DISCUSSION PAPER SERIES

IZA DP No. 7301

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March 2013

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zur Zukunft der Arbeit
Institute for the Study
of Labor

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IZA Discussion Paper No. 7301
March 2013

ABSTRACT

The Effect of Non-Cognitive Traits on Health Behaviours in Adolescence*

This paper investigates the relationship between personality traits in adolescence and health behaviours using a large and recent cohort study. In particular, we investigate the impact of locus of control, self-esteem and conscientiousness at age 15-16, on the incidence of health behaviours such as: alcohol consumption; cannabis and other drug use; unprotected and early sexual activity; and sports and physical activity. We use matching methods to control for a very rich set of adolescent and family characteristics and we find that personality traits do affect health behaviours. In particular, individuals with external locus of control, or with low self-esteem, or with low levels of conscientiousness are more likely to engage in health-risky behaviours.

JEL Classification: I18, I28

Keywords: personality, locus of control, self-esteem, health behaviours

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* We are grateful to the Economic and Social Data Service at the University of Essex and the Department for Education for providing the data. The data can be obtained via http://www.esds.ac.uk/longitudinal/access/lsype/faq.asp and our STATA code is available on request.

1. Introduction

The objective of this paper is to analyse the role of non-cognitive traits on health behaviours in adolescence. Scholars from various fields have examined the determinants of economic success that go beyond those captured by cognitive ability, and have shown that certain traits, other than IQ and measures of cognitive development, significantly affect economic life outcomes.

Our paper contributes to the existing literature in two ways. First, we produce new evidence on the importance of non-cognitive skills, based on a large and recent dataset, consisting of a cohort of children born in 1990 who were followed for seven years, starting in 2004. Second, unlike much other research, our analysis is focused on personality traits in adolescence. This is important as a variety of studies show that, unlike cognitive abilities, personality traits are relatively malleable over the life cycle so policy interventions can target adolescents in order to promote useful traits and supress harmful ones early in life in order to avoid adverse long term negative effects.

Our data allows us to study the effect of personality traits recorded when the child is 15-16 on subsequent health-risky behaviours up to when she/he is 19-20 years old. We use the extensive information available on the child's personality to construct indicators of locus of control, self-esteem and conscientiousness to relate these characteristics to various health-related behaviours.

Our results broadly support the idea that non-cognitive skills are very important in determining people's health choices in life: individuals with external locus of control, low self-esteem and low levels of conscientiousness are more likely to engage in risky behaviours, such as cannabis and drugs taking, unprotected sex, or excessive drinking. The rest of this paper is organized as follows. Section 2 provides a brief overview of the existing literature. Section 3 presents the data and explains the personality indicators and health-

related outcomes that it contains. Section 4 discusses the estimation methods and the results. Section 5 concludes.

2. Overview of existing literature

Risky behaviour with respect to health is important. The World Health Organisation has recently shown (World Health Organisation, 2009) that health-risky behaviours, such as illicit drugs use, alcohol consumption, inadequate physical exercise, etc., significantly increase morbidity and mortality risks in Western developed countries. In addition to this, the US Centre for Disease Control and Prevention noted in its Annual Youth Risk Behaviour Surveillance Report 2011 that "the leading causes of morbidity and mortality among youth and adults in the United States are related to six categories of priority health-risk behaviors: behaviors that contribute to unintentional injuries and violence; tobacco use; alcohol and other drug use; sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases (STDs), including HIV infection; unhealthy dietary behaviors; and physical inactivity". This seems to be particularly relevant for the British population,: according to the UNICEF Innocenti Report on child poverty (UNICEF, 2007), the prevalence of risky behaviours, such as alcohol abuse, illicit drugs use and hazardous sexual activity in the UK is higher than in other similar OECD countries.

The evidence on the effect of personality on health has suggested that personality predicts health through a variety of mechanisms, such as health-related behaviours, longevity, and social relationships. Almlund *et al.* (2011) provide an excellent review of the studies conducted in this area. They conclude that most of the literature in the fields of psychology and health sciences shows that personality traits such as conscientiousness, openness to experience, and agreeableness generally have a positive effect on longevity. Heckman, *et al.* (2006) use data from the National Longitudinal Survey of Youth 1979 to investigate the

effect of cognitive and non-cognitive skills on labour market outcomes and social behaviors and show that non-cognitive abilities, such as locus of control and self-esteem, affect schooling decisions, wages and risky behaviors among youths, such as the probability of smoking, using marijuana, and being a teenager mother. Almlund *et al.* (2011) note that the main difficulty in conducting analyses of this kind is to identify the causal relationship between personality and health, because health status is also likely to have an effect on personality. Controlling for the timing of the events might be a partial solution (Friedman *et al.*, 2010). Some studies in the literature have used structural models to control for reverse causality (Conti and Heckman, 2010; Savelyev, 2010) and have shown a relationship between personality traits, initial health endowments and educational choices.

In general, Conscientiousness, Openess to Experience, and Agreeableness have a positive effect on the length of individual lives, while Neuroticism is associated with shorter lives (see for example Martin et al., 2007; Kern and Friedman, 2008). One of the most important transmission channels from personality to health is likely to be through health-related behaviours. Various papers have shown that non-cognitive traits have an effect on smoking, diet and exercise (Heckman et al., 2006; Hampson et al., 2007; Gale et al., 2008; Hampson et al., 2010), as well as reactions to chronic illness (Mejier et al, 2002) and personality traits recorded at school-age have an effect on behaviours during midlife (Hampson et al., 2007). Personality traits may also have an indirect effect on health through educational attainment (Hampson et al., 2010). However, most of the existing studies tend to use small or unrepresentative samples (see Roberts et al., 2007 for a review, and Bogg and Roberts, 2004 for a meta-analysis. The latter exploits large numbers of small studies and shows statistically significant correlations for almost all outcomes).

