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How adolescent health influences education and employment: investigating longitudinal associations and mechanisms

Daniel R Hale,[1] Russell M Viner[2]

[1]Department of Psychology, Heriot-Watt University, Edinburgh, UK
[2]UCL Institute of Child Health, London, UK

Correspondence to
Dr Daniel R Hale, Heriot-Watt University, Edinburgh EH14 4AS, UK; d.hale@hw.ac.uk

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ABSTRACT

Background Education is recognised as a strong determinant of health. Yet there is increasing concern that health in adolescence may also influence educational attainments and future life chances. We examined associations between health in early adolescence and subsequent academic and employment outcomes, exploring potential mediators of these relationships to inform intervention strategies.

Methods We used data from the Longitudinal Study of Young People in England. Adolescent health was measured at waves 1 and 2. Outcomes included educational attainment at age 16 years and being NEET (not in education, employment or training) at age 19 years. Associations were adjusted for ethnicity, area-level deprivation and early adolescent academic attainment. Where significant associations were identified, we examined the role of hypothesised mediators including attendance and truancy, classroom behaviour, substance use and psychological distress.

Results Health conditions in early adolescence predicted poor subsequent education and employment outcomes (ORs ranged from 1.25 to 1.72) with the exception of long-term chronic conditions and NEET status, which were unassociated. The most consistent mediating variable was social exclusion. School behaviour, truancy and substance use were significant mediators for mental health. Long-term absences mediated associations between mental health and physical health and later outcomes.

Conclusions Health is a key component of academic and vocational achievement. Investment in health is a way of improving life chances. The identification of key mediators such as social exclusion and truancy indicate areas where screening for health conditions and provision of targeted support could improve educational, employment and health outcomes.

INTRODUCTION

Education in childhood and adolescence is increasingly recognised as a powerful social determinant of health across the life course.[1] There are high health and economic burdens associated with finishing compulsory schooling without proceeding to work or further education, the so-called NEET (not in education, employment or training) status.[2] Exploration of risk factors for NEET and its subsequent health burdens to identify preventive strategies have focused on socioeconomic and educational factors.[3] Health problems have been explored as outcomes of being NEET, or once established, as factors that act to maintain disengagement.[4 5]

Evidence regarding a reverse relationship, with poor health leading to poor attainments and disconnection from the workforce, is less common. It is well established that serious illness in childhood can result in impaired educational and employment outcomes.[6] A recent systematic review[7] suggests that poor health in adolescence is equally deleterious for social outcomes. In particular, there is clear evidence that various mental health conditions in adolescence are associated with poor educational outcomes and unemployment. The evidence base regarding physical health is comparatively undeveloped.

These emerging findings indicate that health may be a key contributor to success in education and work. However, the impact of health and well-being in the wider school-age population on education and life chances requires further study, given that approximately 20% of adolescents suffer a mental health problem during a given year[8] and that approximately one in seven have some form of long-term condition (LTC) in adolescence.[9] In particular, evidence regarding the contribution of health to academic performance (as opposed to educational outcomes such as school non-completion or postsecondary education) and the role of physical health is required to contribute to emerging arguments regarding the role of schools in health promotion.[10]

Health interventions to promote academic attainment and employment also require greater understanding of the mechanisms by which poor health disrupts education and employment pathways. An intuitive causal contributor is school attendance with clear findings that poor health is associated with reduced attendance.[11] However, a number of other factors associated with poor health have themselves been associated with poor social outcomes including poor classroom conduct and substance use,[12] low aspirations or social exclusion,[13] and psychological distress relating to illness.[14] Given the complete absence of evidence regarding causal mechanisms of poor health on social outcomes, exploratory work informed by existing evidence regarding education and employment-related proximal outcomes of poor health in adolescence is warranted.

This paper aims to examine the impact of health in early adolescence on educational attainment and NEET status at the end of secondary education in a large contemporary nationally representative longitudinal study. We hypothesised that low adolescent

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physical, mental and general health would predict low educational attainment and NEET status. We also undertook exploratory analyses based on mediation pathways suggested within the literature to examine how health contributes to poor outcomes.

