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What is the Relationship between Cognitive and Non-Cognitive Skills and the Adoption of Risk Behavior in Peru?

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Abstract

For many years, research has dealt with the relationship between the adoption of risk behaviors by teenagers and factors related to the family or the environment, ignoring other factors such as teenagers' own cognitive or non-cognitive skills. This study seeks to demonstrate the relationship between these two variables and ascertain whether adolescents' cognitive and non-cognitive skills are negatively associated with the consumption of legal and illegal drugs, the early initiation of sexual activity, unprotected sex, criminal behaviors and the sedentary lifestyle. The investigation used Peru's Young Lives database and employed a latent static factor model as a first step and two OLS models in the second stage. The results show that the relationship between risk behaviors, specifically use of legal and illegal drugs and criminal behavior, and cognitive and noncognitive skills is negative. That is, adolescents with higher levels of intelligence, self-steeem and self-efficacy are less likely to engage in risk behaviors.

Keywords: adolescents; skills; risk behavior; intelligence; self-esteem; self-efficacy; Peru.

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Acronyms used

ENDES	Demographic and Family Health Survey (Encuesta Demográfica y de Salud Familiar)
GED	General Educational Development Test
PPVT	Peabody Picture Vocabulary Test
YLS	Young Lives Study

INTRODUCTION

Risk behaviors are those that jeopardize an individual's physical and psychological health, as well as his or her social life (OMS 1998; Jessor 1991). The most common of these are: use of legal and illegal drugs; early initiation of sexual activity; unprotected sex; criminal behavior and in the recent years, sedentary lifestyle.

An ever-increasing number of young people engage in risk behaviors of one kind or another at an earlier age. In Peru, the average age of first-time licit and illicit drugs use is 13 (OPD 2012)[1]; meanwhile, 46% of females[2] have their first sexual encounter before the age of 18 (INEI 2015)[3]. Similarly, about 13.6% of adolescents are already mothers or are pregnant for the first time (INEI 2015). Finally, noncommunicable diseases, as a consequence from sedentary lifestyle, are the leading cause of death with 58.5% (MINSA 2015) and rate of victimization is 39%, one of the highest of Latin America (Latinobárometro, 2016).

The literature demonstrates a relationship between the socioeconomic characteristics of adolescents and their propensity to engage in a risk behavior of one type or another. However, two points are being overlooked. On the one hand, the relationship between socioemotional skills (perseverance, extroversion, self-esteem, self-control, among others) and engagement in risk behaviors has been little studied (Heckman & Kautz 2012; Favara *et.al.* 2016). On the other hand, previous studies do not necessarily capture latent abilities.

The objective of this study is to estimate the marginal contribution of cognitive and socioemotional latent abilities to decisions by adolescents to engage in one of the following types of risk behavior (Heckman and Kautz 2012): consumption of legal and illegal drugs, early sexual initiation, unprotected sex, criminal behavior and sedentary lifestyle.

[1] According to the *IV Estudio nacional: prevención y consumo de drogas en estudiantes de secundaria* a study conducted in 2012 by the Peruvian Drug Observatory (Observatorio Peruano de Drogas, OPD), the age at which young people in Peru start to engage in a risk behavior of one kind or another is between 12 and 15.

[2] Women between ages of 20 and 24.

[3] The Demographic and Family Health Survey (Encuesta Demográfica y de Salud Familiar, Endes) is a survey conducted by Peru's National Institute of Statistics and Informatics (Instituto Nacional de Estadística e Informática, INEI).

The contribution of the study is twofold. First, the study uses a methodology which allows to work with a low number of rounds. Early risk behavior studies using YLS database, including the previous version of this paper, exploit longitudinal information using Fixed Effects models, but do not assure consistency of estimation due to the low number of rounds. Secondly, it is the first of its kind to include the sedentary lifestyle in the analysis.

The database employed is from the Young Lives Study (YLS).[4] The Young Lives project constitutes a long-term study in four developing countries: Ethiopia, India, Peru, and Vietnam, with a view to understanding the causes and consequences of child poverty and, in turn, to designing and implementing public policies aimed at reducing it.

This study follows the lives of two groups of children in each country: 2,000 children born between 2001 and 2002 (younger cohort) and 714 children born between 1994 and 1995 (older cohort), and applies rounds of questionnaires to the children and their main caregivers. Four rounds of questionnaires have been conducted to date, in 2002, 2006, 2009 and 2013. This study focuses on the Peruvian case. It employs Rounds 2, 3 and 4 of the questionnaire and works only with children from the older cohort, who were 11 years old during Round 2, 14 and 15 years old during Round 3 and 18 years old during the Round 4.

This paper is divided into five sections. The first section presents a review of the literature; the second sets out the databases used, as well as their characteristics; the third presents the econometric strategy selected to verify the hypotheses designed; and the fourth shows the results obtained using the econometric model. Finally, the fifth section sets out the conclusion and policy recommendations.

1. DETERMINANTS OF RISK BEHAVIOR

The determinants of risk behaviors can be approached from three perspectives: behavioral economics; classical economics; and developmental psychology (National Bureau of Economic Research, 2001).

The first approach, that of behavioral economics, analyzes an adolescent's actions based on psychological tools and the logic of utility maximization. Thus, an individual's

[4] The database of the Young Lives Study in Peru can be found at: <http://www.ninosdelmilenio.org> (also at: <www.younglives.org.uk>).

behavior is determined by two factors; the "passions" that prompt a person to act on impulse, and an "impartial spectator" that acts as a conscience. Both aspects encompass the feelings, knowledge, and preferences of each individual (Ashraf *et al.* 2005). Thus, an increase in the risk perceived by an individual can cause different reactions: abstinence or indulgence (O'Donogue and Rabin 2000). The difference between reacting in one way or the other depends on the person taking the action. That is, an individual who has previously indulged in a risk behavior has already assumed all of the costs associated with that activity (passion), and the marginal cost of further engagement will therefore be increasingly less. This is not true of an individual who has yet to indulge in a risk behavior, as in this case the cost of doing so is greater (impartial spectator).

