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Could teacher-perceived parental interest be an important factor in understanding how education relates to later physiological health? A life course approach --Manuscript Draft--

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Abstract:	<p>Education is associated with later health, and notably with allostatic load (AL), an indicator of physiological health measuring the cost of adapting to stressful conditions. However, education is itself constructed by a number of upstream variables. We examined the origins of educational attainment through the prism of interactions between families and school i.e. teacher-perceived parental interest in their child education (PI). This study aims to examine whether PI is associated with AL, and whether education is a possible mediator of the relationship.</p> <p>We used data from the National Child Development Study. Linear regression analyses on a total of 7850 participants revealed that people whose parents were considered to be uninterested in their education by their teacher had a higher AL on average in midlife (men: $\beta=0.4$ [0.28; 0.54]; women: $\beta = 0.7$ [0.52; 0.88]). PI and AL were related along three pathways: education, material/financial, and behavioural. Among women, 45% of the effect remained unexplained by mediation pathways.</p> <p>This work may provide evidence that dissonance between family and educational cultures in childhood is associated with subsequent physiological health in mid-life.</p>
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Written informed consent was obtained from parents for childhood measurements and ethical approval for the adult data collection was obtained from the National Research Ethics Advisory Panel. NCDS data are open access datasets available to non-profit research organizations. Ethical approval for the age 45 year survey was given by the South East Multicentre Research Ethics Committee.

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NCDS data are available by registering on the UK data service repository <https://ukdataservice.ac.uk/>. However, we are not allowed to share them. All files are available from the 7 database (Persistent identifier (DOI): 10.5255/UKDA-SN-5560-4 and 10.5255/UKDA-SN-5594-2) We used biomedical data, which is sensitive data, accessible via the same site by requesting a special license.

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Additional data availability information:

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4
5

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17

18 Keywords

19 Education gradient; Parental interest; Allostatic load; Embodiment; Lifecourse

20

21 Abstract

22

23 Education is associated with later health, and notably with allostatic load (AL), an indicator of
24 physiological health measuring the cost of adapting to stressful conditions. However, education
25 is itself constructed by a number of upstream variables. We examined the origins of educational
26 attainment through the prism of interactions between families and school i.e. teacher-perceived
27 parental interest in their child's education (PI). This study aims to examine whether PI is
28 associated with AL, and whether education is a possible mediator of the relationship.



29 We used data from the National Child Development Study. Linear regression analyses on a
30 total of 7850 participants revealed that people whose parents were considered to be uninterested
31 in their education by their teacher had a higher AL on average in midlife (men: $\beta=0.4$ [0.28;
32 0.54]; women: $\beta = 0.7$ [0.52; 0.88]). PI and AL were related along three pathways: education,
33 material/financial, and behaviour. Among women, 45% of the effect remained unexplained
34 by mediation pathways.

35 This work may provide evidence that dissonance between family and educational cultures in
36 childhood is associated with subsequent physiological health in mid-life.


37

38 Introduction

39

40  One of the most consistent findings in the field of social epidemiology is that
41 educational attainment is associated with health. Across countries, and over time, lower
42 educational attainment has been associated with poorer health outcomes (1). These associations
43 are often explained by the fact that well educated people are less likely to experience the harsh
44 material conditions or psychosocial distress caused by economic hardship and tend to have
45 healthier lifestyles compared to the less educated (2). However, the mechanisms through which
46 education relates to health, remain poorly understood 

47
48 The concept of embodiment rests upon a key set of mechanisms likely to underlie the
49 relationship between social variables like education and health. This concept “refers to how we,
50 like any living organism, literally incorporate, biologically, the world in which we live,
51 including our societal and ecological circumstances”(3). Allostatic load (AL) is an example of
52 how endogenous mechanisms, by which daily interactions and relationships are perceived and
53 interpreted by the central nervous system, may over time lead to multi-system physiological
54 wear-and-tear. It measures the consequence of a prolonged activation of the stress response
55 system by external challenges, leading to physiological imbalances across systems (4). Previous
56 research has shown that AL is associated with physical and functioning decline, cardiovascular
57 events, and mortality (5,6)


58
59 Life course research indicates that the dynamic processes of adaptive allostasis most likely
60 begin in early life (7,8). Early life socioeconomic conditions are associated with physiological
61 wear-and-tear through educational attainment (9). As such, educational attainment “is an
62 excellent marker of the ‘healthfulness’ of accumulated childhood experience”(10) as the social
63 environment in early life, partly operating through education, may be associated with different
64 physiological responses, leading to physiological wear-and-tear in more  disadvantaged social

65 groups, which in turn affects health. The question is, which elements of the early life
66 environment upstream of education are likely to be involved in the embodiment dynamic,
67 leading to physiological wear-and-tear?

68 This early life social environment, is complex and can be examined through the three
69 dimensions of economic capital, social capital and cultural capital (11,12). Economic capital
70 refers to the material resources and financial support, social capital concerns interpersonal
71 support whereas cultural capital exists in three forms: incorporated (e.g. values, skills),
72 objectivized (e.g. cultural goods, books) and institutionalized (e.g. educational level). Initially,
73 through the family social sphere, these three dimensions are important facets of early childhood
74 socialization. However, the family social sphere, meets the educational social sphere when a
75 child attends school and if families have been socialized outside of the normative educational
76 structure, they potentially do not or cannot adapt to the school environment (13). This
77 dissonance that may be experienced by children exposed to home and school social
78 environments that are socio-culturally distant from each other, may be an early stressor for the
79 child, and lead to a solicitation of their physiological stress response system. In turn, this
80 physiological response may affect subsequent physiological health.

81 Parental interest in their child's education could be a variable of interest to examine how the
82 relationship between the home and school environments in early life affects physiological wear-
83 and-tear, through educational attainment. Indeed, parental interest has been identified as a
84 determinant of education success (14,15). Furthermore, it has positive effects on psychosocial
85 adjustment (16) and later mental health (17). Teacher's evaluations provide one perspective of
86 the situation which may partly reflect the position and viewpoint of the educational institution
87 in terms of their compliance with academic requirements and potentially capture the tension
88 between home and school environments experienced by some children.

89

90 We hypothesize that teacher-perceived parental interest (PI) may capture early life stressors
91 linked to dissonance between the home and school environment and thus be related to
92 physiological wear-and-tear, partly through education. In this study, we take a life course
93 approach to (i) test whether PI is associated with AL, and (ii) we explored four pathways
94 through which PI may be differentially embodied during childhood, adolescence and early
95 adulthood, leading to physiological wear-and-tear, as measured by A 

Materials and methods

2.1. Study population

Data are from the 1958 National Child Development Study (NCDS), which included all live births in Great Britain during one week in 1958 (n = 18,555). The NCDS has been described in detail elsewhere (18). Subsequent data collections (sweeps) were carried out on cohort members aged 7y and 55y. Between 44 and 45 years of age, a biomedical survey was conducted including a self-reported questionnaire, blood and saliva samples as well as anthropometric measurements. The sample inclusion and exclusion criteria for this analysis is described in Fig. 1. Written informed consent was obtained from parents for childhood measurements and ethical approval for the adult data collection was obtained from the National Research Ethics Advisory Panel. NCDS data are open access datasets available to non-profit research organizations. Ethical approval for the age 45 year survey was given by the South East Multicentre Research Ethics Committee.

Figure 1. Diagram of inclusion and exclusion criteria for the analysis from the biomedical survey of the NCDS 58.

2.2. Allostatic load at 44y

The AL score was constructed based on previous work using the NCDS using the initial definition of AL (19) : in order to represent four physiological systems, 14 available biomarkers were used: the neuroendocrine system (salivary cortisol t1, salivary cortisol t1–t2); the immune and inflammatory system (insulin-like growth factor-1 (IGF1), C-reactive protein (CRP), fibrinogen, Immunoglobulin E (IgE)); the metabolic system (high-density lipoprotein (HDL),

121 low-density lipoprotein (LDL), triglycerides, glycosylated hemoglobin (HbA1C)); the
122 cardiovascular and respiratory systems: (systolic blood pressure (SBP), diastolic blood pressure
123 (DBP), heart rate, peak expiratory flow). Using sex-specific quartiles, each biomarker was
124 dichotomized into "high" (coded as 1) and "low" (coded as 0) risk. The sum of these 14
125 dichotomized biomarkers resulted in an overall AL score ranging from 0 to 14, where a higher
126 score represented a higher AL. We also recoded AL into a 3 category variable where a score of
127 0-2 was considered to be "low", 3-4 as "middle", and 5-14 as "high" as used previously within
128 this cohort (20



129

130 **2.3. Teacher-perceived parental interest**

131

132 PI was measured at age 7, 11 and 16 using information provided by the child's
133 teachers. The teacher was asked to report the level of interest of each parent in their child's
134 education, with four possible answers: Overly concerned; Very interested; Some interest; and
135 Little interest. Based on this, we created a new binary variable for PI aiming to identify parents
136 "interested" or with "low/no interest" in their child's education. We grouped the "overly
137 concerned" and "very interested" categories together to represent the "interested" category,
138 while grouping the "some interest" with "little interest" categories together to represent "low/no
139 interest". We hypothesized that interest from both parents at any one age belongs to the
140 category "interested". However, if only one of the parents was considered to be interested or if
141 neither were, we considered this to belong to the category "low/no interest". We conducted a
142 sensitivity analyze for studying the stability of PI, using a series of regression analyses to
143 identify whether changes to the ungrouped categories (Overly concerned; Very interested; Some
144 interest; and Little interest) had an effect on AL. We observed no change to the results (S1 Table
145 A).

