# EXAMINING THE EFFECTIVENESS OF HEALTH WARNINGS ON CIGARETTE PACKAGING IN NIGERIA: A MODELLING STUDY

mma.ekeruche@gmail.com

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This study was authored by Adedeji Adeniran[a], Mma Amara Ekeruche[b], Ariel Bardach[c], Agustín Casarini[d], Federico Rodríguez Cairoli[e], Andrés Pichón-Riviere[f], Alfredo Palacios[g] and Chukwuka Onyekwena[h] with financial support from the African Capacity Building Foundation (ACBF). The authors would like to thank the reviewers of the study, including Prof. Vaughan Rees and Dr Folashayo Adeniji for their comments and suggestions.

# Examining the Effectiveness of Health Warnings on Cigarette Packaging in Nigeria: A Modelling Study


## Abstract

*Introduction***:** Tobacco consumption is associated with about 29,472 deaths in Nigeria alongside other health and economic impact. Meanwhile, evidence has shown that exposure to health warnings reduces tobacco consumption by providing information about the risks of tobacco. Consequently, evaluating the effect of affixing health warnings on cigarette packs on prevented premature deaths and disease events, years of lives lost due to premature death and disability, and savings in health costs is important in the Nigerian context.

*Aim***:** The paper sought to estimate the health and economic implications of existing, new, and the WHO-recommended labelling policies in Nigeria.

Data and Methodology: The data utilized include costs, demographic, epidemiologic and economic data. An individual-level microsimulation model was employed to examine the impact of the current cigarette labelling policies (text only health warnings); new cigarette labelling policies (text and graphic health warnings with the total display area covered increasing from 50% to 80% over 10 years); and the WHO-recommended labelling policies (plain packaging and health warnings covering at least 80% of the pack).

*Findings***:** 748 deaths can be averted in the first scenario (text only health warnings), while 7 478 and 14 208 deaths can be averted in the second (text and graphic warnings), and third scenarios (plain packaging and health warnings) respectively. With respect to diseases, the number of cardiac arrests, cerebrovascular diseases, and cancer that could be averted in the second scenario (text and graphic warnings) are 3 093, 5 093, and 1 346 respectively which increases to 5 876, 9 676, and 2 557 in the third scenario (plain packaging and health warnings). Furthermore, the paper shows that up to 251 794 years can be lost due to early deaths and disability and up to US$180,713 savings can be made in the second scenario which increases to 478 408 years and US$342 353 in savings in the third scenario.




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*Conclusion:* Nigeria should aim to achieve, in the coming years, 100% compliance with its current regulation and the logical next step: plain packaging with large warnings. The present study adds evidence on the potential health effects and cost savings of these levels of implementation, valuable for local policymakers.

## 1.0 Introduction

Tobacco consumption has a significant impact on health and social wellbeing globally and more particularly, in developing countries. Evidence has shown that tobacco use leads to ill health, disability and death: in West African countries, 248.68 million disability-adjusted life-years (DALYs) were attributed to several diseases and injuries including tobacco-related diseases (Murray et al., 2012). Furthermore, tobacco related diseases are responsible for about 29,472 deaths annually in Nigeria based on 2016 estimates (CSEA, forthcoming). The economic impact of tobacco consumption is also well documented as the poorest households, particularly those in low and middle-income countries, spend up to 10% of total household expenditure on tobacco (Eriksen, Mackay & Ross, 2012).

Due to the health effect of tobacco use, the World Health Organization (WHO) introduced the MPOWER measures in 2007 to guide countries in the implementation of interventions aimed at reducing tobacco consumption. A key aspect of the MPOWER measures is the 'warning about the dangers of tobacco (W)' which stipulates that countries should adopt and implement effective packaging and labelling measures. Specifically, there should be health warnings and messages affixed on tobacco product packages in order to increase public awareness of the health effects of tobacco use, and in turn reduce tobacco consumption. Aside from the affixation, the WHO further specifies the need for adopting well-designed health warnings that take into consideration the most appropriate choice of location, size, use of pictorials, colour, and message content. Evidence shows that larger health warnings with pictures are more likely to be read and communicate the negative health effects to low-literacy populations and children, relative to small and text-only health warnings (WHO, 2008). As such, Article 11 of the WHO FCTC stipulates that health warnings should be 50% or more of the principal display areas but shall be no less than 30% of the principal display areas, and this may be in the form of/or include pictures or pictograms.

In line with Article 11, Nigeria's current regulations on health warnings (NIS 463:2014) require that the prescribed health warning ("The Federal Ministry of Health warns that Smokers die

young") must occupy at least 50% of all cigarette packs (SON, 2014). However, the existing regulation mandates only the display of text warning on both sides of cigarette packs. This gap in regulation is expected to be closed with the National Tobacco Control Act (NTCA), 2015 coming into effect in June 2021 with three additional stipulations – (i) increasing the size of the picture health warnings to cover 50% of the front and back of cigarette packs by 2021; (ii) affixing textual health warnings on one of the lateral sides of the pack by 2021; and (iii) increasing the size of the picture health warnings from 50% to 60% of the front and back of cigarette packs by 2024 (Campaign for Tobacco Free Kid [CTFK], 2020a).

The adoption of more robust cigarette packaging policies has created the need to ascertain the effectiveness of the use of text and pictorial health warnings. Specifically, studies evaluating the impact of affixing health warnings on critical metrics including tobacco consumption, morbidity and mortality, and savings in health costs are scarce. In the Nigerian context in particular, there is scarcity of high-quality evidence as no study has ascertained the potential health and economic impact of health warnings to the best of our knowledge. Meanwhile, such a study can play a key role in closing the knowledge gaps, addressing barriers to policy change, and enabling the policy environment.

Against this background, this paper provides evidence on the potential health and economic effects of implementing an improved cigarette pack labelling policy in Nigeria. More specifically, the paper estimates the health and economic implications of the current cigarette labelling policies (text only health warnings) and the impact of the new cigarette labelling policies (text and graphics health warnings), as provided for in the NTCA passed in 2015, and the WHO-recommended labelling policies (plain packaging and health warnings). Furthermore, the paper aims to make recommendations for adopting and improving cigarette labelling policies in Nigeria. Consequently, three scenarios are simulated using an individual-level microsimulation model, where the first scenario is the adoption of text only health warnings; the second scenario is the adoption of text and graphic health warnings with the display area covered increasing from 50% to 80% over 10 years; and the third scenario is the adoption of plain packaging and health warnings covering at least 80% of the pack. The data utilized include costs, demographic, epidemiologic and economic data.

