ECONOMETRIC ANALYSIS OF YOUTH TOBACCO USE: EVIDENCE FROM LESOTHO GLOBAL YOUTH TOBACCO SURVEYS

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Minor dissertation submitted in partial fulfilment for the requirements of the degree of Master of Commerce in Economics

In the School of Economics

University of Cape Town

March 2021

ACKNOWLEDGEMENTS

I will always be very grateful to my supervisor, Professor Corne' van Walbeek, for his guidance and support in making this dissertation possible. His comments, suggestions, and criticisms have been invaluable in improving my thinking and stimulating my interest in the topic. I am also grateful to Professor Martin Wittenberg. He taught me a lot about survey data, applying microeconometrics in practice, and to constantly question and read the literature on econometric tools more perceptively.

I am deeply indebted to Dr Elizabeth Baldwin for many helpful comments and corrections. My gratitude also goes to Dr Ernest Ngeh Tingum; he lured me into economics of tobacco control research and made me aware of the availability of the Global Youth Tobacco Survey (GYTS) datasets during his lectures in Econometric Methods at the National University of Lesotho in 2019. I can not discount the excellent career advice and research mentorship I always receive from Dr Ramaele Moshoeshoe. His role has been statistically significant in making me a better scholar.

Generous scholarship funding from Canon Collins Trust is enormously acknowledged. I would not have made it in Cape Town without its financial assistance. Finally, I owe a special debt of thanks to my mother. Her prayers have been highly significant in enabling me to successfully complete my academic journey at the University of Cape Town during these unprecedented times of Covid-19 pandemic. All remaining errors are my own.

ABSTRACT

This dissertation estimates the prevalence of youth smoking and investigates the determinants of different tobacco products by gender among the youth aged 11 – 17+ years in Lesotho. This is achieved by estimating three independent gender logit regressions using Lesotho Global Youth Tobacco Surveys of 2002 and 2008. The results indicate that most youth smokers in Lesotho are males. The smoking prevalence amongst males is higher than amongst females for all three tobacco products: cigarettes, other smoked tobacco, and smokeless tobacco. Overall, smokeless tobacco has the highest prevalence (16.87%), followed by other smoked tobacco products (13.94%), and, lastly, by cigarettes (12.24%).

The results further reveal that the determinants of smoking vary with the tobacco product type and gender. Cigarette smoking has a strong positive association with peer influence and the availability of loose cigarette sticks at retail stores, irrespective of gender. Exposure to other people's smoking in public and newspaper advertisements increase males' cigarette use, while exposure to other people's smoking inside the home increases females' cigarette smoking.

The use of smokeless tobacco is negatively associated with being in the age group, 13 and 14 years, for both males and females. Among females only, the use of smokeless tobacco is strongly positively associated with having a mother as the only household smoker and parental discussions about smoking. Peer smoking is the primary determinant of the use of other smoked tobacco among males, while, for females, the main determinants of other smoked tobacco use are exposure to other people's smoking at home and parental discussions about tobacco use. The study recommends that Lesotho ban tobacco media advertising and promotions, abolish the sale of loose cigarette sticks, strengthen teaching at school about the dangers of tobacco, and introduce tobacco education in the Science subject in the early primary grades.

Table of Contents

EXECUTIVE SUMMARY

Lesotho has the highest smoking rate among adults in Africa, according to the World Health Organisation (WHO). Many researchers have shown that adult smokers start smoking in their youth/adolescent stage, and this leads to long term addiction and use, which has negative implications for health. Thus, understanding the factors behind youth smoking, from which adult smoking emanates, is key to understanding better how smoking can be controlled at an early stage.

What are the smoking prevalence and determinants of smoking among youths aged 11 to 17 years? Presently, there is a lack of empirical evidence on youth smoking determinants, specifically in the context of Lesotho. This paper estimates the smoking prevalence of three individual tobacco products: cigarettes, other smoked tobacco, and smokeless tobacco, and their associated factors. Using the Global Youth Tobacco Survey (GYTS) wave 1 (2002) and wave 2 (2008), I find that smokeless tobacco has the highest prevalence, followed by smoked tobacco and cigarettes. Males' smoking prevalence is higher than that of females for all the three tobacco products, implying that smoking is mostly done by males.

The descriptive statistics results show that smoking initiation, in terms of trying cigarette smoking for the first time, starts as early as 7 years old and increases with age. For all three tobacco products, smoking is observed to be higher among students in older age groups who struggle academically, that is, those who have repeated their grades. From 2002 to 2008, there was no significant change in cigarette smoking prevalence, such that it remained fixed at 12%. However, the influence of the tobacco industry continues to rise, evidenced by the significant 30% increase in tobacco industry promotions (e.g., free cigarette offers); similarly, the exposure to tobacco media advertising also remained high, above 55% in both 2002 and 2008.

The logit regression analysis results reveal that smoking determinants differ by the type of tobacco product and gender. Irrespective of gender, adolescents who have smoking peers and live near retail stores that sell loose cigarettes are more likely to smoke. The effects of these two variables are not only statistically significant but are large in magnitude as well. Among males only, cigarette smoking is associated with purely demographic variables; those in higher age groups (15 to 17 years) and having fathers as the only smokers in the household are more likely to smoke cigarettes. The environmental factor, seeing other people smoke in public (exposure to other people's smoking), also increases the probability of males' cigarette smoking. Among females, cigarette smoking is correlated with the home environment, seeing other people smoke inside the homes.

For other smoked tobacco, being in a lower age group is associated with lower consumption of other smoked tobacco among males and females. For females only, those with mothers as the only users of any tobacco product in the household are more likely to smoke. Parental discussions about the dangers of using tobacco have counterintuitive results on smokeless tobacco and smoked tobacco use. Females whose parents talk about the dangers of using tobacco are more likely to use smokeless tobacco or other smoked tobacco products. Like cigarette use, the use of smoked tobacco products among females is positively associated with seeing people smoke inside their homes. Among males, those with smoking peers are more likely to smoke. Those who perceive smoking to be risky are less likely to use other smoked tobacco.

The descriptive results and the regression results shed light on three critical policy recommendations. In terms of tobacco control policies, Lesotho is still weak, as it only has two moderate policies: tobacco taxation and cessation programmes. Therefore, the study makes some suggestions of what further interventions are needed. First, given the growing influence of the tobacco industry and high exposure to tobacco advertising, the study recommends banning tobacco media advertisements

and tobacco promotions as quickly as possible. This should be combined with a law banning the sale of the loose sticks of cigarettes that make cigarettes affordable to people below the age of 18. Secondly, it has been seen that peer pressure is highly correlated with smoking and children as young as age 7 are experimenting with cigarette smoking. Therefore, it is vital to introduce education on tobacco products in the early primary school grades and offer lessons on tobacco at least once in every quarter. This has the potential to educate the entire peer group and reduce their smoking, and, by extension, the influence they have on their non-smoking friends.

Finally, the odd and surprising results about the positive relationship between parental discussions and anti-smoking messages and the categories of other smoked and smokeless tobacco have important implications from both a research and a policy perspective. The research suggests that adolescents perceive smokeless tobacco and other smoked tobacco as less risky than cigarettes. This may further be evidenced by the fact that these two products have higher prevalence rates than cigarettes. Therefore, policy-wise, the study recommends that anti-smoking messages be designed so that they convey a strong message about the dangers of tobacco use, and they should be on media platforms such as national television, radios, and billboards at frequent intervals.

1. INTRODUCTION

Tobacco smoking is one of the leading causes of non-communicable diseases (NCDs), and it kills more than 8 million people every year worldwide (WHO, 2019). Worse, if tobacco control advocates do nothing to reduce smoking prevalence, the number of tobacco-related deaths will massively increase to 1 billion in this century (Tobacco Atlas, 2018). Smoking among adolescents[1] is often of particular interest and importance from a research and policy perspective since early smoking is known to have adverse health implications, and to lead to lifetime addiction and regular tobacco use (Nonnemaker & Farrelly, 2011). Compared to adults, adolescents are easily addicted, since few cigarettes and less smoking duration are enough to establish nicotine addiction (WHO, 2016).

According to the WHO (2016), nicotine exposure at the adolescent stage has long-lasting negative effects on brain development and an increased risk of asthma. Growing with nicotine addiction further exacerbates the global epidemic of tuberculosis (TB), mental illness, alcohol abuse, and economic hardships as the result of excessive spending on tobacco (Tobacco Atlas, 2018).

In spite of all these dangers, tobacco use in Sub-Saharan Africa, although low, is progressively increasing, providing a large potential market for the tobacco industry to exploit (Tobacco Atlas, 2018;Veerankiet al., 2015). Most importantly, the tobacco industry specifically targets the youth in developing countries, because nicotine's addictiveness means that smokers will often use tobacco throughout their entire life, they are potential long-term consumers.

In response, the World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC) entered into force in 2005 to reduce tobacco use globally. However, to minimise smoking levels, evidence-based tobacco-control measures are

[1]In this study, the words adolescents and youth are used interchangeably.

needed to ensure that anti-smoking policies to be adopted will be appropriate and effective (Adeniji et al., 2016). Critical to achieving this is understanding tobacco-use patterns among different population groups and the determinants of smoking. Nevertheless, information on the prevalence and correlates of youth smoking in the world's most impoverished countries remains sparse. Particularly, a weak knowledge base restricts the appropriate implementation of tobacco-control policies to reduce the potential growth of smoking and its associated public health burden (Adeniji et al., 2016).