146

147 **2.4. Childhood socioeconomic confounders**

148

149 We measured early life economic capital using parental socioeconomic classification
150 of occupations (SEC), via a questionnaire completed at birth (I-professional occupations & II-
151 intermediate occupations/III-skilled occupations (non-manual)/III-partly skilled occupations
152 (manual)/IV-partly skilled occupations & V-unskilled occupations) and using information on
153 material living conditions, collected at age 7, 11 and 16 (advantaged/disadvantaged).

154 Cultural capital was measured using parental educational attainment self-reported at birth (both
155 parents left school ≥ 15 year/both parents left school <14 year/mother left school ≥ 15 year and
156 father <14 year/father left school ≥ 15 year and mother <14 year) and parenting practices
157 including reading to the child and outdoor activities, measured at age 7
158 (“Frequent/Occasionally, Hardly ever”) (21).


159 Other prior confounding variables potentially associated with PI and AL were selected. At ages
160 7, 11, and 16, a binary adverse childhood experiences variable (ACEs) was constructed, as well
161 as a binary childhood pathologies variable. Using data collected at 7y a birth order variable
162 was created (Single child/Elder/2nd place or more), and an assessment of the child’s cognitive
163 ability (Copy-a-Design test where scores range between 0 and 12). See S2 File for more
164 information about early life confounders’ variables.

165

166 **2.5. Intermediate lifecourse variables**

167

168 In order to determine whether any observed associations between PI and AL were due
169 to subsequent adult intermediate factors, the following mediating factors were added to the
170 models: respondent’s educational attainment at 23 y (A level/O level/no qualification),
171 socioeconomic status [respondent’s occupational social class at 33 y

172 (Favored/Median/Disadvantaged); respondent's financial status at 33 y using a wealth variable
173 based on information about home ownership and the price of the house adjusted for economic
174 inflation of the year of purchase (not owner/Q1—owner lowest price/owner-Q2/owner
175 Q3/owner-Q4)]; psychological/psychosocial status [malaise inventory at 23y (No
176 psychological distress/ psychological distress); sense of personal control (SOC) at 33y
177 (Internal/external)]; health behaviors at 42 y were considered as a proxy for behavioral patterns
178 in adulthood included self-reported physical activity, alcohol consumption and smoking status.
179 See S2 File for more information about intermediate lifecourse variable 

180

181 **2.6. Statistical analysis**

182

183 Our analyses were stratified by sex. Behavior at school differs between the two
184 genders: girls being more compliant with institutional rules, facilitating the teacher's task, boys
185 are more frequently in conflict between academic expectations and their socially recognized
186 particularities. Also, this allows us to take into account sex/gender differences in health.

187

188 First, descriptive and bivariate statistics were carried out using the Chi2 test, considering
189 AL as a categorical variable in three groups, in order to ascertain any association between the
190 covariates and AL. Second, to study the association between *PI* and AL, regression coefficients
191 and 95% confidence intervals (CI) were estimated using linear regressions where AL was
192 entered as a continuous variable. We compared regression coefficients across nested models to
193 observe the change in effect according to subsequent adjustments.

194

195 **To study the link between teachers' perceptions of parental interest and AL**

196 - Model 1: Linear regression between PI and AL

197 - Model 2: Model 1 plus baseline confounders characterizing parental cultural capital (level of
198 parental education, leisure and outdoor activities) and economic capital (SEC and material
199 living conditions) plus other early-life confounders (ACEs, place among the sibling, health
200 problems in childhood, initial cognition).

201

202 **To qualify pathways mediating the relationship between teachers' perceptions of parental**
203 **interest and AL.**

204 Applying the general approach of Baron & Kenny (22) to study the role intermediate
205 variables in models adjusted for mediators, we defined the sets of mediators according to the
206 temporal and causal assumptions of the life course approach.

207 We assumed the set health behaviors (at 42y) came after and could be influenced by
208 socioeconomic status (at 33y), which came after and could be influenced by psychosocial
209 condition (at 23y), which came after and could be influenced by education (at 23y), which came
210 after and could be influenced by teachers' perceptions of parental interest. In these models, we
211 considered that the last set of mediators had an important mediating role if the change of the
212 regression coefficient characterizing the association between teachers' perceptions of parental
213 interest (*PI*) and AL was large and if these mediators were associated to AL.

214

215 - Model 3: Model 2 plus educational level, denoted *EDU* (level of education)

216 - Model 4: Model 3 plus psychosocial/psychological variables, denoted *PSY* (SOC, malaise)

217 - Model 5: Model 4 plus socioeconomic status/financial variables, denoted *SEP* (social class,
218 incomes)

219 - Model 6: Model 5 plus health behaviors variables, denoted *HB* (smoking, alcohol
220 consumption, sportive practice)

221

222 Finally, to disentangle and quantify the direct and indirect effect for PI on AL, we carried-out
223 different steps in both men and women (S3 File), based on previous studies analyzing mediation
224 (23).

225

226 In order to control for potential biases due to missing data, multivariate analyses were
227 conducted on the imputed database using the ICE method of the imputation program available
228 on Stata ®v14. Twenty imputations were performed assuming that the data were missing at
229 random (MAR). Comparisons were then made between full case multivariate analyses and
230 multivariate analyses based on imputation estimates, indicating selection biases in the full case
231 sample (S4 Table B).

232

233 Results

234

235 Descriptive and bivariate analyses from the bivariate analyses by AL group of the
236 nonimputed subsample are given in Table 1 in men and women. The majority of our population
237 (78% in men and 75% in women) had a low [0-2] or medium [3-4] AL. Additionally, 47% of
238 the cohort members' two parents were perceived by the teacher as taking interest in their child's
239 education, while 42% were described as uninterested or not very interested.

240 In general men and women with a high AL at 44y were more likely to have parents described
241 as having a low interest in their education by the teacher and to have no level of education at
242 23y. Other childhood variables associated with AL in both men and women were: parent's
243 education, parent's social class, material living conditions, adverse childhood experiences and
244 cognitive skills. For men, outdoor activities, birth order, and health problems were also
245 associated with adulthood AL. Regarding intermediate variables in adulthood, graded
246 associations were also observed with AL such as SEP, income, SOC, health behavior for both
247 sexes and malaise only for women.

248 Bivariate analyses by PI are reported in Table 2. PI was associated with all childhood variables,
249 and all intermediate variables. In relation to our hypothesis on the educational pathway, female
250 and male participants who were hardly ever read to as children, hardly ever had outdoors
251 activities and whose mothers had left school before the age of 14, who lived in unfavorable
252 conditions and whose parents had a low SEC, were more likely to have parents who were
253 described as uninterested or not very interested in their education by the teacher.

254

255
256
257

Table 1: Bivariate statistics on the subsample (n= 8,113) of the distribution of AL according to confounding and intermediate variables in men and in women.



	Allostatic load at 44y								Total n (%)
	Men n (%) n=4,075 (50%)				Women n (%) n=4056 (50%)				
	Low	Medium	High	<i>p</i>	Low	Medium	High	<i>p</i>	
	1,793 (44%)	1,386 (34%)	878 (22%)		1,824 (44,97%)	1,235 (30%)	997 (25%)		
Teachers' perceptions of parental interest (7-16y)									
Both interested	930 (52%)	634 (46%)	348 (40%)	<0,001	989 (54%)	555 (45%)	362 (36%)	<0,001	3,818 (47%)
Low/No interest	698 (39%)	578 (42%)	427 (49%)		654 (36%)	524 (42%)	488 (49%)		3,369 (42%)
Missing	165 (9%)	174 (13%)	103 (12%)		181 (10%)	156 (13%)	147 (15%)		926 (11%)
<i>Childhood socioeconomic confounders</i>									
Parental education level (birth)									
Both parents left school ≥15y	216 (12%)	139 (10%)	93 (11%)	<0,001	210 (12%)	135 (11%)	80 (8%)	<0,001	873 (11%)
Both parents left school <14y	351 (20%)	272 (20%)	159 (18%)		367 (20%)	244 (20%)	195 (20%)		1,588 (20%)
Mother left school ≥ 15y, father <14 y	298 (17%)	186 (13%)	89 (10%)		342 (19%)	163 (13%)	93 (9%)		1,171 (14%)
Father left school ≥ 15y, mother <14y	885 (49%)	736 (53%)	505 (58%)		857 (47%)	660 (53%)	597 (60%)		4,240 (52%)
Missing	43 (2%)	53 (4%)	32 (4%)		48 (3%)	33 (3%)	32 (3%)		241 (3%)
Reading activities (7y)									
Every week	920 (51%)	687 (50%)	423 (48%)	0,328	893 (49%)	590 (48%)	483 (48%)	0,773	3,996 (49%)
Occasionally	492 (27%)	365 (26%)	249 (28%)		556 (30%)	396 (32%)	309 (31%)		2,367 (29%)
Hardly ever	169 (9%)	132 (10%)	85 (10%)		160 (9%)	91 (7%)	85 (9%)		722 (9%)
Missing	212 (12%)	202 (15%)	121 (14%)		215 (12%)	158 (13%)	120 (12%)		1,028 (13%)
Outdoor activities (7y)									
Most weeks	1,402 (78%)	1,017 (73%)	657 (75%)	0,032	1,449 (79%)	951 (77%)	772 (77%)	0,41	6,248 (77%)
Occasionally/hardly ever	182 (10%)	169 (12%)	101 (12%)		161 (9%)	130 (11%)	105 (11%)		848 (10%)
Missing	209 (12%)	200 (14%)	120 (14%)		214 (12%)	154 (12%)	120 (12%)		1,017 (13%)
Parental SEC (birth)									
I & II	405 (23%)	240 (17%)	103 (12%)	<0,001	414 (23%)	184 (15%)	108 (11%)	<0,001	1,454 (18%)