The second approach is that of classical economics and posits that engagement in risk behavior is the result of a utility maximization process by an adolescent with respect to legal and illegal drug use and engagement in sexual relations. This approach is based on the theory of rational addiction (Becker and Murphy 1988).

Finally, the third approach is that of developmental psychology. This approach holds that the factors that influence the adoption of risk behavior arise out of three spheres: family, context, and personal, which in turn influence an individual's cognitive, emotional, and social development.

The **family** sphere is perhaps that which most influences an adolescent's decision to engage in a risk behavior. This is because the factors that make up this sphere exert their presence in each stage of an adolescent's formation. The most important factors include: the household structure and its relationship with alcohol consumption, as in the case studied by Stroup-Benham *et al*. of Mexican-American single mothers and their children (1990); the absence of one parent, as a consequence of which Blum *et al.* find an increase in alcohol and tobacco use among adolescents in the 7th to 12th grade in the United States (2000); moreover, protective actions against early sexual initiation of adolescents, which are associated with parents' being married and the existence of good family relations according to Anteghini *et al.* (2001).

Other important factors in this sphere are parental monitoring of their children's activities and the level of communication between parents and children. Of course, the former is associated with less engagement by adolescents in sexual behavior and

alcohol use (Cottrell *et al.* 2007), and the latter is correlated to lower rates of alcohol consumption. (Vincent *et al*. 2005) and better physical activity (Ornelas, Perreira, & Ayala, 2007).

The second sphere is the **context**; that is, the place or location where the adolescent functions. The fundamental component of this sphere is socioeconomic, a factor that which derives from the family environment but whose consequences have an important relationship to the reality which surround the adolescent. Low-income individuals, due to their economic circumstances, are found to be more likely to live in areas where drug addiction and violence are entrenched (Verner and Cardoso 2007). In the same way, peer effect and gang membership have a strong relationship with criminal behaviors (CAF 2014; Battin *et al.*1998 and Howell, 1998).

Finally, the sphere on which this paper focuses is that of the **individual** and concerns the cognitive and socioemotional skills possessed by an adolescent. The former (measured in the study by Cueto *et al*. by means of the Peabody Picture Vocabulary Test [PPVT][5]) are negatively associated with the adoption of risk behaviors. That is, an adolescent who obtains a better score on the PPVT is less likely to adopt a risk behavior, specifically use of tobacco (Cueto *et al.* 2011). Moreover, Weiland *et al.* (2014), in a study on substance abuse among young adults, find a negative relationship between total gray matter[6] and the early use of substances such as alcohol and other drugs.

In a study more closely aligned to the objectives of this one, it was found that socioemotional (or non-cognitive) skills also have a negative relationship on the adoption of risk behavior (Heckman and Kautz 2012), based on comparisons between three types of individuals: those who graduated from high school, those who dropped out, and those who dropped out but opted to take the General Educational Development test (GED).[7] The databases used for this study were NSLY79, NSLY97, and NELS and the results show that those students who passed the GED, in contrast to those who graduated from high school, are most vulnerable to the adoption of risk behavior, despite being recognized as having the same cognitive level as the latter group.

[5] This study only employs the PPVT as a measure of cognitive skills.
[6] Gray matter can be considered as a gauge of cognitive skills, as it is responsible for processing the information received by the brain.
[7] The GED test is used in the USA to accredit students who drop out of high school with the same cognitive level as those who graduate.

The difference between students who passed the GED and those who graduate from high school is due to factors such as socioemotional skills because, despite their shared cognitive characteristics, there are different results for the two student types. It should be noted that the authors reach this conclusion by measuring the risk behavior adopted by each type of individual, as they do not use a specific variable to measure socioemotional skills. Specifically, Wang *et al.* (2009) find that self-esteem constitutes a protective factor against risk behavior among young adolescents. Likewise, Favara et al. (2016) find a negative relationship between early self-steem and later risky behaviors.

Finally, Marcus & Owen (1992) found that people who did not exercise, in contrast with those who exercised regularly, has little confidence in their ability to do it. That's mean less self-efficacy.

None of the abovementioned studies estimate the marginal contribution of latents skills on the likelihood of engaging in risk behaviors, especially to the sedentary lifestyle, and that is one of the contributions of this study.

2. DATABASE AND SAMPLE

As mentioned earlier, the database from the Young Lives Study is used in this analysis. Table 1 presents descriptive statistics of the most important variables from four rounds. It can be seen that, on average, those adolescents who have not consumed tobacco, have not use illegal drugs, have not carry a weapon, have not had early sexual relations or unprotected sex have higher levels of both cognitive and socioemotional skills. In case of adolescents who consume alcohol, a different pattern is observed with cognitive abilities. Finally, adolescents who have a sedentary lifestyle, have higher levels of cognitive and non-cognitive skills.

Moreover, adolescents who have not engaged in any of these behaviors enjoy better relationships with their parents than those who have. Besides, parents of those adolescents who use legal or illegal drugs or have a sedentary lifestyle have a high level education.