METHODS

We used data from the Longitudinal Study of Young People in England (LSYPE), a nationally representative study that surveyed young English people from 892 schools annually from 2004 when respondents were approximately 13 years old (n=15 770) to 2011 when respondents were aged 19 years (n=8682). We refer to annual collection points by the age of the respondent. The initial response rate was 74% with annual dropout rates ranging from 8% to 14%. Detailed methodology has been published by the Department of Education.[15]

Health in early adolescence: We included measures of two domains of health from early adolescence. LTCs were assessed at age 13 years. Mental health measures were unavailable at age 13 years and were assessed at age 14 years.

1. LTCs were assessed based on parent-reported presence of physical or mental illness, disability, learning difficulty, abnormality of behaviour or infirmity.
2. Mental health was assessed with the General Health Questionnaire (GHQ-12), a 12-item scale including measures of self-worth, self-confidence and enjoyment of day-to-day activities. A score of 4 or more was considered indicative of psychological distress.[16]

Outcome variables: Educational attainment was based on respondents' performance on coursework for the General Certificate of Secondary Education (GCSE). GCSEs are taken when students are aged 16 years and usually include English, mathematics and science classes, with a full course-load incorporating 10 subjects. School and academic data were available on the cohort through linkage to the National Pupil Database which holds data regarding educational attainment for all state school pupils in England. We used the level 2 threshold, a standard measure of academic success at GCSE level as a marker of educational attainment. This requires at least five GCSE results at grade C or higher. This threshold has been used extensively both within the education system as well as in research.[17 18]

Employment status was based on the respondent's current main economic activity reported at age 19 years. We identified NEET young people as those who were unemployed and not enrolled in school, training, an apprenticeship or postsecondary education. The majority of respondents classified as NEET (68%) were unemployed and looking for work. A further 20% reported their main activity as looking after the home. The remaining 12% were travelling, doing voluntary work, 'taking a break' from formal education, or were NEET due to illness or disability. To identify the role of adolescent health in NEET status among those lacking employment opportunities (rather than out of work for potentially voluntary reasons), we conducted sensitivity analyses in which analyses examining associations between health and NEET were replicated among the 68% of NEET respondents seeking employment.

Hypothesised mediators: We reviewed the literature to identify hypothesised mediators for the relationship between adolescent health and subsequent outcomes. We focused on variables for which the literature indicates clear associations with both health and education and employment outcomes. We include such variables which were plausible based on the causal directionality implied by the model. That is, we included mediators where a justifiable assumption of the causal pathway from health status to mediator, and mediator to outcome could be postulated based on existing evidence. For both LTCs and mental health, we identified reduced school attendance,[13 19 20] social exclusion[13] and psychological distress[20] as potential mediators. Additionally, given clear associations between adolescent mental health and disruptive classroom behaviour and health behaviours, as well as the role of these behaviours in educational attainment and employment,[5 12 21] these were included as potential mediators in associations between mental health and education and employment outcomes. These constructs were represented in the LSYPE data set as follows:

1. Long-term school absence was assessed based on parent reports of absences from school lasting 1 month or longer in the past 12 months either at age 13 years or 14 years.
2. Classroom behaviour and truancy were both self-reported. Truancy was defined as any missed school without permission in the last 12 months reported at ages 13 years, 14 years or 15 years. Frequent troublemaking was defined as self-reporting misbehaving in half or more than half of the respondents' classes at age 13 years.
3. Social exclusion was defined as any reports of being excluded from a group of friends or from joining in an activity in the past 12 months reported at ages 13 years, 14 years or 15 years based on a single-item self-report measure. Previous official reports (produced by the Department of Education) have used this variable within this data set.[22]
4. Health behaviours: Regular alcohol use was defined as drinking alcohol at least once or twice a week at ages 13 years, 14 years or 15 years. Cannabis use was defined as having ever tried cannabis by age 15 years. (No variable regarding current cannabis use was available.) Smoking was defined as reporting smoking on average one cigarette or more a week at ages 13 years, 14 years or 15 years.
5. Psychological distress: We also included psychological distress as a potential mediator for LTC as well as its role as a potential exposure in its own right. Again we used age 14 years GHQ with the same threshold of 4+ to define high scorers.

