Health Burden and Economic Costs of Tobacco Smoking in Nigeria

CSEA
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Acknowledgment

This report was written by Dr. Adedeji Adeniran, Marco Castradori, Faiza Muntaka and Precious Akanonu under the supervision of Dr. Chukwuka Onyekwena. We appreciate the support of Ariel Bardach for the cost modelling and the assistance of Chimere Iheonu, Obinna Clinton Ogwuike, Enemaku Okpanachi and Samuel Chukwudi in data collection. We also acknowledge our consultant Dr Eniola Bamigbose who assisted in validation of the instruments used for the data collection.

Executive Summary

Globally, tobacco consumption continues to cause a huge burden of preventable diseases. Nigeria has been leading tobacco markets in Africa and the absolute number of active smokers remains one of the highest on the continent. Yet, little is known on the economic costs of cigarette smoking in Nigeria which prevents an effective policy response.

This study seeks to address this gap by estimating the economic costs of tobacco use across different groups, as well as the cost-effectiveness of tobacco tax interventions. The study consists of three separate undertakings that taken together, provide personal anecdotal evidence of the detrimental effects that tobacco consumption has in Nigeria; estimate the direct costs associated with tobacco-related diseases; and use an innovative methodology to estimate the indirect costs of tobacco-related illnesses, which were previously unavailable in the country.

A microsimulation economic model was developed within the framework of a multi-country project in order to estimate the burden attributable to smoking in terms of morbidity, mortality, disability-adjusted life-years (DALYs), and direct-indirect costs of care. We also modelled the impact of increasing cigarettes' taxes on this burden.

The analysis found that the Nigerian health system spends 526.4 billion Naira annually (in 2019 NGN, approx. U$D 1.71 billion) in health care treatment of illnesses caused by smoking. Also, 29,472 deaths were attributable to smoking, which represent around 4.9% of all deaths. This burden corresponds to 231,457 DALYs per year. If the price of tobacco cigarettes were to be raised by 50%, 23,838 deaths and 602,325 DALYs from smoking-attributable diseases would be averted in 10 years, with subsequent savings on health care costs, and increased tax revenue collection. In Nigeria, the tobacco tax collection does not currently fully cover the direct healthcare costs attributed to smoking.

We also supplement the quantitative result with qualitative analysis through Focus Group Discussion with smokers and caregivers across 6 states spread over the Nigerian six geopolitical zones. Four key themes emanated from the discussions with the participants. Tobacco smoking resulted into: psychological effect and change in physical health; stigmatization; reduced productivity; and fall in standard of living; and. Overall, the result underscores the need for broader tobacco control policies in Nigeria through more tobacco taxes and other supplementary measures.

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1. Introduction

Tobacco use is a leading cause of preventable death globally, causing the death of more than 8 million people annually (World Health Organization, WHO, 2019). Despite the decline in age-standardised tobacco smoking exposure by more than 1 percent per year between 2010 and 2019, tobacco remains the third leading risk factor for attributable disability-adjusted life year (DALYs) among Level 2 risks Global Burden of Disease (GBD, 2019). Studies have also shown that the poorest households, especially in low-income countries, spent as much as 10 percent of total household expenditure on tobacco, therefore reducing the amount of money available for other basic items such as food, education, and health care (WHO, 2004; Shah, 2014). This indirectly contributes to malnutrition, increased health care costs, lower standards of living and premature death (WHO, 2004).

All these challenges work against efforts towards human development globally, especially for low- and middle-income countries (LMICs). Globally, an estimated 1.3 billion people use tobacco products, of which 80 percent live in LMICs (WHO, 2020). While smoking prevalence in Nigeria is relatively low (at 5.6 percent, or 6 million adults), it is growing at an average of 4 percent per year Global Adult Tobacco Survey (GATS, 2012). Recent evidence also suggests that the tobacco industry increasingly markets its products to women and children in rural areas in efforts to increase market share (National Centre for Chronic Disease Prevention and Health Promotion, 2015).

In controlling tobacco use, a comprehensive approach is widely recognized as the most effective means of reducing the smoking prevalence rate of a population (WHO, 2015). This approach encompasses a range of fiscal policies, such as raising tobacco products' taxes and prices, as well as restrictions on smoking locations, sales to minors, advertising and marketing enforcement and community programmes.

Despite the seemingly clear appropriateness of these tobacco control measures, getting governments to implement effective tobacco control policies is a difficult challenge. For instance, tobacco taxation as a policy measure is proven to yield substantial health and fiscal benefits. Its appropriateness is not new knowledge as Adam Smith made the case over two centuries ago, "Sugar, rum, and tobacco, are commodities which are nowhere necessaries of life, which have become objects of almost universal consumption, and which are therefore extremely proper subjects of taxation" (Smith, 1843, p. 399). Yet only 32 countries in the world have imposed taxes on tobacco that constitute at least 75 percent of retail price, in line with World Health Organization recommendations (WHO, 2018).

In Nigeria, tobacco control efforts are weak, especially on the fiscal side. For several years, Nigeria had maintained an excise tax of just 20 percent ad valorem rate on the unit cost of production for locally produced tobacco products (Nigerian Customs Service, 2015). This amounts to about 12 percent of the retail price and an excise tax burden of about 6 percent of most consumed cigarettes in Nigeria (at NGN200 = US$0.66), which falls significantly short of the WHO-recommended benchmark of 75 percent. Hence, the Nigerian government established a new specific excise tax for tobacco products effective from June 2018 which sets a specific duty of NGN20 per pack (rising to NGN40 and NGN58 in 2019 and 2020 respectively) in addition to the 20 percent ad valorem excise duty. However, the new policy only increases excise tax burden from 12 percent to an estimated 17 percent, implying that a larger percentage of the tax share is still levied on ad valorem base, contrary to tobacco control best practices, and is still much lower than the WHO recommended benchmark. This signals the need for effective evidence-based tobacco control policies in Nigeria.

The apparent difficulty in implementing effective tobacco control measures is partly due to weak research evidence on the economic costs of tobacco. In this regard, the rest of this report details the multi-pronged effort by the Centre for the Study of the Economies of Africa (CSEA) to gather relevant information on the effects of tobacco use – information that can help fill the knowledge gap that prevents more effective policy design. Specifically, the study estimates the economic costs of tobacco use across different groups, as well as cost-effectiveness of tobacco control interventions. The study consists of three separate undertakings that, taken together, provide personal anecdotal evidence of the detrimental effect that tobacco consumption has in Nigeria; estimate the direct costs associated with tobacco-related diseases; and use an innovative methodology to estimate the indirect costs of tobacco-related illnesses, something previously unavailable in the country.

The remainder of this report is structured as follows: A review of the notions of direct and indirect costs follows this brief introduction. Section 3 presents a more in-depth picture of the tobacco situation in Nigeria. This section includes some summary statistics on general tobacco consumption trends, but also outlines some of the findings from a Focus Group Discussion on the effects of tobacco organised by CSEA aimed at providing a greater level of context to the advocated need for better data collection to inform more stringent policymaking. Section 4 outlines the objectives of the costing exercises undertaken by CSEA. Section 5 will focus on the methodology and results concerning the estimation of the direct costs of tobacco-related illness. This is followed by a section on the indirect cost estimation where the methodology used, and the emerging results will be delineated including the outcomes of a simulation of the potential effects of changes in taxation structures in Nigeria to more closely reflect WHO guidelines. Finally, Section 8 provides a summary and conclusion.

2. Economic Costs of Tobacco-Attributable Disease: An Overview

The cost of tobacco smoking as an economic activity should be considered to encapsulate all of the following costs: the healthcare expenditure – a direct cost incurred from the diagnosis and treatment of smoking-related diseases, medical supplies, the cost of conveyance to a physician, drugs prescription and over the counter medication and more – and the indirect cost, or the total economic loss in terms of excess rates of morbidity and mortality caused by smoking-related illnesses[1]. Explicitly, the indirect cost of morbidity typically includes reduced productivity, work absenteeism and premature disabilities and many more deleterious economic effects. Although indirect cost of mortality mainly contributes to reduced levels of productivity, economic cost represents the monetary burden on a tobacco consumer in the form of tobacco-related illnesses and premature death.

Another way of viewing direct cost of tobacco consumption for the economy is in the healthcare strain and what that diminishes from the government budget. Simply put, as government expenditure falls further into healthcare subsidization, an opportunity cost arises in the provision of capital goods and social amenities that will be foregone[2]. This means that in addition to the human and physical capital that would be depleted by tobacco-related diseases, government-provided enforcements would also be cut. Other things being equal, tobacco consumption is harmful to the economy. For instance, in 2010, the Lagos state economy spent ₦2.8 billion to subsidize tobacco-related diseases treatment[3]. These funds could have been channelled towards other pertinent needs in the state.

Further, Atkinson and Meade (1974)[4], in a purely economic framework, gave an illustration of social cost in the form of losses of well-being, pain and suffering. Such costs result from anxiety about the risks a smoker is running, the observation of, sympathy with suffering due to smoking related illness, grief and suffering at the premature death of a tobacco consumer. Another form of social cost takes the form of externalities to non-smokers in form of passive smoking, annoyance, fire risks as well as inexplicable circumstances[5].

The relationship between tobacco-related illnesses and economic cost is skewed towards most heavily affecting poor households and generates an adverse relationship between economic status and tobacco consumption. Explicitly, the higher the consumption of tobacco, the lower the health (Novotny et al. 2015) and standard of living of a consumer (de Beyer, 2005). Besides, this relationship has a ripple effect on the consumer as well as the society in general. Accordingly, the cost of treatment of tobacco illnesses is not only exorbitant but degrades the consumer's quality of life. In a household where a tobacco consumer is under medication for a tobacco-related disease, consumption of more beneficial goods is foregone as households spend funds on seeking healthcare (consultation, hospital bills, treatment costs) for tobacco-related diseases[6]. In addition, smoking tobacco takes up a large chunk of the household's budget of low-income household, thereby draining them of finances to cover vital expenditures. Subsequently, this further reduces the standard of living of the consumer and increases the consumer's cost of living, thereby reducing the consumer's marginal propensity to consume, their ability to produce, and generally their potential impact on the national economy. This

[1] (Goodchild, Nargis, & d'Espaignet, 2018)
[2] (Owoeye & Olaniyan, 2015)
[3] (Bamidele & Olanrewaju, 2015)
[4] (Atkinson & Meade, 1974)
[5] (Markadanya & Pearce, 1989)
[6] (Owoeye & Olaniyan, 2015)

could plunge the tobacco consumer/patient into poverty, which can ultimately lead to macroeconomic problems to the society at large[7].