In Lesotho, as in many other developing nations, much is unknown about the factors behind youth smoking. The existing studies on tobacco use and the demand for tobacco products in Lesotho, such as Nyabongo (2014) and Moshoeshoe (2012) only focused on adults. Furthermore, the Lesotho GYTS reports of 2002 and 2008 only provided estimates on the prevalence of smoking for youths aged 13-15 years. They did not shed any light on the factors behind smoking or the smoking prevalence for the youth of other age groups. This dissertation, therefore, aims to provide new evidence on youth smoking factors in Lesotho and the changes in smoking prevalence and smoking determinants over time.

Specifically, this paper is guided by two critical questions. First, **what is the youth smoking prevalence of different tobacco products in Lesotho, and how has it changed over time**? Secondly, **what are the determinants of youth tobacco use in Lesotho?** The Global Youth Tobacco Surveys (GYTS) data of 2002 and 2008 are used to address the above questions. However, for the determinants of youth smoking, only the latest GYTS of 2008 is used. Lesotho offers an interesting case for the study because for the past decade (2004 – 2015), smoking prevalence increased from 15% to 50% (Tobacco Atlas, 2018), making it the highest tobacco-consuming country in Africa, with an adult smoking rate of 21% (WHO, 2019). Therefore, understanding adult smoking roots, i.e., youth smoking, offers policy insights and direction on how adult tobacco use may be controlled from its origins.

The remainder of this dissertation proceeds as follows. In the next section, I provide the background on tobacco use and control in Lesotho. Section 2 reviews the relevant literature on youth smoking; section 3 explains the data and the methodology. Section 4 presents descriptive and regression results. Section 5 discusses the results and their implications. Section 6 concludes with the policy recommendations.

1.1 Background on Tobacco Use and Control in Lesotho

Lesotho is a small, largely rural, and mountainous country surrounded by South Africa. The World Bank Development Indicator classifies it as a lower-middle-income country with an annual GDP per capita of $1118. According to the WHO (2019), Lesotho has the highest adult daily smoking prevalence in Africa, estimated at 21%. Generally, smoking is more common among men than women, and male smoking is around 43.3% higher than the average smoking prevalence in other lower-Human Development Index (HDI) countries. In comparison, female smoking is 0.3% less than the average smoking in lower-HDI countries (Tobacco Atlas, 2018).

The main tobacco products used are cigarettes (manufactured and hand-rolled), pipes, snuff, and chewing tobacco. Lesotho has the highest prevalence of the use of pipes and snuff in the Southern African Customs Union (SACU)[2] region (Nyabongo, 2014). The products most smoked by men are cigarettes and pipe tobacco. Snuff is common among adult females in older age groups and has the highest prevalence in the SACU region (Nyabongo, 2014). Lesotho smoking activity in all tobacco products is more common in rural areas than in urban areas and generally higher among people with lower levels of education (Nyabongo, 2014).

In terms of tobacco-control policy, earlier efforts include the Ministry of Health and Social Welfare's Internal Circular No.9 of 2000 on the smoking ban and the Government Secretary's Circular Notice No.1 of 2001 on the prohibition of smoking in government offices. These two pieces of legislation are not national and apply only to government ministries. Furthermore, in 2005, Lesotho became the sixth African country to ratify the WHO FCTC to control its tobacco use (WHO, 2015). In response to this, in 2015, Lesotho government introduced the Tobacco Control Bill. This legislation primarily aimed to control the manufacture, distribution, and sales of tobacco products, to promote education on tobacco use's health hazards, to advocate

[2]SACU consists of five countries: Botswana, Eswatini, Lesotho, Namibia, and South Africa.

for and encourage smoking cessation, to ban the advertising and promotion of tobacco products, to raise tobacco taxes, and to enforce smoke-free public places. As part of the achieved tobacco-control bill's objectives, Lesotho currently has three moderate policies (WHO, 2019). First, there are educational and health programmes that promote tobacco-use cessation. Secondly, there is unique training offered for health workers and media professionals to promote awareness of the dangers of tobacco use, targeted at both youth and adults.

Furthermore, as a member of SACU, Lesotho has the excise tax rates on tobacco that are set by South Africa and applied to all the SACU member states. These excise tax revenues are shared by the SACU members using a revenue-sharing formula (World Bank, 2017). The excise tax on tobacco is increased annually depending on the expected inflation or the 52% tax burden of tobacco price. The option that gives higher tax revenue increases is the one that is always chosen (van der Zee and van Walbeek, 2019). Despite this, the members can still set their own tobacco taxes independently of SACU, and these extra taxes are known as "levies" and are not part of the SACU revenue pool (World Bank, 2017).

Lesotho's first tax reforms on tobacco (sin taxes on cigarettes) took place in 2014 (Koatsa and Nchake, 2017). In 2016, Lesotho introduced a 4% levy on tobacco. The government argued, however, that this levy is low compared to those of nearby countries, for instance, Botswana, which has a 40% levy. Consequently, since 2018, Lesotho's government has been proposing implementing a 30% tobacco levy. To date, this levy has not been implemented, but it is hoped that it will be introduced in the 2021/2022 fiscal year. The Lesotho Revenue Authority (2019) indicated that it missed its target revenues by M189.51 million because of the absence of an enabling law on tobacco and alcohol levies, among other factors. Tobacco Atlas (2018) indicated that several governments globally are often reluctant to increase taxes on tobacco and rely on the tobacco industry's opinions that additional taxes will result in declines in tax revenue and the promotion of illicit trade. Lesotho is not an exception to this; British

American Tobacco (BAT), the leading player in the Lesotho tobacco industry, argued that 30% levies would fuel the cigarette black market and result in cigarette tax revenue loss (Lesotho times, 2020).

2. LITERATURE REVIEW

2.1 Theoretical Literature Review

One of the major theories relevant to understanding adolescent smoking is the Theory of Triadic Influence (TTI) (Bricker et al., 2009). According to this theory, determinants of adolescent smoking can be categorised into three hierarchical categories. The first category explains that adolescents' smoking can be determined by their demographic characteristics (age, gender, and education). The second stage consists of social environmental factors, such as friends, family members, and peer groups, and these are considered very important in influencing adolescents' smoking (Bricker et al., 2009). Their influence on smoking reflects natural emotional attachments, such as a weak desire to comply with parents and a strong desire to comply with friends (Bricker et al., 2009). The third stage comprises broader external factors like education on tobacco use and government intervention, among others.

2.2 Empirical Literature Review

There is a growing empirical literature on the determinants of youth tobacco use owing to the availability of GYTS datasets in various countries. These datasets have been used in many studies in order to understand the factors behind youth tobacco use in developing countries. In Madagascar, Veeranki et al. (2015) investigated the correlates of cigarette and other smoked tobacco products. They found that peer smoking had a positive association with youth smoking irrespective of gender and type of tobacco product. The findings further showed that cigarette and non-cigarette products have different correlates. Cigarette use was negatively affected by perceptions of the risk of smoking. Surprisingly, being exposed to anti-smoking

messages increased cigarette smoking, especially among male adolescents. For females, cigarette smoking was positively associated with tobacco promotions and advertising. Non-cigarette smoked tobacco was highly influenced by exposure to other people's smoking inside homes and in public.

Kostova et al. (2011) investigated factors that shape cigarette-smoking participation and intensity among the youth in some selected lower and middle-income countries (LMICs). The results revealed that youth are very sensitive to cigarette prices, and higher prices are useful policy tools for reducing youth smoking in LMICs. Similarly, Nikaj and Chaloupka (2014) analysed the factors behind youth smoking and the demand for cigarettes in some selected developed and developing countries. The demand equation findings showed that youth in developing countries are more responsive to cigarette prices than those in developed countries.

Further, within developing countries, males were found to be more responsive to cigarette prices than females. Nevertheless, in general, higher cigarette prices were effective policy tools for reducing smoking among youth, especially in developing countries. Additionally, the findings showed that reduced access to and availability of cigarettes lowered cigarette smoking prevalence. Street vendors' refusal to sell cigarettes to minors was found to be of utmost importance for reducing tobacco use. Cigarette advertising was found to be powerfully influential in stimulating females' decisions to smoke.

In Bangladesh, Kabir et al. (2015) found that youth cigarette smoking is significantly associated with friendship smoking, seeing other people smoke either at home or elsewhere, having pocket money, and tobacco promotions (being offered free cigarettes) and advertisements. In Nigeria, Itanyi et al. (2020) showed that living in rural areas, having weekly pocket money, having parents, friends and classmates who smoke, exposure to other people's smoking, tobacco advertising, and tobacco availability positively affected current tobacco use. Cigarettes and other smoked

tobacco use were found to have different negative correlates. Cigarette smoking was negatively affected by being female, having both parents employed, and being exposed to tobacco teaching at school. Being in the older age group and having a father with tertiary education decreased the current use of other smoked tobacco products.

In Ghana, Mamudu et al. (2013) found that tobacco use was positively associated with familial relations (friendship and parental smoking) and tobacco promotions, while knowledge of the dangers of secondhand smoke decreased tobacco (non-cigarette) use. Similarly, in Ethiopia, Duko et al. (2019) found that being in older age group, i.e., above 18, having ever used alcohol, chewing khat, the use of other illicit drugs, and having friends who smoke increased the odds of smoking, while being in a higher grade had a negative effect.

