

CUADERNOS DE ECONOMÍA

ISSN 0121-4772

77

Facultad de Ciencias Económicas
Escuela de Economía
Sede Bogotá



UNIVERSIDAD
NACIONAL
DE COLOMBIA

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IS THERE A RELATIONSHIP BETWEEN SCHOOLING AND RISKY HEALTH BEHAVIORS IN COLOMBIA?

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A preliminary version of this paper appeared as a working paper in Iregui, A. M.; Melo, L. A. and Ramírez, M. T. (2015). Risky Health Behaviors: Evidence for an Emerging Economy. *Borradores de Economía*, Number 891, Banco de la República, Bogotá. http://www.banrep.gov.co/sites/default/files/publicaciones/archivos/be_891.pdf

We want to thank Dr. Ángela Camacho, Gerson Javier Pérez, Sergio Prada, and Jorge Ramos for their comments and suggestions. We also wish to thank Helena González for her research assistance. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the Banco de la República or its Board of Directors.

Sugerencia de citación: Iregui-Bohórquez, A. M., Melo-Becerra, L. A., & Ramírez-Giraldo, M. T. (2019). Is there a relationship between schooling and risky health behaviors in Colombia? *Cuadernos de Economía*, 38(77), 365-397. doi: [10.15446/cuad.econ.v38n77.65556](https://doi.org/10.15446/cuad.econ.v38n77.65556)

Este artículo fue recibido el 08 de junio de 2017, ajustado el 23 de enero de 2018, y su publicación aprobada el 12 de febrero de 2018.

Iregui-Bohórquez, A. M., Melo-Becerra, L. A., & Ramírez-Giraldo, M. T. (2019). Is there a relationship between schooling and risky health behaviors in Colombia? *Cuadernos de Economía*, 38(77), 365-397.

This paper uses the National Health Survey to analyze the relationship between education and risky health behaviors, namely smoking, heavy drinking, obesity, and unsafe sexual behavior, by estimating the education gradient. We also provide evidence on the effect of education, socio-economic and knowledge variables on these health behaviors by gender and area of residence. The results indicate that there is a negative and significant effect of years of schooling on the probability of smoking, whereas the probability of heavy drinking and unsafe sexual behaviors increase with education, highlighting the importance of social and cultural factors.

Keywords: Education, risky health behaviors, logit, Colombia.

JEL: I1, I12, I20, C25.

Iregui-Bohórquez, A. M., Melo-Becerra, L. A., & Ramírez-Giraldo, M. T. (2019). ¿Existe una relación entre la educación y los comportamientos riesgosos para la salud en Colombia? *Cuadernos de Economía*, 38(77), 365-397.

Este artículo utiliza la Encuesta Nacional de Salud para analizar la relación entre educación y comportamientos riesgosos para la salud, como fumar, tomar en exceso, ser obeso y tener comportamientos sexuales riesgosos, estimando el gradiente de la educación. Se proporciona evidencia sobre el efecto de la educación, y de variables socioeconómicas y de conocimiento por género y área de residencia. Los resultados indican que existe un efecto negativo y significativo de la educación en la probabilidad de fumar mientras que la probabilidad de beber en exceso y de tener comportamientos sexuales riesgosos aumenta con la educación, destacando la importancia de factores sociales y culturales.

Palabras clave: educación, comportamientos riesgosos para la salud, *logit*, Colombia.

JEL: I1, I12, I20, C25.

Iregui-Bohórquez, A. M., Melo-Becerra, L. A., & Ramírez-Giraldo, M. T. (2019). En Colombie, existe-t-il une relation entre l'éducation et les comportements dangereux pour la santé ? *Cuadernos de Economía*, 38(77), 365-397.

Cet article utilise l'Enquête Nationale de Santé pour analyser la relation entre éducation et comportements à risque pour la santé, comme fumer, boire en excès, être obèse ou avoir des comportements sexuels à risques, en évaluant le niveau d'éducation. Il démontre l'effet de l'éducation, de variables socio-économiques et de connaissance selon le genre et lieu de résidence. Les résultats montrent qu'il existe un effet dissuasif et significatif de l'éducation sur la probabilité de fumer tandis que la probabilité de boire à l'excès et d'avoir des comportements sexuels à risque augmentent avec l'éducation, soulignant l'importance de facteurs sociaux et culturels.

Mots-clés: éducation, comportements à risques pour la santé, logit, Colombie.

JEL: I1, I12, I20, C25.

Iregui-Bohórquez, A. M., Melo-Becerra, L. A., & Ramírez-Giraldo, M. T. (2019). Existe alguma relação entre a educação e os comportamentos de risco para a saúde na Colômbia? *Cuadernos de Economía*, 38(77), 365-397.

Este artigo utiliza a Pesquisa Nacional de Saúde para analisar a relação entre a educação e os comportamentos de risco para a saúde, como fumar, beber em excesso, a obesidade e ter comportamentos sexuais de risco, estimando o gradiente de escolaridade. São fornecidas evidências sobre o efeito da educação e das variáveis socioeconômicas e de conhecimento por gênero e área de residência. Os resultados indicam que há um efeito negativo e significativo da educação sobre a probabilidade de fumar, enquanto a probabilidade de beber em excesso e de ter comportamentos sexuais de risco aumenta com a educação, destacando a importância de fatores sociais e culturais.

Palavras-chave: educação, comportamentos de risco para a saúde, logit, Colômbia.

JEL: I1, I12, I20, C25.

INTRODUCTION

Risky health behaviors such as smoking, drinking and obesity, are considered a major source of morbidity and mortality associated with cardiovascular diseases, cancer, diabetes, and liver diseases. Additionally, having unsafe sexual behavior could be a source of sexually transmitted diseases (STD), which in turn, could be the cause of severe illnesses, infertility, long-term disability, and even death for millions of people. The World Health Organization (WHO, 2014a) estimated that in 2012 about 6% of deaths worldwide were attributable to alcohol consumption, 11% to tobacco use, and 5.7% to insufficient physical activity. Furthermore, according to the WHO (2012) in 2008 there were about 500 million new cases of four STDs in adults between the ages of 15 and 49.

Colombia is not the exception on this matter. The Pan American Health Organization (2012) emphasizes that for individuals between 18 and 69 years old, 7.6% of the population was considered at risk of alcohol dependency, while the prevalence of current smokers was 12.8%. Also, the prevalence rate of HIV for adults aged 15 to 49 was 0.5% in 2013 (UNAIDS, 2014).

Education has played an important role in preventing risky health behaviors. In general, the theoretical literature has found that there are three main channels through which education affects health, and consequently risky health behaviors. The first two channels date back to Grossman (1972) who studied the demand for health, considering health as a form of human capital. In the productive efficiency channel, education directly affects the health production function, considering that more educated people obtain more health output given a certain amount of inputs. In the allocative efficiency channel, education affects the input mix in the health production function, since more educated people choose a different input mix than less educated people in order to produce more output. The third channel, put forward by Fuchs (1980), establishes that education and health are likely to be affected by the same set of unobserved variables.

Specifically, in the case of risky health behaviors, there has been a growing interest in studying empirically the role of education, dating back to Ross and Wu (1995) who evaluate the relationship between education and health in the United States, taking into account health lifestyles. The majority of these studies have been carried out for developed countries; they have found that there is a negative relationship between schooling and the prevalence of smoking, heavy drinking and obesity. For example, Cutler and Lleras-Muney (2010) evaluate the relationship between education and risky health behaviors by means of the education gradient for the United States and the United Kingdom. Buckles, Hagemann, Malamud, Morrill and Wozniak (2016) study the effect of education on smoking, heavy drinking and obesity, and Cawley and Ruhm (2011) analyze the relations between education and smoking, alcohol consumption, physical activity, diet, and the use of illicit drugs, also for the United States.

The association between education and health behaviors has also been studied for several European countries. For example, Brunello, Fort, Schneeweis and Winter-Ebmer (2015) study the effect of education on smoking, drinking, exercising and the body mass index, considering short and long-run mediating effects for 13 European countries. Renner (2011) examines the possible channels through which education affects smoking tobacco, alcohol abuse, and overeating for eleven countries of the European Union. In general, these authors find that education reduces the probability of having some risky behaviors. For specific countries, Etilé and Jones (2011) analyze the relationship between schooling and smoking in France; Jürges, Reinhold and Salm (2011) investigate the effect of schooling on smoking and obesity in West Germany. For Australia, Webbink, Martin and Visscher (2010) analyze the effect of education on the probability of being overweight.

