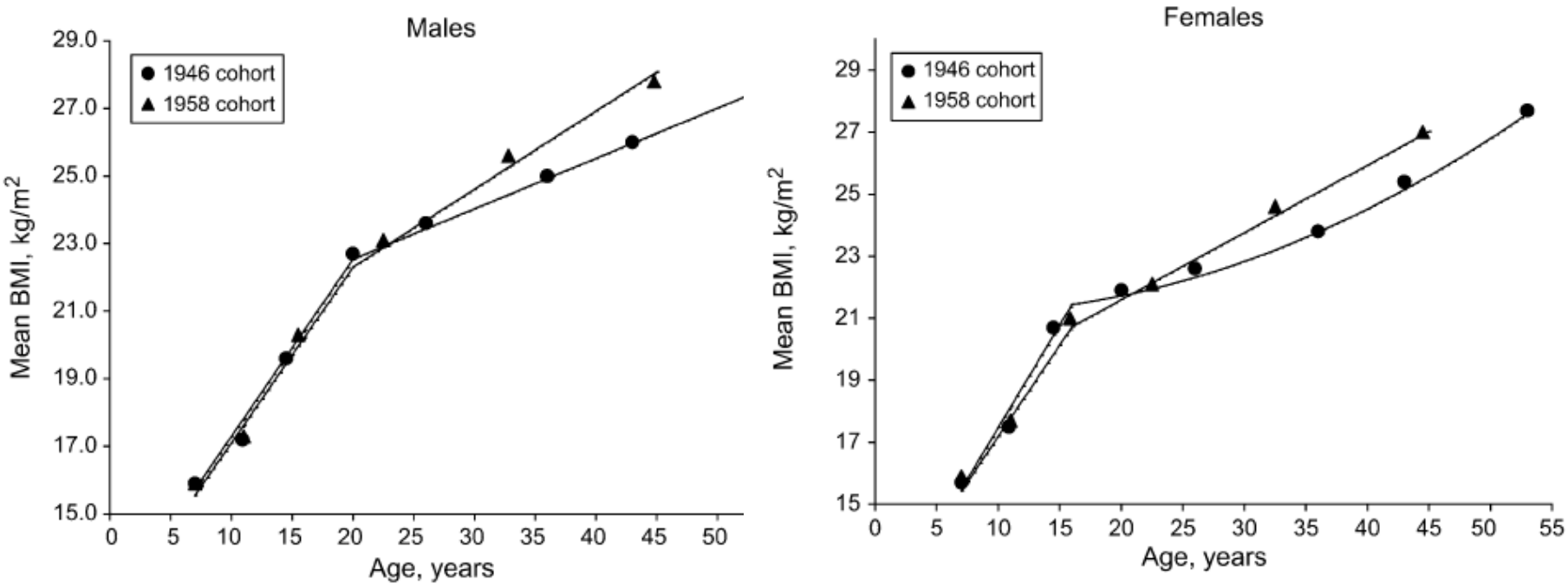


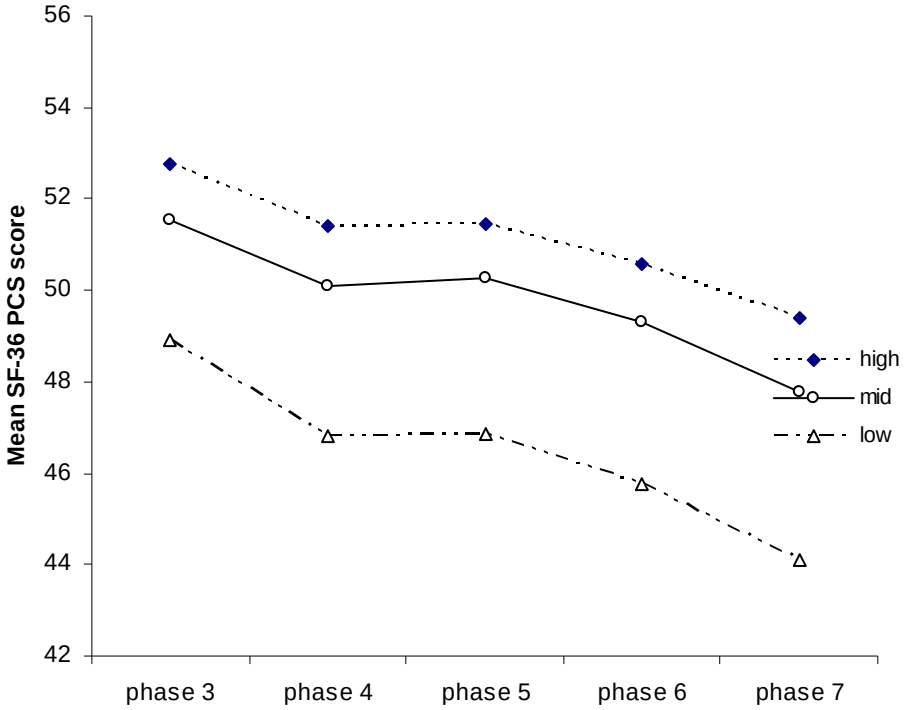
Figure 2. Estimated body mass index (BMI) trajectories and observed mean BMI at different ages for the 1946 and 1958 British cohorts. The knot is at 20 years for males (childhood is 7–<20 years, adulthood is 20–53 years for the 1946 cohort and 20–45 years for the 1958 cohort) and at 16 years for females (childhood is 7–≤16 years, adulthood is >16–53 years and >16–45 years, respectively).

