

The effect of high school on health: the association between education and health self-assessment

Leda Grasielle Oliveira

Universidade Federal de Alfenas, Instituto de Ciências Sociais Aplicadas - ICISA. Área: economia; gestão pública.

Patrícia de Siqueira Ramos

Universidade Federal de Alfenas, Professora da Universidade Federal de Alfenas, campus Varginha.

Lincoln Frias

Universidade Federal de Alfenas, Professor da Universidade Federal de Alfenas, Campus Varginha.

ABSTRACT

The health conditions of individuals are influenced by their incomes and their access to information, both related to low levels of education. Given that more than half of the Brazilian adult population fail to finish high school, the purpose of this paper is to investigate the differences in health conditions between individuals that have only elementary education with those who have completed high school, using logistic regression and taking the self-assessment of health as the response variable. The data comes from the National Health Survey (Pesquisa Nacional de Saúde - PNS), held in Brazil in 2013, based on a partnership between the Ministry of Health and the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE). The results confirm that there are differences between individuals who only have elementary education and those who have finished high school, showing that the latter are on average better off. In addition, the results of the logistic regression models showed that individuals with high school tend to have a 29% to 55% chance (depending on the explanatory variables) of considering themselves healthy compared to individuals with only elementary education.

Keywords: education, health, schooling.

RESUMO

As condições de saúde dos indivíduos sofrem influência da renda e do acesso à informação, ambos relacionados aos baixos níveis de escolaridade dos mesmos. Considerando que mais da metade da população brasileira não possui o ensino médio completo, o objetivo do presente trabalho é investigar as diferenças nas condições de saúde de indivíduos que possuem apenas o ensino fundamental e aqueles que possuem o ensino médio através de uma análise de regressão logística utilizando como variável resposta a autoavaliação de saúde. Os dados foram retirados da Pesquisa Nacional de Saúde (PNS) realizada no Brasil, em 2013, fruto de uma parceria do Ministério da Saúde com o Instituto Brasileiro de Geografia e Estatística (IBGE). Os resultados confirmam que há diferenças entre indivíduos que possuem apenas o ensino fundamental e aqueles que completaram o ensino médio, mostrando que os últimos se encontram em melhores condições. Além disso, os resultados dos modelos de regressão logística indicam que aqueles com ensino médio completo tendem a ter uma chance de 39% a 55% (a depender das variáveis explicativas) maior de se considerarem saudáveis em comparação a indivíduos que possuem apenas o ensino fundamental.

Palavras-chave: educação, saúde, escolaridade.

INTRODUCTION

Education impacts many dimensions of the subjects' lives, from type of employment and level of income to their living conditions and even their health. In general, those with higher levels of education are more likely to enjoy a satisfactory job, take better care of their own health and family, give opinion in public debates, etc. (SEN, 2000).

In the literature on the specific relation between education and health there are three causal hypotheses: i) the individual's education affects his health state; ii) the individual's health state affects his education; and iii) there may be a double causal relationship between education and health (SOUSA; SANTOS; JACINTO, 2013). In addition, common factors such as genetic inheritance, income and social context may affect both health and education (FURNEÉ; GROOT; VAN DEN BRINK, 2008; CUTLER; LLERAS-MUNNEY, 2010).

Stating the causes and consequences in this context is not a simple task. As low levels of education and poor health correlate with each other, as well as correlate with low income, it is hard to explain which factor has a causal effect on the others. Although the relationship between schooling and health is widely discussed, different researchers use different ways of measuring education and health conditions. So the results often diverge, some studies find a significant relationship and others don't.

Thus, the purpose of this study is to investigate the differences in health conditions between individuals with only elementary school and those who have completed high school. This relationship is investigated through a descriptive analysis of variables chosen as measures of health conditions and logistic regression analysis comparing the self-assessment of health among those two groups.

