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By Ernest N. Tingum, Moses A. Ofah & Akwi Tafah

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1. INTRODUCTION

Tobacco use increases morbidity and mortality and is an established health hazard as it contributes to multiple diseases, including cardiovascular, pulmonary, musculoskeletal, immune diseases, and cancer and asthma (WHO, 2011). Such tobacco-related morbidity occurs disproportionately in developing countries, where smoking has reached epidemic rates particularly in the past decades with an increased in tobacco consumption rates especially in Africa. The increase in smoking rates can be attributed to the fact that most of the raw tobacco is processed in developed countries and exported back to Africa for consumption.

Author α: School of Public Policy, Central European University, Hungary. e-mail: ngehernest@gmail.com

Author σ: Department of Economics, Higher Teachers Training College, University of Bamenda; P.O Box 39, Bamili. e-mail: ofeh2002@yahoo.com

Author ρ: Department of Economics, University of Dar es Salaam, Tanzania. e-mail: akwitafofeh@gmail.com

In 2008, tobacco use killed over five million people worldwide as compared to 4.9 million in 2000 (Jha, 2012). In 2015, it was estimated that the global yearly death toll as a result of tobacco use is 6 million (including exposure to secondhand smoke). This is more than tuberculosis, HIV/AIDS and malaria combined. If unchecked, the number of deaths will increase to around ten million in 2030, with more than 80% of these deaths happening in developing countries (ASH, 2015). At the same time, worldwide tobacco usage accounted for 4.1% of global burden of ill health in 2000; much of this burden was due to an increase in the last full decade of tobacco-related illnesses in developing countries (Ezzati et al 2002).

As use of cigarette and other tobacco products declines in high-income countries, increasing attention has turned to the growth of cigarette use in middle- and low-income countries (Jha & Chaloupka, 2000; Opdal, 2008). From 1970 to 2000, per capita cigarette consumption fell by 14% in developed countries and rose by 46% in developing countries (Guindon and Boisclair, 2003). The increase occurred primarily among men but, given marketing efforts of tobacco companies, use by women appears primed to move upward (Ernster, Kaufman, Nichter, Samet, & Yoon, 2000; Mackay, 1998). Largely because of the growth in low- and middle-income nations, the number of smokers worldwide has now risen to 1.3 billion and may well reach 1.5 billion by 2025 (Mackay, Eriksen, and Shafey, 2006).

Tanzania is one of the major producers of tobacco in the world and the second largest producer in Africa after Malawi¹. For the year 2011-2012 the area planted was 118250 hectares with a yield of 126620 tones, amounting to 1.07 tons per hectare. With regards

¹ Tanzania is one among the poorest countries of the world. Per capita income is estimated at about US\$ 450 per year. Covering an area of 945,000 square kilometers, it has a population of about 42 million growing at about 3 percent a year. The economy is heavily dependent on agriculture (primarily, tobacco, coffee, cotton, tea, cloves, cashew nuts, sisal, maize, rice, wheat, and cassava), which accounts for about 50 percent of GDP, provides 85 percent of exports, and is by far the largest employer.

to cigarette use, the overall smoking prevalence rate is 12.4% for males, 8.8% for females and 10.6 overall (WHO, 2012). However, the overall tobacco use increases to 20.5% when the reference population is limited to adults (15 to 60 years). Most smokers in Tanzania appear to lack the understanding of the harmful health effects of tobacco use, the corresponding high health care expenditure as well as reduced earnings that emanate from smoke related diseases (Kidane *et al.*, 2014).

The harm that tobacco use does to health is irrefutable. The evidence in tens of thousands of careful scientific articles from around the world testifies that tobacco use (chewing or smoking) and inhaling "secondhand" or side stream smoke from cigarettes raises the risk of many serious diseases. Moreover, tobacco use is one of the major preventable causes of disease and premature death. The efficacy and cost effectiveness of a well-tested set of policies and interventions have been clearly established over several decades, in many countries around the world, at various income levels and in many different cultures. The adverse effects of tobacco use on the health of an individual are well known. Therefore, it is essential to identify factors leading to tobacco use to plan strategies to limit its use.

