

## Awareness and Adoption of Drug Mobile Authentication Service: A Conscious Approach in Eradication of Fake and Counterfeit Drugs in Nigeria

HELEN ODUNOLA ADEKOYA, CHARLES MADUABUCHI EKEH  
Babcock University, Ilishan-Remo, Ogun State, Nigeria

**Abstract.** A major challenge facing the global pharmaceutical industry is counterfeiting, of which studies have shown to be more prevalent in developing countries. The National Agency for Food and Drug Administration and Control (NAFDAC) has in recent years introduced the Mobile Authentication Service (MAS) as a conscious approach in combating the manufacture, distribution and consumption of fake and counterfeit drugs in Nigeria. This study was carried out to determine the extent of awareness and adoption of drug mobile authentication service among Nigerians in the south-west region. A total of 1,544 questionnaires were administered in three purposively selected states. Mean and standard deviation were used in the analysis of data gathered. Results showed that whereas there was 65% awareness, adoption of the technology was low at 20.3%. Television viewing, radio jingles and word or mouth were found to be major sources of information about the technology, as against internet, newspaper and poster advertisements, which ranked low in awareness creation. Despite this evidence of relatively high level of awareness with a grand mean of  $\bar{x}=3.07$ ,  $SD=.505$ , the result depicts a poor adoption rate of MAS in southwest Nigerian. The study concludes that NAFDAC and government must go beyond just awareness creation to focus more on discovering practicable approaches that can spur the audience to adoption and continuous usage of MAS technology so as to facilitate the reduction, if not eradication of fake and counterfeit drugs in Nigeria.

**Keywords:** Awareness, Adoption, Fake drugs, Counterfeit drugs and Mobile authentication service

### 1. Introduction

Drugs and medicines of different kinds are utilized for varied purposes by many across the globe. The World Health Organisation classified curative,

ameliorative and preventive medicines as essential drugs, which are drugs or medicines that satisfy the priority health-care needs of the population (Health and Care Professional Council, 2013). Over the years, the production and distribution of essential drugs have been faced with many challenges, some of which, depending on the region may include lack of funding for researches leading to the discovery of new drugs, the problem of producing drugs in the right quantity that can cater for the ever increasing health demands of the world's population and the infiltration of fake and counterfeit drugs into the market. Among these and several other challenges, the infiltration of fake and counterfeit drugs has proven to be the most daunting due to its severe adverse economic and public health impact. Wilson and Fenoff (2011) contended that fake and counterfeit drugs reduce economic incentives to develop new products and decrease brand value, brand reputation, and competitive advantage. Also, the World Health Organisation (WHO, 2017) noted that in addition to their public health impact, fake and counterfeit medical products can have a diversified economic and socioeconomic impact that involves the quantification of a combination of several variables. These were enumerated as ranging from increased out-of-pocket and health system spending on health care; economic loss for patients, their families, health systems and manufacturers of quality medical products; waste of human effort and financial outlay across the health system, further straining resources, staff and infrastructure; lost income due to prolonged illness or death; and lost productivity costs to patients and households when seeking additional medical care, the effects of which are felt by businesses and the wider economy (p.21). Beside these socioeconomic impacts, there exists the hazard which falsified medicines and medical products pose to public health among which may include: adverse effects, e.g. toxicity or lack of efficacy from incorrect active ingredients; failure to

cure or prevent future disease, increasing mortality, morbidity and the prevalence of disease, etc. (Wilson and Fenoff, 2011)

Before now, the common assumption was that high-income countries whose regulatory systems are strong and efficient can effectively flush out fake and substandard medicines from their markets. However, the analysis of WHO showed that this may not be the case as there are indication that even countries in Western Europe and North America together with other countries in similar category are also fighting the battle against fake medicines, though at a lower scale. It has been reported that up to around 1 million innocent people can lose their lives around the globe every year, as a result of fake and counterfeit drugs related cases (Peasgood & Capital, 2015; Scutti, 2015) making it one of the major global public health risks (Mackey, Liang, York & Kubic, 2015).

Among the developing regions with a notably high prevalence of incidences involving fake and counterfeit drugs is Africa. The region has suffered more from some of the previously highlighted effects majorly as a result of underdevelopment, which has caused the problem of fake and counterfeit drugs to thrive within the continent at an alarming rate. Africa is seen on many fronts as a continent lacking the capacity to convert its abundant natural resources to products that can carter for the good of its people. As a result, all manner of items, including drugs manufactured in other parts of the world find their way into the continents, and in many cases not in the best condition they can be. Therefore with a weak production capacity, inefficient regulatory systems and porous border controls, the continent boasts of more substandard products of different categories than quality ones (Bamitale, 2016). Africa has subsequently become a safe haven for fake drugs manufacturers and marketers as the drug supply chains of countries within the continent are easy to infiltrate and regulators lack capacity to facilitate detection, these have resulted in high rate of failed prognosis of rampaging diseases, thereby leading to loss of human lives.