This paper is divided into four sections, besides this introduction. The next section reviews the literature on the relationship between education and health conditions; the third section introduces the data set and presents the

methodological choices; the fourth section contains the results and, finally, the last section contains the final remarks.

The relationship between education and health

In studies that investigate the relationship between education and health, the first is seen as an element that influences the personal investment in health, helping to adopt healthier habits (SOUSA; SANTOS; JACINTO, 2013; CUTLER; LLERAS-MUNEY, 2010).

There are several studies on the relationship between individuals' education and health related factors. Mielke et al. (2015), for example, investigated the factors associated with the practice of physical activity in leisure using data from the 2013 PNS and found regional differences, but also differences between age groups, schooling levels and a gender gap. The authors used the educational level as a socioeconomic indicator and concluded that males, the youngest and those with the highest educational levels were the most active at leisure regardless of the analyzed region.

Those with a higher educational level tend to have healthier behaviors. There is a negative correlation between levels of education and obesity, with the less educated having a greater tendency towards obesity and hypertension (RODRIGUES; SILVEIRA, 2015; MONTEIRO; CONDE; CASTRO, 2003). Using data from the United States, Cutler and Lleras-Muney (2010) also found a negative correlation between obesity and education. The results indicate that each additional year of education reduced the probability of being obese by 1.4%, reducing even more quickly for people over 12 years of education.

In the United States, smoking rates among the most educated account for one-third of the less educated rate. Obesity rates are 50% lower among the most educated, as well as excessive alcohol consumption. Cutler and Lleras-Muney (2010) found that each year of schooling is associated with a 3% lower probability that the individual would become a smoker. Thus, the probability of an individual with higher education become a smoker is 12% lower when

compared to an individual who completed only high school. Considering that smoking is associated with a lower life expectancy, this difference is quite relevant (CUTLER; LLERAS-MUNEY, 2010).

Mortality is also associated with the level of education, most likely due to the habits and behaviors of individuals about their own health care. A study conducted in Sweden using data from the population from 30 to 64 years old in 1990 showed that individuals with higher levels of education had a significantly lower mortality risk compared to those with lower levels (ERIKSON; TORSSANDER, 2009).

Liu et al. (2013) found results that point to a negative relationship between the level of education and the risk of developing coronary heart disease in 10 years and also with the behavioral and biological risk factors associated with this disease, such as cigarette, diabetes, high cholesterol, etc. The authors noted that the “sheepskin effect” on health suggests that multiple advantages associated with obtaining a diploma can lead to better health conditions. The sheepskin effect is a phenomenon by which there is a marked increase in the average income for individuals who have completed the educational cycles when compared to additional years of education inside the same cycle.

It is likely that education does not have an effect on health in isolation from other factors, since income, for example, is an important factor that interact in many ways with the education of individuals, influencing their health conditions. Thus, an indirect way of observing the effect of schooling on health is through its effect on income (SOUSA; SANTOS; JACINTO, 2013).

Another factor that is associated with education is information. More educated individuals tend to have more access to information, which can be used to achieve better health conditions and a healthier lifestyle. Parent's education levels, for example, are related to the health of their children due to the importance of information for health care (DESJARDINS; SCHULLER, 2006).

This relationship between education and health through the access to information is highlighted by Grossman (1976) model, in which the author takes

as a starting point the hypothesis that individuals have an initial health stock that will depreciate over time as ages advances and can be increased through a health investment, which includes medical care, proper diet, housing facilities, among other market goods and services.

There are evidences that considerable differences in health occur due to the effects of education and not only to differences that precede or explain education, such as socioeconomic conditions of individuals (DESJARDINS; SCHULLER, 2006). There are effects of education on health-related behaviors, such as the relationship between parent's levels of education and the health of their children, which does not depend on income.

However, identifying the schooling effect on health can be difficult because there are unobservable factors that are correlated with both schooling and health (BÖCKERMAN; MACZULSKIJ, 2016). In view of this, many studies use data from twins, as a way to control the influence of genes on the variables of interest. The use of monozygotic twins (identical twins) raised together is a way of controlling both environmental and genetic factors.

