

## EDUCATIONAL EXPECTATIONS AND ADOLESCENT HEALTH BEHAVIOUR

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Educational Expectations and Adolescent Health Behaviour: An Evolutionary Approach

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9

Abstract

10 Objectives:

11 Previous research finds adolescents expecting to attend university are more likely to demonstrate health-  
12 promoting behaviour than those not expecting university attendance. This suggests public health improvements  
13 may be achievable by encouraging adolescents to adopt academic goals. We investigate confounders of this  
14 putative relationship, focusing on those identified by evolutionary theory.

15 Methods:

16 Multi-level logistic regression was used to analyse the 2010 Scottish Health Behaviour in School-aged Children  
17 survey ( $n=1,834$ ).

18 Results:

19 Adolescents anticipating university attendance exhibited higher levels of engagement in health-protective  
20 behaviours (fruit and vegetable consumption, exercise and tooth brushing) and were more likely to avoid health-  
21 damaging behaviours (crisps, soft drink and alcohol consumption, tobacco and cannabis use, fighting and  
22 intercourse). These relationships persisted when controlling indicators of life history trajectory (pubertal timing,  
23 socioeconomic status and father absence). Pupil-level: gender, age, perceived academic achievement and  
24 peer/family communication and school-level: university expectations, affluence, leavers' destinations, exam  
25 performance and school climate were also adjusted.

26 Conclusions:

27 Encouraging adolescents to consider an academic future may achieve public health benefits, despite social  
28 factors that might otherwise precipitate poor health via an accelerated life history trajectory.

29

30 Keywords: Temporal orientation, academic expectations, adolescent, health behaviour, risk behaviour, life  
31 history theory

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32 Educational expectations and adolescent health behaviour: an evolutionary approach

33 Introduction

34 In order to reduce the personal, societal and economic burden of non-communicable disease it is necessary to  
35 identify determinants of adolescent health- and risk-behaviours as adult behaviour emerges during this life stage  
36 (Due et al. 2011). Public health research focuses on socioeconomic status (Hanson and Chen 2007), gender  
37 (MacArthur et al. 2012), social relationships (Hamdan-Mansour et al. 2007), the school environment (West  
38 2006) and pubertal timing (van Jaarsveld et al. 2007) as underlying determinants of adolescent health- and risk-  
39 behaviours. Although these are unambiguously associated with health-related behaviour, they imply complex  
40 intervention designs, involving factors that are difficult or impossible to manipulate.

41

42 In the context of adolescents' scholastic expectations, evidence points to an approach which could be more  
43 amenable to intervention. Studies conducted in the USA find adolescents expecting to attend university are more  
44 likely to exercise and avoid fast food and cigarettes in young adulthood (McDade et al. 2011). Expectations of  
45 graduating from university are also negatively associated with sexual activity, weapon use and selling drugs  
46 (Harris et al. 2002). Norwegian adolescents' anticipated educational trajectory was associated with health-  
47 protective behaviours (Friestad and Klepp 2006). Finnish adolescents' risk-behaviour engagement was also  
48 negatively associated with the expectation of attending university (Vuori et al. 2012).

49

50 These findings may indicate that educational expectations, henceforth defined as anticipation of university  
51 attendance, influence adolescents' engagement in health-related behaviours. If this is the case, improvements in  
52 public health could be achievable by encouraging adolescents to pursue academic success. It is necessary to  
53 consider possible confounders of this relationship. Investigating this association is also valuable for  
54 understanding the aetiology of socioeconomic inequalities in health (Madarasova-Geckova et al. 2010).

55

56 Previous research in this area supports the argument that educational expectations are important in their own  
57 right after controlling several factors that could otherwise explain this relationship, including socioeconomic  
58 status, family and neighbourhood characteristics, ethnicity and cognitive ability. There remain, however,  
59 significant knowledge gaps which cloud understanding of health inequalities and limit confidence in applying  
60 this model in an intervention setting. Public health researchers have rarely utilised the powerful explanatory  
61 framework offered by evolutionary theory, yet it has much to offer this field (Ellis et al. 2012). As outlined

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62 below, this may include explanation of the association between educational expectations and health-related  
63 behaviour.

