SOCIOECONOMIC DIFFERENCES IN ASTHMA RELATED OUTCOMES AMONG SCHOOL-AGED CHILDREN: RESULTS FROM EPOCH STUDY

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Part I: results from the Generation R Study

- Introduction of the Generation R
- Study design and results

Part II: preliminary results from the EPOCH study

- Study design in EPOCH project
- Current status and preliminary results

Socioeconomic and ethnic differences in school-aged children's asthma and lung function
– the Generation R Study

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Background

- Asthma is one of the most common chronic diseases worldwide

- Childhood asthma is related to school absenteeism, which in turn may cause educational achievement gaps and psychosocial problems

- low family socioeconomic status is associated with asthma related outcomes. however results are inconsistent among children aged 9 and older

- Of asthma-related outcomes, lung function measurements provide an objective measurement

Objectives

- *To assess the associations between sociodemographic factors*
  - *maternal educational level*
  - *Paternal educational level*
  - *net household income*
  - *financial difficulties*
  - *maternal employment status*
  - *Paternal employment status*
  - *ethnic background*

  with current asthma and lung function measurements among a sample of 10-year-old children
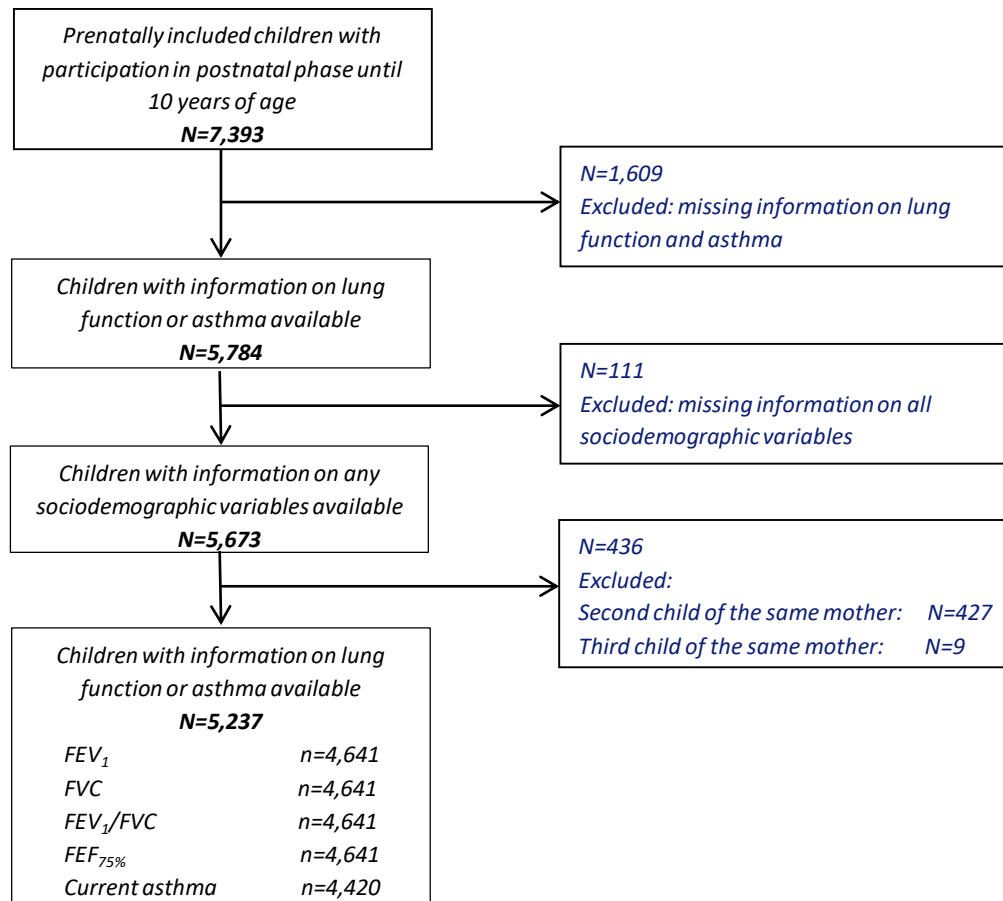
Generation R

