

DIGITAL VERIFICATION IN HEALTHCARE: ASSESSING MOBILE AUTHENTICATION AGAINST COUNTERFEIT MEDICINES IN SOUTH-EAST NIGERIA

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Abstract: The study examined the perception of South-East Nigeria residents on Mobile Authentication Service (MAS) in detecting counterfeit pharmaceutical products. The study was anchored on the technological determinism theory and adopted the survey research design. The population for this study is made up of all residents of the five South Eastern states in Nigeria aged 18 and above, according to the National Bureau of Statistics, the projected population of the aforementioned states for 2021 are 23,856,937. The sample size for the study was 384. The sampling techniques used were purposive, cluster and accidental sampling technique. Findings from the study showed that that South East residents have negative attitudes towards the Mobile Authentication Service of NAFDAC because they believe it is useful in detecting counterfeit drugs, they know the steps involved but believe it is difficult to use and as such, they don't tell others about it, which means silently rejecting the innovation of Mobile Authentication Service. The study recommended that to ensure that South East Residents develop a positive attitude towards the Mobile Authentication Service of NAFDAC, the Agency must constantly and consistently improve on how the service works.

Keywords: Perception, Mobile Authentication Service, Counterfeit Pharmaceutical Products

Introduction

This study is situated in the use of communication for advancing knowledge, information, and creating awareness on matters pertaining to health and specifically detecting counterfeit pharmaceutical products. An overview of communication for health promotion is critical at this point. The concern of health promotion is how strategies are extrapolated from communication and deployed to inform and influence individuals to make decisions about their health. The end product is usually to promote positive changes in attitudes and behaviours. As it relates with this study, health communication encompasses making use of a variety of communication channels to disseminate messages with the aim of changing people's knowledge, attitude and practices. Avalanches of communication channels are available and these range from broadcast (radio and television) to print (newspapers, fliers, magazines and brochures). The Internet has recently been a veritable channel for disseminating health communication messages. The importance of communication channel is evident because audiences vary. While certain health promotion campaigns will succeed when channelled through radio, others may thrive when channelled through social media. In other words, channels of communication may determine the potency of health promotion messages. Odorume (2015) avers that using a variety of communication channels allow for health messages to shape mass media or interpersonal, small group or community level campaigns.

The present study concerns reinforcing positive behaviour and influencing social norms. This leads to the health issue this study is concerned with, counterfeit pharmaceutical products.

One of the most pervasive problems bedeviling the health sector the world over and Nigeria in particular is counterfeit drugs. As noted by Uzochukwu and Chinedu-Okeke (2017), the manufacturing, trading, and use of subsidized drugs and in treating life-threatening conditions is widely agreed to be one of the causes of high morbidity and loss of public confidence in the Nigerian health sector. Fake drugs or counterfeit drugs is said to be one which deliberately or fraudulently mislabeled with respect to identity and/or source. This basically means that counterfeit drugs include products with correct or incorrect ingredients, inactive ingredients, or fake packaging. In Nigeria, counterfeit medicines are prepared without active ingredients as stated, adulterated or expired ingredients are used, expired drugs are labelled, drugs are prepared without the requisite registration by the National Agency for Food and Drug Administration (NAFDAC). Be that as it may, counterfeit drugs constitute one of the major public health risks faced by developing countries. There are basically two key areas counterfeit medicines pose a problem. First is the area of health. Second is the economic impact. There is an avalanche of data to back this assertion up globally. In 2005, in Canada, it was reported that an accredited pharmacy had dispensed counterfeit Norvasc, a popular blood pressure medicine. It resulted in the death of 11 people. In the United States, in 2008, there was a case of counterfeit blood thinner heparin. The active ingredient for the medicine was replaced with a cheaper substance. This was responsible for the death of about 81 people. In the United Kingdom, in 2013, Richard Taylor was sentenced to 11 years imprisonment for introducing counterfeit cancer medication to the supply chain which led to the loss of lives of some cancer patients. However, the one most familiar in this clime is that which happened in Nigeria in 2008. "My pikin", a teething problem remedy was contaminated by the use of diethylene glycol as a solvent. This resulted in children who consumed the medicine to develop kidney injury and later death (Aminu, et al, 2017). The public health risks associated with counterfeit medicines are numerous but three of these as highlighted above stand out namely therapeutic failure, damage to vital organs, and death. Besides public health implications, there is also the economic impact of counterfeited medicines, economic losses as a result of drug counterfeiting is enormous. Many pharmaceutical companies lose large amounts of money because their products are being counterfeited and sold at cheaper rates. Drug therapy has financial implications both on the individual and the national economy. When the wrong drug or counterfeit is used, it is waste and when excess of underdoes of the right drug is used, it is also wasteful (Buoawari 2012).

The perception of South-East residents on the application of Mobile Authentication Service (MAS) in detecting fake pharmaceutical products in Nigeria is an essential protection. The prevalence of counterfeit drugs poses a significant threat to healthcare systems, leading to ineffective treatment, prolonged illness, and increase mortality rates (World Health Organization (WHO), 2018). In response, the introduction of MAS, which allows consumers verify the authenticity of pharmaceutical products via mobile phones, represents a critical innovation in the fight against counterfeit drugs. This service enables users to authenticate products by sending a unique code found on the product packaging to a designated number, thereby receiving an instant confirmation of the product's authenticity (Nwokike, 2017). Understanding how residents of the South-East perceive this technology is crucial for evaluating its effectiveness and potential for widespread adoption.

