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Background
Health selection and SES

- Socioeconomic status (SES) e.g. education is linked to health in a variety of ways (lifestyle, psychosocial).
- Less is known about the possible importance of health on educational outcomes (Kroenke, 2008)
- Health selection processes (i.e. that health affects subsequent SES) has been contested in the litterature on social inequality in health except for selection out of the labour market (e.g. Chandola 2003)
- The associations has been small and deemed mostly irrelevant (Elstad 2004)
- Are the small associations a consequence of too crude measures being used? (Ki et al. 2010)

Background
Health and School Performance

- Low birth weight has consistently been linked to lower cognitive abilities (Saigal et al, 2001).
- Chronic disease has been linked to lower achievement scores in adolescent and having to repeat a grade (Fowler, Johnson & Atkinson, 1985; Cadman, 1987)
- Little is known about adolescent health and subsequent academic performance (such as grades or educational achievement in adulthood) (Haas & Fosse, 2008; Jackson 2009).
- Studies have shown that depression affect school performance (Fröyd et al. 2008) and self-rated health predict subsequent timely high-school completion (Haas & Fosse, 2008), i.e. that health problems may prolong the time before completing e.g. secondary school.

Pathways linking health and school performance (1)

Biological mechanisms

a) damages that lower *cognitive abilities* permanently (e.g. low birth weight, brain damages)
b) diseases or symptoms that lower *ability to concentrate* (e.g. headache, depression etc.)

Pathways linking health and school performance (2)

Social/Psychological mechanisms

c) *absenteeism*, i.e. being sick results in more days absent from school and higher risk of falling behind.

d) *social support*, i.e. parents to chronically ill children may not have the time or resources to help with school work as well as take care of disease management.

e) *stigmatisation* because of sick role, i.e. being sick is a deviant role and that may influence the sick child negatively e.g. via bullying or lack of social relations with peers in school.

f) *self-stigmatisation* because of sick role, i.e. being sick means that teacher or parents may expect less of the child leading to lower performance. In some cases this may be related directly to the disease e.g. in the case of depression.

Aim of this presentation

- To examine the impact of a variety of health measures on school performance at the end of compulsory school (9 years of school).

Methods and Materials (1)

- Birth cohort study of all adolescents living in Ringkjøbing County (in april 2004) born in 1989 (N = 3,681)
- 83% (n = 3,058) completed questionaires at age 14/15 in spring 2004.
- 95+% (n = 2,895) had completed final primary school exams in the period 2004-2007.
- Information linked to register data using CPR.
  - Information on parents' highest education and household income (2003).
  - Information on grades from final exams in compulsory school (after 9 years of education).
  - Information on health – birth weight, hospitalisation due to various diagnoses (ICD9/10) age 0-13.

Methods and Materials (2)

Information from questionnaires answered by adolescents and their parents included:

- Self-reported
  - Self-rated general health (SF-12).
  - Cohens perceived stress scale – 4 items (Cohen, Karmarck & Mermelstein, 1983).
  - CES-CD depressive symptoms scale 4-items (Fendrich, Weissman & Warner, 1990; Radloff, 1977).
  - Hopkins Symptom checklist – SCL-90 – 6 items (Bech, 1994).
- Parent reported:
  - Strenghts and Difficulties Questionnaire – 2 items (Goodman et al 2000)
  - Chronic diseases and periods of illness in childhood

Table 1: Yearly grades for spelling, Danish (oral) and Math (written) by physical health and mental wellbeing (reported by adolescents at age 14). Ordinary Least Squares regression.