The Gambian study by Jallow et al. (2017) found that being in an older age-group, being in a private school, professing Christianity or a faith other than Islam, and having family members and friends who smoke positively influenced smoked tobacco use. The study further found that females were less involved in smoked tobacco use than males. In Uganda, Kadobera et al. (2016) found that parental smoking, friendship smoking, and tobacco media advertisements were positively associated with cigarette smoking. The Indian evidence from the study by Grover et al. (2020) using the Global Adult Tobacco Survey (GATS) of early adults (15-24 years) found that staying in rural areas increased smokeless tobacco use. Being literate (to at least secondary level of education) was associated with decreased smokeless tobacco use.

In developed countries, some studies utilised GYTS data to understand tobacco use determinants among the youth. In Greece, Rachiotis et al. (2008) found that the following factors increased the likelihood of smoking: being a male, being in an older age-group, having pocket money, and having parents who smoke. Most surprisingly, the perception of the harmfulness of smoking also increased smoking especially for

females. That is, although females in Greece perceived smoking as dangerous, that did not discourage them from smoking, they even smoked more. Having parents with high school or university education discouraged youth cigarette smoking. In Turkey, Onder (2012) found no gender differences in cigarette smoking prevalence. The smoking factors results revealed that males' and females' probability of smoking is affected differently, even by the same factor. For instance, the father's or mother's smoking at home positively influenced females' cigarette smoking, while for males, parental smoking was negatively associated with their smoking.

Similarly, exposure to tobacco advertising and promotions increased females' smoking but decreased males' smoking. Having parents who are employed increased smoking among females but reduced it among males. Teaching at school on the dangers of tobacco was more effective than parental teaching or discussion in reducing smoking. Infact, surprisingly, parental discussions about the dangers of tobacco use were found to increase smoking. Cigarette prices and anti-smoking messages reduced cigarette smoking irrespective of gender.

Thrasher et al. (2006) used the United States (US) representative survey, which is different in design from the GYTS. The study revealed that anti-tobacco industry messages offer a vital policy tool for controlling tobacco use among adolescents, irrespective of whether they are highly addicted or mildly addicted to nicotine. Nonnemaker and Farrely (2011) used the US National Longitudinal surveys and found that cigarette smoking prevalence among Whites is more than twice the smoking prevalence among Blacks. The reason for this is that Blacks are highly responsive to excise taxes and prices, while Whites have insignificant responses to them.

Overall, the reviewed studies show mixed results on the factors of youth smoking in both developing and developed countries. They also show evidence of gender differences in the determinants of smoking. The results on male smoking factors are

not consistent in different countries. In comparison, there is some consistency in the determinants of female smoking; tobacco advertisements and promotions are more effective in increasing females' smoking than males'. Irrespective of gender, peer pressure and high tobacco prices are found to strongly affect youth smoking, whether positively or negatively.

2.3 Brief Estimation Technique and Outcome Variable Gap

Many reviewed studies that seek to understand the factors behind youth smoking chose logit models. This may be because logit models allow the estimation of odds ratios, which other probability models (linear and probit models) do not allow. These odds ratios are often of interest to public health and tobacco-control researchers. Nevertheless, they are not considered to have intuitive interpretation; their correct interpretation is far more complicated than commonly believed and reported (Mood, 2010). The odds ratios are therefore commonly misinterpreted and treated as probabilities or risk ratios (Edwards and Dowd, 2018). In this paper, although I still present the odds ratios, I deviate from what is usually done in the literature by reporting and focusing on the average marginal effects because of their straightforward intuition and interpretation.

Additionally, in estimating the factors of adolescents' smoking, many studies did not estimate smoking determinants separately for boys and girls, making it impossible to see differences in boys' and girls' smoking factors. Previous studies also frequently examined the correlates of cigarette and other smoked tobacco use but ignored the factors behind smokeless tobacco. For instance, although not widely studied, WHO (2015) indicated that smokeless tobacco is generally higher among the youth. This is the case also for Lesotho; smokeless tobacco use has the highest prevalence than cigarettes and other tobacco products among the youth. The available evidence is limited and cannot be generalised to other countries. This paper contributes to the literature by providing evidence that various tobacco products (cigarettes, other

smoked tobacco, and smokeless tobacco) have different factors behind their use among males and females.

3. METHODOLOGY

3.1 Data Sources

The data used for this study were obtained from the Global Youth Tobacco Surveys (GYTS) for Lesotho, for 2002 and 2008. GYTS is a component of the Global Tobacco Surveillance System (GTSS).[3] It is also one of the four tobacco surveys conducted in different countries across the globe to monitor tobacco use and its correlates. GYTS is a nationally representative school-based survey of students aged 11-17+, either in primary or secondary school, depending on a specific country's education system. The Lesotho 2008 GYTS data consists of students in the final grade of primary school, i.e., standard 7, and the first two secondary school grades: Form A and Form B. The 2002 GYTS consists of students in the first three secondary school grades, Form A, Form B, and Form C.

The GYTS survey involves a two-stage cluster-sample design, in which the first stage involves the selection of schools with the probability proportional to the enrolment size. In the second stage, a simple random sampling technique was used to select the classes, and all students in selected classes had an equal chance of being selected for the survey. The GYTS had a sample of 4147 and 3426 students in 2002 and 2008, respectively. The overall survey response rates were 85.3% in 2002 and 83.2% in 2008.

A self-administered questionnaire was used to collect the GYTS data, and students completed the scannable paper-based sheets in their respective classrooms in the absence of their teachers. The questionnaire was anonymous to ensure the

[3]GTSS stands for Global Tobacco surveillance, and was established by the World Health Organisation (WHO) and Centres for Diseases Control and Prevention to assist WHO member states in monitoring tobacco use and implementing tobacco control programs.

confidentiality of students' responses. The GYTS standard questionnaire is composed of core questions focusing on the prevalence of cigarette and other tobacco use, as well as information on the determinants of tobacco use, such as access to and availability of cigarettes and other tobacco products, knowledge about and attitude towards smoking, media and advertising, exposure to other people's smoking, and tobacco cessation. The GYTS data also comes with sample weights to account for complex sample design effects, school, and class, as well as student non-responses and overall population representativity. All the results presented in the subsequent analysis are weighted.

3.2 Study variables

The status of tobacco consumption among adolescents in Lesotho is examined using three dependent variable measures: current cigarette smoking, current consumption of any smokeless tobacco product (chewing tobacco, snuff, and Best Blend (BB)), and current use of any form of smoked tobacco products other than cigarettes (cigars, water pipes, cigarillos, and pipes). In line with the literature, the current cigarette smoking is derived from the question, "In the past 30 days, for how many days did you smoke cigarettes?" I generated a new dummy variable called current cigarette smoking, which equals 1 if a student has smoked cigarettes for at least a day in the past 30 days and 0 for those who have not smoked for 30 days (i.e., a month). Similarly, the current use of other smoked tobacco products equals 1 if a student has smoked other smoked tobacco products for at least one day a month and 0 otherwise. The current use of smokeless tobacco is also a dummy variable that equals 1 if a student has used smokeless tobacco for at least one day in a month and 0 otherwise.

I selected the explanatory variables in line with the Theory of Triadic Influence (TTI), choosing from the literature those found to have a statistically significant relationship with current tobacco use among adolescents (Veeranki et al., 2015; Kabir et al., 2015; Duko et al. 2019; Itanyi et al., 2020). These explanatory variables are of five types:

sociodemographic, environmental, knowledge factors, tobacco media and promotions, and perception factors about tobacco use. Sociodemographic variables include age, gender, a categorical variable about parental smoking, and a dummy variable of whether a student has friends who smoke. Environmental variables include exposure to other people's smoking inside the home in a week, exposure to other people's smoking outside the home (in public) in a week, and the availability of loose cigarettes at a nearby retail store.

Knowledge factors include parental discussions and teaching at school about the dangers of tobacco. Tobacco media and promotions include billboard cigarette advertisements, newspaper cigarette advertisements, anti-tobacco smoking media messages, and exposure to tobacco industry promotions (whether a tobacco industry representative has ever offered a student a free cigarette). Lastly, perception factors include a dummy variable of perceived risk from smoking, perceived risk from secondhand smoke (SHS), and the perceived impact of smoking on weight (i.e., whether smoking is perceived to result in weight gain, weight loss, or has no effect).

In the economics of tobacco control literature, tobacco prices have generally been found to be the single most significant determinant of youth smoking. Due to data limitations on the price data for Lesotho, this study does not include tobacco prices in the econometric model. This is an enormous limitation of the study. I discuss in detail the implications of omitting price in section 5, the study limitations subsection.

3.3 Logit Model Specification

Given that the dependent variables are dummy variables, a discrete choice model, i.e., the logit model, is employed. Specifically, a logit regression is estimated separately for each tobacco product (cigarettes, smokeless tobacco, and other smoked tobacco) by gender.

The underlying assumption for this model is that the probability of whether an individual is a smoker or not is determined by the marginal utility or propensity that captures the actual smoking status of an individual. Therefore, the logit model is derived from an underlying **latent variable model** that satisfies the classical linear regression model (CLRM) assumptions. Let **y*** be the latent variable that captures the true smoking status of an individual, which is written as:

$$y^* = \boldsymbol{X}'\beta + \varepsilon\,, y = 1[y^* > 0] \qquad (3.3.1)$$

Where 1[.] defines the index function for the dummy outcome, and equals 1 if the event in brackets, i.e. smoking, occurs and 0 otherwise. Further, I assume exogeneity (i.e., ε is independent of X and follows the standard logit distribution). Therefore, from equation 3.3.1, the response probability for smoking (y) is given as:

$$\begin{aligned} P(y = 1|\boldsymbol{X}) &= P(y^* > 0|\boldsymbol{X}) \\ &= P(e > -\boldsymbol{X}'\beta|\boldsymbol{X}) \\ &= 1 - F(-\boldsymbol{X}'\beta) \\ &= F(\boldsymbol{X}'\beta) \qquad (3.3.2) \end{aligned}$$

Where F is the standard logit distribution function for the error term.