	IIINM	196 (11%)	117 (8%)	67 (8%)		201 (11%)	110 (9%)	80 (8%)		771 (10%)
	IIIM	805 (45%)	666 (48%)	442 (50%)		789 (43%)	613 (50%)	509 (51%)		3,824 (47%)
	IV&V	295 (16%)	262 (19%)	211 (24%)		309 (17%)	248 (20%)	240 (24%)		1,565 (19%)
	Missing	92 (5%)	101 (7%)	55 (6%)		111 (6%)	80 (6%)	60 (6%)		499 (6%)
Material living conditions (7y)										
	Advantaged	1,191 (66%)	804 (58%)	500 (57%)	<0,001	1,158 (63%)	735 (60%)	570 (57%)	<0,001	4,958 (61%)
	Disadvantaged	337 (19%)	360 (26%)	241 (27%)		399 (22%)	308 (25%)	300 (30%)		1,945 (24%)
	Missing	265 (15%)	222 (16%)	137 (16%)		267 (15%)	192 (16%)	127 (13%)		1,210 (15%)
Place in the siblings (7 y)										
	≥ 2	961 (54%)	741 (53%)	476 (54%)	0,024	1,015 (56%)	661 (54%)	528 (53%)	<i>0,344</i>	4,382 (54%)
	Elder	511 (29%)	347 (25%)	210 (24%)		481 (26%)	317 (26%)	273 (27%)		2,139 (26%)
	Single child	115 (6%)	103 (7%)	76 (9%)		119 (7%)	107 (9%)	79 (8%)		599 (7%)
	Missing	206 (11%)	195 (14%)	116 (13%)		209 (11%)	150 (12%)	117 (12%)		993 (12%)
ACEs (7-16y)										
	No	1,285 (72%)	891 (64%)	545 (62%)	<0,001	1,322 (72%)	827 (67%)	626 (63%)	<0,001	5,496 (68%)
	Yes	399 (22%)	374 (27%)	259 (30%)		389 (21%)	320 (26%)	298 (30%)		2,039 (25%)
	Missing	109 (6%)	121 (9%)	74 (8%)		113 (6%)	88 (7%)	73 (7%)		578 (7%)
Health problems in childhood (7-16y)										
	No	1,360 (76%)	1,002 (72%)	626 (71%)	0,014	1,431 (78%)	923 (75%)	748 (75%)	<i>0,09</i>	6,090 (75%)
	Yes	416 (23%)	376 (27%)	248 (28%)		383 (21%)	302 (24%)	244 (24%)		1,969 (24%)
	Missing	17 (1%)	8 (1%)	4 (0%)		10 (1%)	10 (1%)	5 (1%)		54 (1%)
Cognitive skills (7y)										
	Score : med [p25-p75]	8 [6-9]	7 [6-9]	7 [6-8]	<0,001	8 [6-9]	7 [6-8]	7 [6-8]	<0,001	7 [6-9]
	Missing	183 (10%)	180 (13%)	110 (13%)		188 (10%)	131 (11%)	109 (11%)		901 (11%)
Intermediate lifecourse variables										
Education level (23y)										
	A level	565 (32%)	336 (24%)	142 (16%)	<0,001	522 (29%)	252 (20%)	158 (16%)	<0,001	1,975 (24%)
	O level	661 (37%)	498 (36%)	298 (34%)		801 (44%)	541 (44%)	394 (40%)		3,193 (39%)
	No level	510 (28%)	494 (36%)	387 (44%)		448 (25%)	409 (33%)	406 (41%)		2,654 (33%)
	Missing	57 (3%)	58 (4%)	51 (6%)		53 (3%)	33 (3%)	39 (4%)		291 (4%)

Malaise inventory (23y)									
No psychological distress	1,497 (83%)	1,134 (82%)	705 (80%)	0,156	1,508 (83%)	951 (77%)	737 (74%)	<0,001	6,532 (81%)
Psychological distress	42 (2%)	45 (3%)	33 (4%)		109 (6%)	127 (10%)	121 (12%)		477 (6%)
Missing	254 (14%)	207 (15%)	140 (16%)		207 (11%)	157 (13%)	139 (14%)		1,104 (14%)
SOC (33y)									
Internal	1,387 (77%)	1,018 (73%)	628 (72%)	0,012	1,440 (79%)	960 (78%)	740 (74%)	0,037	6,173 (76%)
External	132 (7%)	114 (8%)	78 (9%)		187 (10%)	129 (10%)	135 (14%)		775 (10%)
Missing	274 (15%)	254 (18%)	172 (20%)		197 (11%)	146 (12%)	122 (12%)		1,165 (%)
Occupational social class (33y)									
Favored	713 (40%)	460 (33%)	245 (28%)	<0,001	609 (33%)	339 (27%)	225 (23%)	<0,001	2,591 (32%)
Median	620 (35%)	509 (37%)	333 (38%)		661 (36%)	470 (38%)	376 (38%)		2,969 (37%)
Disadvantaged	186 (10%)	163 (12%)	134 (15%)		289 (16%)	242 (20%)	217 (22%)		1,231 (15%)
Missing	274 (15%)	254 (18%)	166 (19%)		265 (15%)	184 (15%)	179 (18%)		1,322 (16%)
Income (33y)									
No income	273 (15%)	293 (21%)	231 (26%)	<0,001	274 (15%)	270 (22%)	299 (30%)	<0,001	1,640 (20%)
Q1 : very low	281 (16%)	224 (16%)	169 (19%)		281 (15%)	200 (16%)	182 (18%)		1,337 (16%)
Q2 : low	293 (16%)	232 (17%)	141 (16%)		329 (18%)	234 (19%)	156 (16%)		1,385 (17%)
Q3 : median	356 (20%)	220 (16%)	109 (12%)		350 (19%)	203 (16%)	129 (13%)		1,367 (17%)
Q4 : high	370 (21%)	203 (15%)	87 (10%)		395 (22%)	186 (15%)	118 (12%)		1,359 (17%)
Missing	220 (12%)	214 (15%)	141 (16%)		195 (11%)	142 (12%)	113 (11%)		1,025 (13%)
Smoking (42y)									
No/Ex smoker	1,404 (78%)	900 (65%)	497 (57%)	<0,001	1,391 (76%)	825 (67%)	582 (58%)	<0,001	5,599 (69%)
Smoker < 10 cig,/d	130 (7%)	108 (8%)	51 (6%)		143 (8%)	85 (7%)	65 (7%)		582 (7%)
Smoker ≥ 10 cig,/d	206 (11%)	319 (23%)	299 (34%)		240 (13%)	295 (24%)	311 (31%)		1,670 (21%)
Missing	53 (3%)	59 (4%)	31 (4%)		50 (3%)	30 (2%)	39 (4%)		262 (3%)
Alcohol consumption (42y)									
Moderate	1,078 (60%)	730 (53%)	375 (43%)	<0,001	1,249 (68%)	769 (62%)	542 (54%)	<0,001	4,743 (58%)
Abstinent	237 (13%)	233 (17%)	192 (22%)		416 (23%)	364 (29%)	346 (35%)		1,788 (22%)
High	425 (24%)	365 (26%)	280 (32%)		109 (6%)	72 (6%)	70 (7%)		1,321 (16%)
Missing	53 (3%)	58 (4%)	31 (4%)		50 (3%)	30 (2%)	39 (4%)		261 (3%)

Sport (42y)									
Active	1,253 (70%)	877 (63%)	487 (55%)	<0,001	1,252 (69%)	793 (64%)	557 (56%)	<0,001	5,219 (64%)
Moderate	168 (9%)	122 (9%)	90 (10%)		124 (7%)	103 (8%)	71 (7%)		678 (8%)
Inactive	318 (18%)	329 (24%)	270 (31%)		398 (22%)	308 (25%)	330 (33%)		1,953 (24%)
Missing	54 (3%)	58 (4%)	31 (4%)		50 (3%)	31 (3%)	39 (4%)		263 (3%)

258

259 **Table 2: Bivariate statistics on the subsample (n= 8,113) of the distribution of PI according to confounding and**
 260 **intermediate variables in men and in women.**
 261

		Teachers' perceptions of parental interest (7-16y)								Total n (%)
		Men n (%) n=4,075 (50%)				Women n (%) n=4056 (50%)				
		Both interested	Low/No interest	Missing	<i>p</i>	Both interested	Low/No interest	Missing	<i>p</i>	
		1,912 (47%)	1,703 (42%)	442 (11%)		1,906 (47%)	1,666 (41%)	484 (12%)		
Allostatic load (44y)	Low	930 (49%)	698 (41%)	165 (37%)	<0,001	989 (52%)	654 (39%)	181 (37%)	<0,001	3,617 (45%)
	Medium	634 (33%)	578 (34%)	174 (39%)		555 (29%)	524 (31%)	156 (32%)		2,621 (32%)
	High	348 (18%)	427 (25%)	103 (23%)		362 (19%)	488 (29%)	147 (30%)		1,875 (23%)
Parental education level (birth)	Both left school ≥15y	270 (14%)	141 (8%)	37 (8%)	<0,001	255 (13%)	132 (8%)	38 (8%)	<0,001	873 (11%)
	Both left school <14y	383 (20%)	292 (17%)	107 (24%)		370 (19%)	311 (19%)	125 (26%)		1,588 (20%)
	Mother ≥15y, father <14y	434 (23%)	102 (6%)	37 (8%)		469 (25%)	86 (5%)	43 (9%)		1,171 (14%)
	Father ≥15y, mother <14y	786 (41%)	1,127 (66%)	213 (48%)		768 (40%)	1,105 (66%)	241 (50%)		4,240 (52%)
	Missing	39 (2%)	41 (2%)	48 (11%)		44 (2%)	32 (2%)	37 (8%)		241 (3%)
Reading activities (7y)	Every week	1,126 (59%)	747 (44%)	157 (36%)	<0,001	1,076 (56%)	715 (43%)	175 (36%)	<0,001	3,996 (49%)
	Occasionally	464 (24%)	523 (31%)	119 (27%)		515 (27%)	592 (36%)	154 (32%)		2,367 (29%)
	Hardly ever	145 (8%)	215 (13%)	26 (6%)		128 (7%)	177 (11%)	31 (6%)		722 (9%)
	Missing	177 (9%)	218 (13%)	140 (32%)		187 (10%)	182 (11%)	124 (26%)		1,028 (13%)
Outdoor activities (7y)	Most weeks	1,615 (84%)	1,202 (71%)	259 (59%)	<0,001	1,599 (84%)	1,257 (75%)	316 (65%)	<0,001	6,248 (77%)
	Occasionally/hardly ever	125 (7%)	283 (17%)	44 (10%)		128 (7%)	223 (13%)	45 (9%)		848 (10%)
	Missing	172 (9%)	218 (13%)	139 (31%)		179 (9%)	186 (11%)	123 (25%)		1,017 (13%)
Parental SEC (birth)	I & II	564 (30%)	135 (8%)	49 (11%)	<0,001	526 (28%)	132 (8%)	48 (10%)	<0,001	1,454 (18%)

