Computer Simulation of the Impact of Cigarette Smoking On Humans

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Abstract

In this edition, emphasis has been laid on computer simulation of the impact of cigarette smoking on the population between now and the next 50 years, if no government intervention is exercised to control the behaviour of smokers. The statistical indices derived from the previous article (WAJIAR Volume 4) in the series were plugged in as input to the simulation model. The software simulation followed a statistical model. The simulation software was developed using the internationally accepted Software Engineering Methodology – the Structured System Analysis and Design Methodology (SSADM), coding by OOP and packaging by Prototyping methodologies. The simulation is intended to be predictive and to enable policy makers see the impact and dangers of cigarette smoking between now and the next 50 years if current abuse is not controlled, that is, the number of smokers likely to contact liver, brain and related diseases and who are most likely to die from these diseases. The summary of the result shows that in the next fifty years, a total of 2379591 people will likely suffer liver diseases, 2379818 people will likely suffer lung diseases, 2380297 people will likely suffer hepatitis and 2379689 will also likely suffer Brain Damage. Generally, a total of 9519395 people will likely suffer these four diseases caused by cigarette smoking and most importantly, the total number of deaths is expected to be 1903880. This result suggests that the negative impact of cigarette smoking is significant and demands immediate government intervention to avoid further population decimation.

Keywords: Simulation, Software, Model, Population, Design.

1.0 Introduction

In the first publication which appeared in WAJIAR Vol. 4 of Aug. 2012 we had presented a statistical analysis of the impact of cigarette smoking on humans. In the present article which is a simulation of the first, the statistical indices derived from that research, a software model has been developed to predict the future impact of uncontrolled consumption of cigarette on the population. The result of the simulation has been summarized in terms of the number of people who would be affected by liver disease, lungs disease, hepatitis and brain damage, and are presented in the Tables 3 to 7 in appendix A.

2.0 Methodology

The methodology adopted here in the second phase of the study is ***the Structured Systems Analysis and Design Methodology (SSADM) and its Ob ject Oriented Equivalence.*** [1] [2] [3].The SSADM is the standard information system development method. It takes a top-down approach to system

development, in which a high level picture of system requirements is built and then gradually refined into a detailed and rigorous system design. Its steps include:

- Problem identification
- Feasibility study
- Analysis
- Design
- Implementation
- Post implementation maintenance

The Object Oriented Method was used in designing the programs while prototyping was deployed in the packaging of the model

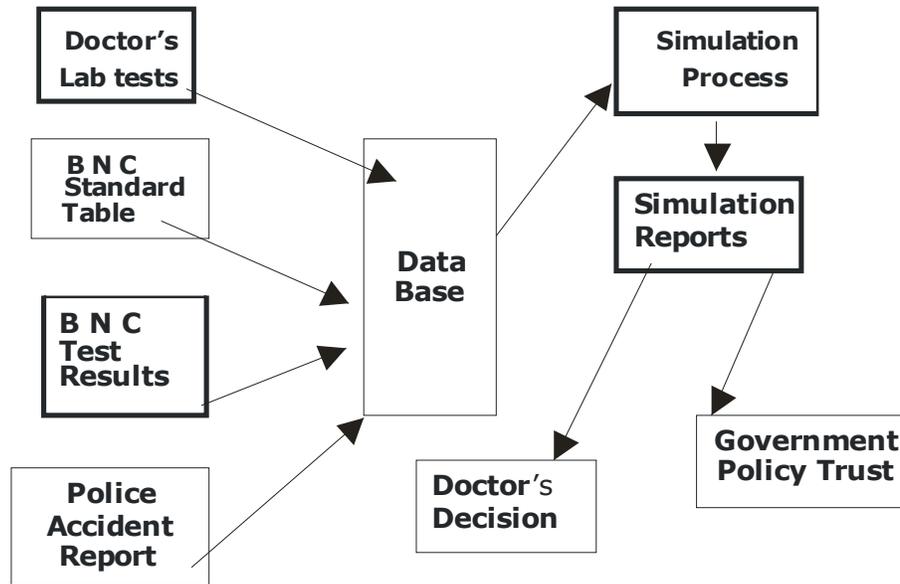## 3.0 Analysis of The Present System Of Nicotine Testing

Fig. 1: Preliminary Data Flow Diagram (DFD) of the Existing System
Source: Imo State University Teaching Hospital.

