Perception of Nigerians on the Use of Information Technology in Managing Counterfeit Drugs I: Prevention of Counterfeiting

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ABSTRACT

Counterfeit drugs impose risk to human life and properties. Many organizations globally are involved in campaigning for combating counterfeit drugs. Almost all these efforts are focused on controlling at various stages of pharmaceutical production and supply chain, while less or rare efforts are invested at terminal intervention by the end users. This paper focused on end users and health care givers in the society as well as stakeholders in the pharmaceutical related fields in the six geopolitical zones of the Federal Republic of Nigeria, namely South-West, South-South, South-East, North-East, North-West and North-Central. The study used Information Technology (IT) services specifically SMS text through Mobile Telecommunication Services, to target general drugs administration and handling by end users. A pilot study was conducted to identify the relationship between the socio-geopolitical awareness of counterfeit drugs as well as capability of Information Technology in preventing counterfeit drugs in Nigeria. A total of 1391 participants were selected for the study, using simple sampling technique across the six geopolitical zones in Nigeria. Furthermore, both descriptive and inferential analytical methods were used via the Statistical Package for the Social Sciences (SPSS) version 20. PHP (Hypertext Preprocessor) is the scripting language used at the server-side of this project. Finally, information technology as a tool for reducing drug counterfeits in Nigeria was examined. Majority of respondents indicate that they were not aware of the use of information technology to prevent fake drugs. The level of awareness about Information Technology on fake drug management is low compared to their awareness on technology devices This study concluded on the need of medication user to have a tailored information system to address the issue of counterfeit drugs in Nigeria.

Keywords: *Counterfeit (Fake) drugs, Health Information System, SPSS, ANOVA, PHP.*

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1. INTRODUCTION

For a nation to be able to prevent any catastrophe in any field of life, there must be a well-tailored information. 'Prevention is better than cure' is a proverbial saying dating back to early 17th century. A similar idea is found in a Latin saying of the mid-13th century - 'it is better and more useful to meet a problem in time than to seek a remedy after the damage is done' (Encyclopedia, 2018). One can relate this proverb to an axiom of famous scientist Benjamin Franklin who said "An Ounce of Prevention is Worth a Pound of Cure" (Archives, 2018) . Although Franklin was credited with this saying while addressing residents of Philadelphia who were being threatened by fire, many use this quote when referring to health care or other fields of life which need to prevent the occurrence of disaster.

In the health services, information technology with its tools plays a significant role in circulating the information to the community vis-a-vis preventing any epidemic. That is, the key to preventing disease and promoting health care is to provide timely, well-documented and useful information.

The employment and utilization of machines, tools and computer-based technologies in health-care services have passed through an evolutionary process. Advancement in information, communication, as well as network technologies gave birth to the emergence of a revolutionary new paradigm for health care that some refer to as Electronic-Health (e-health). As we begin to see the involvement of e-technologies in every aspect of health care and medicine, it gives one clear understanding why courses in e-health and related areas are logical for the health information systems curricula in medical schools as well as allied health, engineering, and business disciplines (Tan, 2005).

Short Message Service (SMS) as a term is considered one of the main landmarks in the history of mobile telephony. With this service, users have created their own dialect to cope with limitations with this service, composed their own communication groups or communities, and are enjoying new channels of interactions. Today, GSM handset or mobile phone has SMS capabilities that if each GSM subscriber sends a message at the same time then more than 1 billion messages would fly over the radio waves of mobile networks worldwide.
Counterfeit means the act of making a product to look like the original of its nature, usually for making money by dishonest or illegal purposes.

A drug is a single chemical substance that forms the active ingredient of a medicine, which later may contain many other substances to deliver the drug in a stable form, acceptable and convenient to the patient (Laurence & Bennett, 1990).

World Health Organization Scientific Group has defined a drug as "any substance or product that is used or intended to be used to modify or explore physiological system or pathological states for the benefit of the recipient" (WHO, 2007).

To overcome and minimize the risk of counterfeit drug at User side, there is the need for development of an Information System which will enable End-User to check for authenticity of the medication in addition to be able to confirm the product at hand, therapeutic use, dosage form, manufacturer and additionally expiry date.

World Health Organization (WHO) defined Counterfeit Medicine as "one which is deliberately and fraudulently mislabelled with respect to identity and/or source. Counterfeiting can apply to both branded and generic products and counterfeit products may include products with the correct ingredients or with the wrong ingredients, without active ingredients, with insufficient active ingredient or with fake packaging" (WHO, Counterfeit Drug, 1999).

An interactive system was developed in this paper which, as recommended by (Asuquo, Oluwade, & Adepoju, 2009), is easy to learn, easy to use, easy to remember as well as effective, efficient, has error tolerance, good aesthetics and user satisfaction. This serves as a contribution to the call for "Educate before medicate", in line with the campaign of the National Council on Patient Information and Education (NCPIE, 2007).

