Social inequality in adolescents' healthy food intake: the interplay between economic, social and cultural capital

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Background: Current explanations of health inequalities in adolescents focus on behavourial and economic determinants and rarely include more meaningful forms of economic, cultural, and social capital. The aim of the study was to investigate how the interplay between capitals constitutes social inequalities in adolescent healthy food intake. **Methods:** Data were collected in the 2013/14 Flemish Health Behavior among School-aged Children (HBSC) survey, which is part of the international WHO HBSC survey. The total sample included 7266 adolescents aged 12–18. A comprehensive set of 58 capital indicators was used to measure economic, cultural and social capital and a healthy food index was computed from a 17-item food frequency questionnaire (FFQ) to assess the consumption frequency of healthy food within the overall food intake. **Results:** The different forms of capital were unequally distributed in accordance with the subdivisions within the education system. Only half of the capital indicators positively related to healthy food intake, and instead 17 interactions were found that both increased or reduced inequalities. Cultural capital was a crucial component for explaining inequalities such that social gradients in healthy food intake increased when adolescents participated in elite cultural practices ($P < 0.05$), and were consequently reduced when adolescents reported to have a high number of books at home ($P < 0.05$). **Conclusion:** A combination of selected resources in the form of economic, cultural and social capital may both increase or reduce healthy food intake inequalities in adolescents. Policy action needs to take into account the unequal distribution of these resources within the education system.

Introduction

Health and health behaviours early in life are shaped by families, schools, and communities and the distribution of power and resources within these entities.[1] A large body of evidence documented social inequalities in adolescent health.[2] Moreover, research has found that health inequalities in adolescents (e.g., physical activity, excess body mass, health symptoms) have increased in rich countries, in step with increased income inequality.[3] Current explanations of health inequalities in adolescents[4–7] focus on behavioural and economic determinants and rarely include more meaningful forms of economic, cultural, and social capital.[8–10] Consequently, there are few examples of policy interventions to reduce health inequalities in especially adolescents as there is no evidence on how to reduce them.

Bourdieu[8] distinguished three forms of capital. Economic capital refers to material assets that are 'immediately and directly convertible into money and may be institutionalized in the form of property rights'.[11] Economic capital is material resources (e.g. financial resources or property) that are used to acquire or maintain better health. Social capital is 'the aggregate of actual or potential social resources that provide a durable network of more or less institutionalized relationships of mutual acquaintance and recognition'.[11] Lastly, cultural capital can be broadly defined as symbolic

and informational resources for action that are embodied or incorporated (e.g. values, skills, knowledge), objectivized (e.g. books, tools), and institutionalized (e.g. educational degrees, professional titles).

Bourdieu argues that forms of capital are unequally distributed in accordance with the social demarcation lines set out by the education system, and in that way, the education system institutionalizes and legitimizes the dominant class system and the existing order.[12] In relation to health inequalities, such structural causes of social inequality have been labeled *the causes of the causes*.[13] Social inequality, in turn, leads to health inequality through the interplay of different forms of capital which refers to social processes wherein capitals interpenetrate or constitute one another (Supplementary figure 1).[14] Different kinds of capital interplay can be conceptually distinguished[15] of which multiplier interplays received the most attention in the study of health inequalities.[9] Capital multiplier interplays refer to processes whereby the successful application of one form of capital is facilitated by possession of another form of capital, that is, where one form of capital increases the effect of another. Therefore, no one form alone can fully explain social inequalities. It is perhaps surprising then that empirical studies have focused on direct links to one or two forms of capital. The few studies on capital interplays were conducted in adults and

produced inconsistent findings. Pinxten and Lievens[9] found significant statistical interactions between capitals on self-rated physical and mental health, but these were considered not interpretable. A Swiss study showed that the positive relation between cultural capital and self-rated health was stronger in young men whose parents had lower cultural and social capital,[15] which is in contrast with Bourdieu's concept of multiplier interplays whereby the interplay between the different forms of capital *increase* inequality.

Another central principle in the work of Bourdieu is that cultural capital explains differences in tastes,[8] including tastes for food.[12] In this context, the study of adolescent food intake is highly relevant given (i) the importance of conceptualizing food intake as a social practice[16] that strongly depends on cultural capital,[17] (ii) the central role that nutrition plays in health, chronic disease and obesity prevention,[18] (iii) that nutrition-related health problems often become established in adolescence,[19] (iv) that the prevalence of childhood and adolescent overweight and obesity has risen substantially worldwide,[20] and (v) the limitation that food intake was rarely analysed in explanations of adolescent health inequalities.[4,5] Studies that take cultural capital into account for explaining health inequalities in adolescents are scarce and have used a limited set of indicators. Two Norwegian studies found that cultural capital (number of books at home) was more strongly associated with healthy eating patterns in adolescents than family material affluence.[17,21] No study analysed how the interplay between capitals relates to dietary health in an adolescent population.