4.0 Data Source:

The source of the data for the work is Imo State University Teaching Hospital, IMUSTH, Orlu. Data were collected on the following variable over a period of 24 months, from the records of patients suffering from cigarette smoking-related killer diseases.

- Liver disease
- Lung disease
- Hepatitis
- Brain damage

From the records, the total number of deaths resulting from these diseases was also recorded. Under the period, about 363 patients were found to be suffering from these diseases. Information was also collected on age of these patients. The data collected were rearranged in Table 1 thus:

Table 1: Number of Deaths From Four Killer Diseases

S/no	Month	No of death	Liver x_1	Lung disease x_2	Hepatitis x_3	Brain damage x_4	Total No of patients
1	Jan.	1	1	0	0	0	19
2	Feb.	2	1	0	1	0	18
3	March 2007	5	4	0	1	0	18
4	April	4	2	2	0	0	23
5	May	1	1	0	0	0	22
6	June	0	0	0	0	0	11
7	July	1	1	0	0	0	19
8	August	2	1	0	1	0	18
9	Sep.	4	1	0	2	1	16
10	Oct.	3	2	0	1	0	20
11	Nov.	3	0	3	0	0	18
12	Dec.	2	0	2	0	0	19
13	Jan. 2008	0	0	0	0	0	24
14	Feb	4	4	0	0	0	10
15	March	10	0	4	0	6	17
16	April	1	0	1	0	0	16
18	June	3	1	0	1	1	19
19	July	5	4	1	0	0	17
20	August	8	6	1	1	0	28
21	Sept.	5	5	0	0	0	12
22	Oct.	3	2	1	0	0	7
23	Nov	2	1	1	0	0	6
24	Dec.	1	0	1	0	0	5

Source: Imo State University Teaching Hospital

5.0   Descriptive Statistics

A preliminary descriptive statistics were done on the data collected for the period of 24 months. The mean numbers of deaths, their correlation, as well as standard deviations were identified. The four identified diseases caused by cigarette smoking were analyzed separately. Below are the computational formula used:

$$Y = a\beta x_1 + \beta x_2 + \dots + \beta x_n \qquad \{1\}$$

6.0   Objectives of the Design

The objectives of the design include:

- Take a sample population, statistically analyze the number of consumers reported to have taken ill in the particular hospital and determine the type of diseases caused by Tobacco smoking, the number of the population that recovered and the number that died.
- Develop a computer simulation with coefficients derived from the statistical analysis of the sample population that will be able,
- Predict numbers of deaths that may arise from liver disease, lung disease, hepatitis, brain damage in the next 50 -100 years using the Simulation Model.
- The computer model will be able to predict the number of deaths in a State, locality or Nigeria that may occur from liver diseases, lung disease, hepatitis and brain damage in the next 50 years.
- To produce timely report that will, support government policy trust on Tobacco smoking in Nigeria.
- The result from the simulation is expected to assist