The main findings of the paper shows that only 748 deaths can be averted in the first scenario (text only health warnings), while 8 226 and 14 756 deaths can be averted in the second (text

and graphic warnings), and third scenarios (plain packaging and health warnings) respectively. With respect to diseases, the number of cardiac arrests, cerebrovascular diseases, and cancer that could be averted are 3 093, 5 093 and 1 346 in the second scenario which matches the present policy environment in Nigeria. Furthermore, the paper shows that up to 251 794 years can be lost due to early deaths and disability and up to US$180 713 in savings can be made in the second scenario. However, the third scenario (plain packaging and health warnings) shows improved outcomes as the number of cardiac arrests, cerebrovascular diseases, and cancer that could be averted are 5 876, 9 676 and 2 557 respectively. Similarly, the years lost due to early deaths and disability increased to 478 408 years and total cost avoided increased to US$342 353. These improved outcomes underscore the need for more stringent cigarette packaging policies in order to achieve better medium and long-term benefits.

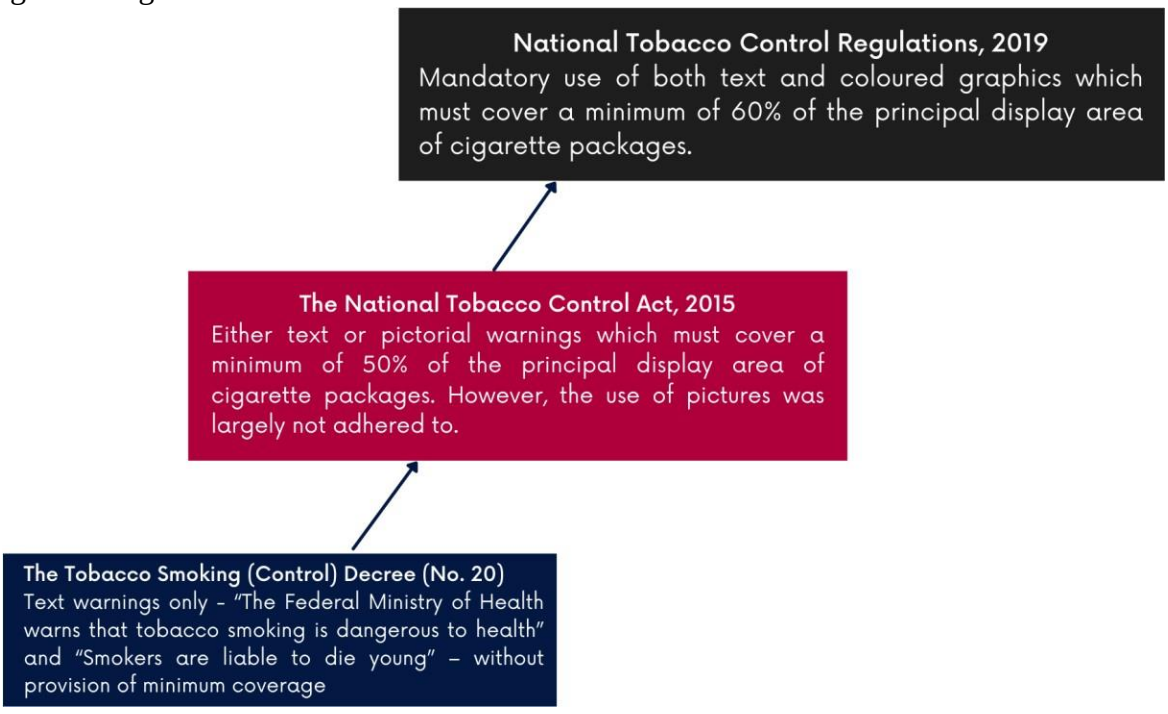
## 2.0 Historical Evolution of Cigarette Packaging in Nigeria

Laws governing tobacco product packaging and labelling in Nigeria have evolved considerably (see Figure 1). In 1990, Nigeria introduced its first tobacco control regulation – the Tobacco Smoking (Control) Decree (No. 20) - under the military government led by General Ibrahim Babangida. The decree (section 3) stipulates that the following text warnings must be affixed on the package of tobacco products: “The Federal Ministry of Health warns that tobacco smoking is dangerous to health” and “Smokers are liable to die young” (Federal Military Government of Nigeria, 1990). However, the decree was largely ineffective considering that it included industry-proposed language that weakened the law and hindered its implementation (Egbe, Bialous & Glantz, 2019).

Following the signing of the WHO Framework Convention for Tobacco Control (FCTC) in 2005, the Nigerian government introduced a WHO FCTC compliant policy in 2015 to replace the Tobacco Smoking (Control) Decree. The National Tobacco Control Act, 2015 (section 20) stipulates that health warnings, either text or graphics, must cover a minimum of 50% of cigarette packages (see Federal Republic of Nigeria, 2015). While the law was strict in ensuring that warnings cover a minimum of 50% of cigarette packages, the flexibility prescribed in allowing for text or graphics led to the tobacco industry excluding graphics from cigarette packages (. In 2019, the new and improved National Tobacco Control Regulations, 2019 was put forward (see Federal Republic of Nigeria, 2019). The law (section 6) stipulates that health warnings will constitute 60% of the principal display area of cigarette packages rather than 50% stipulated by the previous law within a specific time period. The law (section 3 and 5)

further requires the use of both text and coloured graphics that convey the health consequences of tobacco use or exposure to second-hand smoke. This includes pictures of lung cancer, throat cancer, and mouth cancer. Despite Nigeria's new law being WHO FCTC compliant, there are opportunities for improvement. For instance, in Uganda, the Tobacco Control Regulation, 2019 stipulates that health warnings must cover 65% of the cigarette packaging while the picture portion covers 80% of the space reserved for health warnings and text covers the remaining 20% (Uganda Government, 2019). Similarly, Uruguay mandates that health warnings (including text and pictures) must be displayed on 80% of both sides of the tobacco product package (Campaign for Tobacco-Free Kids [CTFK], 2020b). Consequently, Nigeria could emulate countries such as Uganda and Uruguay to increase the coverage of health warnings.

Figure 1. Nigeria's Tobacco Laws




Source: Federal Military Government of Nigeria, 1990; Federal Republic of Nigeria, 2015; and Federal Republic of Nigeria, 2019.

## 3.0 Literature Review on the Effectiveness of Cigarette Packaging Policy

The importance of cigarette packs as a source of information about cigarette components and their associated risks is well noted in the literature. Following the introduction of new health warnings on tobacco products in Australia, 94% of smokers and 56% of non-smokers were able to recall at least one warning statement indicating a higher awareness of tobacco warning

Borland and Hill (1997). Similarly, there was an increase in the understanding and effects of the main constituents of tobacco smoke such as tar, nicotine, and carbon monoxide. In Canada, a survey found that smokers of all ages and eight out of ten adult non-smokers report that they have seen health warning messages on cigarette packages (Environics Research Group, 1999). Likewise, in a survey of 4 482 students in Australia, exposure to graphic warning labels could reduce smoking among adolescents by causing students to more frequently read, think and talk about warning labels (White, Webster & Wakefield, 2008). According to International Tobacco Control (ITC) research, the introduction of pictorial warnings in Thailand led to 53% of smokers thinking more about the health risks of smoking relative to 33% before the warnings (ITC, 2009).