Boardman, Domingue and Daw (2014) investigated the relationship between schooling and health controlling for genes, using genomic data from approximately 4,000 adults for three measures of health conditions: health self-assessment, depression and BMI. The results suggest that the relationship between low education and health-related variables, such as mental health and health self-assessment, can be partially explained by genetic similarity. This kind of result shows that schooling does not have a direct effect on improving the population's health conditions, since its effect on health may not be linear (BÖCKERMAN; MACZULSKIJ, 2016). As has been said, schooling has an important impact on economic factors, such as income and employment, which in turn affect health conditions.

METHODS

The statistical methods used in this research are descriptive analysis and logistic regression analysis. Data were taken from the National Health Survey (Pesquisa Nacional de Saúde - PNS) conducted in 2013 through a partnership between the Ministry of Health and the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE), whose sample had 205,546 observations (IBGE, 2018).

The analysis used the Python programming language (PYTHON, 2018) and the Jupyterlab interface. The first step was to restrict the sample selecting only individuals older than 17 years, those who could already have completed the primary and secondary education. The second restriction was the withdrawal of individuals who are still attending school, since only those who have completed their studies will be analyzed. Finally, the third restriction concerned the educational level, maintaining only those individuals whose highest completed level of education was one of the two levels of interest for the research: elementary or high school.

RESULTS AND DISCUSSION

Descriptive analysis

The proportions of the population according to educational level in 2013 are presented in Table 1. The majority of the population in the sample did not even completed high school. The proportion of uneducated people was about 16%, while those with incomplete elementary school was 25%. Individuals with complete elementary school accounted for about 14% of the sample. Those with high school, in turn, accounted for 32%. Finally, individuals with higher education represented the lowest percentage, about 13% of the sample. This shows that the Brazilian population in 2013 was still very poorly schooled, with over half the population, about 55%, below the high school level.

Table 1: Percentage of people by level of education

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Level of education	Percentage
Uneducated	16.1
Incomplete elementary school	25.1
Elementary school	14.2
High school	31.8
Higher education	12.8

Data source: PNS (2013). Observation: Only those over 17 years old who do not attend school. Individuals with incomplete high school were incorporated into elementary level and those with incomplete higher education were incorporated into high school.

Figure 1 presents the individual's perception about their own health, in 2013, according to the two levels of education: elementary and high school. The perception about their own health tends to be better for those with high school compared to those with elementary education. Among these last ones, 9% considered their own health to be very good, 57% considered good, 28% considered regular, 4% considered poor and 1% considered very poor, against 13%, 64%, 20%, 2% e 0.5%, respectively, for those with high school.

As pointed out by Vintém (2008), different levels of education are associated with different values, norms, habits and attitudes, which end up contributing to the explanation of how each person perceives their own state of health. In addition, schooling plays an important role as a resource that affect health, as more educated individuals are able to adhere more easily to disease prevention and health promotion measures, as well as to more frequently correct their eating habits and lifestyle (VINTÉM, 2008).

Gráfico 1, centralizado.

Figure 1 – Perception about their own health according to education level

Data source: PNS, 2013.

Figure 2 presents box plots that show the relationship between the perception of people about their own health and the income according to their level of education. The value of the income was restricted to R\$ 7,000.00 to facilitate the chart visualization. The box plot present the data ordered in ascending form, with 50% of this data inside the box and the rest outside it. Thus, on the right and on the left side are the other 50%, that is, 25% on each side. The line that is inside the box represents the median, the value that divides the ordered data in half. Finally, the points that are outside the box are the outliers, whose values are calculated to be 1.5 times the value of the distance between the first and third quartiles.

Gráfico 2, centralizado.

Figure 2 - Perception about their own health according to income and level of education

Data source: PNS, 2013.