For most African countries, an up-to-date cost of smoking is unavailable, likely because the region is at an early stage of the tobacco epidemic. Also, the African region has a relatively low mortality rate from chronic diseases caused by tobacco smoking while the reverse is the case with regards to infectious diseases. This could count as a reason why the cost of smoking may have been regarded with a lower precedence for the given countries. However, the prevalence of smoking in some countries in the region looms above that of some higher income countries, hence, the cost of smoking may perhaps be increasing as well[8].

Nigeria is one of the African countries that is experiencing a skyrocketing consumption of tobacco. For example, between 1970 and 2000, Nigeria's cigarette importation has risen more than a hundred-fold. However, as the prevalence of smoking increases, so is the associated mortality from tobacco-related diseases. GBD (2019) estimated that death from tobacco-attributable disease jumped 11.5% between 2010 and 2019. This invariably implies that economic costs of tobacco will be rising in Nigeria. Yet, a definite costs estimate is absence for useful policy guidance and tracking of the deleterious effect from smoking.

3. Approaches to Estimating the Costs of Tobacco Attributable Diseases

Various cost-estimation approaches have been employed in extant literature to estimate the costs of disease burdens. However, two of the most prominent approaches include: the prevalence-based approach and the incidence-based approach. With regards to the prevalence-based approach, it is often performed from a bottom-up approach by adding to the direct costs, the social costs from health insurance, social service and losses in value added (Habetha et al., 2012). Indirect costs from trauma due to tobacco disease and long-term costs due to aftereffects are also accounted for. Basically, the prevalence-based approach values the immediate costs linked to all active cases of tobacco related illness for a reference period. The key data needs for estimation are the number of tobacco related cases and the cost per unit of a tobacco related disease.

However, according to Shaya, Mullins, and Wong (2002), a cost projection which is based on prevalence alone will underestimate the cost of diseases if the incidence of that disease is increasing. Contrarily, in situations where the incidence of diseases is decreasing, the prevalence-based approach would lead to an overestimation of the cost of the disease.

With regards to the incidence-based approach, Hodgson and Meiners (1982) noted that this approach is more appropriate when examining disease burden over a long period of time. For the cost of tobacco related diseases, the incidence approach values all of the cost associated with new cases of tobacco related diseases in the future during the reference year. The incidence-based approach entails having detailed information of the duration of such disease (Hodgson, 1988). It also requires having the knowledge of survival rates of such disease since onset, the medical care and technology deployed for case management and the cost during the period of the disease. Also, the incidence-based approach

[7] (Hu, Mao, Liu, Beyer, & Ong, 2005)
[8] (National Cancer Institute/ World Health Organization, 2016)

further requires having knowledge of the impact of the disease on employment and earnings in order to account for the indirect costs.

The Health Economic Evaluation (HEE) model adopted for this study draws on both ideas in the prevalence and incidence-based approaches. Specifically, the HHE followed-up the lives of thousands of individuals in hypothetical cohorts with tobacco-attributed disease. It calculates the outcomes for each patient in an annual basis and used it for simulating each individual's history to derive aggregated population results in terms of health and costs (Pichon-Riviere et al., 2011). The model is flexible enough to assign to each patient key demographic and disease specific characteristics. While this gives the economic costs of diseases for a given year similar to prevalence-based approach, it is possible to update the values of the various input parameters for each patient in a yearly basis and calculate the event rates for outcomes on the basis of the variables and the underlying risk equations in order to derive a long-term disease burden similar to the incidence-based approach.

The HEE model combines simulation approach and secondary economic and demographic data; hence the data demand is less significant like in the other approaches. Particularly, the model entails three major advantages that make it useful for Nigeria and broader Africa. First, its suitability for a context of data scarcity like Nigeria's. Second, the model is adapted for the country context drawing on their peculiarities in national data availability and health system challenges. Three, its ability to use the model to interrogate different dimensions of tax burden (gender, age group) and simulation of policy responses.

4. The Tobacco Consumption Picture in Nigeria: Trends and Testimonies from Focus Group Discussions

This section begins with some compiled statistics about the prevalence and healthcare-related effects of tobacco consumption in Nigeria. After the more abstract, numerical data presentation, a more anecdotal form of evidence is presented. As one of the several data collection exercises carried out by CSEA, a number of smokers, former smokers, and caregivers were brought together to deliberate upon the most salient concerns regarding tobacco-related illnesses. The outcome of their discussions presents a daunting picture and complete a holistic background to justify the need for the costing exercises undertaken in this study.

4.1 Tobacco smoking prevalence, incidence, and mortality of related diseases in Nigeria

This sub-section of the study provides some of the key statistics on tobacco use and tobacco-related disease burden in Nigeria. The data presented is a combination of available datasets from other sources, and original data collected through fieldwork carried out by CSEA. Thus, this section highlights data on the prevalence of smoking in Nigeria, the health utilities associated with the diseases, and the crude mortality attached to each disease.

4.1.1 Smoking prevalence

We focus on smoking prevalence for smokers aged 35 years and above. Given the substantial lag between age of initiation into smoking and onset of health deterioration, benchmarking the analysis at 35 years yields a robust estimate of tobacco induced disease and deaths. Based on the most recent

GATS (2012) available for Nigeria, there is a higher proportion of men that smoke than women. This trend holds for early adulthood (35-39years), middle age (40-60years) and most part of old age (above 60 years). Similarly, the proportion of former smokers across age groups is also higher among men than women, although this is an indication of higher prevalence level among men. The overall quitting rate is low especially for critical ages between 35-50 years, when incidence rate of disease increases rapidly.

Table 1: Smoking Prevalence by Age and Gender

Age	Current Smokers - Men	Former Smokers - Men	Current Smokers - Women	Former Smokers – Women
35-39	9%	4%	1%	3%
40-44	7%	6%	9%	1%
45-49	8%	6%	2%	2%
50-54	12%	11%	6%	1%
55-59	11%	13%	4%	3%
60-64	13%	16%	8%	6%
>=65	8%	20%	9%	12%

Source: GATS NIGERIA 2012

4.1.2 Incidence of Tobacco Attributable Diseases

Cigarette smoking affects almost every human organ and has been attributed as the causal factor for many diseases. Tobacco contains many cancer-causing toxins and its prolonged usage exposes primary and secondary smokers to various coronary and non-coronary heart disease; cerebrovascular disease; chronic obstructive pulmonary disease (COPD); pneumonia and cancers. Smoking also elevates the risk of many respiratory and dental diseases. However, for this study, we focus on diseases with high linkages to tobacco use or smoking based on existent literature.

As detailed in Table 2, from the GBD [2019], many of the well-established smoking-induced illnesses are cancers. The health system in Nigeria is largely ill-equipped for treatment of such illnesses due to the absence of an early detection system. This is most critical in primary and secondary health institutions that are closest to the populace but lack access to modern treatment plans. These factors suggest that costs (measured by deaths or productivity lost) will be disproportionately large in the Nigerian context, despite its relatively low smoking rate.

Table 2: Annual Incidence of tobacco-attributable diseases, Nigeria (2019)

DISEASE NAME		MALE	FEMALE	TOTAL
Acute Myeloid Leukemia	C81-C96	1517	660	2177

Bladder Cancer	C67	845	429	1273
Cerebrovascular (Stroke)	I60 - I69	45810	50289	96099
Cervix Uterine Cancer	C51-C58	0	18269	18269
Chronic Lower Respiratory Disease; and Unspecified Chronic Bronchitis	J40 - J47	815708	818215	1633923
Diseases of the Arteries, Arterioles and Capillaries	I70-I79	55576	59126	114702
Esophageal Cancer	C15	1949	788	2736
Non-Ischemic Cardiovascular Diseases	I00 - I19; I26-I52	30226	38526	68752
Ischaemic Heart Diseases	I20 -I25	43522	32122	75644
Laryngeal Cancer	C32	990	53	1043
Lungs Cancer	C34	3978	1790	5768
Oral & Pharynx Cancer	C00 - 14	62809	87989	150798
Pancreas Cancer	C25	1404	1649	3052
Pneumonia & Influenza	J10 - J18	67416	61266	128681
Renal Pelvis Cancer	C64 - C65	2170	1892	4062
Stomach Cancer	C16	1610	1347	2957
Tuberculosis	A15 - A19	268289	207135	475423

Source: GBD, 2019

**I20- I25 includes: unstable angina and acute myocardial infarction*
**100 – I19 includes: Acute Rheumatic Fever; Chronic Rheumatic Heart Diseases; Hypertensive Disease; Pulmonary heart diseases; Other Forms of Heart Disease*
**I60 – 169 includes: stroke*

4.1.3 Specific mortality by tobacco-attributable cancers in Nigeria

We profile death from various tobacco-related diseases based on the most recent estimate from the Global Burden of Disease (GBD, 2019). The GBD database gives a prevalence and mortality rate of various diseases across different age groups and gender. Leading cause of death is non-ischemic cardiovascular disease for men and stroke for women. Death rate from cancer is lower than those arising from these cardiovascular diseases, but cervix cancer is the fourth highest leading cause for women (disaggregated data on deaths per cancer type found in Appendix II). The general trend shows death rate increasing for middle-aged and older persons (See tables 4 and 5).