Peasgood and Capital (2015) posited that fake and counterfeit medicines or counterfeit pharmaceuticals are causing untold suffering to the populace especially in some African countries where it takes an alarming proportion from the total drugs in circulation. Renschler (2015) asserted that more than 120,000 children under the age of five who had malaria in 39 sub-Saharan countries may die due to the ingestion of poor-quality anti-malaria drugs. In the same vein, WHO's estimates showed that

between 72,000 and 169,000 children die annually from pneumonia in Africa after receiving substandard drugs, and that counterfeit anti-malarial drugs may likely be responsible for an additional 116,000 deaths (WHO, 2017c). The harmful effect of these drugs stretches from the people to businesses in the region. The multi-billion dollars global industry of fake and counterfeit drugs is steadily flourishing in Africa. In 2008, the United States government estimated the global market value of the counterfeit industry to reach USD 500 billion with an increment rate of 1,700% during the past decade (Chaudhry & Zimmerman, 2013). The World Health Organization (WHO), estimated global sales of counterfeit medications to top USD 75 billion in 2010 alone, which is a 90% rise from 5 years before and could be more than 10% of all medicines sold worldwide (WHO, 2010). In the third world countries, i.e., many African countries and parts of Asia, the percentage in circulation is much higher and could be up to 50% (WHO, 2017).

The situation is rarely different in Nigeria; the country is among those in African where the illicit trade in drug counterfeiting thrives. The passing decades have nonetheless seen a quantum increase in the influx, manufacture and circulation of fake and counterfeit drugs in the country. Nigeria is seen by fake and counterfeit drug producers and marketers as a thriving environment for their illicit trade (Nevin, 2017). This notion has resulted in the manufacture and importations of all manner of drugs, ranging from those that are less potent, to drugs that are out rightly fake and therefore unfit for human consumption (Vanguard, 2019). The report of a World Health Organisation's evaluation of six countries in sub-Saharan Africa found Nigerian samples to have the highest failure rate at 63.9 percent, compared to 28.5 percent of total samples that failed to comply with quality specifications (WHO, 2011). Also, a research by Health Communication Capacity Collaborative (HC3, 2016) reported that a meta-analysis of quality medicine surveys from 21 countries in sub-Saharan Africa including Nigeria showed that 35 percent of samples failed chemical analysis. According to reports published by BiztechAfrica.com (2013), 200,000 out of the one million deaths that occur worldwide annually results directly from the use of counterfeit anti-malaria drugs and a larger proportion out of the total in Africa was recorded in Nigeria. In addition, the World health Organization (WHO) indicated that 700,000 Africans die annually from the consumption of fake anti-malaria or tuberculosis drugs also with the highest number of incidents recorded in Nigeria (BiztechAfrica.com, 2013).

Counterfeit drugs include those with the incorrect or wrong ingredients, without active ingredients, with incorrect amounts of active ingredients, or with fake packaging (WHO, 2017). It is worrisome to know that all the indices for measuring and identifying fake drugs are commonly found in many drugs circulating within Nigeria's supply chains. The country's Agency for Food, Drug Administration and Control (NAFDAC) had identified various forms of fake/counterfeit drugs in Nigeria, including: drugs with no active ingredient(s) e.g. having only lactose or even chalk in capsules and tablets, olive oil in Supradyn capsules; drugs with insufficient active ingredients e.g. 41mg Chloroquine instead of 200mg, 50mg Ampicillin as against 250mg; drugs with active ingredient(s) different from what is stated on the packages e.g. Paracetamol tablets packaged and labeled as Fansidar (Sulphadoxine + Pyrimethamine); clones of fast moving drugs - these are drugs with the same quantity of active ingredients as the genuine original brand, but may not have the same efficacy; drugs without full names and addresses of the manufacturers; herbal preparations that are toxic, harmful, ineffective or deceitfully mixed with orthodox medicine; expired drugs or drugs without expiry date, or expired and re-labeled with the intention of extending their shelf-life and drugs not certified and registered by the agency (Akunyili, 2005). This situation has made Nigeria's drug market one of the most porous and difficult to monitor in sub-Saharan Africa.