64

65 Life History Theory applies evolutionary theory to explain variation in the timing of lifetime reproductive effort  
66 (Chisholm et al. 1993). It considers time and energy as fundamental, but finite resources which necessitate a  
67 trade-off between short-term expenditure and investment in the future. The theory predicts that variation in  
68 behavioural and physiological traits relevant to the timing and frequency of reproduction reflects an evolved  
69 ability to adapt to ecological conditions. In the presence of factors which increase the likelihood of investment  
70 in the future being wasted (such as high mortality, morbidity or resource insecurity), individuals benefit from  
71 prioritising shorter-term gains. Under such conditions, a 'fast' life history trajectory optimises lifetime genetic  
72 propagation by prioritising offspring quantity over quality. In humans' evolutionary past, this strategy would  
73 have increased the chances of offspring surviving to maturity. Conversely, under more stable conditions,  
74 individuals optimise lifetime genetic propagation by adopting a 'slow' life history strategy which delays  
75 maturation and conserves resources over time, ultimately maximising offspring quality.

76

77 Early puberty, a physiological consequence of a 'fast' life history trajectory, is associated with health-  
78 compromising behaviours and avoidance of health-protective activities (van Jaarsveld et al. 2007). From a  
79 theoretical point of view, this apparent disinvestment in health may reflect an adaptive response to perceived  
80 environmental adversity. The effort required for health-protective behaviours stands to be wasted under harsh or  
81 unpredictable circumstances (Nettle 2010). That is, investment in long-term health entails opportunity costs, for  
82 example, expending time and effort to exercise or prepare a healthy meal detracts from other activities that  
83 directly benefit immediate genetic propagation. A 'fast' life history strategy thus involves avoidance of such  
84 costs, and maximisation of shorter-term benefits, discounting long-term consequences. This includes, for  
85 instance, satisfying caloric rather than nutritional demands (van den Bos and de Ridder 2006), and activities  
86 which enhance social status and short-term mating opportunities (e.g., substance use; Tucker et al. 2011).

87

88 General orientation towards shorter-term payoff amongst those adopting a 'fast' life history trajectory thus  
89 optimises genetic benefits for these individuals (Kruger et al. 2008). Consequently, the life history strategy that  
90 one adopts is likely to affect a broad range of health-related behaviours. Many lifestyle choices require  
91 individuals to weigh short-term benefits against long-term health. For example, eating junk food can be regarded

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92 as beneficial in the short-term but costly in terms of long-term health, and the converse true of eating salad.  
93 Indeed, adverse socio-developmental conditions are positively associated with indices of orientation towards the  
94 present, and negatively with future orientation (e.g., Kruger et al. 2008). Temporal orientation is also broadly  
95 associated with engagement in health-related behaviour; those oriented towards the present are less likely to  
96 protect long-term health than those oriented towards the future (e.g., Adams and Nettle 2009).

97

98 Academic and career objectives are likely to be susceptible to individual differences in temporal orientation and  
99 life history trajectory. University attendance in particular is perceived by adolescents to have greater, but  
100 delayed payoffs relative to alternative career choices, for example seeking employment directly after school  
101 (Code et al. 2006). As is the case for health-protective behaviour, university expectations may be less likely  
102 amongst those adopting a ‘faster’ life history strategy as investment in academic achievement necessitates  
103 direction of finite lifetime resources away from activities more directly related to reproductive effort and short-  
104 term gain. Variation in life history trajectory, therefore, may explain an apparent association between  
105 adolescents’ academic expectations and health-related behaviour.