While cigarette smoking is a major health issue, other forms of tobacco use (pipe smoking, snuff and tobacco chewing) are growing concern especially as Tanzania is the second highest producer of tobacco in Africa after Malawi. Like cigarette smoking, these forms of tobacco use have increased considerably among the elderly rural population in Tanzania especially in Tobacco growing regions. Other forms of tobacco use seem to have similar negative health affects to cigarette smoking on consumers although this has not been well explored. Regardless of the type of tobacco product, tobacco use has adverse health effects. The age at which people start tobacco use is crucial, as once smoking is commenced the addictive effect of nicotine is likely to promote continuous consumption (Morrell *et al.*, 2011).

The bottom line is clear: reducing tobacco use is good for health, and makes sound economic sense. Therefore, Tanzania would derive net economic gains, not losses if their demand for tobacco products fell, because economic losses would be offset by economic gains at household and national levels. Despite Tanzania being one of the highest producers and subsequent consumers of tobacco in Africa, hardly any study to the best of our knowledge has empirically estimated the socio-economic determinants of tobacco use using DHS data. Obtaining an understanding of factors influencing tobacco use will facilitate the development of effective interventions to prevent smoking initiation, as well as to assist established smokers to quit smoking. This study examines factors

associated with tobacco use in Tanzania. This research will help us understand the meanings of smoking for the Tanzanian population as well as the social determinants that influence the uptake of smoking and tobacco use, as well as cessation.

Therefore, this study investigates tobacco use in Tanzania because of high rates of prevalence of consumption. Additionally, Tanzania requires more consideration because it is the second largest producer of tobacco in Africa and more especially and tobacco-induced non-communicable diseases (NCDs) such as cardiovascular diseases, cancer and chronic obstructive pulmonary disease have emerged as major causes of mortality (Kidane *et al.*, 2015). More so, even after the ratification of the WHO Framework Convention on Tobacco Control (FCTC), the relatively weak tobacco control policies and programs in Tanzania provide a potential market for the tobacco industry to exploit. Therefore, this study investigates adult tobacco use in Tanzania because of the high rates of prevalence compared with other Sub-Saharan African countries.

This paper analyzes individual tobacco use and consumption by using Demographic Health Survey (DHS) data (2010) of Tanzania. The objective is to identify and examine the socioeconomic and demographic factors that influence individuals' tobacco use.

II. PREVALENCE OF TOBACCO USE IN MAIN CITIES OF TANZANIA

Tobacco use prevalence is rising in the main cities of Tanzania. It is estimated that more than a third (37%) of all adults (age 15+) use some form of tobacco and almost half of adult men (49%) and a quarter of adult women (25%) currently use tobacco products. Among youth (age 13-15) in Dar es Salaam, 6% currently smoke cigarettes (male 10%; female 2%). It was also estimated that more than 10% of youths in Dar es Salaam and other main cities like Arusha and Kilimanjaro currently use tobacco products other than cigarettes (male 13%; female 7%). Tobacco chewing and pipe smoking are popular among the poor in rural areas especially the tobacco cultivating regions of Tabora and Mara regions (Tanzania Step Survey, 2012).

Unlike in developed countries where cigarette smoking is common, both smoking- and chewing-tobacco are prevalent among tobacco users in many developing countries especially in Tanzania which is the 2nd highest producer of tobacco products after Malawi and Zimbabwe in Africa (Kidane *et al.*, 2015). Smoking cigarettes is a common habit among the general male population in Tanzania especially in urban areas while pipe smoking and chewing tobacco are common habits among the elderly people mostly in rural areas. World Health Organization analyzed the cost of tobacco consumption at the national level is found to be

associated with the increased health-care costs, loss of productivity due to illnesses and early deaths and environmental pollution (WHO, 2011)

Using Tanzanian Step Survey-2012 fact sheet, prevalence of tobacco use in Tanzania can be illustrated as show in Table 1.

Table 1: Prevalence of Tobacco use in Tanzania

Results for adults aged 25 - 64 years	Both sexes	Males	Females
<i>Percentage who smoke tobacco</i>	14.10% (12.4% - 15.8%)	26.00% (23.1% -28.9%)	2.90% (1.7% - 4.0%)
<i>Percentage who smoke tobacco daily</i>	11.80% (10.2% - 13.4%)	22.20% (19.7% - 24.7%)	2.00% (0.7% -3.2%)
<i>Percentage of current tobacco users (smoke and smokeless tobacco)</i>	15.90% (14.0% - 17.9%)	28% (25.1% - 30.9%)	4.50% (3.3% - 5.6%)
<i>For those who smoke tobacco daily</i>			
<i>Average age started smoking (years)</i>	21.9 (21.0 - 22.8)	21.8 (21.1 - 22.5)	22.4 (17.8 - 27.0)
<i>Percentage daily smokers smoking manufactured cigarettes</i>	79.80% (72.6% - 87.0%)	81.20% (74.9% - 87.5%)	64.80% (32.6% - 96.9%)