	Spelling. Yearly grade. (N = 2,629)		Danish oral. Yearly grade. (N = 2,631)		Mathematics written. Yearly grade. (N = 2,629)	
	Average grade unadjusted (std. dev)	β (fully adjusted)♥	Average grade unadjusted (std. dev)	β (fully adjusted)♥	Average grade unadjusted (std. dev)	β (fully adjusted)♥
Grand mean (range: 0-13)	8.13 (1.3)	---	8.17 (1.4)	---	8.21 (1.4)	---
Physical Health (reported by adolescents at age 14)						
Self-rated health						
Good, Not so good, Bad vs Excellent, Very good	8.12 (1.43)***	-0,248***	8.05 (1.27)***	-0,294***	8.05 (1.41)***	-0,300***
Symptom Checklist (high degree of annoyance over last week vs. low degree of annoyance)						
Headache	8.09 (1.29)	-0,224*	8.14 (1.28)	-0,221**	8.09 (1.38)**	-0,202*
Dizziness/Fainting	8.14 (1.36)	-0,252	8.02 (1.35)	-0,314**	7.97 (1.36)**	-0,295*
Chest/heart pain	8.02 (1.40)	-0,150	8.08 (1.30)	-0,056	7.92 (1.46)*	-0,281
Low back pain	8.35 (1.33)	-0,055	8.27 (1.31)	-0,076	8.25 (1.27)	-0,113
Nausea/Stomach ache	8.25 (1.38)	-0,178	8.13 (1.27)	-0,237*	8.18 (1.32)	-0,119
Muscle pain	8.31 (1.42)	-0,045	8.31 (1.42)	0,026	8.31 (1.40)	-0,029
Psychological well-being (reported by adolescents at age 14)						
Perceived stress (90% percentile vs. others)	8.04 (1.52)**	-0,339***	7.98 (1.33)***	-0,343***	7.84 (1.41)***	-0,435***
Depressive symptoms (90% percentile vs. others)	8.13 (1.38)*	-0,278**	8.10 (1.20)*	-0,258**	8.00 (1.36)***	-0,328***

*p<.05, **p<.01, ***p<.001

♥ each individual health measure is adjusted for sex, age at completion, ethnicity (Danish vs. non-Danish), parents highest education, household income, split home, age of mother (i.e. results are not adjusted for other health measures).

Table 2: Yearly grades for spelling, Danish (oral) and Math (written) by register based measures of health. Age 0-13. Ordinary Least Squares regression.

	Spelling. Yearly grade. (N = 2,844)		Danish oral. Yearly grade. (N = 2,847)		Mathematics written. Yearly grade. (N = 2,850)	
	β unadjusted	β (fully adjusted)♥	β unadjusted	β (fully adjusted) ♥	β unadjusted	β (fully adjusted) ♥
Birthweight						
Low birth weight (<2,500g) vs. Normal birth weight	0.032	0.038	-0.104	-0.112	-0.099	-0.052
Birth weight (in 100 gram intervals)	0.000	0.000	0.001*	0.001	0.002***	0.001*
Hospitalisation (number of days hospitalized)						
Number of days aged 0-2 years	-0.005	-0.001	-0.006	-0.003	-0.005	-0.002
Number of days aged 3-6 years	-0.011*	-0.007	-0.011*	-0.007	-0.007	-0.005
Number of days aged 7-13 years	-0.012**	-0.009*	-0.006	-0.004	-0.016***	-0.015***
Number of days aged 0-13 years	-0.007**	-0.004*	-0.006**	-0.003	-0.007**	-0.005**

*p<.05, **p<.01, ***p<.001
♥ each individual health measure is adjusted for sex, age at completion, ethnicity (Danish vs. non-danish), parents highest education, household income, split home, age of mother (i.e. results are not adjusted for other health measures).

Table 3: Yearly grades for spelling, Danish (oral) and Math (written) by parent reported health measures (reported by parents at children's age 14). Ordinary Least Squares regression.