Table 1: Descriptive Statistics, Young Lives Study

	Risk behaviors at ages of 15 or 19													
	Smoking		Drinking		Drugs use		Early sexual activity		Carrying Weapon		Unprotected sex		Sedentary Lifestyle	
	Sí	*No*	*Sí*	*No*	*Sí*	*No*	*Sí*	*No*	*Sí*	*No*	*Sí*	*No*	*Sí*	*No*
Characteristics at the age of 12														
PPVT (Raw score)	71.95	71.75	73.30	70.10	71.98	71.78	71.32	72.46	69.54	72.08	69.28	72.74	73.73	70.62
Mathematics test (Raw score)	5.57	5.83	5.82	5.70	5.36	5.81	5.79	5.72	5.16	5.83	5.78	5.75	5.93	5.66
Self-esteem index	4.34	4.29	4.34	4.26	4.24	4.31	4.30	4.31	3.94	4.35	4.14	4.36	4.42	4.23
Self-efficacy index	4.19	4.25	4.22	4.25	4.14	4.24	4.21	4.27	4.18	4.24	4.17	4.26	4.25	4.22
Enrolled in school at 12	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	0.99	1.00
Relationship with parents	3.95	4.10	4.05	4.07	4.17	4.04	3.99	4.15	3.93	4.08	3.76	4.17	4.08	4.05
Wealth index	0.52	0.51	0.53	0.50	0.50	0.52	0.51	0.52	0.45	0.52	0.50	0.52	0.54	0.50
Characteristics at the age of 15														
PPVT (Raw score)	94.27	96.36	96.87	94.61	92.84	96.23	95.51	96.23	92.28	96.27	94.78	96.20	97.33	94.88
Mathematics test (Raw score)	12.94	13.11	13.34	12.75	11.85	13.22	12.94	13.24	11.82	13.21	12.55	13.25	13.35	12.89
Self-esteem index	3.87	3.92	3.85	3.97	3.85	3.92	3.88	3.94	3.77	3.93	3.86	3.93	3.94	3.89
Self-efficacy index	3.63	3.76	3.70	3.76	3.60	3.74	3.70	3.75	3.67	3.73	3.69	3.74	3.78	3.69
Enrolled in school at 15	0.92	0.94	0.93	0.95	0.84	0.95	0.94	0.94	0.83	0.95	0.88	0.96	0.95	0.93
Relationship with parents	2.28	2.41	2.34	2.42	2.37	2.38	2.34	2.42	2.26	2.39	2.32	2.40	2.36	2.39
Wealth index	0.60	0.58	0.61	0.56	0.57	0.59	0.59	0.59	0.52	0.60	0.59	0.59	0.62	0.57
Mother’s education	8.08	7.28	7.85	7.08	7.86	7.44	6.98	8.17	7.02	7.54	6.83	7.73	7.74	7.33
Father’s education	8.45	8.74	8.84	8.47	8.71	8.66	8.62	8.73	7.82	8.77	8.34	8.79	8.85	8.56
Best friend drink	0.75	0.60	0.75	0.50	0.79	0.62	0.73	0.50	0.74	0.62	0.73	0.60	0.65	0.63
Best friend smoke	0.73	0.45	0.60	0.43	0.78	0.49	0.61	0.39	0.67	0.50	0.65	0.47	0.48	0.54
N° Observations	**110**	**311**	**224**	**197**	**50**	**371**	**243**	**178**	**46**	**375**	**114**	**307**	**159**	**262**

3. RISK BEHAVIORS AND COGNITIVE AND SOCIOEMOTIONAL SKILLS

3.1 Risk behaviors

In this section, we will analyze eight risk behaviors in adolescents:[9] consumption of legal and illegal drugs, early sexual initiation, unprotected sex, criminal behavior and sedentary lifestyle. It should be mentioned that these variables are only found in Rounds 3 and 4 of the YLS for the older cohort and were retrieved through a confidential self-administered questionnaire; this means that no questions were directly asked by an interviewer – each adolescent completed the questionnaire autonomously, in an area separate from the staff in charge, and handed it in in a sealed envelope. The application of the questionnaire required the verbal consent of each participant (Cueto *et al.* 2011).

It was decided to make the questionnaire confidential because of the sensitive nature of the issues raised, which are frequently stigmatized by adolescents. Its confidential and self-reported character constitutes an effort to reduce the likelihood of blank responses and bias in answers predicated on what adolescents think is socially acceptable, as well as to increase the likelihood of truthful responses, which are highly unlikely in face-to-face interviews. Finally, it serves to reduce potential bias or partiality on the part of the interviewer (YLS 2011a).

The confidential questionnaire covers questions on the adolescent's relationship with his/her parents and the impact that this has on risk behaviors. These include: abuse of an adolescent by peers, consumption of legal and illegal drugs, practice of sexual relations, access to information on sex and contraceptive methods, depression, and firearm possession.[10]

The indicators for each risk behavior were the frequency of use tobacco or alcohol, the age of sexual debut and the number of days which the adolescent does 60 minutes of physically activity. According BID (2013) and WHO (2010), these indicators show the exposure to addictive substances, early sexual initiation (13 years old) and some dangerous illnesses of the adolescent.

[9] The variables used to measure risk behaviors are in Annex 1, Table 1A.
[10] For information on how the indicators of consumption of legal and illegal drugs, early sexual activity, unprotected sex and criminal behavior are constructed, see Annex 2.

3.2 Cognitive and socioemotional skills

Cognitive and socioemotional skills are covered by the questions in Rounds 2 and 3, for the older cohort of the YLS.

Cognitive skills

In recent years, the application of standardized tests that measure cognitive skills has become a very common practice in developing countries, as they are considered indicators of success in education and the acquisition of knowledge for adult life (YLS 2011b).

Cognitive skills are measured through the following tests:[11] the PPVT and mathematics test. The PPVT[12] is a widely-used receptive vocabulary test in which a series of images are presented to participants, who are required to select the one that best represents the word spoken to them. A number of studies have found that the PPVT has a strong positive correlation with commonly used measures of intelligence, such as the Wechsler and McCarthy scales (Campbell *et al.* 2001; Gray *et al.* 1999; Campbell 1998). Otherwise, the mathematics test measures participants' mathematical skills, requiring them to solve basic operations and problems (Cueto and León 2012).

Socioemotional skills

To measure socioemotional or non-cognitive skills, two indicators were constructed: the self-esteem and self-efficacy indices.[13] Both self-esteem and self-efficacy are notions that have been validated by the psychological literature, as they correlate with an adolescent's economic and social achievements in his/her adult life. Self-esteem assesses how an individual values him/herself, while self-efficacy measures an individual's control over his/her life; that is, whether a person believes that the results of his/her actions are due to individual effort and not to factors such as luck, destiny, or the intervention of others (Dercon and Sánchez 2011).