Table 4: Crude Death Rate per 100,000 Men

	Types of Cancer									
Age	**Lung**	**Oral/ pharynx**	**Oesophagus**	**Stomach**	**Pancreatic**	**Kidney**	**Larynx**	**Leukaemia**	**Bladder**	**Cervix**
35-49	1.4	3.21	0.4	2.8	0.64	0.99	1.5	1.7	0.62	0
50-64	6	6.66	1.9	4.9	5	1.7	5.8	5.1	1.4	0
65+	7.6	13.52	8	20.2	18.1	0.59	8.1	10	8.2	0

Table 5: Crude Death Rate per 100,000 Women

	Types of Cancer									
Age	**Lung**	**Oral/ pharynx**	**Oesophagus**	**Stomach**	**Pancreatic**	**Kidney**	**Larynx**	**Leukaemia**	**Bladder**	**Cervix**
35-49	0.85	1.26	0.38	1.3	0.46	0.94	0.05	1.5	0.47	17.4
50-64	3.2	4.08	0.36	4.7	4.9	1.4	1.3	5.2	1.6	75.3
65+	4.3	8.57	3	9.6	21.5	1.6	2.1	9.9	2.7	95.7

4.2 Focus Group Discussions

Focus Group Discussions (FGDs) were employed to generate data and information for the purpose of achieving the aim of the study – the economic cost of smoking tobacco. FGDs are often applied to obtain knowledge perspectives and attitude of people about issues and seek explanations for behaviour in a way that will be less easily accessible in response to direct questions in one-to-one interviews[9]. Meanwhile, researchers use different forms of communication to access the informants or respondents through FGDs, hence it gives them the prospect to harness untapped information that is inaccessible by other research instruments.

Over time, FGDs have become pertinent research instruments for health and medical research. Particularly because most health-related conditions are created by social environments and made within the social context[10]. Also, FGDs as a research instrument is the most viable method for accessing public experience and understanding certain diseases. Similarly, it is apt for identification of ideas pertaining health risk behaviours/dangers as well as discovering the public perception on diseases[11].

[9] (Wong, 2008)
[10] (Carter & Henderson, 2005)
[11] (Wong, 2008)

Our Focus Group Discussions (FGDs) utilized purposive sampling to ensure diversity in diagnoses, age, gender, socioeconomic background, religion/beliefs and experiences where possible. Also, six states were selected across the geographical region of the country, which are known to have the highest prevalence of cigarette smoking based on the 2012 GATS survey[12]. Twenty (20) participants for FGDs were selected for each of these states; Adamawa (North-East), Anambra (South-East), Kano (North-West), Kogi (North-Central), Lagos (South-West), Rivers (South-South). Two groups of participants were considered critical for the FGDs, specifically; current or former smokers with tobacco-related illnesses, and informal caregivers (relatives, friends or neighbours) for household members with tobacco-related illnesses – across gender, age and socio-economic background. In both cases, targeted participants were both older men and women (above 35 years) as well as youths (below 35 years). No minors (below 18 years of age) participated.

Given the nature of the study, the sampling and data collection procedure guaranteed that there is confidentiality of the data collected and informed consent secured from the participants. The data collection was also preceded by approval and ethnic clearance from the Federal Ministry of Health. The information collected was on tobacco-related illnesses and its impact on productivity and well-being of households. As a limitation to the source of data, the risk of stigmatization to the participants was anticipated. In this regard, formal consent forms were sent out to the participants outlining the objectives and procedures of the study. Participants were made aware of the no cost implication of accepting to participate. Although little or no incentives were provided for the participants, the objective of the study being to promote better tobacco control policies in Nigeria was made known to them. The study is geared towards helping policymakers and other stakeholders understand the cost of tobacco use on individuals and the economy. The option to decline from participating was provided to the participants.

Particularly, for the course of this study, local facilitators (doctors) were engaged. The doctors for all the six states were responsible for the identification of willing participants (samples) and also ensured they were present on the day of the FGD. To capture the core aim of the study, fundamental questions were designed and asked in the course of the FGD; smoking history, experience prior to diagnosis, financial cost, non-economic cost (social cost), number of caregivers, lifestyle changes, as well as mitigating the impact of tobacco smoking on households. Questions were also asked to ascertain whether the respondent (tobacco smoker) has been diagnosed with any tobacco related diseases such as; Oral and Pharyngeal/Pharynx, Esophageal, Stomach cancer, Pancreas, Larynx, Lungs Cancer, Uterus cancer, Kidney and Pelvis cancer as well as Bladder Cancer. Tobacco related diseases also interested in are, Acute Myeloid Leukemia, Acute Myocardial Infarction, Unstable Angina, Non-Ischemic Cardiovascular Diseases (CVD), Stroke, Atherosclerosis, Aneurysms and Dissections, Embolism and Arterial Thrombosis, Pneumonia, Bronchitis/Emphysema as well as Tuberculosis.

A theme-specific summary of some of the highlights raised is presented below.

4.2.1 Fall in household standard of living

This theme is closely related to the notion of direct cost of tobacco consumption and illness. Specifically, in Nigeria, tobacco consumption is more prevalent in the lower income quintiles. As such, tobacco related illnesses and accompanying economic cost will be frequent among them.

[12] (GATS NIGERIA, 2012)

Correspondingly, the cost of hospital admission for in-patient and hospital visit for out-patient for tobacco-related disease patients, force the impoverished into debt traps as well as stern poverty. Responses from the FGD revealed that, most often, money set aside to be expended on food, education, and other households' needs is been shifted to healthcare. For instance, a female caregiver, who is a niece to one of the patients explained that:

Tobacco smoking affected his (patient) kids' education because they were never trained in school, he always didn't have enough money, he would rather use the money he has to smoke and drink with friends outside.

Furthermore, there are propensities that the patient in quest for healthcare may borrow or sell his/her property in order to cover his direct cost of illnesses. The implication is, high economic cost with higher healthcare burden of treating tobacco-related diseases can push the patient and his/her household into a vicious circle of poverty.

We faced the same problem with my brother in the specialist hospital in Yola, Adamawa State. We spent almost one (1) year in the hospital but the sickness was still the same. It reached the level that we sold our house and some of our belongings, yet the sickness persistedg until he lost his life simply because of smoking. It cost us a lot of our time, money, energy and many more including taking risks to stay with him because the disease is communicable.

Given that the majority of the patients are of the male gender – heads of households, their wives are left to bear the resulting financial burden. These they do with meagre and unreliable sources of income. Ultimately, the household will face a financial strain which will multiply into several negative effects on their consumption. One of the caregivers, who is the wife of the patient as well as a fish seller posited that:

I have used part of my capital to treat my husband. Our children dropped out of school as I could not afford to pay their school fees. Feeding has also become an issue.

Thus, tobacco smoking has multiple negative effects. The effects are not limited to the smoker/patient alone, but also on their families.

4.2.2 Reduced Productivity

Empirically, an inverse relationship is said to exist between tobacco-related diseases and productivity. Tobacco-related diseases weakens an individual's health which instigates absenteeism, early retirement and diminishes labor force in form of mortality[13]. This process leads to high dependency ratio, diminishes labor productivity which decreases GDP and ultimately intensifies poverty rate in a given state. Therefore, the economic implication is, an increase in tobacco-related illnesses lessen the economy's labor force through morbidity and mortality.

The FGD responses indicate that smoking decreases the productivity of both the patient and caregiver. Like every other ill-health effect, most respondents stated that tobacco-related illnesses results in a significant decrease in their productivity. While other respondents claimed that as a result of the illness, they lost their job as well as other opportunities. However, these scenarios are time-dependent, as the time to be spent on business activities or at the workplace is at the detriment of staying at the hospital. Narrated by a caregiver:

[13] (Bamidele & Olanrewaju, 2015)

It really affected my business because I had to stay with my friend at the hospital instead of going to work, thereby making me lose money.

Another respondent (smoker/patient), narrated how smoking reduced his level of productivity:

What I used to do before is not possible for me to do it now. Once I start working, I become tired immediately. I am a bricklayer, I used to lay 200 – 250 bricks a day, but the highest bricks I can lay now is 100 – 150 at most. Before I can work the whole day without complaining, but the case is different now.

Similarly, a caregiver also narrated how he lost his patient due to smoking:

I had a patient, who died at 42 years after diagnosis of lung cancer. The smoking behaviour of the patient also affected the wife, as she was diagnosed with upper respiratory system disease. The patient had smoked for 20yrs and always complained of occasional excessive coughing. He received a series of drug prescriptions from a chemist for about 1year due to lack of funds.

The reduction in productivity or business activities transmit into a financial strain. Thereby, plunging potential sources of income of the affected family into jeopardy.

4.2.3 Psychological Effects

Different forms of psychological effects have been identified as the cause as well as the hazards of smoking tobacco. Empirically, social and psychological factors influence the smoking of tobacco across smokers. However, there are other aligning factors that induce whether an individual becomes a regular smoker or otherwise. These include having friends or relatives who smoke and their parents' attitude to smoking. Young people living in poverty are likely to indulge in smoking as they become adults. For example, a respondent narrated what induced him to smoke:

> *I became a cigarette friend through my grandpa, he used to send me to buy for him, if I buy like one pack, I will remove one out of it without his knowledge and keep for myself. By so doing, I gradually became familiar with smoking up to the level that I use my money to buy for my personal use. As I am talking to you, I can consume 3 – 4 packs a day. I know it is very dangerous to my health but I can't stop taking it (cigarettes).*

In a nutshell, these factors also contribute to the level of individual stress. And as most adult smokers asserted, what induced them to smoking is the ability of nicotine tobacco to help them cope with stress[14].

For instance, a participant who is a caregiver as well as a nephew to a patient, while stating the history of his uncle's journey through tobacco smoking, stated that:

Some see smoking as a motivator and enhancer for work.