All analyses were controlled for socioeconomic status (SES), ethnicity and early adolescent educational attainment, as these have been identified as key risk factors for becoming NEET.[3] SES was defined based on the English Index of Multiple Deprivation (IMD) quintiles. IMD categorises areas in England based on seven domains of deprivation including income, employment, health, education and training, housing and services, living environment and crime. Ethnicity was defined based on age 13 years reports, with respondents self-identifying into eight categories: white, mixed, Indian, Pakistani, Bangladeshi, black Caribbean, Black African and other. Adolescent educational attainment was assessed based on Key Stage 3 average point score. Key Stage 3 courses are usually taken from ages 11 years to 14 years and precede GCSE courses. We defined low educational attainment as falling below expected attainment as per the National Curriculum (below level 5 attainment).[23] Within the sample, 71% of students attained the level 5 threshold. This is identical to the national average at the time.[24]

We also controlled for age 19 years self-reported long-standing illness, disability or impairment (contemporaneous with NEET measurement) to examine the role of adolescent health in isolation from current health status.

Analyses

Analyses were stratified by gender due to gender differences within the data in rates of mental and physical health, academic

Table 1 Associations between early adolescent health and later low educational attainment and NEET status by gender

	Low educational attainment						Not in education, employment or training (NEET)					
	Boys			Girls			Boys			Girls		
	OR (95% CI)	P value	N	OR (95% CI)	P value	N	OR (95% CI)	P value	N	OR (95% CI)	P value	
Long-term condition	1.53 (1.26 to 1.86)	<0.001	6291	1.72 (1.40 to 2.14)	<0.001	6193	1.30 (0.92 to 1.83)	0.14	3811	1.37 (0.95 to 1.97)	0.09	4104
Poor mental health	1.25 (1.01 to 1.57)	0.05	6094	1.39 (1.16 to 1.67)	<0.001	6029	1.72 (1.24 to 2.41)	0.001	3750	1.49 (1.11 to 1.99)	0.008	4078

All analyses controlled for socioeconomic status, ethnicity and early adolescent educational attainment.

attainment and employment, as well as potential mediators including risk behaviours, school-related behaviour and social exclusion. These were deemed to have the potential to lead to different mediation pathways for boys and girls. We examined associations between health status in early adolescence and subsequent educational attainment and NEET status in logistic regression analyses adjusted for covariates using svy commands in Stata V.12.[25] Models were weighted for unequal selection probability and follow-up non-response across region, ethnicity, academic achievement, gender, SES and health risk behaviour participation.[15]

We followed Baron and Kenny's[26] steps for determining a mediating relationship for postulated mediators. After establishing associations between the health exposure variables and the education and employment outcome variables, we tested for associations between health exposure variables and each mediator variable again using logistic regression. We tested for interaction between health conditions and mediators with any significant interaction terms included within the models. We tested for possible mediation via all mediator variables associated with the health exposure variable using the khb command in Stata V.12. This command allows for the association between exposure and outcome variable to be partitioned into direct and indirect effects. A significant indirect effect suggests that the variable in question serves as a mediator for the relationship. All mediation models were tested individually.

RESULTS

Data were available on 8489 respondents at age 19 years, though sample sizes vary across analyses due to item non-response. Of the sample, 48.5% (4120) was boys; 51.5% (4369) was girls.

Attrition analyses

We compared rates of survey completion at age 19 years based on key sociodemographic variables and health variables at ages 13 years and 14 years. Attrition was significantly higher among boys (48%) than girls (43%). Black African (60%) and Black Caribbean (59%) respondents had the highest attrition rates, followed by mixed ethnicity (53%), 'other' ethnicity respondents (52%), Pakistani and Bangladeshi respondents (both 48%), White respondents (44%) and Indian respondents (38%). Attrition rose steadily from the least deprived quintile (29%) to the most deprived (46%). There were no significant differences in attrition rates based on health measures assessed at ages 13 years and 14 years.