Government to make tactical and strategic policy on tobacco smoking in Nigeria.
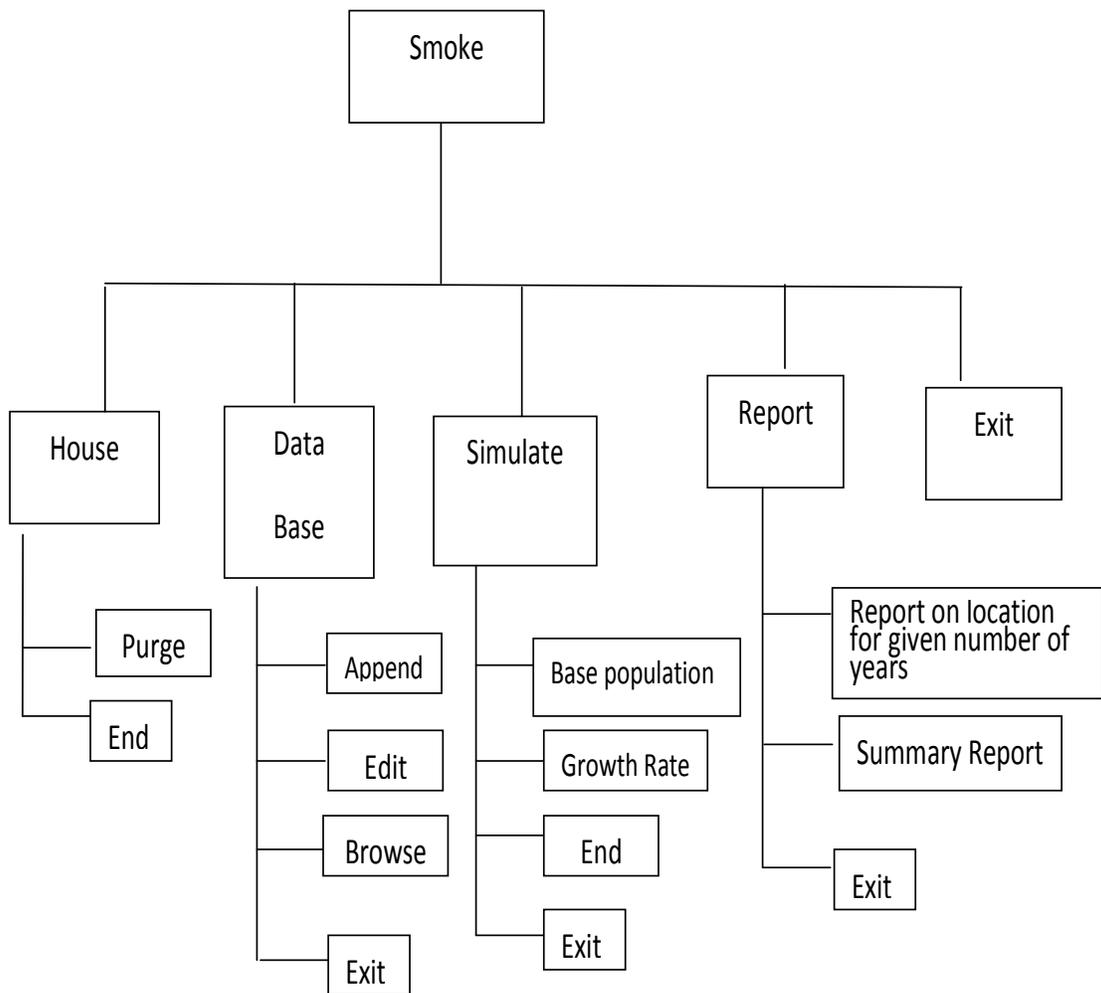
6.1   Control Centre (Main Menu)