The problem of Counterfeit Drugs, according to World Health Assembly, is that Information on the scale of the problem is inadequate and there are little global studies conducted (WHO, 1999). However, it is known to affect both developed countries (sometimes called Advanced countries), and to a great extent, the undeveloped countries. The problem of counterfeit drug is more pronounced in countries where manufacture, importation, distribution, supply and sales of drugs are less regulated and enforcement is weak. Another factor that contributes to the drug counterfeit phenomena is a situation in which an insider (employee) at any legitimate pharmaceutical company (for example, a disgruntled employee) who is ready to take negative action against his or her employer (Amusa, 2012).

Besides trying to prevent the counterfeited drug, the developed system serves to prevent sub-standard product. It will also contribute to the principle of pharmacovigilance that aims to improve patient care and safety in relations to the use of medicine, to help in mitigating medication errors.

This work falls within the area of patient safety, patient drug information, patient health education and patient healthcare services. The scope of this study covers the need and role of Information Technology in curbing counterfeit drug and improvement to the present countermeasure applied in the combat against fake and sub-standard drugs in Nigeria. The paper reflects a study carried out in all the six geopolitical zones of the Federal Republic of Nigeria.

2. LITERATURE REVIEW

In a survey carried out in 2011 on eHealth, the Global Observatory for eHealth (GOe), a body of World Health Organization (WHO), defined mobile health (mhealth) as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices" (GOE, 2011). The report of GOe goes further to say that mhealth involves the use and capitalization on a mobile phone's core utility of voice and short messaging service (SMS) as well as more complex functionalities and applications including general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G systems), global positioning system (GPS), and Bluetooth technology.

Ehealth (electronic health) refers to the use of services provided by information and communication technology such as satellite communications, mobile phones and computers (programs and applications) to provide health information and services. Mhealth (mobile health) involves using mobile communications such as mobile phones services and PDAs (Personal Digital Assistants) for information and health services. Mhealth is a paramount sub-segment of the field of ehealth and it serves as the remote information tools and access point that provide information to healthcare providers.
According to World Health Organization, there are several initiatives that ehealth could be composed of. These include (1) communication between health services and individuals; this category includes appointment reminders, community mobilization on health-related matters, treatment compliance and awareness over health issues. (2) Consultation between health care professionals, including mobile telemedicine. (3) Communication between individuals and health services; this category includes health care telephone help lines namely health call centers and emergency toll-free telephone services. (4) Health monitoring and surveillance, including patient monitoring, mobile surveys and surveillance. (5) Access to information for health care providers at any point, including health-related information and decision support systems. (6) Inter-sector communication in emergencies (GOE, 2011).

In contributing to the prevention of fake drugs getting to the hands of consumers via online pharmacy, (Liang et. al., 2016) designed an automatic drug information screening and content analytical system which can lead to online fake drug websites and to the source of the sellers. Similarly, (Baravalle, Lopez, & Lee, 2016) sheds light on the nature of the drug market online, as well as the organized crime that can evolve from it. They then suggested a way of preventing fake drugs and other products.

Also, despite her well maintained and controlled system of pharmaceutical distribution chain, the counterfeit drug found its way to the Japanese system. For instance, fake drugs for hepatitis C sold at an authorized pharmacy, which shocked officials of Ministry of Health, Labor and Welfare, and this encouraged researchers to develop the an on-dose authentication which can be employed to prevent fake drugs (Fukuoka, Utsumi, & Yamaguchi, 2017). Furthermore, method of authenticating medication packaging is used to prevent unknown drugs from entering the supply and distribution chain (Schraml et. al., 2017).

Social media has also been used as a tool to prevent counterfeit and sub-standard products. An ongoing framework by (Isah, Trundle, & Neagu, 2014) employs social media to gather and analyse the views and experiences of users of drug and cosmetic products via machine learning.

Efforts are also being made to solve the counterfeit problem with a handheld device that uses optical spectrometry to check the chemical composition of medications, especially antimalaria drugs, to prevent them from counterfeiters (Strickland, 2017).

Almost all reviewed literatures employed sophisticated methods and tools to combat counterfeit drugs. However, these techniques may not meet the needs of societies where there is poor infrastructure.

3. METHODOLOGY

In this study, investigation conducted could be identified as exploratory and descriptive. It sought to determine the present awareness and satisfaction of the population with current technology services used in combating counterfeit drugs in Nigeria. The set of all Nigerians who can use mobile telephone is an example of well-defined population and this set is the population targeted in this study. Large populations are complex and not easy to study; therefore, it is traditional to select a sample and study the data in the sample.

3.1 Data Collection

The survey method appeared to be the most appropriate for this type of investigation. Data were collected from participants at selected areas in each of the 6 geopolitical zones of the Federal Republic of Nigeria namely, South-West, South-South, South-East, North-East, North-West and North-Central. The target samples to represent the population were those who can easily identify English letter alphabets. 300 questionnaires were distributed equally at each zone making a total of 1800. For the Secondary sources, some data were collected from the National Bureau of Statistics (NBS) Nigeria (NBS, 2017), which is the national agency responsible for the development and management of official statistics in Nigeria, in additional to some data from The National Information Technology Development Agency (NITDA) Nigeria (NITDA, 2017) which was established to create a framework for the planning, research, development standardization, application coordination, monitoring, evaluation and regulation of information technology practices, activities and system in Nigeria.