Furthermore, evidence has shown that the size and positioning of the warning message determines the visibility of health warnings and could influence the role of cigarette packs in providing information. Hammond, Fong, Borland, Cummings, McNeill and Driezen (2007) carried out an experiment on 14,975 adult smokers in Canada, U.S., U.K. and Australia and found that smokers in countries with larger and more visible warnings reported higher levels of awareness of the dangers of tobacco consumption. For instance, Canadian and U.K. smokers who are exposed to warnings that meet the minimum international standards reported greater levels of awareness and impact compared to smokers in the U.S. and Australia. Notably, four years after the implementation of large graphic warning labels, measures of salience and impact remained high in Canada which is consistent with the principle that larger warnings are more likely to retain their salience over time relative to less prominent warnings. Hassan, Shiu, Thrasher, Fong and Hastings (2008) conducted an analysis of a sample of 901 U.S. smokers and 1,459 U.K. smokers to explore the relative effectiveness of the U.K. and U.S. tobacco legislation (more prominent text-based cigarette pack warnings are used in the U.K. relative to the U.S.). Using structural equation modelling based on longitudinal panel survey data from both countries, the paper found that the more prominent warning labels have a more direct effect on influencing behavioural compliance by smokers. In an experiment, Bansal-Travers, Hammond, Smith and Cummings (2011) showed 12 sets of cigarette packs that vary across design features and warning label style and size to 397 adults in New Jersey and found that larger, pictorial, and loss-framed warning labels are more likely to attract attention, encourage thoughts about health risks, and motivate quitting. Kotnowski, Fong, Gallopel-Morvan, Islam and Hammond (2016) conducted a discrete choice experiment using multinomial logit analysis with 448 females. The study revealed that an increase in the warning label size from 50% to

75% is considered important (23%) when judging a tobacco product's harm. Skurka, Kemp, Davydova, Thrasher, Byrne, Safi, Avery, Dorf, Mathios, Scolere and Niederdeppe (2018) conducted an experiment on 475 subjects in New York and showed that larger graphic warning labels on cigarette packages (50% versus 30% of the front of a cigarette pack) increased visual attention to the picture and warning among people of low socioeconomic status.

Furthermore, the literature documents evidence on the stronger effect of pictorial health warning labels on quitting smoking relative to text warnings. Azagba and Sharaf (2013) using the generalized estimating equation (GEE) model, showed that the use of graphic/pictorial warnings decreased the odds of being a smoker and increased the odds of quitting smoking with an odds ratio of 0.88 and 1.33 (at 95% Confidence Interval) respectively based on population-based surveys in Canada. Also, Cantrell et al. (2013) conducted an experimental study using U.S. adult smokers. Findings in their study revealed that smokers who were exposed to pictorial warnings had stronger reactions and were more likely to quit relative to those exposed to text-only warnings. These results were similar across race/ethnicity and socioeconomic status. Alaouie, Afifi, Haddad, Mahfoud, and Nakkash (2013) based on a cross-sectional study of 2,629 students in Lebanon, found that pictorial warnings were more effective than text warnings with regards to the intention to quit or the decision to initiate smoking. More specifically, 81%, 75%, and 52% of the surveyed population agreed that the 'lung', 'economic impact', and 'heart attack' pictorial warnings were more likely to reduce their intention not to start smoking relative to 57%, 43%, and 20% for the text warning. Conducting a randomized control experiment where 740 young adult smokers were shown four (4) cigarette packs with warnings about lung disease, cancer, stroke/heart disease, and death respectively, Mays, Niaura, Evans, Hammond, Luta, and Tercyak (2015) found that combining pictorial warnings of smoking-related health risks with text-based messages about how quitting reduces risks is likely to achieve better outcomes. Chopra, Rao, Gupta and Vashisth (2014) survey 408 subjects in India and found that more than 70% believe that warnings create awareness about health hazards of tobacco and help in reducing or quitting tobacco. The survey also found that pictorial warning was found to be better as compared to text warning.

Using data obtained from the ITC China Survey (2006-2009) and the ITC Malaysia Survey (2008-2009), Elton-Marshall, Xu, Meng, Quah, Sansone, Feng, Jiang, Driezen, Omar, Awang and Fong (2015) compared the impact of the text-only warning label in China to the pictorial health warnings in Malaysia on six key indicators - noticing, reading, forgoing, avoiding,

thinking about quitting. They found that the pictorial health warnings led to significant and substantial increases in five of the indicators relative to only two for the text-only warning. Using randomized control trials, where participants receive either text or pictorial warnings, Brewer, Hall, Noar, Parada, Stein-Seroussi, Bach, Hanley and Ribisl (2016) found that smokers whose packs had pictorial warnings were more likely than those whose packs had text-only warnings to attempt to quit smoking during the 4-week trial. In addition to quitting smoking, smokers with pictorial warnings were more likely to forgo a cigarette, think about the harms of smoking, and have negative emotional reactions to smoking. Based on a cross-sectional study carried out between 2013 and 2015 in five hospitals in Lebanon, Layoun, Salameh, Waked, Bacha, Zeenny, El Hitti, Godin and Dramaix (2017) found that 66% of the participants reported that pictorial warnings would be a more effective tool to reduce or quit smoking compared to only textual warnings. In a survey of 419 subjects in India (including smokers and non-smokers), Vanishree, Narayan, Naveen, Bullapa, Vignesh and Raveendran (2017) show that exposure to cigarettes with pictorial warning resulted in 78% of the smokers attempting to decrease the frequency of tobacco use and 64% quitting the habit altogether. More generally, pictorial warnings depict the health risks of smoking, are more noticeable, and allow for better information processing. In addition to the use of pictorial warnings, studies have shown that the use of plain packaging has stronger effects. Alcaraz, Hernández-Vásquez, Palacios, Rodríguez, Roberti, García-Martí, Ciapponi, Augustovski, Bardach and Pichon-Riviere (2020) use a probabilistic state-transition microsimulation model, considering natural history, costs, and quality of life losses associated with main tobacco-related diseases, to estimate the effect of implementing cigarette plain packaging in seven (7) Latin American countries as opposed to current cigarette labelling policies. In the event that these countries implement plain packaging strategies, they found that 155 857 premature deaths (vs 69 369 deaths) and 4 133 858 disease events (vs 638 295 disease events) could be averted, which would add 4.1 million healthy years of life (vs 1.2 million years) and save US$13.6 billion (vs US$5.3 billion) in direct health care expenses of diseases caused by smoking.

