closer
Cohort & Longitudinal Studies Enhancement Resources

Breakout sessions: Inequality

Eliot

11:30-12:50

@CLOSER_UK #CLOSERconf

CLOSER website: www.closer.ac.uk
CLOSER Discovery: www.discovery.closer.ac.uk

BRITISH LIBRARY

MRC Medical Research Council

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

NCRM National Centre for Research Methods

A reassessment of socio-economic gradients in child cognitive development using Growth Mixture Models

Katy Sindall, *Department of Sociology, Social Policy, and Criminology, University of Southampton*

Patrick Sturgis, *Department of Social Statistics and Demography, University of Southampton*

Fiona Steele, *Department of Statistics, London School of Economics*

George Leckie, *Centre for Multilevel Modelling, University of Bristol*

Rob French, *Centre for Multilevel Modelling, University of Bristol*

Paper presented at CLOSER Conference, London, 30 November 2015

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

UNIVERSITY OF Southampton

MANCHESTER 1824 The University of Manchester

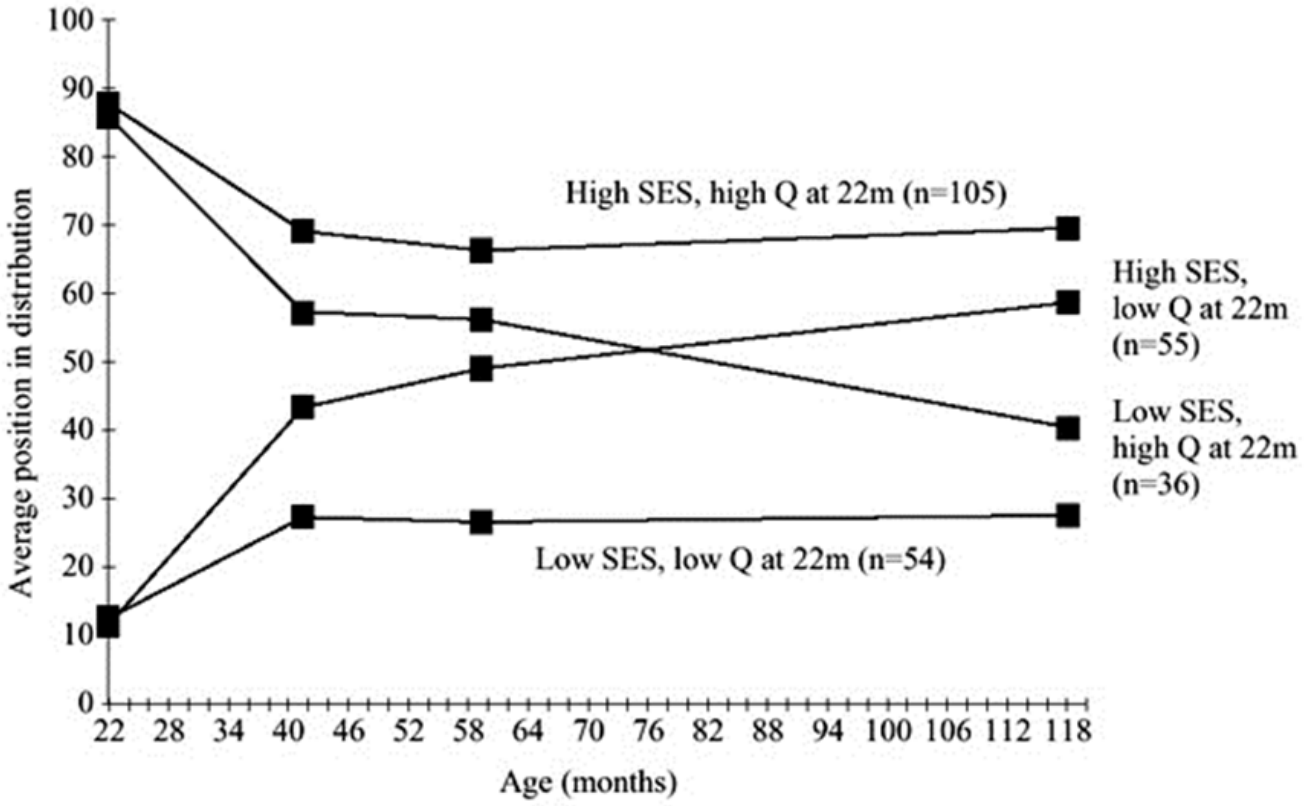
THE UNIVERSITY OF EDINBURGH

NCRM National Centre for Research Methods

Motivation

- Able kids from disadvantaged ses households ‘overtaken’ by less able kids from advantaged ses households at age ~5