- A multiethnic population-based prospective cohort study

- Children born between 2002 and 2006, Rotterdam, the Netherlands

- Data collection in mothers, fathers and children include
  - Questionnaires
  - detailed physical and ultrasound examinations
  - behavioural observations
  - biological samples

- Results from the Generation R Study contribute to the development of strategies for optimizing health and healthcare for pregnant women and children

Methods

Study Population

- Consent for postnatal follow-up was available for 7,393 prenatally included children

- Children's sociodemographic status was measured at child age 6

- Children's asthma and lung function was measured at child age 10

Prenatally included children with participation in postnatal phase until 10 years of age
N=7,393

N=1,609
Excluded: missing information on lung function and asthma

Children with information on lung function or asthma available
N=5,784

N=111
Excluded: missing information on all sociodemographic variables

Children with information on any sociodemographic variables available
N=5,673

N=436
Excluded:
Second child of the same mother: N=427
Third child of the same mother: N=9

Children with information on lung function or asthma available
N=5,237

FEV_1	n=4,641
FVC	n=4,641
FEV_1/FVC	n=4,641
$FEF_{75\%}$	n=4,641
Current asthma	n=4,420

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Methods

Children's sociodemographic status

Maternal and paternal educational level
- obtained by questionnaire
- low (no education, primary school, etc.), mid-low (more than three years general secondary school, etc), mid-high (higher vocational training), and high (university or PhD degree)

Self-reported net household income
- <€2000/month, €2000-€3200/month, >€3200/month

Maternal and paternal employment status
- no paid job, paid job

Financial difficulties
- defined as difficulties in paying rent, electricity bills, food and suchlike during the past year

Child ethnic background
- based on the country of birth of the parents
- Dutch, other western, non-western

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Methods

Asthma and lung function (age 10)

- Current asthma

  - defined as ever diagnosis of asthma, with either wheezing or asthma related medication use in the past 12 months
  - diagnosis of asthma and wheezing was obtained by questionnaire using adapted items of the International Study of Asthma and Allergies in Childhood (ISAAC) core questionnaires
  - medication use was obtained during the child's visit at the research center

- Lung function

  - measured by spirometry according to the American Thoracic Society and European Respiratory Society guidelines
  - measured during the child's visit at the research center
  - FEV_1, FVC, FEV_1/FVC, and FEF_{75} converted into study specific sex-, height- and age-adjusted z-scores

Methods

Statistical analyses

- Parents' and children's characteristics according to current asthma were evaluated by Chi-square tests

- logistic regression models (current asthma) and linear regression models (lung function)

  - Child gender and exact age at measurement were considered confounders and included into the models

  - The first set of models included each indicator of sociodemographic factors separately, adjusted with confounders (i.e. basic models)

  - The second set of models included all indicators of sociodemographic factors (i.e. full models)

- Interactions between ethnic background and each SES indicators were tested in the full models

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Results

Table 1. Children's sociodemographic status (N=5,237)

	Total	Asthma	No asthma	P-value
	N=5,237	N=259 (5.9)	N=4,161 (94.1)	
Maternal education				
Low	395 (9.8)	34 (15.2)	361 (9.5)	0.02
Mid-low	1183 (29.4)	71 (31.7)	1112 (29.2)	
Mid-high	1167 (29.0)	56 (25.0)	1111 (29.2)	
High	1281 (31.8)	63 (28.1)	1218 (32.0)	
Paternal education				
Low	506 (13.7)	40 (20.1)	466 (13.3)	0.06
Mid-low	961 (26.0)	46 (23.1)	915 (26.2)	
Mid-high	891 (24.1)	44 (22.1)	847 (24.2)	
High	1340 (36.2)	69 (34.7)	1271 (36.3)	
Net household income				
Less than €2000/month	738 (19.3)	55 (25.9)	683 (18.9)	0.01
€2000/month-€3200/month	1002 (26.2)	63 (29.7)	939 (26.0)	
More than €3200/month	2088 (54.5)	94 (44.3)	1994 (55.1)	
Financial difficulties (Yes)	612 (18.5)	41 (23.4)	571 (18.2)	0.09
Maternal unemployment	802 (20.9)	47 (22.5)	755 (20.8)	0.57
Paternal unemployment	176 (4.9)	12 (6.6)	164 (4.8)	0.28