	IIINM	223 (12%)	128 (8%)	29 (7%)		238 (12%)	119 (7%)	34 (7%)		771 (10%)
	IIIM	801 (42%)	905 (53%)	207 (47%)		788 (41%)	876 (53%)	247 (51%)		3,824 (47%)
	IV&V	229 (12%)	441 (26%)	98 (22%)		250 (13%)	445 (27%)	102 (21%)		1,565 (19%)
	Missing	95 (5%)	94 (6%)	59 (13%)		104 (5%)	94 (6%)	53 (11%)		499 (6%)
Material living conditions (7y)	Advantaged	1,375 (80%)	930 (68%)	190 (54%)	<i><0,001</i>	1,342 (79%)	902 (69%)	219 (57%)	<i><0,001</i>	4,958 (61%)
	Disadvantaged	292 (10%)	528 (20%)	118 (14%)		315 (11%)	548 (20%)	144 (18%)		1,945 (24%)
	Missing	245 (9%)	245 (13%)	134 (31%)		249 (10%)	216 (11%)	121 (25%)		1,21 (15%)
Place in the siblings (7 y)	≥ 2	975 (51%)	1,017 (60%)	186 (42%)	<i><0,001</i>	965 (51%)	1,021 (61%)	218 (45%)	<i><0,001</i>	4,382 (54%)
	Elder	612 (32%)	377 (22%)	79 (18%)		596 (31%)	377 (23%)	98 (20%)		2,139 (26%)
	Single child	155 (8%)	99 (6%)	40 (9%)		172 (9%)	89 (5%)	44 (9%)		599 (7%)
	Missing	170 (9%)	210 (12%)	137 (31%)		173 (9%)	179 (11%)	124 (26%)		993 (12%)
ACEs (7-16y)	No	1,534 (80%)	1,022 (60%)	165 (37%)	<i><0,001</i>	1,531 (80%)	1,037 (62%)	207 (43%)	<i><0,001</i>	5,496 (68%)
	Yes	287 (15%)	566 (33%)	179 (41%)		267 (14%)	541 (32%)	199 (41%)		2,039 (25%)
	Missing	91 (5%)	115 (7%)	98 (22%)		108 (6%)	88 (5%)	78 (16%)		578 (7%)
Health problems in childhood (7-16y)	No	1,415 (74%)	1,260 (74%)	313 (71%)	<i><0,001</i>	1,495 (78%)	1,254 (75%)	353 (73%)		6,090 (75%)
	Yes	494 (26%)	435 (26%)	111 (25%)		409 (21%)	406 (24%)	114 (24%)	<i><0,001</i>	1,969 (24%)
	Missing	3 (0%)	8 (0%)	18 (4%)		2 (0%)	6 (0%)	17 (4%)		54 (1%)
Cognitive skills (7y)	Score : med [p25-p75]	8 [6-9]	7 [6-8]	7 [6-8]	<i><0,001</i>	8 [6-9]	7 [6-8]	7 [6-8]	<i><0,001</i>	7 [6- 9]
	Missing	145 (8%)	183 (11%)	145 (33%)		151 (8%)	157 (9%)	(25%)		901 (11%)
Education level (23y)	A level	800 (42%)	169 (10%)	74 (17%)	<i><0,001</i>	741 (39%)	111 (7%)	80 (17%)	<i><0,001</i>	1,975 (24%)
	O level	750 (39%)	566 (33%)	141 (32%)		873 (46%)	679 (41%)	184 (38%)		3,193 (39%)
	No level	312 (16%)	875 (51%)	204 (46%)		256 (13%)	810 (49%)	197 (41%)		2,654 (33%)
	Missing	50 (3%)	93 (5%)	23 (5%)		36 (2%)	66 (4%)	23 (5%)		291 (4%)

Malaise inventory (23y)	No	1,623 (85%)	1,374 (81%)	339 (77%)	<0,001	1,610 (84%)	1,237 (74%)	349 (72%)	<0,001	6,532 (81%)
	Yes	36 (2%)	67 (4%)	17 (4%)		103 (5%)	201 (12%)	53 (11%)		477 (6%)
	Missing	253 (13%)	262 (15%)	86 (19%)		193 (10%)	228 (14%)	82 (17%)		1,104 (14%)
SOC (33y)	External	116 (6%)	169 (10%)	39 (9%)	<0,001	146 (8%)	231 (14%)	74 (15%)	<0,001	6,173 (76%)
	Internal	1,513 (79%)	1,218 (72%)	302 (68%)		1,581 (83%)	1,222 (73%)	337 (70%)		775 (10%)
	Missing	283 (15%)	316 (19%)	101 (23%)		179 (9%)	213 (13%)	73 (15%)		1,165 (%)
Occupational social class (33y)	Favored	926 (48%)	378 (22%)	114 (26%)	<0,001	745 (39%)	303 (18%)	125 (26%)	<0,001	2,591 (32%)
	Median	570 (30%)	727 (43%)	165 (37%)		691 (36%)	627 (38%)	189 (39%)		2,969 (37%)
	Disadvantaged	123 (6%)	288 (17%)	72 (16%)		220 (12%)	439 (26%)	89 (18%)		1,231 (15%)
	Missing	293 (15%)	310 (18%)	91 (21%)		250 (13%)	297 (18%)	81 (17%)		1,322 (16%)
Income (33y)	No income	287 (15%)	404 (24%)	106 (24%)	<0,001	268 (14%)	458 (27%)	117 (24%)	<0,001	1,640 (20%)
	Q1 : very low	250 (13%)	351 (21%)	73 (17%)		239 (13%)	335 (20%)	89 (18%)		1,337 (16%)
	Q2 : low	318 (17%)	287 (17%)	61 (14%)		366 (19%)	261 (16%)	92 (19%)		1,385 (17%)
	Q3 : median	400 (21%)	223 (13%)	62 (14%)		401 (21%)	219 (13%)	62 (13%)		1,367 (17%)
	Q4 : high	422 (22%)	178 (10%)	60 (14%)		447 (23%)	189 (11%)	63 (13%)		1,359 (17%)
	Missing	235 (12%)	260 (15%)	80 (18%)		185 (10%)	204 (12%)	61 (13%)		1,025 (13%)
Smoking (42y)	No/Ex smoker	1,420 (74%)	1,088 (64%)	293 (66%)	<0,001	1,480 (78%)	1,003 (60%)	315 (65%)	<0,001	5,599 (69%)
	Smoker < 10 cig./d	154 (8%)	107 (6%)	28 (6%)		133 (7%)	134 (8%)	26 (5%)		582 (7%)
	Smoker ≥ 10 cig./d	281 (15%)	445 (26%)	98 (22%)		244 (13%)	477 (29%)	125 (26%)		1,670 (21%)
	Missing	57 (3%)	63 (4%)	23 (5%)		49 (3%)	52 (3%)	18 (4%)		262 (3%)
Alcohol consumption (42y)	Moderate	1,143 (60%)	821 (48%)	219 (50%)	<0,001	1,312 (69%)	975 (59%)	273 (56%)	<0,001	4,743 (58%)
	Abstinent	232 (12%)	320 (19%)	110 (25%)		421 (22%)	538 (32%)	167 (35%)		1,788 (22%)
	High	480 (25%)	500 (29%)	90 (20%)		124 (7%)	101 (6%)	26 (5%)		1,321 (16%)
	Missing	57 (3%)	62 (4%)	23 (5%)		49 (3%)	52 (3%)	18 (4%)		261 (3%)


Sport (42y)	Active	1,305 (68%)	1,036 (61%)	276 (62%)	<0,001	1,282 (67%)	1,026 (62%)	294 (61%)	<0,001	5,219 (64%)
	Moderate	207 (11%)	134 (8%)	39 (9%)		155 (8%)	112 (7%)	31 (6%)		678 (8%)
	Inactive	342 (18%)	471 (28%)	104 (24%)		420 (22%)	475 (29%)	141 (29%)		1,953 (24%)
	Missing	58 (3%)	62 (4%)	23 (5%)		49 (3%)	53 (3%)	18 (4%)		263 (3%)

262

263

264 Abbreviations and symbols: n = number of people; med = median; p25 = 25e percentile; p75 = 75e percentile; statistically significant results at
 265 the 5% threshold are in bold. Values corresponding to the categories of AL: Low: [0-2]; Medium: [3-4]; High: [5-12]