The objective of this study was to investigate how adolescents' healthy food intake was socially patterned through the interplay of economic, social, and cultural capital. Specifically, the aims were (i) to study the distribution of capital resources within the education system, and (ii) to assess their main association as well as (iii) the association between interplay of capitals and inequalities in adolescent's healthy food intake.

Methods

Study participants

The sample consisted of 7266 adolescents nested within 646 classes and 57 schools. The data were collected in the Flemish 2013–2014 Health Behaviour in School-aged Children (HBSC) survey.[22] Self-completion questionnaires were administered in school classrooms with requirements in terms of sampling, questionnaire items and survey administration being set out in a standardized research protocol.[23] In Flanders, pupils from the 1st year (12 year) to the 6th year (18 year) secondary school were asked to participate. A random sample of schools was drawn from the official school list of Flanders. The response rate on pupil and school level was, respectively, 82 and 35%. Passive informed consent was asked to the parents. The study was approved by the ethics review committee of the University Hospital of Ghent (project EC/2013/1145).

Measures

Healthy food index

A 17-item food frequency questionnaire (FFQ) measured the frequency of important sources of carbohydrates (fruit, vegetables, breakfast cereals, white bread, brown bread), calcium ((semi-) skimmed milk, whole fat milk, cheese, other milk products), water intake, fish and typical comfort food items (crisps, chips, sweets or chocolates, carbonated sugared soft drinks and diet soft drinks).[24] The response categories for each food item were: 1 = never, 2 = less than once a week, 3 = once a week, 4 = 2–4 days/week, 5 = 5–6 days/week, 6 = once every day, 7 = more than once every day. These were recoded as follows: 0 = never, 0.25 = less than once a week (reflecting a consumption frequency of once every four weeks), 1 = once a week, 3 = 2–4 days/week (midpoint of the interval), 5.5 = 5–6 days/week

(midpoint of the interval), 7 = once every day, 14 = more than every day (at least double the frequency of the previous category). A healthy food index was computed from the FFQ by calculating the ratio of the sum of the FFQ consumption frequencies of healthy items and the sum of the total FFQ consumption frequencies [(sum of the frequencies of healthy items/total frequency of all nutrition items) × 100]. This composite index represents the proportion of the consumption frequency of healthy food within the overall food intake. Following national nutrition guidelines fruit, vegetables, water, brown bread, fish and (semi-) skimmed milk were considered healthy items.[25]

Capital variables

Economic capital. The Family Affluence Scale (FAS) is an index of material assets and comprised of six items that address family assets or conditions that indicate objective material wealth (see table 1 for an overview).[26] Responses are summed on a 0–13 scale with higher scores indicating more material assets. Perceived family wealth was also measured with a five-point scale measure of young people's perceptions of their own family's affluence.

Cultural capital. Adolescents' current education was used as an indicator of institutionalized cultural capital.[11] General education is characterized by classical lectures that prepare pupils for higher education studies such as university. Technical education combines classical lectures with practical classes in for example electricity, mechanics or construction. Vocational education prepares pupils that have less strong cognitive skills for early labour market entry in for example horticulture or the health care sector. Objectivized cultural capital was measured by the number of books in the student's home.[17] To measure health-relevant embodied cultural capital, respondents were asked about their hobbies. Three composite scores were computed by summing the frequencies of the items: 'Elite practices', 'Creative practices' and 'Sportive practices'. Differences in recreational and cultural participation as part of embodied cultural capital may be especially relevant for social inequalities in health since they are strongly linked with both economic resources and health outcomes.[9]

Social capital. Network social capital was measured by participation in clubs or organizations.[27,28] Structural family social capital was measured with two separate questions regarding having breakfast and dinner with their parents. Building on previous validation and factor analytic work on the teacher and classmate support scale[29] and the psychosocial school environment index,[30] school social capital was operationalized following the typology of De Clercq *et al.*:[31] 'Horizontal' (three items, related to fellow pupils), 'Vertical' (four items, related to teachers), 'Trust' (three items, reflecting an aspect of trust within the school), and 'Participation' (four items, reflecting involvement in decision making processes within the school). In line with previous conceptual and factor analytic work on school-related parental support[32] and community networks,[28] cognitive family social capital and community social capital were measured using a five-item scale.[27,31] P versus P plots that plot the cumulative probability of each indicator against the cumulative probability of a normal distribution were fitted to inspect the distribution of the five-item scales. Data points all fell very close to the 'ideal' diagonal line, indicating that these indicators were normally distributed. Scatter plots evaluating the nature of the relationship between the indicators and the dependent variable showed a fairly linear pattern.