# 4.0 Methodology

### 4.1 The Institute for Clinical Effectiveness and Health Policy (IECS)model

The IECS model corresponds to a first-order Monte Carlo simulation, which carries out a hypothetical cohort analysis along a discrete-time, in our case over a 10-year period. The Monte

Carlos simulation is important in this study as it helps in predicting the uncertainty around health outcomes using the underlining probability distribution a cohort group. A previous iteration of the model was used by CSEA and IECS (2020) to estimate the burden attributable to smoking in terms of morbidity, mortality, disability-adjusted life-years (DALYs), and direct medical costs and indirect costs (e.g., productivity loss costs, informal caregivers' costs). We also modelled the health and fiscal effect of increasing cigarettes' tax. Similarly, the IECS model has been used to evaluate the 10-year potential impact of legislation related to cigarette packing and warnings in Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Mexico and Peru). Building on these previous studies in Nigeria and Latin America, the present paper further extends the IECS model to intervention around tobacco packaging in Nigeria.

The model followed up individuals in hypothetical cohorts and calculated key health outcomes arising from prevailing tobacco use in the population. The health outcomes covered in the model include disease incidence and fatality, adjusted quality of life and disabilities[1], and healthcare costs, , along key demographic groups in the population (such as sex, age and smoking profile). It also incorporates the natural history, costs, and economic variables to capture the possible impact of the policy environment on tobacco related diseases. This study considers only health incidence arising from tobacco smoking such as cardiac disease, cerebrovascular disease, cancer, pneumonia, and chronic obstructive pulmonary disease (COPD).

First, the study will derive a baseline estimate of the health and economic burden of tobacco consumption under the text only health warnings policy by analyzing the differences in the total absolute numbers and rates of events, deaths, and associated costs from smoking under the current policy environment in Nigeria (with the current prevalence of smokers and ex-smokers) minus an 'hypothetical scenario' in which tobacco smokers never existed. Based on these baseline estimates, we can simulate the effectiveness of various tobacco control interventions captured by changes to key parameters relating to the policy changes and estimating their effect on the prevalence of tobacco use in the population. We illustrated the empirical approach adopted for cigarette packing intervention in Nigeria below. Detailed description and information on the IECS model can be found in Alcaraz *et al.* (2020).

[1] This is estimated based on years of life that would have been lost due to premature death and disability

### 4.2 Modelling of Policy Effect

Our modelling strategy is predicated on the well-established causal link between tobacco control interventions (MPOWER) and the reduction in smoking prevalence. The mediating channel for this in the case of health warning is the use of cigarette packages as an additional publicity tool to smokers and non-smokers on the health consequences of smoking. This will generate lower smoking prevalence through (i) lower smoking intensity (ii) increases in quitting rates and (iii) reduction in smoking initiation. We can formally estimate the effect of health warnings on cigarette packs on prevalence as follows:

$$Prevalance_{post} = Prevalance_{pre} - (E_m * \ I_p * \ Prevalance_{pre})$$

where $Prevalance_{pre}$ is the smoking prevalence in Nigeria before the policy intervention. $E_m$ captures the effectiveness of the intervention measured by reduction in tobacco consumption (this is generated from systemic review of literature see Section 4.5) and $I_p$ is the share of variation in consumption that impacts smoker prevalence.

Across the different scenarios, we assume that the Ip (impact prevalence) is equivalent to 0.5 in the short and mid-term such that for every reduction in tobacco consumption the prevalence would be reduced by 50%. In the long run this parameter is assumed as 0.75. Similarly, the time horizon covers 10 years to account for short (first two years), medium (first six years) and long-term (first 10years) effects of the policy changes (Begh et al., 2015). For example, the model assumes that in the short term, most of the reduction in smoking prevalence will be driven by higher quitting rates. However, in the longer-term, the effect through lower smoking intensity (number of cigarettes smoked per day) and new initiation (reduction in rate of new and young smokers) will also set in.

### 4.3 Model Scenarios

In line with the current stance on tobacco control policy around cigarette packaging in Nigeria, we estimated three possible scenarios in the evolution of the size and scope of the health warning and plain tobacco packaging policy. These scenarios are discussed below:

1. Baseline scenario (Text warnings): Prior to June 2021 commencement of pictorial health warning, cigarette packs in Nigeria only contained text warnings. The analysis sets out by estimating the health and economics benefits measured by number of averted

deaths and averted costs with only text warnings over the ten-year period. We take the policy parameter that coincides with the pre-intervention policy of health warning covering 50% of a package principal surface and assume this will evolve linearly to 80% coverage over the ten-year period (2021-2031).

2. New Policy: Graphic health warnings: In the second scenario, we evaluate the impact of a change to graphic health warnings which starts with an initial coverage of 50% of the cigarette packs and increases to 80% over 10years. This mirrors the new packing policy in Nigeria which involves a change from text to graphic warnings starting with 50% coverage of the packs in 2021 and reaching 60% by 2024.

3. Aspirational scenario: We model in the last scenario a hypothetical setting in which graphic health warnings are fixed at least 80% of the package surface and further combined with a plain packaging policy. Plain packaging further restricts avenues through which tobacco industry could use cigarette packs for promotion and publicity, by restricting the use of logos, colors, and brand images other than brand images or product names displayed in a standard colour or font style to make them less appealing (WHO, 2003). While the Nigerian government has not signaled its intent along this aspirational scenario, we evaluate how effective this will be compared to the baseline and under the new policy setting.

**4.4 Data for the model**

The simulation exercise relies on cost, demographic, epidemiologic and economic data from Nigeria. The data on incidence and mortality from various health conditions were obtained from Global Burden of disease. The model uses Nigerian demographic data for populations above 35 years and this is obtained from the National Bureau of Statistics (2006) but projected to the 2019 estimate using the World Bank estimate of the Nigerian population growth rate. The smoking prevalence by sex and age were sourced from Global Adult Tobacco Survey (2012). This represents the most comprehensive and nationally representative survey on smoking prevalence in Nigeria but has not been updated till date.

An important input into the model is the cost information to enable derivation of direct and indirect costs of tobacco consumption and estimate the cost-effectiveness of intervention. For this, we rely on the initial micro-costing carried out by CSEA in 2019 based on hospital surveys

and expert costing of treatment costs of tobacco attributable diseases in Nigeria. The economic and fiscal parameters were similarly updated up till 2019 which we benchmark the analysis to. Given the cyclical downturn in 2020 due to covid-19 pandemic, we benchmarked the analysis to 2019 to control for outliers in the 2020 data. Detailed description of data sources is provided in Table 1.