The outcome of discrete choice models (dummy variables) follows a Bernoulli distribution with one trial with probabilities of occurrence given in 3.3.2. The logit model is estimated through the Maximum Likelihood estimation procedure. Thus, to obtain the likelihood estimator, conditional on the independent variables, the probability mass function of smoking a particular tobacco product, y_i, given $\boldsymbol{X}_i$, is shown as:

$$f(y_i|\boldsymbol{X}_i) = \left(F(\boldsymbol{X}'\beta)\right)^{y_i}\left(1 - F(\boldsymbol{X}'\beta)\right)^{1-y_i}, \qquad y = 0, 1 \qquad (3.3.3)$$

The log-likelihood function of observation i is given by:

$$\ln L_i(\beta) = y_i \ln F(\boldsymbol{X}'\beta) + (1 - y_i)\ln\left(1 - F(\boldsymbol{X}'\beta)\right) \qquad (3.3.4)$$

For the random sample (n), the likelihood function is given as:

$$\ln L_n(\beta) = \sum_{i=0}^{n} \{y_i \ln F(\boldsymbol{X}'\beta) + (1 - y_i) \ln(1 - F(\boldsymbol{X}'\beta))\} \quad (3.3.5)$$

Therefore, the correct model specification is given as:

$$P(Tobacco = 1|\boldsymbol{X_i}) = F(\boldsymbol{X_i}'\beta) = \Lambda(\boldsymbol{X_i}'\beta) \quad (3.3.6)$$

Where $\Lambda(\boldsymbol{X_i}'\beta)$ is the logit distribution function.

Tobacco consists of cigarettes, other smoked tobacco, and smokeless tobacco. The logit regression model, equation 3.3.6, is estimated separately for each product by gender.

$\boldsymbol{X_i}$ includes all the explanatory variables. All the regressors are dummy variables.

The average partial effect of the explanatory variables on the probability of smoking tobacco (cigarettes, other smoked tobacco, or smokeless tobacco) is calculated as follows:

$$\frac{\partial P(y = 1|\boldsymbol{X_i})}{\partial x_1} = \Lambda(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k) - \Lambda(\beta_0 + \beta_2 x_2 + \cdots + \beta_k x_k) \quad (3.3.7)$$

Where x_1 is any explanatory dummy variable.

4. RESULTS

4.1. Descriptive Statistics

Table 1 compares the descriptive statistics for the selected characteristics of adolescents in the two waves of the GYTS to get a better sense of the data used. In both surveys, there were more females than males (2000 females compared to 1693 males in 2002 and 1717 females compared to 1377 males in 2008). Agewise, there were significantly more students aged 11 to 13 in 2008 than in 2002, and significantly fewer students aged 15 to 17 in 2008 than in 2002. From 2002 to 2008, the percentage of students who had mothers as the only household smokers increased significantly, from 4.8% to 5.59%. The proportion of students seeing other people smoke inside homes and in public decreased significantly. However, the proportion of seeing people smoke in public (52.3%) continued to be greater than seeing people smoke inside homes (39.58%). The estimated percentage of students who reported discussions about tobacco use with their parents or at school was significantly lower in 2008 than in 2002. In 2008, the proportion of students who were taught about tobacco dangers at school (49.56%) still exceeded that of students who were taught about the dangers by their parents at home (31.42%).

Although tobacco advertisements on billboards and in newspapers/magazines were significantly fewer in 2008 relative to 2002, most students were still exposed to them. Approximately 59% and 61% had seen billboard and newspaper/magazine advertisements, respectively. In comparison, in 2002, roughly 66% and 65% of students had seen billboard and newspaper/magazines advertisements, respectively. The tobacco industry's influence through free cigarette offers to young people continued to rise and increased by 5.47[4] percentage points (30%)[5] over the six years between the surveys. The proportion of those seeing anti-smoking messages decreased significantly, by 7 percentage points.

[4]Percentage points = $23.44\% - 17.97\% = 5.47$ percentage points

[5] Percentage (%) change = $\frac{Free\ \ cigarette\ \ \ offers_{2008} - Free\ \ cigarette\ \ \ offer_{2002}}{Free\ \ cigarette\ \ \ offer_{2002}} \times 100 = \frac{23.44\% - 17.97\%}{17.97\%} \times 100 \approx 30\%$

In 2002, more than 6 in 10 students perceived smoking and SHS to be harmful, and this fell to 5 in 10 students in 2008. Despite the decline, the proportion of students thinking of smoking as harmfully reducing weight was still as high as three-quarters. Nevertheless, the proportion of those who thought smoking increases weight increased significantly, by 69% since 2002.

Table 1: Descriptive Statistics

Background characteristics	GYTS 2002 (4147)		GYTS 2008 (3426)		P-Value
	n	%	N	%	
Demographic					
Age					
11 years or younger	186	4.58	286	8.72	0.000
12 years	255	5.43	449	11.31	0.000
13 years	500	10.69	490	13.87	0.0026
14 years	735	17.58	569	17.35	0.2472
15 years	754	19.74	545	18.53	0.0125
16 years	788	20.89	462	15.06	0.000
17 years or older	732	21.09	441	15.15	0.000
Gender					
Male	1693	41.73	1377	42.99	0.3949
Female	2200	58.27	1717	57.01	0.3949
Parental Smoking					
None	2046	59.61	1486	58.15	0.000
Both	178	6.04	141	5.06	0.9024
Father Only	973	29.55	822	28.21	0.1996
Mother Only	146	4.8	145	5.59	0.0625
Guardian	-	-	90	2.99	-
Peer Smoking					
Yes	1534	38.1	1287	37.47	0.5428
Environmental					
Exposure to other people's smoking inside home					
Yes	1707	44.67	1330	39.58	0.0642
Exposure to others people's smoking in public					
Yes	2523	62.69	1695	52.3	0.000

Loose cigarette availability					
Yes	-	-	1799	55.64	-
Knowledge					
Parental discussions					
Yes	1853	44.14	955	31.42	0.000
Taught dangers of tobacco					
Yes	1712	52.21	1267	49.56	0.0133
Media					
Billboard Adverts					
Yes	2701	65.6	1786	58.66	0.000
Newspaper Adverts					
Yes	2638	65.44	2008	61.29	0.006
Anti-smoking media messages					
Yes	3085	74.67	2255	67.24	0.000
Free cigarette offer					
Yes	654	17.97	690	23.44	0.000
Perceptions					
Perceived risk from smoking					
Yes	2702	63.47	1668	51.91	0.000
Perceived risk from SHS					
Yes	2640	62.32	1565	51.5	0.000
Perceptions of smoking on weight					
Gain weight	252	6.35	395	10.7	0.000
Lose weight	3347	82.31	2337	74.47	0.000
No difference	513	11.34	554	14.87	0.000

Source: Author's own computations from Lesotho GYTS 2002 and 2008.
Notes: n is unweighted, but the proportion (%) is weighted. The proportions for guardian smoking and availability of loose cigarettes in 2002 are missing since the GYTS 2002 did not have information on these variables. P-values are for the difference in means t-test.

4.2. Prevalence of tobacco use

Table 2 compares cigarette smoking prevalence among male and female adolescents aged 11 to 17+ years for 2002 and 2008. The results show that male cigarette smoking prevalence was lower (17.78%) in 2008 than male prevalence in 2002 (23.04%). In contrast, female cigarette smoking prevalence in 2008 (8.29%) was higher than the

prevalence in 2002(6.05%). Overall, cigarette smoking prevalence decreased insignificantly from 2002 to 2008. Figure 1 reveals that cigarette smoking initiation (i.e., trying/experiencing cigarette smoking for the first time) increases with age, starting from as early as age 7. In particular, a larger proportion (more than a quarter) of the students in both years began their first cigarette sucking at 14 years or older.

Table 2: Cigarette smoking prevalence by gender between 2002 and 2008

	2002				**2008**		
	Male (n) (%)	Female (n) (%)	Total (n) (%)	$\|t^{cal}\|$ (P-value)	Male (%)	Female (%)	Total (%)
Current smokers							
Yes	301	140	441	0.8809	205	137	342
	(23.04%)	(6.05%)	(12.89%)	(0.3784)	(17.78%)	(8.29%)	(12.24%)
No	1182	1890	3072		924	1334	2258
	(76.96%)	(93.95%)	(87.11%)		(82.22%)	(91.71%)	(87.76%)
Total	1483	2030	3513		1129	1471	2600
	(100%)	(100%)	(100%)		(100%)	(100%)	(100%)

Source: Author's own computations from GYTS 2002 and 2008.

Notes: The frequencies (n) are unweighted, and the proportions (%) are weighted. GYTS 2002 only includes information on cigarette use. Hence, the 2002 smoking prevalence for other smoked tobacco and smokeless tobacco products are not computed. The t-statistic corresponds to the two-sample t-test for assessing the difference in cigarette use between 2002 and 2008.