The situation has also led to failed treatment of different diseases resulting in deformity and in many cases death. Worthy of note is the fact that drugs in their original nature are chemical substances with diverse pharmacological actions. They bring about different changes when they interact with biological systems. They may cause contraction of muscles, alterations of hormonal levels, secretions from glands, modulation of nervous activity and a host of other physiological changes in the body (Bamitale, 2016). This implies that original drugs sometimes can cause negative reactions in the body even when consumed in the right quantity. That being the case, it can only be imagined, the result of consuming fake or counterfeit drugs when attacked by a life-threatening disease, however, this has been a persistent problem in Nigeria for many years.

Apart from fake drugs originating from within the country, there are also those imported from countries such as China, India and Indonesia that are produced below required standards and those that are genuinely imported from the UK, USA, and Canada, but have lost their potency over time. Bamitale (2016) posited that drugs react to climatic conditions that alter its

original formula, changing its condition from one state to another. This is common with drugs imported from well industrialized countries that ends up losing their stability in tropical environments as found in many parts of Africa including Nigeria. The dilemma of fake drugs is therefore compounded by the fact that undetected or repackaged expired drugs are mixed with different classes of counterfeit and a number of original drugs and made available for the public in Nigeria to access.

Dipika, Swathi, Kapil and Pramil (2012) noted that many classes of drugs have been counterfeited and that factors such as poor regulation, high number of intermediaries and lack of awareness by the general public among others could be responsible for this trend. This has brought about the need for strict regulation, adoption of anti-counterfeit measures and the creation of public awareness in order to counter this unwholesome practice. Anti-counterfeit measures have been utilized in many developed countries for a long time. Countries such as the UK, USA, Japan, and Canada, have successfully utilized various anti-counterfeit measures to reduce the circulation of fake drug to as low as 1%, whereas many developing countries in Africa, South America and Asia still have a high level (up to 50%) of fake drugs within their chains of supply (WHO, 2013). Countries in Europe and America recorded lower amount of fake drugs circulation due to advanced technologies like Truscan, Black Eye, Radio Frequency Identification (RFID), 2D barcodes and others, while the problem is more rampant in developing countries like Nigeria, India, and many other African and Asian countries despite the deployment of different anti-counterfeit technologies targeted at detaining illegitimate drugs in their supply chains (Dipika, et al., 2012).

In Nigeria, the National Agency for Food, Drug Administration and Control (NAFDAC) has been at the fore of the fight against fake and counterfeit drug manufacture and distribution since the agency was established in 1993. Over the years, the agency has applied various approaches in its attempt to curb the manufacture and sales of counterfeit drugs and other unwholesome food items. In recent years, the regulatory agency launched the drug Mobile Authentication Service (MAS), to enable potential users verify the originality drugs before purchase through the use of their mobile phones, considering the ubiquity of the device in the country currently. Using this technology, consumers can send a direct short message (SMS) - the assigned 12-digit NAFDAC PIN on the medicine they intend to purchase to 38353, and receive an instant reply from NAFDAC, informing them whether such drug in question is fake or original.



*Fig. 1:* Mobile Authentication System (MAS). *Source:* NAFDAC News, (2013)

The Mobile Authentication Service (MAS) by NAFDAC is an attempt to turn the mobile phone, which is presumably in the hands of majority of Nigerians into a tool for fighting the war against fake and substandard pharmaceutical products in the country. According to NAFDAC News (2013), the agency has deployed the use of SMS text messaging technology to authenticate medicines at the point of purchase, thereby putting the power to detect counterfeit drugs in the hands of Nigerian consumers and by so doing enlisting the entire Nigerian public in the war against drug counterfeiting. This service was made available for public use throughout the country in 2012, after a two-year pilot phase. Many years down the line since 2010, there are indications that the public may not be aware of this service and therefore have failed to adopt it, making them vulnerable to the antics of fake drug dealers. The outcome from studies by Justin and Ilomuanya (2016), and Chinwe and Chinonye (2017) suggests that the audience in various parts of Nigeria may not be aware of Mobile Authentication Service (MAS) and as a result do not utilize the service. Only a few attest to the knowledge of the service and its usefulness and functionality, and yet fewer others who said they tried it without receiving any response (Chinwe et al., 2017).