**Table 1: Overview of main sources for model input parameters, by type**

| Parameter type | Description | Source | Ref |
|---|---|---|---|
| Demographics | Population structure: adults 35-100 years of age | National Bureau of Statistics Projections using 2006 Nigerian census data | https://www.nigerianstat.gov.ng |
| Epidemiology | Smoking prevalence (by sex and age group) | GATS (Global Adult Tobacco Survey) Nigeria 2012 | http://ghdx.healthdata.org/record/nigeria-global-adult-tobacco-survey-2012 |
| Epidemiology | Mortality due to acute and chronic conditions (by sex and age group) | GBD (Global Burden of Disease) 2017 mortality estimates<br>CSEA estimates from data of 3 Nigerian Public Hospitals<br>Globocan 2018 | http://www.healthdata.org/nigeria<br>https://gco.iarc.fr/today/ |
| Epidemiology | Incidence, prevalence, and hospital care of acute and chronic conditions | • GBD (Global Burden of Disease) 2017 mortality estimates<br>• CSEA estimates from data of 3 Nigerian Public Hospitals<br>• Globocan 2018 | http://www.healthdata.org/nigeria<br>https://gco.iarc.fr/today/ |
| Epidemiology | Relative risks of mortality for smokers, ex-smokers, and never-smokers | Cancer prevention study II. U.S. Department of Health and Human Services | https://epi.grants.cancer.gov/cohort-consortium/members/cps.html |
| Epidemiology | Passive smoking | Cancer prevention study II. U.S. Department of Health and Human Services | https://epi.grants.cancer.gov/cohort-consortium/members/cps.html |

| | | | |
|---|---|---|---|
| Costs | Treatment costs for annual and acute events of conditions | Microcosting events. Macro or indirect cost estimation | CSEA & IECS (2021) |
| Economics | Tobacco, cigars, and cigarettes tax collection | "A Scoping Study of Nigeria's Tobacco Market and Policy Space" | CSEA (2019) |
| | 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) |
| | Household expenditures | • GHSP 2018-9 | (National Bureau of Statistics (NBS) 2019) |

### 4.5 Selection of parameters for intervention impact

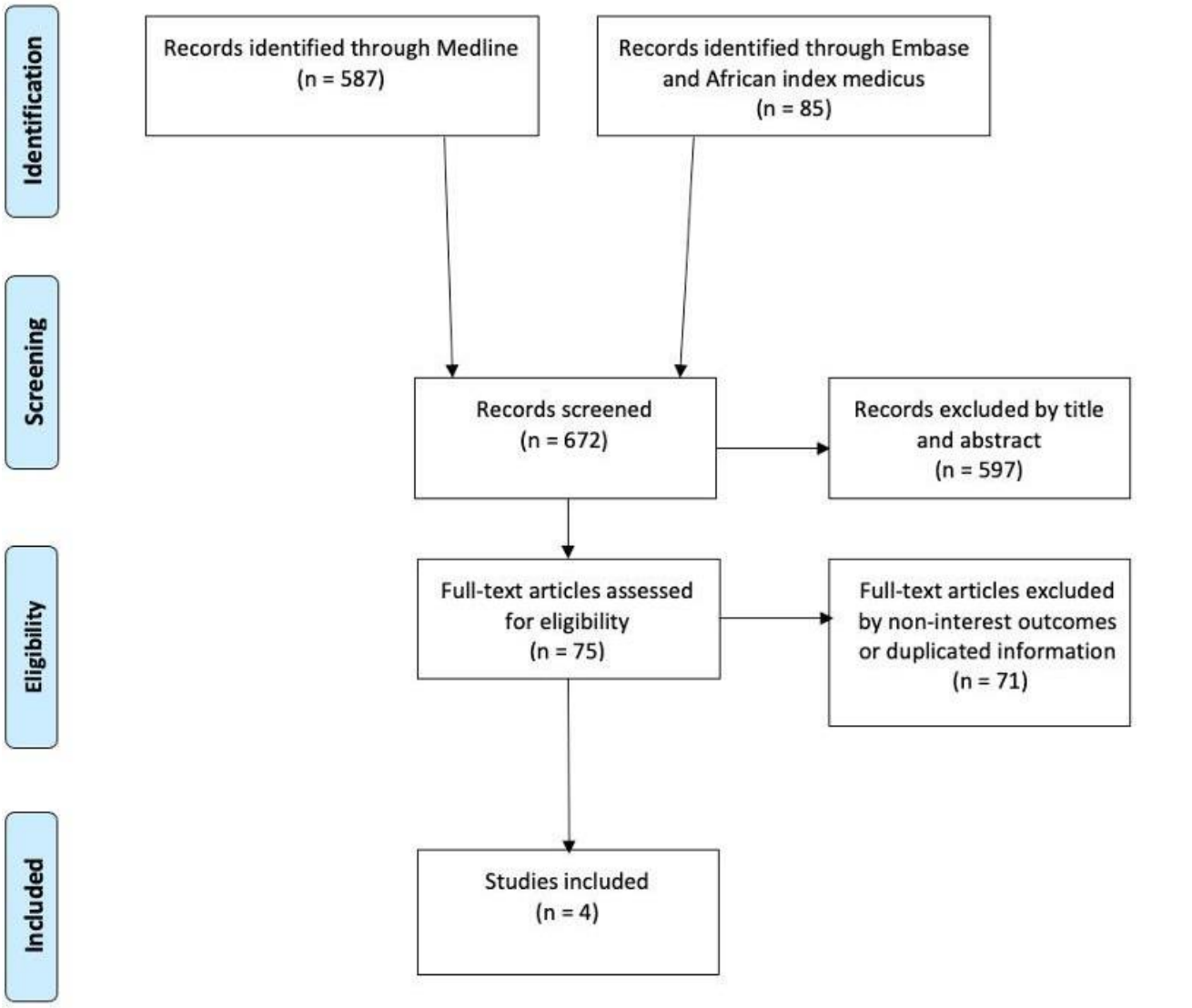
To obtain data on the benefits of implementing health warnings and the plain packaging of tobacco products to populate the simulation model, we carried out a systematic review of studies that adopted the Alcaraz's approach. We searched MEDLINE, Embase and the African index medicus. The search strategies and flow chart are shown in Figure 2. We incorporated the best assumption effectiveness for the case base. A sensitivity analysis was additionally performed to provide the lower and upper confident internal of the case base estimate.

The review on the effectiveness of health warnings showed that smoking prevalence could be reduced by 0.6% (Levy, 2018 & Hnin et al., 2020), and the consumption of cigarettes could decrease up to 8.89% if non-graphic warnings covered less than one-third of the pack (Nihms, 2016). The studies rely on estimations coming from periods when the risk of tobacco use was unknown for the general population, since the impact of this intervention nowadays is expected to be close to zero; for the base case we decide to use 0.6%.