106

107 To our knowledge, only one previous study controlled for life history trajectory when examining links between  
108 academic expectations and health-related activities (Harris et al. 2002). This found an effect of anticipated  
109 graduation on boys’ sexual activity, weapon use and selling drugs after controlling for pubertal timing. This  
110 result implies that academic expectations may protect long-term health even amongst those predisposed towards  
111 shorter-term payoff. Whilst this is encouraging, theory and observational evidence suggest that a broader range  
112 of health-related behaviours could be affected by the individual’s life history trajectory. Existing research also  
113 focuses on changes in health-related behaviour across adolescence (Friestad and Klepp 2006; Harris et al. 2002;  
114 McDade et al. 2011). These longitudinal studies are critical in establishing the direction of causality between  
115 educational expectations and behaviour; however, the statistical models used adjust for prior engagement in the  
116 behaviours of interest. This does not allow for the possibility that these behaviours were already habitual when  
117 expectations are reported. Prior studies are, therefore, most applicable to behaviours emerging over the  
118 measured period, however many behaviours pertinent to long-term health are engaged in from preadolescence  
119 (Currie et al. 2012). Here, we aim to investigate how academic expectations in adolescence relate to health-  
120 related behaviours reported at the same time-point.

121

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122 Most previous work in this area has been conducted in the USA, where university attendance requires  
123 substantial financial investment. It is possible that educational expectations under alternative conditions will  
124 relate differently to health behaviour profiles. The academic landscape in Scotland is fundamentally different to  
125 that in the United States as the Scottish government funds pupils' initial higher education degree. Using data  
126 from the 2010 Scottish Health Behaviour in School-aged Children (HBSC) survey, we examine whether life  
127 history trajectory explains the association between Scottish pupils' academic expectations and health-related  
128 behaviour. We expect that adolescents anticipating university attendance, will, compared to those with  
129 alternative academic expectations, exhibit behavioural profiles which are more protective of future health.  
130 Pubertal timing is controlled as a physiological indicator of life history trajectory. Father absence and  
131 socioeconomic status are also controlled as factors which contribute to an individual's life history trajectory by  
132 influencing the perceived harshness and predictability of ecological conditions (Belsky et al. 1991; Chisholm et  
133 al. 1993; Nettle 2010).

134

### 135 Methods

#### 136 Participants

137 Existing cross-sectional data were used from the 2010 Scottish HBSC survey, a school-based survey of  
138 adolescents' health and wellbeing. Participants were recruited via stratified sampling of Scottish Schools, using  
139 whole classes as the sampling unit. Sampling was stratified proportionately by funding type (state or private)  
140 and education authority for state-funded schools. Indirect stratification for socioeconomic status was based on  
141 the proportion receiving free school meals. Participants self-completed questionnaires in early 2010. Ethical  
142 approval was granted by the Moray House School of Education Ethics Committee, University of Edinburgh.  
143 Consent was obtained at local authority, school, parent/guardian and student levels. Students were able to opt  
144 out from any questionnaire item and received no reimbursement. Seventy two percent of sampled classes  
145 participated and 87% of pupils in participating classes completed the survey. A nationally representative sample  
146 of 2,566 students in the fourth year of secondary school was achieved (mean age 15.5 SD  $\pm$  0.3) from 128  
147 schools (mean 20.0 students, SD  $\pm$  4.5).

148

#### 149 Student-level variables

150 In addition to the measures below, participants reported gender and year and month of birth.

151

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### 152 Post-school expectations

153 Participants reported their anticipated post-school destination: “University”, “Further Education College”,  
154 “Apprenticeship or Trade”, “Youth Training or Skill Seekers”, “Working”, “Unemployed” or “Don’t know”.  
155 Responses were recoded into a new binary variable – “University” versus all other responses. Analyses were  
156 repeated to investigate specificity of any observed effects by extending the definition of a long-term educational  
157 trajectory to also include “Further Education College”.

158

### 159 Pubertal development scale

160 The Pubertal Development Scale (PDS) includes five items: growth spurt, skin changes, and body hair (girls and  
161 boys), breast development and menstruation (girls only) and facial hair and voice deepening (boys only). Scores  
162 were computed by combining responses across items (Petersen et al. 1988). Higher scores reflect advanced  
163 pubertal development. All models including PDS were adjusted for students’ age.