The problems of awareness and adoption can constitute a hitch to the success of mobile authentication service offered by NAFDAC to drug users in Nigeria. Unless the general public becomes aware and knowledgeable about the service, they will not use it. If the service is not adopted and utilized, of what use will it serve? Chinwe et al., (2017) cited the problems of low mobilization, poor network service, partial implementation and poor infrastructures as primarily responsible for the lack of effectiveness of MAS in many parts of the country. They also noted that lack of awareness and knowledge of its usage has the potential to prevent the people from utilizing the service. Justin et al., (2016) found in their study across the six geopolitical zones of Nigeria that 78% of respondents have heard about the service, 51.4%

of those who knew about MAS have tried using it, 48.8% of those who tried it received a positive feedback, while 4.7% did not receive any response. This study therefore seeks to investigate the awareness and adoption situation of drug mobile authentication service in southwest Nigeria, to uncover areas of deficit and thereafter proffer recommendations based on the ascertained patterns of MAS awareness and usage by the general public. Southwest Nigeria is home to millions of residents from all parts of the country and it is believed that if the service is well received and adopted there, the ripple effect will be felt in all other parts as well.

Theoretical underpinnings were drawn from Everett Rogers' (1961) Diffusion of innovation theory which deals with the spreading out of innovation processes by which, through certain channels, novelty is communicated among members of a social system over time (Rogers, 1995). Consequently, it is a process that spreads a new idea or technology out from its discovery or creation to the user or its adopter (Rogers, 2003). The basic assumption of diffusion of innovation theory is that there are four elements involved in the process of idea, practice, or object dissemination; it must be classified as innovation, it must be communicated through certain channels, it must be adopted among members within a social system and it must take into account duration or the time factor. In Rogers's view, the relative advantage is the extent to which a particular group of users perceive such innovation as better than the idea, or practice it replaces (Rogers, 1995). The bigger the perceived relative advantage of innovation by the social system, the faster the level of its adoption (Rogers, 1995, 2003). The key to adoption therefore, is that the adopter must perceive the innovation or idea, as a new one which offers a comparative advantage. The study tested the following hypothesis at 0.05 level of significance.

H<sub>01</sub>: Awareness of drug mobile authentication service has no significant influence on its adoption in South-west Nigeria.

**2. Research Materials and Methodology**

The study setting was the south-west geopolitical zone of Nigeria made up of six states including Lagos state - one of the states where the pilot phase and the initial launch of MAS was carried out. The region also serves as home to millions of Nigerians from all corners of the country and hence was chosen as the study site. Three states; Lagos, Ogun and Oyo were selected, following which one Local Government Area was selected purposively from each of nine senatorial districts (3 in each state) based on LGAs

with the highest population density. The survey instrument was a pretested structured questionnaire. The researchers with six trained research assistants administered a total of 1,544 copies of the research instrument between January and March, 2020. Completed instruments were retrieved, sorted and analyzed using descriptive and inferential statistical tools of mean, standard deviation and frequencies, while hypothesis was tested using linear regression. Ethical approval for the study was obtained from Babcock University Health Research Ethics Committee (BUHREC).

**3. Results**

From the administered and retrieved instrument, 1,518 were validated for analysis, resulting in 98.3% response rate. The Cronbach’s alpha value from the reliability analysis of variables included in the study was 0.851.

**Socio-demographic information**

**Table 1: Demographic characteristics of respondents**

Characteristics	Classification	Frequency (n=1,518)	Percentage %
Gender	Male	729	48.0
	Female	776	51.1
	No response	13	0.9
	Total	1,518	100
Age	18-27 years	342	22.5
	28-37 years	475	31.3
	38-47 years	446	29.4
	48-57 years	142	9.3
	58 years and above	89	5.0
	No response	24	1.6
	Total	1,518	100

(Field Survey, 2020)

Data in Table 1 reveals that there were more females (51.1%) than males (48.0%) participants in the study. The result further revealed that majority of respondents was in the age bracket of 28-37 years (31.1%) while (29.4%) were aged 38-47 years. Others are 18-27 (22.5%), 48-57 years (9.3%) and above 58 years (5%) respectively. This implies that majority of respondents are young, energetic men and women who are still in their prime and should be able to utilize drug mobile authentication service.

RQ1: To what extent are the audience aware about drug mobile authentication service?