Fig. 2 Control Centre
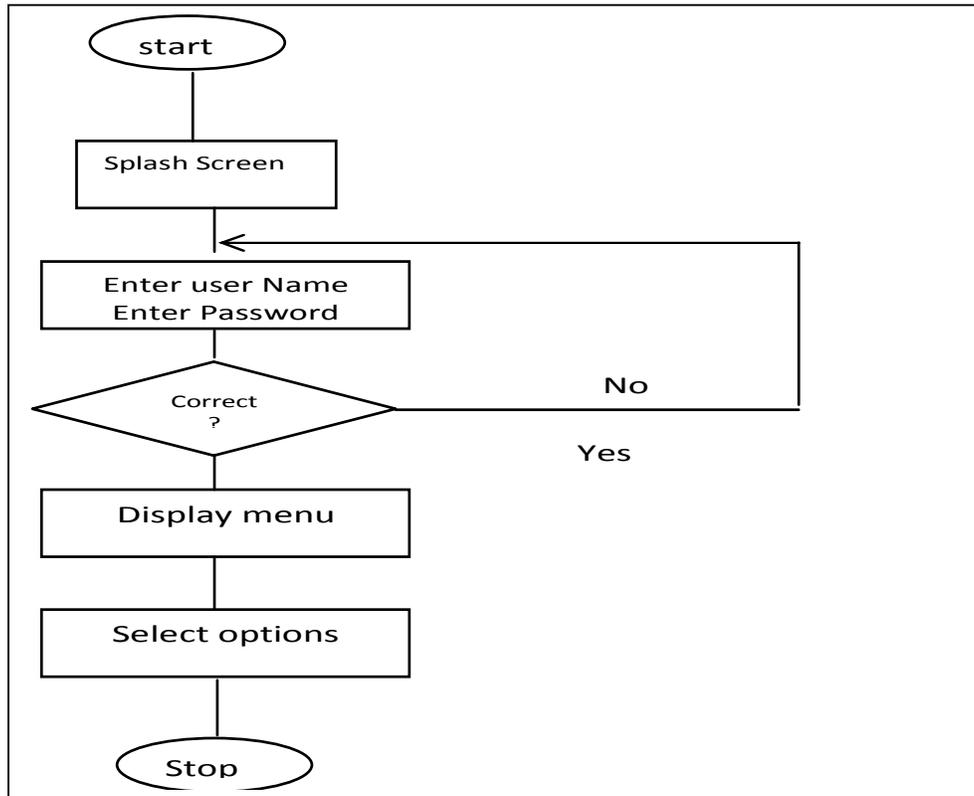
Program Start – Up Procedure