For developing countries, studies have mainly focused on the effects of education on sexual behavior. For example, the effect of schooling on the use and knowledge of contraception for women has been studied by Andalón, Williams and Grossman (2014) for Mexico, by Dinçer, Kaushal and Grossman (2014) for Turkey, and by Mocan and Cannonier (2012) for Sierra Leone. In addition, Agüero and Bhadraraj (2014) find that education has a positive effect on having more knowledge about HIV and a negative effect on the number of sexual partners for women in Zimbabwe. Also, de Walque (2006) finds that education is an important predictor of sexual behaviors in Burkina Faso, Cameroon, Ghana, Kenya, and Tanzania. In the case of Colombia, Varela *et al.* (2011) estimate the prevalence of risky sexual behaviors and analyze their relationship with socio-demographic characteristics in adult population from all regions of the country; Campo-Arias, Ceballos and Herazo (2010) study the prevalence and factors related with risky behaviors for reproductive and sexual health for high school students in the city of Santa Marta, and Brook, Brook, Pahl and Montoya (2002) identify the relationships between drug use, risky sexual behaviors and early pregnancy in Colombian teenagers.

The aim of this paper is to study the relationship between education and risky health behaviors in Colombia. The study of this relationship is important given that the burden of premature deaths and diseases caused by these behaviors is heavily concentrated in low and middle-income countries, causing not only distress for those involved, but also high economic costs for health services.

This paper constitutes, to the best of our knowledge, one of the few applications using data from an emerging economy that considers not only risky sexual behavior, but also other risky behaviors such as alcohol abuse, smoking tobacco and obesity, which have mainly been studied in developed countries. This study also contributes to the literature by providing evidence on the relationship between education and other covariates and health behaviors by area of residence (i.e., rural vs. urban). This analysis is important due to the significant differences observed in years of schooling between urban and rural areas, which has not received a great deal of attention in the literature. Furthermore, we take into account differences

in gender, since traditional gender roles may influence the effects of education on risky health behaviors.

In general, our results are consistent with the empirical literature. In particular, we found that there is a negative and significant effect of education on the probability of smoking and a positive effect on the probability of heavy drinking and having unsafe sexual behavior, underlining the importance of social and cultural factors. In addition, knowledge variables about the negative effect of these behaviors on health reduce the probability of smoking, heavy drinking and obesity.

This paper is divided into four sections, besides this introduction. The second presents the empirical strategy used in the estimations. Section three provides information about the data used in the analysis. Section four presents and discusses the results. The last section concludes.

EMPIRICAL STRATEGY

In order to analyze the effect of education on an individual's risky health behaviors, we follow the empirical strategy proposed by Cutler and Lleras-Muney (2010). Specifically, we first estimate the basic equation, including education and a set of basic controls, that is:

$$H_i = \alpha_0 + \alpha_1 E_i + \alpha_2 X_i + \varepsilon_i \quad (1)$$

where H_i is the risky health behavior of individual i (i.e., current smoker, heavy drinking, obesity, and unsafe sexual behavior); E_i is the education of individual i , measured as the years of schooling; X_i is a set of basic controls, such as age, gender and ethnic group; and ε_i is the error term which is assumed to be normally distributed.

From this estimation we obtain the education gradient, given by the education coefficient (α_1), which measures the effect of schooling on the risky health behavior.

The second step consists of re-estimating equation (1) by adding a set of income and socio-economic variables in order to identify if the effect of education is mediated by these type of variables. That is,

$$H_i = \alpha_0 + \alpha_1 E_i + \alpha_2 X_i + \alpha_3 Y_i + \varepsilon_i \quad (2)$$

where Y_i is a set of socio-economic explanatory variables (e.g., income, marital status, geographical location of the individual, social security regime, labor participation, and overcrowding). From this estimation we can obtain the education gradient (α_1) once this set of explanatory variables is added to the basic equation. This procedure allows us to calculate the percentage of change in the education coefficient from the addition of these variables.

Next, we re-estimate equation (1) adding a set of knowledge variables. These variables could play a mediating role in explaining the relationship between education and risky health behaviors. It is important to consider that people with different education backgrounds can obtain information about health behaviors from several sources and can understand it in different ways. That is,

$$H_i = \alpha_0 + \alpha_1 E_i + \alpha_2 X_i + \alpha_4 Z_i + \varepsilon_i \quad (3)$$

where Z_i is a set of knowledge variables about health risks (e.g., if an individual knows that smoking increases the chance of developing cancer, that smoking is harmful for unborn children and pregnant women, that alcohol is harmful for health, if individuals know that exercise is good for health, if individuals have heard about condoms).

Finally, in the same equation we estimate the effect of years of schooling and all the covariates considered above on each risky health behavior, according to the following equation:

$$H_i = \alpha_0 + \alpha_1 E_i + \alpha_2 X_i + \alpha_3 Y_i + \alpha_4 Z_i + \varepsilon_i \quad (4)$$

Since the risky health behavior variables of individual i (H_i) are binary, the estimations are carried out using *logit* models.

DATA SOURCE AND VARIABLES

The data used in this paper come from the Colombian National Health Survey (NHS) carried out by the Ministerio de la Protección Social de Colombia (2007). The survey has national coverage and provides information on the assessment of general health and the main problems faced by the population from all regions in the country. The survey gathers socio-economic information for all individuals in the household, including education, employment, perceived morbidity, demand and utilization of health services, chronic conditions and risk factors, and physical activity. Also, it includes questions on assault and assault injuries, sexually transmitted diseases, perception and knowledge about HIV/AIDS, and psychoactive substances.

Our empirical analysis is carried out for individuals who are 18 years and older. The resulting sample will depend on the number of individuals who answered the relevant questions about risky health behaviors. Specifically, we consider four risky health behaviors, namely: current smoker, heavy drinking, being obese and unsafe sexual behavior. These variables were defined as dummy variables, based on the information provided by the NHS, where a current smoker takes the value of 1 if the individual smokes cigarettes every day or some days of the week, and 0 otherwise; heavy drinking takes the value of 1 for those who have drunk more than 5 glasses of any alcoholic beverage a day during any of the last 15 days, and 0 otherwise; being obese takes the value of 1 if the individual's body-mass index

is greater than or equal to 30, and 0 otherwise; and unsafe sexual behavior takes the value of 1 for those who have had more than one sexual partner during the last 30 days, and 0 otherwise.¹

To characterize an individual's risky health behaviors, our analysis evaluates the role played by socio-economic variables and some indicators about the knowledge on these risky behaviors, as mentioned in the previous section. These variables were divided into three groups, besides education. First, we have a group of control variables (X_i), including age, gender and ethnic group; second, the socio-economic variables (Y_i) include household total income (in logs), overcrowding, and a set of dummy variables indicating marital status, the geographical location of the individual, labor participation, and whether the individual belongs to the contributory or subsidized social security regime. Third, a set of knowledge variables about health risks was considered (Z_i). In the case of smoking, dummy variables were added, indicating whether individuals consider the following statements to be true: smoking increases the risk of cancer, smokers become chronic coughers, smoking while pregnant affects the unborn child, and it is forbidden to broadcast cigarette advertising on television before 11 pm.

For heavy drinking, a dummy variable was included, indicating if the individual considers that drinking alcohol is detrimental for his/her health; also the age at which the individual started drinking or first drank was considered, since early initiation of alcohol consumption could be associated with increased risk for alcohol dependence at later ages (WHO, 2014b). In the case of being obese a dummy variable for the individual performing vigorous exercise was included, which not only is an indicator of knowledge about the importance of physical activity, but also suggests actual practice. Lastly, for unsafe sexual behavior, a dummy variable about his/her knowledge on condoms was considered.² Tables A1 and A2 in Appendix A present the definition and the descriptive statistics of the variables included in the analysis.