Analysis

One-way ANOVA tests were used to study the capital distribution within the Flemish education system. These were supplemented with η^2-based effect sizes calculated by $r = \sqrt{\frac{SS_{between}}{SS_{total}}}$. We implemented 3 level random intercept linear regression models, with adolescents as level 1 units, classes as level 2 units, and schools as level 3. First, an
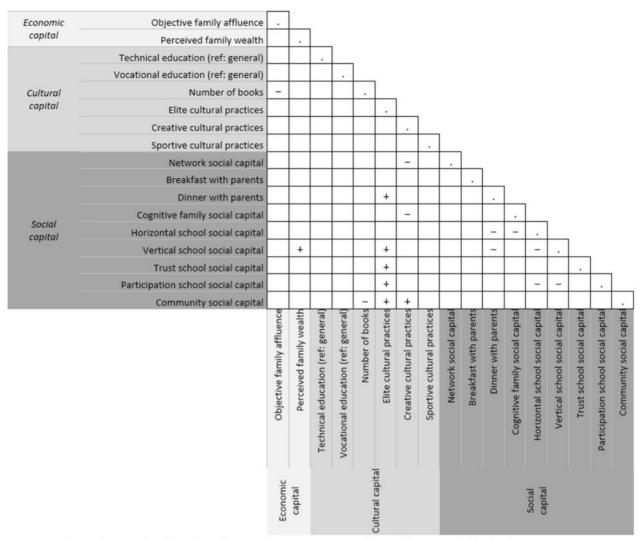
Table 1 Measurement of capital variables, the Flemish Health Behavior in School-Aged Children (HBSC) survey, 2013–2014

Variable		Item	Code
Economic capital	*Objective family affluence*	Does your family own a car, van or truck?	0 = no; 1 = yes one; 2 = yes two or more
		Do you have your own bedroom for yourself?	0 = no; 1 = yes
		During the past 12 months, how many times did you travel away on holiday with your family?	0 = not at all, 1 = once, 2 = twice, 3 = more than twice
		How many computers does your family own?	0 = none, 1 = one, 2 = two, 3 = more than two
		How many bathrooms are in your home?	0 = none, 1 = one, 2 = two, 3 = more than two
		Does your family have a dishwasher at home?	0 = no; 1 = yes
	Perceived family wealth	How well off do you think your family is?	Coded from 1 = not at all well off to 5 = very well off
Cultural capital	*Institutionalized*	Adolescents' current education	1 = general; 2 = technical; 3 = vocational
	Objectivized	How many books are there in your family?	0 = none; 1 = 1–10; 2 = 11–50; 3 = 51–100; 4 = 101–250; 5 = 251–500
	Embodied: elite practices	Do you pursue this hobby yourself at least monthly? ballet, tennis, and horse sports	0 = no; 1=yes
	creative practices	Do you pursue this hobby yourself at least monthly? folk dance, drawing, painting or visual arts, playing music instruments, working with textile, writing (poetry, stories, song texts,…)	0=no; 1=yes
	Sportive practices	Do you pursue this hobby yourself at least monthly? jogging, athletics, fitness, cycling, gymnastics, swimming, and team sports such as basketball, volleyball, football	0=no; 1=yes
Social capital	*Network*	Are you involved in any of these kinds of clubs or organizations? sports club, voluntary service, political organization, cultural organization, religious group, youth club, other club	0=no; 1=yes
	Family (structural)	How often do you have breakfast with your mother or father?	coded from 1=never to 6=every day
		How often do you have dinner with your mother or father?	coded from 1=never to 6=every day
	Family (cognitive)	When I have problems in school, my parents are willing to help me	from here coded from 1=strongly disagree to 5=strongly agree
		My parents encourage me to do well at school	
		My parents are interested in what is happening with me in school	
		My parents are willing to help me with my homework	
		My parent are willing to come to school to talk with the teachers	
	School (horizontal)	My classmates like to be together	
		Most classmates are friendly and helpful	
		My classmates accept me as I am	
	School (vertical)	The teachers treat us fairly	
		If necessary, I get extra help	
		The teachers are interested in who I am	
		Most teachers are friendly	
	School (trust)	Our school is a nice place	
		I feel home at school	
		I feel safe at school	
	School (participation)	Pupils are involved in organizing school activities	
		Pupils are involved in making school regulations	
		Pupils have a say in which kind of activities they do	
		Pupils have a say in how class time is used	
	Community	People say 'hello' and often stop to talk to each other in the street	
		It is safe for younger children to play outside during the day	
		You can trust people around here	
		There are good places to spend your free time	
		I could ask for help or a favor from neighbors	

intercept only model was fitted to estimate the proportion of the variance of the outcome between individuals, classes and schools (Model 1). Model 2 included socio-demographic variables (gender and age). Model 3 was the same as model 2, but with additional economic capital variables (objective family affluence and perceived family wealth). Model 4 introduced the cultural capital components (education, number of books and cultural practices). Finally, all social capital variables were entered simultaneouly (model 5). This

model enables to evaluate the independent association between each form of capital and the healthy food index. In a next step, two-way interactions were computed within (Model 6a-f) and between (Model 6g–q) economic, cultural and social capital variables which resulted in a 17 × 17 matrix with 136 unique combinations (figure 1).