Alternatively, instead of helping people relax, smoking only elevates the levels of tension and anxiety as well as depression. As mentioned above, nicotine has an instant and fleeting upbeat factor through the release of dopamine, yet, this swiftly fades and creates a withdrawal syndrome. Ultimately, this emulates the symptoms of anxiety. This picture is similar to that of depression. Depressed individuals are known to have a lesser level of the natural level of dopamine which prompts happy feelings into the brain. Nevertheless, in the long run, the brain switches off the natural supply of dopamine, thereby increasing the level of depression whenever the smoker negates from smoking.

[14] (Mental Health Foundation, 2016)

For example, a female smoker that smoked for pleasure or when stressed or under pressure proclaimed that:

Whenever I did not smoke, I get pissed off and aggressive easily. I also have mood swings.

Also reported in the FGD is emotional trauma. The patient and his immediate family get emotionally afflicted from the strain caused by the patient's/smoker's illness. Since most of the tobacco-related illnesses are contagious, the patient's family are prone to isolating themselves from the patient or smoker. This scenario is injurious to the mental wellbeing of both parties as it affects them psychologically. As indicated by one of the caregivers, also a sister to a patient:

My brother is the breadwinner of the family, his situation has affected family members' finance, time and emotional wellbeing -- everyone is afraid to lose him.

In another scenario, a female caregiver, who is a daughter to the patient, also stated how smoking actually got to them psychologically. Also, how their father's habit of smoking almost engendered the children into smoking:

It caused emotional trauma, and psychologically affected the family members. Even the kids tried smoking because they grew up seeing their dad smoke.

All the above mentioned are linked to social cost. The psychological effect does not only affect the individual but also his or her close relation. The anxiety, depression, emotional trauma is not only limited to the patient but also extends to the people around him (family, friends and colleagues).

4.2.4 Stigmatization

Literally, stigmatization is the general perception held by other individuals that certain individuals affected by a particular condition (nicotine dependence /smoking) are socially undesirable. Two major concerns emanate from this situation of stigmatization. The first concern is that of self-stigma, in the sense that, affected individuals (tobacco smokers) could internalize this public stigma and create a negative feeling about themselves, thereby creating self-stigmatization. Thus, self-stigma is self-labelling of oneself as someone with an objectionable habit in the society. However, this leads to a decline of self-esteem of an individual which in most cases is applicable to smokers in the recent times[15].

Most of the respondents identified "stigmatization" to be the major challenge they face around their community due to tobacco smoking. This demeaning consequence seemed to be more prominent among immediate and surrounding family members. Majority of the caregivers who were in attendance consisted of the patients' (respondents) family, affirmed this assertion. One of the patients interviewed disclosed that:

Whenever I want to send the neighbours' children on errands, the parents ask their children not to get close to me.

A caregiver of another patient narrated that:

My relative who had tobacco-related disease lost his self-dignity because of the issue of stigmatization. Even I and other relatives are being tagged as "relatives of a smoker".

[15] (Castaldelli-Maia, Ventriglio, & Bhugra, 2016)

Another concern is how stigma associated with smoking leads to late diagnosis of disease. The health workers are often held accountable in this regard as they blame the tobacco-related disease patients for their illnesses[16]. As narrated by a female caregiver:

My clients refused to go for normal or direct care because they are scared of what the physician might say and the cost of treatment.

A caregiver also explained how his client avoids treatment due to stigmatization:

My client prefers to look for alternative treatment instead of going straight to the hospital and that is because of stigmatization. He narrated his experience where he went to a hospital with his client and when his client called on the doctor to attend to him, the doctor screamed "Sit down there, am I the one that asked you to smoke and have problems?

These problems tally up and point to a similar direction – self-esteem. The self-esteem of the afflicted individual in most cases is being injured. In the long-run, this has a ripple effect as it affects the mental wellbeing of the individual, thereby increasing the number of illnesses he has to battle with. Also, stigmatization on the other hand will only boost the level of smoking of an individual which as earlier mentioned helps with relaxation even though it is a fleeting one.

4.3 General Trends and Observations

The data gathered from various sources on the consumption and disease burden of tobacco in Nigeria, as well as the FGDs, highlight the quantitative and qualitative impact of tobacco related disease on smokers and caregivers; The need for the generation of better, more informed data on the effects and costs of tobacco consumption; Improving tobacco-related knowledge sources, and building towards more informed policymaking is an evident need, particularly drawn out in the personal stories recounted during the FGDs.

Four key themes emanated from the discussions with the participants: psychological effect; stigmatization; reduced productivity; fall in standard of living; and change in physical health. Connections exists among these themes, such that one theme links with another. The psychological effect and stigmatization intersect at a point of self-stigmatization which ultimately leads to lower self-esteem. An overlapping point was also deducted from the FGD. Depression is one of the causes of smoking, yet, smoking also leads to depression which is induced by the excessive production of dopamine in the brain caused by nicotine consumption. By implication, smoking eliminates depression only in the short-run but worsens it in the long-run.

A daunting consequence of tobacco-related illnesses on smokers and care givers is the reduced level of productivity which has ripple effects. Statistics indicate that the prevalence of smoking is higher in men who are mainly family breadwinners. The implication is, the incomes of households diminish or even cease to exist, thus, decreasing the standard of living of the family and further plunging the household into poverty. Similarly, the direct cost of treatment does not only affect the patient, but also the caregiver as well as family members. This theme also links with the decline in living standards, as some households lose different forms of wealth in order to cover these direct costs. As a result, they tend to be thrown into a vicious cycle of poverty, widening their income inequality gap.

Having given an in-depth look at the current trends and effects of tobacco consumption in Nigeria at a statistical and more personal level, we provide an explanation of the costing exercises that were undertaken.

[16] (Wheaton, 2019)

5. Direct Cost Estimation

5.1 Methods

This section highlights some of the key features of the methodology used to collate the direct costs. First, we discuss the logic behind the selection of the hospitals surveyed highlighting their strategic locations and importance as hosts of the national cancer registry data. This is followed by a description of the process by which the direct medical costs were estimated. We conclude the section with a brief discussion of the relevance of this methodology in the Nigerian context.

5.1.1 The hospital selection process

Our methodology targets tertiary hospitals hosting Population-Based Cancer Registry (PBCR). There are 13 PBCRs across Nigeria and four host-hospitals are selected for this study. The hospitals selected include: The University of Abuja Teaching Hospital (UATH) and the National Hospital Abuja (NHA) both situated in Abuja; the University College Hospital, in Ibadan, Oyo State; and the University of Nigeria Teaching Hospital (UNTH) in Enugu State.

These four hospitals surveyed were selected with the express purpose of covering three distinct geopolitical and cultural zones across the country. Specifically, the selected venues covered the North-Central Region (covered by the hospitals in Abuja), the South-western region (Ibadan) and the South-eastern region (Enugu). Based on access to treatment facilities, these institutions are rated top within their respective region. This precautionary step thus enhances the representativeness of the data collected, and takes note of the vast social and economic differences that exist throughout the country.

Here, it is worth outlining briefly, the relationship between each of the surveyed hospitals to their respective PBCRs, and their role within their population centres. The Abuja Cancer Registry (ABCR) is domiciled at two of the selected hospitals UATH and NHA. The hospitals cover three Local Government Areas (LGAs) each, together encompassing the six LGAs in Abuja. It should be noted that, due to the relatively higher standard of treatment available in Abuja, and its location as the country's capital surrounded by four states without a PBCR, both UATH and NHA hospitals are destinations for patients from other, neighbouring states.

The Ibadan Cancer Registry (IBCR) located at UCH is the first cancer registry in the country created in 1962 and the second to have been established in Africa. There are only three PBCR in the entirety of Nigeria's South West, and the IBCR possesses the most extensive dataset, which facilitated our selection process.

Finally, the Enugu Cancer Registry, established in 1988, is domiciled at UNTH, Enugu and is the only PBCR in the South Eastern Region of Nigeria. Enugu also borders two states without a PBCR of their own.

5.1.2 The process of estimating direct medical costs.

The derivation of estimates for the medical costs of treatment inevitably hinges on an understanding of the standard treatment praxis, which is summarized here. On a patient's first hospital visit, a case file is opened and s/he is examined by a medical consultant who determines and carries out the procedures (test/drugs) required. In the case where the patient does not require close observation or cannot afford hospitalization, s/he is discharged and recorded as an Out-Patient. If the patient's assessment necessitates admission into the hospital as an In-Patient, the patient receives further

treatments and drugs for as long as it is required by the medical consultant. In the case where the patient is subsequently discharged without having fully recovered, s/he is placed on prescription drugs and may be required to visit the hospital at intervals for more drugs, tests and observation (as an Out-Patient). This is repeated until the patient gets well or dies. In the majority of cases, this is the general treatment procedure followed.

To obtain the cost of treatment of various diseases of interest, questionnaires were used as survey instruments. The questionnaires were categorized into two: active treatment - defined as the period during which the patient receives intensive treatment either via hospitalization or regular engagement; and post-active treatment - defined as the period following the active treatment phase when patients are less intensively monitored.

The methodology then followed a five-step process to ultimately obtain the cost of treatment for the various diseases determined to be of interest. These are detailed below:

1. Interviews were conducted with five doctors in Enugu, five in Ibadan, and seven in Abuja. The doctors provided information on the diseases of interest, treatment plan, prescription drugs and other procedures most frequently involved in treating the diseases of interest. They also listed the frequency for such events. For instance, the number of times a patient with lung cancer needs to run required blood tests (full questionnaire in Appendix I). We focus primarily on cancer and non-cancer cases with established causal links to cigarette smoking.
2. The procedures and prescription drugs obtained from the doctors in Step 1 were costed by visiting test centres (laboratories), wards and pharmacies, records departments and other departments within each hospital.
3. For drugs and tests not available in the hospitals, costs were sourced from pharmacies and tests centres within a 1 kilometre radius of the hospital in question. The proximity of the locations to the hospitals was such that doctors most often directed patients to the centres surveyed.
4. For each disease, we tabulated the list of procedures, their frequencies and the associated procedural cost. To calculate the cost of each procedure, the frequency of the procedure was multiplied by the cost of the procedure, so that the total cost of treating each disease was taken to be the summation of the cost of all procedures.
5. In the cases where post-active treatment periods exceeded 6 months, treatment costs were considered constant over this period. Hence, the costs of treatment are derived by extending the 6 months post-active treatment costs over the entire period in question.