Associations between early adolescent health and later educational attainment and NEET

Table 1 shows associations between the early adolescent health variables and later educational attainment and NEET status. Mental health was significantly associated with both poorer later GCSE outcomes and higher risk of NEET status, while LTC predicted poorer GCSE attainments but not NEET status. Associations were similar for both sexes, and the size of associations was largely similar for all outcomes. Associations between health and NEET held in sensitivity analyses including only NEET respondents who reported actively seeking work. NEET respondents whoreported their main activity as looking after the home, travelling, doing voluntary work, or 'taking a break' from formal education, as well as those who were NEET due to illness or disability were excluded from these analyses. All subsequent analyses include all categories of NEET.

Mediation analyses

No significant health by mediator effects were identified therefore no interaction terms were included within the models. Table 2 shows associations between LTC and hypothesised mediators; table 3 shows associations between mental health and mediators. All potential mediators were associated with mental health in both sexes except alcohol use in boys only. Significant associations were found between LTC and social exclusion in both genders as well as psychological distress and long-term school absences in girls. In nearly all cases, stronger associations were found between adolescent health and potential mediators for girls than for boys.

Those mediators shown to be significantly associated with early adolescent health exposures were then entered into mediator analyses for each outcome. Mediator effects for the associations between early adolescent health status and educational attainment and NEET outcomes are shown in table 4 for psychological distress and table 5 for LTCs.

Table 2 Association between adolescent long-term conditions and hypothesised mediators by gender

	Boys			Girls		
	OR (95% CI)	P value	N	OR (95% CI)	P value	N
Long-term school absences	1.35 (0.97 to 1.89)	0.08	6288	2.01 (1.49 to 2.71)	<0.001	6172
Truancy	0.86 (0.74 to 1.00)	0.06	6249	0.99 (0.82 to 1.21)	0.95	6168
Social exclusion	1.31 (1.10 to 1.56)	0.002	6277	1.38 (1.16 to 1.66)	<0.001	6184
Psychological distress	1.13 (0.89 to 1.44)	0.34	6262	1.24 (1.03 to 1.50)	0.02	6182

Analyses controlled for socioeconomic status, ethnicity and adolescent educational attainment.

Table 3 Association between adolescent poor mental health and hypothesised mediators by gender

	Boys			Girls		
	OR (95% CI)	P value	N	OR (95% CI)	P value	N
Long-term school absences	1.52 (1.04 to 2.22)	0.03	6065	1.71 (1.31 to 2.24)	<0.001	6043
Truancy	2.24 (1.85 to 2.72)	<0.001	6067	2.32 (2.00 to 2.68)	<0.001	6018
Social exclusion	3.22 (2.69 to 3.04)	<0.001	6091	2.92 (2.55 to 3.33)	<0.001	6084
Troublemaking	1.50 (1.20 to 1.86)	<0.001	6104	1.51 (1.25 to 1.82)	<0.001	6055
Alcohol use	1.15 (0.94 to 1.40)	0.18	6092	2.04 (1.74 to 2.39)	<0.001	6076
Smoking	1.41 (1.08 to 1.83)	0.01	6074	2.07 (1.75 to 2.46)	<0.001	6070
Cannabis use	1.34 (1.11 to 1.63)	0.003	6081	2.19 (1.87 to 2.56)	<0.001	6062

For LTC (table 4), the association with later low attainment was mediated by social exclusion in both sexes and long-term school absence and psychological distress in girls. We did not conduct mediator analyses for the association between LTC and NEET because of non-significant associations between these variables. For mental health (table 5), the association with later low attainment was mediated by all included mediators except long-term school absences in both sexes. The major mediators in boys were truancy and social exclusion. Troublemaking in class, smoking and cannabis use were also significant mediators. Patterns of mediation were similar in girls, with substance use, including alcohol use, showing slightly stronger mediation effects. For NEET, the association with poor mental health was mediated by truancy, social exclusion and smoking for both sexes.

DISCUSSION

These prospective longitudinal analyses in a nationally representative large cohort show that poor health in the early secondary school years reduces later academic success and impairs young people's transition into employment and productivity. Young people with poorer health in early adolescence had an approximately 25% to 72% greater chance of low attainments or being NEET at the end of secondary schooling. These relationships held when adjusted for educational attainment at the beginning of secondary school as well as for SES, ethnicity and adult health status.