Figure 2 shows that there was a relationship between income and positive perception about their own health. For example, the median income of individuals who considered their own health to be bad, very bad or regular was quite similar, being less than R\$ 1,000.00 for both those with elementary school and those with high school. Among those who considered their health to be good, the median income of those who only had elementary education was still below R\$ 1,000.00, but the median of those with high school was above this value. Among those who considered that their health was good, the median income was above R\$ 1,000.00 for both levels of education. In addition, the median income of those who only had elementary education was always lower compared with those with high school.

Table 2 presents a statistical summary of the data set used in the logistic regression and charts presented in this paper. Regarding to elementary school,

the proportion of men and women who completed this level was the same. For high school, the proportion of men was lower than the proportion of women (46% and 54%, respectively). Regarding age, for those with elementary school the age was higher compared to those with high school. The same occurred with the median age, which was also higher for the less educated group.

The average income of those who had elementary education was lower when compared to the group that had high school, R\$ 1,169.00 for the first and R\$ 1,405.00 for the latter. The median showed the same pattern. The median income of the group that only had elementary school was R\$ 850.00 while the median of those with high school was R\$ 1,000.00.

Finally, it is observed that the group that only had elementary school tended to evaluate their own health worse than those who had high school. Among those who only had attended elementary school, about 9% considered their health status to be good, 57% considered it good, 28% regular, 4% bad, and about 1% considered it very bad, against about 13%, 64%, 20%, 2% e 0.5% of the group that had high school, respectively. These values are rounded and are shown in Figure 1.

Table 2 - Descriptive analysis

		elementary school	high school
Gender (%)	male	50	46
	female	50	54
Age (years)	mean	41.4	37.1
	standard deviation	15.5	13.9
	minimum	18	18
	median	40	34
	maximum	99	105
Income (R\$)	mean	1,169	1,405
	standard deviation	1,786	1,814
	minimum	10	20

	median	850	1,000
	maximum	100,000	130,000
	very good	9.2	13.3
	good	57.3	64
Perception (%)	regular	28.4	20
	bad	4.2	2.2
	very bad	0.9	0.4

Data source: PNS (2013). Observation: Only those over 17 years old who do not attend school.

Thus, the descriptive analysis shows a difference between the two groups of schooling regarding to health indicators, with the less educated group being in a worse situation than the more educated one. This result is in agreement with the literature on the subject, which also points to the existence of a relationship between schooling and health indicators.

The mean income of the individuals was also different between the two groups, with the less educated group having a lower income. This can be an evidence of the existence of a vicious circle where the level of education affects the income and, consequently, the state of health, just as the income and the state of health affect both the level of education and each other (WINSLOW, 1951; DESJARDINS, SCHULLER, 2006). Thus, there is not necessarily a cause and effect relationship between variables, since a double causality situation is also possible, as suggested by Sousa, Santos and Jacinto (2013).

Regression analysis

Five models were elaborated, whose results are presented in Tables 3 and 4. Due to the logistic function used in the model, the original coefficients are not directly interpretable, since they refer to the linear relationship between the explanatory variables and the outcome variable. The following tables presents two columns for each of the models: the original coefficients and their respective standard errors are in the first column, while the values of the coefficients already transformed through the exponential function are in the

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second column, which allows them to be interpreted as an odds ratio (a ratio of chances).

In all models of Table 3, the outcome variable is the perception of the individuals about their own health. This variable was initially composed of five categories: good, very good, regular, bad and very bad. However, the logistic regression model requires that the outcome variable be binary. So the answers were grouped into only two categories, 0 and 1, where 0 represents a good health condition (composed of good and very good categories) and 1 represents a bad health condition (composed of regular, bad and very bad categories).