¹ The definitions of risky health behaviors are based on the information provided by the NHS, which are similar to the international definitions. Given the availability of data in the NHS, we chose having more than one sexual partner in the last month as an indicator of risky sexual behavior. However, there are several variables that could measure this behavior, such as condom use, unwanted pregnancies, and sexually transmitted diseases, among others. In Appendix B, we present, as an additional exercise, the results of the estimations, considering the use of condoms during the last sexual relation as the dependent variable. Results indicate that education has a positive and significant effect on the probability of using condoms, whereas being married has a negative impact.

² In the case of these knowledge variables, it is worth mentioning that we do not know to what extent the answers given by the individuals to these questions correspond to their true beliefs or to what they think they should answer.

RESULTS

First, we present the prevalence rates and the predicted probabilities of the effect of years of schooling on each risky health behavior, after controlling for age and gender. Table 1 shows prevalence rates by gender of risky health behaviors of the population under consideration. In all cases except obesity, male prevalence rates are higher than those for females.³ For example, in the case of males, the prevalence of current smoking is 21.1%, while for females this rate is 8.1%. For heavy drinking, the difference between males and females reaches more than 22 percentage points, whereas the prevalence of having more than one sexual partner during the last 30 days is almost 14 percentage points higher for males.⁴

Table 1.
Risky Health Behaviors Prevalence Rates (Percentage)

	Complete sample ^{1/}		Females		Males	
	Num. obs.	Prevalence rate	Num. obs.	Prevalence rate	Num. obs.	Prevalence rate
Current smoker	40,932	13.8%	23,221	8.1%	17,711	21.1%
Heavy drinking	40,932	23.5%	23,221	13.6%	17,711	36.3%
Being obese	26,278	10.4%	14,143	11.1%	12,135	9.5%
Unsafe sexual behavior	29,763	7.6%	16,875	1.7%	12,888	15.5%

^{1/} The resulting samples for being obese and unsafe sexual behavior are smaller than for the other two behaviors. In the first case, some individuals did not know either their height or weight which is required to calculate the BMI; in the case of unsafe sexual behavior, the relevant questions came from a different survey module.

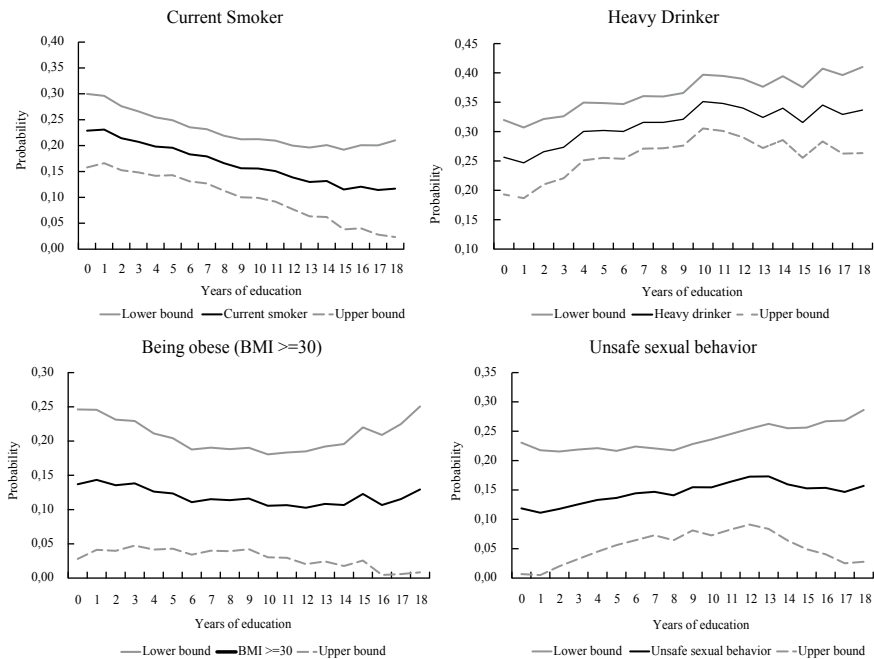
Source: Authors' calculations based on NHS (Ministerio de la Protección Social de Colombia, 2007).

³ Regarding obesity, Case and Menendez (2009) report based on WHO statistics that in 138 out of 194 countries the prevalence of obesity for women is 50% higher than for men.

⁴ It is important to bear in mind that missing responses of a variable could be a problem if they are related to the dependent variable. In particular, we check whether missing values in the education and income variables alter the prevalence rates calculated for all four health behaviors. In Appendix C, Table C.1, we compare the results of the prevalence rates for three subsamples: in the first one, we report the results for the complete sample, presented in Table 1; in the second subsample, we include only the observations where respondents gave a valid answer for years of schooling; and in the third one, we include all observations where respondents did not give a valid answer. As can be seen, the rates do not differ a lot between the complete sample and the one that includes only valid answers. However, when we consider only the sample of respondents who did not give a valid answer, we find that the shares of smokers and obese individuals will be lower, whereas the heavy drinking and unsafe sexual behavior rates will be higher. A similar exercise was performed for the income variable. Results are presented in Appendix C, Table C.2. When we consider only the sample of respondents who did not give a valid answer, we find that the shares of smokers, heavy drinkers, and unsafe sexual behavior will be lower, whereas the obesity rate remains the same.

The relationship between education and risky health behaviors is illustrated in Figure 1 by means of the predicted probabilities of the effect of years of schooling on current smoker, heavy drinking, being obese, and unsafe sexual behavior, controlling for age and gender. The effect of years of education on these behaviors is mixed. In general, there is a negative relationship between years of education and smoking; a positive relation with heavy drinking, and no particular pattern in the cases of being obese and unsafe sexual behavior. In particular, each additional year of education reduces the probability of being a current smoker from 23% for individuals without education, to 12% for those individuals with 18 or more years of schooling. Conversely, the probability of drinking heavily increases with each additional year of schooling, up to 10 years, where this probability is 35%; beyond this level of education, the probability remains around this percentage. In the case of being obese, this probability remains around 12% independently of each additional year of education. Similarly, the probability of having more than one sexual partner during the last month does not present significant changes with each additional year of education, remaining at about 15%.

Figure 1.
Effect of Education On Risky Health Behaviors: Predicted Probabilities



Note: Predicted probability from *Logit* regressions on education, controlling for age and gender. 95% confidence intervals.

Source: Authors' calculations.

Next, for each risky health behavior, we present the education gradient and the percentage change in the schooling coefficient from the addition of each set of explanatory variables (namely, socio-economic (equation 2) and knowledge variables (equation 3)). In a second exercise, we characterize each risky health behavior based on the estimation of equation (4). The analysis is carried out for the complete sample and also by gender and area of residence, where the latter splits the sample depending on whether the individual lives in an urban or rural area.

Education Gradient

Table 2 presents the effect of socio-economic and knowledge variables on the education gradient for the four risky health behaviors under consideration.⁵ First, we estimate the basic equation (1) for the complete sample. The results indicate that the probability of smoking reduces with each additional year of education. On the contrary, the probability of heavy drinking increases with education, since alcohol appears to be a normal good (Cutler & Lleras-Muney, 2012). Similarly, the probability of having unsafe sexual behavior increases with education. Meanwhile, education does not affect the probability of being obese; hence, in this case, it is not possible to calculate the education gradient.

The results suggest that education has helped reduce the incidence of smoking in Colombia, but not that of alcohol consumption, which can be linked to cultural and social factors and/or to the failure to recognize the damage that alcohol abuse causes to an individual's health, as has been done in the case of cigarette smoking. Nowadays, cigarette smoking generates social rejection, since it is forbidden to smoke in public places, while it has not been the same with alcohol consumption, which historically has been a social activity and whose "... consumption and behavior have been subject to self-imposed social controls" (The Social Issues Research Centre, 1998, p. 6). Moreover, despite that, individuals recognize that alcohol consumption is harmful, they tend to disregard the impact of alcohol consumption in everyday life; namely, the development of chronic diseases, mental disorders, alcohol dependence, as well as the injuries caused by traffic accidents and violence. The positive effect of education on having more than one sexual partner may be linked to cultural and social factors. More educated people may not only have a greater knowledge on risky sexual behaviors, but also on how to avoid their negative effect on health. According to de Walque (2006) and Cutler and Lleras-Muney (2012), education increases the use of protection, but at the same time, it predicts more infidelity and less abstinence. It is worth mentioning, that the results differ by gender. In particular, education increases the probability of having risky sexual behaviors in men, whereas in women the opposite occurs. These results could be explained by traditional gender attitudes still rooted in countries like Colombia, such as machismo. For example, women are judged more harshly for having casual sex (England & Bearak, 2014).