266

267 Multivariate results, between PI and AL, examining the *a priori* set of confounding and
268 intermediate factors are presented in Table 3  4, for men and women respectively. Men with
269 parents perceived as uninterested or not very interested had higher AL scores at 44 years
270 compared to those perceived as interested by the school teacher (Model 1 $\beta= 0.41 [0.28; 0.54]$).
271 After adjustment for cultural capital, economic capital and other confounding factors in
272 childhood, the link between PI and AL was weakened (Model 2, $\beta= 0.18 [0.03; 0.32]$) partly
273 attributable to parental SEC, ACEs, health problems in childhood and cognitive skills.
274 Controlling for educational attainment at 23y reduced the strength of the association between
275 PI and AL (Model 3, $\beta= 0.05 [-0.1; 0.2]$). The association was only marginally affected when
276 psychological status at 23 y were accounted for (Model 4, $\beta= 0.04 [-0.1; 0.19]$). Social position
277 and income strongly affected the association (Model 5, $\beta= 0.009 [-0.14; 0.16]$) with income
278 making a significant contribution. The association was attenuated after sequentially controlling
279 all for time-ordered life course, SEP and health behaviours, (Model 6, $\beta=-0.02 [-0.17; 0.13]$).
280
281 A similar pattern was observed for women: women whose parents were perceived uninterested
282 or not very interested by the teacher had higher AL scores at 44 years (Model 1, $\beta = 0.67 [0.52;$
283 $0.81]$). The association between PI and AL was attenuated after controlling for early life
284 confounder (Model 2, $\beta= 0.39 [0.22; 0.55]$) partly explained by parental educational level and
285 SEC and ACEs and cognitive skills. Further adjustment for educational attainment at 23 y
286 reduced the strength of the association (Model 3, $\beta= 0.28 [0.1; 0.46]$). When psychological
287 status was accounted for, the association between PI and AL was marginally affected (Model
288 4, $\beta= 0.26 [0.08; 0.44]$) but was explained by the malaise inventory. Further adjustment for
289 social position and income slightly attenuated the association with income affecting it more
290 strongly (Model 5, $\beta= 0.21 [0.03; 0.39]$) as well as health behaviors (Model 6, $\beta= 0.17 [0.001;$

291 0.35]). When all potential mediators were controlled for (Model 6), PI remained significantly
292 associated with AL score ($\beta = 0.17[0.001; 0.35]$).

293 **Table 3: Life course multivariate linear regression between AL and PI using data obtained from multiple imputation for men**
 294 **(n = 3,914)**

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>
PI												
Both interested	1		1		1		1		1		1	
Low/No interest	0,41 [0,28; 0,54]	<i>< 0,001</i>	0,18 [0,03; 0,32]	<i>0,016</i>	0,05 [-0,1; 0,2]	<i>0,52</i>	0,04 [-0,1; 0,19]	<i>0,56</i>	0,009 [-0,14; 0,16]	<i>0,91</i>	-0,02 [-0,17; 0,13]	<i>0,79</i>
Parental education level												
Both left school ≥15y			1		1		1		1		1	
Both left school <14y			0,09 [-0,13; 0,32]	<i>0,42</i>	0,09 [-0,14; 0,31]	<i>0,44</i>	0,09 [-0,14; 0,32]	<i>0,43</i>	0,08 [-0,14; 0,31]	<i>0,48</i>	0,06 [-0,16; 0,28]	<i>0,57</i>
Mother ≥ 15y, father <14y			-0,02 [-0,27; 0,24]	<i>0,89</i>	0,03 [-0,22; 0,29]	<i>0,80</i>	0,04 [-0,22; 0,29]	<i>0,78</i>	0,03 [-0,22; 0,28]	<i>0,81</i>	-0,01 [-0,26; 0,24]	<i>0,94</i>
Father ≥ 15y, mother <14y			0,14 [-0,06; 0,35]	<i>0,17</i>	0,09 [-0,12; 0,29]	<i>0,40</i>	0,09 [-0,12; 0,29]	<i>0,39</i>	0,07 [-0,14; 0,27]	<i>0,51</i>	0,07 [-0,13; 0,26]	<i>0,52</i>
Reading activities												
Every week			1		1		1		1		1	
Occasionally			-0,004 [-0,15; 0,14]	<i>0,96</i>	-0,02 [-0,17; 0,12]	<i>0,77</i>	-0,02 [-0,17; 0,12]	<i>0,77</i>	-0,01 [-0,15; 0,14]	<i>0,93</i>	-0,01 [-0,15; 0,13]	<i>0,91</i>
Hardly ever			0,03 [-0,2; 0,26]	<i>0,78</i>	0,02 [-0,21; 0,25]	<i>0,86</i>	0,02 [-0,21; 0,25]	<i>0,87</i>	0,03 [-0,2; 0,25]	<i>0,80</i>	-0,005 [-0,22; 0,21]	<i>0,97</i>
Outdoor activities												
Most weeks			1		1		1		1		1	
Occasionally/hardly ever			-0,15 [-0,35; 0,05]	<i>0,14</i>	-0,17 [-0,36; 0,03]	<i>0,10</i>	-0,17 [-0,37; 0,03]	<i>0,10</i>	-0,18 [-0,38; 0,01]	<i>0,07</i>	-0,18 [-0,37; 0,01]	<i>0,07</i>
Parental SEC												
I & II			1		1		1		1		1	
IIINM			0,02 [-0,23; 0,26]	<i>0,88</i>	-0,01 [-0,25; 0,24]	<i>0,96</i>	-0,004 [-0,25; 0,24]	<i>0,98</i>	0,01 [-0,23; 0,26]	<i>0,91</i>	-0,01 [-0,25; 0,23]	<i>0,92</i>
IIIM			0,33 [0,14; 0,52]	<i>0,001</i>	0,27 [0,08; 0,46]	<i>0,005</i>	0,27 [0,08; 0,46]	<i>0,005</i>	0,26 [0,08; 0,45]	<i>0,005</i>	0,22 [0,03; 0,4]	<i>0,02</i>
IV&V			0,43 [0,21; 0,65]	<i>< 0,001</i>	0,34 [0,11; 0,56]	<i>0,003</i>	0,34 [0,12; 0,56]	<i>0,003</i>	0,3 [0,08; 0,52]	<i>0,008</i>	0,25 [0,04; 0,47]	<i>0,022</i>
Material living conditions												
Advantaged			1		1		1		1		1	
Disadvantaged			0,15 [-0,01; 0,3]	<i>0,07</i>	0,14 [-0,02; 0,29]	<i>0,09</i>	0,13 [-0,02; 0,29]	<i>0,10</i>	0,12 [-0,04; 0,27]	<i>0,15</i>	0,11 [-0,04; 0,26]	<i>0,15</i>
Place in the siblings												
≥ 2			1		1		1		1		1	
Elder			-0,03 [-0,17; 0,11]	<i>0,71</i>	-0,01 [-0,15; 0,14]	<i>0,92</i>	-0,003 [-0,14; 0,14]	<i>0,97</i>	0,01 [-0,13; 0,15]	<i>0,91</i>	0,02 [-0,12; 0,16]	<i>0,79</i>
Single child			0,2 [-0,04; 0,44]	<i>0,10</i>	0,24 [0,003; 0,47]	<i>0,047</i>	0,24 [0,004; 0,47]	<i>0,046</i>	0,24 [0,01; 0,48]	<i>0,043</i>	0,25 [0,02; 0,48]	<i>0,032</i>
ACEs												
No			1		1		1		1		1	
Yes			0,21 [0,06; 0,36]	<i>0,007</i>	0,17 [0,02; 0,32]	<i>0,027</i>	0,17 [0,01; 0,32]	<i>0,03</i>	0,13 [-0,02; 0,29]	<i>0,09</i>	0,06 [-0,09; 0,21]	<i>0,43</i>
Health problems												
No			1		1		1		1		1	

	Yes	0,19 [0,05; 0,33]	<i>0,008</i>	0,17 [0,03; 0,31]	<i>0,017</i>	0,17 [0,03; 0,3]	<i>0,02</i>	0,14 [-0,01; 0,27]	<i>0,06</i>	0,12 [-0,02; 0,26]	<i>0,08</i>
Cognitive skills											
	Score : med [p25-p75]	-0,07 [-0,11; -0,03]	<i>< 0,001</i>	-0,05 [-0,09; -0,01]	<i>0,007</i>	-0,05 [-0,09; -0,01]	<i>0,008</i>	-0,04 [-0,08; -0,01]	<i>0,016</i>	-0,04 [-0,07; -0,004]	<i>0,029</i>
Education level											
	A level			1		1		1		1	
	O level			0,28 [0,11; 0,45]	<i>0,001</i>	0,28 [0,11; 0,45]	<i>0,001</i>	0,24 [0,07; 0,41]	<i>0,007</i>	0,15 [-0,02; 0,32]	<i>0,08</i>
	No level			0,57 [0,38; 0,76]	<i>< 0,001</i>	0,56 [0,37; 0,75]	<i>< 0,001</i>	0,47 [0,26; 0,67]	<i>< 0,001</i>	0,31 [0,1; 0,51]	<i>0,003</i>
Malaise inventory											
	No					1		1		1	
	Yes					0,16 [-0,22; 0,53]	<i>0,41</i>	0,12 [-0,26; 0,49]	<i>0,54</i>	0,03 [-0,35; 0,4]	<i>0,89</i>
SOC											
	External					1		1		1	
	Internal					-0,12 [-0,36; 0,12]	<i>0,32</i>	-0,05 [-0,29; 0,19]	<i>0,67</i>	0,03 [-0,2; 0,27]	<i>0,78</i>
Occupational social class											
	Favored							1		1	
	Median							-0,04 [-0,21; 0,12]	<i>0,62</i>	-0,08 [-0,24; 0,08]	<i>0,35</i>
	Disadvantaged							-0,005 [-0,23; 0,23]	<i>0,97</i>	-0,06 [-0,28; 0,16]	<i>0,61</i>
Income											
	No income							1		1	
	Q1 : very low							-0,29 [-0,49; -0,09]	<i>0,004</i>	-0,20 [-0,39; -0,003]	<i>0,047</i>
	Q2 : low							-0,34 [-0,56; -0,12]	<i>0,002</i>	-0,20 [-0,42; 0,01]	<i>0,062</i>
	Q3 : median							-0,60 [-0,8; -0,4]	<i>< 0,001</i>	-0,40 [-0,6; -0,2]	<i>< 0,001</i>
	Q4 : high							-0,64 [-0,85; -0,42]	<i>< 0,001</i>	-0,43 [-0,64; -0,23]	<i>< 0,001</i>
Smoking											
	No/Ex smoker									1	
	Smoker < 10 cig,/d									0,03 [-0,2; 0,25]	<i>0,82</i>
	Smoker ≥ 10 cig,/d									0,82 [0,66; 0,97]	<i>< 0,001</i>
Alcohol consumption											
	Moderate									1	
	Abstinent									0,33 [0,17; 0,5]	<i>< 0,001</i>
	High									0,27 [0,13; 0,41]	<i>< 0,001</i>
Sport											
	Active									1	
	Moderate									0,12 [-0,08; 0,32]	<i>0,24</i>
	Inactive									0,34 [0,19; 0,48]	<i>< 0,001</i>