164

### 165 Father absence

166 Students indicated whether their father lives “...where you live all or most of the time”. Those that did not  
167 report that their father lived with them were coded as father-absent.

168

### 169 Socioeconomic status

170 The Family Affluence Scale (FAS) (Currie et al. 2008) was computed using four indicators of material wealth:  
171 computer ownership, car ownership, family holidays and own bedroom. Items were combined producing  
172 affluence tertiles (Batista-Foguet et al. 2004). Separately, mother and father’s places of work and occupations  
173 were coded according to standard occupational classification (Office for National Statistics 1990). A binary  
174 classification was made reflecting whether either parent was employed in the highest two categories  
175 (“Professional etc.” and “Managerial and Technical” versus “Skilled”, “Partly-skilled” and “Unskilled”).

176

### 177 Perceived academic achievement

178 Self-perceived academic achievement relative to peers was measured with response options ranging from “Very  
179 good” to “Below average”.

180

### 181 Family and peer communication

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182 Ease of communication with family and friends was measured for “Mother”, “Father”, “Stepmother (or father’s  
183 partner)”, “Stepfather (or mother’s partner)”, “Friends of the same sex” and “Friends of the opposite sex”. A  
184 binary ‘mother communication’ variable was created by recoding the most positive response for Mother and  
185 Stepmother into “Very easy/easy” or “Difficult/Very difficult”. This variable was coded missing where  
186 participants responded that they did not have or see either. This process was used to create ‘father  
187 communication’ and ‘peer communication’ variables.

188

189 Diet

190 Consumption frequency was measured for “Fruit”, “Vegetables”, “Potato crisps”, and “Coke or other soft drinks  
191 that contain sugar”, with response options ranging from “Never” to “Every day, more than once”. Binary  
192 variables were created to reflect daily versus less than daily consumption.

193

194 Physical exercise

195 Duration of weekly leisure-time vigorous exercise was assessed with response options ranging from “None” to  
196 “7 hours or more”. A binary variable was created to reflect engagement in less than two, versus two or more  
197 hours of exercise per week.

198

199 Tooth brushing

200 Participants reported how often they brushed their teeth. Responses were coded to create a binary variable  
201 reflecting twice daily, versus less frequent brushing.

202

203 Alcohol consumption

204 Participants reported consumption frequency of seven types of alcoholic drink (beer, wine, spirits, alcopops,  
205 cider, fortified wine and other) with response options ranging from “Every day” to “Never”. Responses were  
206 recoded into a single binary variable to reflect at least weekly alcohol consumption.

207

208 Tobacco use

209 Participants were asked “Have you ever smoked tobacco? (At least one cigarette, cigar or pipe)”, with response  
210 options “Yes” and “No”.

211



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212 Cannabis use

213 Participants were asked “Have you ever taken cannabis in your life?”. Responses were recoded to reflect  
214 whether or not participants had used cannabis in their lifetime.

215

216 Fighting

217 Participants were asked how many physical fights they had in the past year. A binary variable was created  
218 reflecting engagement in no fights versus one or more.

219

220 Sexual intercourse

221 Participants reported if they had ever had sexual intercourse. Response options were “Yes” and “No”.

222

223 School-level variables

224 School-level socioeconomic profile

225 Student-level affluence was aggregated to reflect the proportion of students per school that fell within each FAS  
226 tertile. School-level data on free school meals (FSM) eligibility was obtained (Scottish Government 2009a).  
227 Missing data for two schools (31 students) was imputed with the mean proportion receiving FSM within their  
228 local authority. Schools were categorised into approximately equal tertiles reflecting FSM provision of less than  
229 10.5%, between 10.5% and 20.5% and over 20.5%. Based on their postcode, schools were assigned a ranking  
230 quintile within the 2009 Scottish Index of Multiple Deprivation (Scottish Government 2009b), a multi-  
231 dimensional index of local area deprivation.