⁵ The estimations were carried out using linear probability. These results are very similar if we use *Logit* models instead. The results from the *Logit* estimations are available upon request.

Table 2. Effect of Socio-economic and Knowledge Variables On Education Gradients (OLS estimates)

	# of obs.	Demographic controls		Adding income and other economic controls ^{1/}		Reduction in education coefficient		Adding knowledge variables ^{2/}		Reduction in education coefficient
		Years of education (β)	Standard error	Years of education (β)	Standard error	Years of education (β)	Standard error	Years of education (β)	Standard error	
Total sample										
Current smoker	22,163	-0.0057***	0.0005	-0.0041***	0.0006	29.3%	-0.0052***	0.0005	8.6%	
Heavy drinker	14,666	0.0042***	0.0008	0.0017*	0.0010	59.8%	0.0044***	0.0008	-5.2%	
Obesity	14,909	-0.0002	0.0006	-0.0021***	0.0007		0.0001	0.0006		
Unsafe sexual behavior	16,441	0.0010**	0.0005	0.0002	0.0006	78.2%	0.0006	0.0005	38.7%	
By gender										
Females										
Current smoker	9,972	-0.0023***	0.0006	-0.0015*	0.0008	32.2%	-0.0018***	0.0006	21.8%	
Heavy drinker	6,162	0.0031***	0.0011	0.0003	0.0013	89.5%	0.0031***	0.0011	-0.7%	
Obesity	6,434	-0.0044***	0.0009	-0.0049***	0.0011	-11.8%	-0.0042***	0.0009	5.6%	
Unsafe sexual behavior	7,374	-0.0008**	0.0003	-0.0014***	0.0004	-79.8%	-0.0008**	0.0003	-10.8%	
Males										
Current smoker	12,191	-0.0087***	0.0008	-0.0063***	0.0010	27.5%	-0.0082***	0.0008	5.7%	
Heavy drinker	8,504	0.0052***	0.0012	0.0028**	0.0013	46.5%	0.0058***	0.0012	-12.4%	
Obesity	8,475	0.0031***	0.0007	-0.0001	0.0084	95.5%	0.0034***	0.0007	-10.1%	
Unsafe sexual behavior	9,067	0.0028***	0.0008	0.0016*	0.0010	43.8%	0.0020**	0.0008	27.0%	

*** p < 0.01, ** p < 0.05, * p < 0.1

^{1/} The variables included are: income, marital status, contributory health regime, the region where the individual lives (Bogotá, Andean region, Pacific region, Caribbean region), labor force participation, and overcrowding. See Appendix A for a description of the variables.

^{2/} Dummy variables were included to account for the knowledge of individuals about health risks.

^{3/} Percentage change in the education coefficient of the basic regression.

^{4/} The reduction in the education coefficient is not calculated when this coefficient is not statistically significant in the basic equation.

Source: Authors' calculations.

The direction of the effects by gender are very similar to those obtained by using the complete sample in the case of current smoking and heavy drinking (Table 2). We found contrasting results for males and females regarding the impact of each additional year of education on the probability of being obese and having more than one sexual partner during the last 30 days. For females, these effects are negative, whereas for males they are positive, highlighting the importance of education to reduce the incidence of these behaviors in women.

In addition, it is important to take into account the area of residence, given the significant differences observed in years of schooling between the urban and rural areas. In particular, in our sample, the average years of education in urban areas is 8 years, while in rural areas it is 5 years. The main differences are observed in obesity and unsafe sexual behavior. While for individuals in urban areas education negatively affects the probability of being obese, whereas education is not significant in rural areas. In the case of unsafe sexual behavior, in urban areas education does not affect the probability of having more than one sexual partner during the last 30 days, whereas in rural areas its effect is positive (Table 3).⁶

Next, income and other socio-economic variables were added to the basic equation (equation 2). The results show that these variables account for some of the education effect (Table 2). For instance, the coefficient on years of education in the current smoking equation falls by 29%. In addition, in the heavy drinking equation, this coefficient falls by 60%, which is much higher than the result obtained by Cutler and Lleras-Muney (2010) for the United States (13%), indicating that, in Colombia, more than half of the effect of education on the probability of heavy drinking is mediated by income and other socio-economic variables. The education coefficient on the equation for unsafe sexual behavior falls by 78%, indicating that almost two-thirds of the effect that education has on the probability of having more than one sexual partner during the last month is mediated by income and other socio-economic variables. The high reduction in the education gradient for heavy drinking and risky sexual behavior highlights the importance of socio-economic variables.

For females, in the case of current smoking, results are similar to those obtained for the complete sample (Table 2). The differences arise in the case of heavy drinking, where the coefficient of education does not differ from zero when adding these variables, which could be due to a correlation between income and education. In the case of obesity and unsafe sexual behavior, including socio-economic variables in the basic equation increases the education gradient by 12% and 80%, respectively, indicating an opposite effect to that of education. For males, the reduction in the education gradient for smoking, heavy drinking and unsafe sexual behavior is similar to the one found for the complete sample. Meanwhile, the inclusion of socio-economic variables in the equation for obesity makes the education coefficient insignificant.

⁶ Interesting differences are observed when analyzing the results by area of residence and gender. For example, for men, education has a positive impact on the probability of being obese for individuals who live in rural areas. For urban women, by contrast, education reduces the likelihood of obesity. These results are not reported here but are available upon request.

Table 3. Effect of Socio-economic and Knowledge Variables On Education Gradients by Area of Residence (OLS estimates)

	# of obs.	Demographic controls (age, gender, ethnic group)		Adding income and other economic controls ^{1/}		Reduction in education coefficient ^{3,4/}	Adding knowledge variables ^{2/}		Reduction in education coefficient ^{3,4/}	
		Years of education (β)	Standard error	Years of education (β)	Standard error		Years of education (β)	Standard error		
Urban area										
Current smoker	17,375	-0.0058***	0.0006	-0.0039***	0.0007	33.0%	-0.0053***	0.0006	8.0%	
Heavy drinker	11,250	0.0030***	0.0009	0.0014	0.0011	52.9%	0.0031***	0.0009	-6.2%	
Obesity	12,185	-0.0015**	0.0007	-0.0030***	0.0008	-101.3%	-0.0011	0.0007	23.3%	
Unsafe sexual behavior	12,621	0.0003	0.0006	-0.0003	0.0006		0.0001	0.0005		
Rural area										
Current smoker	4,788	-0.0053***	0.0015	-0.0049***	0.0016	8.3%	-0.0048***	0.0015	9.3%	
Heavy drinker	3,416	0.0040**	0.0020	0.0016	0.0022	59.8%	0.0043**	0.0020	-7.1%	
Obesity	2,724	0.0017	0.0014	-0.0001	0.0015		0.0016	0.0014		
Unsafe sexual behavior	3,820	0.0023**	0.0012	0.0016	0.0014	32.7%	0.0016	0.0012	32.4%	

*** p < 0.01, ** p < 0.05, * p < 0.1

^{1/} The variables included are: income, marital status, contributory health regime, the region where the individual lives (Bogotá, Andean region, Pacific region, Caribbean region), labor force participation, and overcrowding. See Appendix A for a description of the variables.

^{2/} Dummy variables were included to account for the knowledge of individuals about health risks.

^{3/} Percentage change in the education coefficient of the basic regression.

^{4/} The reduction in the education coefficient is not calculated when this coefficient is not statistically significant in the basic equation.

Source: Authors' calculations.

By area of residence, the mediating effect of the socio-economic variables is higher in the case of individuals living in urban areas (Table 3). The presence of socio-economic variables in the heavy drinking equation renders the education variable insignificant, in both urban and rural areas. In urban areas, the education gradient increases after socio-economic variables are added, emphasizing the role of these variables on the probability of being obese. In rural areas, these variables reduce the positive effect education has on the probability of having more than one sexual partner during the last 30 days.