A questionnaire was designed as the tool for information gathering about the mobile users. In the questionnaire with Close-ended Questions, 5-point Likert scale with the following options were used: A- Strongly Disagree, B-Disagree C- Neutral D-Strongly Agree E- I cannot say. Some statements in the designed questionnaire consist of Yes and No response. And there is a room for participants to provide any free information (if any) that is useful for the subject matter of this study from their education and experience perspectives. To ensure a comprehensive understanding of the issues around counterfeit drugs, interviews were conducted with the Director of National Agency for Food & Drug Administration and Control - NAFDAC - (South West Zonal Director), Chairman of Association of Industrial Pharmacist of Nigeria (Oyo State Branch). These interviewees were potential 'strategic leaders' in fostering the fight against counterfeit drugs.

The designed questionnaire consists of four sections. Section A is concerned with personal profiles and data of the respondents (BIODATA), while Section B consists of Profession and Geopolitical Zones of respondents. Section C is about Drug Related Statements and it consists of 1-19 questions or statements to determine the source of medication information of respondents as well as preferred source to procure the medication. Finally, Section D is dedicated to Information Technology and its applicability. It also provides information on the participants' awareness of use of Information Technology as a countermeasure for counterfeit drugs. A statement is dedicated to know how participants enjoy the phone technology and SMS service on GSM.

3.2 Data Analysis

The descriptive statistical tools used to interpret some of the data in the study are percentages, frequency counts, means and cross tabulations. In addition, inferential statistical methods such as the chi square, correlation analysis, stepwise multiple regression, analysis of variance (ANOVA) and factor analysis were used for confirming associations of variables. Also, cross-tabulations of major dependent and independent variables, including socio-demographic data were conducted, to identify the differences in opinions and responses.

3.3 System Analysis and Design

System analysis is concerned with becoming aware of a problem, identifying the relevant and decisional variables, analyzing and synthesizing the various factors and determining an optimal and at least a satisfactory solution to the system.

After gathering the requirements for a software application, a concept fulfilling these requirements has to be developed. A prototyping methodology is a software development process which allows developers to create portions of the solution to demonstrate functionality and make needed refinements before developing the final solution. This technique can save considerable development time by reducing re-work as users see the product for the first time. Moreover, software prototyping is an effective tool used to reduce risks and point out requirements that should be considered.

For this study, a life license for SMS broker and aggregator was procured to be used for real time development and implementation of prototype system. XAMPP which stands for Cross-Platform (X), Apache (A), MySQL (M), PHP (P) and Perl (P) is essentially an Apache Web server, while MySQL is a database server.

It can work on Linux, Windows, Solaris, MacOS X, etc. The windows version named (XAMPP for Windows) is used in this study. It is open source and free for download. Dvorski (2007) describes XAMPP as a small and light Apache distribution that contains the most common web development technologies in a single package. Its contents, small size, and portability make it the ideal tool for students developing and testing applications in PHP and MySQL. Recently, XAMPP is available freely to be downloaded in two specific packages: full package version and lite package version. The full package provides a wide array of development tools, and lite package, which contains the necessary technologies, is a small package containing Apache HTTP Server, PHP, MySQL, phpMyAdmin, Openssl, and SQLite.

A fundamental resource for an information system is a database; that is; an organized collection of data; A data base may be implemented using a general database management system; or may be structured specific to the application. For this study a database is specifically structured.

PHP stands for Hypertext Preprocessor and is the web development language written by and for web developers. It is very simple and one of server-side scripting languages like Java. PHP is usually used to create web applications in combination with a web server, such as Apache and others; end users will not see what PHP does. When one looks at a PHP page, it will look as HTML page, whereas the page is not purely so.

3.4 Hardware Part of the System

The system consists mainly of a PC with capability of running the graphic user interface (GUI) application and a modem interfaced with the PC over the Universal Serial Bus Port. In this system, a Samsung 250Ei phone was used to send and receive SMS via its hardware serial port, as specified by SMSEnabler that served as SMS Broker in this research work. The USB modem driver for the phone was installed and then the settings were done according to specification and recommendation.

3.5 Algorithm (User side)

Stage 0 (Start)
Stage 1 – User possesses a product to be authenticated.
Stage 2 – User operates his or her mobile phone at call mode.
Stage 3 - User sends predefined code on drug container to Short Message Service Center (SMSC) through Base Station (Cell Tower) via wireless link as text message.
Stage 4 - SMSC forwards the message to SMS Broker also known as Aggregator.
Stage 5 – Message arrives at Content Provider entity.
Stage 6 (Stop)

These operations and processes are bi-directional. Figure 1 shows the process direction followed in full details by each process for simplicity. The following are the constituents of the figure.