232

233 School performance indicators

234 School-level data on national qualifications and leavers’ destinations were obtained (Education Scotland 2012).  
235 The percentage of each school’s fourth-year roll achieving five or more ‘Standard Grade’ awards at level four or  
236 better in 2010 was used to indicate school performance, as was the percentage of each school’s leavers in higher  
237 education after the 2010/11 school year.

238

239 School-level university expectation

240 Student-level responses were aggregated to reflect the proportion per school that expected to attend university.

241

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242 School climate

243 Students were asked “How do you feel about school at present?”, with response options ranging from “I like it a  
244 lot” to “I don’t like it at all”. Responses were aggregated to reflect the proportion of respondents that like school  
245 “a bit” or “a lot”. Participants responded to three statements on peer support, for example, “The students in my  
246 class(es) enjoy being together” and three statements on teacher support for example “I feel that my teachers  
247 accept me as I am”. Response options ranged from “Strongly agree” to “Strongly disagree”. Responses were  
248 summed to create separate peer- and teacher-support scores (range 0-12, higher scores reflect better support).  
249 Students were assigned the mean score per scale across all responding students at their school.

250

251 Statistical Analyses

252 Multi-level logistic regressions (STATA 13.1) were used to investigate associations between university  
253 expectations and health-behaviours. Student and school were entered as separate analysis levels. Two models  
254 were applied separately to each health-behaviour variable. Model 1 examined bivariate relationships between  
255 students’ university expectations and health-related behaviour. Model 2 controlled for family affluence, pubertal  
256 development, age and father absence. Additional factors were controlled in Model 2, including student-level:  
257 gender, perceived academic success and family and peer relationships, and school-level: family affluence, exam  
258 performance, university expectation, leavers’ destination and climate, all of which are feasibly associated both  
259 with individuals’ likelihood of attending university (Beavis 2005; Christofides et al. 2008; Fitz-Gibbon 1996;  
260 Ryan 2000; Topor et al. 2010) and engagement in behaviours relevant to health (Denny et al. 2011; Hamdan-  
261 Mansour et al. 2007; MacArthur et al. 2012; West 2006).

262

263 Results

264 Main analysis was conducted amongst those for whom data was available on all student- and school-level  
265 control variables. Missing data were more likely amongst females ( $\chi^2(1)=7.6, p=0.006$ ) and lower FAS tertiles  
266 ( $\chi^2(2)=18.9, p<0.001$ ). School data was unavailable for three state schools (46 students) and all six independent  
267 schools (98 students). A main sample of 1,834 (71.5%) participants remained from 113 Scottish secondary  
268 schools (mean 16.2 students per school,  $SD \pm 4.2$ ). The number available for individual behaviours differed  
269 slightly due to missing responses on these outcome variables (see Table 2).

270

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271 Approximately half of this sample (53.5%) expected to attend university, with 46.5% either reporting “Don’t  
272 know” (10.3%) or expecting another destination. Table 1 summarises student-level control variables and  
273 demography. Expected university attendance was higher among females ( $\chi^2(1)=31.4, p<0.001$ ), students from  
274 high affluence families ( $\chi^2(2)=39.9, p<0.001$ ), father-present students ( $\chi^2(1)=16.9, p<0.001$ ), students perceiving  
275 higher academic performance ( $\chi^2(3)=226.2, p<0.001$ ) and those further in pubertal development ( $t(1832)=2.54,$   
276  $p=0.011$ ). No association was seen between university expectation and age or communication with mother,  
277 father or friends (all  $p\geq 0.241$ ). Online Resource ESM.1 presents associations with school-level variables.

278  
279 University expectations were positively associated with the four health-protective behaviours and negatively  
280 associated with the seven health-compromising behaviours (Table 2; all  $\chi^2>9.6, p<0.002$ ). Table 3 summarises  
281 multi-level logistic regression models for each behaviour. Online Resources ESM.2-12 present full model  
282 information. The association between university expectation and each behaviour remained when adjusting for  
283 clustering of students within school (Model 1; all  $p\leq 0.005$ ). The effect of university expectation also remained  
284 for all behaviours (all  $p\leq 0.001$ ) when Model 1 was repeated using all available participants.