	Spelling. Yearly grade. (N = 2,366)		Danish oral. Yearly grade. (N = 2,368)		Mathematics written. Yearly grade. (N = 2,364)	
	Average grade unadjusted (std. dev)	β (fully adjusted)♥	Average grade unadjusted (std. dev)	β (fully adjusted) ♥	Average grade unadjusted (std. dev)	β (fully adjusted) ♥
Childhood health (reported by parents at age 14) (Yes/No)						
Health problems 0-1 years	7.91 (1.39)**	-0.168	7.93 (1.25)**	-0.125	8.05 (1.46)*	-0.186
Health problems 2-6 years	7.56 (1.53)***	-0.451*	7.76 (1.26)**	-0.256	7.85 (1.56)*	-0.287
Health problems 7-14 years	7.60 (1.39)**	-0.499*	7.55 (1.33)***	-0.534**	7.38 (1.39)***	-0.728***
Health problems 0-14 years index (90% percentile vs. others)	7.82 (1.33)***	-0.345**	7.98 (1.33)**	-0.155	7.93 (1.41)***	-0.347**
Any chronic disease	8.26 (1.42)	-0.061	8.23 (1.32)	-0.059	8.38 (1.37)	0.009
Asthma	8.12 (1.36)	-0.138	8.14 (1.31)	-0.079	8.40 (1.43)	0.079
Allergic Rhinitis	8.14 (1.41)*	-0.114	8.18 (1.31)	-0.039	8.40 (1.36)	0.004
Eczema	8.39 (1.38)	0.055	8.25 (1.30)	-0.053	8.54 (1.31)	0.215
Diabetes	7.67 (1.15)	-0.588	8.33 (1.15)	0.091	7.67 (2.31)	-0.487
Epilepsy	7.88 (1.25)	-0.404	7.25 (1.04)*	-0.932*	7.63 (1.69)	-0.641
Parent reporting adolescent's behavior (at age 14)						
Troubled by headache, nausea, stomach ache (last 6 months)	p < 0.001		p < 0.001		p < 0.001	
Does not fit	8.42 (1.40)	Ref.	8.38 (1.25)	Ref.	8.53 (1.32)	Ref.
Fit to some degree	8.19 (1.40)	-0.277***	8.15 (1.30)	-0.293***	8.14 (1.33)	-0.315***
Fits nicely	7.81 (1.48)	-0.408***	7.76 (1.24)	-0.444***	7.59 (1.46)	-0.623***
Often sad or cries easily (last 6 months)	p < 0.001		p < 0.001		p < 0.001	
Does not fit	8.41 (1.38)	Ref.	8.36 (1.25)	Ref.	8.48 (1.32)	Ref.
Fit to some degree	7.87 (1.48)	-0.479***	7.90 (1.37)	-0.401***	7.92 (1.46)	-0.376***
Fits nicely	7.77 (1.52)	-0.580***	7.91 (1.43)	-0.405**	7.68 (1.25)	-0.559***

*p<.05, **p<.01, ***p<.001

♥ each individual health measure is adjusted for sex, age at completion, ethnicity (Danish vs. non-Danish), parents highest education, household income, split home, age of mother (i.e. results are not adjusted for other health measures).

Table 5: Yearly grades for spelling, Danish (oral) and Math (written) by all health measures. Ordinary Least Squares regression. Forward stepwise selection. (N = 2,165)

	Spelling. Yearly grade.	Danish oral. Yearly grade.	Mathematics written. Yearly grade.
Self-reported measures of health			
Self-rated health			
Good/Not so good/Bad vs. Excellent/Very good	-0.196**	-0.241***	-0.179***
Psychological well-being			
Perceived stress (90% percentile vs. others)	Not selected	Not selected	-0.239*
Register-based measures of adolescents' health			
Hospitalisation (number of days hospitalized)			
Number of days hospitalised aged 3-6 years	Not selected	-0.008*	Not selected
Number of days hospitalised aged 7-13 years	Not selected	Not selected	-0.010*
Parent-reported measures of adolescents' health			
Parent reporting adolescent's behavior			
Troubled by headache, nausea, stomach ache (last 6 months)	p = 0.002	p = 0.001	p = 0.001
Does not fit	Ref	Ref	Ref
Fit to some degree	-0.200**	-0.215***	-0.234**
Fits nicely	-0.052	-0.199	-0.201
Often sad or cries easily (last 6 months)	P < 0.001	p = 0.001	p = 0.001
Does not fit	Ref	Ref	Ref
Fit to some degree	-0.458***	-0.335***	-0.283**
Fits nicely	-0.451*	-0.081	-0.396

*p<.05, **p<.01, ***p<.001

♥ each individual health measure is adjusted for sex, age at completion, ethnicity (Danish vs. non-Danish), parents highest education, household income, split home, age of mother and the other health measures selected.

Conclusions

1. Health may contribute via its effects on lowered school performance to the production of socioeconomic (SES) differences. (But all the effects may also be the result of residual confounding due to no measures of e.g. IQ or similar).

2. Bad self-rated general health, perceived stress, depressive symptoms and headache all contribute to lower school performance. Low birth weight was *only marginally* associated with lower grades at primary school ending. Hospitalisation especially in school age (7-13 yrs) may decrease school performance.

3. How big are the effects? Grade reductions of -0.3 if these are thought to persist at upper secondary school level would be capable of forcing some adolescents with poor health to choose other study directions e.g. at university level than they aspired for, i.e. an example of health selection. But other factors have more effect.