We applied Bayesian inference to estimate the parameters using Markov Chain Monte Carlo (MCMC) simulation procedures in

Figure 1 Overview of the 136 two-way interaction terms computed in the multilevel healthy food intake model in 7266 adolescents, the Flemish Health Behavior in School-Aged Children (HBSC) survey, 2013–2014

MLwiN 2.32.[33] We used Metropolis Hastings sampling with non-informative improper uniform priors for the fixed effects and weakly informative uniform priors (derived from the iterative generalized least squares [IGLS] algorithm)[34] for the between-class and between-school variances. The Raftery–Lewis diagnostic was used to monitor the length of the MCMC chain required for convergence after a burn-in of 5000 simulations. Model coefficient estimates and variance components estimates are reported with their posterior standard deviation (SD) and *P*-values. We used the Deviance Information Criterion (DIC) to test the improvement of fit for each model.[33]

Results

Table 2 shows the descriptive characteristics of the sample. Respondents (*n* = 7266) were secondary school pupils between 12 and 18 years old (Mean = 15 years) with slightly more boys (58.9%) than girls (41.1%) in the overall sample. The mean proportion of healthy food within their overall food intake was 49%. Consistent significant differences were found within the Flemish education system such that pupils from general education have more capital resources at their disposal than technical education students which in turn possess more capital resources

than pupils from vocational education. Especially objective family affluence was unequally distributed (*r* = 0.67) whereas only community social capital was equally distributed across the different education systems.

Table 3 presents the regression coefficient estimates from the sequential multilevel models. About 10% of the variability in healthy food intake was attributable to contextual factors, and thus class and school related differences. Controlling for socio-demographic differences (model 2), model 3 showed a positive association between objective family affluence and healthy food intake (*b* = 0.690, SD = 0.110), but not for perceived family wealth (*b* = 0.481, SD = 0.308). Model 4 additionally included cultural capital components. Regarding institutionalized cultural capital, strong educational differences in healthy food intake were found: compared to pupils in general education both technical (*b* = −1.685, SD = 0.801) and vocational (*b* = −5.685, SD = 0.809) pupils eat less healthy. A high number of books in the house (objectivized cultural capital) and a high level of creative and sportive practices (embodied cultural capital) positively related to healthy food intake (*P* < 0.05). Elite practices were not significantly associated with the outcome. Model 5 included all nine social capital variables of which only network social capital (*b* = 0.688, SD = 0.231), breakfast with parents (*b* = 0.936,

Table 2 Descriptive characteristics and capital distribution of 7266 adolescents, the Flemish Health Behavior in School-Aged Children (HBSC) survey, 2013–2014

	All (*n* = 7266)	General education (*n* = 3208)	Technical education (*n* = 2282)	Vocational education (n = 1667)	*P*∗	*r*
Socio-demographics						
Gender, %						
Boy	58.9	50.0	66.4	65.7	< 0.001	0.18
Girl	41.1	50.0	33.6	34.3		
Age (range, 12–18), mean (SD)	15.2 (1.84)	14.5 (1.66)	15.7 (1.72)	15.9 (1.78)	< 0.001	0.04
Economic capital						
Objective family affluence (range, 0–13), mean (SD)	8.60 (2.15)	9.05 (2.04)	8.54 (1.98)	7.83 (2.30)	< 0.001	0.67
Perceived family wealth (range, 1–5), mean (SD)	3.06 (0.73)	3.13 (0.68)	3.02 (0.72)	2.99 (0.83)	< 0.001	0.08
Cultural capital						
Number of books (range, 1–6), mean (SD)	3.62 (1.47)	3.95 (1.39)	3.51 (1.43)	3.07 (1.49)	< 0.001	0.20
Cultural practices, %						
Elite practices	22.4	43.3	30.2	28.5	< 0.001	0.13
Creative practices	25.6	30.5	20.7	22.6	< 0.001	0.09
Sportive practices	69.6	73.6	70.3	60.4	< 0.001	0.11
Social capital						
Network social capital (range, 0–7), mean (SD)	1.23 (1.10)	1.39 (1.06)	1.17 (1.05)	0.97 (1.15)	< 0.001	0.14
Structural family social capital (range, 1–6), mean (SD)						
Breakfast with parents	3.42 (1.79)	3.72 (1.73)	3.29 (1.77)	2.94 (1.79)	< 0.001	0.18
Dinner with parents	5.17 (1.27)	5.23 (1.17)	5.22 (1.23)	4.98 (1.48)	< 0.001	0.09
Cognitive family social capital (range, 1–5), mean (SD)	3.86 (0.82)	3.94 (0.76)	3.80 (0.82)	3.79 (0.90)	< 0.001	0.10
School social capital (range, 1–5), mean (SD)						
Horizontal	3.85 (0.79)	3.92 (0.73)	3.85 (0.76)	3.73 (0.89)	< 0.001	0.10
Vertical	3.67 (0.73)	3.69 (0.71)	3.63 (0.71)	3.67 (0.78)	< 0.05	0.07
Trust	3.49 (0.91)	3.69 (0.84)	3.34 (0.91)	3.31 (0.96)	< 0.001	0.22
Participation	2.98 (0.80)	3.01 (0.80)	2.92 (0.79)	3.01 (0.81)	< 0.001	0.07
Community social capital (range, 1–5), mean (SD)	3.68 (0.76)	3.69 (0.74)	3.67 (0.74)	3.65 (0.81)	n.s.	0.05
Healthy food intake, % (range, 11–69), mean (SD)	49.08 (7.76)	52.12 (7.16)	48.42 (7.77)	43.44 (8.16)	< 0.001	0.20