Social inequalities in self reported health in early old age: follow-up of prospective cohort study

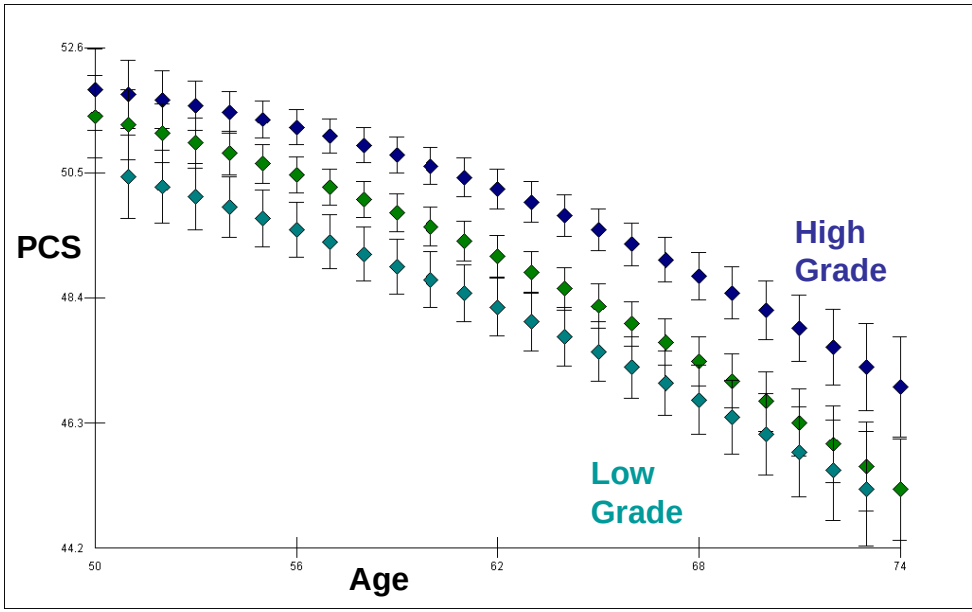
Tarani Chandola, senior lecturer,[1] Jane Ferrie, senior research fellow,[1] Amanda Sacker, principal research fellow,[1] Michael Marmot professor[1]