- The ‘pre-assigned groups’ method
- SES ‘advantage’ & ability groups defined by ‘sharp’ thresholds on t1 measures

Feinstein (2003) showing average rank of test scores at 22, 42, 60 and 120 months, by SES of parents and early rank position



Regression to the mean

- Caused by regression to the mean & measurement error (Tu & Law, 2010; Jerrim & Vignoles 20; Goldstein & French 2015)?

- Selecting kids from the tails of the ability distribution at t1 means they will move toward the mean at t2 (and vice versa)

- This will be more pronounced for kids in low ses households as they have lower long-run mean

Growth Mixture Models (GMMs)

- Extend linear growth curve model (Muthen 2004)
- Finite mixture model applied to individual growth trajectories
- Identify sub-groups with *qualitatively different* trajectory parameters
- Predict group membership via multinomial logit regression

Advantages

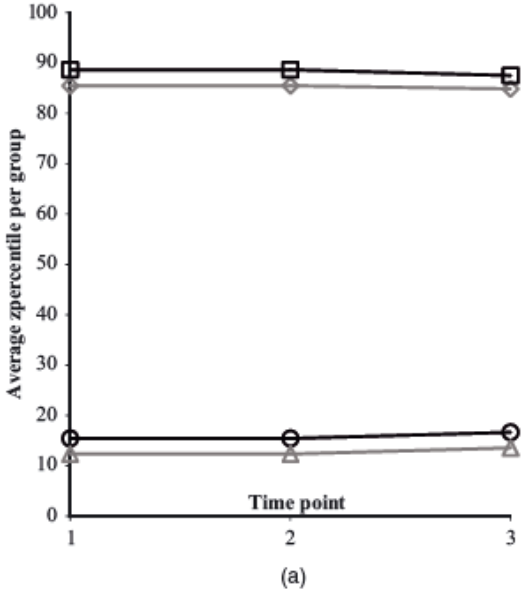
- Uses all time points to define groups, rather than first time point

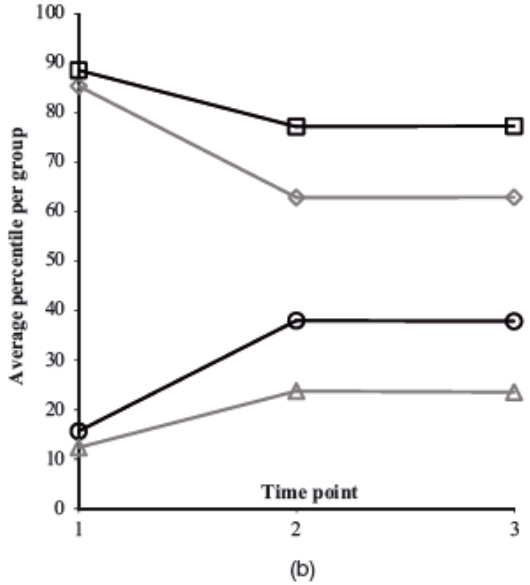
- Model based
  - Uses all data
  - Group membership probabilistic
  - Applicable to data with multiple waves
  - Deal with nonresponse/missing data flexibly
  - Detect potentially interesting additional groups
  - Include multiple predictors of group membership