Results

Table 1. Children's sociodemographic status (N=5,237)

	Total	Asthma	No asthma	P-value
	N=5,237	N=259 (5.9)	N=4,161 (94.1)	
Child ethnic background				
Dutch	2826 (64.1)	141 (54.4)	2685 (64.7)	<0.001
Other western	387 (8.8)	14 (5.4)	373 (9.0)	
Non-western	1197 (27.1)	104 (40.2)	1093 (26.3)	
Female sex	2216 (50.1)	95 (36.7)	2121 (51.0)	<0.001
FEV_1, mean (SD), L	2.01 (0.29)	1.97 (0.30)	2.01 (0.29)	0.05
FVC, mean (SD), L	2.33 (0.36)	2.36 (0.36)	2.33 (0.36)	0.14
FEV_1/FVC, mean (SD), %	86.70 (5.71)	83.90 (6.65)	86.87 (5.60)	<0.001
$FEF_{75\%}$, mean (SD), L/s	1.14 (0.34)	1.02 (0.34)	1.15 (0.34)	<0.001

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Results

Associations of socioeconomic and sociodemographic factors with asthma and lung function at 10 years of age (basic models*)

	OR (95% CI)	z Score change (95% CI)			
	Current asthma	FEV_1	FVC	FEV_1/FVC	$FEF_{75\%}$
	n=4,420	n=4,641	n=4,641	n=4,641	n=4,641
Maternal educational level					
High	Reference	Reference	Reference	Reference	Reference
Mid-high	0.97 (0.67, 1.41)	-0.06 (-0.14, 0.02)	-0.04 (-0.12, 0.04)	-0.04 (-0.12, 0.04)	-0.03 (-0.11, 0.05)
Mid-low	1.24 (0.87, 1.76)	**-0.13 (-0.21, -0.05)**	**-0.15 (-0.23, -0.07)**	0.03 (-0.05, 0.11)	0.03 (-0.05, 0.10)
Low	**1.86 (1.20, 2.87)**	-0.05 (-0.16, 0.06)	**-0.11 (-0.22, -0.002)**	0.11 (-0.001, 0.21)	0.09 (-0.02, 0.20)
Paternal educational level					
High	Reference	Reference	Reference	Reference	Reference
Mid-high	0.96 (0.65, 1.41)	-0.05 (-0.13, 0.04)	-0.05 (-0.13, 0.04)	0.003 (-0.08, 0.09)	0.02 (-0.07, 0.10)
Mid-low	0.93 (0.64, 1.37)	-0.07 (-0.15, 0.01)	**-0.11 (-0.19, -0.03)**	0.07 (-0.01, 0.15)	0.05 (-0.04, 0.13)
Low	**1.61 (1.08, 2.42)**	**-0.14 (-0.24, -0.05)**	**-0.20 (-0.29, -0.10)**	0.09 (-0.01, 0.19)	0.04 (-0.06, 0.14)

* Basic models included each indicator of sociodemographic factors separately, and adjusted with child age and gender.

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Results

Associations of socioeconomic and sociodemographic factors with asthma and lung function at 10 years of age (basic models)