As we have already mentioned, the economics literature on the impact of personality traits on health behaviours is limited. And, as noted before, Heckman *et al.* (2006) show that

non-cognitive skills affect the probability of smoking, using marijuana, and being a teenager mother in US NLSY data, while Chiteji (2010) uses data from the US PSID to show that self-efficacy is associated with lower alcohol consumption and more physical exercise. Cobb-Clark *et al.* (2012) use Australian data to analyse the relationship between locus of control and healthy habits, such as diet, physical exercise, smoking and drinking and show that individual with an internal locus of control are more likely to eat well and exercise regularly, even if this link cannot be explained by individual time preferences toward the future.

Social scientists and health economists have devoted a significant amount of effort to investigating the determinants of health risky behaviours, as they are one of the main causes of differences in health outcomes (Cutler and Glaeser, 2005). Cutler and Lleras-Muney (2005) note that income and prices account for a small part of the variation in health behaviours, and many unhealthy behaviours are costly, so differences in tastes and information are likely to play a major role in these choices. A large literature has shown that education affects health behaviours (Grossman, 2000 and 2006; Cutler and Lleras-Muney, 2005) because of its effect on individual health production efficiency (Grossman, 1975) or because they are both affected by a third factor (Fuch, 1982; Arendt, 2005; Lleras Muney, 2005) such as: risk attitudes (Anderson and Mellor, 2008), or discounting and time preferences (Van Der Pol, 2011). Stress and lack of control have also been found to have an impact on health choices (Salovey, 1998; Hamilton et al., 2009). Other factors, such as family relationships (Roche et al., 2008), religiosity (Nonnemaker et al., 2003), peer effects and social networks are also likely to play a major role, especially in analysing behaviours of adolescents (Cutler and Lleras-Muney, 2005). However, most of this literature has not directly taken into account specific personality traits, such as Self-Esteem, Locus of Control or Conscientiousness.

3. **Data**

This paper uses data from the Longitudinal Study of Young People in England (LSYPE), which is a large scale panel survey of English adolescents, interviewed for the first time when they were in school year 9 in 2004 at the age of 14. The study is managed by the Department of Education and covers wide range of social policy issues. The questionnaires cover a variety of topics, including academic achievements, family relationships, attitudes toward school, family and labour market, and some more sensitive or challenging issues, such as risky health behaviours (smoking, alcohol drinking, drug taking), personal relationships, etc.

In the first wave, selected to be representative of the young people in England, around 15,500 young people were interviewed. In the first four waves, parents/guardians were also interviewed. Our final sample includes around 7,000 observations of children with non-missing information on personality traits, health behaviours and other essential information on the child's birth and family background (the selected observations were not significantly different from the original data in terms of their observable characteristics).

Outcomes

The LSYPE includes information on various outcomes, measured from adolescence to early adulthood, and we are interested in investigating the effect of personality traits recorded at wave 2 (or 4) on health-risky behaviours recorded at wave 6 or 7. These questions are answered by the child through self-completion questionnaires, in order to minimise the risk of misreporting on these sensitive topics. We focus on four groups of outcomes: cannabis and drug use; sex behaviour; drinking and sport and physical activity. Unfortunately, information about smoking is only available in LSYPE until wave 4 and no information is collected about nutrition habits.

Table 1 Outcomes

Health Behaviours	***Variable***
Ever tried cannabis	=1 if yes
Ever tried other drugs such as: cocaine, LSD, ecstasy, heroin, crack, speed	=1 if yes
Age of first sexual intercourse	=1 if 15 or younger
Ever had unprotected sex	=1 if yes and ever had sex
Heavy drinking	=1 if drinking at least 3-4 times a week in the last year
Often drunk	=1 if gets drunk most or every times drinks
Never drunk	=1 if never gets drunk when has an alcoholic drink
Low physical activity	=1 if does sports hardly ever or never.

Personality

Non-cognitive skills and personality traits cannot be measured directly, unlike other personal characteristics, such as weight or height. Factor analysis has been extensively utilised in personality psychology to identify a number of common factors underlying various questions (Caliendo *et al.*, 2010). This approach utilises a set of measurements that have the purpose of capturing a particular trait, and measures within-cluster and across-cluster correlations of the measurements to isolate latent factors (Almlund *et al.*, 2011). Most of the literature looking at the impact of personality traits on various outcomes uses the Big Five which are obtained from factor analysis using 19 measures of different domains of personality based on self-reports or observer reports. However, the Five Factor model is not without critics and Almlund *et al.* (2011) provide a review of the various alternative systems that have been proposed over time. Our data does not include information about the Big Five personality traits, but it includes a series of questions on locus of control, self-esteem and hard-working attitude. Locus of control and self-esteem are not part of the traditional Big Five but, as Almlund *et al.* (2011) show, they can be associated with the Big Five factors of

Neuroticism and Emotional Stability, as positive self-evaluation generally indicate a proactive and positive attitude towards oneself and the rest of the world.

Locus of control refers to individual beliefs about whether life events are mostly internally or externally determined (Rotter, 1966). People with an external locus of control believe that what happens in life is largely determined by events beyond their control, while individuals with internal locus of control generally believe that life events are mostly caused by their own decisions and behaviours. People with an internal locus of control would be more likely to set higher goals and persevere to achieve those. We measure locus of control using children's responses to six questions related to individual beliefs about their own chances of affecting their future life circumstances (see the Appendix for details).

We follow Caliendo et al. (2010) and use factor analysis to identify the common factors underlying our six questions. Our factor analysis shows that the six items load onto two factors (see Appendix for details) and we use this factorization to create two indexes of internal and external locus of control. Further, children are coded as external (internal) if they have a score in the top quartile of the distribution of the external (internal) index, derived from factor analysis.