285  
286 In Model 2, advanced pubertal development was predominantly associated with students’ engagement in health-  
287 compromising behaviours (alcohol consumption,  $p=0.015$ ; smoking,  $p<0.001$ ; cannabis use,  $p=0.001$ ;  
288 intercourse,  $p<0.001$ ; also tooth brushing,  $p=.048$ ), rather than avoidance of health-protective behaviours  
289 ( $p\geq 0.086$  for all other behaviours). A similar pattern was seen for father absence (alcohol consumption,  $p=0.011$ ;  
290 smoking,  $p<0.001$ ; cannabis use,  $p<0.001$ ; fighting,  $p=0.003$ ; intercourse,  $p<0.001$ ; vegetable consumption,  
291  $p=0.016$ ; other behaviours  $p\geq 0.102$ ). Family affluence was only predictive of engagement in exercise (low  
292 versus high,  $p<0.001$ ), alcohol consumption (low versus high,  $p=0.012$ ) and fighting (medium versus high,  
293  $p=0.048$ ). Controlling for these effects (in addition to age, gender, perceived academic success and  
294 communication with family and friends, and school-level: family affluence, exam performance, university  
295 expectations, leaver’s destination and school climate), an effect of students’ university expectation remained on  
296 all assessed behaviours (all  $p\leq 0.044$ ). This was also the case for all but three behaviours (exercise, tooth  
297 brushing and crisps consumption) when replacing family affluence with parental occupation classification (all  
298  $p\leq 0.004$ ; information was available to categorise mother or father’s occupation for 87.1%). Two further  
299 repetitions of Model 2 replaced school-level family affluence with free-school meals provision tertile or school  
300 area deprivation rank quintile. The effect of university expectation remained for all behaviours assessed in these

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301 models (all  $p \leq 0.048$  and  $p \leq 0.047$  respectively). Likelihood ratio tests revealed that post-hoc removal of non-  
302 predictive variables from Model 2 did not affect model fit (all  $p \geq 0.160$ ) except for sugary drink consumption  
303 ( $\chi^2(19)=65.3, p < 0.001$ ).

304  
305 Further repetitions of Models 1 and 2 extended the definition of a long-term educational trajectory to also  
306 include further education college. Of 1,834 participants, 75.0% expected to attend either university or further  
307 education college. This alternative categorisation yielded an effect for most behaviours (all  $p \leq 0.022$ ), except for  
308 exercise (Model 1  $p=0.268$ , Model 2  $p=0.470$ ), crisps consumption (Model 1  $p=0.059$ , Model 2  $p=0.116$ ) and  
309 fighting (non-significant only in Model 2  $p=0.102$ ).

310  
311 After Bonferroni correction (2 models  $\times$  11 behaviours), the effect of university expectation in Model 1  
312 remained for all behaviours except crisps consumption. Effects of university expectation remained in Model 2  
313 for all behaviours except exercise, tooth brushing and crisps consumption.

314

315 Discussion

316 The 2010 Scottish HBSC survey was analysed to investigate an apparent association between adolescents'  
317 academic expectations and engagement in health-related behaviours. We examined whether differences in life  
318 history trajectory explain why adolescents harbouring long-term academic goals tend to also protect their  
319 health.. Whilst accelerated pubertal development is a physiological correlate of a 'fast' life history trajectory, it  
320 was not found to be associated with shorter-term educational expectations. Rather, a small opposing relationship  
321 was found; earlier pubertal development was associated with higher expectations of university attendance. This  
322 may reflect an effect of psychosocial maturity (Steinberg et al. 1989). Father absence and socioeconomic status,  
323 however, as *contextual* factors important in establishing the pace of one's life history trajectory (Belsky et al.  
324 1991; Chisholm et al. 1993; Nettle 2010), were associated with expected university attendance in the direction  
325 predicted by a life history framework. Adolescents living with their father or from more affluent families were  
326 more likely to expect university attendance. These discrepant findings could suggest a role of behavioural  
327 plasticity in a life history context and highlight the potential for positive intervention in the adolescent period.  
328 The questions asked of students on family structure and socioeconomic status elicit information on *current*  
329 contextual conditions. However, the measure of pubertal development relates to an independent process started  
330 during early development when potentially different contextual conditions established the pace of physical