	OR (95% CI)	z Score change (95% CI)			
	Current asthma	FEV_1	FVC	FEV_1/FVC	$FEF_{75\%}$
	n=4,420	n=4,641	n=4,641	n=4,641	n=4,641
Net household income					
More than €3200/month	Reference	Reference	Reference	Reference	Reference
€2000-€3200/month	**1.44 (1.04, 2.00)**	-0.03 (-0.10, 0.05)	-0.06 (-0.14, 0.01)	0.06 (-0.02, 0.13)	0.04 (-0.04, 0.11)
Less than €2000/month	**1.73 (1.23, 2.45)**	**-0.20 (-0.28, -0.12)**	**-0.22 (-0.30, -0.14)**	0.03 (-0.04, 0.11)	-0.04 (-0.12, 0.04)
Financial difficulties (Yes)	1.36 (0.94, 1.95)	-0.01 (-0.09, 0.08)	-0.08 (-0.16, 0.01)	**0.12 (0.03, 0.20)**	0.08 (-0.01, 0.16)
Paternal unemployment	1.39 (0.76, 2.56)	-0.04 (-0.17, 0.10)	-0.02 (-0.16, 0.11)	-0.01 (-0.15, 0.12)	-0.03 (-0.16, 0.11)
Maternal unemployment	1.12 (0.80, 1.57)	0.02 (-0.05, 0.10)	0.03 (-0.04, 0.11)	-0.02 (-0.09, 0.06)	-0.003 (-0.08, 0.07)
Ethnic background					
Dutch	Reference	Reference	Reference	Reference	Reference
Other western	0.74 (0.42, 1.30)	0.13 (0.03, 0.23)	0.10 (-0.001, 0.21)	0.06 (-0.04, 0.16)	0.08 (-0.02, 0.19)
Non-western	**1.84 (1.41, 2.41)**	**-0.22 (-0.28, -0.16)**	**-0.33 (-0.40, -0.27)**	**0.20 (0.14, 0.26)**	0.05 (-0.02, 0.11)

* Basic models included each indicator of sociodemographic factors separately, and adjusted with child age and gender

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Results

Associations of socioeconomic and sociodemographic factors with asthma and lung function at 10 years of age (full models[*])

	OR (95% CI)	z Score change (95% CI)			
	Current asthma	FEV$_1$	FVC	FEV$_1$/FVC	FEF$_{75}$
	n=4,420	n=4,641	n=4,641	n=4,641	n=4,641
Maternal educational level					
High	Reference	Reference	Reference	Reference	Reference
Mid-high	0.97 (0.60, 1.56)	-0.004 (-0.10, 0.09)	0.03 (-0.06, 0.13)	-0.06 (-0.15, 0.04)	-0.02 (-0.12, 0.07)
Mid-low	1.20 (0.70, 2.06)	-0.03 (-0.14, 0.09)	0.01 (-0.11, 0.13)	-0.05 (-0.17, 0.06)	0.02 (-0.10, 0.13)
Low	1.25 (0.53, 2.93)	0.15 (-0.05, 0.35)	0.13 (-0.07, 0.32)	0.07 (-0.13, 0.27)	0.14 (-0.06, 0.34)
Paternal educational level					
High	Reference	Reference	Reference	Reference	Reference
Mid-high	0.66 (0.40, 1.09)	-0.03 (-0.13, 0.07)	-0.05 (-0.15, 0.05)	0.03 (-0.08, 0.13)	0.04 (-0.06, 0.14)
Mid-low	0.62 (0.36, 1.09)	-0.07 (-0.18, 0.04)	-0.09 (-0.20, 0.03)	0.02 (-0.09, 0.13)	0.01 (-0.10, 0.12)
Low	1.06 (0.55, 2.05)	-0.02 (-0.18, 0.14)	-0.04 (-0.20, 0.12)	0.05 (-0.11, 0.21)	0.02 (-0.14, 0.18)

* Full model is additional adjusted for all other socioeconomic factors and ethnic background

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Results

Associations of socioeconomic and sociodemographic factors with asthma and lung function at 10 years of age (full models[*])