Self-esteem refers to an individual perception of her/his own value. LSYPE data includes two questions on self-esteem, asked at wave 2 and 4: "How useful you have felt recently?" and "How much you have been thinking of yourself as a worthless person recently?": not at all; no more than usual; rather more than usual; much more than usual. We construct an indicator of low self-esteem equal to 1 if they have placed themselves in the most distressed category for one of the two questions at least once between the two waves (around 26% of the children in the sample). Alternative/more restrictive indicators of locus of control and self-esteem have been constructed to test our estimates and results are available on request.

Almlund *et al*. (2011) present competence, dutifulness, self-discipline, perseverance and work-ethic as facets of Conscientiousness. LSYPE includes four questions on hard-working attitudes (see the Appendix for details) and we use factor analysis to identify the common factors underlying the four questions and to create an index of Conscientiousness. Then, we construct an indicator of high conscientiousness, which is equal to 1 if the children have a score in the top quartile of the distribution of the index of conscientiousness, derived from factor analysis.

Other explanatory variables

We estimate three versions of our model, progressively increasing the set of independent variables. All of the variables we control for are, arguably, pre-determined variables – that is, not themselves influenced by personality traits. Our first, most parsimonious, model only includes at-birth characteristics such as: birth-weight; whether the child was premature; ethnic background; sex of the child; and family characteristics such as marital status and age of the mother at birth. In the second model we include other family's characteristics (measured at wave 1) which are unlikely to have changed since the child's birth, such as: maternal education, child and mother disability, grandparents' education, and older siblings. The last model includes further characteristics at wave 1 such as: younger siblings; maternal working and marital status; household income; family size; and whether the child has ever been in care.

Descriptive statistics

Table 2 presents the distribution of the outcome variables, by personality traits. Individuals with external locus of control and low self-esteem are more likely to engage in risky behaviours, such as cannabis and drug-taking, or early and unprotected sexual activity. They are also less likely to engage in regular physical activity. Interestingly, the association

with alcohol consumption is less pronounced. On the other hand, children with high level of conscientiousness seem less likely to engage in health-risky behaviours, such as drinking, drug-taking or unprotected sex.

Children with an external locus of control are more likely to come from disadvantaged families, with single or very young mothers at birth, and lower household income and level of education. On the other hand, children with low self-esteem and high conscientiousness (mostly girls) are more likely to have highly educated mums, who work, and have relatively high family income.

Table 2 Distribution of outcome variables by locus of control, self-esteem and conscientiousness

	Whole sample	**External**	**Low Self Esteem**	**High Conscientiousness**
Ever tried cannabis (%)	32	35	39	22
Taking cannabis in last 4 weeks (%)	36	38	38	33
Ever tried other drugs (%)	11	14	15	6
Ever had sex (%)	67	77	70	59
First sexual intercourse <16 (%)	31	37	35	25
Ever had unprotected sex (%)	43	48	48	35
Heavy drinking (%)	20	19	21	18
Drinking Rarely (%)	17	19	19	19
Often drunk (%)	29	32	32	26
Never drunk (%)	11	10	10	12
Low physical activity (%)	19	23	25	15

Note: All outcomes are recorded at wave 6 or 7.

4. Estimation

While we begin by using Ordinary Least Squares, to control for observable confounders, this is well known to lead to biased estimates of the causal effects because of neglected heterogeneity. The linear model can be written as:

$$H_i = \alpha + \beta_i \boldsymbol{P}_i + \gamma_i \boldsymbol{X}_i + \varepsilon_i$$

where H_i represents a particular health behaviour, $\boldsymbol{P}_i$ is a vector of psychological traits (binary indicators of external locus of control; low self-esteem; high conscientiousness) and $\boldsymbol{X}_i$ is a vector of child's and family's characteristics.

We estimate the three versions of our model including all the three personality traits and then we test the stability of our results by including one or two personality traits at a time. Interestingly, our results are very consistent and stable across all the specifications.

The major challenge in this analysis is establishing causal connections between personality and child outcomes, given that children did not receive personality characteristics through random assignment and the children who exhibit a particular trait may have unobserved characteristics which also affect their health behaviour. Therefore, we think of OLS as providing upper bounds to the causal effects.

The effect non-cognitive skills on children's health behaviours may be estimated correctly through OLS if several assumptions are true. First, the "selection on observables" assumption must be satisfied (see Heckman, 1979). This means that all variables that predict both personality and children's health behaviours should be included in our model. Second, the model must be correctly specified: this is very problematic because assumptions like linearity and additivity are really difficult to verify when we include several independent variables. Further, if there is a lack of overlap in covariate distributions across children who have, and do not have, a specific personality trait– that is, for example, if there are children with internal locus of control for whom there are no comparable children without internal locus of control- linear regression models extrapolate results over portions of the distribution where there is no support (comparing incomparable children).

We cannot, in this data, address the selection on unobservables problem. There is simply no quasi-experimental variation across our sample to exploit. However, we can go some way towards addressing the other problems. Firstly, we try to lower the upper bound

provided by OLS estimation, through the inclusion of a progressively more detailed set of independent variables. Second, we exploit propensity score matching, that does not strongly rely on functional form assumptions and restricts inference to samples where we can find overlap in the distribution of covariates across the treatment (i.e. personality traits). Propensity Score Matching has been used in various recent papers investigating the determinants of children well-being (see for example Ruhm, 2008; Berger *et al.*, 2005; and Goodman and Sianesi, 2005) and the effect of personality traits (Caliendo et al., 2005).