296 **Table 4: Life course multivariate linear regression between AL and PI using data obtained from multiple imputation for**
 297 **women (n = 3,936)**

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>	Coeff, [IC 95%]	<i>p</i>
PI												
Both interested	1		1		1		1		1		1	
Low/No interest	0,67 [0,52; 0,81]	<i>< 0,001</i>	0,39 [0,22; 0,55]	<i>< 0,001</i>	0,28 [0,1; 0,46]	<i>0,002</i>	0,26 [0,08; 0,44]	<i>0,004</i>	0,209 [0,03; 0,39]	<i>0,02</i>	0,17 [0,001; 0,35]	<i>0,049</i>
Parental education level												
Both left school ≥15y			1		1		1		1		1	
Both left school <14y			0,16 [-0,09; 0,41]	<i>0,22</i>	0,16 [-0,1; 0,41]	<i>0,23</i>	0,16 [-0,09; 0,41]	<i>0,22</i>	0,19 [-0,06; 0,44]	<i>0,14</i>	0,19 [-0,05; 0,44]	<i>0,12</i>
Mother ≥ 15y, father <14y			0,02 [-0,26; 0,29]	<i>0,90</i>	0,05 [-0,22; 0,33]	<i>0,70</i>	0,06 [-0,22; 0,33]	<i>0,69</i>	0,09 [-0,19; 0,36]	<i>0,54</i>	0,08 [-0,19; 0,36]	<i>0,54</i>
Father ≥ 15y, mother <14y			0,34 [0,11; 0,57]	<i>0,003</i>	0,30 [0,07; 0,53]	<i>0,01</i>	0,31 [0,08; 0,54]	<i>0,008</i>	0,31 [0,08; 0,53]	<i>0,008</i>	0,31 [0,08; 0,53]	<i>0,008</i>
Reading activities												
Every week			1		1		1		1		1	
Occasionally			-0,11 [-0,27; 0,05]	<i>0,18</i>	-0,11 [-0,27; 0,05]	<i>0,17</i>	-0,11 [-0,27; 0,05]	<i>0,18</i>	-0,11 [-0,27; 0,04]	<i>0,16</i>	-0,13 [-0,28; 0,02]	<i>0,10</i>
Hardly ever			-0,06 [-0,33; 0,21]	<i>0,68</i>	-0,07 [-0,34; 0,2]	<i>0,63</i>	-0,08 [-0,34; 0,19]	<i>0,58</i>	-0,08 [-0,34; 0,19]	<i>0,56</i>	-0,1 [-0,36; 0,17]	<i>0,47</i>
Outdoor activities												
Most weeks			1		1		1		1		1	
Occasionally/hardly ever			0,12 [-0,12; 0,37]	<i>0,32</i>	0,11 [-0,14; 0,35]	<i>0,38</i>	0,10 [-0,15; 0,34]	<i>0,44</i>	0,07 [-0,17; 0,31]	<i>0,54</i>	0,08 [-0,15; 0,32]	<i>0,48</i>
Parental SEC												
I & II			1		1		1		1		1	
IIINM			0,12 [-0,15; 0,4]	<i>0,37</i>	0,11 [-0,16; 0,39]	<i>0,42</i>	0,12 [-0,15; 0,39]	<i>0,40</i>	0,12 [-0,15; 0,39]	<i>0,40</i>	0,08 [-0,19; 0,35]	<i>0,58</i>
IIIM			0,38 [0,17; 0,595]	<i>< 0,001</i>	0,35 [0,13; 0,56]	<i>0,001</i>	0,34 [0,13; 0,56]	<i>0,002</i>	0,3 [0,09; 0,52]	<i>0,005</i>	0,28 [0,07; 0,49]	<i>0,008</i>
IV&V			0,479 [0,23; 0,73]	<i>< 0,001</i>	0,42 [0,17; 0,68]	<i>0,001</i>	0,42 [0,16; 0,67]	<i>0,001</i>	0,33 [0,08; 0,59]	<i>0,01</i>	0,29 [0,03; 0,54]	<i>0,03</i>
Material living conditions												
Advantaged			1		1		1		1		1	
Disadvantaged			0,08 [-0,08; 0,24]	<i>0,33</i>	0,07 [-0,09; 0,23]	<i>0,37</i>	0,06 [-0,09; 0,22]	<i>0,43</i>	0,04 [-0,12; 0,19]	<i>0,66</i>	0,01 [-0,15; 0,17]	<i>0,91</i>
Place in the siblings												
≥ 2			1		1		1		1		1	
Elder			0,12 [-0,04; 0,28]	<i>0,13</i>	0,14 [-0,02; 0,3]	<i>0,08</i>	0,15 [-0,01; 0,3]	<i>0,07</i>	0,15 [-0,01; 0,3]	<i>0,07</i>	0,15 [-0,004; 0,31]	<i>0,06</i>
Single child			0,2 [-0,08; 0,47]	<i>0,16</i>	0,23 [-0,05; 0,5]	<i>0,10</i>	0,23 [-0,04; 0,5]	<i>0,09</i>	0,23 [-0,04; 0,5]	<i>0,10</i>	0,27 [0,01; 0,53]	<i>0,04</i>
ACEs												
No			1		1		1		1		1	
Yes			0,2 [0,02; 0,38]	<i>0,03</i>	0,17 [-0,01; 0,34]	<i>0,06</i>	0,15 [-0,02; 0,33]	<i>0,09</i>	0,11 [-0,06; 0,28]	<i>0,22</i>	0,06 [-0,11; 0,23]	<i>0,47</i>
Health problems												

	No	1	1	1	1	1	1	1	1	1	1
	Yes	0,14 [-0,02; 0,3]	0,08	0,13 [-0,03; 0,28]	0,12	0,12 [-0,04; 0,28]	0,14	0,11 [-0,04; 0,27]	0,16	0,09 [-0,06; 0,25]	0,25
Cognitive skills											
	Score : med [p25-p75]	-0,08 [-0,12; -0,05]	< 0,001	-0,07 [-0,1; -0,03]	0,001	-0,06 [-0,1; -0,02]	0,001	-0,05 [-0,09; -0,02]	0,005	-0,05 [-0,09; -0,01]	0,007
Education level											
	A level			1		1		1		1	
	O level			0,14 [-0,05; 0,33]	0,14	0,14 [-0,05; 0,32]	0,15	0,06 [-0,13; 0,25]	0,53	0,01 [-0,18; 0,2]	0,94
	No level			0,46 [0,23; 0,68]	< 0,001	0,43 [0,2; 0,66]	< 0,001	0,23 [-0,01; 0,47]	0,06	0,08 [-0,16; 0,32]	0,51
Malaise inventory											
	No					1		1		1	
	Yes					0,36 [0,12; 0,6]	0,003	0,35 [0,11; 0,58]	0,004	0,26 [0,03; 0,49]	0,03
SOC											
	External					1		1		1	
	Internal					-0,11 [-0,32; 0,1]	0,31	0,01 [-0,2; 0,22]	0,95	0,08 [-0,13; 0,29]	0,47
Occupational social class											
	Favored							1		1	
	Median							0,12 [-0,05; 0,3]	0,16	0,13 [-0,04; 0,3]	0,13
	Disadvantaged							0,14 [-0,09; 0,38]	0,22	0,13 [-0,1; 0,36]	0,27
Income											
	No income							1		1	
	Q1 : very low							-0,39 [-0,61; -0,18]	< 0,001	-0,31 [-0,52; -0,09]	0,006
	Q2 : low							-0,62 [-0,83; -0,4]	< 0,001	-0,44 [-0,66; -0,23]	< 0,001
	Q3 : median							-0,68 [-0,9; -0,46]	< 0,001	-0,50 [-0,71; -0,28]	< 0,001
	Q4 : high							-0,76 [-0,99; -0,54]	< 0,001	-0,56 [-0,79; -0,34]	< 0,001
Smoking											
	No/Ex smoker									1	
	Smoker < 10 cig,/d									-0,07 [-0,32; 0,18]	0,6
	Smoker ≥ 10 cig,/d									0,66 [0,49; 0,84]	< 0,001
Alcohol consumption											
	Moderate									1	
	Abstinent									0,34 [0,19; 0,49]	< 0,001
	High									0,04 [-0,23; 0,31]	0,77
Sport											
	Active									1	
	Moderate									0,15 [-0,1; 0,4]	0,2
	Inactive									0,31 [0,16; 0,46]	< 0,001

299 The analyses of the direct and indirect effects of PI on AL are presented in Fig 2 and Fig 3. For
300 men, the direct link between PI and AL was completely mediated, mainly by the educational
301 pathway (72% of the total indirect effect) but also through other intermediate factors (28% of
302 the total indirect effect), without operating through education.
303 For women, 55% of the link between PI and AL was mediated, through the educational pathway
304 (28% of the total indirect effect) and by other intermediate factors (27% of the total indirect
305 effect). A direct effect of 45% persisted after adjustment for confounding factors and mediators.
306 For this calculation among men, we did not take into account the direct effect PI on AL because
307 the estimation $\hat{\beta}_{PI.2} = -0,02 [-0,17; 0,13]$ had a large confidence interval with a value close
308 to 0.