When health warnings covered between 30 to 80% of the pack's surface, we found decreases in consumption of cigarettes from only 2% reported in Mexico and 8.68% in Canada or decreases in relative prevalence of tobacco use of 8% in Canada and 17.1% in Uruguay (Nihms, 2016). A systematic review reported a 13% decrease in relative prevalence of tobacco use but included health warnings of any size, including plain packaging (Noar, 2016). For the base case of our study, we decided to maintain the benefit of 3% if health warnings covered at least one third of the pack, and 6% if they covered at least 50% of the pack as we used in the previous study (Alcaraz et al., 2020).

Due to the limited studies, there is more uncertainty regarding the potential effect of implementing plain packaging. Available data indicate that this effect could be an additional 3.66% to 24.1% (Noar, 2016; Nihms, 2016). For the base case, we assumed that plain packaging would reach a relative reduction of 6% and we explored the range 3.15%-15.2% in the sensitivity analysis as was used in the previous study. (Alcaraz et al., 2020)

***Fig 2. Study Flow Diagram (2016-2021)***



## 5.0 Results

The health outcomes of interest are number of deaths and disease events averted, years of life that would have been lost due to premature death and disability, saving generated through avoided health costs and productivity lost and total costs avoided.

Table 2 shows that under the first scenario (text only health warning) led to only 748 averted deaths, while 8226 deaths can be averted in the second scenario (text+graphic warnings=748+7478) and 14756 deaths in third scenario (text+plain packaging+health warnings=748+14208). Furthermore, the paper shows that up to 276973 years will otherwise have been lost to early deaths and disability can be avoided in the second scenario which matches the present policy environment in Nigeria. The third scenario leads to better outcomes as the number of years that would otherwise have been lost to early deaths and disability increase to 503587. These improved outcomes underscore the need to improve cigarette packaging policies to achieve better long-term benefits. The averted death estimates reported for the three scenarios cover ten-year period (see Tables 3 for case base, and annex for the estimate for lower and upper confidence interval).

Table 4 shows the economic benefits of the health warnings measures through productivity gains and averted death and disability. Regarding the health benefits provided only with text warnings, the conditions for which the highest number of disease events are saved are COPD (1157 (Lower Limit, LL, at 579 and Upper Limit, UL, at 1736) and pneumonia (976, LL 488 UL 1464) and this effect is particularly most noticeable in the last 5 years of implementation. On the other hand, if we look at costs, we can observe that with this text-only intervention, also chronic obstructive pulmonary disease (7.7 million Naira LL 3.9 million UL 11.6 million) and stroke (4 million, LL 2million UL 6million) are the conditions with which more costs would be saved in the base case.

In contrast, for the benefits expected with graphic health warnings between 50 and 80% of the surface of the package only, i.e. matching the current implementation, if 100% compliance is achieved, a reduction of 11574 (LL 5787 UL 17361) COPD events (over 10 years, and 9761 pneumonias (LL 4881 UL 14642) can be expected. In terms of costs, a savings of 77.2 million per COPD (LL 38.6 million UL 115.8 million) and 39.8 million (LL 19.9million; UL 59.7million) for stroke could be expected among the most costly tobacco-related conditions for the country. Additional important benefits would be gained considering the other tobacco-related conditions.

For the last scenario, plain packaging plus health warnings> 80% of the package surface, the benefits expected if 100% of compliance was achieved, are the highest potentially achievable, with a reduction of 21990 (LL 11284 UL 45003) COPD events (over 10 years, and 18546 pneumonias (LL 9517 UL 37955) after 10-year time. In terms of costs, among the most costly tobacco-related conditions for the country, savings of 146.7 million for COPD (LL 75.3million UL 300.1million) and 76.6 million (LL 38.8million; UL 154.7million) for stroke could be expected. Again, more benefits would be derived from the other attributable diseases.

**Table 2. Health and economic benefit expected with health warnings and plain packaging of tobacco products. 10-year accumulated results**

| | | **Averted events** | **(n) / Costs saved** |
|---|---|---|---|
| | **Text warning** | **Graphic health warnings between 50 and 80% of the surface of the package** | **Plain packaging plus health warnings> 80% of the package surface** |
| Deaths | 748 | 7 478 | 14 208 |
| Cardiac disease | 309 | 3 093 | 5 876 |
| Cerebrovascular disease | 509 | 5 093 | 9 676 |
| Cancer | 135 | 1 346 | 2 557 |
| COPD | 1 157 | 11 574 | 21 990 |
| Years of life due to premature death and Disability | 25 179 | 251 794 | 478 408 |

| | | | |
|---|---|---|---|
| Health cost savings in millons ($=Naira) | $16 145 | $161 449 | $306 753 |
| Lost productivity costs avoided in millons ($=Naira) | $1 926 | $19 264 | $36 599 |
| **Total cost avoided in millons ($=Naira)** | **$18 071** | **$180 713** | **$343 353** |

*Note: Exchange rate: 1 USD= 411 $ Naira*

| | Table 3. Averted events (Case based) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Disease** | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | **10-year accumulated** |
| Ischemic heart disease | 160 | 198 | 238 | 281 | 327 | 343 | 360 | 377 | 395 | 413 | **3093** |
| Stroke | 310 | 371 | 431 | 492 | 554 | 565 | 576 | 587 | 598 | 609 | **5093** |
| Lung cancer | 13 | 17 | 20 | 24 | 27 | 29 | 30 | 32 | 33 | 35 | **260** |
| Pneumonia | 524 | 643 | 768 | 900 | 1038 | 1083 | 1130 | 1177 | 1225 | 1274 | **9761** |
| COPD | 370 | 523 | 704 | 910 | 1144 | 1286 | 1432 | 1581 | 1734 | 1890 | **11574** |
| Mouth and pharynx cancer | 20 | 25 | 29 | 34 | 39 | 41 | 43 | 44 | 46 | 48 | **369** |
| Esophagus cancer | 3 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | **68** |
| Stomach cancer | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 7 | 8 | **55** |
| Pancreatic cancer | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | **85** |
| Kidney cancer | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | **18** |
| Laryngeal cancer | 11 | 13 | 16 | 20 | 23 | 24 | 26 | 27 | 29 | 30 | **219** |
| Leukemia | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | **42** |
| Bladder cancer | 2 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | **43** |
| Cervical cancer | 10 | 12 | 15 | 17 | 20 | 21 | 22 | 22 | 23 | 24 | **186** |

Direct economic benefit (**₦162.402,78 Million**) expected with graphic health warnings between 50 and 80% of the surface of the package only. Year by year and 10-year accumulated results