In order to estimate the effect of personality on children's outcomes, we would ideally need to compare the average outcomes for children who have low self-esteem (for example) with the average outcomes for the same children had they not had low self-esteem. However, the latter is an unobserved counterfactual and the evaluation problem is to provide unbiased estimates of this average counterfactual using appropriate methods and assumptions. The idea of propensity score matching is to make children with different personality traits (i.e. internal and external; conscientious and non-conscientious; with low and high self-esteem) as comparable as possible in all other characteristics. More specifically, firstly we estimate the conditional probability of having a specific personality trait, like being external (being in the treatment group) for each child, given our covariates. This is called the propensity score. Then, estimated propensity scores are used to create a matched control group and for each treated child we find the comparison member with the closest propensity score. Non matched individuals are dropped from the analysis. Our analysis is performed using *psmatch2* and appropriate tests have been run, in order to compare covariate distributions across our matched groups to ensure that adequate has been obtained (results available on request). Our approach is similar to Goodman and Sianesi (2005) and we use propensity score matching with the nearest neighbour method with replacement (as it has been shown to reduce bias relative to matching without replacement, see Dehejia and Wahba, 2002) and then used the

common option, so that off-support observations are automatically dropped. Similar results were obtained with other methods.

Matching is more robust than OLS because it does not restrict the way in which personality may affect behaviours to be linear, and inference is limited to samples that are effectively comparable, based on the covariates distribution. Matching attaches appropriate weights to the observations in the control group, so that the distribution of their observable characteristics is realigned to the treatment group.

5. Results

The results from the estimation of the effect of personality traits on health behaviours are presented in Tables 3 and 4. We begin by using OLS with the three indicators of external locus of control, low self-esteem and high conscientiousness and then we change the specifications by including one or two personality traits at a time (see Table 3). The indicator of internal locus of control was included in a previous version of the model: however, it never led to significant effects and therefore we decided to omit it from the final specification. This shows that the effect of personality on health behaviours is mostly driven by the negative effect of being external (rather than by the positive effect of being internal). The models have also been estimated with continuous indexes of internal and external locus of control, self-esteem and conscientiousness and results are available on request.

OLS estimation restricts the possibility to control for children's differences parametrically – for example, in a linear way. Therefore, our results have also been estimated by using PSM (see Table 4), that allows to compare individuals with different personality traits on the basis of their observable characteristics without the functional form restrictions of OLS. PSM estimation only allows to match individuals on the basis of one treatment but, as we show in table 3, the effect of personality is very stable and the size and magnitude of the effects do not change when we include one or two traits at a time.

Results presented in Tables 3 and 4 show that non-cognitive skills generally have significant effect on health behaviours and the sizes of the effects are notable. Having external locus of control is associated with higher chances to use cannabis or other drugs by about 3-4 percentage points (p.p.). This result is stable across different specification of the model, as well as including/excluding other personality traits. Similarly, external locus of control has a strong negative impact on sexual behaviours and the size of the effect is even higher (between 6 and 7 p.p). The negative effect of external locus of control is not surprising, as external individuals tend to think that their choices have less impact on their future, which is mostly driven by luck and external circumstances. As a consequence, they also seem less cautious in engaging in various health-risky behaviours. The effect of low self-esteem and high conscientiousness on cannabis/drug-taking and risky sexual behaviours are higher than the effect of locus of control and, again, very stable across different specifications of the model. Children's low self-esteem increases the chances of taking cannabis by about 10 p.p. and the effect on the chances of trying drugs is a bit lower (around 6 p.p.) but still very significant. Low self-esteem also increases the incidence of risky sexual activity by about 7-8 p.p. High conscientiousness seems to have an important protective effect from health-risky behaviours, with significant effects on cannabis (around 8 p.p) and drugs use (around 4 p.p.), as well as decreasing chances of engaging in early and unprotected sexual behaviour (by around 5 to 7 p.p.).

As expected, children with low self-esteem seem to underestimate the consequences of their risky health behaviours and, possibly because they struggle to see themselves as valuable, they are less cautious with respect to their health. On the other hand more conscientious children are more likely to carefully evaluate the consequences of their actions and to have a proactive orientation towards the future.

Table 3 Effect of personality traits on health behaviours – OLS Estimation Results