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310 **Figure 2: Direct and indirect effect results between PI and AL for men**

311 **Figure 3: Direct and indirect effect results between PI and AL for women**

312 Discussion

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Teacher-perceived parental interest, measured when cohort members were school children, was associated with their physiological health in mid-life in both men and women. Cohort members whose parents were perceived as uninterested or not very interested in their child's education, as reported by the children's teachers, had a higher AL compared to individuals whose parents were considered by the teacher to be interested. PI appear to be related to the parent's own education level for women and parent's social class for both men and women. The association between teacher-perceived parental interest and cohort member's physiological wear-and-tear operates over the life course through intermediate pathways. Among men, 72% of the association operated through the educational pathway, and 28% through the other variables including income, smoking, alcohol consumption and physical activity. Among women, only 28% of the association operated through the education pathway, with 27% through the other variables in adulthood, including psychological variables. Much of the association (45%) was direct, and unexplained by the tested pathways. Our results are in line with other studies where parental interest in their offspring's studies was found to predict adult allostatic and may buffer against poor mental health (24,25). Our findings provide insight into understanding how educational attainment as a reflection of dynamic life course social processes relates to physiological health, but also underline that parental-interest in children's education has not been given much attention in relation to health over the life course.

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It may be here that our findings underline an interplay between culture and biology (26,27) whereby a tension between a child's home and school cultural environments may lead to a physiological stress response partly mediated by the educational trajectory. This dissonance between the family and school environments may have lasting effects on the child's educational trajectory, and become reflected in their physiological functioning over time. Our results

338 suggest this pathway, especially for boys/men. Our findings also suggest that dissonance affects
339 the physiological health for girls/ women directly, or through pathways that remain to be tested.
340 Children who experience dissonance, as a chronically stressful challenge, may solicit their
341 biological resources, experience multi-system physiological dysregulation as measured by AL,
342 and this embodiment may represent the cost of adaptation for the children. Our findings may
343 highlight the consequence of this hypothesized mechanism. It is also possible that the behavior
344 of teachers towards children whose parents they consider to be less involved, could be different.
345 Teachers easily perceive the families' economic and cultural capital once children enter school
346 and may unconsciously show favoritism toward those students from the upper classes (28). It
347 is possible that our findings reflect a bias or difference whereby some teachers behaved
348 differently towards those children, which would contribute to increasing their stress and
349 therefore impact their AL.

350

351 An important aim of our analysis was to grasp the role of intermediate factors through
352 which teacher-perceived parental interest may affect physiological processes.

353 We observed two different scenarii for each gender. For women our results show that, after
354 controlling for confounders and mediators, a sizable part of the initial effect remained
355 unexplained. This may represent other possible pathways, or differential early life socialization
356 and embodiment processes among girls. This suggests that intersecting domains of power
357 including class, gender and others (race, disability etc) are likely to be at play (29,30). For men,
358 the educational pathway had a significant and stronger effect on AL, consistent with observed
359 differences in mortality by educational level across age groups more pronounced in men than
360 in women (31).

361 Later in the life course, adult income captured a large portion of the association for women and
362 explained the association between educational level and AL for men. Our findings suggest that

363 consonant relationships between family and school, captured partly by PI, could promote
364 ascending social mobility and therefore act as a vehicle towards social advantage, that may
365 "buffer" the effects of an initially disadvantaged socio-economic environment on AL (32,33).
366 Furthermore, health behavior pathways appeared to explain a part of the association between
367 PI and AL for women and effects of education level on AL for men. A consonant educational
368 socialization could promote the embodiment of a health-relevant capital, i.e. the resources for
369 acting in favor of health. Such consonance refers to all the "health related values, behavioral
370 norm, knowledge and operational skills" (34). However psychological malaise was found to
371 explain the association between PI for women and AL. Further analysis should be conducted in
372 other cohorts to explore this association and ascertain its potential contextual specificity.

373

374 The main weakness of this study is that our variable measuring parental interest is one-
375 sided, reflecting only the teacher's point of view. It would have been interesting to compare
376 this measure with parents' perceptions. However, such data were unavailable. Attrition, and
377 selection bias, common features related to longitudinal studies also pose issue. We carried out
378 multiple imputations, a recommended method to avoid the interpretation of biased results,
379 allowed them to be redressed to some extent. Information and recall biases may also be present,
380 related to the self-reported nature of the data. Furthermore, we were not able to take into account
381 a teacher-level effect on a classroom of children. This would have required having detailed data
382 on others children in the class or school which we did not have. With regard to alcohol
383 consumption, we must consider that people with pathologies, but also those prone to alcohol
384 addiction, are probably part of this group, thus biasing the results. Several years passed between
385 the data collection sweeps and several life events probably took place between them. However,
386 some variables in our study were measured at one given point in time, because we had only one
387 measure available (i.e. AL, SOC, malaise), or we considered that they had a constant inertia

388 over time (i.e. behavior, social position). It is a regret that there is no earlier measurement of
389 AL in order to analyze its dynamic changes over time. However, other studies show that the
390 inertia of the measurement in adulthood remains generally constant over time, which leads us
391 to consider that this measurement is reliable in our analysis (35). The choice of the statistical
392 models and the variables tested are based on *a priori* theoretical and conceptual considerations.
393 Therefore, it is possible that we overlooked variables or assumptions, other factor may
394 contribute in the relationship between PI and AL. Lastly, NCDS 58 is a UK cohort, with unique
395 cultural and historical aspects. It is therefore necessary to take precautions when extrapolating
396 our results.

397 Despite these limitations, this study has a number of strengths. It is a longitudinal population-
398 based study containing prospectively collected data with great detail and breadth across the life
399 span, allowing us to control for a number variables of potential confounding and mediating
400 factors. A parental interest measure operationalized here as a prospective variable, where
401 information collected during childhood reported by the teacher was used to create the variable.
402 Another important strength is in the sample size included in the biomedical survey, and the
403 large number of biomarkers available.

404

405 Education is often used as a measure of social position, where higher educational
406 attainment is associated with better health outcomes. Our findings suggest the importance of
407 considering education as a product of early life interactions between family and school social
408 sphere. In this context of coexisting social spheres, socio-cultural dissonance may occur
409 between family and the school environment. Indeed, “The standards of the school are not
410 neutral; their requests for parental involvement may be laden with the cultural experiences of
411 intellectual and economic elites” (36). Among the socially disadvantaged, who potentially don’t
412 possess a common language and know how to negotiate the institution of school, educational

413 success at school may indicate a conversion of their cultural capital, described as
414 “acculturation”. Conversely, for more socially advantaged students, this progression would be
415 the result of the mobilization of their cultural capital heritage (37). Consequently, the
416 dissonance between the family social sphere and the school environment may lead to an
417 “educational acculturation”, requiring the family to assimilate to the new educational culture.

418 This work calls for additional studies to examine and better understand the effects of social
419 distance between the family social sphere and the school environment in a variety of contexts.

420

421



422 Conclusion

423 Teacher-perceived parental interest measured during childhood was associated with
424 physiological wear-and-tear in mid-life in both men and women. This may be due to a
425 physiological stress response induced from early life due to a possible dissonance between
426 family and school cultural environments which have lasting effects on health, through
427 pathways, including educational attainment, particularly in men. These results suggest that
428 awareness of children’s socio-cultural environments and gender should be taken into account
429 when developing school or educational policies. As such, understanding family educational
430 culture, cultural capital and socioeconomic position may contribute to developing adapted
431 public policies supporting early childhood environments to reduce social inequalities in health.

432

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436

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Supporting information captions

- **S1 Table A:** Sensitivity analyses PI in 4 categories on complete-case data for men and women
- **S2 File:** Detail on variable constructions
- **S3 File:** Direct and indirect effect
- **S4 Table B:** Sensitivity analyses imputing PI measurement vs non-imputed PI measurement for men and women