**Table 4. Averted costs (Base case ) in million Naira,**

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cardiac disease** | ₦685,71 | ₦846,65 | ₦1.017,80 | ₦1.199,18 | ₦1.390,77 | ₦1.459,01 | ₦1.528,62 | ₦1.599,59 | ₦1.671,92 | ₦1.745,61 | ₦13.144,86 |
| **Stroke** | ₦2.422,26 | ₦2.891,58 | ₦3.365,68 | ₦3.844,56 | ₦4.328,23 | ₦4.412,70 | ₦4.497,80 | ₦4.583,55 | ₦4.669,93 | ₦4.756,95 | ₦39.773,23 |
| **COPD** | ₦3.048,01 | ₦4.042,53 | ₦5.170,64 | ₦6.432,33 | ₦7.827,61 | ₦8.571,74 | ₦9.333,68 | ₦10.113,43 | ₦10.910,99 | ₦11.726,36 | ₦77.177,31 |
| **Pneumonia** | ₦57,10 | ₦70,04 | ₦83,68 | ₦98,03 | ₦113,08 | ₦118,03 | ₦123,07 | ₦128,21 | ₦133,44 | ₦138,76 | ₦1.063,42 |
| **Lung cancer** | ₦228,17 | ₦282,78 | ₦341,13 | ₦403,22 | ₦469,04 | ₦493,42 | ₦518,31 | ₦543,69 | ₦569,57 | ₦595,94 | ₦4.445,27 |
| **Other cancers** | ₦422,51 | ₦522,57 | ₦629,20 | ₦742,42 | ₦862,21 | ₦905,67 | ₦950,00 | ₦995,22 | ₦1.041,31 | ₦1.088,27 | ₦8.159,37 |
| **Passive smoking** | ₦887,59 | ₦1.120,09 | ₦1.373,47 | ₦1.647,71 | ₦1.942,81 | ₦2.069,34 | ₦2.198,65 | ₦2.330,75 | ₦2.465,62 | ₦2.603,28 | ₦18.639,32 |
| **Total** | **₦7.751,35** | **₦9.776,24** | **₦11.981,60** | **₦14.367,43** | **₦16.933,75** | **₦18.029,91** | **₦19.150,13** | **₦20.294,42** | **₦21.462,77** | **₦22.655,18** | **₦162.402,78** |

3

## 6.0 Discussion

In the past six years, Nigeria has introduced several tobacco control initiatives in line with WHO Framework Convention on Tobacco Control. Starting with the passage of the National Tobacco Control Act in 2015 that provides policy guidance for effective coordination on tobacco control policies and interventions, the government followed up on this with the introduction of tobacco taxes consecutively between 2018 and 2020. The new cigarette packaging regulation is the next phase in this series of tobacco control interventions. These interventions work together as an effective strategy to reduce the tobacco epidemic, if effectively implemented and sustained.

Our results show that a change from text only health warnings to text and graphic warnings will lead to 8226 averted deaths as against 748 deaths averts with only text warnings over 10 years. This translates to about 251794 years saved in terms of early deaths and disability and up to US$180,713 saved in health costs. The health benefits from text and graphic warnings come from averted disease events through COPD (11574), followed by pneumonia (9761), Cerebrovascular disease (5093), cardiac disease (3093) and cancer (1364). The health benefits are also progressive with the lowest death and disease event averted occurring in the first year and the highest gains recorded in the $10^{th}$ year. This underscores the importance of not only making policy pronouncement but effective implementation and monitoring overtime to sustain the gains.

It is not unexpected for the tobacco industry and their lobbyists will respond to this policy with a strategy to sidestep the impact on tobacco consumption or resort to alternative packaging and promotional mediums. Hence, realizing these gains require effective implementation, while maintaining sustained surveillance to track loopholes that can be exploited. Moreover, our simulation also points to much higher benefits when the graphic and text health warnings are combined with plain packaging to further reduce the attractiveness and promotional value of cigarette packs. Evidently, we envisioned this as the next step in the Nigerian tobacco control policy. This aspiration scenario almost doubles the number of averts deaths and disease incidence and leads to higher savings in health costs.

Overall, we have empirically shown that the new packing policy reinforces the broader tobacco control policies in Nigeria. Together they will depress the smoking population, support productivity growth, and enhance a healthy population. A potential benefit from the packaging

policy is the low cost of implementation and monitoring. There are minimal costs on the government in implementation and enforcement given that custom officials are already stationed at the production site of tobacco industry to take stock for tax purposes. The customs also have a further role in tracking violations of the policy through illicit trade. Non-state actors are also important agents in enforcement of the new policy. They can track compliance in hard-to-reach localities and rural areas. Hence, the ministry of health has the coordination role to work with other government institutions and stakeholders for effective compliance.

Another key challenge that might reduce the effectiveness of the policy is when purchases are made in sticks rather than in packs. The NCTA (2015) already places a ban on the sale of cigarettes in single sticks. However, in a study of cigarette packaging policy in 10 African countries, African Research Alliance on Tobacco (2018) ranked Nigeria third in terms of accessibility of sticks to smokers despite single sticks being prohibited. This could be a major challenge to the effective implementation of the policy.

Our study has important limitations that further study can address. First, the relative risks employed for the simulation are based on evidence from other countries and could be different from Nigeria. We cannot predict the degree and direction that this bias works given Nigerian population structure and level of economic development. However, we are not aware of any past or present attempts at generating national estimates of relative risks from smoking, which is an important area for future study. Second, we have only focused on tobacco attributable diseases that are already well established in the literature thereby excluding disease incidence like diabetes among others that smoking has the potential to cause or amplify. This could underestimate the health burden of smoking and the benefits from graphic and text health warnings intervention. More evidence will be needed here as well.

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**Annex**

| | **Table 5. Averted Events (lower limit of confidence interval)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Disease** | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | **10-year accumulated** |
| Ischemic heart disease | 80 | 99 | 119 | 141 | 163 | 172 | 180 | 189 | 197 | 206 | **1546** |
| Stroke | 155 | 185 | 216 | 246 | 277 | 283 | 288 | 293 | 299 | 304 | **2546** |
| Lung cancer | 7 | 8 | 10 | 12 | 14 | 14 | 15 | 16 | 17 | 17 | **130** |
| Pneumonia | 262 | 321 | 384 | 450 | 519 | 542 | 565 | 588 | 612 | 637 | **4881** |
| COPD | 185 | 262 | 352 | 455 | 572 | 643 | 716 | 791 | 867 | 945 | **5787** |
| Mouth and pharynx cancer | 10 | 12 | 15 | 17 | 20 | 20 | 21 | 22 | 23 | 24 | **185** |
| Esophagus cancer | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | **34** |
| Stomach cancer | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | **27** |
| Pancreatic cancer | 2 | 3 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | **42** |
| Kidney cancer | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **9** |
| Laryngeal cancer | 5 | 7 | 8 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | **110** |
| Leukemia | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | **21** |
| Bladder cancer | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | **21** |
| Cervical cancer | 5 | 6 | 7 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | **93** |