Lastly, knowledge variables were added to the basic equation (Table 2). In the case of smoking, the survey asks about their knowledge on the risk of cancer, chronic cough, the effect on unborn children, and advertising. Results indicate that adding these four variables reduces the coefficient on years of education in the current smoking equation by 9%, indicating that the probability of smoking is mediated by knowledge variables. In the case of heavy drinking, the survey includes information on the age at which the individual started drinking or first drank, which may have an impact on alcohol dependence. Also, the survey asks about the awareness of individuals on the harmful effects of alcohol consumption. Conversely to the case of smoking, including these variables increases the coefficient on education by 5%, indicating that these knowledge variables have the opposite effect of education on the probability of heavy drinking, contributing to reduce its incidence. In the case of unsafe sexual behavior, the survey asks about the individual's knowledge on the use of condoms; the inclusion of this variable reduces the coefficient on education by 39%. As mentioned, in this behavior, unlike the others, knowledge variables could increase the likelihood of engaging in unsafe sexual behaviors, such as having more than one sexual partner. In particular, knowledge and use of condoms could prevent negative health effects.

For women, the effect of education on the probability of current smoking and obesity is mediated by knowledge variables, since the coefficients reduce by 22% and 6%, respectively (Table 2). On the contrary, the inclusion of these variables in the heavy drinking and unsafe sexual behavior equations does add a little to the explanation of the education effect. For males, in the case of smoking, the education gradient reduces by 6%. For obesity and heavy drinking, adding knowledge variables increases the education gradient, offsetting the positive effect of education on the probability of being obese and heavy drinking.

In both rural and urban areas, the inclusion of knowledge variables offset the positive effect of education on the probability of heavy drinking, highlighting the importance of the age at which the individual started drinking or first drank and of the knowledge about the detrimental effect of heavy alcohol consumption on one's health (Table 3). Regarding obesity, the education gradient reduces by 23% in urban areas, indicating the importance of exercising to reduce the probability of being obese.⁷ For unsafe sexual behavior, in rural areas, the education gradient reduces by 32%, indicating that knowledge about condoms increases the probability of this risky behavior.

⁷ Some authors have recognized that obesity could be associated with sedentary lifestyles brought about by technological progress (e.g., Atella & Kopinska, 2014; Cutler, Glaeser & Shapiro 2003; Lakdawalla & Phillipsen, 2009).

The Effect of Education and Other Covariates

We also estimate the effects of the socio-economic and knowledge variables on each risky health behavior (equation (4)) using *logit* models for the complete sample, by area of residence and by gender.⁸

Smoking

When considering socio-economic and knowledge variables altogether, education remains negative and significant, except in the case of women (Table 4). The probability of current smoking is higher for men than for women in both urban and rural areas. This probability increases with age until about 53 years old, when it starts to decrease. In rural areas, this probability begins to decline later in life (60 years old); this could be partly explained by the lack of effect of the knowledge variables, highlighting the importance of education to reduce the incidence of this risky behavior.

Being married reduces the probability of current smoking in all cases; this result could be influenced by the negative effect secondhand smoke exposure has on the partner's health, which could affect an individual's decisions about smoking (see for example, United States Department of Health and Human Services, 2006). Also, being affiliated to the contributory health regime reduces this probability in all cases, except for individuals who live in rural areas where it is more common to be affiliated to the subsidized regime, which, by the time the survey was carried out, had a basket of services that was different to that of the contributory regime. Interesting differences are observed among regions of the country. In the full sample, inhabitants of the Caribbean region are less likely to be current smokers than individuals living in the rest of the country. The same behavior is observed when the analysis is performed for individuals in urban areas and for men. For women, only those living in the Andean region and the capital of the country (Bogotá) have a higher probability of smoking that those living in the rest of the country.

Regarding knowledge variables, they negatively affect the probability of current smoking, indicating that campaigns and studies on the negative effects of smoking have raised awareness about how harmful smoking is. In the case of women, campaigns on the harmful effects of smoking during pregnancy seem to have been quite effective, reducing this probability significantly (e.g., Cornelius & Day, 2000). Moreover, the WHO (2013) highlights the importance of campaigns against smoking. However, when estimations are carried out by area of residence and gender, it is observed that for women living in rural areas, these knowledge variables do not have a significant effect on reducing the probability of smoking.⁹ Lastly, it is worth mentioning that individual income does not significantly affect the probability of current smoking. Since it is a bad habit, its consumption might not be tied to income.

⁸ We also carried out the estimations by gender, taking into account the area of residence (urban and rural). These results are not reported here but are available upon request.

⁹ These results are not reported here but are available upon request.

Table 4. The Impact of Education and Other Covariates On the Probability of Current Smoking: Logit Estimation

Variables	Total sample		Urban area		Rural area		Females		Males	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Years of education	-0.0038***	0.0006	-0.0036***	0.0007	-0.0051***	0.0017	-0.0010	0.0008	-0.0061***	0.0010
Gender (Male=1)	0.1336***	0.0059	0.1314***	0.0063	0.1555***	0.0158				
Age	0.0071***	0.0012	0.0061***	0.0014	0.0116***	0.0028	0.0097***	0.0016	0.0062***	0.0019
Age squared	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000
Ethnic group	-0.0114*	0.0062	-0.0117*	0.0071	-0.0072	0.0128	-0.0148*	0.0077	-0.0094	0.0093
Income	-0.0027	0.0032	-0.0046	0.0037	-0.0012	0.0066	0.0003	0.0037	-0.0059	0.0050
Married	-0.0449***	0.0053	-0.0473***	0.0059	-0.0375***	0.0123	-0.0266***	0.0062	-0.0573***	0.0084
Contributory regime	-0.0272***	0.0060	-0.0293***	0.0063	-0.0036	0.0181	-0.0179***	0.0069	-0.0347***	0.0093
Bogotá	0.0659***	0.0098	0.0634***	0.0096	0.0000	0.0000	0.0612***	0.0111	0.0682***	0.0153
Andean region	0.0211***	0.0072	0.0323***	0.0076	0.0203	0.0260	0.0314***	0.0088	0.0104	0.0109
Pacific region	0.0267***	0.0082	0.0201**	0.0092	0.0734**	0.0272	0.0131	0.0103	0.0349***	0.0124
Caribbean region	-0.0172**	0.0078	-0.0204**	0.0082	0.0207	0.0273	0.0060	0.0096	-0.0388***	0.0118
Participation	0.0075	0.0072	0.0012	0.0080	0.0149	0.0173	0.0009	0.0067	0.0148	0.0137
Overcrowding	0.0080***	0.0025	0.0090***	0.0028	0.0065	0.0052	0.0032	0.0031	0.0121***	0.0038
Smoking-cancer	-0.0291**	0.0116	-0.0313**	0.0130	-0.0351	0.0254	-0.0061	0.0134	-0.0501***	0.0183
Smoking-cough	-0.0626***	0.0094	-0.0710***	0.0103	-0.0329	0.0219	-0.0478***	0.0106	-0.0732***	0.0147
Effect-babies	-0.0157	0.0121	-0.0237*	0.0138	0.0029	0.0255	-0.0410***	0.0136	0.0086	0.0189
Smoking-publicity	-0.0110**	0.0049	-0.0124**	0.0054	-0.0109	0.0113	-0.0067	0.0059	-0.0139*	0.0075
Number of obs.	22,163		17,375		4,788		9,972		12,191	

*** p < 0.01, ** p < 0.05, * p < 0.1
Source: Authors' calculations.

Heavy Drinking

Results do not show significant differences when the estimations are carried out by gender and area of residence. Education has a positive and significant effect on the probability of heavy drinking for the complete sample, for individuals living in urban areas, and for males (Table 5).