1 - Mobile User: Anybody using or operating mobile phones (in this study, user who sends text message enquiring for appropriate response from the content provider).
2- Cell Tower or Base Station: A base station is a transmitting tower mounted at suitable places to be able to transmit and receive enough signal for proper communication with mobile phones up to few kilometres. Cell Towers transmit radiation continuously, so people living within 10's of meters from the tower will receive 10,000 to 10,000,000 times stronger signal than required for mobile communication (Kumar, 2010).
3- SMSC Service Provider: When a user sends a text message to another user (in this study to Drug Regulatory Agency), the phone actually sends the message to the SMSC, which stores the message and then delivers it when the recipient is on the network. The SMSC access protocol, which is Short Message Peer-to-Peer (SMPP) protocol, enables interactions between external SMEs and service centers (Brown, Shipman, & Vetter, 2007).
4- SMS Broker or Aggregator: An aggregator acts as a business entity that negotiates agreements with network providers to act as a middleman providing access to a cellular network for messaging services to third parties who have no direct relationship with the cellular network. For the purpose of this study, a life license was procured from Smsenabler to be able to implement the systems. The message aggregator uses the SMPP to maintain connections with carrier networks. Typically, aggregators provide access to their servers either through SMPP or using custom APIs written in Java, PHP, Perl, and so on. PHP has been used in this study for its simplicity.
5- Content Provider: A mobile content provider is an entity that provides value-added content and applications for mobile devices. In this study, the content provider is the Drug Regulatory Agency. A mobile phone user sends an interactive text message to retrieve information, the content provider returns the information in the form of text message back to the user through the aggregator.

3.6 Algorithm (Administrative side)

Stage 0 (Start)

Stage 1 - At the administrative side (Drug Regulatory Agency), the system will generate a file in which all the operations are recorded. The contents of this file are (1) Code sent to the system from a user requesting authentication of the product at hand, (2) Date and time (including time in minute and seconds) (3) telephone number of sender (by international format). This is as shown in figure 3.

Stage 2 - An officer or operator will discover any invalid code from user side. This invalid code may be a key-in error from user or fake code from counterfeiter.

Stage 3 - There will be a report from officer to decision makers to take proper actions such as:

(1) Notify the public to be aware of the fake product in circulation.
(2) Depending on severity of this detected product, Drug Regulatory agency my contact other Agencies like NCC to retrieve the SIM identity of sender.
(3) Notify the manufacturer of the genuine product in case of expired item. The necessary action should be made to withdraw the expired items from the circulation.
(4) Notify the public and manufacturer in case the product is substandard.

Stage 4 (Stop)

4. RESULTS AND DISCUSSION

Data for the analysis were collected in a wide survey of all the six geo-political zones of the Federal Republic of Nigeria. As earlier mentioned, a total of 1800 questionnaires were distributed to participants across the six geopolitical zones. The total response received is 1501 (83.4% of distributed). Out of this, 1391 were valid, which represents 92.7% of the total response and 72.3% of distributed questionnaires.

4.1 Biodata of Respondents

Table 1 to Table 6 show the information of respondents on the age, gender, profession, sectors, location and educational status. It indicates that majority (56.4%) of respondents were within the age of 20-40 years; 28.4% of respondents were within 40-60 years; 13.8% of respondents were below age of 20 years and 1.4% of respondents were 60 years and above. This implies that majority of the respondents were youths.

Based on gender, it was observed that majority (51.8%) of respondents were male while 48.2% of respondents were female. This indicates that we have more male respondents in this study. Based on respondents working experience, majority of respondents (50%) have 6-10 years experiences, 28% have 10-15 years, 16% of respondents have 1-5 years experiences and very few (6%) of respondents have above 16 years' experience.

Furthermore, educational status of respondents shows that 46.6% of respondents have BSc/BA/MBBS. 23.1% of respondents have OND/HND, 16.5% of respondents have MA/MSc, 10.6% of respondents have secondary school certificate, 2.6% of respondents have Primary school leaving certificate and 1.6% of respondents were PhD holders. This implies that, majority of respondents were first degree holders (University Graduates) and very few of respondents have Primary school education. This indicates that none of the respondents have below primary school certificate, Figure 3 additionally shows clear graphical presentation of educational background of respondents. It was observed that 50.6% of respondents were working in government sector and 49.4% were in private sector. On profession, majority of respondents were in medical field while 38.6% were non-medical. Based on location of respondents, 19.1% are from South West, 16.8% from South-South, 17.4% from North Central, 16.1% from South-East, 17.1% from North West, and 13.5% from North East. These were the factors considered for socio-demographic indicators for each respondent under this study.

There were very good response rates everywhere except in the North East, where a high proportion of the population are nomadic in orientation. This zone (North East) is situated at a fragile socio-political setting in Northern Nigeria. The conflicts in this zone and challenges of on-going fight against insurgency, otherwise called Boko Haram militancy, caused many residents to be considered as Internally Displaced Persons (IDP).

38 respondents left the question in Table 5 unanswered, which makes the total number of valid respondents to be 1353 instead of 1391. Also, 5 respondents left the question in Table 6 unanswered, which makes the total number of valid respondents to be 1386 instead of 1391.

4.2. Basic Information on Drugs

This section of the questionnaire was designed to get basic information on how respondents procure the medication, sources of the medication information as well as other related and useful information on fake drugs.

Table 7 depicts the opinions of respondents on the source of medication information. It indicates that majority of respondents get their source of medication through physicians (50.4%), 34.4% through pharmacists, 7.4% through relatives and 7.7% through media/internet.

