



Educational expectations and adolescent health behaviour: an evolutionary approach

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Abstract

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

Methods Multi-level logistic regression was used to analyse the 2010 Scottish Health Behaviour in School-aged Children survey ($n = 1834$).

Results Adolescents anticipating university attendance exhibited higher levels of engagement in health-protective behaviours (fruit and vegetable consumption, exercise and tooth brushing) and were more likely to avoid health-damaging behaviours (crisps, soft drink and alcohol consumption, tobacco and cannabis use, fighting and intercourse). These relationships persisted when controlling indicators of life history trajectory (pubertal timing,

socioeconomic status and father absence). Pupil level: gender, age, perceived academic achievement and peer-/family communication and school level: university expectations, affluence, leavers' destinations, exam performance and school climate were also adjusted.

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

Keywords Temporal orientation · Academic expectations · Adolescent · Health behaviour · Risk behaviour · Life history theory

Introduction

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

In the context of adolescents' scholastic expectations, evidence points to an approach which could be more amenable to intervention. Studies conducted in the USA find adolescents expecting to attend university are more likely to exercise and avoid fast food and cigarettes in

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young adulthood (McDade et al. 2011). Expectations of graduating from university are also negatively associated with sexual activity, weapon use and selling drugs (Harris et al. 2002). Norwegian adolescents' anticipated educational trajectory was associated with health-protective behaviours (Friestad and Klepp 2006). Finnish adolescents' risk-behaviour engagement was also negatively associated with the expectation of attending university (Vuori et al. 2012).

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

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

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

maturation and conserves resources over time, ultimately maximising offspring quality.

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

General orientation towards shorter term payoff amongst those adopting a 'fast' life history trajectory thus optimises genetic benefits for these individuals (Kruger et al. 2008). Consequently, the life history strategy that one adopts is likely to affect a broad range of health-related behaviours. Many lifestyle choices require individuals to weigh short-term benefits against long-term health. For example, eating junk food can be regarded as beneficial in the short-term but costly in terms of long-term health, and the converse true of eating salad. Indeed, adverse socio-developmental conditions are positively associated with indices of orientation towards the present, and negatively with future orientation (e.g. Kruger et al. 2008). Temporal orientation is also broadly associated with engagement in health-related behaviour; those oriented towards the present are less likely to protect long-term health than those oriented towards the future (e.g. Adams and Nettle 2009).

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

association between adolescents' academic expectations and health-related behaviour.

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

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

Methods

Participants

Existing cross-sectional data were used from the 2010 Scottish HBSC survey, a school-based survey of adolescents' health and well-being. Participants were recruited via stratified sampling of Scottish Schools, using whole classes as the sampling unit. Sampling was stratified proportionately by funding type (state or private) and education authority for state-funded schools. Indirect stratification for socioeconomic status was based on the proportion receiving free school meals. Participants self-completed questionnaires in early 2010. Ethical approval was granted by the Moray House School of Education Ethics Committee, University of Edinburgh. Consent was obtained at local authority, school, parent/guardian and student levels. Students were able to opt out from any questionnaire item and received no reimbursement. Seventy two percent of sampled classes participated and 87 % of pupils in participating classes completed the survey. A nationally representative sample of 2566 students in the fourth year of secondary school was achieved (mean age 15.5, SD ± 0.3) from 128 schools (mean 20.0 students, SD ± 4.5).

Student-level variables

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

Post-school expectations

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

Pubertal development scale

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

Father absence

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

Socioeconomic status

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

Perceived academic achievement

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

Family and peer communication

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

Diet

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

Physical exercise

Duration of weekly leisure-time vigorous exercise was assessed with response options ranging from "None" to

"7 h or more". A binary variable was created to reflect engagement in less than two, versus two or more hours of exercise per week.

Tooth brushing

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

Alcohol consumption

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

Tobacco use

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

Cannabis use

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

Fighting

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

Sexual intercourse

Participants reported if they had ever had sexual intercourse. Response options were "Yes" and "No".

School-level variables

School-level socioeconomic profile

Student-level affluence was aggregated to reflect the proportion of students per school that fell within each FAS tertile. School-level data on free school meals (FSM) eligibility were obtained (Scottish Government 2009a). Missing data for two schools (31 students) were imputed with the mean proportion receiving FSM within their local authority. Schools were categorised into approximately

equal tertiles reflecting FSM provision of less than 10.5 %, between 10.5 and 20.5 % and over 20.5 %. Based on their postcode, schools were assigned a ranking quintile within the 2009 Scottish Index of Multiple Deprivation (Scottish Government 2009b), a multi-dimensional index of local area deprivation.