Similarly to smoking, men are more likely to be heavy drinkers than women, due mainly to cultural factors (see The Social Issues Research Centre, 1998). Contrary to the case of current smoking, income and labor force participation have a positive and significant effect on the probability of heavy drinking.¹⁰ Similarly, for developed countries, the WHO (2014b) mentions that there are more drinkers in higher socio-economic groups; moreover, this report also suggests that in lower socio-economic groups people are more susceptible to the consequences of alcohol abuse. Results also indicate that ethnicity is an important factor in determining the probability of heavy drinking, which is consistent with other studies that find differences in alcohol consumption between ethnic groups within countries.

The probability of heavy drinking is lower for married individuals. Alcohol consumption can have both health and social consequences, not only for the drinker, but also for other individuals (such as family members or friends). Hence, the possible negative consequences of heavy drinking on others may reduce the probability of drinking for individuals living with a partner. In addition, individuals living in the Caribbean region have a higher likelihood of heavy drinking than those in the rest of the country, when the estimations are carried out for the complete sample, for individuals living in urban areas, and for males.

The age at which an individual started drinking has a negative and significant effect on the probability of heavy drinking. That is, the younger the individual started drinking, the higher the probability of becoming a heavy drinker. Regarding this, the WHO (2014b) states that: "... early initiation of alcohol use (before 14 years of age) is a predictor of impaired health status because it is associated with an increased risk for alcohol dependence and abuse at later ages..., alcohol-related motor vehicle crashes..., and other unintentional injuries (p. 7)." In turn, despite the fact that education increases the probability of heavy drinking, knowing about the harmful effects of alcohol reduces this probability.

¹⁰It is worth mentioning that in the heavy drinking variable it is not possible to distinguish whether the individual is an alcoholic or an occasional drinker. In the former, since it is a bad habit, its consumption might not be affected by income; in the latter, on the contrary, its consumption might be dictated by income availability.

Table 5. The Impact of Education and Other Covariates On the Probability of Heavy Drinking: Logit Estimation

Variables	Total sample		Urban area		Rural area		Females		Males	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Years of education	0.0022**	0.0009	0.0018*	0.0011	0.0027	0.0021	0.0002	0.0013	0.0035***	0.0013
Gender (Male=1)	0.1796***	0.0084	0.1815***	0.0092	0.1933***	0.0212				
Age	0.0007	0.0019	-0.0003	0.0022	0.0039	0.0037	-0.0025	0.0025	0.0032	0.0027
Age squared	-0.0000**	0.0000	-0.0000	0.0000	-0.0001	0.0000	-0.0000	0.0000	-0.0001**	0.0000
Ethnic group	-0.0539***	0.0089	-0.0531***	0.0104	-0.0572***	0.0171	-0.0342***	0.0120	-0.0682***	0.0126
Income	0.0232***	0.0049	0.0224***	0.0059	0.0228**	0.0091	0.0243***	0.0065	0.0229***	0.0071
Married	-0.0480***	0.0079	-0.0486***	0.0091	-0.0461***	0.0165	-0.0363***	0.0098	-0.0572***	0.0120
Contributory regime	-0.0087	0.0088	-0.0104	0.0095	0.0014	0.0235	-0.0020	0.0111	-0.0138	0.0128
Bogotá	0.0208	0.0151	0.0222	0.0154	0.0000	0.0000	-0.0202	0.0191	0.0587***	0.0225
Andean region	-0.0635***	0.0107	-0.0626***	0.0122	-0.0596***	0.0301	-0.0456***	0.0141	-0.0743***	0.0154
Pacific region	-0.0364***	0.0123	-0.0346**	0.0143	-0.0297	0.0322	-0.0396**	0.0160	-0.0320*	0.0177
Caribbean region	0.0265**	0.0105	0.0333***	0.0113	0.0122	0.0315	0.0080	0.0135	0.0428***	0.0152
Participation	0.0494***	0.0114	0.0431***	0.0130	0.0549**	0.0246	0.0309***	0.0117	0.0645***	0.0202
Overcrowding	-0.0006	0.0037	0.0030	0.0044	-0.0086	0.0071	0.0038	0.0050	-0.0038	0.0054
Age starting drinking	-0.0085***	0.0009	-0.0073***	0.0011	-0.0125***	0.0020	-0.0042***	0.0010	-0.0127***	0.0015
Alcohol-harmful	-0.0798***	0.0100	-0.0767***	0.0116	-0.0859***	0.0200	-0.0259*	0.0148	-0.1130***	0.0139
Number of obs.	14,666		11,250		3,416		6,162		8,504	

*** p < 0.01, ** p < 0.05, * p < 0.1
Source: Authors' calculations.

Obesity

The analysis of this health behavior is important given that it is a major risk factor for some chronic diseases, including diabetes, cardiovascular diseases, and hypertension. According to the WHO (2014b), worldwide incidence of obesity almost doubled between 1980 and 2014, when 15% of women and 11% of men were considered obese. Moreover, the prevalence of obesity is not restricted to developed countries. Its incidence has been increasing in low and middle income countries, particularly in urban areas (WHO, 2015).

Regarding the effect of education, each additional year reduces the probability of becoming obese for the complete sample, in urban areas and for women (Table 6), while for rural areas and men it is not statistically significant. The likelihood of becoming obese is higher for women than for men. This probability increases with age until about 51 years old for the complete sample, which could be related to muscle loss due to aging. However, differences are observed by gender. For women, the probability of being obese starts to decrease at 58 years old, whereas for men it starts to decline at 49 years old. In addition, results differ by ethnic group; this coefficient is only significant for women.

The probability of being obese also increases with income in the case of men.¹¹ This probability is higher for married individuals than for singles, widows/widowers, or divorced people. Conversely, this likelihood is lower for individuals living in overcrowded conditions and for those living in Bogotá and the Andean Region, which could be related with differences in lifestyles. Lastly, vigorous exercise reduces the probability of becoming obese. This result is consistent with the findings of the WHO (2010) which point out that physical activity is a key determinant of weight control.

Risky Sexual Behavior

Risky sexual behaviors could increase the incidence of sexually transmitted diseases (including HIV), cervical cancer, and unwanted pregnancies. Interestingly, only in the case of women, every additional year of education reduces the probability of engaging in risky sexual behavior (Table 7). Consequently, education is an important tool to enhance female sexual and reproductive health, which could also result in lower maternal and neonatal mortality and morbidity rates.

¹¹In the literature, the evidence about the relationship between income and obesity is not conclusive. For example, Pampel *et al.* (2012) mention that socio-economic status and obesity are positively correlated in lower-income countries, but negatively associated in higher-income countries.

Table 6. The Impact of Education and Other Covariates On the Probability of Being Obese: Logit Estimation

Variables	Total sample		Urban area		Rural area		Females		Males	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Years of education	-0.0019***	0.0007	-0.0026***	0.0007	-0.0006	0.0014	-0.0043***	0.0010	0.0001	0.0008
Gender (Male=1)	-0.0225***	0.0058	-0.0132**	0.0064	-0.0570***	0.0128				
Age	0.0141***	0.0016	0.0150***	0.0018	0.0107***	0.0031	0.0148***	0.0025	0.0121***	0.0020
Age squared	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000
Ethnic group	-0.0099	0.0065	-0.0132*	0.0075	-0.0038	0.0123	-0.0281***	0.0102	0.0005	0.0084
Income	0.0120***	0.0034	0.0095**	0.0040	0.0134**	0.0065	0.0052	0.0051	0.0193***	0.0048
Married	0.0361***	0.0057	0.0395***	0.0064	0.0235**	0.0117	0.0246***	0.0080	0.0568***	0.0087
Contributory regime	0.0071	0.0056	0.0040	0.0063	0.0078	0.0129	-0.0174**	0.0087	0.0205***	0.0072
Bogotá	-0.0687***	0.0113	-0.0704***	0.0120	0.0000	0.0000	-0.0680***	0.0170	-0.0703***	0.0151
Andean region	-0.0364***	0.0070	-0.0319***	0.0079	-0.0346**	0.0177	-0.0463***	0.0111	-0.0238***	0.0089
Pacific region	-0.0245***	0.0085	-0.0196**	0.0097	-0.0278	0.0198	-0.0118	0.0127	-0.0344***	0.0115
Caribbean region	-0.0118	0.0073	-0.0065	0.0080	-0.0259	0.0196	-0.0128	0.0117	-0.0073	0.0093
Participation	-0.0129*	0.0069	-0.0123	0.0078	-0.0021	0.0143	-0.0032	0.0092	-0.0028	0.0118
Overcrowding	-0.0124***	0.0029	-0.0120***	0.0034	-0.0118**	0.0054	-0.0100**	0.0046	-0.0154***	0.0038
Vigorous exercise	-0.0173***	0.0060	-0.0234***	0.0069	0.0111	0.0118	-0.0253**	0.0110	-0.0169**	0.0071
Number of obs.	14,909		12,185		2,724		6,434		8,475	