BMJ

Mean physical functioning (PCS) by Whitehall II phases



Trajectories of physical functioning (PCS) by age in Whitehall II



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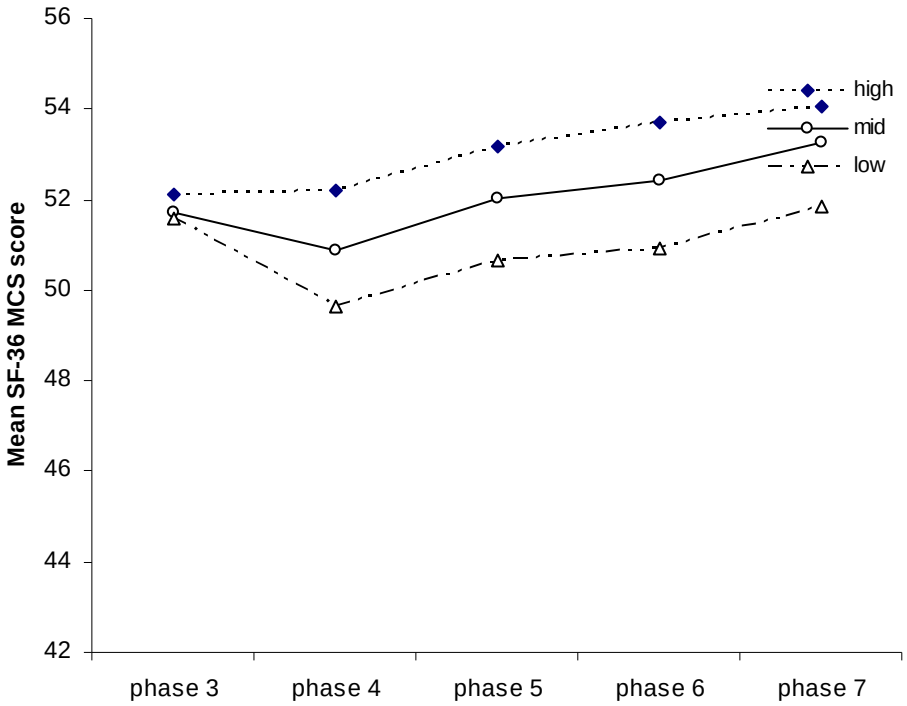
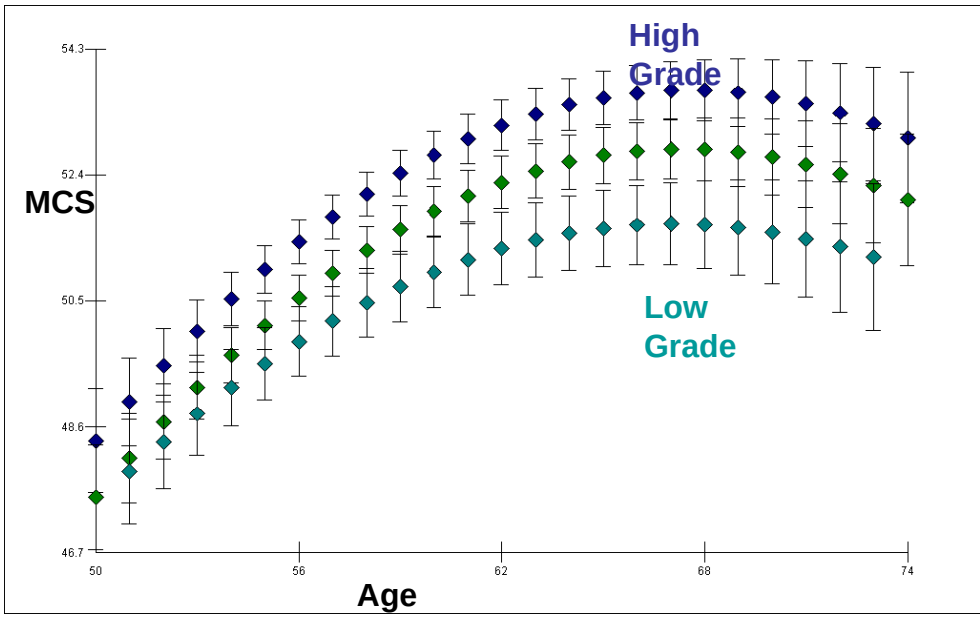
BMJ