Note. SD = standard deviation.

∗Results derived from chi-square test or one-way ANOVA; *r* = Cramer's V or $\sqrt{(\eta^2)}$ effect size; n.s., not significant.

SD = 0.143) and cognitive family social capital (*b* = 0.835, SD = 0.306) positively related to healthy food intake. School and community social capital indicators were not associated with the outcome.

In a next step, interactions within and between economic, cultural and social capital indicators were tested (see figure 1 for an overview). In total, 17 significant two-way interactions were found of which six interactions were found within the same form of capital (Supplementary table 1) and 11 interactions between different forms of capital (Supplementary table 2). These interactions took various forms. In about half of the cases (7 out of 17), the interaction between capitals generated increased social inequalities in health. For example, the positive relation between teacher support (vertical school social capital) and healthy food intake was increased by taking part in elite cultural practices (cultural capital) (Supplementary figure 2A). Another type of interactions reduced social inequalities in healthy food intake, of which we found 10 out of 17. Here for example, the number of books at home (cultural capital) moderated the positive relation between objective family affluence (economic capital) and healthy food intake, such that the relation between objective family affluence and healthy food intake was decreased by the number of books at home (Supplementary figure 2B).

Overall, cultural capital hardly interacted with economic capital. Instead, 9 out of 17 interactions involve cultural and social capital with increasing social inequalities in most of these cases. Five out of 17 interactions involving family social capital explained unequal healthy food intake, of which three included dinner with parents (structural family social capital). Interestingly, structural family social capital increased social inequalities in combination with elite cultural practices and reduced social inequalities in combination with horizontal and vertical school social capital.

Discussion

This study attempted to explain social inequalities in adolescents' healthy food intake using a comprehensive set of 58 capital indicators. The interactions found of economic, cultural and social capital in relation to adolescents' intake of healthy nutrition partly confirm Bourdieu's[8] capital theory and offer alternative explanations.

First, we analysed the distribution of capital resources within the education system. We found that the different forms of capital were unequally distributed in accordance with the subdivisions within the education system which confirms with other studies undertaken.[12] This finding touches upon the social processes (i.e. organization of society) underlying the unequal distribution of the social factors that impact on the health of young people.[35] The school system seemed to be a fundamental social cause rooted in the organization of society that operates as a societal sorting mechanism. Sociological research argued that the specific structure of the education system strengthens existing social inequalities in a way that pupils from general education, which have typically high socio-economic backgrounds, benefit more.[36] Rather than treating education as a control variable, it should be considered a fundamental cause in social inequality research in adolescents.[37]

Our second aim was to further assess the main associations between capitals and healthy food intake. In addition to the expected positive association between affluence (economic capital) and health, an independent positive association was found between almost all cultural capital indicators and healthy food intake. The additive nature across capitals is in line with the conventional research on one or two forms of capital and adolescent health which tends to emphasize the positive associations between capitals and health.[17,21,26,27] However, using a comprehensive set of capital indicators, the present study demonstrated a more

Table 3 Fixed and random parameters of the multilevel healthy food intake model in 7266 adolescents, the Flemish Health Behavior in School-Aged Children (HBSC) survey, 2013–2014