5.2 Results

Table 7 reports the average across each of the four hospitals and Table 8 compares the cost of treating each illness to Nigeria's per capita GDP as well as the Naira value of the UN poverty line in 2019 (approximately NGN 137,140 according to NBS). Expectedly, most of the costs of treatment comes during the active treatment period. Particularly for cancers, the Active cost of treatment was found to often be in the range of 100 times greater than that of Post-Active treatment. This was significantly smaller for non-cancerous illnesses where the average cost of Post-Active treatment was between one-half and one-sixth of the Active costs. The notable exception was for Diseases of the Arteries, Arterioles and Capillaries which, in all four hospitals surveyed, were recorded to have no Active treatment costs – patients going directly into Post-Active treatment.

In general, cancers were found to be the diseases with the greatest treatment costs when Active and Post-Active costs were aggregated. The total costs of treatment for cancers were recorded to exceed the per capita national income (PCI) in many cases, almost doubling the PCI. Only non-Ischemic Cardiovascular and Cerebrovascular Diseases were found to exceed yearly national income among non-cancers, but are not up to 200 percent as was the case for all of the cancers.

Table 7: Cost of Treatment for Tobacco related Diseases in selected Locations

	Ibadan (N)		Enugu(N)		Abuja(N)	
Diseases	**Active**	**Post-Active**	**Active**	**Post-Active**	**Active**	**Post-Active**
Oral & Pharynx Cancer	1,270,400	14,600	1,031,580	21,800	3,587,780	25,280
Oesophagus Cancer	809,400	14,600	812,620	21,800	2,846,780	34,380
Stomach Cancer	898,310	9,070	983,430	9,070	2,452,010	30,250
Pancreas Cancer	1,170,400	14,600	1,013,490	21,800	4,791,670	36,170
Laryngeal Cancer	1,348,400	14,600	1,095,200	28,775	3,561,050	136,000
Lung Cancer	3,733,930	72,940	3,728,600	45,600	4,007,610	52,600
Cervix Uterine Cancer	2,300,600	30,500	2,317,720	30,500	2,821,050	30,400
Renal Pelvis Cancer	889,400	14,600	852,960	21,800	3,813,970	47,060
Bladder Cancer	860,400	14,600	842,960	21,800	2,563,170	47,060
Acute Myeloid Leukemia	1,564,450	105,500	1,425,910	105,500	3,569,050	108,500
Ischaemic Heart Diseases	233,200	171,985	235,865	171,985	280,880	107,720
Non-Ischemic Cardiovascular	997,000	140,500	902,775	144,245	1,257,624	172,020
Cerebrovascular Diseases	997,000	140,500	902,775	144,245	1,421,964	169,280
Diseases of the Arteries, Arterioles and Capillaries	0	273,200	0	293,333	0	213,200
Pneumonia & Influenza	42,550	6,920	50,620	3,500	95,540	3,050
Chronic Lower Respiratory Disease; and Unspecified Chronic Bronchitis	161,630	51,310	172,510	20,340	264,480	67,400
Tuberculosis	297,640	151,500	270,640	221,420	242,785	50,315

We also found variations in treatment costs across locations, with Abuja consistently having a higher estimate. For example, treatment of stomach cancer for an average patient costs about NGN 4 million

in Abuja, but just NGN 983,000 in Enugu and NGN 896,000 in Ibadan. The Key Informant Interview with doctors indicates that these cost differentials could be attributed to high costs of living in Abuja that feed into health institutions' billing procedures and availability of modern cancer treatment facilities and equipment compared to what is obtainable in Ibadan and Enugu.

The treatment of lung cancer has the highest average costs at more than NGN 3.88 million. This equates to some 565 percent of the national per capita income, and over 28 times the yearly income of someone living on the poverty line. Oppositely, the treatment of pneumonia and influenza has the least costs at about NGN 67,000. It is important to note the scale of these average expenditures in relation to the income of the average Nigerian household. Cancers in particular have an expenditure burden that often well-surpasses the yearly income of the average Nigerian, with lung cancer (565 percent) and Cervix Uterine Cancer (366 percent) standing out as especially burdensome. These statistics are particularly effective in highlighting the economic damage (beyond the health impact) that tobacco has in Nigeria.

Table 8: Average Treatment Costs Compared to Yearly Household and Poverty Line Income

Diseases	**Average**	**Weighted Average**	**% of per capita Income**	**Relation avg cost by per capita health expenditure% of Poverty Line**
Oral & Pharynx Cancer	1,983,813	1,714,859	289	70.11444
Oesophagus Cancer	1,513,193	1,264,945	221	53.51101
Stomach Cancer	1,460,713	1,266,866	213	51.61063
Pancreas Cancer	2,349,376	1,918,056	342	83.11710
Laryngeal Cancer	2,061,341	1,792,030	300	72.91500
Lung Cancer	3,880,426	3,851,526	565	137.22824
Cervix Uterine Cancer	2,510,256	2,446,750	366	88.81827
Renal Pelvis Cancer	1,879,930	1,525,267	274	66.51368
Bladder Cancer	1,449,996	1,241,534	211	51.31055
Acute Myeloid Leukemia	2,292,970	2,650,265	334	81.11668
Ischaemic Heart Diseases	400,545	402,411	58	14.2291
Non-Ischemic Cardiovascular	1,204,721	1,173,994	176	42.6877
Cerebrovascular Diseases	1,258,588	1,208,400	183	44.5916
Diseases of the Arteries, Arterioles and Capillaries	259,911	266,145	38	9.2189
Pneumonia & Influenza	67393	61,249	10	2.449

Chronic Lower Respiratory Disease; and Unspecified Chronic Bronchitis	245,890	232,556	36	8.7179
Tuberculosis	411,433	428,111	60	14.5299

6. Total Cost Estimation: Direct and Indirect Costs

Having outlined the procedure and results employed to obtain estimates for the direct cost of tobacco-related illnesses, we proceed to the presentation of the Health Economic Evaluation (HEE) model employed to obtain the estimates for the indirect, and thus the total cost of tobacco consumption and related illnesses in the country.

6.1 Methods

A model for estimating probabilities of people becoming ill or dying from smoking related conditions was performed following the input requirements and calibration process of the model done by (Pichon-Riviere et al. 2011). The model, programmed in Excel (Microsoft® Office Excel Professional Edition 2003) with Macros in Visual Basic (Microsoft Visual Basic® 6.3), corresponds to a first order Monte Carlo simulation, which carries out the analysis of a hypothetical cohort, along a discrete time period.

This model estimates a variety of outcomes as disease incidence, quality of life, health outcomes and healthcare costs, as well as other opportunity costs for each sex and age strata in Nigeria for smokers, ex-smokers and never-smokers from a first order Monte Carlo microsimulation. By incorporating the natural history, costs, and quality of life of all the tobacco-related adult-specific diseases, the model allows for mock-up lifetimes of individuals in hypothetical cohorts in which health outcomes will occur according to annual risk equations whether individuals are smokers, never-smokers or ex-smokers .

The health conditions analysed were coronary and non-coronary heart disease; cerebrovascular disease; chronic obstructive pulmonary disease (COPD); pneumonia; lung, mouth, larynx, pharynx, oesophagus, stomach, pancreas, kidney, bladder, and cervix cancer; and leukaemia.

We considered an estimated cohort of people of 35 years of age and older living in Nigeria in 2020. We used probabilities that reflect the risk of occurrence of acute and chronic events based on the relative risks (RR) of never-smokers (baseline incidence) against those of smoking status. Risk of death was defined according to the events and conditions that individuals suffered, including general mortality (by sex and age). Finally, using previously determined parameters of quality of life and unit costs, we estimated the costs and quality-adjusted life-years (QALYs) for the overall survival time of the cohort.

The study used the disability-adjusted life-years (DALY) approach to decompose years of life lost due to premature mortality (YLL) and years lost due to disability (YLD). However, DALYs were not age-weighted, and for the base-case scenario values, they were not discounted either. To estimate YLD, we used utility values identified through an extensive literature searching, where disability weights equal 1 – utility, while YLL was derived from Nigerian life tables.

Productivity losses and informal caregivers cost are considered as well. As regard the former, the value of statistical life is computed using the income generated by a person during his workable ages, assuming an income adjustment according to the growth of gross domestic product per capita from the last 60 years. As regard the latter, it was estimated through a literature review and expert consultations for getting the total hours of care needed for each event and those hours were prices considering different proxies to represent the opportunity cost of the informal caregiver (e.g. the minimum wage, the average expenditure of workers).

An analysis of the differences in events, deaths, and associated costs was conducted, in order to quantify the smoking-attributable disease burden. We did this initially by simulating a hypothetical Nigerian cohort without smokers or ex-smokers, and by running a cohort to which the prevalence of

smokers and ex-smokers were incorporated. The evaluation platform allows for the simulation of the effect of different strategies aimed at preventing and controlling tobacco consumption, such as increasing cigarette taxes. The model was validated and used to estimate the burden of disease attributable to smoking and the potential impact of different interventions.