As shown in Table 8, majority of respondents prefer to get their medication in Government hospital pharmacist centre (54.1%), 30.7% of respondents prefer community pharmacy, 12.1% prefer street vendors, 2.1% prefer internet and very few (1%) prefer other means such as recommendation from relatives, family members, friends and colleagues.

Based on identification of fake drugs, Table 9 shows that 32.9% could not identify fake drugs, 29.9% could identify little, 12.9% of respondents could identify it somewhat, 17.5% could identify it very much and 6.8% cannot say. This indicates that fake drugs cannot be identified conveniently in Nigeria. Furthermore, as shown in Table 10, 31.9% were very familiar with methods of preventing fake drugs, 19% are totally not familiar and 2.1% cannot say that they are familiar with method of preventing fake drugs in Nigeria.

From Figure 4, respondents indicate that expiry date (19%) is the most important additional information needed for medication, side effect is 17%, dosage form is 18%, storage condition and indication are each 16%, and manufacturer details has a percentage of 14%. This implies that all the selected additional information was important on medication and it will reduce fake drugs in the country.

4.3 Analysis on Level of Awareness

The respondents' level of awareness about fake drugs in Nigeria is analysed in this section using appropriate approach. From Table 11, majority of respondents (80.6%) know very much about a fake drug and 10.4% of respondents know little. Very few respondents (2.5%) do not know what fake drug is at all. This implies Nigerians know what a fake drug is. From Table 12, majority of respondents (44.3%) have never used fake drug which was eventually discovered, 23% have used drug which was eventually discovered to be fake, and 32% cannot say.

Furthermore, level of awareness of respondents shows that some of respondents were aware about means of preventing fake drugs in Nigeria, 30.6% of respondents were very much aware and 27.3% of respondents were aware a little. This is clearly shown in the Table 13.

4.4 Applicability of Information Technology

In Table 14, we analyse available technology adequacy on fake drug prevention in Nigeria. For prevention measure, majority of respondents (47%) indicate that available technology is not adequate for preventing fake drug. 45.6% of respondents indicate that there is adequate available technology for prevention while 7.4% of respondents cannot say whether there is adequate technology to prevent fake drugs in Nigeria. Generally, respondents have shown that there is no significant available technology that is adequate for drug counterfeits in Nigeria.

Table 15 depicts the respondents' accessibility of technology for fake drug prevention. 56% of respondents do not have access to the technology for preventing fake drug, 36% of respondents have accessibility and 8% of respondents cannot say. 13 respondents left the question in the table unanswered, which makes the total number of valid respondents to be 1378 instead of 1391.

From Table 16, we confirm that there is a significant relationship between the location and their accessibility of technology to prevent fake drugs, since the P value (0.000) obtained is less than 0.05. This means that locations of respondents have significant contribution to their accessibility of the technology to prevent fake drugs in Nigeria. The level of accessibility differs across locations in Nigeria.

4.5 Respondents' Satisfaction on Existing Technology

The respondents' satisfaction about existing technology to manage fake drugs in Nigeria is classified into satisfied and not satisfied. Figure 5 shows respondents level of satisfaction about existing technology. Majority of respondents 66%, were not satisfied for prevention measures for counterfeit drugs and 34% respondents indicated their satisfaction.

Table 17 shows respondents' awareness about the use of information technology to prevent fake drug in other countries. Majority of respondents (71.8%) indicated that they were not aware of the use of information technology to prevent fake drugs and 28.2% were aware. 13 respondents left the question in the table unanswered, which makes the total number of valid respondents to be 1378 instead of 1391.

5. CONCLUSION

This paper is a study of the phenomenon of counterfeit drug and the means of preventing its effects on individual and on the nation. The results of the study bring out certain conclusions that move with its main objectives. That is, the results obtained from this study confirmed the need to have a tailored information system to control counterfeit drug. The findings suggest that facets of the pharmaceutical systems in Nigeria remain fairly vulnerable to corruption. This supports the findings of other researchers on this issue (Garuba, Kohler, & Huisman, 2009). The findings also indicate that educational status of respondents is a factor that will determine their level of knowledge about counterfeit drugs in Nigeria. In addition, the study finds that fake drugs cannot be identified conveniently in Nigeria. It was discovered that a significant portion of participants in our survey have used drugs which were eventually discovered to be fake. This is an alert that active and positive action needs to be taken by relevant authorities to address this phenomenon.

Furthermore, level of awareness of respondents shows that majority of respondents were aware about means of preventing fake drugs in Nigeria. Although the present study was carried out in the year 2015, it was discovered that a similar study (Uzochukwu & Chinedu-Okeke, 2017) was carried in the year 2016. However, the latter study was restricted to Delta State of Nigeria (which is just a state in the South-South geopolitical zone of Nigeria) and uses smaller population. Both findings agreed on the fact that there is an urgent need to address the issue of counterfeit drugs.

Generally, respondents have shown that there is no significant available technology that is adequate for counterfeit drug in Nigeria. This study finds evidence which confirms that the lack of political will from the authority (Government), in providing necessary infrastructures, is a source of annoyance to some local pharmaceutical manufacturers. This prevents them from operating optimally.