	Model 1		Model 2		Model 3		Model 4		Model 5	
	b	(SD)	b	(SD)	b	(SD)	b	(SD)	b	(SD)
Fixed parameters:										
Constant	48.858	(0.630)*	47.029	(0.589)*	46.799	(0.606)*	45.240	(0.729)*	45.777	(0.748)*
Individual level										
Socio-demographics										
Gender (ref: boys)			4.808	(0.477)*	5.156	(0.485)*	4.930	(0.506)*	5.180	(0.517)*
Age			−0.591	(0.220)*	−0.577	(0.224)*	−0.064	(0.211)$^{n.s.}$	0.253	(0.214)^{ns}
Economic capital										
Objective family affluence					0.690	(0.110)*	0.445	(0.122)*	0.366	(0.124)*
Perceived family wealth					0.481	(0.308)$^{n.s.}$	0.393	(0.332)$^{n.s.}$	0.218	(0.333)^{ns}
Cultural capital										
Education (ref: general)										
Technical							−1.685	(0.801)*	−1.527	(0.792)*
Vocational							−5.685	(0.809)*	−5.197	(0.809)*
Number of books							1.355	(0.164)*	1.231	(0.172)*
Cultural practices										
Elite practices							0.750	(0.471)$^{n.s.}$	0.546	(0.502)^{ns}
Creative practices							1.174	(0.524)*	1.226	(0.542)*
Sportive practices							4.245	(0.487)*	3.556	(0.505)*
Social capital										
Network social capital									0.688	(0.231)*
Structural family social capital										
Breakfast with parents									0.936	(0.143)*
Dinner with parents									−0.276	(0.191)^{ns}
Cognitive family social capital									0.835	(0.306)*
School social capital										
Horizontal									0.364	(0.332)^{ns}
Vertical									0.523	(0.383)^{ns}
Trust									0.086	(0.325)^{ns}
Participation									0.200	(0.320)^{ns}
Community social capital									0.312	(0.315)^{ns}
Class level										
—										
School level										
—										
Random parameters:										
σ^2_{e0} (individual)	264.456	(4.810)*	260.563	(4.750)*	259.153	(5.018)*	249.894	(5.049)*	247.833	(5.233)*
σ^2_{u0} (class)	14.147	(2.390)*	13.987	(2.485)*	12.008	(2.515)*	3.938	(1.757)*	3.378	(1.973)$^{n.s.}$
σ^2_{v0} (school)	15.415	(4.057)*	11.880	(3.315)*	10.259	(3.139)*	4.868	(1.747)*	4.535	(1.656)*
DIC	56 595.110		55 131.498		51 011.595		44 706.732		42 316.081	

Figures in parentheses represent posterior standard deviations (SD).
*$P < 0.05$.

nuanced picture. It seemed that only half of the capital indicators positively related to the outcome, and instead several interactions were found that took various forms.

Our final aim was to explain these capital interplays. In total 17 interactions within one form of capital and between different forms of capital explained social inequalities in healthy food intake. In line with Bourdieu's[8] model of capital interplays, inequalities increased in about half of the cases. Hereby the relation between one form of capital and healthy food intake was increased by another form of capital. In contrast to Bourdieu's theory, the other half were buffer effects which reduced inequalities so that the relation between one form of capital and healthy food intake was toned by another form of capital. Comparing single main and interaction effects of the three forms of capital adds to ongoing research on the relative importance of social determinants of youth health in European countries.[10] In line with this perspective, cultural capital was a crucial component for explaining health inequalities. Other research also advocated for including measures of cultural capital in explanatory approaches to social inequality in health and health behaviours.[14] It is likely that previous studies focusing exclusively on the interplay between economic and social capital were unable to detect underlying mechanisms between social position and health outcomes.[31] In

this context, some coherent patterns occurred such that social gradients in healthy food intake increased when adolescents participated in elite cultural practices, and were consequently reduced when adolescents reported to have a high number of books at home. On the one hand, these findings support the idea that cultural capital is a key factor in the social production of health inequalities.[14] On the other hand, our findings open new perspectives for health promotion since cultural capital may be a way to decrease social gradients in health. Other studies also demonstrated the existence of such buffer effects between economic and social capital in adolescent populations.[27]

In terms of food intake, previous research emphasized that it is crucial to disentangle whether it is eating together that positively influences children's diets or whether it is the interplay of cognitive resources of families that simultaneously influences what children eat.[38] The present study showed that eating together (i.e. an aspect of structural family social capital) in combination with elite cultural practices increased social inequalities in adolescents' healthy food intake whereas eating together in combination with both teacher and pupil support reduced inequalities. Also family support and communication (i.e. an aspect of cognitive family social capital) consequently reduced inequalities. From a health

promotion perspective, this complex interaction illustrates that eating together may be an inadequate condition for protecting young people from the negative health consequences of social inequality. Instead, supportive relations at school and among family members should be considered as a necessary condition for reducing social inequality in adolescent health.

