The Effects of Education on Tobacco Consumption: A Panel Data Analysis

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Abstract

This study tests the hypothesis that acquiring more education improves health by reducing smoking habits. The study investigates whether higher levels of education influence smokers' behaviour or not. A panel dataset from South Africa's National Income Dynamic Survey (2008–2017) was used as a data collection source. The study employs a logistic model to conclude that people in South Africa with more education are less likely to smoke than those without education. Also noteworthy is the discovery that individuals with mental health-related behavioural disorders are more likely to smoke as a form of self-medication. Our results are particularly significant for policymakers since they demonstrate that education reduces the likelihood of smoking. These findings indicate the need for increased government support for educational opportunities in South Africa. In the long run, the population health of a country may benefit from free public education. Programs aimed at reducing smoking ought to focus on individuals with lower levels of education, younger people, and city dwellers because they are more likely to be engaged in smoking.

Keywords: *Education, Tobacco consumption, Health, Panel data, Spending.*

Introduction

There has been a lot of research on smoking and factors that could reduce smoking behaviour. The research on smoking is believed to be motivated by the fact that smoking is responsible for more deaths worldwide than any other factor (Goodchild, Nargis, and d'Espaignet, 2018; Nkomo, Biyase, and Simo-Kengne, 2023). There is substantial scientific evidence connecting smoking to negative health outcomes, such as: being directly linked to several life-threatening illnesses, including lung cancer, heart disease, and a host of others (National Academies of Sciences, Engineering, and Medicine, 2017; Adanlawo and Chaka, 2023). According to research conducted by Bergmans et al. (2019), education and smoking have a considerable cross-sectional relationship, with higher educated people being significantly less likely to smoke. Severs et al. (2017) and Reddy and Adanlawo (2018) aver that a higher level of education is associated with a lower risk of smoking, alcoholism, obesity, and employment in hazardous occupations.

People with a high level of education also have a higher rate of healthy offspring output, increased longevity, and increased activity levels (Chaka and Adanlawo, 2022; Mirowsky, 2017). Education and health have a substantial correlation, but the mechanism linking the two is yet unknown. Several hypotheses have surfaced through research that state that individuals who are more educated may more effectively transform health-related inputs into improved health (Li and Powdthavee, 2015). One alternative theory suggests that formal education does not matter in explaining people's health-related actions. In contrast, the same unnoticed features that motivate people to invest in education may equally motivate them to invest in their health. This can establish a link between education attainment and well-being, even when no causal relationship exists (Vuik, Devaux, and Cecchini, 2019; Adanlawo, 2017). To achieve the aim of this research, a panel dataset from South Africa's National Income Dynamic Survey (2008–2017) was used to examine the effect of education on smoking behaviour. Given the potential bias in aggregate data, estimating the influence of education level on smoking and testing the significant effect of individual characteristics on smoking are made possible through panel data analysis. The study adds to the growing body of research on health education by examining how education affects smoking behaviour.

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Literature

According to the theory of productive efficiency, an individual's stock of human capital affects the production function that transforms health inputs into health outputs (Faggian, Modrego, and McCann, 2019), among which education is a crucial one. Those with greater human capital are better able to efficiently translate healthy inputs into healthy outcomes. As an alternative, the notion of allocative efficiency is predicated on the idea that those with more education select a set of health inputs that is more productive (Wong, 2021; Zondi, Nkomo, and Adanlawo, 2023; Utete and Zhou, 2024). The development of human capital may provide insight into the health production function that enables those with more education to choose an input combination that is more effective. For instance, education might raise people's understanding of smoking's harmful consequences on their health and enable a more thorough cost-benefit analysis.

Shohaimi et al. (2003); Kuipers et al. (2016) studies, for example reveal that education has a significant effect on smoking behaviour. However, some studies conclude that education has no effect on smoking behaviour (Koning, Webbink, and Martin, 2015; Sanderson et al., 2019). The decision to smoke is especially difficult to assess. Studies have examined how the price of cigarettes has changed the desire of individuals to smoke but have not taken into account other aspects, such as the influence of educational level. There are reasons to believe that a person's level of education may affect whether or not they choose to smoke.