Finally, we carried out a simulation of possible effects of increased taxation on a number of measures (another benefit of the HEE model). We explored three scenarios for price increase assuming policies for a cigarette tax increase that resulted in generating 25%, 50% and 75% total price increases. Furthermore, the model allows an adjustment by possible effect on illicit trade of tobacco because of the increase in prices of licit market. The effect of these price increases on the prevalence of smoking was calculated as:

$$Prevalence = Prev_B + \left(a * e_d + (1-a) * e_{cp}\right) * \Delta P * I_p * Prev_B$$

Where $\mathrm{Prev_B}$ is the baseline prevalence of smoking before price increase; α is the market share of legal tobacco products; $\mathrm{e_d}$ the price elasticity of demand; $\mathrm{e_{cp}}$ is the cross-price elasticity of demand between illicit and legal cigarettes obtained from literature; ΔP is the percent price variation for each scenario (25%, 50% or 75%); and $\mathrm{I_p}$ is the proportion of the variation on cigarette consumption expected to impact on smoking prevalence. $\mathrm{I_p}$ was assumed to range from 0.11 for a 25% price increase to a maximum of 0.34 for a 75% price increase. The reduction in prevalence assumedly affects all ages and both sexes proportionally.

6.2 Data Sources

Regarding epidemiological data, local sources of good quality were the first choice; when not available, international sources were used as a second option. If none of the previous options were available, an estimate was derived based on the best available data for the country. The probability of acute events, the incidence of chronic diseases and its progression, as well as mortality rates associated with the conditions analysed for each age and sex group, were drawn mainly by combining estimations from a local source and two different international sources. On the one hand, primary data were obtained from three public referral hospitals in Nigeria (National Hospital Abuja (NHA), University College Hospital (UCH), Ibadan, and University of Nigeria Teaching Hospital (UNTH), Enugu State). On the other hand, the Global Burden of Cancer (Globocan, 2020) and IHME's Global Burden of Disease (GBD, 2019) were the two international sources that provided important data in relation to these inputs. Epidemiological parameters for cancer were calibrated through a Markov model considering country-specific data on diagnosis and survival.

Since the model does not assess the consequences of passive smoking directly, the estimate of deaths, years of life lost, and costs associated with passive smoking were incorporated using approximations made in studies from the US, which can be considered conservative, since the US has been implementing smoking regulation long before Nigeria. Indeed, an additional burden of 13.6% in men and 12% in women over direct estimations was applied, based on studies of the U.S. Department of Health and Human Services (2020). Table 9 shows an overview of the main input parameters and its sources, grouped by type.

Table 9: Overview of main sources for model input parameters, by type

Parameter type	Description	Source
Demographics	• Population structure: adults 35-100 years of age	• National Bureau of Statistics Projections using 2006 Nigerian census data
Epidemiology	• Smoking prevalence (by sex and age group)	• GATS (Global Adult Tobacco Survey) Nigeria 2012
Epidemiology	• Mortality due to acute and chronic conditions (by sex and age group)	• GBD (Global Burden of Disease) 2017 mortality estimates • CSEA estimates from data of 3 Nigerian Public Hospitals • Globocan 2018
Epidemiology	• Incidence, prevalence, and hospital care of acute and chronic conditions	• GBD (Global Burden of Disease) 2017 mortality estimates • CSEA estimates from data of 3 Nigerian Public Hospitals • Globocan 2018
Epidemiology	• Relative risks of mortality for smokers, ex-smokers, and never-smokers	• Cancer prevention study II. U.S. Department of Health and Human Services
Epidemiology	• Passive smoking	• Cancer prevention study II. U.S. Department of Health and Human Services
Economics	• Treatment costs for annual and acute events of conditions	• Microcosting events. Macro or indirect cost estimation
Quality of life	• Several international sources reporting utilities in a 0-1 scale for the construction of QALYs	• Systematic evaluation of various international sources for each of the conditions analyzed see Annex 3
Economics	• Tobacco, cigars, and cigarettes tax collection	• "A Scoping Study of Nigeria's Tobacco Market and Policy Space" CSEA (2019)
Economics	• Price elasticity of cigarette demand [-0,496]	• Study: The effect of cigarette price increases on cigarette consumption, tax revenue, and smoking-related death in Africa from 1999 to 2013." (Ho et al. 2017)
Economics	• Household expenditures	• GHSP 2018-9 (National Bureau of Statistics (NBS) 2019)

6.3 Results

6.3.1 Mortality, morbidity, and costs of smoking

Based on the parameters inputted into the HEE model, we estimate 28,876 deaths attributable to smoking annually in Nigeria, a number that represents around 16% of deaths from smoking-related diseases (183,883) and about 5% of all cases of death. Among the diseases analysed, nearly 737,366 events are expected each year, of which 127,859 (17%) are attributable to cigarette consumption. In

terms of costs, these conditions burden the Nigerian healthcare system with nearly ₦ 634 billion, of which ₦ 526.4 billion (83%) are smoking-attributable treatment costs. We show the main results drawn from modelling the burden attributable to cigarettes consumption in Table 10.

Chronic obstructive pulmonary disease (COPD) represents the top cause of smoking-attributable mortality (29%), followed by ischemic heart disease (17.5%), stroke (13%), passive smoking (11.5%), lower respiratory tract infection (11%), and cardiovascular deaths of non-ischemic cause (5.5%). When aggregated by disease groups, COPD (29%) is followed by the group of cardiovascular diseases (23%). In terms of smoking-attributable morbidity, considering that these events are heterogeneous for comparison, COPD holds the top place with 68,937 acute events (54% of the total), followed by the group of lower respiratory tract infection (24.8%), stroke (9%) and ischemic heart disease (8.75%). Finally, the economic burden for the healthcare system attributed to smoking is distributed among COPD (64.3%), the group of nine other cancers (3.7%), lung cancer (2.2%), cardiovascular diseases (6.8%), and passive smoking (11.5%).

Smoking generates a direct annual treatment cost of ₦ 526.45 billion (approx. U$D 1.7 billion), which is equivalent to 0.36% of the Nigerian GDP in 2019, and 9.63% of the country's annual healthcare spending. Furthermore, adding up productivity losses due to illness, early death, and informal caregivers, tobacco related diseases represent 0.44% of GDP.

Table 10: Smoking-attributable deaths, events, and directs costs for the healthcare system for 2019

Tobacco-related conditions	Total deaths	Smoking- attributable deaths			Total events	Smoking- attributable events			Total costs (in millions)		Smoking- attributable costs (millions)			
		n	% row	% col		n	% row	% col	NGN	U$D*	NGN	U$D*	% row	% col
Cardiovascular diseases	**72225**	**6616**	**9**	**23**	**95704**	**11150**	**12**	**8.75**	₦273,188.06	**$890.10**	**₦37,751.78**	**$123.00**	**14%**	**6%**
Ischemic Heart Disease	49830	5067	10	17.5	95704	11150	12	**8.75**						
CV death of non-ischemic cause	22395	1549	7	5.5	-	-	-	-						
Stroke	**44275**	**3767**	**9**	**13**	**100989**	**11477**	**11**	**9**	**₦505,892.10**	**$1,648.29**	**₦71,912.25**	**$234.30**	**14%**	**12%**
Lung cancer	**1255**	**843**	**67**	**3**	**1376**	**906**	**66**	**0.7**	**₦18,904.37**	**$61.59**	**₦12,123.07**	**$39.50**	**64%**	**2%**
Pneumonia/influenza	**30442**	**3093**	**10**	**11**	**366013**	**31663**	**9**	**24.8**	**₦31,712.70**	**$103.33**	**₦2,743.44**	**$8.94**	**9%**	**0%**
COPD	**13162**	**8311**	**63**	**29**	**146411**	**68937**	**47**	**54**	**₦589,193.32**	**$1,919.70**	**₦371,549.39**	**$1,210.57**	**63%**	**63%**
Other cancers	**19202**	**2923**	**15**	**10**	**26872**	**3726**	**14**	**3**	**₦205,733.58**	**$670.32**	**₦21,895.25**	**$71.34**	**4%**	**3.74%**
Mouth and pharyngeal cancer	1954	890	46	3	2518	1134	45	1						
Esophageal cancer	624	269	43	1	735	320	44	0.2						
Stomach cancer	2 060	219	11	0.8	2401	250	10	0.2						
Pancreatic cancer	1947	246	13	0.9	2110	265	13	0.2						
Kidney cancer	481	56	12	0.2	575	67	12	0.1						
Laryngeal cancer	1002	635	63	2	1282	805	63	0.6						
Leukemia	1634	128	8	0.4	2090	162	8	0.1						
Bladder cancer	683	151	22	0.5	943	202	21	0.2						
Cervical cancer	8817	329	4	1.1	14218	521	4	0.4						
Second-hand smoking (SHS) and other causes														
SHS and other causes	**3322**	**3322**	**100**	**11**										NA
Total	**183883**	**28876**	**16**	**100**	**737366**	**127859**	**17**	**100**	**₦1,624,624.13**	**$5,293.31**	**₦585,631.56**	**$1,907.84**	36%	100

6.3.2 DALYs (premature mortality and disability)

Smoking causes a total of 816,230 DALYs (undiscounted and not age-weighted). Of these, DALYs due to premature mortality account for 77% of total, while the rest is due to disability. The DALY burden falls mainly on men (69%). Table 10 shows the distribution of DALYs by sex and disease group for the entire cohort analysed, as well as the mean differential QALY for smokers and ex-smokers (in relation to never-smokers), when simulating a cohort of 35 years of age by its survival time.