Table 3: Results of the regression models (perception about their own health)

	Model 1		Model 2		Model 3	
	original	expon.	original	expon.	original	expon.
Intercept	1.84 (0.04)	6.28	1.99 (0.05)	7.29	2.06 (0.10)	7.88
Schooling (high school)	0.44 (0.02)	1.55	0.39 (0.03)	1.48	0.33 (0.06)	1.39
Gender (female)	0.34 (0.02)	1.40	0.26 (0.03)	1.29	0.16 (0.05)	1.17
Age	-0.03 (0.00)	0.97	-0.04 (0.00)	0.96	-0.04 (0.00)	0.97
Income			0.02 (0.00)	1.02	0.01 (0.00)	1.01
Health insurance					0.73 (0.06)	2.08
Smoker					-0.13 (0.08)	0.88
Doctor's appointment					-0.12 (0.01)	0.89
Physical activities					0.26	1.30

			(0.05)
Pseudo R-squared	0.05	0.04	0.09
No. observations	51,155	34,479	9,437

Observation: Standard error in parenthesis.

In the first model, schooling, gender and age of the individuals were used as explanatory variables. The purpose is to understand how these variables influence the perception of individuals about their own health. Analyzing the coefficients presented in Table 3, it is observed that having a high school education increases by 55% the chance of the individual considering himself healthy. The chance that women consider themselves healthy is 40% higher in comparison to men. Finally, one year of age decreases by 3% the chance of the individual considering himself healthy. In this model, the three variables were significant.

In the second model, the same previous variables were used, and income was added. Thus, it is observed that the effect of high school decreased compared to the first model. In this model, having high school increases by 48% the chance of the individual consider himself healthy. The effect of gender is also lower, with women having a 29% higher chance of considering themselves healthy compared to men. The effect of age remained almost the same: one year of age decreased by 4% the chance of the individual considering himself healthy. Each increase of R\$ 100 in income increases by 2% the chance that the individual considers himself healthy. Again all variables were statistically significant.

Finally, in the third model the following variables were added: health insurance, which shows whether or not the individual has a health plan; smoker, which indicates whether or not the individual is a smoker; doctor's appointment, which indicates the number of times the individual went to the doctor in the last year; and physical activities, which indicates whether the individual has practiced any physical activity or sport in the last three months.

The results point again to a positive effect of high school. This level of education increases by 39% the chance of the individual considering himself healthy. Being female still have a positive relationship with self-perception, with women having a 17% higher chance of considering themselves healthy compared to men. The effect of age was the same as that of the first model: one year of age decreased by 3% the chance of the individual considering himself healthy. On the other hand, the effect of income decreased in relation to the second model, with each increase of R\$ 100.00 in the income leading to a 1% increase in the chance of the individual considering himself healthy. The health plan variable, in turn, shows that an individual who has health insurance has a 108% higher chance of considering himself healthy compared to those who has not. However, an additional medical visit in the last 12 months reduces by 11% the chance of the individual considering himself healthy. This relationship may seem unexpected, but this can happen because people who seek the doctor usually are already less healthy. Finally, physical activity in the last 3 months increases by 30% the chance of the individual considering himself healthy. In this model, only the smoking variable was not statistically significant.

Table 4 presents the results of two other regression models with different outcome variables. Instead of investigating the best predictors of health self-assessment, they focus on the effects of schooling and other predictors on variables that represent chronic diseases. The outcome variable of the fourth model indicates whether the individual was diagnosed with any chronic disease, while the fifth model addresses hypertension (high blood pressure) specifically.