[11] The variables used to measure cognitive skills are found in Annex 1, Table 1B.
[12] In Peru, the Spanish-language version of the PPVT (PPVT-R) is employed, which consists of a single form containing 125 items, as compared to the 204 in the PPVT form used in other countries (PPVT-III-A).
[13] The variables used to measure non cognitive skills are found in Annex 1, Table 1B.

The indices are constructed based on the degree to which each adolescent agrees with statements related to personality traits, such as self-esteem and self-efficacy, measured using Likert's 5-point scale.[14]

To measure self-esteem,[15] the statements used are centered on positive and negative dimensions of pride and shame based on the Rosenberg self-esteem scale, with a focus on the adolescents' everyday circumstances. To measure self-efficacy,[16] statements are employed that relate to the adolescents' decision-making about their lives.

4. Empirical Strategy

The main objective of this study is to estimate the marginal contribution of cognitive and socioemotional skills on the adoption of eight types of risk behavior (use of legal and illegal drugs, early initiation of sexual life, unprotected sex, carrying weapons, criminal behaviors and sedentary lifestyle). Nevertheless, skills are described as latent insofar as they go unobserved by the econometrician but are known by the individual.

Because latent skills are not directly observed by the econoometrician, the estimation of models is usually carried out using proxy variables; that is, test that measure both cognitive and noncognitives skills (Yamada et al. 2013; Dercon and Sánchez 2011) with error.

However, the use of these tests would generate endogeneity in the estimation of the final model. Latent skills would be ommited, afecting both propensity for engagement in a risk behavior, and in turn, the performance tests, and consequenly the parameters estimated would be inconsistent and would not reflect the effect of skills on propensity to engage in a risk behavior.

In this regard, the strategy to compute the latent abilities, using longitudinal data information on measurement test, is proposed by Cunha et.al (2010).

[14] The Likert scale has a "neutral" option for when an adolescent cannot respond to a statement. The other four options used in the Likert scale are: "Strongly agree," "agree," "disagree," and "strongly disagree." A 5-point scale is broadly recommended, by Likert (1932), DeVellis (2003), and Nunally and Bernstein (1994).
[15] See Annex 3, Table 3A.
[16] See Annex 3, Table 3B.

Estimation of latent skills

We asume that measurements are linear and additively separable function of the latent ability. Let $Z_{j,k,t}$ be the jth test for $k \in \{C, S\}$.

$$Z_{j,k,t} = \mu_{j,k,t} + \alpha_{j,k,t}\theta_{k,t} + \varepsilon_{j,k,t} \quad (1)$$

Where $\theta_{k,t}$ is the latent ability for $k \in \{C, S\}$ at $t = 3{,}4$[17], $\mu_{j,k,t}$ represents the mean function of $Z_{j,k,t}$, $\alpha_{j,k,t}$ are factor loadings and ε are independent measurement errors. Assuming that $\mathrm{E}(\theta_{k,t}) = 0$ and $\alpha_{1,k,t}$=1 for all $k \in \{C, S\}$ and $t = 3{,}4$, we can identified $\alpha_{2,k,t}$ and later $\theta_{k,t}$. The first, through intertemporal correlations of measures[18] of cognitive and non-cognitive skills and the second, rewriting equation (1) as follow:

$$\theta_{k,t} = \frac{1}{N^k}\sum_{j=1}^{N^k} \frac{Z_{j,t}^k - \mu_{j,t}^k}{\alpha_{j,t}^k} \quad (2)$$

Where N^k is the total number of tests by type of skills.

Models for Risk Behaviors

We define two linear probability models (OLS) using panel data information. The first one, seek to find if latents abilities (cognitive and noncognitive) at the age of 12 or variations of them between 12 and 15 years old can predict risk behaviors observed at ages of 15 or 19, controlling for a set characteristics at the age of 15 or changes since 12 years old, as follow:

$$Y_{i,15\,o\,19} = \beta_0 + \beta_1\theta_{i,C,12} + \beta_2\theta_{i,S,12} + \beta_3\Delta\theta_{i,C,15-12} + \beta_4\Delta\theta_{i,S,15-12} + X_{i,15}\Gamma_1 + \mathrm{Z}_{i,12}\Gamma_2 + \Delta Z_{i,15-12}\Gamma_3 + \epsilon_{i,t} \quad (3)$$

Let $Y_{i,15}$ the risk behavior outcomes of individual i observed at age of 15, $\theta_{i,C,12}$ and $\theta_{i,s,12}$ are the latent cognitive and noncognitive abilities at the age of 12, $\Delta\theta_{i,C,15-12}$ and $\Delta\theta_{i,S,15-12}$ are the changes of latent ability between ages 12 and 15, $X_{i,15}$ is a vector of characteristics of individual i at the age of 15[19], $\mathrm{Z}_{i,12}$ includes wealth index and relation

[17] Round 3 and 4 that were administered in 2009 and 2013, respectively.
[18] We have two measures of cognitive and noncognitive skills for each round.
[19] These features are variables that have not change over the time or only are in round 3.

parents at the age of 12 and $\Delta Z_{i,15-12}$ the variation of these between 15 and 12 years old.

Likewise, we use a a second model in order to investigate if latent abilities at the age of 12 or changes of cognitive and noncognitive latent skills between 12, 15 or 19 years old have a relationship with risk behaviors observed at age of 19, controlling for a set of characteristics at the same age and variation of these between 12, 15 and 19 years old.

$$Y_{i,19} = \delta_0 + \delta_1\theta_{i,C,12} + \delta_2\theta_{i,s,12} + \delta_3\Delta\theta_{i,C,15-12} + \delta_4\Delta\theta_{i,s,15-12} + \delta_3\Delta\theta_{i,C,19-15} + \delta_4\Delta\theta_{i,s,19-15} + X_{i,19}\Gamma_4 + \mathrm{Z}_{i,12}\Gamma_5 + \Delta\mathrm{Z}_{\mathrm{i},15-12}\Gamma_6 + \Delta\mathrm{Z}_{\mathrm{i},19-15}\Gamma_7 + \epsilon_{\mathrm{i},19} \quad (4)$$

The objective to propose two models is to maximize information on risk behaviors at different stages of adolescence, considering the low prevalence of risky beahviors observed at age of 15.