Mean mental functioning (MCS) by Whitehall II phases

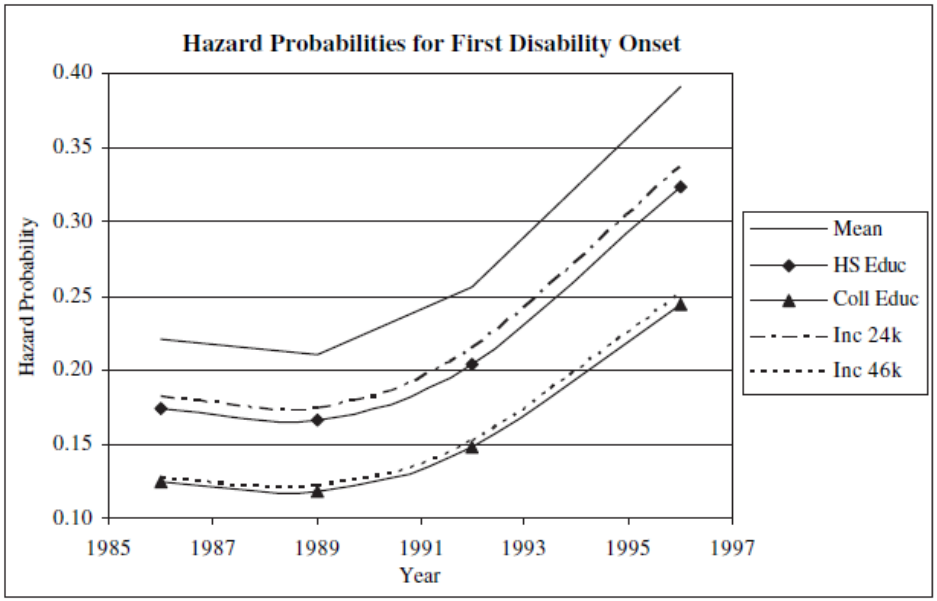


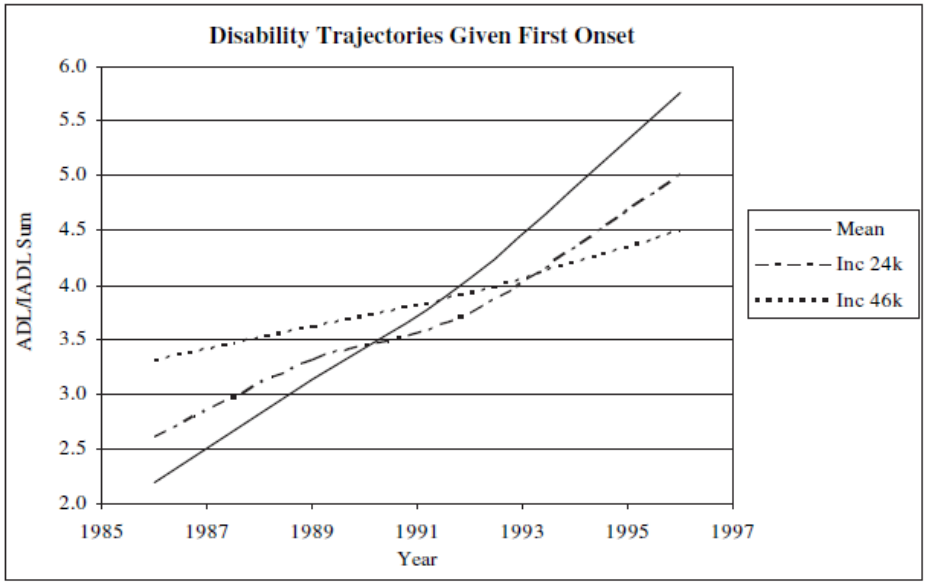
Trajectories of mental functioning (MCS) by age in Whitehall II



Taylor, M.G. (2010). Capturing transitions and trajectories: the role of socioeconomic status in later life disability. *Journal of Gerontology: Social Sciences,* 10.1093/geronb/gbq018

Figure 1. Socioeconomic Status effects in the 1912–1921 cohort.





Limitations

- Repeated health measures
- Differences in meaning over the lifecourse
- Missing Data
- Age, period, cohort effects

Summary

Health trajectories are about “Velocity”

The unit of time is usually age

Easy to fit in a multilevel framework

Predict group differences between (random) age intercepts and slopes

Resources

Experts/users at Manchester:

Professor Jianxin Pan
http://personalpages.manchester.ac.uk/staff/Jianxin.Pan/book.html
Dr Nick Shrayne
http://www.manchester.ac.uk/research/n.shryane/research
Professor Graham Dunn
http://www.medicine.manchester.ac.uk/staff/1470

Links to on-line resources:

Latent Growth Curve Analysis: A Gentle Introduction
Alan C. Acock
http://oregonstate.edu/dept/hdfs/papers/lgcgeneral.pdf
Statistical analysis with latent variables
http://www.ats.ucla.edu/stat/seminars/ed231e/default.htm
Longitudinal Data Analysis: Multilevel modelling and Structural Equation Modelling Approachesn 20-21 Sep 2010 Bristol
Materials will be available here after the workshop
http://www.cmm.bristol.ac.uk/MLwiN/tech-support/workshops/index.shtml
Mlwin user's guide
http://www.cmm.bristol.ac.uk/MLwiN/download/MLwiN-userman-09.pdf
Chapter on Repeated Measures Data