	Model 1			Model 2			Model 3		
	External LC	**Conscientious**	**Low Self-Esteem**	**External LC**	**Conscientious**	**Low Self-Est.**	**External LC**	**Conscientious**	**Low Self-Esteem**
Ever tried cannabis	0.024 (0.016)	-0.090** (0.016)	0.106** (0.015)	0.038*(0.015)	-0.084 **(0.015)	0.103** (0.014)	0.027(0.017)	-0.071**(0.017)	0.113**(0.016)
	0.040* (0.015)	-0.094** (0.016)		0.053* (0.015)	-0.088** (0.015)		0.044**(0.017)	-0.076**(0.017)	
		-0.084** (0.014)	0.103** (0.013)		-0.081** (0.013)	0.102** (0.012)		-0..072**(0.014)	0.108**(0.014)
	0.035*(0.015)		0.107 **(0.014)	0.048**(0.015)		0.105**(0.014)	0.034*(0.017)		0.115 **(0.016)
	0.051** (0.015)			0.063**(0.015)			0.051**(0.017)		
		-0.090** (0.014)			-0.087**(0.013)			-0.079**(0.015)	
			0.109** (0.011)			0.108**(0.011)			0.112**(0.013)
Ever tried other drugs	0.025**(0.010)	-0.043**(0.010)	0.053**(0.010)	0.029**(0.011)	-0.041**(0.011)	0.053**(0.011)	0.028**(0.012)	-0.035**(0.011)	0.055*(0.011)
	0.032**(0.010)	-0.045**(0.010)		0.037**(0.011)	-0.043**(0.009)		0.036**(0.012)	-0.037**(0.012)	
		-0.045**(0.009)	0.051**(0.008)		-0.043**(0.009)	0.051**(0.008)		-0.041**(0.010)	0.049*(0.009)
	0.031**(0.010)		0.051**(0.009)	0.036**(0.010)		0.052**(0.009)	0.033**(0.012)		0.052**(0.011)
	0.039**(0.010)			0.044**(0.010)			0.042**(0.011)		
		-0.048**(0.009)			-0.046**(0.009)			-0.044**(0.01)	
			0.052**(0.008)			0.052**(0.008)			0.051**(0.009)
Younger than 16 at first sexual intercourse	0.066**(0.018)	-0.052**(0.018)	0.069**(0.017)	0.053**(0.018)	-0.053**(0.018)	.067**(0.017)	0.049**(0.021)	-0.054**(0.021)	0.077** (0.018)
	0.076** (0.018)	-0.053**(0.018)		0.062**(0.018)	-0.054**(0.018)		0.059**(.020)	-0.057**(0.021)	
		-0.054**(0.016)	0.083 **(0.014)		-0.053**(0.016)	0.081**(0.014)		-0.057**(0.018)	0.093**(0.016)
	0.061** (0.017)		0.067 **(0.016)	0.049**(0.018)		0.065**(0.017)	0.043**(0.019)		0.079**(0.018)
	0.071 **(0.017)			0.058**(0.017)			0.055**(0.019)		
		-0.057 **(0.016)			-0.055**(0.016)			-0.062**(0.018)	
			0.077**(0.013)			0.074**(0.014)			0.089**(0.015)
Ever had unprotected sex	0.064**(0.019)	-0.081**(0.018)	0.082**(0.018)	0.059**(0.019)	-0.076**(0.020)	0.082**(0.019)	0.044*(0.021)	-0.083** (0.019)	0.083**(0.021)
	0.075**(0.019)	-0.083**(0.019)		0.070**(0.019)	-0.078**(0.019)		0.056**(0.021)	-0.086**(0.021)	
		-0.081**(0.017)	0.090**(0.015)		-0.077**(0.017)	0.088**(0.015)		-0.073**(0.019)	0.092**(0.017)
	0.079**(0.018)		0.079**(0.017)	0.073**(0.018)		0.079**(0.018)	0.060**(0.020)		0.079**(0.019)
	0.090**(0.018)			0.084**(0.018)			0.072**(0.020)		
		-0.086**(0.0174)			-0.081**(0.017)			-0.078**(0.019)	
			0.087**(0.014)			0.084**(0.014)			0.088**(0.016)

Table 3 (continued)

	Model 1			Model 2			Model 3		
	External LC	**Conscientious**	**Low Self- Esteem.**	**External LC**	**Conscientious**	**Low Self-Est.**	**External LC**	**Conscientious**	**Low Self-Esteem**
Heavy drinker	-0.030* (0.014)	-0.030* (0.015)	0.009 (0.013)	-0.003 (0.015)	-0.028+(0.015)	0.006 (0.013)	0.005 (0.016)	-0.027+ (0.016)	0.007 (0.015)
	-0.029*(0.014)	-0.030*(0.014)		-0.002 (0.014)	-0.028+ (0.015)		0.007 (0.016)	-0.028* (0.016)	
		-0.029*(0.013)	0.010 (0.011)		-0.028*(0.013	0.009 (0.011)		-0.030* (0.014)	0.008 (0.015)
	-0.025 +(0.014)		0.006 (0.013)	0.001 (0.014)		0.004 (0.013)	0.007 (0.016)		0.006 (0.015)
	-0.024+(0.014)			0.002 (0.014)			0.008 (0.016)		
		-0.029* (0.013)			-0.028*(0.013)			-0.030*(0.014)	
			0.013 (0.016)			0.012 (0.011)			0.0143 (0.012)
Often Drunk	0.033*(0.016)	-0.003(0.016)	0.029*(0.015)	0.038*(0.017)	0.003 (0.016)	0.029+(0.015)	0.0267 (0.018)	0.003 (0.018)	0.027 (0.017)
	0.037*(0.016)	-0.004(0.016)		0.042*(0.016)	0.002 (0.016)		0.0306+(0.018)	0.001 (0.018)	
		-0.016(0.014)	0.038*(0.013)		-0.011 (0.014)	0.040*(0.013)		-0.009 (0.016)	0.036*(0.014)
	0.0310*(0.015)		0.0319*(0.015)	0.035*(0.016)		0.032*(0.015)	0.023 (0.018)		0.030+ (0.016)
	0.036*(0.015)			0.040*(0.016)			0.028 (0.017)		
		-0.018(0.014)			-0.014 (0.014)			-0.011 (0.016)	
			0.040**(0.012)			0.042**(0.012)			0.041*(0.013)
Never Drunk	0.006 (0.010)	-0.014+ (0.010)	-0.014*(0.009)	-0.003 (0.010)	0.014 (0.010)	-0.015 (0.009)	-0.0138 (0.011)	-0.014 (0.010)	0.010 (0.011)
	0.004 (0.010)	0.017*(0.010)		-0.005 (0.010)	0.015 (0.010)		-0.015 (0.011)	0.0108 (0.011)	
		0.021*(0.009)	-0.013 (0.008)		0.019 (0.009)	-0.013 (0.008)		0.015 (0.010)	-0.015 (0.009)
	0.008(0.009)		0.015+(0.009)	-0.002 (0.010)		-0.015 (0.010)	-0.010 (0.011)		-0.015 (0.010)
	0.005(0.009)			-0.004 (0.001)			-0.012 (0.010)		
		0.021*(0.009)			0.019 (0.009)			0.016 (0.010)	
			-0.012(0.008)			-0.013 (0.008)			-0.015+ (.008)
Plays sports rarely	0.023*(0.011)	-0.016 (0.011)	0.035**(0.010)	0.018 (0.011)	-0.016 (0.011)	0.035 *(0.010)	0.013 (0.012	-0.021+(0.012)	0.041**(0.01)
	0.028**(0.010)	-0.017**(0.011)		0.023*(0.011)	-0.017 (0.011)		0.020 (0.012)	-0.024*(0.012)	
		-0.019** (0.009)	0.037**(0.009)		-0.018*(0.009)	0.037*(0.009)		-0.022*(0.011)	0.042* (0.010)
	0.025**(0.010)		0.037**(0.010)	0.019+(0.011)		0.037*(0.011)	0.015 (0.012)		0.046*(0.011)
	0.031**(0.010)			0.025* (0.011)			0.022**(0.012)		
		-0.021**(0.009)			-0.020*(0.009)			-0.024**(0.011)	
			0.036**(0.008)			0.037**(0.008)			0.042**(.009)

Note: Standard errors are in brackets + indicates that the underlying coefficient is significant at 10% level, * at 5% and **at 1%.