NCRM National Centre for Research Methods

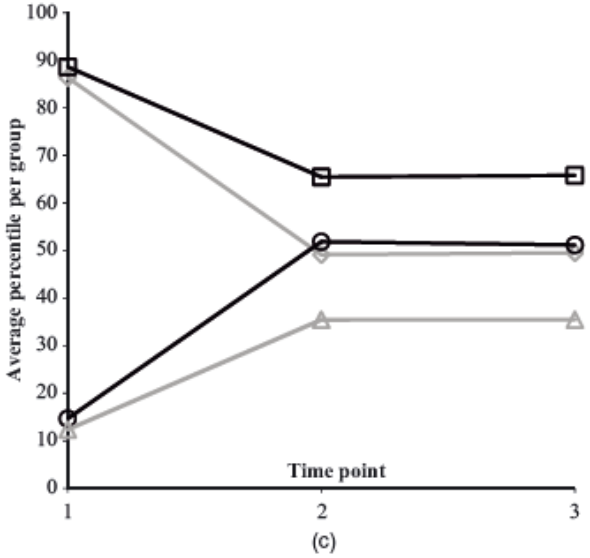
Application to simulated data

Pre-assigned groups method





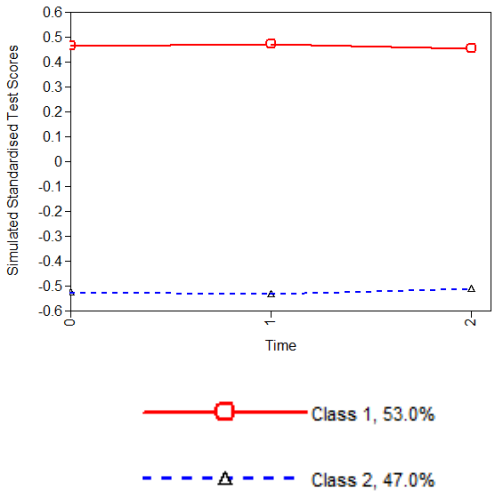
Reliability = 0.75



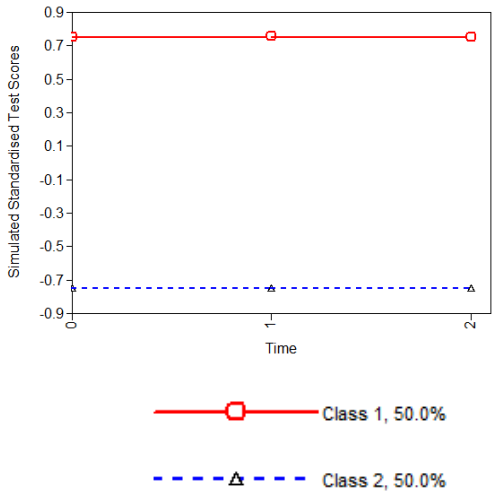
Reliability = 0.4

Predicted trajectories and latent group membership probabilities from 2-class GMM model with quadratic growth and random intercepts within classes