Strengths and limitations

The major strength of the present study is the development of a new approach to measure health-relevant embodied cultural capital in adolescents which we integrated with previous operationalizations of economic[26] and social capital.[31] Secondary data-analysis is common practice in scientific research, but as a result, researchers tend to use data obtained for other purposes rather than using variables designed for measuring social[39] and cultural capital.[40] Anyhow, such data is scarce in adolescent populations[10] and the Health Behaviour in School-aged Children (HBSC) survey is the only school-based survey that provides information on adolescent health behaviour and sources of social capital and with such a wide range of different cultural capital dimensions.[22] Consequently, the downside is that only rather rough capital indicators were included in the survey. In this context, our measure of structural family social capital (i.e. having breakfast or dinner with parents) reaches beyond Bourdieu's[11] specific definition of social capital which is hard to avoid given the fact that Bourdieu provided only a few empirical indicators of capitals that would directly relate to health. Despite the limited operationalization and unknown validity of some of our capital indicators, our findings should encourage researchers to include more intricate forms of capital in future surveys. Another limitation is that only capital multiplier interplay was modeled. Testing other kinds of capital interplay such as capital acquisition interplay and capital transmission interplay requires additional mediation or path analysis. Also, unmeasured confounders such as immigration status and family structure may potentially alter the present findings. Finally, given the cross-sectional design of the study causal inference is hampered by the possibility of reverse causality.

Conclusion and implications for policy

The present study showed how a combination of selected resources in the form of economic, cultural and social capital may both increase or reduce social inequalities in adolescents' healthy food intake. Policy action needs to take into account the unequal distribution of these resources within the education system.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

Ethics approval

HBSC is a WHO collaborative study and as such fulfills all WHO ethical requirements. The study is approved in each country separately by national or ministry ethical committees and consent is obtained from involved children and their families. The Flemish study was approved by the ethic committee of the University hospital of Ghent (project EC/2013/1145).

Key points

- Social inequalities in health are well-documented in both adulthood and adolescence.
- Recent research found that health inequalities in adolescents have increased in rich countries, in step with increased income inequality.
- So far, still little is known about the underlying factors and mechanisms for health inequalities in adolescence.
- This study is the first to explain social inequalities in adolescents' healthy food intake using a comprehensive set of capital indicators.
- A combination of selected resources in the form of economic, cultural and social capital can both increase or reduce healthy food intake inequalities in adolescents.
- Policy intervention programs that focus on enhancing capital in Flemish adolescents may increase inequalities in health because of the unequal distribution of capital resources within the education system

References

1 Commission on Social Determinants of Health. *Closing the gap in a generation - health equity through action on the social determinants of health*. Geneva: World Health Organization; 2008.

2 Viner RM, Ozer EM, Denny S, et al. Adolescence and the social determinants of health. *Lancet* 2012;379:1641–52.

3 Elgar FJ, Pfoertner TK, Moor I, et al. Socioeconomic inequalities in adolescent health 2002-2010: a time-series analysis of 34 countries participating in the Health Behaviour in School-aged Children study. *Lancet* 2015;385:2088–95.

4 Moor I, Rathmann K, Stronks K, et al. Psychosocial and behavioural factors in the explanation of socioeconomic inequalities in adolescent health: a multilevel analysis in 28 European and North American countries. *J Epidemiol Commun Health* 2014;68:912–21.

5 Richter M, Moor I, van Lenthe FJ. Explaining socioeconomic differences in adolescent self-rated health: The contribution of material, psychosocial and behavioural factors. *J Epidemiol Commun Health* 2012;66:691–7.

6 Kroenke C. Socioeconomic status and health: youth development and neomaterialist and psychosocial mechanisms. *Soc Sci Med* 2008;66:31–42.

7 Due P, Krolner R, Rasmussen M, et al. Pathways and mechanisms in adolescence contribute to adult health inequalities. *Scand J Public Health* 2011;39:62–78.

8 Bourdieu P. *Distinction. A social critique of the judgement of taste*. Cambridge, Massachusetts: Harvard University Press, 1984.

9 Pinxten W, Lievens J. The importance of economic, social and cultural capital in understanding health inequalities: using a Bourdieu-based approach in research on physical and mental health perceptions. *Sociol Health Illn* 2014;36:1095–110.

10 Gagné T, Frohlich KL, Abel T. Cultural capital and smoking in young adults: applying new indicators to explore social inequalities in health behaviour. *Eur J Public Health* 2015;25:818–23.

11 Bourdieu P. The forms of capital. In: Richardson JG, editors. *Handbook of Theory and Research for the Sociology of Education*. New York: Greenwood Press, 1986.

12 Bourdieu P, Passeron JC. *La Reproduction. Éléments pour une théorie du système d'enseignement*. Paris: Les Éditions de Minuit, 1970.

13 Marmot M. The art of medicine. Europe: good, bad, and beautiful. *Lancet* 2013;381:1090–1.

14 Abel T. Cultural capital and social inequality in health. *J Epidemiol Commun Health* 2008;62:e13.

15 Veenstra G, Abel T. Capital interplays and the self-rated health of young men: results from a cross-sectional study in Switzerland. *Int J Equity Health* 2015;14.