School performance indicators

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

School-level university expectation

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

School climate

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

Statistical analyses

Multi-level logistic regressions (STATA 13.1) were used to investigate associations between university expectations and health behaviours. Student and school were entered as separate analysis levels. Two models were applied separately to each health behaviour variable. Model 1 examined bivariate relationships between students' university expectations and health-related behaviour. Model 2 controlled for family affluence, pubertal development, age and father absence. Additional factors were controlled in Model 2, including student level: gender, perceived academic success and family and peer relationships, and school level: family affluence, exam performance, university

expectation, leavers' destination and climate, all of which are feasibly associated both with individuals' likelihood of attending university (Beavis 2005; Christofides et al. 2008; Fitz-Gibbon 1996; Ryan 2000; Topor et al. 2010) and engagement in behaviours relevant to health (Denny et al. 2011; Hamdan-Mansour et al. 2007; MacArthur et al. 2012; West 2006).

Results

Main analysis was conducted amongst those for whom data were available on all student- and school-level control variables. Missing data were more likely amongst females ($\chi^2(1) = 7.6$, $p = 0.006$) and lower FAS tertiles ($\chi^2(2) = 18.9$, $p < 0.001$). School data were unavailable for three state schools (46 students) and all six independent schools (98 students). A main sample of 1834 (71.5 %) participants remained from 113 Scottish secondary schools (mean 16.2 students per school, SD ± 4.2). The number available for individual behaviours differed slightly due to missing responses on these outcome variables (see Table 2).

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

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

In Model 2, advanced pubertal development was predominantly associated with students' engagement in health-compromising behaviours (alcohol consumption, $p = 0.015$; smoking, $p < 0.001$; cannabis use, $p = 0.001$;

Table 1 Descriptive statistics for demographic and pupil-level control variables and bivariate associations with expected university attendance in a 2010 sample of Scottish school children

	<i>N</i> (%)	% Expecting university attendance
Total	1834 (100)	53.5
Gender***		
Female	922 (50.3)	60.0
Male	912 (49.7)	46.9
Family affluence***		
High	711 (38.8)	61.7
Medium	537 (29.3)	52.7
Low	586 (32.0)	44.2
Father absence***		
Father present	1374 (74.9)	56.3
Father absent	460 (25.1)	45.2
Perceived academic achievement***		
Very good	389 (21.2)	79.7
Good	818 (44.6)	56.7
Average	541 (29.5)	35.5
Below average	86 (4.7)	17.4
Mother communication		
Very easy/easy	1363 (74.3)	54.3
Difficult/very difficult	471 (25.7)	51.7
Father communication		
Very easy/easy	1013 (55.2)	54.4
Difficult/very difficult	821 (44.8)	52.4
Peer communication		
Very easy/easy	1687 (92.0)	53.7
Difficult/very difficult	147 (8.0)	51.2
	Mean (\pm SD)	
Age (years)	15.5 (0.3)	
Expecting university attendance	15.6 (0.3)	
Not expecting university attendance	15.5 (0.3)	
Pubertal Development Scale*	3.2 (0.5)	
Expecting university attendance	3.2 (0.4)	
Not expecting university attendance	3.2 (0.5)	

Associations between categorical and continuous variables and expected university attendance were determined by χ^2 and *t* tests, respectively

*** $p < 0.001$, ** $p < 0.005$, * $p < 0.050$

intercourse, $p < 0.001$; also tooth brushing, $p = 0.048$), rather than avoidance of health-protective behaviours ($p \geq 0.086$ for all other behaviours). A similar pattern was seen for father absence (alcohol consumption, $p = 0.011$; smoking, $p < 0.001$; cannabis use, $p < 0.001$; fighting, $p = 0.003$; intercourse, $p < 0.001$; vegetable consumption, $p = 0.016$; other behaviours $p \geq 0.102$). Family affluence

Table 2 Descriptive statistics for binary health-related behaviour variables and bivariate associations with expected university attendance in a 2010 sample of Scottish school children

	<i>N</i> (%)	% Expecting university attendance
Daily fruit ($N = 1828$)***		
Yes	549 (30.0)	67.0
No	1279 (70.0)	47.9
Daily vegetables ($N = 1827$)***		
Yes	616 (33.7)	64.5
No	1211 (66.3)	48.1
2+ hours exercise per week ($N = 1805$)***		
Yes	1088 (60.3)	57.6
No	717 (39.7)	47.6
Twice daily tooth brushing ($N = 1827$)***		
Yes	1347 (73.7)	57.2
No	480 (26.3)	43.1
Daily crisps ($N = 1806$)**		
Yes	382 (21.2)	46.6
No	1424 (78.9)	55.5
Daily coke/sugary drinks ($N = 1830$)***		
Yes	470 (25.7)	38.5
No	1360 (74.3)	58.8
Weekly alcohol ($N = 1736$)***		
Yes	459 (26.4)	37.5
No	1277 (73.6)	59.6
Ever smoked tobacco ($N = 1831$)***		
Yes	717 (39.2)	40.6
No	1114 (60.8)	61.7
Ever smoked cannabis ($N = 1821$)***		
Yes	337 (18.5)	37.4
No	1484 (81.5)	57.4
One or more physical fights ($N = 1792$)***		
Yes	536 (29.9)	40.5
No	1256 (70.1)	59.2
Sexual intercourse ($N = 1806$)***		
Yes	560 (31.0)	38.8
No	1246 (69.0)	60.4