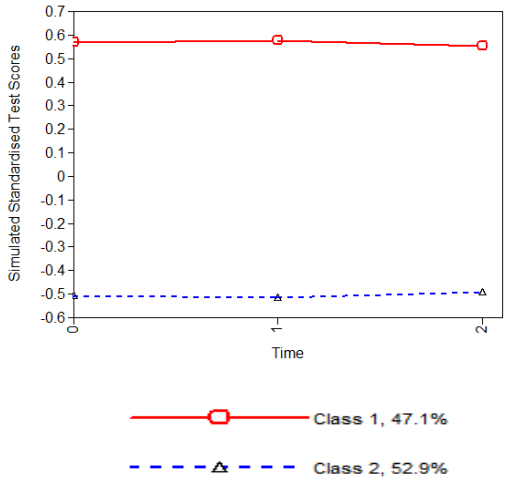
(a) $\theta_1 = 1.4, r = 0.75$



(b) $\theta_1 = 3, r = 0.75$



(c) $\theta_1 = 3, r = 0.40$



NCRM National Centre for Research Methods

Application to MCS data

5 class solution, fit statistics, entropy, posterior probabilities

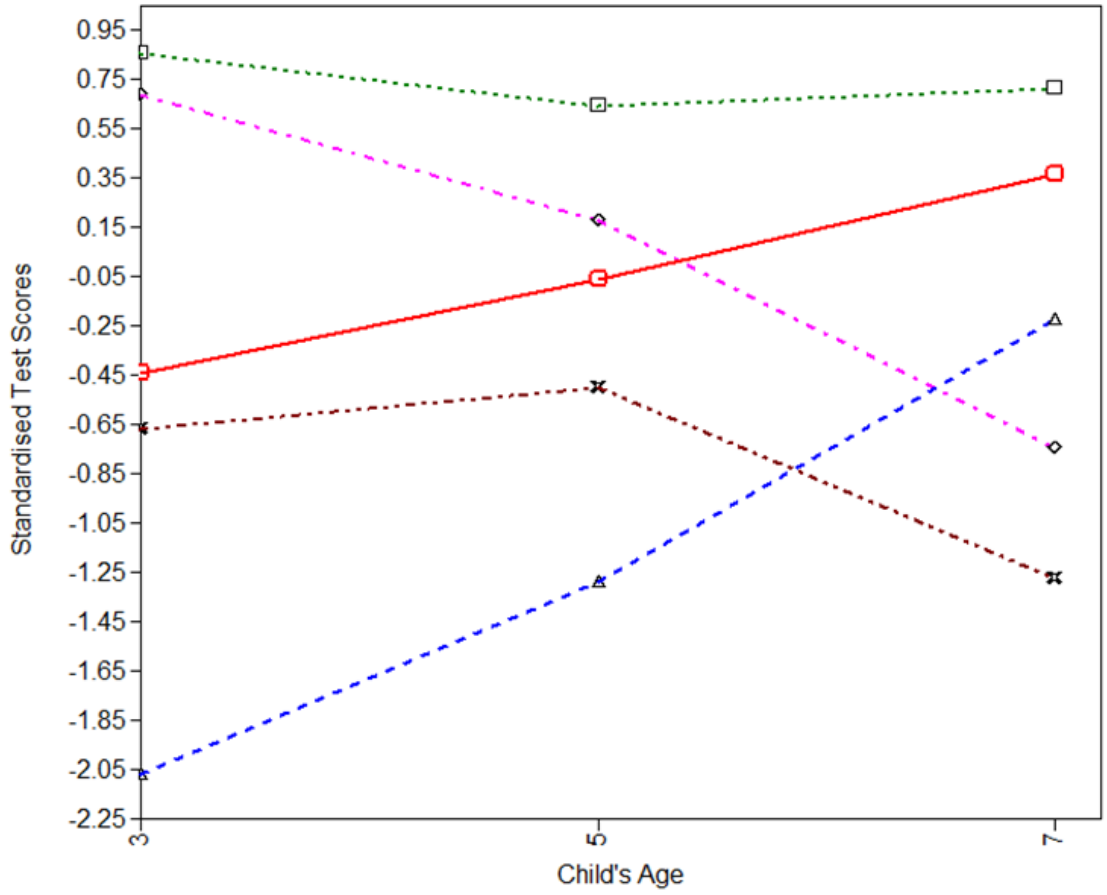
Table 2. MCS model fit statistics and entropy

Classes	BIC	Sample Size Adjusted BIC	LMR p-value	Entropy
2	94905	94816	<.001	.523
3	94299	94149	<.001	.616
4	94032	93822	0.106	.632
5	93654	93383	.001	.643
6	93615	93284	0.571	.653

Table 3. Average Latent Class Probabilities by Most Likely Classes for 5 Class Model

		Average latent class probabilities				
	Groups	1	2	3	4	5
Most	1	*0.818*	0.106	0.074	0.002	0.000
likely	2	0.140	*0.710*	0.072	0.077	0.001
group	3	0.111	0.051	*0.726*	0.089	0.022
	4	0.004	0.082	0.142	*0.736*	0.035
	5	0.003	0.006	0.077	0.09	*0.824*

Latent trajectory plot for 5 class growth mixture model (MCS data)