16 Delormier T, Frohlich KL, Potvin L. Food and eating as social practice - understanding eating patterns as social phenomena and implications for public health. *Sociol Health Illn* 2009;32:215–8.

17 Fismen AS, Samdal O, Torsheim T. Family affluence and cultural capital as indicators of social inequalities in adolescent's eating behaviours: a population-based survey. *BMC Public Health* 2012;12:

18 Roberto CA, Swinburn B, Hawkes C, et al. Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking. *Lancet* 2015;385: 2400–9.

19 Kelder SH, Perry CL, Klepp KI, L LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *Am J Public Health* 1994;84:1121–6.

20 Lobstein T, Jackson-Leach R, Moodie ML, et al. Child and adolescent obesity: part of a bigger picture. *Lancet* 2015;385:2510–20.

21 Iversen AC, Holsen I. Inequality in health, psychosocial resources and health behavior in early adolescence: the influence of different indicators of socioeconomic position. *Child Indic Res* 2008;1:291–302.

22 Currie C, Alemán-Díaz AY. Building knowledge on adolescent health: reflections on the contribution of the Health Behaviour in School-aged Children (HBSC) study. *Eur J Public Health* 2015;25:4–6.

23 Currie C, Inchley J, Molcho M, Lenzi M, Veselska Z, Wild F. (eds.) 2014. *Health Behaviour in School-aged Children (HBSC) Study Protocol: Background, Methodology and Mandatory items for the 2013/14 Survey*. St Andrews: CAHRU.

24 Vereecken CA, Maes L. Belgian study on the reliability and relative validity of the Health Behaviour in School-Aged Children food frequency questionnaire. *Public Health Nutr* 2003;6:581–8.

25 Flemish Institute for Health and Disease Preventions. The active food guide pyramid. Available at: http://www.vigez.be/themas/voeding-en-beweging/actieve-voedingsdriehoek (17 July 2015, date last accessed).

26 Currie C, Molcho M, Boyce W, et al. Researching health inequalities in adolescents: the development of the Health Behaviour in School-Aged Children (HBSC) family affluence scale. *Soc Sci Med* 2008;66:1429–36.

27 De Clercq B, Vyncke V, Hublet A, et al. Social capital and social inequality in adolescents' health in 601 Flemish communities: a multilevel analysis. *Soc Sci Med* 2012;74:202–10.

28 Morgan A, Zambon A, Due P, Holstein B. HBSC Research Protocol for 2005/06 Survey. Section 2, Scientific rationales for focus areas: Social and Community Networks. Health Behaviour in School-aged Children (HBSC) survey, 2005.

29 Torsheim T, Wold B, Samdal O. The Teacher and Classmate Support Scale: Factor Structure, Test-Retest Reliability and Validity in Samples of 13-and 15-Year-Old Adolescents. *School Psychol Int* 2000;21:195–212.

30 Samdal O, Wold B, Torsheim T. Rationale for school items: The relationship between students' perception of school and their reported health and quality of life. In Currie C, editor *Health Behaviour in School-aged Children. Research protocol for the 1997-98 Survey*, 1998.

31 De Clercq B, Pfoertner TK, Elgar FJ, et al. Social capital and adolescent smoking in schools and communities: A cross-classified multilevel analysis. *Soc Sci Med* 2014;119:81–7.

32 Rasmussen M. HBSC Research Protocol for 2005/06 Survey. Section 2, Scientific rationales for focus areas: School Setting. Health Behaviour in School-aged Children (HBSC) survey; 2005.

33 Browne WJ. *MCMC Estimation in MLwiN*, v2.26. University of Bristol: Centre for Multilevel Modelling, 2012.

34 Goldstein H, Rasbash J. Improved approximations for multilevel models with binary responses. *J R Stat Soc* 1996;159:505–13.

35 Katikireddi SV, Higgins M, Smith KE, Williams G. Health inequalities: the need to move beyond bad behaviours. *J Epidemiol Commun Health* 2013;67:715–6.

36 Boone S, Van Houtte M. In search of the mechanisms conducive to class differentials in educational choice: a mixed method research. *Sociol Rev* 2013;61:549–72.

37 Mackenbach J. Education programs are likely to improve health, but will they improve health equity?. *Am J Prev Med* 2015;48:e5–6.

38 Skafida V. The family meal panacea: exploring how different aspects of family meal occurrence, meal habits and meal enjoyment relate to young children's diets. *Sociol Health Illn* 2013;35:906–23.

39 Choi M, Mesa-Frias M, Nüesch E, et al. Social capital, mortality, cardiovascular events and cancer: a systematic review of prospective studies. *Int J Epidemiol* 2014;43:1895–920.

40 Lareau A, Weininger EB. Cultural capital in educational research: a critical assessment. *Theory Soc* 2003;32:567–606.