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331 maturation (Rickard et al. 2014). In evolutionary terms, it would remain advantageous for individuals to adapt  
332 any cognitive aspects of life history trajectory to current ecological conditions even if the pace of physiological  
333 development were fixed by early conditions.. Our findings suggest that temporal orientation, as a mechanism  
334 likely to provide the cognitive architecture for achieving such flexibility (Kruger et al. 2008), is particularly  
335 sensitive to information about one's *current* circumstances.

336

337 Contingent with previous findings (Friestad and Klepp 2006; Harris et al. 2002; McDade et al. 2011; Vuori et al.  
338 2012), the main analysis here finds that students' expectation of attending university was associated with  
339 increased prevalence of four health-protective behaviours and decreased prevalence of seven health-  
340 compromising behaviours. These relationships remained when controlling pubertal timing, socioeconomic status  
341 and father absence as factors linked to life history trajectory. In light of the evolutionary framework outlined  
342 above, this may indicate that factors intrinsic to the individual may contribute to the perceived harshness or  
343 predictability of one's circumstances (and hence the tendency to invest in long-term health). In this respect,  
344 expected university attendance is likely to be particularly important, due to a robust and visible association with  
345 long-term health and economic prosperity (Kaplan and Keil 1993; Walker and Zhu 2013). We speculate that  
346 because of the visibility and perceived reliability of these associations anticipating university attendance may  
347 maintain long-term health by instilling optimism and a sense of controllability over one's destiny, despite  
348 current conditions. That is, choosing a future in education may provide a reason to invest finite lifetime  
349 resources in long-term health (rather than expending them for short-term gains), as it is viewed as a means by  
350 which an individual can escape harsh and unpredictable socio-environmental conditions and concomitant health  
351 issues.

352

353 Our findings re-emphasise the importance of adolescence as a critical life stage for public health outcomes and  
354 suggest that interventions which motivate adolescents to form long-term academic goals (e.g., Children's  
355 Parliament, 2014) may achieve broad improvements in health-related behaviour. An advantage of this approach  
356 is that it avoids explicit communication about particular health-behaviours, circumventing potential habituation  
357 to, or active rejection of, direct health messages. Longitudinal evaluation of such methodologies will determine  
358 their effect on health-related behaviour over time.

359

360

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361 Limitations of this study include its cross-sectional design, which restricts causal inferences. Previous studies  
362 (Friestad and Klepp 2006; Harris et al. 2002; McDade et al. 2011), however, find that academic expectations  
363 precede the initiation of protective behaviour, implying that future orientation is not a consequence of  
364 engagement in healthy behaviour. Whilst extending the indicator of academic expectations did not substantively  
365 alter results, the simple dichotomous nature of these indicators necessitates investigation with more sensitive  
366 instruments. For instance, it will be informative to investigate the extent to which an index of temporal  
367 orientation mediates the relationship between university expectations and later health-related behaviour.  
368 Adjusting for parental occupation and school-level factors strengthens the argument that students' own  
369 academic expectations remain important, but future work which considers the valence and motivational value of  
370 individual's attitude towards specific goals may assist intervention design. Further, the main analysis was  
371 conducted amongst those for whom there was no missing data. Although this means these analyses slightly over  
372 represent males and more affluent students, post-hoc analyses amongst all available participants showed similar  
373 results. Further work will allow further generalisation of these findings to different cultures and age groups  
374 (especially younger children, given the developmental importance of middle childhood; Del Giudice, 2014).

375

376 These results further support the notion that academic expectations are protective of future health, even when  
377 contextual factors beyond the individual's control predispose them otherwise via an accelerated life history  
378 trajectory. There is potentially scope to employ these findings in behavioural intervention programmes.

379 However, further work is required to establish the generalisability of these effects.

380

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