Methodology and Data

The NIDS dataset was utilized in this study to examine how education level affected cigarette usage. The data set consists of a long-term household survey in South Africa. The Southern Africa Labour and Development Research Unit (SALDRU) conducts the survey every two years. This research uses the five waves between 2008 and 2017. The primary explanatory variable in this analysis was the education variable, a categorical variable divided into five groups: no formal education, primary, secondary, matriculation, and higher education. Additionally, control factors such the resident's race, household income, gender, marital status, employment status, and age were also included. All variables, with the exception of household income and age, are either binary or categorical. Regular smoking and frequency of smoking are dependent variables. The survey questions that questioned people whether they smoked or not were the source of the regular smoking variable. Binary categories were used to classify this variable (0 if they do not smoke and 1 if they do). However, 0 represents a non-smoker, and it also represents a smoker who smokes but cannot afford to smoke at a particular moment for any reason.

Fitting models using logistic regression and conducting conditional logistic regression analysis in Stata, version 15, were used to examine the impact of education level on tobacco use in South Africa. In a panel setup, smoking status (smoker and non-smoker) was used as the variable of interest or outcome in logistic regression models. We used conditional logistic regression to examine smoking probabilities. A logistic model measures the probability of being a smoker considering the educational levels of an individual using a logistic function.

The logit model is specified below as:

$$\mathrm{Re}\,gular\_smo\ker_{it} = \beta_0 + \beta_1 education_{it} + \beta_2 Age_{it} + \beta_3 AgeSqd_{it} + \beta_4 married_{it} + \beta_5 employed_{it}$$
$$+ \beta_6 race_{it} + \beta_7 urban_{it} + \beta_8 gender_{it} + \beta_9 Mentalbehaviours_{it} + \beta_{10} province_{it}$$
$$+ \beta_{11} Language_{it} + \beta_{12} unemployment_{it} + \beta_{13} Healthstatus_{it} + \varepsilon_{it}$$

Therefore, the anticipated results from the NIDS are representative on a nationwide scale. Evaluations and reports on model fits were made for the estimated models. We therefore, offer estimates of the influence of academic achievement on smoking that account for the selection bias and are broadly applicable. Since

the negative health impacts of smoking are now well-known, we may use this information to determine if education has any effect on the decision to smoke using the logit model. We do not place exclusion constraints on previous research's use of relationships between age, generation, time, and region. The following table shows the summarised statistics of the used variables:

Table 1: Descriptive statistics

Variable		Mean	Std. Dev.	Min	Max
Regular smoker		.0358	.1858	0	1
Primary		.3534	.4780	0	1
Secondary		.2754	.4467	0	1
Matric		.0971	.2961	0	1
Tertiary		.0911	.2878	0	1
Depressed		.4225	.4939	0	1
Lonely		.3532	.4779	0	1
Restless		.4308	.4951	0	1
Stressed		.3009	.4586	0	1
Sleepless		.1314	.3378	0	1
Urban		.5180	.4996	0	1
Female		.5468	.4978	0	1
Married		.2388	.4263	0	1
Unemployed		.4374	.4960	0	1
Asian_Indian		.0155	.1237	0	1
Coloured		.1415	.3485	0	1
White		.0423	.2014	0	1
African		.8006	.3995	0	1
Age		23.7159	19.2201	0	107
AgeSQD		931.8576	1321.579	0	11449
IsiXhosa		.1689	.3747	0	1
IsiZulu		.3023	.4592	0	1
Sepedi		.0865	.2812	0	1
Sesotho		.0834	.2765	0	1
Setshwana		.0964	.2952	0	1
Seswati		.0192	.1375	0	1
TshiVenda		.0094	.0968	0	1
IsiTsonga		.0152	.1225	0	1
Afrikaans		.1677	.3736	0	1
English		.0393	.1943	0	1
Other Language		.0006	.0248	0	1
Eastern Cape		.1277	.3337	0	1
Northen Cape		.0694	.2541	0	1
Free State		.0583	.2343	0	1
KwaZulu-Natal		.2836	.4507	0	1
North West		.0695	.2543	0	1
Gauteng		.1170	.3214	0	1
Mpumalanga		.0717	.2580	0	1

Limpopo		.0827	.2754	0	1
Household income		7322.526	18463.29	0	2605524
Poor health		.1106	.3136	0	1
Excellent health		.8893	.3136	0	1

Table 1 provides a concise summary of the sample's characteristics. Only 0.03% of respondents reported being smokers on a regular basis. Among those interviewed, 0.01 percent were of Indian descent, 80 percent were of African descent, 14 percent were of coloured descent, and 0.04 percent were White. Approximately 0.35 percent were in primary school, 0.27 percent in secondary school, 0.9 percent were matriculants, and 0.9 percent were in tertiary. According to Table 1, smokers with lower levels of education (some primary' or lower) had a higher probability to smoking more cigarettes on average, with women making up a sizable proportion (54.6%). Self-reported depression was found at 42.5 percent, with restlessness at 43 percent, indications of insomnia at 13 percent, stress at 30 percent, and agitation at 43 percent. Females accounted for over half of our respondents (54.6%). For each of the two possible outcomes in a binary expression, "0" is used as a baseline against which "1" can be measured. A man's marital status (married or not married), educational background, employment status, and smoking habits are all taken into account.