*** p < 0.01, ** p < 0.05, * p < 0.1
Source: Authors' calculations.

Table 7. The Impact of Education and Other Covariates On the Probability of Having Risky Sexual Behavior: Logit Estimation

Variables	Total sample		Urban area		Rural area		Females		Males	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Years of education	0.0000	0.0006	-0.0004	0.0006	0.0011	0.0013	-0.0015***	0.0004	0.0010	0.0009
Gender (Male=1)	0.1792***	0.0076	0.1723***	0.0081	0.2193***	0.0218				
Age	0.0006	0.0011	-0.0005	0.0013	0.0042*	0.0024	0.0008	0.0010	0.0019	0.0019
Age squared	-0.0000	0.0000	-0.0000	0.0000	-0.0001**	0.0000	-0.0000**	0.0000	-0.0000*	0.0000
Ethnic group	-0.0247***	0.0050	-0.0211***	0.0058	-0.0343***	0.0102	0.0031	0.0044	-0.0454***	0.0085
Income	0.0164***	0.0030	0.0166***	0.0036	0.0140**	0.0057	0.0043*	0.0022	0.0272***	0.0051
Married	-0.0585***	0.0048	-0.0587***	0.0054	-0.0580***	0.0103	-0.0098***	0.0034	-0.1007***	0.0082
Contributory regime	-0.0188***	0.0054	-0.0228***	0.0057	0.0076	0.0147	-0.0019	0.0038	-0.0325***	0.0092
Bogotá	-0.0145	0.0103	-0.0146	0.0102	0.0000	0.0000	0.0104*	0.0057	-0.0410*	0.0185
Andean region	-0.0159**	0.0069	-0.0173**	0.0077	-0.0071	0.0205	0.0028	0.0048	-0.0293**	0.0118
Pacific region	0.0171**	0.0072	0.0158*	0.0082	0.0250	0.0212	0.0066	0.0052	0.0280**	0.0123
Caribbean region	0.0278***	0.0063	0.0326***	0.0066	0.0175	0.0208	0.0035	0.0048	0.0494***	0.0107
Participation	0.0021	0.0077	0.0080	0.0087	-0.0170	0.0167	0.0053	0.0041	-0.0086	0.0139
Overcrowding	0.0011	0.0023	0.0001	0.0026	0.0044	0.0045	-0.0013	0.0016	0.0029	0.0039
Heard of condoms	0.1121***	0.0113	0.1041***	0.0129	0.1340***	0.0231	0.0394***	0.0129	0.1742***	0.0187
Number of obs.	16,441		12,621		3,820		7,374		9,067	

*** p < 0.01, ** p < 0.05, * p < 0.1

Source: Authors' calculations.

The probability of having more than one sexual partner during the last month is higher for men than for women and lower for married individuals.¹² There are also differences by ethnic group and region of residence. For example, residents in the Caribbean and Pacific regions have a higher likelihood of risky sexual behavior, especially in the case of urban areas and males. Furthermore, income has a positive and significant effect on this risky behavior, whereas for those living in urban areas and males, being affiliated to the contributory health social security regime has a negative effect on the probability of this risky behavior. This last result could be associated with more effective campaigns aimed at reducing the incidence of disease and unwanted pregnancies. As mentioned, the knowledge about condoms increases the probability of this risky behavior, once again highlighting the importance of cultural factors.

FINAL REMARKS

This paper analyses the relationship between education and four risky health behaviors, namely smoking, heavy drinking, obesity, and unsafe sexual behavior for Colombia. To this end, we assess the effect of socio-economic variables and some indicators about the knowledge on these risky behaviors by means of the education gradients. We also provide evidence on the effects education and other covariates have on these health behaviors by gender and area of residence.

The results of the education gradient indicate that years of schooling negatively and significantly affect the probability of smoking. Conversely, the probabilities of heavy drinking and having unsafe sexual behavior increase with education; meanwhile, there is no significant effect of education on the probability of being obese. These findings suggest that in Colombia, education has helped reduce the incidence of smoking, but not that of alcohol consumption, which could be explained by cultural and social factors and/or by the failure to acknowledge the harmful effect alcohol abuse has on health. The positive effect of education on unsafe sexual behavior may also be related to cultural and social factors. People who are more educated may have, not only more knowledge on risky sexual behaviors, but also on how to avoid its negative influence on one's health.

Income and other socio-economic variables account for some of the education effect. In particular, there is a large reduction in the education gradient for heavy drinking and risky sexual behavior, highlighting the importance of socio-economic variables in Colombia. Moreover, when knowledge variables are included, the results indicate that the coefficients of education in the smoking and unsafe sexual behavior equations fall. Conversely, the inclusion of knowledge

¹²These results are consistent with the findings of Varela *et al.* (2011). They state that men expose themselves more than women to risky sexual situations, and have a rate of sexual partners twice that of women.

variables in the heavy drinking equation increases the coefficient on education, indicating that these variables contribute to reduce its incidence.

In a second exercise, we characterize each risky health behavior using *logit* models, taking into account socio-economic and knowledge variables altogether. The results show that being married reduces the probability of current smoking, heavy drinking and having unsafe sexual behavior, due to the negative consequences that these behaviors could have on family members. In general, the probability of engaging in these risky behaviors increases with age, up to a certain age, when it starts to decline. Knowledge variables reduce the probability of smoking, heavy drinking and obesity, indicating that campaigns and research on the negative effects of these behaviors raised awareness about how harmful they are.

The evidence presented in this paper highlights the importance of education and knowledge about the negative effects of these risky behaviors on one's health. Since there are significant differences in education by area of residence, it is important for public policy to increase the years of schooling in rural areas. Regarding knowledge, in the case of smoking, campaigns have proven to be successful in reducing the incidence of this risky behavior, especially in the case of women, since campaigns on the harmful effects of smoking during pregnancy seem to have been quite effective. In the case of heavy drinking, results indicate that although its incidence could be highly linked to social and cultural factors, knowledge about its harmful effects contributes to reduce the probability of drinking heavily. Moreover, physical activity should be promoted, since it is a key determinant of weight control and it helps to curb the risk of some chronic diseases. In this sense, Law 1355 of 2009 was enacted in order to adopt measures to control, prevent, and treat obesity and non-communicable chronic diseases associated with it as a public health priority.

Public policy should continue implementing policies aimed at reducing the prevalence of risky health behaviors since they are a major source of mortality and morbidity associated with chronic and sexually transmitted diseases, as well as an important source of demand for health services.

Finally, it is important to mention that in this paper we evaluate neither the joint effect of all behaviors nor the effect that one risky behavior may have on another one. For example, we do not take into account if smoking may increase the probability of drinking alcohol, or vice versa. In addition, due to the lack of suitable data, it was not possible to gather information on other forms of unsafe sexual behaviors in order to further our understanding of their relationship with education.

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APPENDIX A VARIABLES USED IN THE MODEL

Table A1.
Description of Variables

Variables	Description
Dependent variables – Risky behavior	
<i>Current smoker</i>	1 if the individual smokes cigarettes every day or on some days 0 otherwise
<i>Heavy drinking</i>	1 for those who have drunk more than 5 glasses a day, of any alcoholic beverage, during any of the last 15 days. 0 otherwise
<i>Obesity</i>	1 if the body mass index is greater than or equal to 30 0 otherwise
<i>Unsafe sexual behavior</i>	1 for those who have had more than one sexual partner during the last 30 days 0 otherwise
Explanatory variables	
<i>Demographic controls</i>	
Age	Individual’s age in years at the time of the survey
Gender	1 Male 0 Female
Marital status	1 if married or on a common-law marriage 0 otherwise
Ethnic group	1 if the individual considers himself / herself mestizo 0 if the individual does consider himself / herself <i>raizal</i> from the archipelago, gypsy, indigenous, <i>palenquero</i> , black, and mulatto (Afro-descendants)
<i>Economic controls</i>	
Years of education	Number of years completed

(Continued)

Table A1.