Table 4 Effect of personality traits on health behaviours Propensity Score Matching Results

Outcomes	Model 1 External LC	Model 1 Conscientious	Model 1 Low Self-Esteem	Model 2 External LC	Model 2 Conscientious	Model 2 Low Self-Esteem
Ever tried cannabis	0.0738 (0.03)**	-0.025 (0.026)	0.135 (0.029)**	0.078 (0.019)**	-0.054 (0.017)**	0.118 (0.015)**
Ever tried other drugs	0.009 (0.022)	-0.046 (0.017)**	0.060 (0.019)**	0.051 (0.014)**	-0.037 (0.011)**	0.056 (0.010)**
<16 at first sexual intercourse	-0.013 (0.035)	-0.090 (0.033)**	0.049 (0.033)	0.0599 (0.025)**	-0.042 (0.022)+	0.096 (0.019)**
Ever had unprotected sex	0.067 (0.035)*	-0.082 (0.034)	0.106 (0.034)**	0.075 (0.026)**	-0.077 (0.022)**	0.086 (0.019)**
Heavy drinking	0.003 (0.027)	0.005 (0.024)	0.031 (0.026)	0.016 (0.013)	-0.029 (0.016)+	0.017 (0.014)
Often drunk	0.064 (0.030)**	0.021 (0.028)	0.031 (0.030)	0.045 (0.019)**	-0.045 (0.019)	0.027 (0.016)+
Never drunk	0.026 (0.021)	0.0085 (0.021)	0.009 (0.022)	-0.019 (0.013)	0.0206 (0.012)+	-0.016 (0.011)
Low physical activity	0.032 (0.021)**	-0.060 (0.022)**	0.015 (0.022)	0.026 (0.014)+	-0.012 (0.012)	0.025 (0.011)**

Note: Standard errors are in brackets + indicates that the underlying coefficient is significant at 10% level, * at 5% and **at 1%.

As shown in Table A1, the effects of personality traits are comparable with the effect of other important variables, such as: the presence of siblings, the child gender, having a young or single mother, or growing up with a disable parent, and are, in most cases stronger than the effect of child's special needs and maternal education.

Interestingly, the effect of locus of control, self-esteem and conscientiousness on drinking habits is smaller, even if external individuals and those with low self-esteem seem more likely to be drunk often (by about 3 p.p.). On the other hand, youths with high conscientiousness are less likely to be heavy drinkers in all specifications of the model by around 3 p.p.

Lastly, personality has a moderate effect on the frequency of playing sports with a negative effect of external locus of control and low self-esteem (by about 2-3 p.p) and a positive effect of high conscientiousness (by about 2 p.p.).

In order to improve the accuracy and efficiency of our estimation, we use propensity score matching (PSM) to evaluate the effect of personality traits on health-risky behaviours.

First, we estimate the probability of having different personality traits (propensity score) and these scores are used in the subsequent matching process. Figure 5 in the Appendix shows the distribution of propensity scores across treatment and control groups.

Table 4 presents results from the estimation performed using Model 1 and Model 2. PSM estimates are not provided for Model 3 because it seems unwise to match according to data that are more likely to have changed between wave 1 and wave 6 or 7. However, sensitivity analyses have been run including some of these variables (i.e. household income, maternal employment or marital status at wave 1) and results are unchanged.

Results from Table 4 confirm that personality has a strong effect on some health-risky behaviours, and particularly cannabis and drug use, unprotected sex and low level of physical activity. Results are generally consistent with those reported in Table 3 from OLS estimation, with slightly lower effects reported from PSM estimation. In Model 2, being external significantly increases the risk of taking cannabis and other drugs, (between 5 and 6 p.p.), as well as the chances of having ever had unprotected sexual intercourse (6-7 p.p.). Young people with low self-esteem face an increased risk of taking drugs and cannabis (11 p.p), engaging in unprotected sexual activity(8-9 p.p.), and having a low level of physical activity (2.5 p.p.). The effects on drinking habits and physical activity are smaller (between 2 and 3 p.p) but still significant.

On the other hand, a high level of conscientiousness seem to decrease chances of engaging in risk-taking behaviours, such as cannabis or drug use and unprotected sex (results between 4 and 5 p.p.) and increase chances of drink moderately (by around 2 p.p.). As already noted, personality has a smaller effect on drinking habits, but external children are

more likely to get drunk often (by around 5-6 p.p.). They are also more likely to not engage in regular physical activity by around 3-4 p.p.

Our findings are consistent with previous literature from psychology and economics. For example, Hampson et al. (2007) showing that extraversion, agreeableness and conscientiousness affect health-related behaviours, such as smoking, diet and exercise (with correlation coefficients between 0.06 and 0.12); Gale, Batty and Deary (2008) find that a one standard deviation increase in age-10 locus of control decreases the risk of adult obesity by 8%; Cobb-Clark et al. (2012), show that one standard deviation increase in Internal behaviour increases the chances of healthy habits by around 2 p.p.