**Table 6. Averted events (upper limit of confidence interval)**

| **Disease** | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | **10-year accumulated** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ischemic heart disease | 240 | 297 | 357 | 422 | 490 | 515 | 540 | 566 | 592 | 619 | **4639** |
| Stroke | 466 | 556 | 647 | 739 | 831 | 848 | 864 | 880 | 896 | 913 | **7639** |
| Lung cancer | 20 | 25 | 30 | 35 | 41 | 43 | 46 | 48 | 50 | 52 | **390** |
| Pneumonia | 786 | 964 | 1152 | 1350 | 1557 | 1625 | 1694 | 1765 | 1837 | 1911 | **14642** |
| COPD | 555 | 785 | 1055 | 1365 | 1716 | 1929 | 2148 | 2372 | 2601 | 2836 | **17361** |
| Mouth and pharynx cancer | 30 | 37 | 44 | 51 | 59 | 61 | 64 | 66 | 69 | 72 | **554** |
| Esophagus cancer | 4 | 6 | 7 | 9 | 11 | 11 | 12 | 13 | 14 | 15 | **103** |
| Stomach cancer | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | **82** |
| Pancreatic cancer | 7 | 8 | 10 | 12 | 14 | 14 | 15 | 15 | 16 | 16 | **127** |
| Kidney cancer | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | **26** |
| Laryngeal cancer | 16 | 20 | 25 | 29 | 34 | 36 | 39 | 41 | 43 | 45 | **329** |
| Leukemia | 3 | 4 | 5 | 6 | 7 | 7 | 7 | 8 | 8 | 9 | **63** |
| Bladder cancer | 3 | 4 | 4 | 5 | 7 | 7 | 8 | 8 | 9 | 9 | **64** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cervical cancer | 15 | 19 | 22 | 26 | 30 | 31 | 32 | 34 | 35 | 36 | **280** |

**Table 7. Averted costs (in million Naira, Lower limit of confidence interval)**

| | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Year 7** | **Year 8** | **Year 9** | **Year 10** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cardiac disease** | ₦342,86 | ₦423,32 | ₦508,90 | ₦599,59 | ₦695,39 | ₦729,51 | ₦764,31 | ₦799,79 | ₦835,96 | ₦872,81 | ₦6.572,43 |
| **Stroke** | ₦1.211,13 | ₦1.445,79 | ₦1.682,84 | ₦1.922,28 | ₦2.164,11 | ₦2.206,35 | ₦2.248,90 | ₦2.291,77 | ₦2.334,96 | ₦2.378,47 | ₦19.886,62 |
| **COPD** | ₦1.524,00 | ₦2.021,27 | ₦2.585,32 | ₦3.216,17 | ₦3.913,81 | ₦4.285,87 | ₦4.666,84 | ₦5.056,71 | ₦5.455,49 | ₦5.863,18 | ₦38.588,65 |
| **Pneumonia** | ₦28,55 | ₦35,02 | ₦41,84 | ₦49,01 | ₦56,54 | ₦59,01 | ₦61,53 | ₦64,10 | ₦66,72 | ₦69,38 | ₦531,71 |
| **Lung cancer** | ₦114,09 | ₦141,39 | ₦170,57 | ₦201,61 | ₦234,52 | ₦246,71 | ₦259,15 | ₦271,84 | ₦284,78 | ₦297,97 | ₦2.222,63 |
| **Other cancers** | ₦211,26 | ₦261,28 | ₦314,60 | ₦371,21 | ₦431,10 | ₦452,83 | ₦475,00 | ₦497,61 | ₦520,65 | ₦544,14 | ₦4.079,69 |
| **Passive smoking** | ₦443,79 | ₦560,05 | ₦686,73 | ₦823,85 | ₦971,41 | ₦1.034,67 | ₦1.099,33 | ₦1.165,37 | ₦1.232,81 | ₦1.301,64 | ₦9.319,66 |
| **Total** | **₦3.875,68** | **₦4.888,12** | **₦5.990,80** | **₦7.183,72** | **₦8.466,87** | **₦9.014,95** | **₦9.575,07** | **₦10.147,21** | **₦10.731,38** | **₦11.327,59** | **₦81.201,39** |

**Table 8. Averted costs (in million Naira, upper limit of confidence interval)**

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cardiac disease** | ₦1.028,57 | ₦1.269,97 | ₦1.526,70 | ₦1.798,76 | ₦2.086,16 | ₦2.188,52 | ₦2.292,93 | ₦2.399,38 | ₦2.507,88 | ₦2.618,42 | ₦19.717,29 |
| **Stroke** | ₦3.633,39 | ₦4.337,37 | ₦5.048,52 | ₦5.766,84 | ₦6.492,34 | ₦6.619,05 | ₦6.746,71 | ₦6.875,32 | ₦7.004,89 | ₦7.135,42 | ₦59.659,85 |
| **COPD** | ₦4.572,01 | ₦6.063,80 | ₦7.755,96 | ₦9.648,50 | ₦11.741,42 | ₦12.857,61 | ₦14.000,51 | ₦15.170,14 | ₦16.366,48 | ₦17.589,54 | ₦115.765,96 |
| **Pneumonia** | ₦85,65 | ₦105,06 | ₦125,52 | ₦147,04 | ₦169,61 | ₦177,04 | ₦184,60 | ₦192,31 | ₦200,16 | ₦208,15 | ₦1.595,13 |
| **Lung cancer** | ₦342,26 | ₦424,17 | ₦511,70 | ₦604,83 | ₦703,56 | ₦740,13 | ₦777,46 | ₦815,53 | ₦854,35 | ₦893,92 | ₦6.667,90 |
| **Other cancers** | ₦633,77 | ₦783,85 | ₦943,80 | ₦1.113,62 | ₦1.293,31 | ₦1.358,50 | ₦1.425,00 | ₦1.492,82 | ₦1.561,96 | ₦1.632,41 | ₦12.239,06 |
| **Passive smoking** | ₦1.331,38 | ₦1.680,14 | ₦2.060,20 | ₦2.471,56 | ₦2.914,22 | ₦3.104,01 | ₦3.297,98 | ₦3.496,12 | ₦3.698,44 | ₦3.904,92 | ₦27.958,98 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | **₦11.627,03** | **₦14.664,36** | **₦17.972,40** | **₦21.551,15** | **₦25.400,62** | **₦27.044,86** | **₦28.725,20** | **₦30.441,63** | **₦32.194,15** | **₦33.982,78** | **₦243.604,17** |