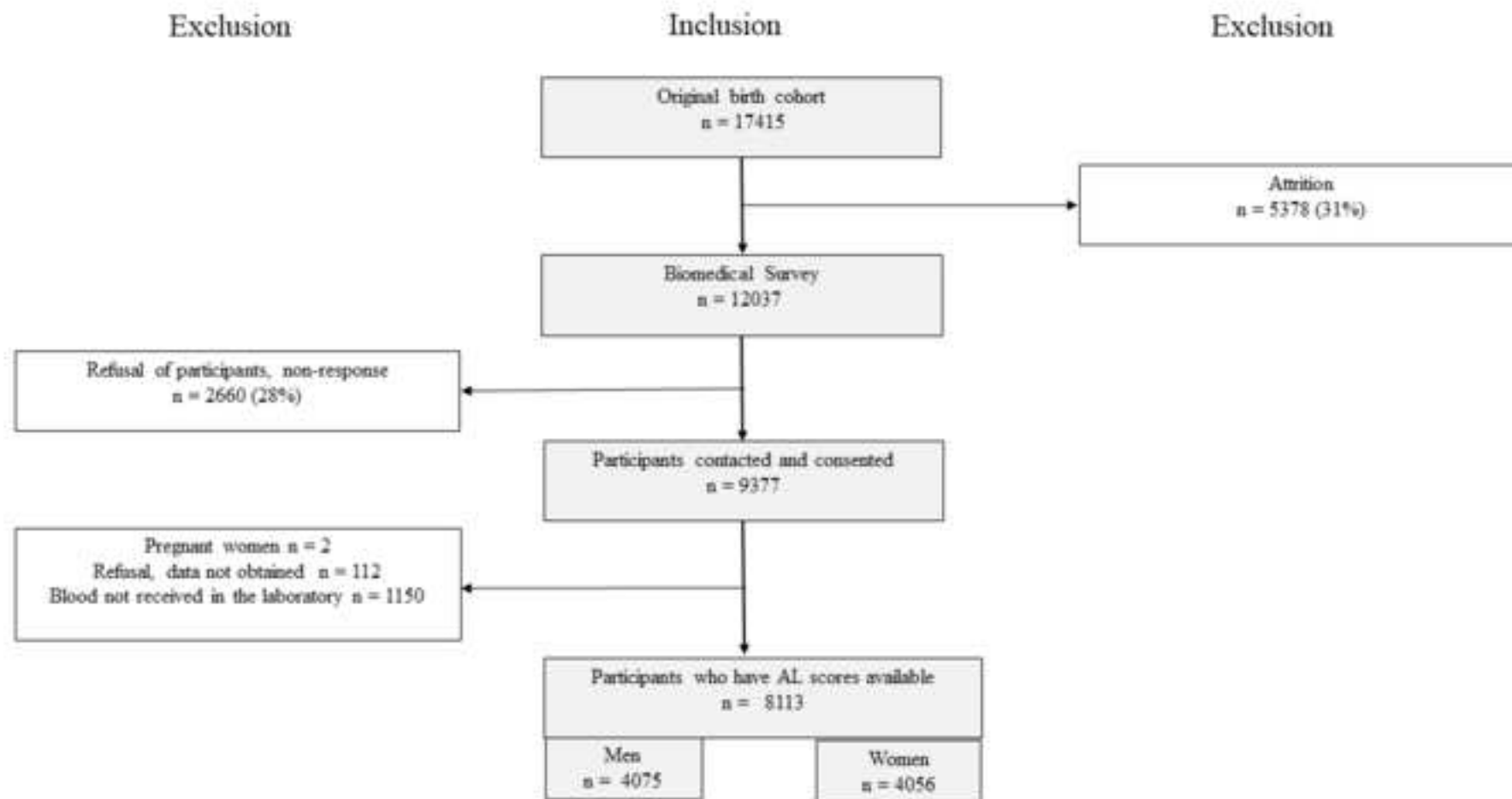


Figure 2: Direct and indirect effect results between PI and AL using data obtained from multiple imputation for men (n = 3,914)

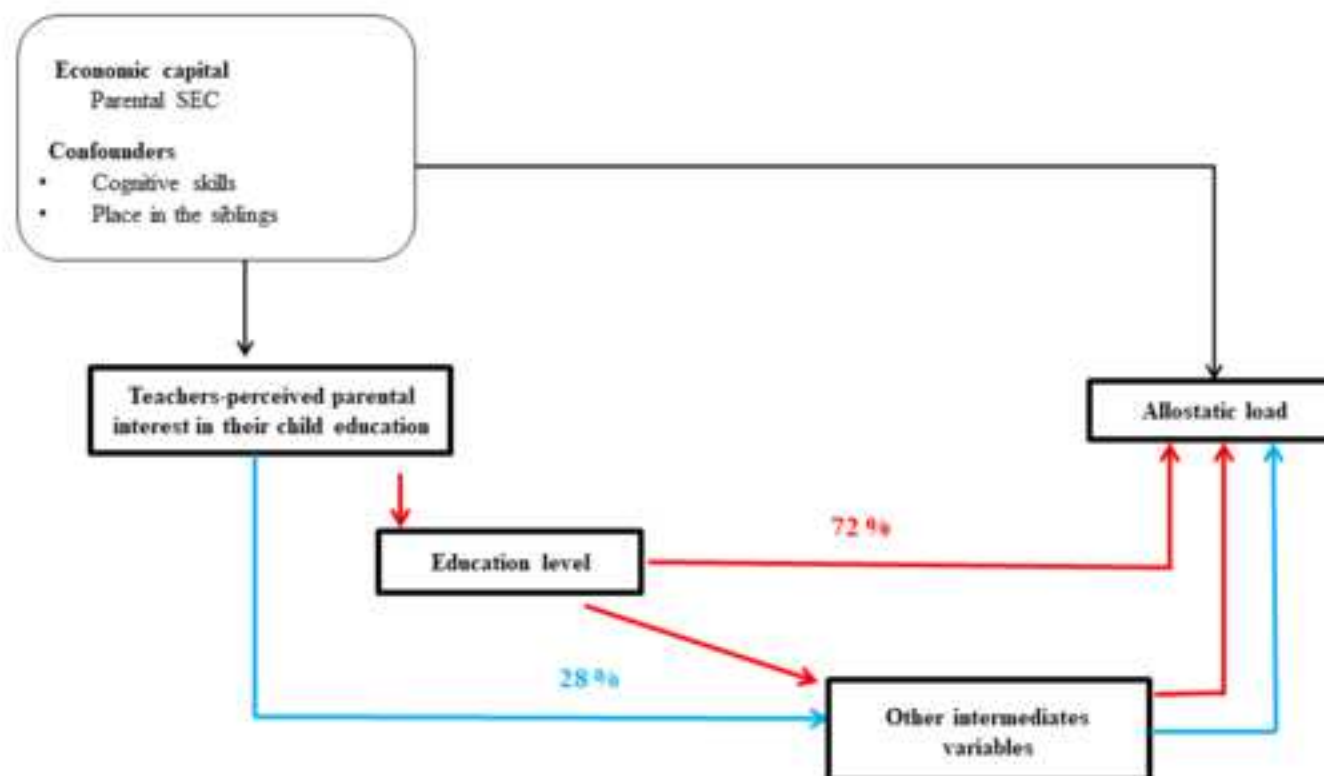
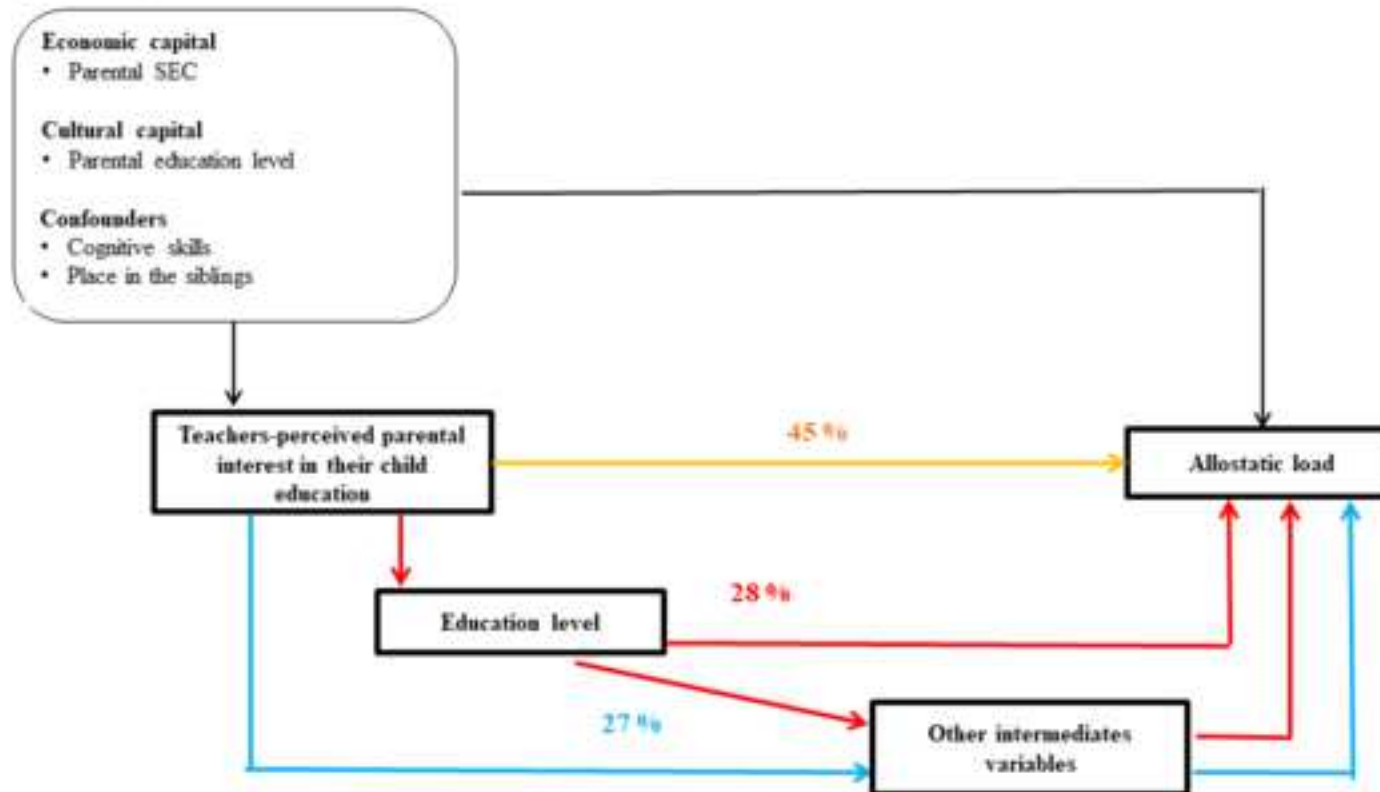



Figure 3: Direct and indirect effect results between PI and AL using data obtained from multiple imputation for women (n=3,936)

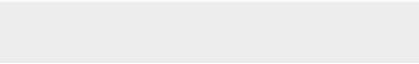






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