Figure 1

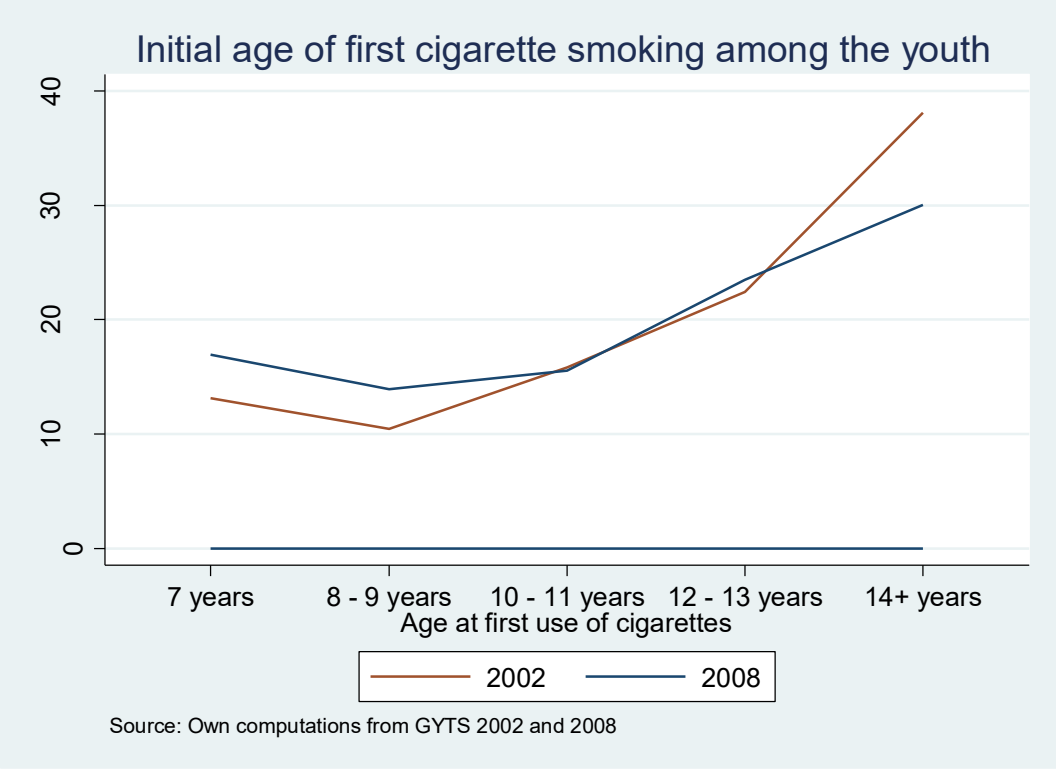


Table 3 shows the prevalence of other smoked tobacco and smokeless tobacco products by gender. It reveals that in 2008 the smokeless tobacco prevalence (18.93% for males and 15.31% for females) was higher than the prevalence of other smoked tobacco (16.65% for males and 11.92% for females) among both males and females. Thus, for all three tobacco products, the male smoking prevalence was higher than the female smoking prevalence.

Table 3: Prevalence of Other Smoked Tobacco and Smokeless Tobacco in 2008

	Males		Females		Males and Females	
	n	Prevalence (%)	n	Prevalence (%)	n	Prevalence (%)
Current smoked tobacco use						
Yes	224	16.65%	196	11.92%	420	13.94%
No	1,097	83.35%	1,477	88.08%	2,574	86.06%
Total	1,321	100%	1,673	100%	2,994	100%
Current smokeless tobacco use						
Yes	260	18.93%	264	15.31%	524	16.87%
No	1,102	81.07%	1,434	84.69%	2,536	83.13%
Total	1,362	100%	1,698	100%	3,060	100%

Source: Author's own computations from GYTS 2008.
Notes: The frequencies (*n*) are unweighted, and the prevalence rates (%) are weighted.

Furthermore, figures 2 and 3 show that, overall, smokeless tobacco use has the highest smoking prevalence in all age groups among male and female tobacco users. Most notably, among males, smokeless tobacco is consumed most intensively (highest smoking prevalence of above 10%) by younger adolescents (11 years or younger) and older adolescents (17+ years). In comparison, among females, smokeless tobacco has the highest prevalence rate among adolescents in the middle age-group (14-15 years).

Among males, cigarettes have the second-highest prevalence rate among higher age-groups (15–16 years); other smoked tobacco use has the second-highest prevalence rate among the lower age-groups (11-14 years). In contrast, other smoked tobacco is the second most common product among female adolescents in higher age groups (14 – 17 years). Cigarettes are the second most common product among lower female age-groups (12 – 13 years). Overall, these results show the existence of gender and age disparity in the use of different tobacco products.

Figure 2: Distribution of tobacco use, by age, among males.

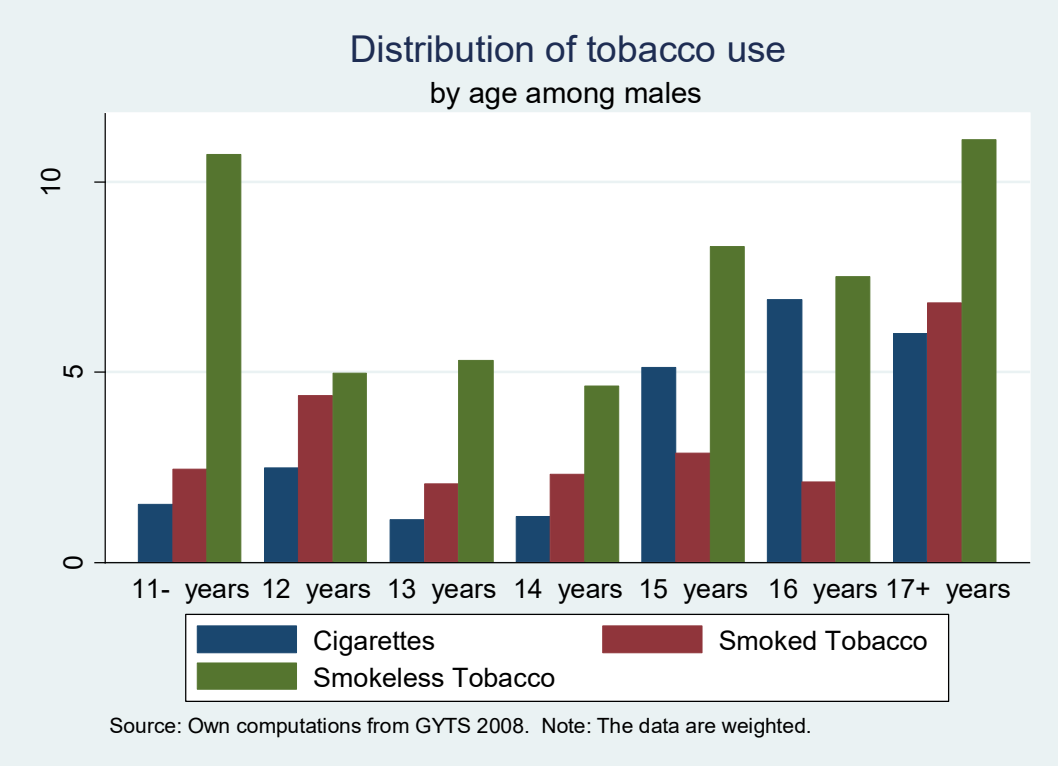
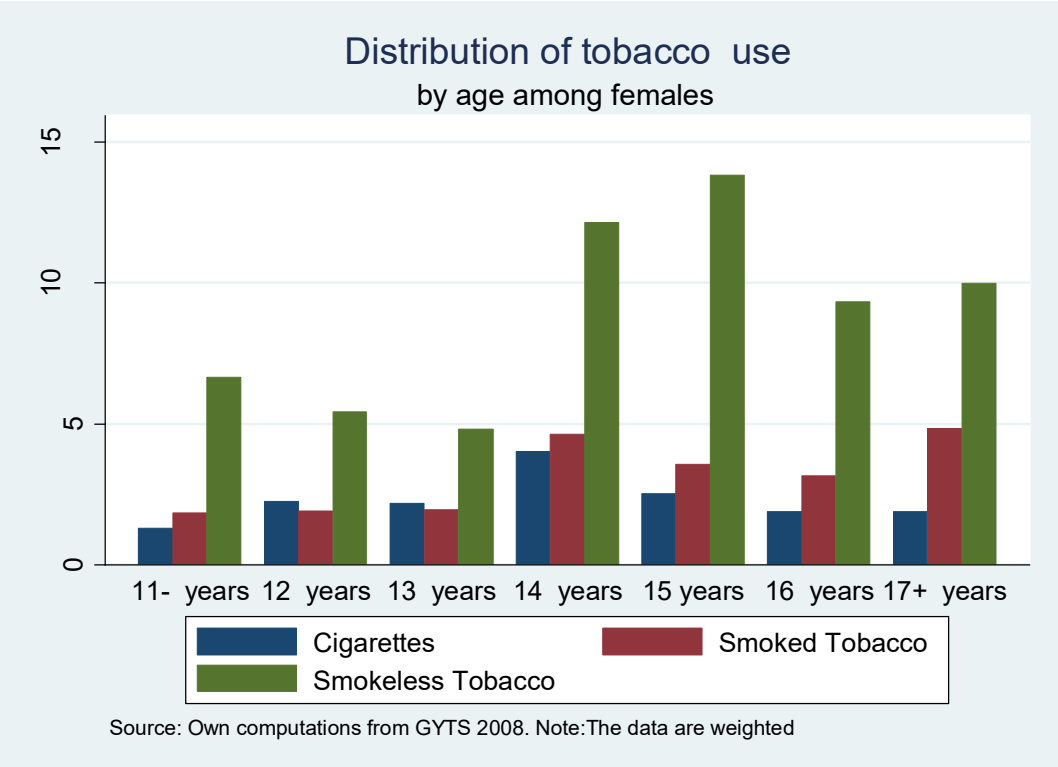


Figure 3: Distribution of tobacco use, by age, among females



4.3.Regression Analysis

4.3.1 Logit Models

Table 4 shows the regression results of the correlates of cigarette smoking for males and females separately. It shows both the marginal effects (Logit Average Partial Effect (APE)) and Odds ratios. Logit coefficients are not presented since, econometrically, they do not make intuitive sense and cannot be interpreted. Only their signs can be interpreted. The best and most intuitive way to interpret the logit model is through the average partial effects (Stock and Watson, 2011). The odds ratios are also presented since this is normal practice in public health and tobacco research.