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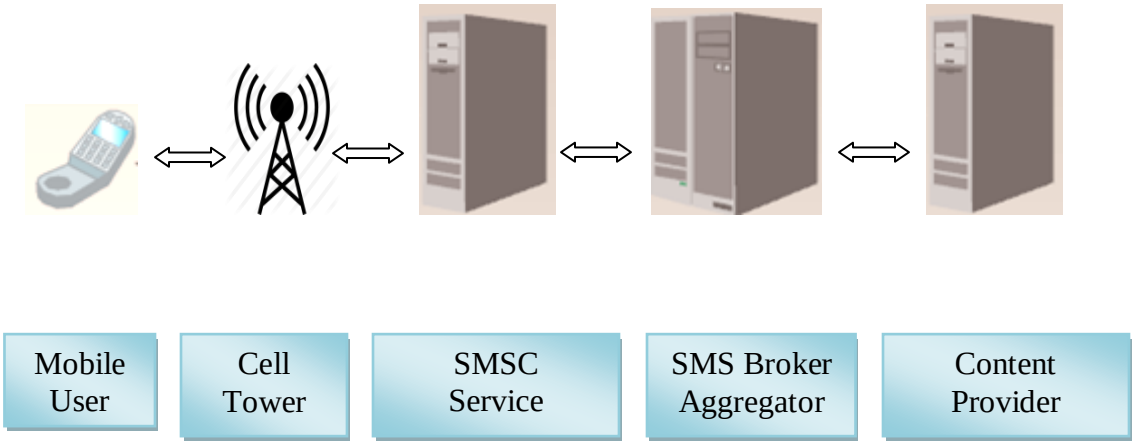

Figure 1: Process of Communication between a Mobile User and a Content Provider

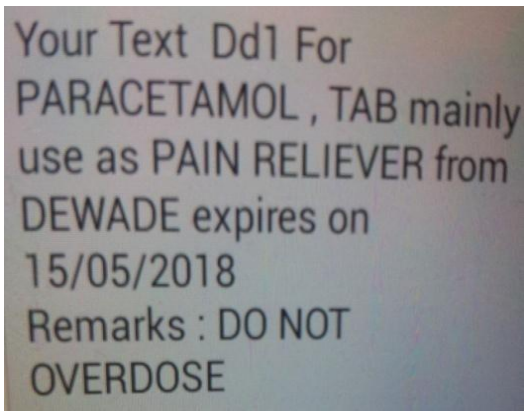

Figure 2 : Response from System to User's Mobile Phone
Source: Field demonstration, 2015

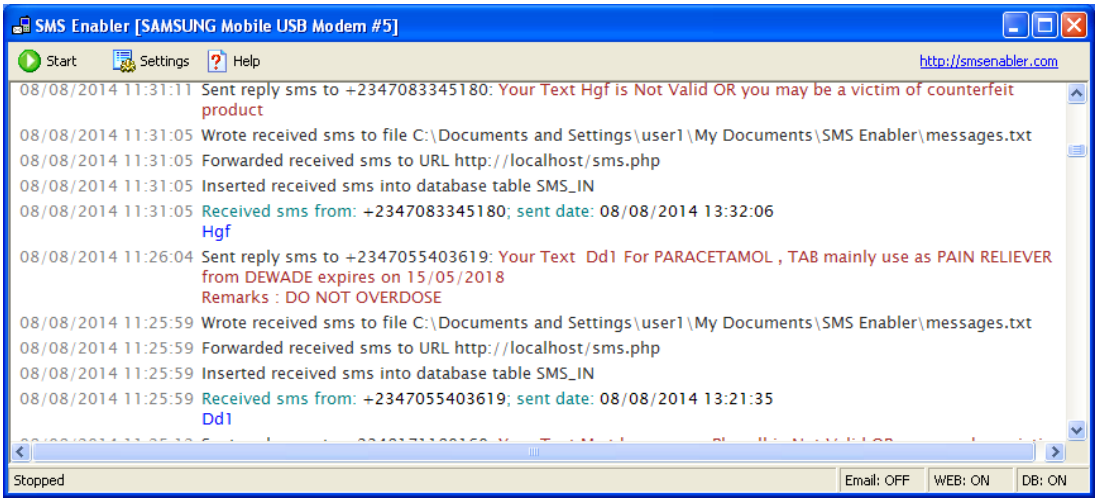

Figure 3: Generation of file at the Administrative side

Table 1 – Respondents according to their group

VARIABLE	FREQUENCY	PERCENTAGE %
AGE		
Below 20 years	193	13.9
20 - 40 years	784	56.4
40 - 60 years	395	28.4
60 years above	19	1.4
Total	1391	100

Table 2 – Respondents according to their Education background

VARIABLE	FREQUENCY	PERCENTAGE %
EDUCATION		
Primary	37	2.7
Secondary	147	10.6
OND / HND	320	23.0
BSc / BA / MBBS	631	45.4
MA/MSc	228	16.4
PhD	22	1.6
Total	1391	100

Table 3 – Respondents according to their gender

VARIABLE	FREQUENCY	PERCENTAGE %
GENDER		
MALE	721	51.8
FEMALE	670	48.2
Total	1391	100

Table 4 – Respondents according to their Location

VARIABLE	FREQUENCY	PERCENTAGE %
LOCATION		
North West	238	17.1
North East	186	13.5
North Central	242	17.4
South West	266	19.1
South East	224	16.1
South South	233	16.8
Total	1391	100