	OR (95% CI)	z Score change (95% CI)			
	Current asthma	FEV_1	FVC	FEV_1/FVC	FEF_{75}
	n=4,420	n=4,641	n=4,641	n=4,641	n=4,641
Net household income					
More than €3200/month	Reference	Reference	Reference	Reference	Reference
€2000-€3200/month	1.25 (0.78, 2.02)	-0.002 (-0.10, 0.10)	-0.01 (-0.11, 0.09)	0.01 (-0.09, 0.11)	-0.02 (-0.12, 0.08)
Less than €2000/month	1.77 (0.89, 3.51)	**-0.16 (-0.32, -0.001)**	-0.13 (-0.29, 0.03)	-0.07 (-0.23, 0.09)	-0.09 (-0.25, 0.07)
Financial difficulties (Yes)	0.91 (0.54, 1.52)	0.09 (-0.02, 0.20)	0.02 (-0.09, 0.13)	**0.12 (0.01, 0.23)**	0.09 (-0.02, 0.20)
Paternal unemployment	0.49 (0.17, 1.43)	-0.07 (-0.26, 0.13)	-0.005 (-0.20, 0.19)	-0.11 (-0.30, 0.09)	-0.13 (-0.32, 0.07)
Maternal unemployment	0.84 (0.50, 1.40)	0.08 (-0.02, 0.19)	**0.13 (0.03, 0.24)**	-0.09 (-0.19, 0.02)	-0.04 (-0.15, 0.07)
Ethnic background					
Dutch	Reference	Reference	Reference	Reference	Reference
Other western	0.94 (0.48, 1.85)	0.13 (-0.003, 0.26)	0.12 (-0.01, 0.26)	0.03 (-0.10, 0.16)	0.10 (-0.03, 0.23)
Non-western	**1.61 (1.02, 2.53)**	**-0.10 (-0.21, -0.001)**	**-0.25 (-0.36, -0.15)**	**0.26 (0.16, 0.37)**	**0.15 (0.04, 0.25)**

[*] Full model is additional adjusted for all other socioeconomic factors and ethnic background

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Conclusions

- This study contributes to current understanding of risk factors through analysis of various sociodemographic factors for school-aged child asthma and lung function

  - After adjustment for all sociodemographic factors, less household income was associated with lower FEV_1

  - maternal unemployment was associated with higher FVC

  - financial difficulties was associated with higher FEV_1/FVC

  - **Children from non-western ethnic background were significantly more likely to have higher risk of current asthma, lower FEV_1 and FVC, higher FEV_1/FVC and higher FEF_{75}**

Socioeconomic differences in asthma related outcomes in school-aged children: results from EPOCH study

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Objectives

- Existing evidence is restricted to a handful of developed countries and has limited comparability due, in part, to the use of inconsistent socioeconomic position indictors

- Meta analyses focusing on social inequalities in children's asthma related outcomes are lacking

- *To describe the prevalence of asthma related outcomes in school-aged children in the participating countries/cohorts*

- *To study the association between family socioeconomic status and the asthma related outcomes*
  (by meta analyses of data from different countries)

Methods

- **Study population:** in total, complete data was available for 31 610 children from 6 cohorts (GenR: the Netherlands; LSAC K: Australia; LSAC B: Australia; ABIS: Sweden; MCS: United Kingdom; ELDEQ: Canada)

Socioeconomic status

- maternal educational level

  - Education levels across countries were converted to the same scale using the international Standard Classification of Education (ISCED 97)

  - seven levels of the ISCED 97 were banded into three: low, up to lower secondary education (ISCED 0-2); medium, upper secondary education (ISCED 3); and high, post-secondary education and higher (ISCED 4-6).

- net household income

  - converted into quintile groups in each cohort

Methods

Asthma related outcomes

- wheezing/breathlessness symptoms in the last 12 months

  - Available in 5 cohorts (GenR, LSAC K, LSAC B, ABIS, MCS)

- asthma diagnose

  - primary care takers' answer to a survey question: whether their child had: had a doctor diagnosis of asthma (GenR age 10, LSAC K age 9, LSAC B age 9, MCS age 11, ELDEQ age 10)

  - ABIS retrieved doctor diagnoses directly from primary care and hospital records at age 8 **(not very sure)**