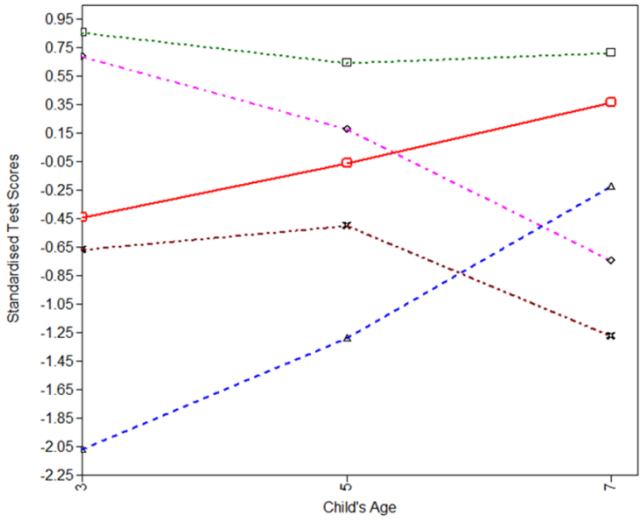


Predictors of class membership

Table 4. Covariate coefficient contrasts with group 3 of the MCS 5 class multinomial logistic model for trajectory group membership

	1 v 3	2 v 3	4 v 3	5 v 3
Standardised income	0.254* (0.043)	0.011 (0.059)	-0.804* (0.095)	-1.44* (0.227)
benefit payments				
Yes	-0.379* (0.083)	0.016 (0.102)	0.073 (0.099)	0.035 (0.145)
NS-SEC, ref: Managerial/prof				
Intermediate	-0.408* (0.084)	-0.09 (0.115)	-0.016 (0.147)	0.314 (0.244)
Self Employed	-0.181 (0.158)	0.165 (0.204)	0.502* (0.229)	0.993* (0.322)
Technical	-0.57* (0.148)	0.215 (0.164)	0.522* (0.186)	0.872* (0.283)
Routine	-0.709* (0.091)	-0.029 (0.114)	0.671* (0.128)	1.059* (0.205)
Marital Status ref: single				
Married	-0.102 (0.077)	-0.21* (0.092)	-0.156 (0.094)	1.78* (0.224)
Divorce/Separate	0.154 (0.141)	0.08 (0.159)	0.193 (0.15)	1.157* (0.284)
Widowed	-0.442 (0.740)	0.106 (0.712)	-0.519 (0.974)	2.102* (0.775)
Parent long term illness				
Yes	-0.006 (0.073)	-0.021 (0.091)	0.031 (0.091)	-0.337* (0.147)
Parent's Age at Birth: ref: Under 20				
20-39	0.225 (0.172)	0.065 (0.163)	0.062 (0.143)	-0.022 (0.285)
40+	0.323 (0.258)	0.376 (0.282)	0.087 (0.312)	-0.009 (0.515)
Child's gender				
Female	0.599* (0.061)	0.244* (0.095)	-0.444* (0.082)	-0.302* (0.12)

*p<=0.05; Standard errors in parentheses



NCRM National Centre for Research Methods

Summary

- No SES measure related to the ‘crossing’ groups
- ‘rising’ group more likely to come from more advantaged homes
- ‘declining’ group more likely to come from disadvantaged homes
- GMM useful for addressing this question

NCRM National Centre for Research Methods

NCRM working paper available:

http://eprints.ncrm.ac.uk/3768/

Mackenbach's Paradox of Increasing Socioeconomic Inequalities in Health: Do Cognitive Scores Have a Role to play?

[Work in progress]

Tomos Robinson, PhD Student

PhD Supervisors: Dr Heather Brown, Dr Jing Shen, Prof John Wildman

Institute of Health&Society

Athena SWAN Silver Award

Motivation (i)

- Despite the development of large welfare states, socioeconomic health inequalities have widened in the UK and across Europe since the 1950's (Marmot 2005, 2012)
- Mackenbach (2012) reviews 9 theories which attempt to explain this paradox, including social selection, psychological pathways, 'neo-material' factors, personal characteristics and cultural capital
- From the social selection theory (West 1991) and the personal characteristics theory (Batty *et al* 2006), Mackenbach derives a general hypothesis that attempts to address this paradox

Motivation (ii)