Fig.3: Program Start-up Menu
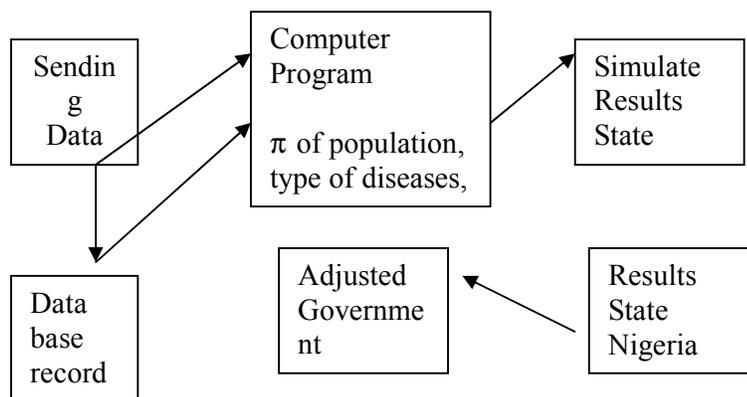

Overall Data Flow Diagram of The New System

Fig.4   ODFD of the new simulation model
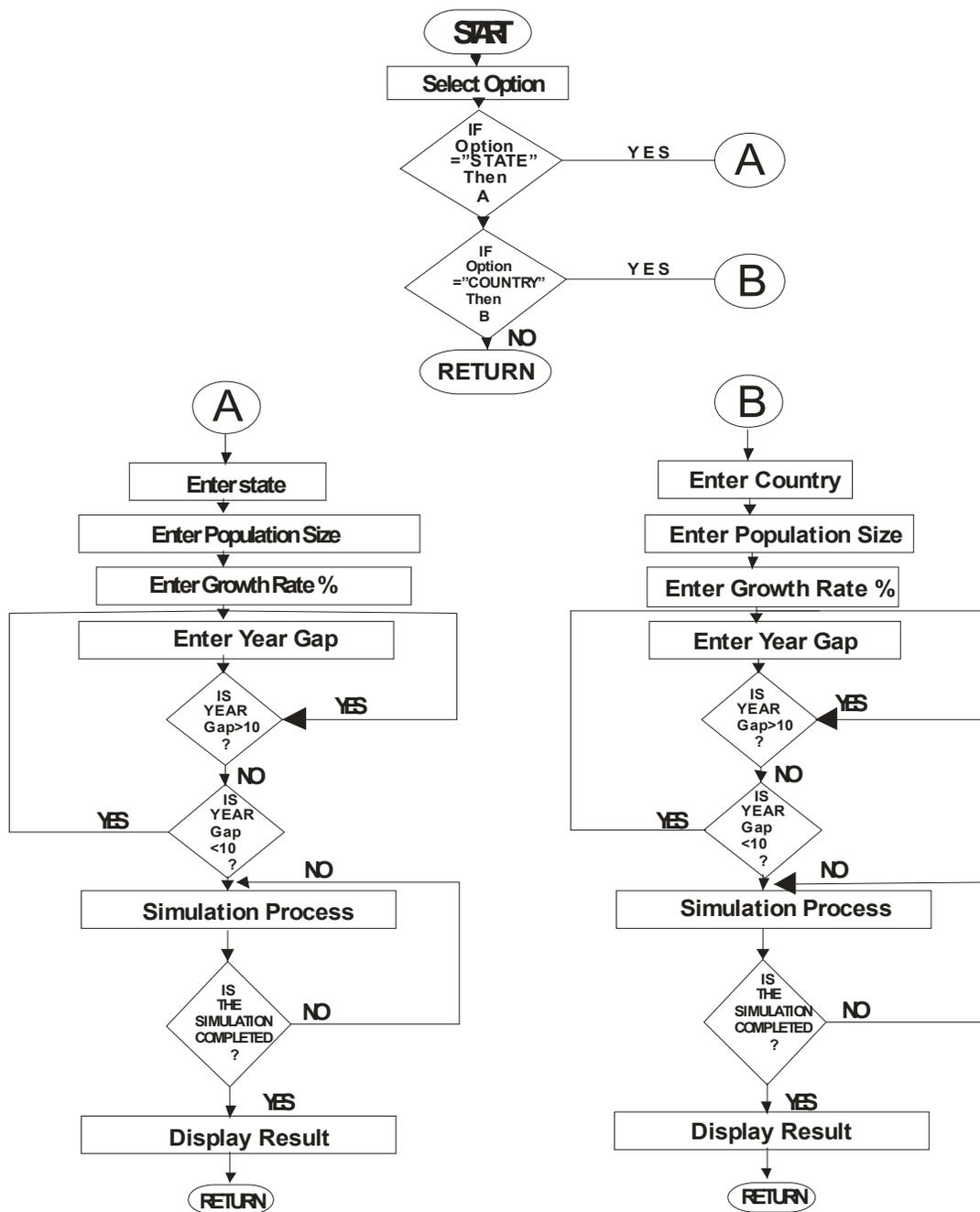
6.2 Program Flowcharts

Fig.5: Program Flowcharts for operation procedure for the simulation model

System Requirements:

These are the hardware minimum requirements that will enable the proposed system operate efficiently. The requirements are based on both the hardware and software.

6.3 Hardware Requirements to run the simulation:

Appropriate installation of the right hardware will enhance the running of the simulation model. Computer hardware refers to the physical parts of a computer and related devices. Internal hardware devices include motherboards, hard drives and RAM. External hardware devices include Monitors keyboards, mice, printers, and scanners [5]. Software runs on computer hardware, software programs often have system requirements that list the minimum hardware required for the software to run. For the effective functioning of the simulation program, the following should be put in place.

- Hard disk with minimum of .5GB free space
- Cache of 1000KB
- At least 1GB of RAM
- CD Rom Drive
- Floppy disk drive
- Intel Processor, Pentium III or higher
- Keyboard
- Mouse
- UPS
- Stabilizer
- Speaker
- Printer
- Surge Protector
- 14" SVGA Monitor

6.4 Software Requirements:

Some software must be installed for the designed system to work. They are:
Windows XP, 2000, Vista, Linux etc
Visual Basic 6.0

6.5 Running the Program

To run the program, the following steps are involved
- Boot your system
- At the windows desktop click on simulation icon and for other instructions
- Type in the user name
- Type in the user pass word
- Type in the state name
- Type in the state base population
- Type in the population gap
- Type in the growth rate

The program displays the output screen

6.5 System Test and Evaluation

Test and evaluation are two critical conditions of assuring software quality [4] .Software has been developed to accomplish the objectives set out in chapter one of this thesis. They are as follows:

(a) Take a sample population, statistically analyze the number of consumer reported to have taken ill in the Imo State University Teaching Hospital and determine the type of diseases caused by smoking, the proportion of the population that survived and those that died.