Table 2 displays the estimated odds ratio with random effects, which controls for unobserved heterogeneity while taking into account time-invariant characteristics like race.

Table 2: Logit regression model on the decision to smoke

VARIABLES	Regular smoker
Primary	0.0435
	(0.0402)
Secondary	-0.134***
	(0.0407)
Matric	-0.268***
	(0.0436)
Tertiary	-0.309***
	(0.0440)
Depressed	0.142***
	(0.0151)
Lonely	0.0486***
	(0.0152)
Restless	-0.0147
	(0.0161)
Stress	0.0570***
	(0.0156)
Sleepless	0.0973***
	(0.0214)
Urban	0.185***
	(0.0175)
Female	-1.235***
	(0.0142)
Married	-0.233***
	(0.0177)
Age	0.424***
	(0.0151)
AgeSQD	-0.0003***
	(0.0001)
Coloured	0.636***

	(0.0507)
Asian_Indian	0.189**
	(0.0766)
White	0.501***
	(0.0571)
IsiXhosa	-0.0920
	(0.0732)
IsiZulu	-0.0299
	(0.0699)
Sepedi	-0.130*
	(0.0750)
Sesotho	0.0390
	(0.0739)
Setswana	-0.0490
	(0.0748)
Seswati	-0.241***
	(0.0856)
TshiVenda	-0.310***
	(0.107)
IsiTsonga	-0.453***
	(0.0919)
Afrikaans	0.474***
	(0.0859)
English	0.451***
	(0.0891)
Other Languages	-0.581*
	(0.335)
Eastern Cape	-0.107***
	(0.0304)
Northern Cape	-0.102***
	(0.0274)
Free State	0.0361
	(0.0407)
KwaZulu-Natal	-0.313***
	(0.0367)
North West	-0.00787
	(0.0409)
Gauteng	-0.0142
	(0.0313)
Mpumalanga	-0.0803*
	(0.0414)
Limpopo	-0.150***
	(0.0504)
LHHincome	-0.0828***
	(0.00785)
Poor health	0.153***
	(0.0215)
Unemployed	-0.119***
	(0.0150)
Constant	-0.256**
	(0.107)
Observations	65,642

Note: ***, **,* 1%, 5%, and 10% level of significance signs, respectively, signify statistical significance. Parentheses are used to indicate standard errors. The Western Cape, Eastern Cape, Northern Cape, Free State, Kwa-Zulu-Natal, North West, Gauteng, Mpumalanga, and Limpopo are the nine provinces, and 11 official languages in South Africa. The estimated output uses Western Cape and IsiNdebele as the reference variables.

Results

First, we use a fixed logit model that controls for covariates other than education to estimate the association between education and tobacco use. We use a linear probability model that accounts for respondents' gender, race/ethnicity, marital status, place of residence, employment status, marital status, language, and province. The results of this model are summarized in Table 2. The reported odds ratios for smoking rates compare the levels of education (no education as the reference variable, primary, secondary, matric, and tertiary). People with higher levels of education are more likely to be aware of the risks associated with smoking. The conclusion drawn from the NIDS dataset is that exposure to this knowledge reduces tobacco use among educated individuals.

According to the data in Table 2, persons with more education are less likely to be smokers than those who have less education (secondary-level education (-0.134), matriculating students (-0.268), and tertiary (-0.309). Whereas people who are depressed, lonely, stressed, or having trouble sleeping are more likely to be smokers. This is consistent with the findings of Nkomo, Biyase, and Simo-Kengne (2023); Chaka and Adanlawo (2023), who found that people with behavioural issues related to their mental health are more likely to smoke as a kind of self-medication.   According to the results, urban dwellers are statistically more likely to be smokers than their rural counterparts. Married individuals are less likely to smoke according to our analysis. Furthermore, the findings also indicate that being a female compared to a male significantly decreases one's likelihood of smoking.