Table 5 – Respondents according to their working sector

VARIABLE	FREQUENCY	PERCENTAGE %
SECTOR		
Private	669	49.4
Government	684	50.6
Total	1353	17.4

Table 6 – Respondents according to their profession

VARIABLE	FREQUENCY	PERCENTAGE %
PROFESSION		
Medical	851	61.4
Non-Medical	535	38.6
Total	1386	100

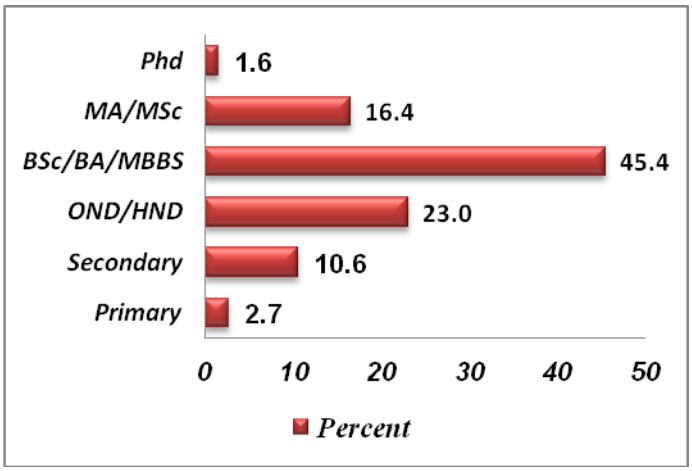

Figure 3: Pictorial Representation of Educational Qualification of Respondents

Table 7 - Source of Medication Information

Statement/ Question; What is the source of your medication information?		
	FREQUENCY	**PERCENTAGE**
Physician	701	50.4
Pharmacist	478	34.4
Relative/Family Member	103	7.4
Media/internet	107	7.7
Others	2	0.1
TOTAL	1391	100

Table 8 - Preferred source of medication procurement

Statement/ Question; when procuring, where do you prefer to get the medication?		
	FREQUENCY	**PERCENTAGE**
Government Hospital Pharmacy	752	54.1
Community Pharmacy	425	30.7
Street vendors	168	12.1
Internet	29	2.1
Others	15	1.0
TOTAL	1391	100

Table 9 - Capability of respondents to identify fake drugs

Statement/ Question: Could you identify fake drug ?		
	FREQUENCY	**PERCENTAGE**
Not at all	447	32.9
A little	407	29.9
Somewhat	176	12.9
Very much	238	17.5
I cannot say	95	6.8
TOTAL	1391	100

Table 10 - Respondents according to method of preventing fake drugs

Statement/ Question: Are you familiar with method of preventing fake drug in Nigeria?		
	FREQUENCY	**PERCENTAGE**
Not at all	264	19.0
A little	405	29.1
Somewhat	249	17.9
Very much	444	31.9
I cannot say	29	2.1
TOTAL	1391	100

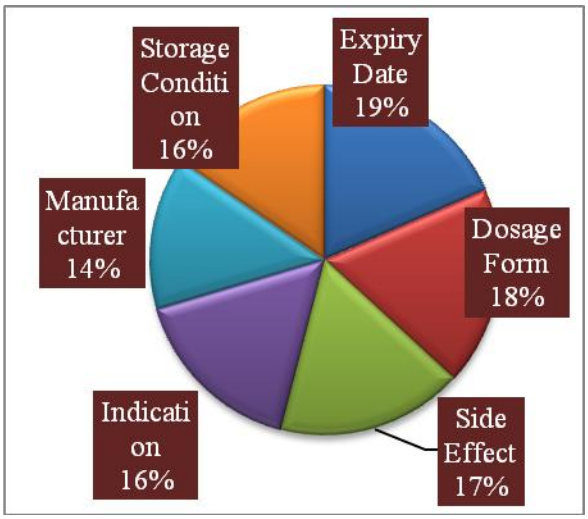

Figure 4: Respondents distribution on Additional information needed on medication

Table 11- Respondents' knowledge of fake drug

Statement/ Question: Can you recognize fake drugs ?		
	FREQUENCY	**PERCENTAGE**
Not at all	35	2.5
A little	145	10.4
Somewhat	89	6.4
Very much	1120	80.6
I cannot say	2	0.1
TOTAL	1391	100

Table 12- Respondents' reply on using fake drug

Statement/ Question: Have you ever used a drug that was eventually discovered to be fake ?		
	FREQUENCY	**PERCENTAGE**
Not at all	616	44.3
A little	323	23.3
Somewhat	5	0.4
Very much	2	0.1
I cannot say	445	32
TOTAL	1391	100

Table 13- Respondents' awareness about means of preventing fake drugs

Statement/ Question: Are you aware about means of preventing fake drugs?		
	FREQUENCY	**PERCENTAGE**
Not at all	236	17
A little	380	27.3
Somewhat	292	21
Very much	426	30.6
I cannot say	57	4.1
TOTAL	1391	100