Table 10: Years of life lost due to premature mortality and years of disability - 2017

Disability-adjusted life-years (DALY) (NOT APPLYING DISCOUNT)	***Women***	***Men***	***Total***	***%***
DALYS due to premature mortality (YLL)	196618	431683	628302	77%
DALYS due to disability (YLD)	60661	127267	187929	23%
Total DALY	***257279***	***558951***	***816230***	***100%***
Disability-adjusted life-years (DALY)* due to premature mortality *by disease group (NOT APPLYING DISCOUNT)				
Cardiovascular disease	39032	87590	126623	**20.2%**
Stroke	47156	59418	106574	**17%**
Pneumonia /influenza	22535	43944	66479	**10.6%**
COPD	48731	119418	168149	**26.8%**
Lung cancer	5947	21190	27137	**4%**
Other cancers	23041	74197	97237	**15.4%**
Total DALY (YLL)	***196618***	***431683***	***628301***	***100.0%***
Differential QALY per person in relation to a never-smoker				
Smoking status	***Women***	***Men***		
Smoker	-5.83	-5.49		
Ex- smoker	-1.93	-2.45		

COPD: chronic obstructive pulmonary disease, DALY: disability-adjusted life-years, YLL: years of life lost (YLL), YLD: years of life with disability

Cost-effective of Taxation as Tobacco Control Tool

The tax collection on cigarettes sales (and other tobacco products) was around ₦ 36 billion in 2019 (Onyekwena et al., 2018) an amount that covers 6.3% of the direct expenses in the health system caused by smoking. Table 11 shows that increases in the final price of a cigarettes pack through different tax increases, would allow, in a ten-year period, for further reductions in deaths, health events, and DALYs, a fact which also comes with significant savings on treatment costs and higher tax revenue collection.

As can be seen from the table, a 50% increase in the final price of a cigarette package could prevent 26,757 deaths, 11,067 heart diseases, 4,815 new cancers and 18,223 strokes in ten years. In addition, financial resources could be generated for around ₦ 886,381 million, a figure that is derived from savings in health expenses (₦410,970 millions), informal caregiver costs and productivity losses avoided (₦51,204.80 and ₦55,138.09 correspondingly) and increased tax collection for cigarette consumption (₦369,067 millions).

Table 11: Economic consequences of smoking and potential effects of price increase - 2020

Category	*NGN (millions)*	*U$D (millions)*	*Source*
Total health expenditure (THE) (millions of U$D)	4,422,604	14,500	WDI, WB
Gross domestic product (GDP)(millions of U$D)	121,167,234	397,270	WDI, WB
Tobacco-tax collection (millions of U$D)	36,300	119	CSEA (2019). "A Scoping Study of Nigeria's Tobacco Market and Policy Space". CTFK. January, 2019, Abuja
Smoking-attributable direct costs of treatment	526,457	1,715	
Treatment costs as % of GDP	0.36%		
Treatment costs as % of THE	9.63%		
% of treatment costs recovered with taxes	6.90%		
% of total costs recovered with taxes	5.73%		
Scenarios for price increase: 10 years effect for different % increase			
% increase in final price of a package	***25%***	***50%***	***75%***
Deaths prevented	15 454	30 908	46 361
Heart disease avoided	6 392	12 784	19 175
Number of Strokes avoided	10 525	21 049	31 574
New cases of cancer avoided	2 781	5 562	8 342
New cases of COPD avoided	23 919	47 838	71 757
DALYs avoided	520 374	1040 747	1561 121
Health costs avoided (millions of U$D)	773	1,547	2,320
Productivity losses avoided (millions of U$D)	96	193	289
Increase in tax collection (millions of U$D)	104	208	311
Total economic benefit (millions of U$D)	***725***	***1,202***	***1,434***
Health costs avoided (millions of NGN)	237,356	474,712	712,068
Informal caregivers' costs avoided (millions of NGN)	29,573	59,147	88,720
Productivity losses avoided (millions of NGN)	31,848	63,688	95,522
Increase in tax collection (millions of NGN)	222,385	369,068	440,050

Total economic benefit (millions of NGN)	***521,161***	***966,615***	***1,336,359***
NGN: Nigerian Naira, DALY: disability-adjusted life-years, GDP: gross domestic product, THE: total health expenditure, U$D: US dollars, WB: World Bank, WDI: World Development Indicators			

7. Discussion and Conclusions

To conclude this report, it is worth briefly discussing the results outlined, and drawing from work done elsewhere to gain an international perspective on these findings. In this report, we presented some descriptive data to present the reader with an informed picture of the current status of tobacco consumption in Nigeria. This was compounded with a summary of the Focus Group Discussions organised as part of the background data collection procedure. In addition, an analysis of the direct and indirect cost estimation of tobacco consumption was carried out and compounded with a simulation of the effect of potential tax-induced price increases. We now seek to synthesise the main outcomes of the research undertaken, and point to a few potential weaknesses in our methods.

In terms of prevalence of use, the most recent GATS survey in Nigeria (2012) highlights a number of trends. In line with international findings, Nigerian men are far more likely than are women to be tobacco consumers. It must be noted that, although rising, the prevalence of tobacco smoke among the Nigerian population is still relatively low when compared both at an African and global level. For the purpose of comparison, Nigeria's prevalence rate of 5.6 percent (note that the data is from 2012) is about a quarter and a fifth of that of South Africa (20.3 percent) and Egypt (25.2 percent) respectively. Looking farther afield, comparable developing countries by GDP per capita such as Pakistan and Vietnam both report prevalence in the range of 20 percent, far exceeding Nigeria's (World Bank, 2020).

Expectedly, the crude occurrence rates of tobacco-related disease display a similar gendered divide. As might be predicted by the higher consumption rates of males, all tracked diseases are more common among males than they are for women for those aged 35 to 65, with the obvious exception of cervix cancer. The higher frequency of disease among men is also visible at older ages, although not as uniformly, with a variety of cancers occurring more frequently among older women than coetaneous men. This mirrors the generally lower discrepancy in consumption statistics among the more elderly age groups.

In terms of deaths attributable to tobacco-related disease, the data on total fatalities does not indicate an increased incidence among men. This may be caused by the fact that, although potentially linked to tobacco consumption, many of these diseases can be caused by other, non-tobacco factors. Care must therefore be employed when generalizing and attributing all such deaths to tobacco use. Again, models like HEE can assist in addressing over-reporting or underreporting of tobacco-attributable disease.

The novel data presented relating to the reported costs of treatment for various diseases raise several important considerations. A number of key facts merit a specific mention. To begin with, as reported above, Abuja's costs are significantly higher than they are in the other two locations surveyed. For instance, treatment costs of pancreatic cancer were reported to be almost four times as high in Abuja than in Enugu and Ibadan. Albeit somewhat predictable given the Capital's higher costs of living, the discrepancy is quite marked for a number of illnesses and contrasts findings in other countries that do not find links between costs of living and the cost of medical procedures (Newman et al, 2016).

While the population in Abuja has a higher income, and is thus more able to pay such high fees, the generally high costs both in the capital and elsewhere in relation to average per capita income is

troubling. In the majority of cases, tobacco-related diseases exceeded Nigerian per capita income. This is particularly so for cancers. Yet, this only represents a preliminary analysis as productivity losses due to patients and caregiver are not included. Some associated out-of-pocket costs incurred in the initial stages of the diseases before seeking treatment from tertiary health institutions are also not accounted for. For the poor and middle-class household, tobacco-related disease represents a catastrophic health-related expenditure that can often push the households into a vicious poverty cycle, underscoring the severity of the impact unrestrained tobacco consumption can have.

It is also worth commenting on international comparisons. It should be noted that no universally accepted methodology to obtain direct cost of illness treatments exists. For this reason, estimates can skew widely for methodological reasons. Nevertheless, looking at Pichon-Riviere (2020), it is interesting to compare direct treatment costs of various illnesses in Nigeria in comparison to the 12 Latin American countries studied in their paper.

Take, for instance, the case of Honduras – the country surveyed whose per capita GDP most closely resembles that of Nigeria – and Argentina, whose per capita GDP is approximately four times greater than that of Nigeria (IMF, 2020). From the data, it appears that direct treatment costs tend to reflect the average income of the countries, and do not change much as a proportion of average per capita GDP. For instance, for the case of lung cancer, although significantly higher in Argentina than in Honduras and Nigeria, the direct costs of treatment come out to 571 percent of average national income in Argentina, while that figure is 552 and 565 percent in Honduras and Nigeria respectively. This warrants two comments: first, it is clear the direct treatment burden that tobacco-related illnesses cause in Nigeria, while large, is generally in line with findings in other countries. Secondly, and perhaps more worryingly, the fact that costs do not tend to decrease as a share of per capita income as a country grows (as shown by the case of Argentina) signals that Nigeria cannot expect to 'grow out' of this problem. Unless addressed through active policy to reduce consumption, the direct costs of tobacco consumption and related illnesses is likely to persist as a pernicious burden to household finances.

Beyond direct costs, section 6 delves into the more complex estimation of indirect costs of tobacco consumption. The model-based health economic evaluations (HEEs) utilized in this paper is an adaptation of that developed by Pichon-Riviere et al. (2011) for Latin American countries and is particularly relevant for the purposes of this study.

For starters, it allows for estimation of cost of disease and their disaggregation along disease-type, age group, sex and regional location. Due to its development in similar, data-poor contexts, it is designed to be inherently adaptable to Nigeria (see Pinchon-Riviere et al, 2011). In addition, the model follows a first order Monte Carlo process and is constructed in a bottom up approach, which allows for disaggregation of economic cost overtime and across groups. Finally, the model can be extended to do budget analysis and cost-effectiveness analysis of tobacco control interventions like smoke-free air laws (citation Bardach NTR 2020), plain packaging (Alcaraz NTR 2020), taxation, advertising and smoking-cessation interventions—a feature particularly useful for Nigeria given the changed taxation of tobacco starting in July 2018.

This analysis shows that Nigeria faces an important burden associated with smoking. Annually, 28,876 deaths, 6616 cases of ischemic heart diseases and other cardiovascular events, 3767 strokes and 3766 new cancer cases are attributable to smoking.

The healthcare system spends around ₦526.45 billion per year in direct costs of care of smoking-attributable diseases, which represents 9.63% of the total healthcare budget. Despite the current taxes, revenues do not fully compensate for the healthcare system costs. We estimate that a further increase in cigarette taxes that could drive-up the final price of the pack by 50% would have important accumulated benefits within the next 10 years, such as better health (26,757 deaths prevented), healthcare savings, and further tax revenue collection.