With reference to column 1 and column 3, as males become older, the probability of smoking cigarettes increases significantly. Males aged 15 years are 11.3 percentage points more likely to smoke than those aged 11 years or younger. Those aged 16 years are 16.7 percentage points more likely to smoke than those aged 11 or less. Similarly, males aged 17 years or older are 18.3 percentage points more likely to smoke than males aged 11 or less. In contrast, for females, those in other age groups (12 – 17+ years) are insignificantly less likely to smoke cigarettes than those aged 11 years or younger.

Males whose fathers are the only smokers in the household are 8.8 percentage points more likely to smoke than those whose parents do not smoke. On the other hand, those who have mothers as the only smokers (or users of any tobacco product) in the household are insignificantly, less likely to smoke than those with non-smoking parents. Peer smoking is highly statistically significant in increasing the probability of smoking cigarettes for both males and females. Males who have smoking friends are 13.9 percentage points more likely to smoke than those who have non-smoking friends.

For females, those with smoking friends are 8.87 percentage points more likely to smoke than those who do not have smoking friends. Parental discussions about the dangers of tobacco use decrease the males' probability of smoking by 3.79 percentage points compared to males whose parents have never discussed the hazards of smoking with them. For females, parental discussions have an insignificant effect on the probability of smoking.

With regard to cigarette advertising, males who have seen advertisements in the newspapers and magazines in the past 30 days (i.e., one month) are 9.01 percentage points more likely to smoke than males who have never seen them. Newspaper/ magazines advertisements are very significant in stimulating males' chances of smoking but insignificant in increasing females' probability of smoking. Anti-smoking messages have surprising and unexpected results. Male students who have seen the anti-smoking media messages in a given month are 6.7 percentage points more likely to smoke than those who have not seen them. Availability of loose cigarettes at nearby retail outlets increases the chances of males smoking by 6.7 percentage points and of females smoking by 3.8 percentage points compared to those for whom loose cigarettes are not available in this way. Of the two genders, only females who have been exposed to other people's smoking inside their homes are 5.68 percentage points more likely to smoke than those who have not.

Exposure to other people's smoking in public places has a significant association with males' cigarette smoking only. That is, male students who are around people who smoke in public places are 15.9 percentage points more likely to smoke cigarettes than those who are not. Perceptions of the effects of smoking on weight indicate that males who believe that smoking results in weight loss are 13.5 percentage points less likely to smoke than those who perceive smoking as increasing weight. Similarly, males who perceive that smoking does not make any difference in weight are 12.3 percentage points less likely to smoke compared to those who perceive smoking as

increasing body weight. Perceptions of the effect of smoking on weight have an insignificant association with females' smoking.

Table 4: Logit regression output of cigarettes among males and females

	Cigarettes			
	Males		Females	
	(1)	(2)	(3)	(4)
Independent Variables	Logit APE	Odds Ratios.	Logit APE	Odds Ratios
Age (Base: 11 years or younger)				
12 years	0.0396	2.151	-0.0298	0.599
	(0.0419)	(1.719)	(0.0556)	(0.577)
13 years	0.0464	2.392	-0.0256	0.649
	(0.0715)	(3.116)	(0.0612)	(0.645)
14 years	0.0236	1.632	-0.0383	0.5
	(0.0352)	(1.273)	(0.0474)	(0.381)
15 years	0.113**	5.694**	-0.0324	0.568
	(0.0485)	(4.368)	(0.0522)	(0.47)
16 years	0.167***	9.911***	-0.0448	0.429
	(0.0440)	(7.109)	(0.0486)	(0.377)
17 years +	0.183***	11.465***	-0.00895	0.87
	(0.0465)	(7.772)	(0.0631)	(0.842)
Parental smoking(Base: None)				
Both	-0.0645	0.328	0.0859	3.573
	(0.0552)	(0.359)	(0.0831)	(3.335)
Father only	0.0880**	2.773***	0.00192	1.041
	(0.0361)	(1.059)	(0.0214)	(0.462)
Mother only	-0.00562	0.924	-0.0195	0.62
	(0.0589)	(0.772)	(0.0316)	(0.523)
Guardian	0.0941	2.945	0.101	4.215
	(0.0820)	(2.581)	(0.121)	(5.174)
Peer/Friendship smoking	0.139***	5.886***	0.0887***	5.957***
	(0.0295)	(2.923)	(0.0177)	(1.698)
Parental discussions	-0.0379*	0.611*	-0.00121	0.976
	(0.0208)	(0.166)	(0.0367)	(0.726)
Billboard Adverts	-0.0156	0.82	0.0111	1.255
	(0.0267)	(0.277)	(0.0257)	(0.661)
Newspaper/Magazine Adverts	0.0901***	3.358***	0.00598	1.13

	(0.0212)	(1.119)	(0.0275)	(0.643)
Anti-smoking messages	0.0670*	2.494*	0.0286	1.912
	(0.0347)	(1.23)	(0.0200)	(1.113)
Offered free cigarette	0.0526	1.891	0.0200	1.458
	(0.0622)	(1.319)	(0.0220)	(0.574)
Taught effects	0.0161	1.227	-0.0168	0.718
	(0.0299)	(0.47)	(0.0141)	(0.19)
Loose cigarette availability	0.0670**	2.434**	0.0389**	2.455**
	(0.0310)	1.027	(0.0189)	(1.09)
Exposure to other ‘s smoking inside home	0.00588	1.077	0.0568***	3.249***
	(0.0286)	(0.39)	(0.0196)	(1.282)
Exposure to other’s smoking in public	0.159***	8.545***	0.0194	1.51
	(0.0251)	(3.048)	(0.0182)	(0.671)
Perceived risk from SHS	-0.0241	0.736	-0.00823	0.849
	(0.0229)	0.22	(0.0219)	(0.369)
Perceived risk from smoking	-0.0314	0.674	0.0158	1.382
	(0.0369)	0.309	(0.0285)	(0.792)
Perceptions of smoking (Base: Weight gain)		1		1
Lose weight	-0.135**	0.236***	-0.0502	0.419
	(0.0528)	(0.11)	(0.0448)	(0.279)
No difference	-0.123*	0.274**	0.00462	1.065
	(0.0629)	(0.172)	(0.0595)	(0.867)
Constant		0.001***		0.009***
		(0.001)		(0.013)
Observations	535		749	

Source: Author’s own computation from GYTS 2008.

Notes: The robust and clustered standard errors are in parentheses. The asterisks ***, **, and * show significance levels at 1%, 5%, and 10% respectively. The fact that marginal effects are typically non-linear functions of the estimated regressors does not guarantee that marginal effects will be significant if odds ratios are significant. Thus, marginal effects and odds ratios may have different levels of significance denoted by the asterisks (*).

Table 5 shows the regression results for the correlates of smokeless tobacco for males and females. Some explanatory variables, namely, the availability of loose cigarettes at a nearby retail outlet, billboard advertisements, newspaper advertisements, free cigarette offers, and perceptions of the effect of smoking on weight, are omitted in the

regression for other smoked and smokeless tobacco, as they are mainly related to cigarette use only.

Column 1 results show that male students of all other age groups are less likely to use smokeless tobacco compared to those aged 11 or younger. Most significantly, males aged 13 are 16.5 percentage points, and those aged 14 are 18.1 percentage points, less likely to use smokeless tobacco than those aged 11 years or younger. Of all the regressors in the male regression, only age groups 13 and 14 are statistically significant. For smokeless tobacco use among females, females of all other age groups are still less likely to smoke than those aged 11 or younger. However, relative to the 11 years or younger group, only females in the age groups 13, 14, 16, and 17 or older are significantly less likely to use smokeless tobacco (APEs/Marginal effects are all negative).