LTCs influenced later educational attainment only through long-term school absence, social exclusion and psychological distress. In contrast, behavioural and social problems (truancy, classroom disruption, social exclusion and substance use) were the primary pathways through which poor mental health influenced later educational attainment.

Explanations and implications

Our data show clearly that health in adolescence strongly influences gains in educational attainments across adolescence and crucially impacts on transition into the workforce at the end of schooling. Our findings are consistent with a literature showing that serious physical illness in childhood and adolescence can result in impaired educational and employment outcomes,[6 7] as can psychiatric distress disorder.[27 28] Our study extends previous findings by showing that health in adolescence influences change in attainments across secondary school and risk of NEET status regardless of earlier attainment levels.

Long-term absences were an important mechanism through which LTCs influenced educational attainment. Some studies note a school absence rate for children with a chronic condition of over five times that of healthy children.[29] School attendance is strongly associated with attainment.[30] In contrast, truancy was a mechanism by which poor mental health influenced educational attainment. Truancy is up to four times more prevalent than the average among adolescents with an emotional disorder.[31 32] Social exclusion is a common feature of physical or mental health problems in adolescence,[33] and we found that isolation from peer groups was a common mechanism by which health influences educational attainment, emphasising the importance of peer group connection for supporting academic development.[34]

Psychological distress was another important mechanism in young women, although not in young men. This may reflect the greater psychological valence that poor health has for young women during adolescence,[35] leading to greater impacts on educational attainment. Substance use appeared to be an important mechanism through which low mental health influenced later educational attainment, particularly among young men. Young people with poor mental health are more likely

Table 4 Indirect (mediating) effects for association between adolescent long-term condition and low educational attainment.

	Low educational attainment							
	Boys				Girls			
	Indirect effects OR (CI)	P value	% mediated	N	Indirect effects OR (CI)	P value	% mediated	N
Long-term school absences	–	–	–	–	1.08 (1.03 to 1.12)	<0.001	14.09	4952
Truancy	–	–	–	–	–	–	–	–
Social exclusion	1.03 (1.01 to 1.05)	.008	6.28	5132	1.02 (1.00 to 1.03)	0.02	3.30	4966
Psychological distress	–	–	–	–	1.01 (1.00 to 1.03)	0.05	2.96	4942

Analyses controlled for socioeconomic status, ethnicity and early adolescent educational attainment.
– indicates a non-significant relationship between health indicator and hypothesised mediator; therefore, mediator analyses were not conducted.

Table 5 Indirect (mediating) effects for association between early adolescent poor mental health and low educational attainment and NEET status.

	Low educational attainment							Not in education, employment or training (NEET)						
	Boys				Girls			Boys				Girls		
	Indirect effects OR (CI)	P value	% mediated	N	Indirect effects OR (CI)	P value	% mediated	N	Indirect effects OR (CI)	P value	% mediated	N	Indirect effects OR (CI)	P value	% mediated	N
Long-term school absences	1.03 (1.00 to 1.06)	0.06	13.66	4855	1.01 (0.99 to 1.03)	0.17	3.56	4883	1.01 (0.99 to 1.03)	0.33	2.10	3747	1.00 (0.99 to 1.01)	0.4	1.04	3890
Truancy	1.21 (1.15 to 1.28)	<0.001	86.14	4916	1.17 (1.12 to 1.22)	<0.001	45.78	4360	1.10 (1.04 to 1.17)	<0.001	17.31	3825	1.07 (1.02 to 1.12)	0.006	17.42	3788
Social exclusion	1.13 (1.08 to 1.18)	<0.001	53.97	4976	1.05 (1.01 to 1.09)	.03	13.63	4835	1.12 (1.04 to 1.20)	<0.001	20.32	3747	1.11 (1.04 to 1.19)	0.003	26.34	3854
Troublemaking	1.06 (1.02 to 1.11)	0.002	27.14	4966	1.04 (1.02 to 1.06)	<0.001	12.35	4864	1.01 (0.99, 1.03)	0.52	1.40	3718	1.02 (1.00, 1.04)	0.10	5.59	3908
Alcohol use	–		–	–	1.06 (1.03 to 1.09)	<0.001	18.46	4707	–		–	–	1.02 (0.98 to 1.06)	0.32	4.72	3930
Smoking	1.07 (1.01 to 1.12)	0.02	31.93	4762	1.17 (1.12 to 1.22)	<0.001	48.66	4833	1.04 (1.00 to 1.08)	0.04	7.26	3719	1.06 (1.01 to 1.10)	0.01	13.83	3924
Cannabis use	1.04 (1.01 to 1.07)	0.007	16.56	4703	1.12 (1.08 to 1.16)	<0.001	35.60	4985	1.03 (1.00 to 1.06)	0.05	4.98	3762	1.03 (0.98 to 1.08)	0.37	7.26	3946