Table 14. Adequacy of available Information Technology for Fake drug prevention

Statement/ Question; Do you think available technology is adequate for Preventing Fake Drug		
	FREQUENCY	**PERCENTAGE %**
Not at all	654	47
Very much	634	45.6
I cannot say	103	7.4
TOTAL	1391	100

Source; Field Survey, 2015

Table 15 - Accessibility of Technology for Fake Drug Prevention

Statement/ Question: What do you have to say about accessibility of the technology for preventing Fake Drug		
	FREQUENCY	**PERCENTAGE**
Not Accessible	779	56
Very much Accessible	494	36
I cannot say	105	8
TOTAL	1378	100

Table 16 - Cross Tabulation (Chi-Square) Of Respondents Location And Accessibility of Technology for Preventing Fake Drugs

Accessibility of technology to Prevent * LOCATION Cross tabulation

			LOCATION						Total
			North West	North East	North Central	South West	South East	South South	
	Not Accessible	Count	51	31	33	35	50	30	230
		%	3.7%	2.2%	2.4%	2.5%	3.6%	2.2%	16.7%
	Little Accessible	Count	91	74	97	122	74	91	549
		%	6.6%	5.4%	7.0%	8.9%	5.4%	6.6%	39.9%
	Somewhat Accessible	Count	35	37	52	54	44	54	276
		%	2.5%	2.7%	3.8%	3.9%	3.2%	3.9%	20.0%
	Very much Accessible	Count	32	34	39	40	33	40	218
		%	2.3%	2.5%	2.8%	2.9%	2.4%	2.9%	15.8%
	I cannot say	Count	27	10	19	15	19	15	105
		%	2.0%	.7%	1.4%	1.1%	1.4%	1.1%	7.6%
Total		Count	236	186	240	266	220	230	1378
		%	17.1%	13.5%	17.4%	19.3%	16.0%	16.7%	100.0%

$X^2 = 32.711$, **DF =20, P- Value = 0.036**

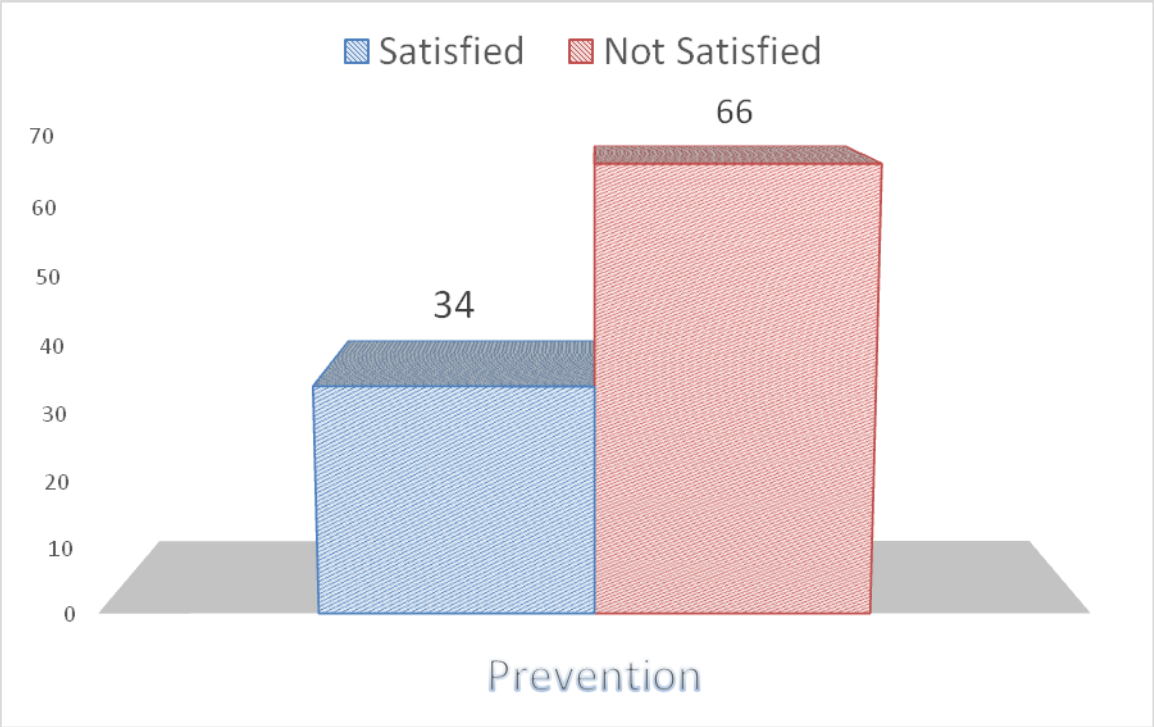

Figure 5: Mean score Percentage of Respondents Level of Satisfaction on effect of Information technology on Fake Drug Prevention

Table 17 - Respondents' awareness of use of Information Technology to prevent Fake Drug in other countries

Statement/ Question: Are you aware about the use of information technology to prevent Fake Drug in other countries?		
	FREQUENCY	**PERCENTAGE**
Yes	389	28.2
No	989	71.8
TOTAL	1378	100