5. RESULTS

5.1 Risk behavior at the ages of 15 or 19

In this model we studied seven risk behaviors[20]: use of legal (cigarettes and alcohol) and illegal drugs, carrying a weapon, early sexual life, unprotected sex and sedentary lifestyle.

Table I show that greater noncognitive skills at 12 years old and improvement of these between ages of 12 and 15, reduces the likelihood to smoke frequently and use alcohol in approximately 10% and 13%, respectively. In addition, a teenager with strong noncognitive skills between 12 and 15 years old are less likely to use illegal drugs. This means the strengthening of self-esteem, self-efficacy and self-control play an important role in the decision to adopt a risk behavior, specifically use of legal and illegal drugs.

On the other hand, young men are more likely to adopt risk behaviors, except sedentary lifestyle, where the relationship is reversed. Likewise, better mother's education increases the likelihood that adolescents smoke, drink and use illegal drugs. In contrast, higher father's education has a negative relationship with tobacco use by teenager. The difference may be due to the importance of the supervisory role of the mother.

Finally, variables such as relationship with parents, wealth index and peer effects are statistically significant to explain some risk behavior. The first one has a negative relationship with tobacco use, while the last two has a positive relationship with risk some risk behavior. Adolescents, whose families have higher incomes, are more likely to use alcohol and teenagers, whose best friends have adopted a risk behavior, are more likely not only to consume alcohol, but also to use tobacco and illegal drug; have an early initiation of her/his sexual life and have unprotected sex.

[20] Information for criminal behavior is only available for round 4.

Table I: Risk Behavior at ages of 15 or 19

	Use of Tobacco	Alcohol Consumption	Use of drugs	Carrying a weapon	Early Sexual life	Unprotected sex	Sedentary lifestyle
Child is male	0.229***	0.155***	0.098***	0.051*	0.176***	0.013	-0.252***
	(0.04)	(0.05)	(0.03)	(0.03)	(0.05)	(0.05)	(0.05)
Child always lives in an urban area (at 12 and 15 years old)	0.036	0.019	-0.006	-0.024	-0.087	-0.109	-0.053
	(0.07)	(0.08)	(0.05)	(0.05)	(0.08)	(0.08)	(0.08)
Change in cognitive latent ability between ages 12 and 15	-0.006	-0.007	-0.003	0.002	-0.007	0.005	-0.005
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Change in noncognitive latent ability between ages 12 and 15	-0.106***	-0.132***	-0.052*	-0.006	-0.021	-0.018	0.015
	(0.04)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)	(0.05)
Cognitive latent ability, age of 12	-0.029	-0.008	-0.006	-0.008	-0.021	-0.016	0.044
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Noncognitive latent ability, age 12	-0.101**	-0.149***	-0.057*	-0.009	-0.035	-0.051	0.038
	(0.04)	(0.05)	(0.03)	(0.03)	(0.05)	(0.04)	(0.05)
Enrolled in school at 12 and 15 years old	-0.159	-0.044	-0.155	-0.037	-0.081	-0.216	-0.019
	(0.11)	(0.11)	(0.10)	(0.08)	(0.11)	(0.14)	(0.11)
Mother's education: secondary school	0.102*	0.003	0.085**	-0.017	0.007	-0.035	-0.095
	(0.05)	(0.07)	(0.04)	(0.04)	(0.07)	(0.06)	(0.07)
Mother's education: higher school	0.280***	0.264***	0.108	0.015	-0.106	-0.021	0.017
	(0.08)	(0.10)	(0.07)	(0.06)	(0.11)	(0.10)	(0.11)
Father's education: secondary school	0.002	-0.035	-0.017	-0.010	0.036	0.009	0.055
	(0.06)	(0.07)	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)
Father's education: higher school	-0.128*	-0.074	-0.070	0.017	0.005	-0.004	-0.067
	(0.08)	(0.09)	(0.06)	(0.06)	(0.09)	(0.08)	(0.10)
Relationship with parents, age 12	-0.074**	-0.023	0.028	-0.029	-0.042	-0.072**	-0.025
	(0.03)	(0.04)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Change in relationship with parents between ages 12 and 15	-0.080***	-0.038	0.019	-0.032	-0.027	-0.032	-0.022
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Change in wealth index between ages 12 and 15	0.328	0.577**	0.057	-0.122	0.239	0.334	0.298
	(0.20)	(0.25)	(0.16)	(0.17)	(0.25)	(0.22)	(0.25)
Wealth index, age 12	0.141	0.355	0.123	-0.064	0.325	0.457**	0.220
	(0.20)	(0.22)	(0.14)	(0.15)	(0.22)	(0.20)	(0.23)
Best friends smoke, age 15	0.183***	0.028	0.091***	0.051	0.105*	0.124**	-0.097
	(0.05)	(0.06)	(0.03)	(0.03)	(0.06)	(0.05)	(0.06)
Best friends drink, age 15	0.066	0.258***	0.035	0.040	0.165***	0.020	0.049

	(0.05)	(0.06)	(0.03)	(0.03)	(0.06)	(0.05)	(0.06)
Constant	-0.004	0.095	0.044	0.120	0.286**	0.197	0.468***
	(0.12)	(0.13)	(0.11)	(0.10)	(0.14)	(0.15)	(0.14)
Observations	344	344	344	344	344	344	344
R-square	0.234	0.154	0.107	0.047	0.127	0.079	0.117

5.2 Risk behavior at age of 19

In this model we assess eight risk behaviors due to available information. In case of changes in cognitive latent ability between 15 and 19 years old reduces the likelihood that adolescent have a criminal behavior -including carry a weapon- at age of 19, while changes in the same ability between 12 and 15 has not impact on these. This can be explained because the criminal propensity, which is built by cognitive and noncognitive skills, changes over time[21] (CAF, 2014). On the other hand, strong cognitive skills at early ages (12 years old) increase the likelihood that the child will have a sedentary life at age 19.