- This general hypothesis argues that continued increases in upward intergenerational social mobility have increased opportunities for social selection
- Due to this, Mackenbach argues that the lower social classes may have become more homogenous with regards to personal characteristics (such as cognitive ability), and that this may have paradoxically *increased* health inequalities
- There is a well-known association between personal characteristics and health, with recent economic literature arguing that it is in fact *early life* personal characteristics that may drive disparities in later life health (Heckman *et al* 2006)

This Study

- Mackenbach notes that “the theory on the changing composition of social classes can be empirically tested by comparing socioeconomic inequalities in personality profiles and cognitive abilities between different birth cohorts”
- If socioeconomic inequalities in cognitive ability have increased over time, Mackenbach argues that this could help to explain the persistence of socioeconomic health inequalities in developed countries
- In order to compare socioeconomic inequalities in cognitive ability between birth cohorts in the UK, this study uses information from the National Child Development Study (1958) & UK Millennium Cohort Study (2000/1)

Measure of Socioeconomic Status

- The measure of socioeconomic status used in the study (thus far) is household income
- Commonly used measure of socioeconomic status in the context of child cognitive ability
- Due to inadequacy of the income measures in the first two waves of the NCDS, a derived measure of 'Permanent Predicated Income' has been calculated in order to capture the average living standard in childhood
- An equivalised measure of household income can be calculated using information from the MCS regarding income and family composition

Measure of Cognitive Ability

Newcastle University

Institute of Health&Society

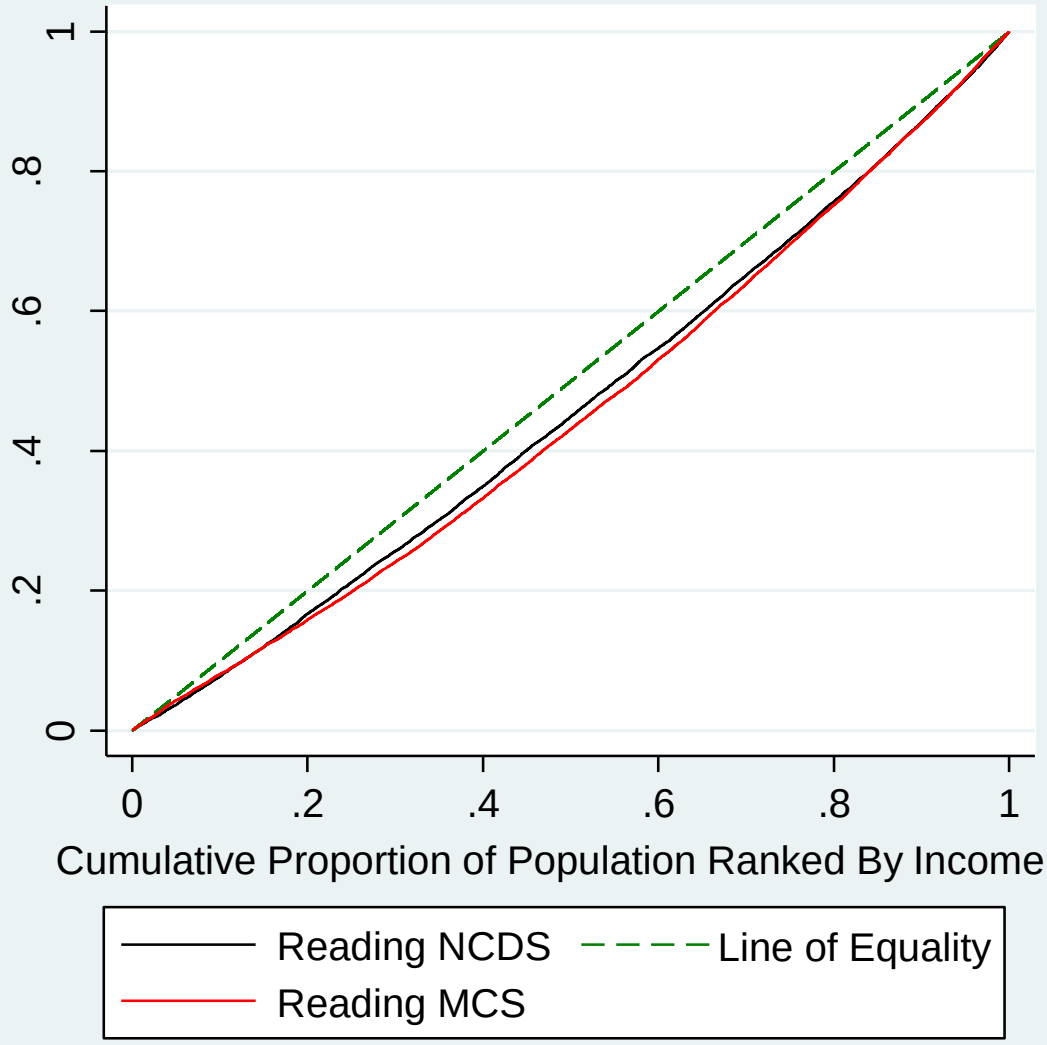
- The measure of cognitive ability used in the study is reading ability, with the NCDS and MCS having broadly comparable measures of reading ability taken at age 7
- NCDS has the Southgate Reading Test (Southgate 1962), scored on scale between 0 and 30
- MCS has the British Ability Scales Word Reading Test (Elliot *et al* 1996), scored between 0 and 90 and converted into an 'ability score' to take account the specific items answered
- Alike other studies in the field, for instance Gregg and McMillan (2010), the measures are standardised to mean 0, standard deviation 1 for cross cohort comparison