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Results

variables	GenR	LSAC K	LSAC B	ABIS	MCS	ELDEQ
	N=4,484	N=4,331	N=4,077	N=4,030	N=13,354	N=1,334
Maternal educational level						
High School or less (Low)	686 (15.3)	1186 (27.4)	797 (19.6)	951 (23.6)	2335 (17.5)	335 (25.1)
Post High School (Middle)	1275 (28.4)	1747 (40.3)	1668 (40.9)	1117 (24.7)	5219 (39.0)	536 (40.2)
University (High)	2246 (50.1)	1350 (31.2)	1582 (38.8)	1937 (48.1)	4581 (34.3)	463 (34.7)
Missing	277 (6.2)	48 (1.1)	30 (0.7)	25 (0.6)	1228 (9.2)	0
Household income quintile						
Quintile 1 (lowest)	735 (16.4)	867 (20.0)	816 (20.0)	802 (19.9)	2517 (18.8)	218 (16.3)
Quintile 2	1008 (22.5)	866 (20.0)	815 (20.0)	805 (20.0)	2623 (19.6)	257 (19.3)
Quintile 3	686 (15.3)	866 (20.0)	816 (20.0)	805 (20.0)	2455 (18.4)	288 (21.6)
Quintile 4	493 (11.0)	875 (20.2)	818 (20.1)	805 (20.0)	2490 (18.5)	253 (19.0)
Quintile 5	927 (20.7)	857 (19.8)	812 (19.9)	807 (19.9)	2357 (17.7)	262 (19.6)
Child ethnic background						
Prevalent ethnic background	2842 (63.4)	4155 (95.9)	4062 (99.6)	3904 (96.9)	10496 (78.6)	1224 (91.8)
Minority ethnic background	1592 (35.5)	176 (4.1)	15 (0.37)	82 (2.0)	2007 (15.0)	109 (8.2)
Missing	50 (1.1)	0 (0)	0 (0)	44 (1.1)	851 (6.4)	1 (0.1)
Child age (mean, SD)	9.7 (0.3)	8.86 (0.24)	8.96 (0.31)	7.91 (0.33)	10.7 (0.5)	10.1 (0.3)
Sex of study child						
Male	2232 (49.8)	2211 (51.1)	2093 (51.3)	2121 (52.6)	6730 (50.4)	635 (47.6)
Female	2252 (50.2)	2120 (49.0)	1984 (48.7)	1909 (47.4)	6624 (49.6)	699 (52.4)
Ever diagnose asthma						
Yes	439 (9.8)	1315 (30.4)	1075 (26.3)	393 (9.8)	2401 (18.0)	302 (22.6)
No	4045 (90.2)	3012 (69.5)	2947 (72.1)	3637 (90.2)	10945 (82.0)	1032 (77.4)
Missing	0	4 (0.1)			8 (0.0)	0 (0.0)
Wheezing last 12 months						
Yes	208 (4.6)	527 (12.2)	499 (12.2)	496 (12.3)	1592 (11.9)	Not available
No	4276 (95.4)	3802 (87.8)	3549 (86.9)	3534 (87.7)	12761 (88.0)	
Missing	0	2 (0.0)	29 (0.7)		1 (0.0)	

Results

Table 2a. Child's asthma according to maternal educational level

	Total asthma		Maternal educational level			P-value
			Asthma %			
	n	%	Low	Middle	High	
GenR	439	9.8	14.4	10.0	8.1	<0.001
LSAC K	1315	30.4				
LSAC B	1075	26.3				
ABIS	393	9.8				
MCS	2401	18.0				
ELDEQ	302	22.6	26.0	22.9	19.9	0.124

Results

Table 2b. Child's asthma according to net household income

	Total asthma		Household income					P-value
			Asthma %					
	n	%	Quintile 1 (lowest)	Quintile 2	Quintile 3	Quintile 4	Quintile 5	
GenR	439	9.8	13.3	10.0	7.6	8.7	7.8	0.001
LSAC K	1315	30.4						
LSAC B	1075	26.3						
ABIS	393	9.8						
MCS	2401	18.0						
ELDEQ	302	22.6						

Results

Table 3a. Child's wheezing according to maternal educational level

	Total wheezing		Maternal educational level			P-value
			wheezing %			
	n	%	Low	Middle	High	
GenR	208	4.6	6.7	5.7	3.5	<0.001
LSAC K	527	12.2				
LSAC B	499	12.2				
ABIS	496	12.3				
MCS	1592	11.9				

Results

Table 3b. Child's wheezing according to net household income

	Total wheezing		Household income					P-value
			wheezing %					
	n	%	Quintile 1 (lowest)	Quintile 2	Quintile 3	Quintile 4	Quintile 5	
GenR	208	4.6	6.4	5.3	3.1	4.3	3.2	0.006
LSAC K	527	12.2						
LSAC B	499	12.2						
ABIS	496	12.3						
MCS	1592	11.9						

Thank you!