Results showing the effect of other independent variables on health behaviours are presented in Table A1. Generally, children who were less healthy at birth or had a disability or a special need are less likely to engage in risky behaviours. Boys seem more likely to experiment with cannabis, drugs, excessive drinking and risky sexual behaviour. Children who grew up in a single-parent family also face an increased risk for all negative behaviours, while maternal age at birth seems less important. Having older siblings increases your chances to experiment with cannabis . Interestingly, ethnic minorities (and especially children with an Asian background) seem less likely to engage in risky behaviours and maternal education increases the chances of taking drugs or cannabis or being a heavy drinker but decreases chances to engage in risky sexual behaviour or not practicing regular physical exercise. Higher maternal education is likely to be associated with maternal employment and higher household income, as well as lower adult supervision and all these factors may contribute to increased chances of some health-risky behaviours.

6. Conclusion

In this paper, we have investigated the effect of personality traits on health behaviours. We have used the Longitudinal Study of Young People in England, which is a rich source of information on English teenagers who were followed from age 14 for 7 waves. We find that non-cognitive skills have a notable effect on the incidence of health-risky behaviours and particularly, children with external locus of control and low self-esteem are more likely to use cannabis and drugs, engage in risky sexual activity and get drunk often. The size of the effect is statistically significant, economically important, and is comparable to other important variables, such as sex of the child, family composition or family circumstances at birth.

Our analysis is performed using Ordinary Least Squares and Propensity Score Matching. We make extensive use of the amount of information contained in LSYPE and gradually increase our set of independent variables, in order to try to control for all factors affecting both personality and health behaviours. Our results are stable over different specifications of our model. Propensity Score Matching allow us to find a group of children who did not have a particular personality trait as similar as possible to our treatment group (children who have that same personality characteristic), given our independent variables. We can then compare outcomes between these two groups and check whether there are any significant differences.

This analysis fills a gap in the existing literature, by providing new evidence on recent British data. Governments across various Western countries have been devoting a significant amount of resources to the improvement of adolescents' well-being and there has been considerable debate about the need to reduce the incidence of health risky behaviours among teenagers. This paper provides further evidence of the importance of non-cognitive skills and our results underline the potential positive effects of policy interventions targeting specific

negative attitudes and personality traits (such as external locus of control or low self-esteem) among teenagers. However, further research is needed to assess the stability of our results in the presence of selection on unobservables and to establish the transmission channels of the effects.

Our results have important policy implications: policies aimed at promoting positive personality traits have been proved to be particularly effective when targeting adolescence (see Almlund et al., 2011 for a review and Bloom et al., 2009 and Martin et al., 2010 for specific examples), while changes in personality become more difficult later in life (Borghans et al., 2008). If personality is an important determinant of health-related choices in early adulthood, these interventions will also decrease the incidence of health-risky behaviours.

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Appendix

Locus of control – Questions in LSYPE

1. I can pretty much decide what happens in my life
2. If someone is not a success in life, it is usually his fault
3. How well you get in this world is mostly a matter of luck
4. Even if I do well at school, I will have a hard time
5. People like me don't have much of a chance
6. If you work hard at something, you will usually succeed

Possible answers:

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Conscientiousness – Questions in LSYPE

1. Doing well at school means a lot to me
2. At school, I work as hard as I can
3. Working hard at school now will help me to get on later in life
4. If you work hard at something, you will usually succeed

Possible answers:

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Table A1 Effect of other independent variables on health behaviours – OLS Estimation Results from Model 2 (Including all Personality Traits)

	Ever tried cannabis	Ever tried other drugs	First sexual intercourse <16	Ever had unprotected sex
Premature birth	-0.061**	-0.022	0.004	-0.003
	(0.024)	(0.016)	(0.028)	(0.029)
Birth weight in kg	0.002	0.002	0.014	-0.003
	(0.013)	(0.009)	(0.015)	(0.016)
Male	0.090**	0.046**	0.026+	0.036*
	(0.013)	(0.009)	(0.015)	(0.016)
Single parent household at birth	0.073**	0.028*	0.062**	0.070**
	(0.017)	(0.012)	(0.020)	(0.021)
Mother<20 at birth	0.000	0.039+	0.023	0.070+
	(0.030)	(0.021)	(0.035)	(0.037)
Background				
Black	-0.132**	-0.132**	-0.038	0.004
	(0.031)	(0.021)	(0.038)	(0.039)
Asian	-0.219**	-0.116**	-0.213**	-0.160**
	(0.023)	(0.016)	(0.039)	(0.041)
Mixed	-0.034	-0.054**	-0.028	-0.014
	(0.028)	(0.019)	(0.034)	(0.035)
N. older siblings	0.024**	0.006	0.013	0.008
	(0.006)	(0.004)	(0.008)	(0.008)
Grandparents went to university	0.013	0.010	-0.002	-0.031
	(0.022)	(0.015)	(0.028)	(0.029)
Child has special needs	-0.060**	-0.023*	0.021	0.003
	(0.017)	(0.012)	(0.020)	(0.021)
Child has a disability	0.001	-0.014	0.001	-0.004
	(0.019)	(0.013)	(0.023)	(0.024)
Main parent has a disability	0.030+	0.004	0.043*	0.036+
	(0.016)	(0.011)	(0.020)	(0.020)
Mother has a university degree	0.126**	0.055**	-0.038	-0.037
	(0.025)	(0.017)	(0.031)	(0.032)
Mother has other higher education	0.103**	0.028+	-0.023	0.013
	(0.025)	(0.017)	(0.030)	(0.031)
Mother senior high school graduate	0.040	0.039*	-0.007	-0.010
	(0.024)	(0.017)	(0.029)	(0.031)
Mother high school graduate	0.018	0.014	0.013	-0.015
	(0.021)	(0.015)	(0.026)	(0.028)
Mother junior high school graduate	0.004	-0.017	0.038	0.040
	(0.028)	(0.020)	(0.034)	(0.036)
Mother has other qualification	0.029	0.004	-0.023	-0.078
	(0.041)	(0.028)	(0.050)	(0.051)