(b) Developing a simulation model with coefficient derived from statistical analysis of the population to predict the long term impact of cigarette consumption in the next 50 years.

(c) Developing a model that will assist government to make tactical and strategically policy trust on smoking in Nigeria.

Software (A) is for data entry and collection. The test plan is that the software captures and saves data in the specified format. These processes are described in Table 1. For (B), the Test Plan: Model development with coefficients derived from statistical analysis of the sample population will be detailed in

various subsections of the chapter. For (c), the test plan will also be detailed below.

6.6   Test Plan

In spite of the assistance of the Imo State University Teaching Hospital Personnel, lack of proper record keeping by the Hospital made it difficult to obtain comprehensive data for this research. Available data was incomplete and inconsistent. However, data was obtained for the following diseases.

(1)   Liver Diseases
(2)   Lungs Diseases
(3)   Hepatitis
(4)   Brain Damage

These data were statistically analyzed using the software statistical package for scientific studies. The following results were obtained. The statistical indices obtained were used in programming the smoke simulates. The data are represented below. The test output result is presented in table 2.

Table 2:   SUMMARY DISCUSSION ON THE RESULT

Year	Liver Disease	Lungs Disease	Hepatitis	Brian Damage	TOTAL
2007 – 2016	97	143	239	117	596
2017 – 2026	362	407	503	381	1653
2007 - 2036	5676	5721	5817	5696	22910
2037 – 2046	112527	112572	112668	112546	450313
2047-2056	2260929	2260975	2261070	2260949	9043923
Total	**2379591**	**2379818**	**2380297**	**2379689**	**9519395**

From the summary output result of the smoke simulate in the table 2, it is observed that a total of 9 people suffered liver disease, 13 suffered lungs disease, 23 people suffered hepatitis and 11 suffered Brain Damage, all resulting from cigarette smoking, in the year 2007. It is also recorded that the total number of 11 people died as a result of these diseases caused by same cigarette smoking in that year. Similarly, in the year 2008, 9 people suffered Liver Disease, 13 suffered lungs disease, 23 suffered Hepatitis and 11 suffered Brain Damage as a result of cigarette smoking and a total of 11 died etc. it is expected that from 2007- 2016, a total of 97 people will suffer liver diseases, 143 will suffer Lungs Diseases, 239 will suffer Hepatitis and 117 will suffer Brain Damage in Imo State alone. It is also expected that within that range of time (2007 – 2016) a total 119 people will die from the effects of cigarette smoking.

It is clear from the above that from 2007 – 2016 a total of 596 will suffer these diseases, 1653 people will suffer from these cigarette induced diseases from 2017 – 2026. A total of 22910 people will suffer same diseases from 2027 – 2036. Similarly, a total of 450314 and 9043923 people will suffer this disease from 2037 – 2046 and 2047 – 2056 respectively.

It is obvious from the summary output result in the above analysis that a total population of 9519395 people will suffer from cigarette induced diseases. This implies that in the next fifty years, a total of 2379591 will suffer liver diseases, 2379818 will suffer lungs diseases, 2380297 will suffer hepatitis and 2379689 will suffer Brain Damage. Generally, a total of 9519395 people will suffer these four disease caused by cigarette smoking.

This population is huge and has far reaching budgetary socio-economic implication**.**

The implications of this result is that in the next 50 years, this figure, 9519395 people, that will suffer these disease is very alarming and will lead to more deaths being recorded if not properly checked. Therefore smoking should be banned in all public places as obtained in the United States of America. It is evident from the above results that resources that ought to be utilized for other meaningful economic ventures are wasted in curing avoidable diseases. This will passive on hospital budgets, medicine and human resources.

The model result sample outputs are placed in Appendix A.