Description of Variables

Variables	Description
<i>Economic controls</i>	
Income	Logarithm of money received the previous month. It includes wages, gifts, pensions, contribution, and income from renting property, received from any person or institution outside the home.
Participation	1 if the individual participates in the labor market 0 otherwise
Contributory health regime	1 if the individual is affiliated to the contributory health social security regime 0 otherwise
Regions	Dummy variables were included: 1 if household lives in Bogotá, the Caribbean Region, the Andean Region and the Pacific Region 0 otherwise
Overcrowding	Number of people per room (excluding living room and dining room)
<i>Knowledge about risky health behaviors</i>	
Smoking increases the risk of cancer	1 if the individual considers this statement to be true 0 otherwise
Smokers become chronic coughers	1 if the individual considers this statement to be true 0 otherwise
A pregnant woman who smokes affects the baby	1 if the individual considers this statement to be true 0 otherwise
It is forbidden to broadcast cigarette advertising on television before 11 pm	1 if the individual considers this statement to be true 0 otherwise
Alcohol is harmful to health	1 if the individual considers this statement to be true 0 otherwise
Age started drinking	Age at which the individual took or first drunk a glass of beer, <i>chicha</i> , wine or a shot of brandy, rum, <i>cola and pola</i> , <i>forcha</i> , punch or any other liquor
Vigorous exercise	1 if over the past 30 days, the individual did vigorous physical activities 0 otherwise
Have you heard of condoms?	1 if the individual considers this statement to be true 0 otherwise

Table A2.
Summary of descriptive statistics explanatory variables

Variables	Total sample		Females		Males	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age	41.2	17.014	41.4	17.106	40.9	16.902
Gender			53.6%		46.4%	
Marital status	56.8%		53.3%		60.7%	
Ethnic group	80.2%		81.6%		78.3%	
Years of education	7.4	4.621	7.4	4.633	7.4	4.605
Ln(income)	12.6	0.956	12.5	1.009	12.7	0.904
Labor participation	57.6%		39.1%		81.9%	
Contributory health regime	33.4		34.4%		32.3%	
<i>Region</i>						
Bogota	8.0%		8.1%		7.9%	
Caribbean region	26.6%		26.3%		26.9%	
Andean region	32.5%		32.9%		32.1%	
Pacific region	15.6%		15.5%		15.6%	
Rest of the country	7.3%		17.2%		17.5%	
Overcrowding	2.0	1.083	1.9	1.081	2.0	1.085
Smoking increases the risk of cancer	95.5%		95.4%		95.7%	
Smokers become chronic coughers	93.0%		93.3%		92.7%	
Smoking while pregnant affect the baby	96.0%		96.3%		95.7%	
It is forbidden to broadcast cigarette advertising on television before 11 pm	47.2%		45.6%		49.4%	
Alcohol is harmful to health	87.6%		89.4%		85.3%	
Age started drinking	16.8	5.169	18.1	5.848	15.2	3.715
Vigorous exercise	25.3%		17.0%		36.1%	
Have you heard of condoms?	85.6%		84.5%		87.0%	

Source: Authors' calculations.

APPENDIX B

Table B.1.
The Impact of Education and Other Covariates On the Probability of Use of Condoms: Logit Estimation

Variables	Total sample		Urban area		Rural area		Females		Males	
	dy/dx	Delta methodStd. Err.	dy/dx	Delta methodStd. Err.	dy/dx	Delta methodStd. Err.	dy/dx	Delta methodStd. Err.	dy/dx	Delta methodStd. Err.
Years of education	0.0048***	0.0008	0.0047***	0.0009	0.0039**	0.0016	0.0049***	0.0011	0.0044***	0.0010
Gender (Male=1)	0.1040***	0.0065	0.1029***	0.0073	0.1127***	0.0150				
Age	-0.0024	0.0015	-0.0015	0.0018	-0.0046	0.0029	0.0039	0.0025	-0.0045**	0.0020
Age squared	-0.0000	0.0000	-0.0000	0.0000	0.0000	0.0000	-0.0001***	0.0000	0.0000	0.0000
Ethnic group	0.0005	0.0075	-0.0008	0.0090	0.0001	0.0135	-0.0102	0.0111	0.0078	0.0102
Income	0.0010	0.0040	0.0024	0.0048	-0.0038	0.0069	-0.0051	0.0057	0.0091	0.0055
Married	-0.2077***	0.0061	-0.2085***	0.0070	-0.2007***	0.0122	-0.1389***	0.0093	-0.2540***	0.0076
Contributory regime	0.0053	0.0071	0.0031	0.0078	0.0023	0.0187	0.0018	0.0098	0.0102	0.0099
Bogotá	-0.0446***	0.0119	-0.0480***	0.0124			-0.0435***	0.0162	-0.0415**	0.0171
Andean region	-0.0465***	0.0082	-0.0473***	0.0094	-0.0177	0.0230	-0.0462***	0.0115	-0.0432***	0.0116
Pacific region	-0.0447***	0.0095	-0.0425***	0.0111	-0.0202	0.0246	-0.0489***	0.0134	-0.0377***	0.0133
Caribbean region	-0.0911***	0.0085	-0.0963***	0.0095	-0.0540**	0.0242	-0.1016***	0.0124	-0.0810***	0.0118
Participation	0.0199**	0.0091	0.0222**	0.0106	0.0089	0.0181	0.0262**	0.0106	-0.0005	0.0158
Overcrowding	-0.0090***	0.0032	-0.0119***	0.0038	-0.0009	0.0057	-0.0105**	0.0044	-0.0041	0.0045
Number of obs.	14,322		11,135		3,187		6,357		7,965	

*** p < 0.01, ** p < 0.05, * p < 0.1
Source: Authors' calculations.

APPENDIX C

Table C.1.

Risky Health Behaviors Prevalence Rates with and Without Missing Values in Years of Schooling (Percentage)

	Complete sample ^{1/}		Only respondents who gave a valid answer to years of schooling		Only respondents who did not gave a valid answer to years of schooling	
	Num. Obs.	Prevalence rate	Num. Obs.	Prevalence rate	Num. Obs.	Prevalence rate
Current smoker	40,932	13.8%	37,173	14.2%	3,759	9.6%
Heavy drinking	40,932	23.5%	37,173	22.7%	3,759	30.6%
Being obese	26,278	10.4%	23,627	11.0%	2,651	5.1%
Unsafe sexual behavior	29,763	7.6%	27,087	7.4%	2,676	9.8%

^{1/} The resulting samples for being obese and unsafe sexual behavior are smaller than for the other two behaviors. In the first case, some individuals did not know either their height or weight required to calculate the BMI; in the case of unsafe sexual behavior, the relevant questions came from a different survey module.

Source: Authors' calculations based on NHS (Ministerio de la Protección Social de Colombia, 2007).

Table C.2.

Risky Health Behaviors Prevalence Rates with and Without Missing Values in Income (Percentage)

	Complete sample ^{1/}		Only respondents who gave a valid answer to income		Only respondents who did not gave a valid answer to income	
	Num. Obs.	Prevalence rate	Num. Obs.	Prevalence rate	Num. Obs.	Prevalence rate
Current smoker	40,932	13.8%	23,805	15.7%	17,127	11.0%
Heavy drinking	40,932	23.5%	23,805	27.5%	17,127	17.8%
Being obese	26,278	10.4%	16,137	10.4%	10,141	10.4%
Unsafe sexual behavior	29,763	7.6%	17,647	9.3%	12,116	5.1%

^{1/} The resulting samples for being obese and unsafe sexual behavior are smaller than for the other two behaviors. In the first case, some individuals did not know either their height or weight required to calculate the BMI; in the case of unsafe sexual behavior, the relevant questions came from a different survey module.

Source: Authors' calculations based on NHS (Ministerio de la Protección Social de Colombia, 2007).

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ISSN 0121-4772



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