Associations with pupil level expected university attendance were determined by χ^2 test

*** $p < 0.001$, ** $p < 0.005$

was only predictive of engagement in exercise (low versus high, $p < 0.001$), alcohol consumption (low versus high, $p = 0.012$) and fighting (medium versus high, $p = 0.048$). Controlling for these effects (in addition to age, gender, perceived academic success and communication with family and friends, and school level: family affluence, exam performance, university expectations, leaver's

Table 3 Odds ratios (95 % CI) showing the effect of university expectation (reference = alternative expectation) on engagement in health-related behaviours in a 2010 sample of Scottish school children

	Model 1 ^a	Model 2 ^b
Daily fruit (<i>N</i> = 1828)	2.22 (1.79, 2.76)***	1.69 (1.33, 2.15)***
Daily vegetables (<i>N</i> = 1827)	1.97 (1.61, 2.43)***	1.50 (1.19, 1.89)**
2+ hours exercise per week (<i>N</i> = 1805)	1.48 (1.22, 1.80)***	1.31 (1.05, 1.64)*
Twice daily tooth brushing (<i>N</i> = 1827)	1.75 (1.41, 2.17)***	1.34 (1.05, 1.72)*
Daily crisps (<i>N</i> = 1806)	0.72 (0.57, 0.91)*	0.76 (0.59, 0.99)*
Daily coke/sugary drinks (<i>N</i> = 1830)	0.45 (0.36, 0.56)***	0.59 (0.46, 0.76)***
Weekly alcohol (<i>N</i> = 1736)	0.41 (0.32, 0.51)***	0.52 (0.40, 0.67)***
Ever smoked tobacco (<i>N</i> = 1831)	0.42 (0.34, 0.51)***	0.49 (0.39, 0.62)***
Ever smoked cannabis (<i>N</i> = 1821)	0.43 (0.33, 0.55)***	0.56 (0.42, 0.75)***
One or more fights (<i>N</i> = 1792)	0.46 (0.37, 0.57)***	0.62 (0.48, 0.79)***
Had sexual intercourse (<i>N</i> = 1806)	0.42 (0.34, 0.52)***	0.51 (0.40, 0.65)***

*** $p < 0.001$, ** $p < 0.005$, * $p < 0.050$

^a Model 1 examines bivariate relationship between university expectation and health-related behaviours

^b Model 2 adds controls for pupil level: pubertal development, age, father absence, family affluence, gender, perceived academic success and communication with family and friends. Model 2 also controls for school level: family affluence, exam performance, university expectations, leaver's destination and school climate. Full model details are available as appendices

destination and school climate), an effect of students' university expectation remained on all assessed behaviours (all $p \leq 0.044$). This was also the case for all but three behaviours (exercise, tooth brushing and crisps consumption) when replacing family affluence with parental occupation classification (all $p \leq 0.004$; information was available to categorise mother or father's occupation for 87.1 %). Two further repetitions of Model 2 replaced school-level family affluence with free school meals provision tertile or school area deprivation rank quintile. The effect of university expectation remained for all behaviours assessed in these models (all $p \leq 0.048$ and $p \leq 0.047$, respectively). Likelihood ratio tests revealed that post hoc removal of non-predictive variables from Model 2 did not affect model fit (all $p \geq 0.160$) except for sugary drink consumption ($\chi^2(19) = 65.3$, $p < 0.001$).

Further repetitions of Models 1 and 2 extended the definition of a long-term educational trajectory to also include further education college. Of 1834 participants, 75.0 % expected to attend either university or further education college. This alternative categorisation yielded an effect for most behaviours (all $p \leq 0.022$), except for exercise (Model 1 $p = 0.268$, Model 2 $p = 0.470$), crisps consumption (Model 1 $p = 0.059$, Model 2 $p = 0.116$) and fighting (non-significant only in Model 2 $p = 0.102$).

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

Discussion

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

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

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

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

Limitations of this study include its cross-sectional design, which restricts causal inferences. Previous studies (Friestad and Klepp 2006; Harris et al. 2002; McDade et al. 2011), however, find that academic expectations precede the initiation of protective behaviour, implying that future orientation is not a consequence of engagement in healthy

behaviour. Whilst extending the indicator of academic expectations did not substantively alter results, the simple dichotomous nature of these indicators necessitates investigation with more sensitive instruments. For instance, it will be informative to investigate the extent to which an index of temporal orientation mediates the relationship between university expectations and later health-related behaviour. Adjusting for parental occupation and school-level factors strengthens the argument that students' own academic expectations remain important, but future work which considers the valence and motivational value of individual's attitude towards specific goals may assist intervention design. Further, the main analysis was conducted amongst those for whom there was no missing data. Although this means these analyses slightly overrepresent males and more affluent students, post hoc analyses amongst all available participants showed similar results. Further work will allow further generalisation of these findings to different cultures and age groups (especially younger children, given the developmental importance of middle childhood; Del Giudice 2014).

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

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