This study found that the probability of smoking among young people was higher (odds ratio, 0.424), but that the odds decreased significantly with age (odds ratio, 0.0003). This finding agrees with previous studies on tobacco use (Van Hasselt et al., 2015; Song, 2015). The diversity of culture and language in South Africa also influences smoking behaviour. According to the research, one's native tongue may also play a role in whether or not they choose to take up smoking. This study found that people who speak Sepedi (-0.130), Seswati (-0.241), TshiVenda (-0.310), IsiTsonga (-0.453), and other unidentified languages (-0.581) in South Africa are less likely to smoke than people who speak Afrikaans (0.474) and English (0.451).

This study identifies language as a factor that influence smoking. Seswati, TshiVenda, and IsiTsonga language speakers are mostly rural dwellers, and they are more grounded in cultural values that believe that smoking is dangerous to health. It can thereby be said that the value of culture affects their smoking behaviour A person's home province was also a key factor in determining whether or not they smoked (Adanlawo, reddy, and Ruugbeer, 2021). Smoking rates are lowest in Limpopo, Eastern Cape, Northern Cape, KwaZulu-Natal, and Mpumalanga. This may be due to the fact that these provinces are mostly populated with elderly people who value their health more and are not influenced by peer pressure. Last but not least, being unemployed (-0.119) is a condition that is less likely to cause one to smoke. This research also shows that people with incomes of any type (-0.0828) are less likely to be smokers. Smoking prevalence among those who report worse health status is higher than among those who report higher health status (0.153).

Discussion

Research into the correlation between cigarette prices and smoking habits in South Africa is extensive. However, little research has examined the role of education attainment in tobacco use. This research adds to the existing body of knowledge on the subject of tobacco consumption by examining how educational level affects smoking behaviour in South Africa. The results generally indicate that educational attainment is a key determinant of the decision to smoke, even when other factors influencing the decision to smoke

are taken into account. The study discovers that the likelihood of making the choice to smoke decreases with increasing levels of education. Tenn et al. (2010), Koning, Webbink, and Martin's (2015) findings are consistent with these results.

The findings of this study show a significant correlation between education levels and cigarette use. The study found that people in South Africa with greater levels of education are less likely to smoke. compared to those with no education. The study correlates with the study by Boachie and Ross (2020). These results may be explained by the fact that those with education may be more knowledgeable and aware of the harmful effects of smoking. Hence, the study concludes that accumulated education does affect the decision to smoke, but having low levels of education increases the decision to smoke. This is in line with De Walque (2007) and Viscusi and Hakes (2008) studies that test the hypothesis that future education predicts current smoking behaviour. Their results confirm that an additional level of education reduces smoking behaviour.

The results from this panel data show that, regardless of race or gender, a lower smoking rate is associated with a higher degree of education held by an individual. A greater degree of education has been shown to have a detrimental influence on health, however, among smokers with no education, this effect appears to be negligible compared to those that have obtained some level of education. The study also found that the likelihood of smoking decreased significantly with age. The one possible explanation for the decreasing trend is that older people in South Africa are more amenable to changing their smoking habits than younger people. This study also reveals that Blacks are less likely to smoke as compared to their other races (Coloured, Indian, and White).

Conclusion

We investigate whether or not a person's choice to smoke is influenced by their educational level in South Africa. Individuals' levels of education, marital status, residency, language proficiency, age, employment, and province of residence are all taken into account in the logit methodology comparisons. We draw the conclusion that educational attainment significantly affects smoking habits. This study compares and contrasts the smoking habits of people with primary school, secondary school, matriculation, and tertiary education. People with lower levels of education are more likely to become smokers. While, we do find evidence that education influences smoking decisions, more study is needed to determine whether this is also true for household heads. Similarly, although education is not likely to play a significant role in the decision to start smoking for older adults, it may be worthwhile to investigate if education influences the decision to quit.

Our findings have important implications for policymakers since they show that education does reduce the chances of smoking. This study suggests that the government of South Africa should promote educational opportunities for its citizens. Free public education has the potential to improve the health of the country's population in the long run (Nkomo and Adanlaw, 2023). The younger generation and urban residents represent those prone to indulge in smoking activities; therefore, it is suggested that education and smoking cessation programs should be directed toward these groups. Existing smokers' spending may be reduced if appropriate action is taken. Our research suggests that South African cities with large populations of young, low-income people would be an ideal target for anti-smoking initiatives focused on reducing cigarette and tobacco use. In addition, as smokers' spending on cigarettes rises in parallel with their incomes, it may be reasonable to raise cigarette rates in order to deter usage and enhance tax revenues. The effectiveness of anti-smoking efforts launched in South Africa could likewise be the subject of longitudinal research.

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