7.0 Summary, conclusion and Recommendations:

A study of the impact of Tobacco smoking on human smokers using systematic modeling has been carried out for about four years. It has been found that smoking is the main source of liver, heart, kidney and lungs related diseases including hypertension and death. There is need therefore to establish some level of control over tobacco smoking to prevent untimely deaths of the larger population of citizens.

7.1 Conclusions:

Continuous in-take of Tobacco can threaten the longevity and existence of a community and the whole nation. The study reveals that if the ugly habit of smoking is not controlled, the consequences on the Nigeria population are far-reaching and have the potential of decimating the Nigerian population or rendering a large proportion of the population productively impotent. It has the same potency like a nation in a state of war. Decisive measures need to be taken by government to control tobacco smoking to avert the possibility of human existential risk.

7.2 Recommendations

There is overwhelming evidence from the study that the negative consequences of tobacco smoking is enormous and therefore requires government control intervention. We therefore recommend thus:

1. There is immediate need for the Federal, State and Local governments to create or expand job opportunities for our teaming unemployed youths who have taken to tobacco smoking as the only source of stress reduction or escape mechanism.

2. Knowledge of health implications of tobacco smoking should form part of Secondary School curriculum in Nigeria.

3. Workshops and seminars should be organized at both Local and Federal levels by the Ministries of Health, National Orientation Agency, to create the awareness of the Social and Health impacts of tobacco smoking in Nigeria.

4. There is the need for the intensification of the use of specifically designed public enlightenment methods, through the print and electronic media. This will serve as a "spring board" for improved public awareness of the impact of tobacco smoking

5. There is need to strengthen the NDE to expand her skill empowerment programs to accommodate more youths in other for them to develop self-employment skills. A busy mind will be less exposed to tobacco abuse.

6. The Federal government should as a matter of policy implement the use of Digital Display Tobacco Tester (DDTT) by the Federal Road Safety Commission (FRSC) workers in all Nigerian motor parks. In other words, the Federal government should enact and enforce the Driving under Intoxication (DUI) law and provide strict sanctions for any driver whose Blood Tobacco Concentration (BTC) level is found to exceed maximum standard for driving. Such sanctions may

include withdrawal of driving license, fines and imprisonment.

7. The Federal government should enact laws restricting the importation of tobacco and local production and smoking of tobacco. This will invariably reduce the number of liver cirrhosis patients in
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Nigeria. This is in the overall interest of the country.

8. There should be Federal government policy trust on the sale and smoking of tobacco at prohibited areas such as motor parks and secondary schools environment

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References

[1]   http://en.wikipedia.org/wiki/Structured_systems_analysis_and_design_ method#Stage_4_.E2.80.93_Technical_system_options.

[2]   http://www.sparxsystems.com/?gclid=CNv_34OW0bQCFQ7LtAod_nEAhQ

[3]   http://www.interaction-design.org/encyclopedia/prototyping.html

[4]   http://valuelabs.com/services/quality-assurance-and-testing

[5]   http://www.techterms.com/definition/hardware

Appendix A – Sample Output Result

Table 3

Simulation Result

Population Proportion Result for Imo State
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Base & Population Growth 2006 To 2016

Population Size: 75481358   Population Growth Rate: 1.35

Projected Smoking Disease:

Year	Population Rate	Liver	Lung	Hepatitis	Brain Damage	Total	Total Death
2007	5067990	9	13	23	11	55	11
2008	6841787	9	13	23	11	55	11
2009	9236413	9	13	23	11	56	11
2010	12469157	9	14	23	11	57	11
2011	16833362	9	14	23	11	57	11
2012	22725039	9	14	24	11	59	12
2013	30678802	10	14	24	12	60	12
2014	41416383	10	15	25	12	62	12
2015	55912117	11	16	25	13	65	13
2016	75481358	12	17	26	14	69	14
		97	143	239	117		

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Total Number of Patients: 596
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Total Death From Cigarette Smoking   119
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Table 4: Sample Simulation Result

Simulation Result

Population Proportion Result for Imo State
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Base & Population Growth 2016 To 2026

Population Size: 1517670142   Population Growth Rate: 1.35

Projected Smoking Disease:

Year	Population Rate	Liver	Lung	Hepatitis	Brain Damage	Total	Total Death
2017	101899833	13	18	28	15	74	15
2018	137564775	15	20	29	17	82	16
2019	185712446	18	22	32	20	91	18
2020	250711802	21	25	35	23	104	21
2021	338460933	25	30	39	27	122	24
2022	456922260	31	36	45	33	145	29
2023	616845051	39	44	53	41	177	35
2024	832740818	50	55	64	52	221	44
2025	1124200105	65	69	79	67	279	56
2026	1517670142	84	89	98	86	358	72
		362	407	503	381		

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Total Number of Patients: 1653
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Total Death From Cigarette Smoking   331
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Table 5

Population Proportion Result for Imo State
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Base & Population Growth 2026 To 2036

Population Size: 30515119500   Population Growth Rate: 1.35

Projected Smoking Disease:

Year	Population Rate	Liver	Lung	Hepatitis	Brain Damage	Total	Total Death
====	============	====	====	======	==========	====	===========
2027	2048854692	115	115	125	113	464	93
2028	2765953834	147	151	161	149	607	121
2029	3734037676	195	200	209	197	801	160
2030	5040950862	260	265	275	262	1062	212
2031	6805283664	349	353	363	351	1415	283
2032	9187132946	468	472	482	470	1892	378
2033	12402629477	628	633	643	630	2535	507
2034	16743549794	846	850	860	847	3403	681
2035	22603792222	1139	1143	1153	1141	4575	915
2036	30515119500	1534	1539	1548	1536	6157	1231
		___	___	___	___		
		5676	5721	5817	5696		

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Total Number of Patients: 22910
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Total Death From Cigarette Smoking   4582
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Table 6

Simulation Result

Population Proportion Result for Imo State
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Base & Population Growth 2036 To 2046

Population Size: 613553955064   Population Growth Rate: 1.35

Projected Smoking Disease:

Year	Population Rate	Liver	Lung	Hepatitis	Brain Damage	Total	Total Death
====	============	====	====	=======	==========	====	==========
2037	41195411325	2068	2073	2082	2070	8293	1659
2038	55613805289	2789	2794	2803	2791	11177	2235
2039	75078637140	3762	3767	3776	3764	15070	3014
2040	101356160139	5076	5081	5090	5078	20325	4065
2041	136830816187	6850	6854	6864	6852	27420	5484
2042	184721601853	9244	9249	9259	9246	36998	7400
2043	249374162501	12477	12482	12491	12479	49929	9986
2044	336655119377	16841	16846	16855	16843	67385	13477
2045	454484411159	22733	22737	22747	22735	90951	18190
2046	613553955064	30686	30691	30700	30688	122765	24553

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112527 112572 112668   112546

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Total Number of Patients: 450314
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Total Death From Cigarette Smoking   900163
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Table 7

Simulation Result

Population Proportion Result for Imo State
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Base & Population Growth 2046 To 2056

Population Size: 12336456875906   Population Growth Rate: 1.35

Projected Smoking Disease:

Year	Population Rate	Liver	Lung	Hepatitis	Brain Damage	Total	Total Death
====	=============	====	====	=======	===========	====	==========
2047	828297839336	41423	41428	41437	41437	165714	33143
2048	1118202083104	55918	55923	55933	55920	223694	44739
2049	1509572812191	75487	75492	75501	75489	301969	60394
2050	2037923296457	101905	101909	101919	101906	407639	81528
2051	2751196450217	137568	137573	137582	137570	550293	110059
2052	3714115207793	185714	185719	185728	185716	742877	148575
2053	5014055530521	250711	250716	250725	250713	1002865	200573
2054	6768974966204	338457	338462	338471	338459	1353849	270770
2055	9138116204375	456914	456919	456928	456916	1827677	365535
2056	12336456875906	616831	616836	616845	616833	2467345	493469

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2260929 2260975 2261070 2260949

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Total Number of Patients: 9043923
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Total Death From Cigarette Smoking   1808785
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