Source: Tanzania Step Survey – 2012 Fact sheet

Table 2: Prevalence of Tobacco use from three regions in Tanzania

Type	Arusha			Dar es Salaam			Kilimanjaro		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
- Ever smoked cigarettes	7.5%	4.9%	6.2%	12.7%	6.0%	9.2%	16.3%	11.8%	14.1%
- Current users of Cigarettes	2.2%	1.1%	1.7%	4.6%	0.7%	2.6%	3.3%	3.8%	3.6%
- Ever users of any tobacco products	12.4%	8.8%	10.6%	9.7%	5.3%	7.6%	12.5%	9.3%	10.9%
- Current users of other tobacco products	10.8%	8.2%	9.5%	6.2%	4.7%	5.7%	10.4%	6.9%	8.7%

Source: Global Youth Tobacco Survey (Tanzania, 2008)

From the surveys, the following observations are with regards to the three main cities

Arusha - 10.6% of students currently use any form of tobacco; 1.7% currently smoke cigarettes; 9.5% currently use some other form of tobacco.

Dar es Salaam - 9.2% of students currently use any form of tobacco; 2.6% currently smoke cigarettes; 5.7% currently use some other form of tobacco.

Kilimanjaro - 10.9% of students currently use any form of tobacco; 3.6% currently smoke cigarettes; 8.7% currently use some other form of tobacco.

III. METHODOLOGY

a) Data

The study uses data from the DHS which provides reliable and nationally representative data on fertility, family planning, health, and nutrition of populations in developing nations. The survey has been conducted in 79 countries across the world since the mid-1980s. In Tanzania, a couple of the DHS have been

conducted with the most recent being in 2010. The surveys use stratified two-stage cluster designs that oversample low-populated provinces, identify clusters within regions, and choose households randomly within clusters. The surveys thus select nationally representative samples that appropriately include rural as well as urban residents.

For sampled households, one member answers questions about the household in general and provides a list of household residents. Interviews of household representatives were completed for 97–99% of selected households, but response rates were a bit lower for household members. The age ranges of the samples are limited to 15–49 years because the DHS are designed to study fertility, which may bias estimates of tobacco use among all adults. The low end of the age range begins at age 15 years, by which time a small but meaningful percentage of youth has already started smoking whereas, the high end of the range misses older smokers (Mackay *et al.*, 2006).

Table xx: Descriptive Statistics

Variables	Categories/description	Cigarettes	Others
<i>gender</i>	female	83.50	80.23
	male	16.49	19.77
<i>marital status</i>	Married	46.27	9.63
	Widowed / Divorced	7.970	50.15
	Never Married	45.76	40.22
<i>Residence</i>	Urban	53.98	23.54
	Rural	46.02	76.46
<i>sector</i>	Unemployed	19.98	39.20
	Agriculture, manufacturing	44.70	37.90
	Domestic workers and construction	25.10	17.52
	Public sector, health care, education	10.14	5.380
<i>wealth</i>	poorest	17.47	33.37
	poor	31.22	29.35
	middle	24.84	20.69
	Rich	18.43	12.39
	Richest	8.040	4.370
<i>insurance</i>	percentage coverage	20.01	16.85
<i>education</i>	No education or less than primary	38.36	40.3
	Primary education	27.37	31.73
	Secondary and higher	34.27	27.97
<i>age (mean)</i>	mean age of respondents in years	34.0	37.2

In terms of gender, we see about typical distribution of 88.33% females among the cigarette smokers and 80.23% among other tobacco users respectively, while men tend to be under-represented in the sample. Cigarette smokers are better educated than other users. The data shows that mostly the poorest and poor respondent have a high proportion of tobacco use. Meanwhile, cigarette smokers are relatively more covered by insurance, other tobacco users are less covered. This may be due to the fact that most respondents using other forms of tobacco are mostly residing in the rural areas (76.46%). In terms of marital status, mostly the married and never married are cigarette smokers while other forms of tobacco use is mostly among the divorced/widowed and never married. The mean age of respondents (34 years and 37.2 years for cigarette smokers and other users respectively) show that tobacco users are mature and should be able to make rational decisions about their tobacco use or consumption.

b) Model Specification

In this section, two models will be specified.

The first model examines the determinants of tobacco use taking into consideration the place of residence. The probability of using tobacco is a function of social and economic variables, and a multinomial logit framework is utilized in exploring the effects of these variables on smoking prevalence. The dependent variable, smoking prevalence, has three classes: 0 = non-smokers, 1 = cigarette smokers and 2 = pipe smokers, snuff and chewing tobacco i.e., the estimates give the probability of cigarette smokers and pipe smokers, snuff and chewing tobacco relative to the reference state of non smokers. The standard errors are corrected for repeated observations on the same persons. This approach will present odds ratios for belonging to the two tobacco smoking categories (cigarettes and pipe/other) relative to the baseline category of non-smokers.

A Multinomial Logit Model (MNL) which simultaneously estimates binary logits for all possible comparisons among the outcome categories is well

suited to examine such multiple outcomes (Long, 1996). Each nominal outcome is specified as a nonlinear function of the independent variables. The MNLM is formally stated as follows:

Let y be a dependent variable with J nominal outcomes. The J categories are numbered $1, \dots, J$ but

$$\ln \Omega_{m/X}(X) = \ln \frac{\Pr(y = m/X)}{\Pr(y = b/X)} = X \beta_{m/b} \text{ for } m = 1, \dots, J \quad (1)$$

Where b is the base or reference category, also referred to as the comparison group. These J

are not ordered in any way. Let $\Pr(y_i = m/X_i)$ be the probability of observing outcome m for individual i given X , the set explanatory variables. As a probability model, the MNLM is written as:

$$\Pr(y = m/X) = \frac{\exp(X \beta_{m/b})}{\sum_{j=1}^J \exp(X \beta_{j/b})} \quad (2)$$

The tobacco smoking questions consider only current behavior, and the surveys contain no information on age of adoption, former smoking, or age of cessation. For the analysis of multinomial logit, the dependent variable (y) has 3 outcome categories (J) namely: no tobacco use (base category- b), smoking cigarettes (excluding those who use both cigarettes and

other tobacco), and using other forms of tobacco (pipe smoking, snuff and chewing tobacco).

In addition to the multinomial logit model, we also use a logit model to investigate determinant of the decision to smoke among current smokers (number of cigarettes in the last 24 hours). It means that we use the standard logit model to estimate the probability of smoking among current smokers in Tanzania.

$$p(y = 2/x) = \frac{e^{x\beta}}{1 + e^{x\beta}} \quad (3)$$

where x are the economic and demographic variables as explained below:

c) Factors influencing tobacco use

The surveys ask respondents four questions, each with yes or no responses available, on whether they smoke cigarettes, pipes, other tobacco, or nothing. Respondents using a mix of non-smoking tobacco use with cigarette smoking are identified and dropped from the analysis.

The analyses examine the association of tobacco use with the following economic and demographic variables. Age in single years ranges from 15–49 years for women and 15–54 years for men. All other variables are treated as dummy variables. Urban residence equals one for those living in cities and zero otherwise. Education has four categories: (1) no school (reference category), (2) completed primary school, (3) completed secondary school, and (4) post-secondary schooling. Employment status include: (1) employed and zero other. Occupation includes: (1) not working (reference category), (2) agricultural self-employed workers and employees, (3) household, domestic, service, and skilled or unskilled manual workers, and (4) professionals, technicians, managers, and clerical and sales workers. Analysis will be based on male and females since DHS data is normally divided into male and female datasets.

Although the choice of these variables are informed by the literature (John *et al.*, 2012; Palipudi *et al.*, 2012; Hosseinpoor *et al.*, 2011), it was simultaneously constrained by the information available in the Tanzanian DHS dataset. All the variables, except age, are categorical. Although price is an important variable in the estimation of determinants of tobacco and cigarette use (Jha and Chaloupka, 2000), was not included in the regression because the price paid for tobacco was not collected by the survey and the cross-sectional nature of data limited variation in tobacco prices across time. Religion and ethnicity are not included in the Tanzanian DHS according to the constitution of the United Republic of Tanzania. Therefore, these two variables are not being included in our analysis.

IV. ESTIMATION RESULTS (MORE INTERPRETATION)

Table 3 presents the multinomial logit regression and logit regression for both male and female individuals. Since the coefficients of these regressions do not have clear economic meaning, the marginal effects of the explanatory variables are computed. The marginal effect is equal to the partial derivative of response probabilities with respect to the explanatory variables, calculated at the mean value of the explanatory variables.

The results show that the probability of smoking first increases and then decreases when the age increases for both males and females. These findings are consistent with Laxminarayan and Deolalikar (2004) and Cuong (2012).

People with no education and primary education are more likely to smoke than people with secondary and post secondary education. Similar to other results, people with the high of education are more likely to reduce smoking prevalence rate. Individuals belonging to the poorest and poor income groups are more likely to smoke than people in the rich group, in respective of the gender. This result stipulates that increase in income can lead to a reduction in smoking. These findings are similar to those of several studies such as Townsend *et al.*, (1994), Evans *et al.*, (1996), Laxminarayan and Deolalikar (2004) and Cuong (2012).

People who have never married are mostly likely to increase smoking prevalence for males. The effect is most likely to reduce for females even though it is not significant. Married people are less likely to smoke. This shows that the effect of marriage is positive and statistically significant on reducing the smoking intensity rates among Tanzanians.

The results show that being a domestic unskilled female worker increases the probability of smoking as compared to male domestic unskilled workers which is not statistically significant.

Household size does not have a significant effect on the smoking status for all the models. However, the negative sign on the coefficients shows that individuals living in a household with a larger proportion of members are less likely to smoke.

Table 3: Multinomial Logit and Logit regression for Tobacco use in Tanzania (2010)

Variable	Male			Female		
	Multinomial logit Cigarette	Others	Logit Smoking	Multinomial logit Cigarette	Others	Logit Smoking
<i>Age</i>	0.349*** (0.539)	0.5101*** (0.193)	0.339** (0.052)	0.0138** (0.008)	0.473** (0.139)	0.161*** (0.056)
<i>Agesq</i>	-0.004*** (0.001)	-0.0067** (0.003)	-0.004 (0.001)	-0.0001 (0.000)	-0.003 (0.002)	-0.001 (0.001)
<i>Urban</i>	0.4719** (0.179)	-0.7986 (0.557)	0.427 (0.176)	-0.005 (0.006)	-0.502 (0.054)	-0.276 (0.184)
<i>Rural</i>	Omitted					
<i>Noeduc</i>	0.4927** (0.237)	14.929*** (0.527)	0.564** (0.230)	0.262* (0.016)	2.36*** (0.002)	-1.873*** (0.724)
<i>Primary</i>	0.5078*** (0.168)	14.381*** (0.373)	0.549*** (0.166)	0.0678 (0.019)	0.024** (0.004)	-2.42*** (0.722)
<i>Sec_high</i>	Omitted					
<i>Hhsiz</i>	-0.043* (0.017)	-0.031 (0.040)	-0.039* (0.017)	-0.058 (0.006)	0.028 (0.019)	0.015 (0.013)
<i>Poorest</i>	0.9692*** (0.259)	1.302* (0.782)	1.077*** (0.251)	0.8807** (0.105)	1.1555*** (0.074)	1.908*** (0.288)
<i>Poor</i>	0.7465** (0.248)	0.7649 (0.805)	0.793*** (0.241)	0.655** (0.104)	0.532** (0.099)	1.714** (0.293)
<i>Middle</i>	0.4203* (0.244)	0.2426 (0.810)	0.431* (0.239)	0.984 (0.111)	0.609 (0.162)	1.104*** (0.291)
<i>Rich</i>	0.198 (0.213)	0.044 (0.723)	0.185 (0.208)	-0.583 (0.118)	0.269 (0.077)	0.192 (0.297)
<i>Richest</i>	Omitted					
<i>Insurance</i>	0.144 (0.256)	-14.073*** (0.280)	0.103 (0.257)	-0.233 (0.145)	-0.0207 (0.127)	-0.268 (0.286)
<i>Never_married</i>	0.864*** (0.255)	0.836* (0.868)	0.855*** (0.251)	0.056 (0.015)	-0.036 (0.021)	-0.581 (0.593)
<i>Married</i>	-1.274*** (0.199)	-1.129* (0.578)	-1.255*** (0.198)	-0.064** (0.017)	-0.019*** (0.022)	0.051 (0.110)
<i>Divorced/widow</i>	Omitted					
<i>Unemployed</i>	-0.516	0.328	-0.692	0.523**	0.325*	0.445*

	(0.935)	(0.886)	(0.865)	(0.142)	(0.021)	(0.453)
<i>Agriculture</i>	-0.018	-0.399	-0.005	0.556*	0.155	0.387
	(0.182)	(0.684)	(0.178)	(0.099)	(0.074)	(0.395)
<i>Domestic/unskilled</i>	0.225	-1.26	0.185	0.609***	0.984***	0.798*
	(0.202)	(0.120)	(0.201)	(0.162)	(0.111)	(0.400)
<i>Skilled/service</i>	Omitted					
<i>Constant</i>	-8.378***	-26.794***	-7.935***	-6.713**	9.003**	-7.308***
	(1.343)	(3.099)	(1.259)	(0.799)	(2.501)	(1.181)
<i>Pseudo-Rsquared</i>	0.1537		0.1602	0.1472		0.159
<i>Observation</i>	2524		2527	12779		12779

Note: ***, **, * represents significance level at 1%, 5% and 10% respectively.

Table 4: Probability table for logit regression model

Male			Female		
Probability	Frequency	Percent	Probability	Frequency	Percent
0.05	535	21.17	0.05	10924.77	85.49
0.1	277	10.96	0.1	1536.03	12.02
0.15	277	10.96	0.15	283.69	2.22
0.2	286	11.32	0.2	20.45	0.16
0.25	280	11.08	0.25	8.95	0.07
0.3	281	11.12	0.3	3.83	0.03
0.35	185	7.32	-	-	-
0.4	150	5.94	-	-	-
0.45	115	4.55	-	-	-
0.5	56	2.22	-	-	-
0.6	34	1.35	-	-	-
0.7	27	1.07	-	-	-
0.8	22	0.87	-	-	-
0.9	2	0.08	-	-	-
Total	2527	100	Total	12779	100
Mean	0.1982			0.0244	

Source: Author's Calculation

Table 4 shows that the probability decreases substantially with the increase intensity of tobacco use in Tanzania. As for males, 535 out of 2527 have 0.05 probability of using Tobacco while for females, 10924 out of 12779 have a 0.05 probability of using tobacco in Tanzania. The mean values show that if a male individual is chosen at random, there will be a 19.82 percent that he a tobacco user, whereas for females the percentage is relatively low at 2.44.

V. CONCLUSION

Tanzania is a developing country with a high prevalence of tobacco use with respect to other SSA countries. In the recent years young people as well as adults have been highly involved in tobacco consumption. This might be attributed to the fact that Tanzania is one of the highest producer and exporter of tobacco in Africa (second after Malawi). Even though Tanzania ratified the WHO Framework Convention on Tobacco Control (FCTC) like many SSA countries, the

government does not have strong legal framework to reduce tobacco use. Smoking is still allowed in public areas. People can smoke almost everywhere. This increases the harms of the second-hand smoke on health.

Understanding the factors affecting smoking is helpful for policies on tobacco reduction in Tanzania. This paper examines how socio-economic characteristics can affect individual tobacco use using 2010 DHS data. Using the multinomial model and logit model, the paper finds age, no education, primary education; poorest and poor individuals are the most crucial determinants of tobacco use for both male and female individuals where as unemployment and working in the domestic or unskilled labour are also crucial determinants of tobacco use for female individuals. Household size, age squared and being married are negatively correlated with tobacco use. Therefore, being married reduces the probability of smoking significantly. The finding on household size is interesting but further

in-depth studies would be needed to find out how household composition can affect tobacco use decisions of household members.

VI. LIMITATIONS

The age truncation used in the DHS data (15-49 years) limited the ability to provide an overall picture of adult tobacco use in Tanzania. Even though the choice of the explanatory variables for the study was informed by the existing literature, it was simultaneously constrained by information available in the DHS dataset and analyses were based on the structure of the data. One of the variables of importance (religion) was not included in the analysis to better inform policies because it is a sensitive issue and consequently not included in the survey. This study was cross-sectional in nature, which limited the ability to make any causal inferences. Nevertheless, the study provided a comprehensive investigation into tobacco use in Tanzania that could assist the government, public health community and policy makers to target their efforts to reduce the high level of tobacco use and consequently reducing the effects of second-hand smoking.

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