Table 5: Logit Regression Output of Smokeless Tobacco among Males and Females

	Smokeless Tobacco			
	Males		Females	
	(1)	(2)	(3)	(4)
Smokeless Tobacco	logit APE	Odds Ratios	Logit-APE	Odds Ratios
Age (Base: 11 years or younger)		1		1
12 years	-0.0600	0.7	-0.162	0.411
	(0.103)	(0.433)	(0.118)	(.255)
13 years	-0.165**	0.283**	-0.290***	0.118***
	(0.0804)	(0.182)	(0.0986)	(0.07)
14 years	-0.181***	0.23***	-0.217**	0.273***
	(0.0653)	(0.128)	(0.0988)	(0.137)
15 years	-0.0910	0.564	-0.153	0.438
	(0.0654)	(0.208)	(0.102)	(0.22)
16 years	-0.0166	0.912	-0.241**	0.219***
	(0.0735)	(0.37)	(0.0969)	(0.106)
17 years or older	-0.112	0.481	-0.223**	0.259**
	(0.0776)	(0.245)	(0.103)	(0.14)
Parental smoking (Base: None)		1		1
Both	0.0820	1.726	0.144	2.77*

	(0.0881)	(0.96)	(0.0992)	(1.553)
Father only	-0.00918	0.93	0.0427	1.442
	(0.0359)	(0.262)	(0.0322)	(0.359)
Mother only	-0.00714	0.946	0.183**	3.416***
	(0.0733)	(0.548)	(0.0868)	(1.604)
Guardian	0.107	1.991	0.0369	1.378
	(0.141)	(1.564)	(0.107)	(1.175)
Peer/Friendship smoking	0.0208	1.171	0.0412	1.417
	(0.0310)	(0.274)	(0.0294)	(0.348)
Parental discussions	0.0220	1.18	0.0888***	2.01***
	(0.0385)	(0.337)	(0.0338)	(0.495)
Anti-smoking messages	0.0370	1.338	0.0179	1.167
	(0.0320)	(0.339)	(0.0295)	(0.299)
Taught effects	0.0423	1.377	-0.0172	0.865
	(0.0538)	(0.589)	(0.0279)	(0.207)
Exposure to others' smoking inside home	0.0173	1.139	0.0505	1.514
	(0.0255)	(0.213)	(0.0439)	(0.532)
Exposure to others' smoking outside home	0.0647	1.641	-0.00535	0.956
	(0.0442)	(0.576)	(0.0420)	(0.339)
Perceived risk from SHS	-0.0291	0.801	0.0595*	1.675*
	(0.0503)	0.321	(0.0306)	(0.472)
Perceived risk from smoking	-0.0571	0.649	-0.0292	0.784
	(0.0419)	0.193	(0.0243)	(0.161)
Constant		0.212***		0.238**
		(0.118)		(0.135)
Observations	746		966	

Source: Author's own Computations from GYTS 2008.
Notes: Robust and clustered standard errors are in parentheses.The asterisks: ***, **, and * show significance levels at 1%, 5%, and 10% respectively.

Furthermore, females who have mothers as the only smokers in the household are 18.3 percentage points more likely to consume smokeless tobacco compared to those who have non-smoking parents. Counterintuitively, in contrast to the findings on cigarette smoking, parental discussions about the dangers of tobacco use show that females whose parents discuss tobacco use's repercussions are 8.88 percentage points more likely to consume smokeless tobacco than those whose parents do not discuss

the dangers of tobacco use. Similarly, perception factors also show significant counterintuitive results; females who perceived SHS to be hazardous to their health are 5.95 percentage points more likely to use smokeless tobacco than those who do not perceive any risk from SHS.

Table 6 shows the regression results for the correlates of other smoked tobacco among males and females. In the logit regression for males, all the explanatory variables are statistically insignificant except three variables, age group of 14, peer/friendship smoking, and perceived risk from smoking. Relative to students aged 11 years or younger, males aged 14 are, on average, 12.5 percentage points less likely to smoke other smoked tobacco products.

Males with friends who smoke any of the tobacco products are, on average, approximately 10 percentage points more likely to use smoked tobacco compared to students who do not have smoking peers. The same result, but in the opposite sign, applies to the perceptions about the risk of smoking. Male students who perceived smoking to pose health risks are 10 percentage points less likely to use smoked tobacco products than those who do not perceive smoking to be risky.

For females, only parental discussions about the dangers of tobacco use and exposure to others' smoking inside the home have a statistically significant association with females' use of other smoked tobacco. Counterintuitively, similar to smokeless tobacco use but different from cigarette use, females whose parents have discussed the consequences of tobacco use are approximately 9 percentage points more likely to smoke than those whose parents have not discussed the consequences. Female students who saw other people smoking inside their homes, in their presence, in a week are 4.24 percentage points more likely to smoke than those who have not had such experiences.

Table 6: Logistic Regression Output of Other Smoked Tobacco

	Other smoked tobacco			
	Males		Females	
	(1)	(2)	(3)	(4)
Smoked Tobacco	logit APE	Odds Ratios.	logit APE	Odds Ratios
Age (Base: 11 years or younger)		1		1
12 years	0.0398	1.28	-0.00796	0.934
	(0.0900)	(0.709)	(0.0925)	(0.738)
13 years	-0.0403	0.75	-0.107	0.228**
	(0.0756)	(0.405)	(0.0729)	(0.16)
14 years	-0.125**	0.311**	-0.0373	0.703
	(0.0603)	(0.174)	(0.0769)	(0.467)
15 years	-0.0816	0.522	-0.0163	0.866
	(0.0762)	(0.308)	(0.0766)	(0.565)
16 years	-0.00869	0.943	-0.0524	0.591
	(0.0602)	(0.382)	(0.0837)	(0.454)
17 years or older	-0.0299	0.811	-0.00856	0.929
	(0.0777)	(0.441)	(0.0874)	0.692
Parental smoking(Base: None)		1		1
Both	-0.0285	0.771	0.0171	1.206
	(0.0668)	(0.5)	(0.0691)	(0.863)
Father only	0.0348	1.31	0.0150	1.181
	(0.0556)	(0.555)	(0.0253)	(0.317)
Mother only	0.0291	1.257	-0.00967	0.888
	(0.0679)	(0.645)	(0.0532)	(0.6)
Guardian	0.165	2.853	0.0588	1.759
	(0.172)	(2.514)	(0.0631)	(0.928)
Peer/Friendship smoking	0.0980***	2.183***	0.0350	1.477
	(0.0284)	(0.464)	(0.0287)	(0.451)
Parental discussions	0.0444	1.41	0.0865***	2.401***
	(0.0474)	(0.507)	(0.0316)	(0.717)
Anti-smoking messages	-0.0296	0.794	-0.0284	0.738
	(0.0430)	(0.258)	(0.0326)	(0.24)
Taught effects	0.00907	1.075	0.0179	1.224
	(0.0345)	(0.295)	(0.0203)	(0.282)
Exposure to others' smoking inside home	-0.0152	0.885	0.0424*	1.581**
	(0.0276)	(0.197)	(0.0219)	(0.366)
Exposure to others' smoking in public	0.0101	1.084	-0.00736	0.922

	(0.0488)	(0.421)	(0.0268)	(0.275)
Perceived risk from SHS	-0.0251	0.818	0.0361	1.516
	(0.0544)	(0.355)	(0.0264)	(0.449)
Perceived risk from smoking	-0.104**	0.439**	0.0260	1.347
	(0.0415)	(0.148)	(0.0257)	(0.423)
Constant		0.269**		.061***
		(0.149)		(0.046)
Observations	738		962	

Source: Author's own Computations from the GYTS 2008.

Notes: Robust and clustered standard errors are in parentheses. The asterisks: ***, ** and * show significance levels at 1%, 5% and 10 % respectively.

5. DISCUSSION

5.1 On the Prevalence of Tobacco Use

Among the three investigated tobacco products, smokeless tobacco has the highest prevalence (16.87%), followed by the other smoked tobacco category (13.94%). Cigarette smoking has the lowest current prevalence at 12.24%, and there were no significant differences in cigarette smoking prevalence in 2002 and 2008. The fact that smoking prevalence among males exceeded that of females in all the three products suggests tobacco use, among the Lesotho youth, is predominantly a male activity. This is in line with Moshoeshoe (2012), who found that tobacco use is male-oriented even among Lesotho adults.

The results (figures 4 and 5),showing that tobacco prevalence is higher in the older age groups(15 – 17+ years) among both males and females, suggest that tobacco use is more common among students who have repeated school grades. That is, those who are below the grades that are normal for people of their age.[6]Since the students included in the 2008 GYTS were in standard 7, form A, and form B, the corresponding normal age for them would be 12, 13, and 14 years respectively. Thus, those aged above 14 but still in the grades surveyed have repeated at least a year. This result implies that smoking is mostly done by students who struggle academically, i.e., students with lower academic performance rather than those with higher. This supports Robert et al.'s (2018) findings in six European countries (Italy, Netherlands, Finland, Germany, Belgium, and Portugal).

5.2 On the Determinants of Tobacco Use

Overall, the results show that the relationship between tobacco use and various explanatory variables depends on the particular tobacco product and on gender. For

[6]In Lesotho's educational system, a child begins primary education at age 6 and completes standard 7 at age 12. By default, those in form A and form B should be aged 13 and 14 respectively. Therefore, a student who is below the grade that is normal for his/her age has had a lower academic performance and repeated grades while a student who is above the grade that is normal for his/her age might have skipped grades because of outstanding academic ability. However, skipping grades is not common and rarely happens.

males, cigarette smoking is correlated with different factors: demographic, environmental, the tobacco media, and access to and availability of cigarettes. For females, only demographics and access to and availability of cigarettes are factors that are significantly associated with cigarette smoking.