On the side of noncognitve skills, changes of these between 12 and 15 years old reduce the likelihood to child smoke frequently at age of 19, whereas increases self-esteem and self-efficacy between 15 and 19 reduce the likelihood that adolescents have unprotected sex or present criminal behaviors in approximately 10%.

Male children are more likely to involve in risky behavior, except for sedentary lifestyle. Moreover, if the child lived in a urban area during ages of 12 and 15, or has studied at ages 12, 15 and 19 years old is less likely to has begun his/her sexual life before 19 years old. Likewise, higher mother's education reduce the likelihood to adolescent uses drugs at age of 19.

Finally, a higher socioeconomic level when child has 12 years old has a positive relationship with alcohol consumption and start of sexual life at age of 19 or under. Peer effects at ages of 15 or 19 also increase the likelihood to adolescente adopt risk behaviors at age of 19 (alcohol consumption, use drugs, carrying a weapon, early sexual life, unprotected sex and criminal behavior).

[21] The criminal propensity has major changes in the early stages of children, however in the later stages such as adolescence and adulthood minor changes also occur.

Table II: Risk Behaviors at age of 19

	Use of Tobacco	Alcohol Consumption	Use of Drugs	Carrying a weapon	Early sexual life	Criminal Behavior	Unprotected sex	Sedentary lifestyle
Child is male	0.110**	0.084	0.081*	-0.001	0.253***	0.089	0.040	-0.268***
	(0.05)	(0.07)	(0.05)	(0.03)	(0.07)	(0.06)	(0.06)	(0.07)
Child always lives in an urban area (at 12 and 15 years old)	0.040	-0.077	-0.003	-0.012	-0.287**	-0.077	-0.106	-0.038
	(0.09)	(0.11)	(0.08)	(0.05)	(0.11)	(0.11)	(0.10)	(0.11)
Change in cognitive latent ability between ages 15 and 19	-0.005	-0.003	-0.004	-0.010*	-0.001	-0.018**	-0.002	0.002
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Change in noncognitive latent ability between ages 15 and 19	-0.009	0.018	0.005	-0.033	-0.030	-0.083*	-0.085*	0.052
	(0.04)	(0.06)	(0.04)	(0.03)	(0.06)	(0.05)	(0.04)	(0.06)
Change in cognitive latent ability between ages 12 and 15	-0.001	0.006	0.002	0.004	-0.009	0.004	-0.003	-0.017
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Change in noncognitive latent ability between ages 12 and 15	-0.118**	-0.031	-0.009	-0.028	-0.066	-0.072	-0.047	0.037
	(0.06)	(0.08)	(0.05)	(0.03)	(0.08)	(0.07)	(0.07)	(0.08)
Cognitive latent ability, age of 12	-0.006	-0.033	-0.046*	-0.007	0.014	-0.034	-0.001	0.090**
	(0.03)	(0.04)	(0.03)	(0.02)	(0.04)	(0.03)	(0.03)	(0.04)
Noncognitive latent ability, age of 12	-0.118**	-0.088	-0.034	-0.027	-0.070	-0.046	-0.022	0.065
	(0.06)	(0.08)	(0.05)	(0.03)	(0.08)	(0.06)	(0.06)	(0.08)
Study at ages of 12,15 and 19	0.034	-0.046	-0.041	-0.003	-0.139*	-0.063	-0.099	0.011
	(0.05)	(0.07)	(0.05)	(0.04)	(0.07)	(0.08)	(0.06)	(0.07)
Mother's education: secondary school	0.005	-0.115	0.063	-0.051	-0.086	-0.025	0.070	-0.113
	(0.07)	(0.09)	(0.05)	(0.05)	(0.09)	(0.09)	(0.07)	(0.09)
Mother's education: higher school	0.058	-0.043	0.137*	-0.016	-0.184	0.125	0.057	-0.001
	(0.10)	(0.13)	(0.08)	(0.07)	(0.12)	(0.13)	(0.09)	(0.13)
Father's education: secondary school	0.054	0.099	-0.024	-0.007	0.047	-0.108	0.002	-0.055
	(0.08)	(0.09)	(0.06)	(0.05)	(0.10)	(0.10)	(0.09)	(0.09)
Father's education: higher school	-0.051	0.114	0.003	-0.015	0.023	-0.074	-0.058	-0.174
	(0.10)	(0.12)	(0.08)	(0.06)	(0.12)	(0.12)	(0.10)	(0.13)
Relationship with parents, age 12	-0.000	0.019	0.028	0.011	-0.008	-0.050	-0.007	-0.047
	(0.04)	(0.05)	(0.03)	(0.04)	(0.06)	(0.07)	(0.04)	(0.06)
Change in relationship with parents between ages 12 and 15	-0.046	-0.026	-0.016	-0.007	-0.031	-0.072	0.055	-0.064
	(0.03)	(0.05)	(0.03)	(0.03)	(0.05)	(0.07)	(0.04)	(0.05)
Change in relationship with parents between ages 15 and 19	-0.004	0.001	0.007	0.012	-0.004	0.002	0.029	-0.026
	(0.03)	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.04)
Change in wealth index between ages 15 and 19	-0.053	0.275	-0.143	-0.006	0.304	-0.114	-0.089	0.176
	(0.29)	(0.32)	(0.28)	(0.19)	(0.34)	(0.33)	(0.31)	(0.33)