Analyses controlled for socioeconomic status, ethnicity and early adolescent educational attainment.
–indicates a non-significant relationship between health indicator and hypothesised mediator; therefore, mediator analyses were not conducted.

to initiate and use substances than the general population.[36] Substance use has clear deleterious effects on subsequent academic achievement.[37] Troublemaking in class mediated associations between mental health and educational attainment, consistent with past research implicating poor conduct and inattention with the deleterious academic consequences of psychiatric disorders in childhood.[38]

The intrinsic relationship between health and education suggests that health should be part of the core business of schools. Remarkably large mediating effects for mental health through truancy suggest that screening for mental health problems among young people who play truant may be an important initiative to disrupt trajectories towards educational exclusion and low attainment. Similarly, troublemaking in class and substance use may be markers of poor mental health which are particularly preindicative of poor academic attainment. Current strategies for reducing youth unemployment often fail to take into account pre-existing and concurrent health issues. Health screening for economically inactive young people may help prevent mental health problems;[5] currently, health and educational/vocational services are uncoordinated.

Because the burden of poor health falls disproportionately on adolescents in deprived households, poor academic and professional attainments resulting from poor health may serve to entrench socioeconomic health inequalities.[39] NEET appears to have transgenerational effects, with periods of unemployment associated with NEET in subsequent generations.[3] Past research suggests that poor health may be a key impediment to social mobility.[40]

Limitations

Our data are subject to a number of limitations. First, the causal relationship of the mediators remains unclear despite benefiting from the use of longitudinal data; the relationship with predictor and outcome variables may partially be a result of confounding, rather than mediation. Associations between health and education and employment outcomes may partially represent relationships between outcomes and contemporaneous health, rather than the lagged association proposed; this limitation was mitigated by including a measure of contemporaneous (age 19 years) health as a covariate. A further limitation relates to the availability of mediator variables within the data set. Several potential mediators, as suggested by the literature, were not represented in the data set, such as reduced cognitive function, increased metabolic demands or increased family and parental stress related to illnesses.[41] While we included ethnicity and parental income as confounders, other confounders such as childhood health status and cognitive function and parental health status were not included within the models raising the possibility of insufficient control of confounding. Finally, our sample may be biased due to attrition, though there were no differences in attrition based on health exposure variables. We used sample weights to partially account for differential attrition. Within-wave non-response, though low, may have also introduced some bias into the analyses.

Conclusions

Adolescent health is a significant predictor of subsequent academic success and employment in young adulthood after accounting for childhood academic performance. Key mediators for the association between health and education and employment outcomes can inform intervention strategies, though these mediators differ across health indicators. While the health implications of unemployment in young adulthood are recognised as having substantial policy relevance,[1] the reverse causal pathways

also have clear implications for intervention. Health in adolescence may set in motion a downward spiral towards academic underachievement, unemployment and the further health risks that come with it.

What is already known on this subject

- Serious illness in childhood impairs educational and employment outcomes. The impact of adolescent health on subsequent education and employment outcomes is less clear. Potential mediators for associations between health and subsequent outcomes have been hypothesised but not empirically verified.

What this study adds

- This study suggests that health in adolescence strongly predicts academic attainment and unemployment after controlling for childhood attainment, adult health and sociodemographics. The identified mediators for these associations, including social exclusion, school behaviour, truancy, substance use and long-term absences, inform interventions for improving life chances for young people with poor health, and reducing health inequalities.

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