**Table 2: Audience awareness about drug mobile authentication service**

ITEMS	Very high Extent (%)	High Extent (%)	Low Extent (%)	Very low Extent (%)	Mean $\bar{x}$	SD
I have heard about drug mobile authentication service	155(10.3)	719(47.3)	357(23.5)	287(18.9)	3.69	.481
I am aware of it but never used it	104(6.8)	442(29.2)	703(46.3)	269(17.7)	2.38	.468
I am aware of it and I use it any time I am buying drugs	77(5.1)	313(20.7)	771(50.7)	357(23.5)	2.29	.494
Someone told me about drug mobile authentication service	157(10.5)	812(53.4)	327(21.5)	222(14.6)	3.57	.510
I heard about MAS over the radio	230(15.2)	940(62.0)	179(11.7)	169(11.1)	3.89	.501
I became aware of it through the television	133(8.7)	1,126(74.1)	178(11.7)	81(5.3)	3.98	.580
I read the advert about MAS in the newspapers	157(10.5)	334(22.2)	722(45.5)	305(20.0)	1.46	.575

I saw a poster containing information about it	24(1.8)	144(9.4)	936(61.6)	414(27.2)	1.35	.520
I have never heard of anything like that until now	122(8.2)	151(9.9)	918(60.4)	327(21.5)	1.38	.609
I knew about MAS from the internet	135(8.9)	315(20.7)	724(47.6)	344(22.8)	2.38	.677
<b>Grand Mean</b>					<b>3.07</b>	<b>.505</b>

**Decision rule:** if mean is  $\leq 1.49$  = very low extent,  $1.5 - 2.49$  = low extent,  $2.5 - 3.49$  = high extent,  $3.5 - 4.0$  = very high extent. (Field Survey, 2020)

The grand mean of ( $\bar{x}=3.07$ ,  $SD=.505$ ) indicate that the level of awareness about drug mobile authentication service in the country is high as shown in Table 2. To a very high extent ( $\bar{x}=3.69$ ), the audience know of drug mobile authentication service, however, the result also showed that many who are aware of the service never used it ( $\bar{x}=2.38$ ), and those who use it anytime they purchased drugs were also low ( $\bar{x}=2.29$ ). Again, to a very high extent ( $\bar{x}=3.98$ ), television viewing served as a major source of awareness, followed by radio jingles ( $\bar{x}=3.89$ ) and by word of mouth ( $\bar{x}=3.57$ ); as against online (internet) adverts ( $\bar{x}=2.38$ ), newspaper advertisements ( $\bar{x}=1.46$ ), and posters ( $\bar{x}=1.35$ ), which all raked low.

RQ2: What is the level of adoption of drug mobile authentication service?

**Table 3: Adoption of drug mobile authentication service in South-west Nigeria**

ITEMS	Very high Extent (%)	High Extent (%)	Low Extent (%)	Very Low Extent (%)	Mean $\bar{x}$	SD
I have been using drug mobile authentication service regularly since I knew about it	95(6.3)	241(15.9)	754(49.6)	428(28.2)	1.48	.767
I have only used it a few times	128(8.4)	199(13.1)	778(51.2)	413(27.3)	1.45	.673
I don't know much about it so I have never used it	299(19.6)	796(52.4)	197(12.9)	226(14.8)	3.67	.721
Although I know about the service, I have not used it.	361(23.7)	894(58.8)	263(17.5)	-	3.97	.723
I always use MAS to check every drug I buy	89(5.8)	195(12.8)	969(63.9)	265(17.4)	1.47	.806
Each time I use MAS I always get a positive result	57(3.7)	94(6.2)	987(65.1)	380(25.0)	1.41	.767
I use MAS only when buying drugs from a sources I don't trust	-	541(35.7)	837(55.1)	140(9.2)	1.43	.741
I used it once but got no reply and stopped since then	-	85(5.5)	998(65.7)	435(28.8)	1.40	.748
I do not use it because the process is not easy	573(37.7)	945(62.3)	-	-	3.99	.819
I like the service and I use it every time	54(3.5)	149(9.8)	551(36.3)	764(50.4)	1.49	.857
<b>Grand Mean</b>					<b>2.23</b>	<b>.721</b>

**Decision rule:** if mean is  $\leq 1.49$  = very low extent,  $1.5 - 2.49$  = low extent,  $2.5 - 3.49$  = high extent,  $3.5 - 4.0$  = very high extent. (Field Survey, 2020)

With a grand mean of ( $\bar{x}=2.23$ ,  $SD=.721$ ) the result in Table 3 depict a low-level adoption of drug mobile authentication service. This is also corroborated by values of individual items in the research instrument which reveals that participants who use MAS since they became aware of the service were very low ( $\bar{x}=1.48$ ), so also were those who have used the service a few times ( $\bar{x}=1.45$ ). However, those who attribute non-usage to lack of full knowledge about how the service runs were very high ( $\bar{x}=3.67$ ), just as those who knew about MAS but never used it were also very high ( $\bar{x}=3.97$ ). Conversely, respondents who always used MAS to check drugs before purchase were very low ( $\bar{x}=1.47$ ), even when purchasing from untrusted sources ( $\bar{x}=1.43$ ). To a very low extent ( $\bar{x}=1.40$ ) respondents used MAS once but got no reply and therefore stopped – implying non usage in the first place, with the result also showing that to a very high extent ( $\bar{x}=3.99$ ), nearly all respondents do not use drug mobile authentication service because of the belief that the process is cumbersome. Just as majority of respondents like the service and use it all the time to a very low extent ( $\bar{x}=1.49$ ). Overall, it is evident that the result depicts very poor adoption rate of MAS among study participants ( $\bar{x}=2.23$ ,  $SD=.721$ ), despite evidence of a significantly high level of awareness ( $\bar{x}=3.07$ ,  $SD=.505$ ) and knowledge of the service.

**Test of hypothesis**

H<sub>01</sub>: Awareness of drug mobile authentication service has no significant influence on its adoption in south-west Nigeria.

**Table 4:** ANOVA & Model Summary Testing Significant Influence of Awareness on adoption of drug mobile authentication service

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4132.673	2	1073.337	21.411	0.000 <sup>b</sup>
	Residual	10189.755	116	19.216		
	Total	14322.428	118			
R=.215		R Square= .127		Adj. R Square= .121		
Coefficients						
Construct	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	R			
(Constant)	10.060	2.133			14.220	0.000
Awareness of MAS	0.095	.126	0.045		1.024	0.083
Dependent Variable: Adoption of mobile authentication service						

(Field Survey, 2020)

Table 4 indicate that awareness of drug mobile authentication service had no significant influence on its adoption in Nigeria ( $F_{(2, 116)} = 21.411$ , Adj.  $R^2 = 0.121$ ,  $p > 0.05$ ). This implies that awareness of drug mobile authentication service (MAS) did not significantly influence the technology’s adoption in verifying the originality of drugs before purchase among study participants ( $\beta = 0.095$ ,  $r = 0.045$ ,  $T = 1.024$ ,  $p > 0.05$ ). In other words, being aware of MAS did not lead to its adoption and usage among. While the common understanding from literature is that awareness of a technology can be the first step towards its adoption and utilization, results from this study points to the contrary as the table indicates that awareness explained only 12.1 percent (Adj.  $R^2 = 0.121$ ) variation of adoption of drug mobile authentication service among study participants. Consequently, the null hypothesis that drug mobile authentication service awareness has no significant influence on its adoption in Nigeria was accepted.

**4. Discussion**

This study, which investigated the awareness and adoption of drug mobile authentication service in Nigeria, revealed that 65% of participants are aware of the technology’s existence in the country. Whereas the grand mean of ( $\bar{x} = 3.07$ ,  $SD = .505$ ) derived from answers to RQ1 indicated a relatively high level of awareness, RQ2 with a grand mean of ( $\bar{x} = 2.23$ ,  $SD = .721$ ) indicated a low level of adoption, with results from hypothesis test showing no significant influence of awareness on adoption of the technology. This result, despite being similar to that of Ukaoha, Dim, Daodu, and Odikayor-Ogbomo

(2015), which also showed a relatively high level of awareness, but identified a number of usability issues that were barriers to the technology’s adoption, it is dissimilar to those of Justin and Ilomuanya (2016) and Chinwe and Chinonye (2017) whose studies revealed that members of the audience were unaware of drug mobile authentication service (MAS) in various parts of Nigeria as a result of which they do not utilize the technology. Daberkow and McBride, (2003) argued that awareness can take place when an individual gains or acquires information about the existence of a phenomenon, but possesses little or no understanding about it. This could likely be the case here because, though aware of drug mobile authentication service, Nigerians are yet to gain enough understanding of the service to the point of massively deploying it in everyday usage to avert or minimize negative consequences of non-adoption.

Straub (2009) stressed that adoption of a product or technology can be influenced by individual characteristics such as belief, curiosity and need, socio-economic aspects and access to awareness channels such as communication media. Since participants in this study showed to a certain degree that they are aware of drug mobile authentication service, the last factor can be downplayed since there are evidences from the result showing that they had access to different media used for awareness creation. This therefore accentuates individual characteristic and socio-economic factors as possible reasons for its low adoption. In terms of individual characteristics, the lack of belief in the effectiveness of government projects due to previous experiences over the years is a factor many Nigerians can identify with. Quite a

number of ideas championed by the government in Nigeria have not been effectively implemented in the past. Premised on these previous experiences, potential users of MAS doubt its credibility and effectiveness. This doubt has heightened disbelief in the minds of many, to the point that only few among the populace can be curious enough or may see the need to give such laudable project as mobile authentication service a trial or trust it to the level of adoption. Also, telecommunication, which is meant to be the chief driver of MAS is still underdeveloped in the country. Interconnectivity issues, dropped calls, poor network coverage, unstable network service, delayed feedback, erratic power supply, unfriendly customer services and many others are among major issues stifling the progress in drug mobile authentication service adoption. Many are of the belief that it is difficult, if not impossible for a sector still struggling to find its feet in terms of quality service delivery to champion such important service as drug mobile authentication.

Socio-economic factors can as well be a barrier to the adoption of this technology. Many Nigerians are poor, barely surviving on less than one dollar a day. This means that many Nigerians are more concerned with how to earn a daily living than thinking of what technology to use in authenticating drugs before purchase. Although NAFDAC announced that the service is free of charge, many may still think that it could attract some hidden charges as it is the case with most online services offered by telecom companies, banks and other online based service providers. This implies therefore that government and its agencies have a task in hand to prove to the public that the service is genuine and can be dependable, and the fight against fake and counterfeit drugs is one which the government is determined to win through the collaboration of the public as they adopt and utilize drug mobile authentication service whenever they want to purchase drugs.

## 5. Conclusion

This study investigated the awareness and adoption levels of drug mobile authentication service in Nigeria. It discovered that adoption of MAS is low comparatively to the level of awareness shown in the study. This situation can rarely be acceptable since the ultimate aim for launching MAS technology is to enable the detection of fake and substandard drugs by individuals before purchasing and consumption takes place and considering the fact that the problem of fake drugs remains daunting in the country. This implies that NAFDAC and government must go beyond just awareness creation to focus more on

discovering practicable approaches that can spur the audience to adoption and continuous usage of MAS technology so as to facilitate the reduction, if not eradication of fake and counterfeit drugs in Nigeria.

## 6. Recommendations

Findings from this study has shown that the launch of drug mobile authentication service and the creation of awareness for it was not enough to motivate the populace to adopt the technology in order to rid the country of fake and counterfeit drugs. It is therefore recommended that having implemented and launched the service, NAFDAC and the government of Nigeria should step further to imbibe concrete and realistic approaches that can enable them gain the trust of the people by addressing especially the socio-economic factors capable of bedeviling its adoption. Also, government must ensure that telecommunication service in the country is improved upon especially in the area of network coverage since it is the bedrock upon which the service is driven. This improvement can lead to increased access to MAS by both rural and urban dwellers. Not oblivious of the fact that merely 65% of respondents are aware of MAS, there is need for more awareness creation using additional channels that will reach all and sundry within Nigeria, irrespective of geographical locations. Finally regulations on customer services, with particular reference to delayed feedback should be consciously minimized in order to gain people's trust in MAS to drive motivation towards adoption which in the long run can foster strong collaborations between the citizens, government and its agencies in fighting fake and counterfeit drugs out of Nigeria.

## References

- Aminu, N. & Gwarzo, M. S. (2017). The imminent threats of counterfeit drugs to quality health care delivery in Africa: Updates on consequences and way forward. *Asian Journal of Pharmaceutical and Clinical Research*, 10(7), pp. 63-67, doi:10.22159/ajpcr.2017.v10i7.18384.
- Akunyili, D. (2005). *Counterfeit drugs and pharmacovigilance*. Available at [www.nafdacnigeria.org](http://www.nafdacnigeria.org) Accessed 15/9/2018
- Bamitale, K. D. S. (2016). The effect of fake and expired drugs on health. *African Journal of Pharmacy and Pharmacology*, 7(1), 59-80.
- BiztechAfrica.com (2013). *Sproxil, IBM partner to fight counterfeit drugs*. Retrieved from <http://www.biztechAfrica.com/article/sproxil-ibm-partner-to-fight-counterfeit-drugs/2739> on 20/10/2018.

- Chaudhry, P. & Zimmerman, A. (2013). The global growth of counterfeit trade. *Protecting Your Intellectual Property Rights, Management for Professionals*. New York: Springer Science+Business Media; 2013. p. 7-31.
- Chinwe, E. U. & Chinonye, F. C. (2017). Audience awareness and use of mobile authentication service (MAS) in identifying fake and substandard drugs in Nigeria. *Mgbaoigba Journal of African Studies*, 7(1), 46-66.
- Daberkow, S. G. & McBride, W. D. (2003). Farm and operator characteristics affecting the awareness and adoption of precision agriculture technologies in the US. *Precision of Agriculture*, 163-177.
- Dipika, B., Swathi, M., Kapil, G. & Pramila, T. (2012). Anti-counterfeit technologies: A pharmaceutical industry perspective. *Scientia Pharmaceutica (Open Access) Journal*. Available at [www.scipharm.at](http://www.scipharm.at), assessed 4/10/2018.
- Health and Care Professions Council (2013). About registration: Medicines and prescribing. *Archived from the original on 2016-01-13*. Available at [hcpc-uk.org](http://hcpc-uk.org). Accessed May 05, 2020.
- Health Communication Capacity Collaborative (HC3, 2016). Landscape of antimalarial medicines in Nigeria. *Johns Hopkins Center for Communication Programs*. [www.healthcommcapacity.org](http://www.healthcommcapacity.org) Accessed 15/7/2019  
<https://www.strategyand.pwc.com/gx/en/insights/2017/fighting-counterfeit-pharmaceuticals/fighting-counterfeit-pharmaceuticals.pdf>
- Justine, A. & Ilomuanya, M. O. (2016). Securing the pharmaceutical supply chain: A study of the use of mobile authentication service (MAS) among the Nigerian populace utilizing antimalarials. *African Journal of Pharmacy and Pharmacology*, 10(39), 839-848.
- Mackey, T. K., Liang, B. A., York, P. & Kubic, T. (2015). Counterfeit drug penetration into global legitimate medicine supply chains: A Global Assessment. *Am J Trop Med Hyg*, 92(6), 59-67.
- Nevin, A. (2017). Keynote address presented at the annual general meeting of the pharmaceutical council of Nigeria. (Unpublished).
- Peasgood, S. & Capital, S. (2015). How technology can protect consumers and pharma companies from fake drugs. *Cantech Lett*. Available from: <http://www.cantechletter.com/2015/04/how-technology-can-protect-consumers-and-pharma-companies-from-fake-drugs/>. Accessed May 05, 2020.
- Rahman, M. S. (2018). The health consequences of falsified medicines: A study of the published literature. *Tropical Medicine & International Health*, 23(12), pp.1294–1303.
- Renschler, J. P. (2015). Estimated under-five deaths associated with poor-quality antimalarials in sub-Saharan Africa. *The American Journal of Tropical Medicine and Hygiene*, 92(6), 119–126.
- Rogers, E.M. (2003). *Diffusion of Innovations (5th ed.)*. New York: Free Press.
- Scutti, S. (2015). Global problem of counterfeit drugs affects even legitimate sources, such as hospitals and pharmacies. *Med Dly 2015*. Available from: <http://www.medicaldaily.com/global-problem-counterfeit-drugs-affects-even-legitimate-sources-such-hospitals-and-329914>. Accessed May 05, 2020.
- Ukaoha, K. C., Dim, C. N., Daodu, S. S. & Odikayor-Ogbomo, F. I. (2015). Towards a mobile drugs authentication system for Nigerian users. *Computing, Information systems, Development Informatics and Allied Research Journal*. Available at [https://www.researchgate.net/publication/303945378\\_Towards\\_a\\_Mobile\\_Drugs\\_Authentication\\_System\\_for\\_Nigerian\\_Users/citation/download](https://www.researchgate.net/publication/303945378_Towards_a_Mobile_Drugs_Authentication_System_for_Nigerian_Users/citation/download). Accessed May 05, 2020
- Wilson, J. M. & Fenoff, R. (2011). *The health and economic effects of counterfeit pharmaceuticals in Africa*. *Global Health Business Review*, 5(6), 1-3.
- Wayne, W. L. (2019). *Diffusion of Innovation Theory*. Boston University School of Public Health.
- World Health Organization (WHO, 2017). Essential Medicines. Retrieved May 05, 2020
- World Health Organization (WHO, 2011). Survey of the Quality of Selected Antimalarial Medicines Circulating in Six Countries of Sub-Saharan Africa. Retrieved from [http://www.who.int/medicines/publications/WHO\\_QAMSA\\_report.pdf](http://www.who.int/medicines/publications/WHO_QAMSA_report.pdf) on 25/04/2019.