Table 4: Results of regression models (with others outcome variables)

Dependent variable	Model 4		Model 5	
	original	expon.	original	expon.
Intercept	-4.26	0.01	-4.84	0.01

	(0.14)		(0.14)	
Schooling (high school)	-0.06	0.94	-0.13	0.88
	(0.07)		(0.07)	
Gender (female)	-0.25	0.78	-0.04	0.97
	(0.06)		(0.06)	
Age	0.06	1.06	0.08	1.08
	(0.00)		(0.00)	
Income	0.00	1.00	0	1.00
	(0.00)		(0.00)	
Health insurance	0.02	1.02	-0.14	0.87
	(0.07)		(0.07)	
Smoker	0.09	1.09	-0.1	0.91
	(0.10)		(0.10)	
Doctor's appointment	0.09	1.10	0.06	1.06
	(0.01)		(0.01)	
Physical activities	-0.03	0.97	-0.15	0.86
	(0.07)		(0.07)	
Pseudo R-squared	0.10		0.14	
No. observations	9,437		9,136	

Observation: The coefficients are the exponential transformation of the originals coefficients. Standard error in parentheses.

As already noted, in the fourth model the outcome variable is whether the individual has ever been diagnosed with any chronic, physical or mental disease, or long term disease (over 6 months in duration). From this model, it is observed that women have a 22% higher chance of being diagnosed with some chronic disease compared to men. One year of age increases the chance of the individual being diagnosed with any chronic disease by 6%. And one more medical appointment in the last year increases by 10% the chance of the individual being diagnosed with some chronic disease. In this model, schooling, health insurance, income, smoker and physical activities variables were not statistically significant.

Finally, in the fifth model the outcome variable was whether the individual had ever been diagnosed with hypertension. The coefficients in the last column of Table 4 shows that one year of age increases the chance of being diagnosed with the disease by 8%. Having a health insurance decreases it by 13%. One more medical appointment increases the diagnosis by 6%. Finally, having done some physical activity in the last three months decreases it by 14%. In this model, schooling, gender, health plan, income and smoker variables were not significant.

Thus, the first three models indicate the association of education and health self-assessment. The results indicate that individuals with high school tend to have a 39% to 55% chance (depending on the explanatory variables) of considering themselves healthy compared to individuals with only elementary education. On the other hand, the last two models indicate that schooling does not have the same importance for the presence or absence of chronic diseases, since the educational variable was not significant.

This result is a sign that education has no effect on chronic diseases, probably because they have an strong genetic component. However, this research has shown that education is closely associated with perception of the individuals about their own health, indicating that it is related to health conditions that are important to individuals other than chronic diseases. Although this paper has not investigated these conditions, they probably include acute illnesses, accidents and malaise in general, such as infections, sore throats, colds, pneumonia, etc.

It is important to highlight the possibility that individuals from both educational groups have similar health conditions, but the group that only has elementary education tends to perceive their health as worse in comparison to the group that has high school. This can happen because, as mentioned previously, the data used in this research for the regression models refer to individuals' perceptions about their own health and this perception can be influenced by several factors (for example, physical effort at work, financial

security, leisure time, access to health services and nutritional conditions), varying among different groups for different reasons.

Final remarks

The purpose of this study was to investigate the differences in health conditions between those who only have elementary education and those who have completed high school. The descriptive analysis points to the existence of a positive relationship between education and health indicators since individuals with only elementary education considered themselves, on average, in a worse situation than those with high school. Both the literature consulted and the results presented here point in the same direction.

According to the reviewed literature, it is likely that there is a vicious/virtuous cycle in which individuals with lower incomes tend to have fewer educational opportunities and worse health conditions, as well as individuals with higher incomes tend to have better educational opportunities and also better health conditions.

The regression models also showed a positive effect of high school on individuals' perception about their own health, since the chance of a high school student to evaluate positively his own health status is higher compared to those who only have elementary education.

However, high school seems to have no effect on the likelihood of being diagnosed with some chronic disease, probably because, unlike the perception about their own health, this kind of disease has a strong genetic component, that is, they do not depend so much on health care or access to information.

Regarding the limitations of this study, there are several other factors that were not part of its scope and are capable of influencing both the health conditions and the educational level of the individuals. Examples of this are the quality of the public health service, the quality of schools, nutritional status, among others. In addition to these more specific factors, educational and

health policies also directly affect the population, especially the most needy. Therefore, these are variables that should be included in future works.

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