Athena SWAN Silver Award

Concentration Index

- To compare socioeconomic inequalities across cohorts, this study utilises the concentration index
- Traditionally a means of assessing the degree of income related inequality in the distribution of health variables (Wagstaff *et al* 1991), the method has more recently been applied to cognitive ability (Maika *et al* 2013)
- The CI takes a value between -1 and 1, with higher, positive values in this context indicating increased pro-rich inequality
- The associated concentration curve graphically displays this inequality, plotting the cumulative proportion of cognitive ability on the Y-axis, and the cumulative proportion of the population (ranked by income) on the X-axis

Preliminary Results (i)



Newcastle University

Institute of Health&Society

Athena SWAN Silver Award

Preliminary Results (ii)

- The corresponding concentration indices for the NCDS and MCS are **0.076** and **0.094** respectively, implying that income related inequalities in cognitive ability may have marginally increased from the NCDS to the MCS
- However, such point estimates are not sufficient to establish significant differences, as the CC is calculated from survey data, and may display sampling variability
- Dominance analysis (using the intersect unity principle) displays that no CC dominates the other, implying that the changes in socioeconomic inequality measured by the CC and CI are unlikely to be statistically significant

Conclusions

- Preliminary estimates from concentration indices imply that there has been small increase in income related inequality in reading ability from the NCDS to the MCS
- However, dominance analysis implies that this increase is unlikely to be statistically significant
- This suggests that the socioeconomic inequality in cognitive ability has been relatively stable over time
- Therefore, the “changing composition of the social strata” hypothesis (Mackenbach 2012) may not be a pathway through which health inequalities have persisted in the UK

Future Research

Newcastle University

Institute of Health&Society

- Planned future work includes using different measures of cognitive ability and socioeconomic status as a form of sensitivity analysis
- Potentially utilise the harmonised socioeconomic variables currently be developed by CLOSER for cross cohort comparisons (Crawford *et al*)
- Also potentially incorporate the 1970 British Cohort Study, which has broadly comparable measures at age 5 and 10 to the MCS in Verbal Ability

Athena SWAN Silver Award

Newcastle University

Institute of Health&Society

Thank you for listening!

Any comments would be very much welcomed

Athena SWAN Silver Award

closer
Cohort & Longitudinal Studies Enhancement Resources

Lunch

CLOSER search platform demonstrations and poster session

12:50-14:00

@CLOSER_UK #CLOSERconf

CLOSER website: www.closer.ac.uk
CLOSER Discovery: www.discovery.closer.ac.uk

BRITISH LIBRARY

MRC Medical Research Council

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL