



Institute of Policy Analysis  
and Research - Rwanda



THE AFRICAN CAPACITY  
BUILDING FOUNDATION

# **DETERMINANTS OF CIGARETTE SMOKING AND SMOKING INTENSITY AMONG MALE ADULTS IN RWANDA**

Final Report, 2022



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# LIST OF ACRONYMS

- 12YBE:** 12 Year Basic Education
- ACBF:** African Capacity Building Foundation
- ACS:** American Cancer Society
- DHS:** Demographic and Health Surveys
- EAC:** East African Community
- EAs:** Enumeration Areas
- FCTC:** Framework Convention on Tobacco Control
- FDA:** Food and Drugs Authority
- GDP:** Gross Domestic Product
- GoR:** Government of Rwanda
- IPAR-Rwanda:** Institute of Policy Analysis and Research – Rwanda
- KII:** Key informant interview
- LMICs:** Low and Middle-Income Countries
- MINAGRI:** Ministry of Agriculture and Animal Resources
- MINECOFIN:** Ministry of Finance and Economic Planning
- MINIJUST:** Ministry of Justice
- MoH:** Ministry of Health
- NCI:** National Cancer Institute
- NISR:** National Institute of Statistics of Rwanda
- NST1:** National Strategy for Transformation
- RBC:** Rwanda Biomedical Center
- RDB:** Rwanda Development Board
- RDHS:** Rwanda Demographic and Health Surveys
- RRA:** Rwanda Revenue Authority
- Rwf:** Rwandan francs
- SSA:** Sub-Saharan Africa
- TV:** Television
- USA:** United States of America
- USD:** United States Dollar
- VAT:** Value Added Tax
- WHO:** World Health Organization

# EXECUTIVE SUMMARY

## 1. INTRODUCTION

While deaths resulting from tobacco use are preventable. However, smoking kills over 8 million people per year across the world. Over 7 million of these deaths result directly from tobacco use, while second-hand smoke causes around 1.2 million deaths (WHO, 2019). Tobacco smoking causes several diseases including diverse cancers (e.g., lung cancer, bladder cancer, pancreatic cancer), respiratory diseases, cardiovascular diseases, low birth weight, and poses other serious burdens to individuals and health systems (Ozoh et al., 2016; WHO, 2019; ACS, 2020). Therefore, these smoking-related diseases have high economic costs. For example, the United States spends over \$300 billion to deal with smoking-related diseases every year (CDC, 2020).

Progress has been made in protecting communities from tobacco use and its harmful effects. Some measures include, for example, raising taxes on tobacco, enforcing bans on tobacco advertising and protecting people from tobacco smoke, among others (WHO, 2003<sup>1</sup> & 2019). Although, these measures have contributed to a decrease in the number of male smokers in developed countries, the number of tobacco smokers is still increasing in developing countries. This is mainly because more than 80% of the world's 1.3 billion tobacco smokers are in Low and Middle-Income Countries (LMCs) (WHO, 2020). Thus, the majority of smokers are in poor households living in LMCs and smoking deepens poverty levels as households divert the resources allocated to basic needs such as food and shelter to tobacco (WHO, 2020). The factors contributing to the rising number of smokers in the Sub-Saharan African (SSA) countries include adoption of the western lifestyle, weak tobacco control measures, market penetration of transnational tobacco companies and policies, among many others (Yach & Bettcher, 2000; Weeks, 2001; WHO, 2011).

In Rwanda, the prevalence of tobacco use (smoking) is respectively 7% and less than 1% for men and women aged between 15 and 49 years (NISR, 2021). Research shows that the smoking habit has declined over time. For example, the National Institute of Statistics of Rwanda (NISR) reports that the smoking

rate among males and females aged 15-59 has respectively decreased from 12% to 7% and from 2% to 0.9% between 2014-15 and 2019-20 (NISR, 2021). This reduction in smoking is attributed to the implementation of the tobacco control law<sup>2</sup> as well as the World Health Organization Framework Convention on Tobacco Control (WHO FCTC). More precisely, the tobacco control law prohibits selling tobacco to youths under 18 years, smoking in public places and packing as well as labelling, among others (GoR, 2013). Generally, any level of tobacco smoking/use poses a big problem to public health because smoking affects nonsmokers through secondhand smoke due to its negative externalities (Nketiah-Amponsah et al., 2018). The current study has two main drivers. : First, previous studies in Rwanda have mostly focused on factors driving smoking among youth aged between 15 to 34 years (Habiyaremye et al., 2019). However, the recent Rwanda Demographic and Health Survey (RDHS) indicates that 43.4% of cigarettes smokers in Rwanda are aged between 35 and 49 while 18.2% are young people (NISR, 2021). The latter survey suggests that a large number of smokers in Rwanda are adults rather than the youth. Second, the adverse health effects of tobacco use become more severe at the old age than in other age groups (Nketiah-Amponsah et al., 2018). However, not much is known about the determinants of cigarette smoking and its intensity among male adults in Rwanda. In this regard, we conducted this study to investigate the determinants of cigarette smoking and its intensity among male adults<sup>3</sup> in Rwanda using a mixture of both quantitative and qualitative methods to fill this gap in the literature and inform the policymaking process. This empirical evidence also provides insight into the determinants of smoking, and thereby informs public policy in controlling smoking among male adults.

## 2. RESEARCH METHODS

The study uses the latest data available on Rwanda from the Rwanda Demographic and Health Surveys (RDHS) 2019-2020. The NISR implemented the RDHS 2019-2020 survey, and the data was abstracted from the Demographic and Health Surveys (DHS) database. In addition, a questionnaire, which included questions on tobacco use, was administered to about

1 The Framework Convention on Tobacco Control (FCTC) approved by WHO approved in 2003

2 The tobacco control law N°08/2013 was published in the Official Gazette n°14bis of 08/04/2013 (GoR, 2013)

3 This is because the number females smoking or using tobacco products is relatively small, only less than one percent.

6,513 men and 14,634 women. Finally, we conducted 4 key informant interviews with representatives of key stakeholders involved in tobacco control (RBC, Butaro Hospital, RRA and FDA) in order to gain further insights into what stimulates adults to smoke. For quantitative data analysis, we used descriptive statistics and regressions such as logit and negative binomial models.

### 3. FINDINGS

The study found that being in a lower wealth category/income, old age, low level education, being Muslims and living in the Kigali City are the key determinants of cigarette smoking among male adults in Rwanda. Also, using media and being Christian were found to be significant factors in explaining smoking behaviour in Rwanda. Furthermore, the smokers who reside in the Eastern province and in the City of Kigali as well as smokers in the higher wealth category are reported to smoke greater quantities of cigarettes. The sampled male smokers smoke about 5 sticks of cigarettes daily on average. Qualitative data analysis also led to similar findings: having a low or no education level, middle education level (mainly casual workers), old age, social cultural and historical background, peer groups and tobacco industry attraction and dependency are the key factors leading adult male Rwandans to smoke.

### 4. RECOMMENDATIONS

Based on the findings from the study, we recommend the following measures:

**Increasing public awareness and education on smoking risks through media:** this study proved that media (mainly radio) plays a vital role in discouraging the smoking behaviour among male adults in Rwanda. Thus, the government and key stakeholders could use media to publicize relevant information on the health risks of smoking to the community.

**Removing structural barriers affecting the 12 Year Basic Education (12YBE):** the findings from the study revealed that most male adults smokers spent only one year in school compared to nine years spent by the non-smokers in school. The findings also indicate that the smoking behaviour only starts declining after 4 years of schooling. Therefore, removing structural barriers which prevent people from attending and completing the 12 year basic education (12YBE) which, however, is offered free of charge in public schools, and compulsory for all children. This will help to reduce smoking among Rwandan male adults

in the near future. To achieve this, the government should tackle the issues that increase the cost of education such as non tuition related expenditure including higher transportation and food costs. These have been identified as major obstacles to entering secondary school (see Laterite, 2019).

**Improving income of poor households:** The study indicates that male adults in the lower wealth category have a higher probability of smoking. The reasons are that adults in the high income group are aware of harmful effect of tobacco smoking and it is easier for them to quit smoking than their counterparts in the lower income group. Therefore, government poverty eradication policies that raise poor households' income will also help to control tobacco smoking.

**Avail Designated Smoking Areas (DSA) in cheap bars and their surroundings:** The findings show that very few places, including big and decent hotels and restaurants, have smoking areas. Therefore, the government and its stakeholders should put more efforts to encourage the setting up of designated smoking areas in places where many people are gathered such as cheap bars in the neighborhoods to protect people from health risks associated with second-hand smoking.

**Increase tobacco taxes and set fixed tobacco prices:** The qualitative interviews indicate that there is no fixed price for both stick and the whole package for all sellers at the market. The tobacco price varies from one seller to another and from small shops to big supermarkets. There is also a need to increase taxes on tobacco in order to discourage smoking. Indeed, taxes on tobacco are 36% of the retail price plus specific excise of 130 Rwf per pack of 20 sticks; this is below the 75% minimum tax share of the retail price of tobacco recommended by the World Health Organization (WHO). Thus, increasing tobacco taxes and setting specific tobacco prices on both stick and the whole package could discourage people from smoking.

**Promote and enhance research on tobacco control:** The key informant interviews points to the need to promote and enhance research on tobacco control that involve key actors such as cancerology departments. This is because these actors address many tobacco related issues that exist. The research also should focus on the types of tobacco products and their respective impacts. In this regards, the government, in collaboration with key stakeholders in tobacco control should encourage more research to provide evidence on effective tobacco control

# 1. BACKGROUND

interventions and their implementation.

## 1.1. INTRODUCTION

While deaths resulting from tobacco use are preventable, smoking kills many people across the world. More specifically, smoking (tobacco use) accounts for over 8 million deaths per year globally. Over 7 million of these result directly from tobacco use, while second-hand smoke causes around 1.2 million deaths (WHO, 2019). Tobacco use/smoking is a trigger of several diseases including diverse cancers (e.g., lung cancer, bladder cancer, pancreatic cancer), respiratory diseases, cardiovascular diseases and low birth weight, and poses other serious burdens to individuals and health systems (Ozoh et al., 2016 WHO, 2019; ACS, 2020). Therefore, these smoking-related diseases have high economic costs. For example, the United States spends over \$300 billion to deal with smoking-related diseases every year (CDC, 2020).

Nevertheless, progress has been made to reduce tobacco use in communities. These include raising taxes on tobacco, enforcing bans on tobacco advertising and protecting people from tobacco smoke, among others (WHO, 2019). The outcomes of these measures were positive, as the number of male smokers has decreased. Despite the significant decrease in tobacco use in developed countries, however, the number of smokers is still increasing in developing countries. Indeed, more than 80% of the world's 1.3 billion tobacco smokers are in Low and Middle-Income Countries (LMCs) (WHO, 2020). Thus, the majority of smokers are in poor households living in LMCs. Furthermore, smoking deepens poverty levels as households divert the resources allocated to basic needs such as food and shelter to tobacco (WHO, 2020). Factors contributing to the rising number of smoking in Sub Sahara African countries include the adoption of the western lifestyle, weak tobacco control measures, market penetration of transnational tobacco companies and weak policies among many others (Yach & Bettcher, 2000; Weeks, 2001; WHO, 2011).

In the 1990s, there were about one billion smokers around the world and about 47% and 12% were adult men and women respectively (Begg et al.,

2007). While the majority of smokers in developed countries are youth, the majority of smokers in developing countries are adults who are vulnerable to the adverse health effects of tobacco use (Ozoh and Opoola, 2016). This means that the impact of smoking is greater in developing countries. To reduce the harmful health effects related to smoking, the WHO approved the Framework Convention on Tobacco Control (FCTC) in 2003 (WHO, 2003). Several countries, including Rwanda, have signed and adopted some smoking control legal instruments.

In Rwanda, the prevalence of tobacco use/smoking is respectively 7% and less than 1% for men and women aged between 15 to 49 years (NISR, 2021). The smoking habit has declined over time. As reported by the NISR, the smoking rate among persons aged 15 to 49 has decreased from 12% in 2014-15 to 7% in 2019-20 (NISR, 2021). This reduction in smoking may be attributed to the tobacco control measures such as tobacco taxations and implementation of the tobacco control law as well as the WHO FCTC. Regarding tobacco taxation, the government of Rwanda (GoR) initiated a mixed tax regime on tobacco since 2015; this tax regime is ad-valorem and specific excise, and this reduced tobacco consumption by 17.4% (RRA, 2017). Specifically, taxes on tobacco are 36% of the retail price plus specific excise of 20 Rwf (0.02015 USD) per pack of 20 sticks<sup>4</sup>. This has increased government revenue from 5.2 billion Rwandan francs (6,200,350.25 USD) in 2015 to 7.6 billion Rwandan francs (9,062,053.6 USD) in 2016 (RRA, 2017). However, this tax rate is still below the 75% which is the minimum tax share of the retail price of tobacco recommended by the WHO.

Concerning the tobacco control regulations, the tobacco control law N°08/2013 was published in the Official Gazette n°14bis of 08/04/2013 (GoR, 2013). This law is about the prohibition of selling tobacco to the youth under 18 years, smoking in public places and packing as well as labelling, among others (GoR, 2013). Generally, any level of tobacco smoking/use poses a big problem to public health because smoking affects secondhand smokers due to its negative externalities (Nketiah-Amponsah et al., 2018). It is against this background that this study has been conducted to investigate the determinants of cigarette smoking and cigarette smoking intensity

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<sup>4</sup> The current taxes on tobacco are 36% of the retail price plus specific excise of 20 Rwf (0.02015 USD) per pack of 20 sticks.



among male adults<sup>5</sup> in Rwanda. This is because the females who smoke or use tobacco products are relatively few, less than one percent. Further, the study focuses on cigarette smoking and its intensity due to the fact that very few people (less than 0.5% of smokers aged 18-59) use other types of tobacco smoking like pipe and data on smokes pipe are not accounted for in the RHDS.

A number of empirical studies on determinants of smoking have been conducted and findings vary across countries, age ranges and years. For example, Cuong (2012) found that gender, age, education, employment and marital status are the determinants of smoking in Vietnam. Similarly, Palipudi et al. (2012) China, Egypt, India, Mexico, Philippines, Poland, Russian Federation, Thailand, Turkey, Ukraine, Uruguay, and Viet Nam. These surveys provided information on 209,027 respondent's aged 15 years and above and the country datasets were analyzed individually for estimating current tobacco use across various socio-demographic factors (gender, age, place of residence, education, wealth index, and knowledge on harmful effects of smoking found that education and income are the main determinants of smoking in 13 low and middle-income countries. Other studies on determinants of smoking have focused on the age ranges such as youth versus adults. Regarding the determinants of smoking among youth, Al-Kubaisy et al. (2012) studied the factors associated with the smoking behaviour among University students in Syria and found that smoking was significantly higher among students staying away from their families. O'Loughlin et al. (2014) 293 students recruited in 1999-2000 from all grade 7 classes in a convenience sample of 10 high schools in Montreal, Canada. Participants were 12.7 years of age on average at cohort inception and 24.0 years of age in cycle 22. Independent predictors of smoking initiation in young adulthood (post-high school reported that alcohol use, impulsivity, and poor academic performance are the main predictors of smoking among Canadian young adults. A study in Ethiopia indicated that being above 18 years old, having a friend who smokes, illicit drug use and alcohol consumption are the key factors determining cigarette smoking among adolescents (Duko et al., 2019). In Rwanda, Habiyaemye et al. (2019) found that being male, aged 25 years and above, having some income, and residing in the Eastern and Southern Provinces and the City of Kigali

<sup>5</sup> The United Nations Convention on the Rights of the Child defines a child as a person below the age of 18 (UN, 1990). Similarly, in Rwanda, an adult is legally referred to as a person aged 18 years and above since a child is anybody aged below 18 years (MINIJUST, 2001).

were associated with smoking among the Rwandan youth aged between 15 and 34 years.

Further, some other studies have focused on determinants of smoking among adults. Ozoh and Opoola (2016) found that being a male who does not take alcohol regularly is associated with cigarette smoking among adults (25-64 years old) in Nigeria. Conversely, Nicolaou et al. (2016) we investigate the prevalence and socioeconomic factors that contribute to smoking disparities in Greek Cypriot adults. Material and methods: In 2009, using the Countrywide Integrated Noncommunicable Disease Intervention questionnaire a representative sample of Greek Cypriot adults was surveyed (response rate 100% reported that staying in urban and being an employed woman are determinants of smoking among adults the Greek Cypriot population. In Ghana, Nketiah-Amponsah et al. (2018) found that being a poor and man with a low level education, and region are determinants of cigarette smoking among Ghanaian adults men. In short, empirical literature that was reviewed indicate that there is a variation in the results of determinants of smoking behaviour among smokers.

The current study was conducted because of two main reasons: first the previous studies in Rwanda have mostly focused on factors driving smoking among the youth aged between 15 and 34 years (Habiyaemye et al., 2019). This study places more emphasis on the youth while DHS descriptive statistics indicate that 43.4% of cigarettes smokers are aged between 35 and 49 compared to 18.2% of the youth (NISR, 2021). These findings indicate that a large number of smokers in Rwanda are adults rather than the youth and, therefore, studying the determinants of tobacco smoking among adults is very important for policy making. The empirical evidence from this study provides insights into the drivers of smoking to inform public policy in controlling smoking among adults. Second, the adverse health effects of tobacco use become more severe at the old age than in other age groups (Nketiah-Amponsah et al., 2018). This suggests that more emphasis should be laid on adult smokers and help them to quit smoking. This study empirically investigated the determinants of cigarette smoking and smoking intensity among male adults drawing from the latest data available from the Rwanda Demographic and Health Survey (RDHS)



conducted between 2019 and 2020.

## 1.2. RESEARCH QUESTIONS

1. What are the determinants of cigarette smoking and smoking intensity among male adults (18-59) in Rwanda?
2. What should policy and decision-makers do about these?

## 1.3. OBJECTIVES

This study aims at investigating the determinants of cigarette smoking and smoking intensity among male adults in Rwanda. More specifically, the study seeks to:

1. Investigate the determinants of cigarette smoking among male adults in Rwanda,
2. Assess the determinants of smoking intensity among male adults in Rwanda, and
3. Suggest policy implications and recommendations.

## 2. METHODOLOGY

The study is structured as follows: the first section introduces the study; the second section presents the study methodology; the third section provides a discussion of the results of both descriptive statistics and regression analysis; section four discusses the qualitative findings and section five concludes the study and provides policy implications and recommendations.

### 2.1. DATA AND VARIABLES

The study uses the latest data available on Rwanda from the Rwanda Demographic and Health Surveys (RDHS) 2019-2020. The National Institute of Statistics of Rwanda (NISR) implemented the RDHS 2019-2020 Survey between November 2019 and July 2020. This was the sixth RDHS conducted after the previous five conducted in 1992, 2000, 2005, 2010 and 2014-15 (NISR, 2021). The 2019-2020 RDHS was a nationally representative survey of key demographic and health including aspects such as fertility, use of family planning methods, breastfeeding practices, nutritional status of women and children, maternal and child health, adult and childhood mortality, women's empowerment, domestic violence, awareness and behaviour regarding HIV/AIDS and other sexually transmitted infections (STIs), and other health-related issues such as smoking. The RDHS survey employed a two-stage sampling technique. The first stage involved a random selection of Enumeration Areas (EAs) from sample points (stratum) while the second stage entailed a systematic sampling of households. Given that samples are not proportionally allocated to various provinces and their respective districts as well as possible differences in the response rate, the RDHS 2019-2021 was weighted to make sure that the survey results are representative at the national level (NISR, 2021).

About 12,949 households were interviewed. Also, 14,634 eligible women aged 15-49, and 6,513 men aged 15-59 were interviewed. The 2019-2021 RDHS survey included indicators on tobacco use among the surveyed population (men and women). These produced response rates of about 99 % for households and 99% for both men and women in the sample (NISR, 2021). The study employed data for men and women questionnaires; the total men and women interviewed are about 6,513 and 14,634 respectively.

The tobacco products in which were the focus of this study include both manufactured and hand-rolled cigarettes as the most used tobacco products in Rwanda. Generally, this study looked at the same questions asked on cigarette smoking and smoking intensity in the RDHS as well as socioeconomic and demographic variables. More specifically, the questions on tobacco use include the following: (i) do you currently smoke cigarettes? (ii) in the last 24 hours, how many cigarettes did you smoke? The dependent variables are cigarette smoking status and the number of cigarette sticks smoked in the last 24 hours while explanatory variables include age, educational attainment, employment status, religious affiliation, area of residence, use of radio and use of Television (TV), among others. The selection of these variables follows previous studies such as those conducted by Nguyen (2012), Blazer and Wu (2012), Blazer and Wu (2012), Khanal et al. (2013), Widome et al., (2015) and Nketiah-Amponsah et al., (2018). The description and measurement of variables are provided in **Table 1**.

### 2.2. DESCRIPTION AND MEASUREMENT OF VARIABLES

#### *Outcome variables*

The RDHS 2019-2020 collected data on cigarette smoking and the number of cigarettes smoked by respondent in the previous 24 hours was captured. About Cigarette smoking practices among adults in Rwanda, the survey asked male respondents if they smoke a cigarette or not. Since data on cigarette smoking were not included in the published RDHS, frequency currently smokes tobacco, a categorical variables (do not smoke, every day and some days), was used to proxy smoking status. This categorical variable was coded into a binary variable to form the first dependent variable, the smoking status, which was employed to investigate socioeconomic and demographic factors behind cigarette smoking amongst male adults in the sample. Regarding smoking intensity, one more question about the number of cigarettes smoked in the previous 24 hours was added for the survey respondents who smoked. Because the data on the number of cigarette smoked in the previous 24 hours are not included in the RDHS published data, we used data on the average respondent's daily manufactured and hand-rolled

cigarette smoking. These responses were used to form the dependent variable for smoking intensity, which is a continuous variable used to analyse the contributing factors of smoking intensity among male adults in Rwanda.

### **Predictor variables**

In addition to the outcome variables, the key socioeconomic and demographic features including

age, educational attainment, the health insurance status, the employment status, the religious affiliation, the region of residence, and the frequency of radio use, and TV availability in the dataset were used as predictor variables. Age is the continuous variable in the RHDS dataset and it was put under age categories and converted to binary. The use of radio and television are binaries in the RHDS dataset and remained the same in this study. Also, wealth, region

and religion are categorical variables in the RHDS dataset and they were transformed into binary variables in this study. The description and the measurement of the selected outcome and predictor variables are provided in Table 1 below.

**Table 1: Description and measurement of Variables**

Variables	Description	Measurement
<b>Outcome Variables</b>		
Smokes	Smoking status	1 = smokes cigarette, otherwise = 0
Smoking intensity	Smoking frequency	Number of cigarette sticks smoked in the previous 24h
<b>Predictor Variables</b>		
18-32	Age category	1 = 18–32 years; otherwise = 0
33-47	Age category	1 = 33–47 years; otherwise = 0
48-59	Age category	1 = 48–59 years; otherwise = 0
Education	Years of education	Number of years spent in school
Old*educated	Age and education interacted	1 if years of education is greater than 0 and 44 years < age < 60 years, otherwise 0
Use of radio	Utilization of radio	1 = sometimes, 0 = never
Use of TV	Utilization of television	1 = sometimes, 0 = never
Lower	Wealth category	1 = lower wealth category, otherwise = 0
Middle	Wealth category	1 = average wealth category, otherwise = 0
Higher	Wealth category	1 = higher wealth category, otherwise = 0
Christianity	Religious affiliation	1 = Christianity, otherwise = 0
Muslim	Religious affiliation	1 = Islam, otherwise = 0
Other religion	Religious affiliation	1 = other religions aside from Christianity and Islam, otherwise = 0
Kigali City	Region of residence	1 = Kigali City, otherwise = 0
North province	Region of residence	1 = North province, otherwise = 0
South province	Region of residence	1 = South province, otherwise = 0
Eastern province	Region of residence	1 = Eastern province, otherwise = 0
Western province	Region of residence	1 = Eastern province, otherwise = 0

## 2.3. THE QUANTITATIVE APPROACH

To achieve the objective of the study, a negative binomial-logit hurdle model, for details on a count model (see Mullahy 1986 and Min & Agresti, 2005), were estimated to determine the socioeconomic and demographic features connected with cigarette smoking and smoking intensity among male adults in Rwanda. As stated by Min & Agresti (2005), the hurdle model stands for a two part model employed in modelling count data. In addition, Mullahy (1986) and Min & Agresti (2005) mentioned that the hurdle model has a two-stage modelling process. These include the first stage, a binary model and the second stage, a truncated model. In the application

of the hurdle model in this study a logit model was estimated in the first stage in order to achieve the first objective, because people make a binary decision which is either smoke or not. In the second stage, a negative binomial model which fits the modelling of the overdispersed count data was estimated in order to achieve the second objective because it allows, conditional to smoking, smokers make a decision on the number of cigarettes sticks to smoke. The motivation for using the negative binomial model is that the assumption of equi-dispersion (equality in mean and variance) of the Poisson model is fictitious (Jones 2007). For the robustness checks of the model, separate estimations were executed for both logit and negative binomials.

### Model 1: The Logit Model

$$\text{Smokes}_i = \beta_0 + \beta_1 \text{Age\_Category}_i + \beta_2 \text{Education}_i + \beta_3 \text{Education\_Squared}_i + \beta_4 \text{Age}_i * \text{Education}_i + \beta_5 \text{Wealth\_Category}_i + \beta_6 \text{radio\_use}_i + \beta_7 \text{TV\_use}_i + \beta_8 \text{Religion}_i + \beta_9 \text{Region}_i + \varepsilon_i(1)$$

### Model 2: The Negative Binomial Regression Model

$$\text{Smoking\_Intensity}_i = \beta_0 + \beta_1 \text{Age\_Category}_i + \beta_2 \text{Education}_i + \beta_3 \text{Education\_Squared}_i + \beta_4 \text{Age}_i * \text{Education}_i + \beta_5 \text{Wealth\_Category}_i + \beta_6 \text{radio\_use}_i + \beta_7 \text{TV\_use}_i + \beta_8 \text{Religion}_i + \beta_9 \text{Region}_i + \varepsilon_i(2)$$

Whereby  $\beta_0$  stands for an intercept;  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8,$  and  $\beta_9$  represent the slope coefficients to be determined while  $\varepsilon_i$  is an error term.

## 2.4. THE QUALITATIVE APPROACH

In addition to the quantitative analysis, we conducted a qualitative analysis. The qualitative data collection serves to complement the quantitative one and provide deeper insights while validating the results (Dan Maxwell, 1998; Julia Brannen, 2005). This was achieved through Key Informants' Interviews (KIIs).

### Key Informants Interviews

The discussions (KIIs) revolved around the specific components of the study and our approach is participatory in design. The qualitative data were analysed through content analysis using the NVivo software, version 12, using a coding frame, which thematically focuses on different components/aspects.

Key informants' interviews were conducted at the national level. The informants were identified through a mapping of the key stakeholders, who are mainly government officials and other key players involved in tobacco control in the country. This set of key informants' interviews helps to understand the phenomenon under study at the national level. We conducted 4 interviews with informants from Rwanda Biomedical Center (RBC), Butaro Hospital, Food and Drugs Authority (FDA) and Rwanda Revenue Authority (RRA).

## 3. RESULTS AND DISCUSSIONS

### 3.1. SUMMARY STATISTICS OF THE VARIABLES:

The data included in Table 2 indicates that about 10.4% of the sampled males aged 18-59 years smoke cigarettes. Regarding the smoking intensity, smokers smoke an average of 5 sticks daily. A larger part of the sampled men (49.1%) is in the 18-32 year age

category followed by the men in the age group of 33-47 (35.6%). On average, the sampled men spent around 6 years in school which is equivalent to the current primary level education. Also, about 44.4% of the sampled men are in the higher wealth group. Almost all the sampled men (92.3%) listen to radio while about 64.9% watch television. Finally, about 95% of the sampled men are Christians.

**Table 2: Summary statistics of the variables used in the estimation**

Variable	Mean	Std. Dev.
Smoking	.104	.305
Age grp (18-32)	.491	.5
Age grp (33-47)	.356	.479
Age grp (48-59)	.153	.36
South	.243	.429
West	.226	.418
North	.156	.363
East	.237	.425
Christian	.947	.224
Muslim	.027	.162
Other Religions	.008	.087
Lower Wealth category	.348	.476
Middle Wealth category	.203	.403
Higher Wealth category	.448	.497
Years of Education	5.844	4.192
Radio Use	.923	.266
TV Use	.649	.477
Smoked Cigarette (In the last 24 hours)	4.131	3.488

## 3.2. BIVARIATE ANALYSIS OF EXPLANATORY VARIABLES BY SMOKING STATUS

Table 3 provides information on a bivariate analysis of the selected independent variables by smoking status.

**Table 3: Bivariate Analysis of Explanatory Variables by Smoking Status**

	Cigarette smoking		F-statistics	P-value
	Yes	No		
Age category			111.5414	0.0000
18-32 years	0.042	0.958		
33-47years	0.136	0.864		
48-59 years	0.228	0.772		
Region			8.6771	0.0000
Kigali	0.097	0.903		
South	0.144	0.856		
West	0.069	0.931		
North	0.077	0.923		
East	0.119	0.881		
Religious Affiliation			13.0554	0.0000
Christian	0.088	0.902		
Muslim	0.236	0.764		
Other Religions	0.048	0.952		
Wealth category			51.1236	0.0000
Lower Wealth	0.170	0.830		
Middle Wealth	0.085	0.915		
Higher Wealth	0.062	0.938		
Years of Education	1.04	8.96	10.2492	0.0000
Radio Use	0.096	0.904	37.8471	0.0000
TV Use	0.087	0.913	29.0219	0.0000

Column proportions reported. Survey design accounted for in estimations. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

The findings indicate that a big number of men who smoke (22.3%) are in the 48-59 year category while 13.6% and 4.2% are in 33-47 and 18-32 year categories respectively. Furthermore, a big number of male smokers (17%) are in the lower income category compared to the male non-smokers in higher-income wealth category (6.2%). While a larger number of the male smokers (14.4%), are from the Southern Province, 11% are from the Eastern Province and only about 7% of the male smokers are from the Western province. Given that all provinces, except the City of Kigali, are share borders with other countries, policymakers dealing with tobacco control should tighten the measures to control tobacco illicit trade.

This is because the illicit trade of tobacco increases the prevalence of smoking. On average, a good number among the sampled smokers (23.6%) are Muslims while a few of them (8.8%) are Christians. The bivariate results reveal that the number of years men spend in school impacts decisions about smoking. More specifically, the results indicate that the male non-smokers in the sample spend around 8 additional years in school compared to their peer smokers. In addition, most of the male non-smokers (90.4%) listen to the radio and 91.3% watch television too.

All the selected variables in the model are statistically significant at a 1% level of significance, ( $p$ -value < 0.01). This indicates that cigarette-smoking related decisions among adult males (aged between 18 and 59 years) in Rwanda are strongly correlated with the selected variables/indicators. Given this situation, the same variables employed in the bivariate analysis were employed in the multivariate analysis to investigate the main determinants of cigarette smoking among Rwandan adult males. The F-statistics, given in the bivariate results table, capture the null hypothesis of no difference in the mean smoking status and intensity among various groups.

### 3.3. REGRESSION ANALYSIS

To assess the determinants of cigarette smoking and its intensity among male adults, Eq. (1) and (2) were estimated using the two-part model (column 1<sup>b</sup> and column 2<sup>c</sup>) where column 1<sup>b</sup> and column 2<sup>c</sup> stand for the logit and negative binomial model. For the robustness check of the model, separate estimations were executed for both logit (column 3) and negative binomial (column 4) using the same Eq. 1 and 2. All the results for both the two-part model and the robustness check model (logit and negative binomial) are interpreted as coefficients. Table 4 below portrays the results from the estimated equations.

**Table 4: Determinants (Coefficients) of Cigarette Smoking and Smoking Intensity**

Independent Variables	Two-Part Model <sup>a</sup>		Logit Model	Negative Binomial Model
	1 <sup>b</sup>	2 <sup>c</sup>	3	4
<b>Age Category (48-59 years)</b>	<b>Reference</b>			
18-32 years	-1.933(0.158)***	0.333(0.512)	-2.020(0.186)***	0.065(0.100)
33-47 years	-0.619(0.126)***	0.202(0.386)	-0.659(0.129)***	0.024(0.076)
Years of Education	0.069(0.067)	-0.086(0.225)	0.093(0.075)	-0.017(0.043)
Years of Education Squared	-0.010(0.005)**	-0.001(0.016)	-0.012(0.005)**	-0.000(0.003)
Age*Education	-0.557(0.242)**	0.493(0.779)	-0.667(0.257)***	0.115(0.152)
<b>Wealth category (Lower)</b>	<b>Reference</b>			
Middle	-0.706(0.151)***	-0.227(0.483)	-0.799(0.166)***	-0.049(0.097)
Higher	-1.128(0.153)***	0.693(0.466)	-1.082(0.193)***	0.158(0.089)*
<b>Religious (other) affiliation</b>	<b>Reference</b>			
Christian	-0.571(0.295)**	0.361(0.894)	-0.535(0.309)*	0.062(0.180)
Muslim	0.752(0.375)**	-0.915(1.095)	0.881(0.399)**	-0.243(0.221)
Radio_Use	-0.411(0.179)**	-0.216(0.566)	-0.387(0.188)**	-0.050(0.111)
TV_Use	0.124(0.122)	-0.006(0.386)	0.01(0.139)	0.019(0.077)
<b>Region (South)</b>	<b>Reference</b>			
Kigali	0.410(0.190)**	1.116(0.576)**	0.399(0.220)*	0.268(0.111)**
West	-1.024(0.172)***	-0.100(0.558)	-1.051(0.175)***	-0.028(0.114)
North	-0.934(0.199)***	-0.142(0.646)	-0.951(0.208)***	-0.0349(0.133)
East	-0.265(0.143)*	1.648(0.448)***	-0.203(0.171)	0.377(0.087)***
Constant	0.571(0.353)	3.176(1.051)***	0.647(0.361)*	1.190(0.213)***
Observation	<b>5336</b>	<b>411</b>	<b>5336</b>	<b>411</b>
F-statistic*	-	1.83**	21.37***	-
F-adjusted mean residual			0.62( 0.78)	



LR chi2*	468.42***	-	-	38.31***
Pseudo-R2	-	-	-	0.0200
Alpha	-	-	-	0.210***
AIC statistic	4657.174	-	-	-

Standard errors in parentheses. \*\*\*, \*\*, \* denote significance at 1, 5 and 10% levels respectively. Estimation of the separate logit model accounted for the survey design.

a: Negative Binomial-Logit Hurdle Model

b: Logit Model

c: Negative Binomial Model

Dependent variables were tobacco smoking and smoking intensity while explanatory variables in the regressions were age categories (18-32; 33-47 and 48-59), location (Kigali, South, East and West), religion (Christian, Muslim and others), wealth (lower, middle and higher wealth categories), education (number of years of schooling completed, education squared and age-education interaction), listening to radio and watching TV. Besides, the coefficients of the estimated variables have the expected signs and are statistically significant at conventional levels. This implies that the selected variables are the main determinants of cigarette smoking and its intensity among male adults in Rwanda.

To check if the model fits the data well, different statistical tests, including F-Statistical, LR chi2, AIC and Alpha, were evaluated. The reasons why these statistical test were conducted include that using a model that does not fit the data well may lead to wrong answers to the research questions under study. The F-statistic of the logit model, the Wald chi2 test for both the two-part model and the negative binomial model are statistically significant, which shows the robustness of the corresponding models in explaining the determinants of cigarette smoking and its intensity. Additionally, the goodness-of-fit test for the logit model illustrates that the F-adjusted mean residual test is not significant, indicating no proof of poor fit and revealing that the model is well specified. Moreover, the alpha in the negative binomial model is significant which validates the selection and use of a negative binomial model over a Poisson model. Consequently, using a negative binomial model in this study addresses the issues of potential unobserved

heterogeneity. Finally, the lower value of the hurdle models AIC shows that the model fits well.

Regarding the determinants of cigarette smoking, the main findings are that men in the following categories are more likely to smoke: lower wealth, old age, poorly and lowly educated. The main reason for this is that, compared to old men between 45 and 59 years of age, the young men (between 15–29 and 30–44 years) are reported to be less likely to smoke. Besides, the men in the higher wealth category are found to have a lower likelihood to smoke than their peer in the lower wealth category. Education (number of years of education squared) indicates that the smoking behavior only declines after some threshold of years of schooling which is 4 years<sup>6</sup>. The aforementioned results are in line with the previous literature (Khanal et al., 2013; Nketiah-Amponsah et al., 2018).

With reference to religious affiliation, the men affiliated to Islam are more likely to smoke than those affiliated to Christianity. Moreover, the findings indicate that area of residence is a main forecaster of the likelihood of smoking among male adults in Rwanda. Compared to the men who live in the Southern Province, those in the West and North provinces are reported to be less likely to smoke while those in the Kigali city are reported to be more likely to smoke than the men in the rest of the provinces. Finally, the male adults who listen to the radio are reported to be less likely to smoke.

Pertaining to the determinants of cigarette smoking intensity, the study further reports that the male adults in the Eastern Province and city of Kigali

<sup>6</sup> This is calculated from the estimated coefficient of the column labelled (3),  $\partial(\text{Smoking decision})/\partial(\text{Years of Education}) = 0.0925057 - 0.0240078 \text{ Years of Education}$ . Setting up the first derivation equal to zero, we can have the following model:  $0.0925057 - 0.0240078 \text{ Years of Education} = 0$   
Therefore,  $\text{Years of Education} = 3.853 \gg 4$

smoke greater quantities of cigarette compared to male smokers who live in the Southern province. Conversely, the smokers who reside in the Western and Northern Provinces were found to smoke with the lowest level intensity. Additionally, the men in the higher wealth category are reported to smoke more intensively than their counterparts in the middle and lower wealth categories.

### 3.3.1. Results Discussion

#### ***Determinants of cigarette smoking and smoking intensity***

Older men (45–59 years) are reported to be more likely to smoke than the younger men (15–29 and 30–44 years). These results corroborate the findings reported by Nketiah-Amponsah et al. (2018) and Khanalet al. (2013) who investigated the determinants of tobacco consumption among Nepalese men and found that male adults (36–49 years) are more likely to smoke tobacco than the younger ones.

While the stock of health depreciates with age and people respond to this through increasing investment in health-related goods and services as they age (Grossman, 1972), the present study found that older Rwandan men have a higher probability to smoke as they age. This higher probability of smoking among male adults may be due to their addiction to tobacco smoking habits formed during youthful years; such habits are hard to break. Additionally, male adults smoke cigarette as a way to overcome stress and anxiety when they are unable to meet their families' financial needs, especially those related to housing, health and education (Widome et al., 2015). This is confirmed by the fact that men in lower wealth categories are more likely to smoke than their counterparts in the upper categories. As the adverse health effects of cigarette smoking become more severe at the old age than in other age groups (Nketiah-Amponsah et al., 2018), this high prevalence of tobacco smoking among older Rwandan men is likely to cause major health problems. This is because all types of tobacco including cigarettes, smokeless, cigars and pipes contribute to cancers, heart and respiratory disease (NCI, 2011; Blazer and Wu, 2012). Thus, Rwandan adult males should be encouraged to quit smoking because it is crucial for male

adults' healthcare because it diminishes functional impairments and mortality related to respiratory and cardiovascular diseases (Lacroix and Omenn, 1992; Blazer and Wu, 2012).

One other reason why wealthier men are reported to be less likely to smoke than their peers in the lower wealth categories, despite that cigarettes are affordable for wealthier men, is that the former are more aware of the harmful effects of tobacco smoking than the latter. Moreover, the adults in the lower income group (below the poverty level) have less success in quitting smoking than those living above the poverty level<sup>7</sup>. This finding is in line with those reported earlier (Nketiah-Amponsah et al., 2018; Blazer and Wu, 2012); Blazer and Wu (2012) reported a higher prevalence of tobacco use among American male adults in lower-income groups. Thus, the results suggest that the policies to create jobs and eradicate poverty could also contribute to controlling tobacco smoking among Rwandan male adults. In this vein, government development programs in place such as NST1 and Vision 2050 that target poverty reduction might help to reduce tobacco smoking among male adults.

Education influences smoking-related decisions through as it raises awareness about the harmful effects of tobacco use. Accordingly, government education policies to provide free and compulsory 12 year basic education (12YBE) for all is a useful tool to control tobacco smoking among Rwandan male adults in the near future. The reason is that the number of years of education squared was found to be negatively correlated with the probability of smoking but not with smoking intensity. This implies that smoking declines after some threshold of years of schooling, which is four years. The results on the impact of education on tobacco smoking and its intensity corroborate with those of previous studies (for example Nguyen, 2012; Blazer and Wu, 2012; Khanal et al., 2013; Nketiah-Amponsah et al., 2018). Nguyen (2012) reported that the low education level is associated with a higher probability of tobacco smoking among male adults in Vietnam while Blazer and Wu (2012) as well as Khanal et al. (2013) found similar results in the USA and Nepal respectively.

<sup>7</sup> CDC: Cigarette Smoking and Tobacco Use Among People of Low Socioeconomic Status, <https://www.cdc.gov/tobacco/disparities/low-ses/index.htm> [accessed 2022 March 31].

Furthermore, media was found to be an important tool in reducing tobacco smoking among male adults in Rwanda. This is because the men who listen to the radio are less likely to smoke. This suggests that, when used properly, media constitutes an effective tool for raising public awareness about the health risks of tobacco use. Compared to male adults affiliated to other religions (Jehovah witness and Traditional among others), the sampled male adults affiliated with Christianity are less likely to smoke a cigarette while those affiliated with Islam are more likely to smoke. These findings suggest that religious leaders, especially in Islam, have a big task of reducing tobacco smoking amongst their members and this should be integrated in their programs. Nonetheless, religious affiliation was found to have no significant effects on cigarette smoking intensity.

One other finding is that the province of residence was found to be a key forecaster of the likelihood of tobacco smoking among male adults in Rwanda. For example, the men living in the Western and Northern Provinces are found to be less likely to smoke a cigarette than those who live in the Southern Province, while those in Kigali have the highest likelihood to smoke tobacco. Regarding smoking intensity, smokers residing in Kigali and in the Eastern Province are found to smoke greater quantities of cigarettes than their peers in the other provinces (see Table 4 column 2). The findings are statistically significant at 5% for Kigali and 1% for East. The fact that smokers living in Kigali city smoke more cigarettes is linked to the high income in this city because the majority of people with high income people in Kigali City. The smokers in the sample smoke an average of 5 sticks of cigarettes daily. Additionally, the men in the higher wealth category are reported to smoke more intensively than their counterparts in the middle and lower wealth categories mainly because cigarette is more affordable to them.

## 4. QUALITATIVE FINDINGS

To complement the findings from the quantitative data analysis, qualitative data was collected using key informant interviews with key stakeholders, including government officials and other key players in tobacco control in the country. We conducted interviews with officials from RBC, Butaro Hospital, FDA and RRA. These interviews have focused on tobacco control policies in place, key determinants of tobacco smoking among adults, health risks and challenges of smoking as well as recommendations. The findings are summarized in the following sections.

### 4.1. KEY DETERMINANTS OF TOBACCO SMOKING AND SMOKING TREND

Similar to the quantitative analysis, the qualitative analysis found that many smokers are uneducated (mainly casual workers), have low level education and/or are old. All the interviewees mentioned that tobacco use/smoking has decreased over the past years.

### 4.2. TOBACCO CONTROL POLICIES IN PLACE

The government of Rwanda implements health policies through its central health implementation agency, the Rwanda Biomedical Centre (RBC). With reference to tobacco control, RBC works closely with other key stakeholders, including the Ministry of Health<sup>8</sup>, the Ministry of Finance and Economic Planning (MINECOFIN), RRA<sup>9</sup>, the Ministry of Agriculture and Animal Resources (MINAGRI)<sup>10</sup>, Rwanda Development Board (RDB)<sup>11</sup>, the Ministry of Justice (MINIJUST)<sup>12</sup> and FDA<sup>13</sup> to implement various tobacco control laws and policies. The Government's measures aimed at reducing smoking include public awareness, prohibiting the access to tobacco products by children below 18 years,

8 Sets policy measures of tobacco control and prevention, plus advocating for people's good health.

9 Responsible for tobacco product tax regulations.

10 Controlling tobacco products farming; for instance, in Nyungwe where traditional tobacco is cultivated.

11 Sets laws that govern tobacco consumption in hotels and public bars; for instance, by providing smoking areas and prohibiting smoking in public.

12 Tobacco control laws and policies implementation.

13 FDA controls if tobacco meets the requirements, according to the tobacco control law, such as components/substance, labelling procedures and packaging among others.

increasing tobacco taxes, market authorization for tobacco products, prohibiting tobacco products advertisements and farming and stopping smoking in public. All these have helped to reduce tobacco consumption in Rwanda over the past few years. High taxes on tobacco have significantly increased the overall taxes while reducing tobacco consumption. Also, prohibiting smoking in the public has played a key role in reducing tobacco consumption/smoking.

### 4.3. CHALLENGES IN TOBACCO CONTROL

Despite good progress in tobacco control, some challenges are still persistent. Those challenges include inadequate coordination among stakeholders, some patients not stopping smoking while undergoing cancer treatment, tobacco price volatility on the market, some tobacco consumers not being aware of its harmful effects and laws on tobacco control which are not fully implemented.

### 4.4. SUGGESTIONS TO OVERCOME CHALLENGES IN TOBACCO CONTROL

The findings of the qualitative survey suggest increasing awareness and education campaigns on the harmful effects of smoking harmful, increasing taxes and prohibiting smoking in public areas. Other suggestions include the provision of more smoking areas in public places such as cheap bars and in their neighbourhoods and setting fixed tobacco prices on both the stick and the whole package. A detailed list of the findings from qualitative analysis is provided in Table 5 below:

**Table 5: Qualitative findings**

Considered variables	Consulted Institutions			Observation	
	RBC	Butaro Hospital	RRA		FDA
Factors influencing smoking	Socio-cultural and historical backgrounds, Peer groups, tobacco industry attraction and dependency.	-	-	-	Social factors influencing the smoking related decisions. Thus, increasing community awareness about harmful effects of smoking and formal education are key factor for tobacco control.
Categories of current smokers in Rwanda	Males smoke more than females (7 vs 0.9%), Many smokers are uneducated people (mainly casual workers)	Males smoke more than females, many smokers are people with little or no education (Middle education), aged people (55-70 years) and many smokers have smoked for a long time.	-	-	Education is confirmed to be a key determinant of smoking. Precisely, smokers are people with little or no. In addition, aged people smoke more than young.
The trend of tobacco smoking/use in Rwanda over the last 5 years	Decreased	Decreased	Decreased	-	Tobacco smoking has significantly decreased over the past 5 years. This shows that the current tobacco control policies and measures such as prohibiting smoking in the public and high tobacco taxes are being effective in reducing smoking.
Health risks associated with tobacco smoking	Cancers (throat, stomach; lungs; tongue); high blood pressure; diabetes and nerves	Lungs cancer; urinary bladder; leukaemia; stomach cancer; pancreas cancer; colon; cervix	-	-	Tobacco smoking is the leading cause of various types of cancer (lungs cancer; urinary bladder; leukaemia; stomach cancer; pancreas cancer; colon; cervix). The other related diseases include high blood pressure, diabetes and nervous
Established strategies to reduce the negative effects of tobacco smoking/use	Public awareness and education, prohibiting access to tobacco products by children below 18 years, increased tobacco taxes, prohibiting tobacco products related advertisements, farming, and prohibiting smoking in public.	Advise patients to stop smoking because nicotine contained in tobacco negatively affects mitochondria (DNA) which fails medicine reaction in the organism.	Increasing tobacco taxes	FDA is setting up measures to reinforce tobacco control.	Key stakeholders identified prohibiting smoking in public and increasing tobacco taxes as the main drivers in reducing tobacco smoking.

Considered variables	Consulted Institutions				Observation
	RBC	Butaro Hospital	RRA	FDA	
Key partners/collaborations	MoH, MINECOFIN, RRA, MIN-AGRI, RDB, MINIJUST, FDA.	-	-	-	RBC's key partners in tobacco control include MoH, MINECOFIN, RRA, MINAGRI, RDB, MINIJUST and FDA.
Contribution of tobacco-related tax to the overall tax revenue.	-	-	Tobacco taxes have a very positive impact on the overall taxes; it contributes one billion of taxes per month on average.	-	Increase in tobacco taxes leads to an increase in the overall taxes
Market Authorization	-	-	-	Tobacco substances, labelling and packaging are checked before issuing market authorization.	Market authorization helps to control and eliminate illicit tobacco trade in Rwanda.
Challenges	Inadequate coordination among stakeholders involved in tobacco control: this negatively affects the implementation and enforcement of laws and regulations related to tobacco control while limiting the access to, and control of, tobacco farming	Some cancer patients fail to comply with medical instructions; for example, they continue to smoke while undergoing the chemotherapy treatment.	No fixed tobacco price at the market (price volatility).	Some tobacco consumers are not aware of its health risks.  The law on tobacco control is not fully implemented.	The key challenges in tobacco control include inadequate coordination among stakeholders involved in tobacco control, tobacco price volatility and some of the tobacco consumers who are not aware of its health related risks.
Recommendations	Public awareness; prohibiting the access to tobacco products for children below 18 years; further increase tobacco taxes.	Collective efforts on smoking risk awareness, education, and complying with medical instructions by the patients undergoing treatment and diagnosis.  Place more emphasis on research studies involving key actors such as cancerology and others.	Reducing tobacco smoking through increasing taxes and prohibiting smoking in public.  Providing more smoking areas (in cheap bars and in their neighbourhoods)  Setting fixed and specific tobacco prices on both the cigarette and the whole cigarette package.	Increasing awareness and education campaigns on the harmful effects of smoking (targeting new and potential consumers).	Key recommendations are: raising public awareness and education on smoking risks, initiating more research studies involving key actors such as cancerology and others, establishing a law that prohibits sending children to buy tobacco, rising tobacco taxes and setting fixed tobacco prices.



## 5. CONCLUSION AND RECOMMENDATION

This study investigated the determinants of cigarette smoking and its intensity among male adults in Rwanda using the data from the latest nationally representative survey, the RDHS 2019-2020. The study employed descriptive statistics, a bivariate analysis and a negative binomial-logit hurdle model. We also conducted key informant interviews with officials from key stakeholder institutions involved in tobacco control. The study found that being in a lower wealth category/income, old age, low education, being Muslims and staying in the City of Kigali are the key determinants of cigarette smoking among male adults in Rwanda. Furthermore, the male smokers who reside in the East Province and the City of Kigali as well as those in the high wealth category are reported to smoke greater quantity of cigarettes. In addition, the higher the number of years spent in school the lower the probability of smoking tobacco among men adults. Also, using media (such as listening to Radio) and being Christian were found to be significant in explaining the smoking behaviour in Rwanda: Muslims were found to smoke more cigarettes than Christians. The sampled male smokers smoke an average of about 5 sticks of cigarettes daily. The qualitative analysis has also reported similar findings, indicating that having low level of education or no education at all (especially among casual workers), being old, the social cultural and historical background, peer pressure and the tobacco industry attraction and dependency.

The findings of study have led to the formulation of the following recommendations to address the negative effects of cigarette smoking (such as illness, deaths and poverty) and its intensity among male adults in Rwanda:

- 1. Increasing public awareness and education on smoking risks through media:** this study proved that media (mainly radio) plays a vital role in discouraging the smoking behaviour among male adults in Rwanda. Thus, the Government and other key stakeholders should publicize relevant information and messages on the health risks of smoking to the community through media.
- 2. Removing structural barriers affecting the 12 Year Basic Education (12YBE):** the findings from the study revealed that most male

adults smokers spent only one year in school compared to nine years spent by the non-smokers in school. The findings also indicate that the smoking behaviour only starts declining after 4 years of schooling. Therefore, removing structural barriers which prevent people from attending and completing the 12 year basic education (12YBE) which, however, is offered free of charge in public schools, and compulsory for all children. This will help to reduce smoking among Rwandan male adults in the near future. To achieve this, the government should tackle the issues that increase the cost of education such as non-tuition related expenditure including higher transportation and food costs. These have been identified as major obstacles to entering secondary school (see Laterite, 2019).

- 3. Improving the income of poor households:** The study indicates that male adults in the lower wealth category have a higher probability of smoking and smoking intensively. Some of the reasons for this include that the adults in the high-income group are more aware of the harmful effects of tobacco smoking and find it easier to quit smoking than their counterparts in lower income group. As a result, government poverty eradication policies that raise poor households' income could help to control tobacco smoking.
- 4. Avail Designated Smoking Areas (DSA) in cheap bars and their surroundings:** The findings show that very few places, including big and decent hotels and restaurants, have smoking areas. Therefore, the government and its stakeholders should put more efforts to encourage the setting up of designated smoking areas in places where many people are gathered such as cheap bars in the neighborhoods to protect people from health risks associated with second-hand smoking.
- 5. Increase tobacco taxes and set fixed tobacco prices:** The qualitative interviews indicate that there is no fixed price for both stick and the whole package for all sellers at the market. The tobacco price varies from one seller to another and from small shops to big supermarkets. There is also a need to increase taxes on tobacco in order to discourage smoking. Indeed, taxes on tobacco are 36% of the retail price plus specific



excise of 130 Rwf per pack of 20 sticks; this is below the 75% minimum tax share of the retail price of tobacco recommended by the World Health Organization (WHO). Thus, increasing tobacco taxes and setting specific tobacco prices on both stick and the whole package could discourage people from smoking.

**6. Promote and enhance research on tobacco**

**control:** The findings from the qualitative survey point to the need for promoting and enhancing research studies on tobacco control that involve key actors such as cancerology departments among others. The research should focus on the types of tobacco products and their respective impacts. In this regard, the government, in collaboration with key stakeholders in tobacco control, should encourage such research to provide evidence based recommendations on the effectiveness of tobacco control interventions.

While this study drew from the nationally representative data, a few limitations are worth noting. For example, the sample employed in investigating the intensity of cigarette smoking is quite small because some smokers did not answer the question on the smoking intensity. In spite of this, however, the outcomes of the study provide empirical basis for public health policy making in Rwanda as the sample is nationally representative. To get more insights into smoking and inform policies in Rwanda, further studies should consider interviewing smokers to provide more elaborate explanations on smoking, beyond the empirical estimations. Besides, further studies on tobacco use should consider investigating the link between tobacco and alcohol consumption especially among the young generation, among other research areas.

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# APPENDIX: QUALITATIVE QUESTIONNAIRE

## “Determinants of cigarette smoking and smoking intensity among male adults in Rwanda”

### I. Key Informant Interview (KII) with an official from the Rwanda Biomedical Centre (NCDs Department) representing the Ministry of Health.

1. What is the current tobacco smoking status in the country? (**Probe for:** increase/decrease, **other (specify)**).
2. What are some of the reasons why people smoke? What are the categories/groups of the population smoke the most currently? (**Probe for:** gender, youth/adult, educated/uneducated, job/occupation, religion, region, **other (specify)**).
3. What collaboration mechanisms are there between the partners involved in tobacco control and prevention? (**Probe for:** Key stakeholders, their respective roles, **other (specify)**).
4. Does tobacco smoking have negatively effects on smokers? If yes, what are the effects? And what are the strategies in place to overcome these effects?
5. What are the main challenges faced in the prevention of tobacco smoking? What policies are in place to overcome the challenges?

### II. Key Informant Interview (KII) with an official from Butaro Hospital (Cancerology Department at BUTARO Hospital).

1. What are the main diseases caused by smoking among the patients treated in this hospital? Which categories/groups of the population are mostly affected by these diseases? (**Probe for:** Diseases, percentage, gender, youth/elders, educated/uneducated, job occupation, religion, region, **other (specify)**)

2. What is the trend of patients suffering from tobacco-caused diseases over the last 5 years? (**Probe for:** Increase/Decreased, **other (specify)**)
3. What are the main challenges faced in the treatment of diseases caused by smoking? What do you recommend to overcome these challenges?

### III. Key Informant Interview [KII] with an official from the Food and Drug Authority (FDA)


1. Could you please explain the requirements that are checked for tobacco products when they are imported? (**Probe for:** Market Authorization, Labeling, User Fees, **other (specify)**)
2. What is the trend of tobacco importation over the last 5 years? (**Probe for:** Increase/Decreased, brands increased/decreased, **other (specify)**)?
3. What are the main challenges faced in tobacco products control and regulation in Rwanda? What do you recommend to overcome these?

### IV. Key Informant Interview [KII] with an official from Rwanda Revenue Authority (RRA)

1. Could you please explain the impact of the current tobacco-related tax on the overall tax revenue in the country? (**Probe for:** Increased, no change, **other (specify)**)
2. Could you please describe the current tobacco tax levels and structure? (**Probe for:** type of taxes, tax rates, tax per pack of cigarettes/one cigarette, **other (specify)**)
3. Does the current tobacco tax reduce tobacco consumption in the country? Please explain (**Probe for:** Increase/decrease, No change, **other (specify)**)

What are the challenges in tobacco taxation in Rwanda? What do you recommend to overcome them?

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