Change in wealth index between ages 12 and 15	-0.068	0.542	-0.106	-0.164	0.423	-0.091	0.156	0.319
	(0.30)	(0.37)	(0.25)	(0.27)	(0.39)	(0.46)	(0.34)	(0.38)
Wealth index, age12	0.015	0.601*	-0.022	-0.151	0.761**	0.090	0.312	0.323
	(0.26)	(0.34)	(0.23)	(0.16)	(0.33)	(0.27)	(0.28)	(0.33)
Best friends smoke, age of 15 or 19	0.025	-0.006	0.072*	0.010	0.045	-0.016	0.179***	-0.023
	(0.05)	(0.10)	(0.04)	(0.03)	(0.09)	(0.06)	(0.05)	(0.10)
Best friends drinks, age of 15 or 19	0.061	0.295**	-0.054	0.070*	0.234*	0.148**	0.079	-0.095
	(0.05)	(0.11)	(0.07)	(0.04)	(0.12)	(0.07)	(0.08)	(0.14)
Best friend belong to gang, age of 19	0.069	0.406***	0.248***	0.051	0.149*	0.364***	0.050	-0.021
	(0.07)	(0.07)	(0.07)	(0.05)	(0.09)	(0.10)	(0.07)	(0.08)
Constant	-0.084	-0.197	0.032	0.109	0.003	0.018	-0.126	0.563***
	(0.15)	(0.17)	(0.13)	(0.09)	(0.19)	(0.14)	(0.16)	(0.20)
Observations	210	210	210	210	210	210	210	210
R-square	0.142	0.234	0.230	0.108	0.200	0.219	0.131	0.178

6. CONCLUSION AND RECOMMENDATIONS

The estimation strategy employed in the previous section allows the following conclusions to be drawn. The results show that cognitive skills reduce the likelihood that an adolescent has adopted a criminal behavior at age of 19 or under. Meanwhile, socioemotional skills reduces the likelihood to use legal and illegal drugs at age of 15 or 19 and criminal behavior at age of 19.

Currently, Peru has not yet implemented any social policies aimed at the development of young people's cognitive and socioemotional skills. Given the influence that these skills have on an adolescent's final decision to engage in a risk behavior such as tobacco or alcohol use or early sexual initiation, the recommended political strategy is to implement social programs that seek to promote the development of cognitive and socioemotional skills based on a comprehensive evaluation of individuals; that is, both a psychological and intelligence test through which each adolescent's weak points, which might prompt him or her to engage a risk behavior, can be evaluated. This assessment should be carried out periodically, starting from the early years of an individual's life cycle (Dercon and Sánchez 2011; Yamada *et al.* 2013).

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ANNEXES

Annex 1

Endogenous variables, relevant exogenous variables, and control variables according to values or indices used in the study

Table 1A

Endogenous variables

Name	Type of variable	Description
Use of tobacco	Discrete	Takes two values: (i) 1, if the adolescent uses tobacco; (ii) 0, otherwise.
Alcohol consumption	Discrete	Takes two values: (i) 1, if the adolescent uses alcohol or sometime she/he been drunk; (ii) 0, otherwise.
Early sexual life	Discrete	Takes two values: (i) 1, if the adolescent has had sexual relations at an early age; (ii) 0, otherwise.
Drugs use	Discrete	Takes two values: (i) 1, if the adolescent use any kind of drugs; (ii) 0, otherwise
Unprotected sex	Discrete	Takes two values: (i) 1, if the adolescent did not use condom or used any other contraceptive (injections, morning-after pill, so on.); (ii) 0, otherwise.
Carrying a weapon	Discrete	Takes two values: (i) 1, if the adolescent has carried a weapon in last 30 days ; (ii) 0, otherwise
Criminal behavior	Discrete	Sum of the following dummies: - Use a weapon in the last 30 days - Have you ever been a member of a gang? - Have you been arrested by the police or take into custody for and illegal or delinquency behavior? - Have you ever been sentenced to spend time in a corrections institution
Physics	Discrete	Takes two values: (i) 1, if the adolescent has a sedentary life; (ii) 0, otherwise.

Table 1B

Relevant exogenous variables

Name	Type of variable	Description
iautoestima	Continuous	Index that equals the sum of the percentage obtained in questions on pride and shame applied to the adolescent.
iautoeficacia	Continuous	Index that equals the sum of the percentage obtained in questions on the adolescent's decision-making on his or her future applied to the adolescent.
PPVT	Continuous	Percentage obtained in the PPVT applied to the adolescent.
Math	Continuous	Percentage obtained in the mathematics test applied to the adolescent.

Table 1C

Explanatory control variables

Name	Type of variable	Description
Gender	Qualitative	Sex of the child
Enrolled in school[(1)]	Discrete	Assigned two values: (i) 1, if the adolescent is enrolled in school or study full time; (ii) 0, otherwise.
Relationparents[(2)]	Continuous	Index that equals the sum of the percentage obtained in questions on the relationship between the adolescent and his or her parents, applied to the adolescent.
Friendsmoke	Discrete	Assigned two values: (i) 1, if the adolescent's friends use tobacco; (ii) 0, otherwise.
Friendsdrink	Discrete	Assigned two values: (i) 1, if the adolescent's friends use alcohol; (ii) 0, otherwise.
Typesite	Discrete	Assigned two values: (i) 1, if the adolescent lives in an urban area; (ii) 0, otherwise.
Mother's education	Continuous	Level of education attained by the adolescent's mother. Assigned the following values: (i) 0, has not any studies; (ii) k, for all k = 1, 2, …, 18, if the adolescent is currently in level k.
Father's education	Continuous	Level of education attained by the adolescent's father. Assigned the following values: (i) 0, has not any studies; (ii) k, for all k = 1, 2, …, 16, if the adolescent is currently in level k.
Wi	Continual	Wealth index, comprised of the sum of the following indicators; quality of home infrastructure; consumption of durable goods (appliances) and access to basic utilities in the home.

Notes

(1) In round 4 the question is "Are you currently in full-time education?"

(2) To construct the index that measures the adolescent's relationship with his or her parents, the following statements were used: "Do you feel comfortable expressing your opinions and feelings to your parents or guardians?"; "Most of the time, your parents or guardians treat you fairly when you do something wrong;" "In comparison with your sibling(s), you are given less things"; and "in comparison with your sibling(s), you have less freedom to go out when you please".