The gender-separated logit regression results show that, irrespective of gender, peer smoking is highly correlated with cigarette smoking. This is in line with other studies involving youth smoking in developing countries, such as Veeranki et al. (2015) in Madagascar, Mamudu et al. (2013) in Ghana, and Kabir et al. (2015) in Madagascar. It is evident that adolescents' smoking is strongly associated with their peers'smoking behaviour than with their parental smoking addiction. This association is even more pronounced for females. For instance, among males, having a friend who smokes increases the probability of smoking cigarettes by approximately 14 percentage points on average, while having a parent who smokes, especially a father, increases the probability of smoking by approximately 9 percentage points. Among females, only friendship smoking has a significant effect (8.87 percentage points) on the probability of cigarette smoking and parental smoking does not have any significant effect. Similarly, for other smoked tobacco, peer smoking has a significant association with smoking while parental smoking is insignificant.

Furthermore, in Lesotho, male adolescents' cigarette smoking behaviour is strongly positively correlated with the father's smoking habits. This may be because adolescents may consider smoking a norm and socially accepted, given that the head of the family smokes. This result is consistent with the findings of Kabir et al. (2015) and Mamudu et al. (2013) although, for Mamudu et al. (2013), the father's smoking habits had a significant association with cigarette smoking irrespective of gender. The probability of cigarette smoking increases with the easy access to and availability of loose cigarettes at nearby retail outlets irrespective of gender. This may be explained by Lesotho's weak tobacco-control laws regarding the sale of addictive nicotine products to young people. Cigarette advertising in the newspapers/magazines has a

strong significant relationship with males' cigarette smoking only. This may explain why cigarette smoking prevalence among males exceeds that of females. This result contradicts Veeranki et al. (2015) and Nikaj and Chaloupka (2014) who found that cigarette advertisements have a significant positive association with the females' smoking only.

In line with Veeranki et al. (2015), cigarette smoking among female adolescents is strongly associated with the home environment. This may be because when females are not at school, or during holidays, they are mostly at home doing home chores and are often exposed to people who smoke in their presence. Moreover, cigarette smoking among males is highly correlated with the public environment. This result contradicts Veeranki et al. (2015). The explanation may be that in Lesotho, during off-school terms and weekends, rural schoolboys are often ordered go to the veld to look after their family's animals and spend minimal time indoors, so they are mostly exposed to people who smoke publicly, i.e., on the veld. Those in urban areas spend most of their time in townships or at the sports arenas, watching movies, or playing football and are often exposed to people smoking publicly at these places.

The counterintuitive result that anti-smoking media messages have a positive association with cigarette smoking supports Veeranki et al.'s (2015) results in Madagascar. However, it contradicts Thrasher et al.'s (2006), and Onder's (2012) intuitive results in the United States (US) and Turkey, respectively. The counterintuitive result may be explained by the fact that the individuals' actions at the time of the survey can influence the pertinence and ability to clearly recall about the anti-tobacco advertisements and any discussions held for the past 30 days before the survey. These mixed results from anti-tobacco smoking messages reflect the nature of those anti-smoking messages that adolescents were exposed to (Veeranki et al., 2015). For Lesotho, it may suggest that anti-smoking messages are not designed in such a way that they strongly emphasise the consequences of smoking at a young age. Hence, adolescents may have confused these warnings with cigarette promotions.

The result that perceiving smoking to be risky has a significant negative association with smoked tobacco use deserves attention. Both perceived risk from smoking and perceptions of harmful smoking effects on weight generally have a negative relationship with adolescents' tobacco consumption, thus providing an important policy tool and direction for tobacco control. As shown in figures 1 and 2, trying one or two puffs of a cigarette starts as early as age 7.This implies that children may view smoking as a regular activity and may not be aware of the health repercussions and long-term implications of smoking, such as addiction. Consequently, introducing tobacco education in the early primary school grades as part of the Science subject is essential to instill knowledge about the effects and dangers of tobacco at a young age.

Equally important, strengthening the educational curriculum in terms of the frequency of lessons offered to adolescents about the negative health implications of smoking could lead them to see smoking as socially unacceptable (Mamudu, 2013). This can prevent tobacco use at an early age, even before they reach the adolescent stage. For Lesotho, this policy approach may be fundamental, given that the adolescents seem to confuse anti-smoking media messages with tobacco advertisements, as shown by the strange and unexpected result that anti-smoking messages have strong positive association with smoking.

The finding that parental/family discussions about tobacco dangers have different effects on particular tobacco products suggests that adolescents believe that some tobacco products are less risky than others and socially acceptable. Among females, parental discussions about the dangers of tobacco use have surprising results. Females whose parents discuss these dangers are more likely to use smokeless tobacco and other smoked tobacco, while for males, parental discussions decrease cigarette smoking. For females, this odd result may be because females view other smoked tobacco and smokeless tobacco as less risky than cigarettes, which may further be the reason for the higher prevalence of the use of smokeless tobacco and other smoked

tobacco compared to cigarettes. Secondly, given that female adolescents are often at home doing indoor chores, their parents may use tobacco in their presence and be less inclined to talk about smoking dangers. Policywise, this implies a need for parents with minors to have smoke-free homes (Farkas et al. 2000) since this can reduce and prevent smoking and exposure to SHS among adolescents (Mamudu et al. 2013).

5.3 On the Limitations of the Study

The GYTS data used are relatively old, meaning that it explains the smoking behaviour as it was in 2008. Nonetheless, given that cultural norms and beliefs change only gradually, the results still shed some light on Lesotho's current practices and behaviour (Moshoeshoe, 2019). Like other GYTS, the Lesotho GYTS only includes school-going adolescents and excluded all the students who were not at school on the day of the survey and those who do not attend school at all. Therefore, the results cannot be generalised to all the adolescents in Lesotho.

The logit regression analysis of cigarettes did not include prices. This is a considerable limitation, given that Kostova et al. (2011) and Nikaj and Chaloupka (2014) found that price is the single most important determinant of smoking among young people, especially in developing countries. This limitation might be the reason for some insignificant regressors. Also, unlike the linear models (Ordinary Least Squares estimation), in the logit model (Maximum Likelihood estimation), the omission of a relevant variable even if it is not correlated with any of the included regressors may produce biased coefficients since Logit is sensitive to unobserved heterogeneities (Mood,2010). Nevertheless, I used the GYTS data for only 2008 when assessing smoking determinants to ensure that prices are held constant. The fact that the data used are for only one year means that it is likely that tobacco prices did not change during that time.

In addition, given the cross sectional nature of the data and limited information on the individuals, classes and schools, it's not possible to account for the identification problems that fully characterise the empirical model of youth smoking. For instance, unobserved school specific factors such smoking behaviour of teachers, different schools policy on smoking and proximity to tobacco retail outlets, among others, affect smoking behaviour but can't be controlled for.

Furthermore, smokeless tobacco and other smoked tobacco have a higher smoking prevalence compared to cigarettes, but they had many insignificant variables. This may be because some variables deemed important were not included because of data unavailability. For instance, the amount of students' pocket money is significant. WHO (2015) indicated that smokeless tobacco is more prevalent among young people since it is generally cheaper than cigarettes. This means omitting amount pocket money in the regression may have biased the results. Urban-rural geographic location was also found to be a significant factor for smokeless tobacco use (Nyabongo, 2014, and Grover, 2020). Therefore, addressing all the above-mentioned limitations will enable future research to understand better and more precisely the determinants of youth smoking. Lastly, it may also be interesting to utilise the health beliefs model for future research to better understand the role of risk perceptions since the current study has found that there is an underestimation of the risk of tobacco use among the youth.

6. CONCLUSION AND POLICY RECOMMENDATIONS

This paper investigated the determinants and the prevalence of smoking among Lesotho youth by differentiating smoking by the type of tobacco product and by gender. The results revealed that youth smoking determinants differ by gender and tobacco product type. The overall smoking prevalence in each of the three tobacco products is above 10%, and this is not good from a health perspective; efforts should be made to ensure smoking is minimised.

The results on smoking determinants from the paper lead to three policy recommendations. First, even though Lesotho became part of the WHO Framework Convention on Tobacco Control (FCTC) in 2005 with the aim of making its tobacco-control laws effective, the country still has weak tobacco-control laws. Since 2015, the laws in operation have focused on tobacco cessation programmes and tobacco taxation; more needs to be done for effective tobacco control. The tobacco industry's influence continues to rise, evidenced by the fact that tobacco industry promotions in which free cigarettes are offered to young people have increased significantly by 30% since 2002. Therefore, the study recommends that Lesotho introduce a ban on tobacco advertising and cigarette promotions as soon as possible.

Secondly, the availability of loose cigarettes at retail stores has a high significance in increasing cigarette smoking irrespective of gender. Therefore, to minimise cigarette smoking, this thesis recommends that Lesotho enact a law to prohibit the sale of cigarettes individually, which increases their affordability. Equally important, the study found that trying one or two puffs of a cigarette increases with age from as early as age 7 years; the prohibition of the sale of loose cigarettes should go together with a strong restriction on cigarette sales to all those aged below 18 years.

Furthermore, smokeless tobacco and other smoked tobacco products have higher prevalence rates, and parental discussions about the dangers of their use surprisingly stimulate chances of consuming them, especially among females. Therefore, introducing tobacco education in the early primary grades as one of the main health topics taught in the Science subject and offering lessons at least once in a quarter is highly recommended to prevent smoking initiation. The anti-smoking messages in the media should be designed to have a formidable impact, emphasising the dangers of tobacco frequently to improve knowledge of smoking even among adults, whose smoking habits are positively associated youth smoking.

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