Table A1 contd

	Heavy drinking	Often drunk	Never drunk	Low physical activity
Birth weight in kg	-0.020	0.007	0.009	-0.033+
	(0.022)	(0.025)	(0.016)	(0.017)
Premature birth	0.005	0.043**	0.003	-0.002
	(0.012)	(0.014)	(0.008)	(0.009)
Male	0.094**	-0.009	-0.017+	-0.113**
	(0.012)	(0.014)	(0.009)	(0.009)
Single parent household at birth	-0.034*	0.044*	-0.017	0.013
	(0.016)	(0.018)	(0.011)	(0.012)
Mother<20 at birth	-0.039	-0.012	0.037+	0.023
	(0.029)	(0.033)	(0.021)	(0.022)
Background				
Black	-0.178**	-0.167**	0.215**	0.049*
	(0.031)	(0.035)	(0.022)	(0.022)
Asian	-0.052+	-0.114**	0.074**	-0.011
	(0.028)	(0.032)	(0.020)	(0.016)
Mixed	-0.058*	-0.014	0.046*	0.022
	(0.026)	(0.030)	(0.018)	(0.020)
N. older siblings	-0.012*	0.014*	-0.002	0.003
	(0.006)	(0.007)	(0.004)	(0.005)
Grandparents went to university	0.044*	-0.038	0.002	0.012
	(0.022)	(0.024)	(0.015)	(0.016)
Child has special needs	-0.053**	-0.056**	0.050**	0.002
	(0.016)	(0.018)	(0.011)	(0.012)
Child has a disability	-0.040*	-0.015	0.026*	0.008
	(0.018)	(0.020)	(0.012)	(0.014)
Main parent has a disability	0.004	0.000	0.020+	0.008
	(0.016)	(0.017)	(0.011)	(0.012)
Mother has a university degree	0.179**	0.049+	-0.045**	-0.056**
	(0.024)	(0.027)	(0.017)	(0.018)
Mother has other higher education	0.127**	0.037	-0.040*	-0.035*
	(0.024)	(0.027)	(0.017)	(0.018)
Mother senior high school graduate	0.074**	0.036	-0.022	-0.035*
	(0.024)	(0.026)	(0.017)	(0.018)
Mother high school graduate	0.073**	0.017	-0.020	-0.015
	(0.021)	(0.024)	(0.015)	(0.015)
Mother junior high school graduate	0.027	0.035	-0.002	-0.010
	(0.027)	(0.031)	(0.019)	(0.020)
Mother has other qualification	0.032	0.096*	-0.026	0.008
	(0.040)	(0.045)	(0.028)	(0.029)

Figure 1 *Histogram of propensity scores of treatment vs. control group (Model 2 External = 1, Full LC Index – Outcome: Ever tried cannabis)*

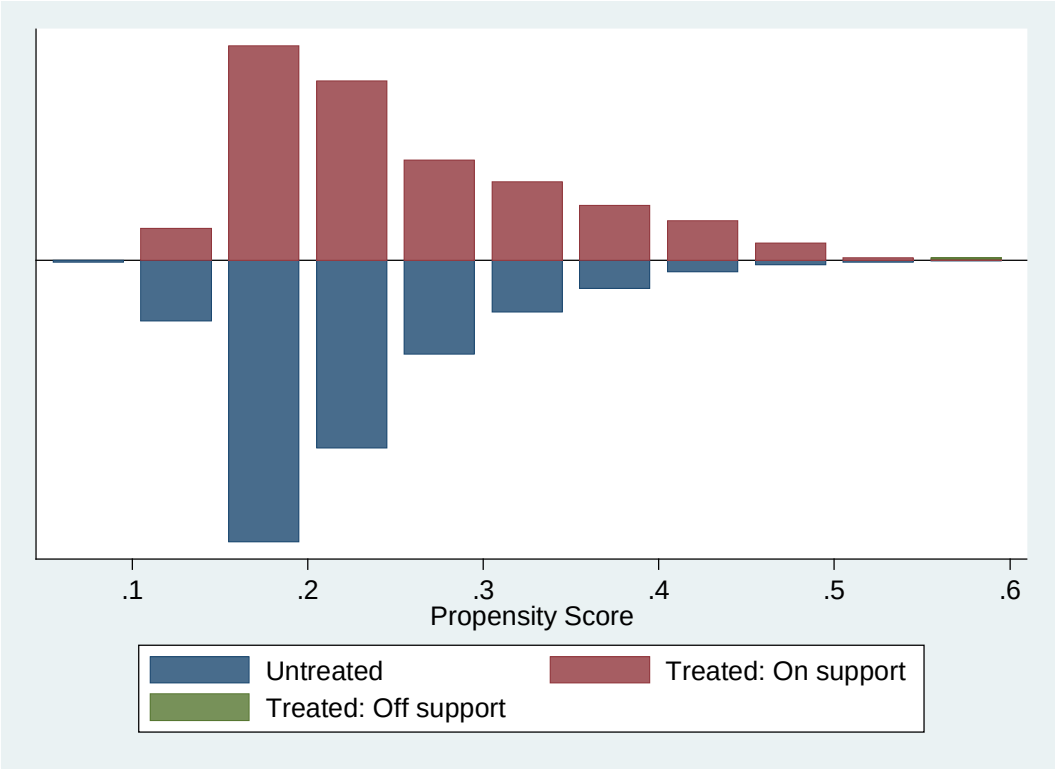

Figure 6 - Kernel graphs of propensity score for treated and control group