Annex 2

Construction of indicators of legal and illegal drugs, early sexual relationships, unprotected sex, criminal behavior and sedentary lifestyle.

1. Legal and illegal drugs

To construct the indicators of tobacco and alcohol use, the following questions were employed in the confidential questionnaire:

- How often do you smoke cigarettes now?
- How often do you usually drink alcohol?

The indicators of alcohol and tobacco were assigned the value of 1 if the adolescent responded that he/she consumes every day, at least once per week or month and only on special occasions. In case of alcohol consumption was also considered whether adolescent says that rarely or never has drunk alcohol but she/he has been drunk at least one time. Otherwise, if the adolescent responds that he/she has never used alcohol (frequency or intensity) or use tobacco, the indicator will take the value of 0.

For use drugs, the questions, in round 4, used were:

- Have you ever tried any of the following drugs? Inhalantes (terokal, etc)
- Have you ever tried any of the following drugs? Marijuana
- Have you ever tried any of the following drugs? Coca paste –PBC
- Have you ever tried any of the following drugs? Cocaina
- Have you ever tried any of the following drugs? Extasis
- Have you ever tried any of the following drugs? Methamphetamines
- Have you ever tried any of the following drugs? Hallucinogens (San Pedro, Ayahuasca)
- Have you ever tried any of the following drugs? Other drugs (crack, heroin, so on)

The indicator of drugs use takes value of 1 if adolescent have used any type of drugs and 0, otherwise.

In Roun3, the question use was: During your life, have you ever tried drugs like marijuana?, which is a dummy.

2. Early sexual life and unprotected sex

The indicator that shows whether adolescents have had sexual relations is constructed on the basis of the following statement:

- I have never had sex.

The indicator was assigned the value of 1 if the adolescent responds negatively to the above statement, and the value of 0 if the adolescent responds affirmatively to the statement.

Moreover the indicator of unprotected sex was built on basis of the following questions:

- The last time you had sex, what did you do to prevent getting pregnant or a disease? I never had sex
- The last time you had sex, what did you do to prevent getting pregnant or a disease? We used a condom
- The last time you had sex, what did you do to prevent getting pregnant or a disease? Drink infusion or mate
- The last time you had sex, what did you do to prevent getting pregnant or a disease? Use after morning pill
- The last time you had sex, what did you do to prevent getting pregnant or a disease? Use injections to prevent getting pregnant
- The last time you had sex, what did you do to prevent getting pregnant or a disease? I don't know if use any method
- The last time you had sex, what did you do to prevent getting pregnant or a disease? We did not use any method
- The last time you had sex, what did you do to prevent getting pregnant or a disease? Other method, please say what

If the adolescent uses a condom as a contraceptive method or she/he has never had sex, the indicator takes the value of 1. Otherwise, the indicator takes the value of 0.

3. Carrying a weapon and criminal behavior

To construct these indicators, the following questions were employed:

- During the last 30 days on how many days did you carry a weapon such as a knife, machete or gun to be able to protect yourself?
- Have you ever been member of a gang?
- Have you been arrested by the police or taken into custody for an illegal or delinquent offense?
- Have you ever been sentenced to spend time in a corrections institution, like a jail, prison or a youth institution like a juvenile hall or reform school or training school or to perform community service?

Indicator of carrying a weapon is a dummy variable takes value of 1 if the adolescent has carried a weapon at least 1 day in the last 30 days and 0 otherwise.

On the other, indicator of criminal behavior is the sum of the dummy variables mentioned above.

4. Sedentary Lifestyle

Finally, the indicator of sedentary use the following question:

- During the past 7 days, on how many days were you physically active for at least

The indicator was assigned the value of 1 if the adolescent does not do exercises and the value 0 if the adolescent does 60 minutes of exercise at least 1 day a week.

Annex 3

Statements employed to construct the indices of self-esteem and self-efficacy

Table 3A

Index of self-esteem

Positive (+) or Negative (-)	Statements by round
Statements from round 4 of YLS	
+	**“** I am proud of my clothes.”
+	“ I am proud of the work I have to do.”
+	“ I feel my clothing is right for all occasions.”
+	“ I am proud of my shoes or of having shoes”
Statements from Round 3 of the YLS	
+	"I am proud of my shoes or of having shoes."
+	"I am proud of my clothes."
+	"I am never ashamed because I don’t have the materials I need for school."
+	"I am proud of having the proper uniform."
+	"I am proud of the work I have to do."
Statements from Round 2 of the YLS	
+	"I am proud to show my friends where I live."
+	"I am proud of the work the household head does."
+	"I am proud of my achievements at school."
+	"I am proud of the work I have to do."
-	"I am ashamed of my clothes."
-	"I am ashamed of my shoes."
-	"At times I feel ashamed because I do not have the materials I need for school."
-	"I am ashamed not to have the proper uniform."
-	"I am ashamed of the work I have to do."

Table 3B

Index of self-efficacy

Positive (+) or Negative (-)	Statements by round
Statements from Round 4 of the YLS	
-	“Other people in my family make all the decisions about how I spend my time.”
-	“I have no choice about the work I do - I must do this sort of work.”
+	“If I try hard, I can improve my situation in life.”
+	“I like to make plans for my future studies and work.”
+	“If I study hard at school I will be rewarded by a better job in future.”
Statements from Round 3 of the YLS	
+	"If I make an effort, I can improve my situation in life."
+	"I like to make plans for my education and future work."
+	"If I study hard at school, I will be rewarded with better work in the future."
+	"I can choose what job to do."
-	"Other people in my family make decisions on how I spend my time."
Statements from Round 2 of the YLS	
+	"If I make an effort, I can improve my situation in life."
+	"I like to make plans concerning my education and future work."
+	"If I study hard at school, I will be rewarded with better work in the future."
+	"I have no choice in what job I do."
-	"Other people in my family make decisions on how I spend my time."