From the results estimated by Pichon-Riviere et al. (2020), it is possible to draw some comparisons between the tobacco burden in Latin America (LA) and that of Nigeria. In terms of the economic costs attributable to smoking conditions as a proportion of GDP seems to be 60% lower in Nigeria than the average of LA countries however, it is similar to the results obtained in Honduras, Mexico and Peru. Nevertheless, the highest difference is related with the percentage of the direct costs recovered by excise administration. While in LA 36% of the direct medical costs are recovered through taxes, with Peru the worst performer at 9%, Nigeria collects only 5.73% of that cost with their tax structure. This situation highlights the need to strengthen duty policies on Nigeria that still have a lot of a space to increase.

Tobacco use and tobacco control in Africa have received little attention relative to other regions. This is due to the perceived low smoking prevalence in Africa in addition to the more immediate need for interventions against infectious diseases. However, the trends are quickly changing. With improving economic growth and health in Africa, the number of smokers and cigarettes smoked in the region is rising. In Nigeria, smoking prevalence is growing at an average of 4 percent each year; from 11.3 percent in 2000 to 17.4 percent in 2015 (World Bank, 2017). According to data from Nigeria Customs Service (NCS) and GlobalData Plc, a total of 920 million cigarette packs were sold in Nigeria in 2015; of which 74 percent is produced domestically.

In 2018, Nigeria introduced a new scheme on tobacco taxation in order to operate Tobacco control policies. This scheme included the previous ad-valorem rate of 20% over the unit of production, a specific component of ₦ 20 per pack for the first year, with further rises, reaching ₦ 58 per pack of 20 cigarettes in 2020. Even though the amount of the tax per package was doubled, according to the WHO, the percentage of the price due to taxes is around 20% (including VAT), a figure quite far from the 75% recommended by the WHO.
From a taxation perspective, a TetSim model has simulated the impact of the tax reform (Onyekwena et al. 2018), as well as different suggested scenarios, on consumption, government revenue, net-of-tax revenue, and excise tax burden. The results show that after the implementation of the new tax policy the government revenue increased by 53% during the first year and more than doubled the excise tax burden but still being at low levels, which means that cigarettes in Nigeria are highly affordable and there remains space for further increase in excise tax.

This study provides some insights on how the duty of excise could be raised by the government to advance tobacco control policies. It was estimated that due to a possible increase of 168% on tobacco

taxes, cigarette price will rise 50%. Consequently, the revenue would increase by 101% meaning an economic benefit of ₦886 billion, of which 41% corresponds to increased tax collection.

Although our methodology was rigorously designed, it is still worth mentioning a few potential distorting factors that must be kept into account. To begin with, although socio-politically diverse, our survey encompassed just three locations and did not include data from the Northern part of the country. In addition to Abuja's apparent uniqueness, care must be used in treating our findings as universal across the country. More data collection in different areas would certainly be useful. It should also be noted that the model has taken, as input on the prevalence of smoking, data from the GATS 2012 survey. As far as we know, it was the last representative survey conducted in Nigeria. Perhaps, with current smoking prevalence data the results may be different from the reported data in this study.

In conclusion, this study provides relevant information for accomplishing objectives focused on Nigeria's 2017 Voluntary National Review (VNR) which depict the development priorities of the Federal Government over the Sustainable Developments Goals. In particular, tobacco control policies are central for accomplishing SDG-3 that calls for reducing by one-third, premature mortality from non-communicable diseases through prevention and treatment, promoting mental health and well-being, and strengthening the prevention and treatment of substance abuse among other things. Additionally, SDG-5 was addressed by estimating the benefits avoided in the informal care provided, which tends to be an unpaid activity commonly led by women. Finally, the SDG-17 is at the core of the elaboration of this study through a South-South collaboration process between IECS and CSEA.

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Focus Group Discussions (FGD) Questionnaire

Aim of FGD:

To emphasize the qualitative cost of tobacco use on households, through experiences/stories shared.

Questions

For Smokers

1. Can you describe your personal smoking history, such as how long you have been smoking for, quitting attempts, cigarettes per day, etc.?
2. Can you describe your experience prior to the eventual diagnosis of the illness you suffer? How long it took to be diagnosed? How many health institutions you have been to before the present one? How you know the illness was caused by smoking?
3. Since the diagnosis, describe what has been the costs of treating the illness?
    - *Hint: This is more focused on the economic costs*
4. Are there other costs involved that are not related to treatments?
    - *Hint: Probe for costs such as reduced productivity, opportunity costs to patient and care givers and other non-economic costs.*
    - *Interrogate the gender dimension of costs of treatment here especially if caregiver is a male.*
5. In what way is the illness affecting you, your family, and the person who takes care of you?
    - *Hint: Ask: the number of caregivers and their gender composition)*
6. How has the illness changed your lifestyle?
    - *Hint: probe how it affects frequency or intensity of other minor illnesses like malaria*
7. Since the diagnosis, have you quit or reduced smoking? Why or why not?
8. What can be done to prevent and better manage the impact of the sickness on the household?

For Caregivers:

1. Can you describe the personal smoking history of the person you care for, such as how long he/she has been smoking for, quitting attempts, cigarettes per day, etc.?
2. Can you describe his/her experience prior to the eventual diagnosis of the illness? How long it took to be diagnosed? How many health institutions he/she has been to? How you know the illness was caused by smoking?
3. Since the diagnosis, describe what has been the costs of treating the illness?
    - *Hint: This is more focused on the economic costs*
9. Are there other costs involved that are not related to treatments?
    - *Hint: Probe for costs such as reduced productivity, opportunity costs to patient and care givers and other non-economic costs.*
    - *Hint: Interrogate the gender dimension of costs of treatment here especially if caregiver is a male.*

10. In what way is the illness affecting you, your family, and the person who takes care of you?
    - *Hint: Ask about the number of caregivers and their gender composition)*
11. In what way do you think the illness is affecting the person, their family, and you as the caregiver and if any?
    - Hint: Ask about the number of caregivers and their gender composition)
12. How has the illness changed the person's lifestyle?
    - Since the diagnosis, has he/she quit or reduced smoking? Why or why not?
13. What can be done to prevent and better manage the impact of the sickness on the household?

Economic Cost Questionnaire

In the last 12 months, which of the listed diseases has been treated at NHA and how frequent do you encounter these diseases at the facility? The purpose of this question is to understand how frequent/common the diseases in the table below are in the Nigerian context.

Respondent: Medical Practitioners.

Cancer Cases		**Non-cancer Cases**	
Oral & Pharyngeal/Pharynx Cancer	**i. Often** ii. Occasionally iii. Never	Acute Myocardial Infarction	**i. Often** ii. Occasionally iii. Never
Stomach Cancer	**i. Often** ii. Occasionally iii. Never	Unstable Angina	i. Often **ii. Occasionally** iii. Never
Pancreas Cancer	i. Often **ii. Occasionally** iii. Never	Non-Ischemic Cardiovascular Diseases (CVD)	**i. Often** ii. Occasionally iii. Never
Larynx Cancer	**i. Often** ii. Occasionally iii. Never	Stroke	**i. Often** ii. Occasionally iii. Never
Lungs Cancer	**i. Often** ii. Occasionally iii. Never	Atherosclerosis	**i. Often** ii. Occasionally iii. Never
Uterus Cancer	**i. Often** ii. Occasionally iii. Never	Aneurysms & Dissections	i. Often **ii. Occasionally** iii. Never
Esophageal Cancer	i. Often **ii. Occasionally** iii. Never	Embolism & Arterial Thrombosis	I. Often **II. Occasionally** III. Never
Kidney and Pelvis Cancer	**i. Often** ii. Occasionally iii. Never	Pneumonia	**i. Often** ii. Occasionally iii. Never
Bladder Cancer	**i. Often** ii. Occasionally iii. Never	Bronchitis/Emphysema	**i. Often** ii. Occasionally iii. Never

Acute Myeloid Leukemia Cancer	**i. Often** ii. Occasionally iii. Never	Tuberculosis	**i. Often** ii. Occasionally iii. Never

----------Indicate the disease case.

Active Treatment			Post Hospital (6months)		
Procedure	Cost (N)	Frequency	Procedure	Cost (N)	Frequency
Registration					
Cost of Hospital bed					
Consultations					
Blood Test I. FBC II. E/u/Cr					
Urine					
CT Scan					
Chest X-Ray					
ECG					
Echocardiography					
Spyrometry					
Carotid Doppler					
Angiography					
Medicine					
Others					

Annex 3: Health Utilities of considered tobacco-attributable diseases.

Even among survivors, tobacco-attributable diseases lower the quality of life and this creates a strong impetus for effective tobacco control policy. Estimates from global literature have demonstrated that most survivors of tobacco-attributable diseases experienced lower quality of life as measured by Health Utility (HU).

Table 9: Health utilities for Selected Tobacco-related Diseases

Event	Health Utility	Source	Year
Ischemic heart disease (chronic management)	0.85	Wijeysundera	2014
Myocardial infarction (year of the event)	0.803	Smith	2013
Chronic obstructive pulmonary disease - 1	0.935	Rutten	2006
Chronic obstructive pulmonary disease - 2	0.776	Rutten	2006
Chronic obstructive pulmonary disease - 3	0.689	Rutten	2006
Stroke (year of the event)	0.62	Yeoh	2019
Stroke (chronic management)	0.78	Yeoh	2019
Ischemic heart event (non myocardial infarction)	0.803	Smith	2013
Ischemic heart (non myocardial infarction) First year	0.85	Smith	2013
Pneumonia	0.994	Pepper/Hamel	2002
Lung Cancer	0.66	Chouaid	2013
Cancer of mouth, lip and pharynx	0.745	Nie	2018
Esophagus cancer	0.63	Graham	2007
Stomach Cancer	0.55	Dan	2006
Pancreatic Cancer	0.55	Gordois	2003
kidney Cancer	0.78	Pickard	2016
Larynx Cancer	0.76	Pickard	2016
Leukemia	0.82	Leunis	2014
Bladder Cancer	0.678	Hevér	2014
Cervix Cancer	0.758	Endarti	2015

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