The application of MAS in Nigeria is part of a broader strategy to enhance drug safety and restore consumer confidence in the pharmaceutical market. By leveraging the widespread use of mobile phones, MAS provides an accessible and user-friendly solution to the pervasive problem of counterfeit medications (Akinyandenu, 2019). However, the success of this technology depends significantly on public awareness, acceptance and utilization. Factors such as technological literacy, trust in the system, and perceived benefits play pivotal roles in shaping the perception and adoption of MAS among South-East residents. Analysing these perceptions helps identify the barriers and facilitators to the effective implementation of MAS, ensuring that the technology meets the needs and expectations of its users.

Despite the potential benefits of MAS, there are challenges related to its adoption in the South-East region. Issues such as lack of awareness, skepticism about the reliability of the service, and limited access to mobile technology can hinder its widespread use. Additionally, socio-cultural factors and the general mistrust in regulatory bodies can affect how residents perceive and interact with MAS. By exploring the perceptions of South-East residents, this study aims to provide insights into the effectiveness of MAS and offer recommendations for enhancing its acceptance and utilization. Addressing these challenges through targeted education campaigns and improving the system's reliability can significantly contribute to reducing the prevalence of counterfeit pharmaceuticals and improving public health outcomes in Nigeria.

Aim and Objectives of the Study

The aim of this study is to examine perception of South-East Nigeria residents on Mobile Authentication Service (MAS) in detecting fake pharmaceutical products. The objectives are:

1. Identify the attitudes of South East residents in the utilization of the Mobile Authentication Service in detecting counterfeit pharmaceutical products.
2. Find out the practices of South East residents in the application of the Mobile Authentic Service in detecting counterfeit pharmaceutical products.
3. Identify, if any, constraints to the utilization of Mobile Authentication Service (MAS) in detecting counterfeit pharmaceutical products.

Literature Review Conceptual Review Perception

It is common knowledge that humans are creatures that are capable of processing information obtained around them. Humans can assess what they see, feel, or think. Therefore, humans can perceive something according to their thoughts. Perception is an opinion on something in an environment. Perception is a term that is closely related to human psychology and it has been defined in various ways. According to Martono (2015), perception is a process in assessing or building impression towards various things that exist in the human senses. Nelson and Quick (1997) posit that perception is a process used to analyses information provided by others. Zulhernanda (2017) states that perception is the processes whereby people select, organize, and interpret sensory stimulations into meaningful information about their work environment.

Discussion on perception often contains various meanings, the varying meanings lie in the connotation of the term perception itself. Perception according to Nurohman (2018), is the perception is defined in accordance with the opinions and views of someone. And Solso (2008) posits that perception is an advanced cognitive level in the interpretation of sensory information. The term perception according to Lindgren (2013), perception is viewed as the mediating processes that are initiated by sensations. Clifford (2011) states that perception is the process of

discriminating among stimuli and of interpreting their meanings while, Huffman and Vernoy (2010), perception is the process of selecting, organizing, and interpreting sensory data into useable mental representation of the world.

Worchel and Shebilske (2019) state that perception is the process of interpreting information. Szilagy and Wallace (2010) explain perception as a process by which individuals attend to incoming stimuli, organise, and interpret such stimuli into message that in turn indicate an appropriate action or behaviour. Thus, perception is an action in which someone gives the stimulus and response about something which happens in reality. Although some people are facing a similar object, they may have a different perception about it. It is because everyone has their own experience in the past. There are many experts that describe the relation between people's experience and perception (Szilagy & Wallace, 2010).

Mouly (2013) states that two persons looking at the same phenomenon may see very different things. Wick and Pick (2018) state that, there is a connection between perception and experience. According to Desmita (2010), in developmental psychology of students, the term perception comes from the English "perception", taken from the Latin "perceptio", which means to accept or take. In addition, the perception in the narrow sense is "the vision", that is how someone sees something, whereas in a broader sense, the perception is "view", namely how someone looks or sees something. Perception is closely related to attitudes. Perception is the process by which organisms interpret and organize sensation to produce a meaningful experience of the world (Lindsay & Norman).

In other words, people are dealing and interpreting the stimulation into something meaningful to them based on their former experiences. However, what an individual interprets or perceives may be substantially different from reality. Warlito (2010) posit that perception is a process of organising and interpreting the stimulus received by individuals so that it becomes something meaningful and an integrated activity within the individual. Warlito adds that with perception, the individual will be aware of the circumstances surrounding and also own situation, because perception is an integrated activity within the individual, then what is in the individual will participate actively in the perception.

Perception *has also been seen as* a favorable or unfavorable evaluative reaction to something or someone, exhibited in one's beliefs, feelings, or intended behaviour (Williams, 2014). It is also said to be a social orientation - an underlying inclination to respond to something either favorably or unfavorably. Chu (2011) sees perception as a psychological tendency that is expressed by evaluating a particular entity with some level of favour or disfavour. From the foregoing, one can say that perception is the tendency to respond or act favourably or unfavourably to a person, activity or object. Chu (2011) posits that perceptions influence behaviour by affecting intentions. One can therefore, say that perception of a website or social media is a good indicator of audience reception of the sites or media's content. In other words, audience members are more likely to rely on the website/media's content as a source of information when they have favorable perceptions toward the site.

Health Communication

Health communication is a very broad term that means different things to different people. Scholars have defined and described health communication from different perspectives. This is because like most concepts, there is no universal definition but perspectives that define health communication. In a broader and wider view, Sixsmith et al. (2014) define health communication as the study and use of communication strategies to inform and influence individual and community decision that enhance health. It encompasses health promotion, health protection,

disease prevention and treatment, and is pivotal to the overall achievement of the objectives and aims of public health. However, Kreps (2015) believes that health communication examines the influence of human and mediated communication on health care delivery and the promotion of health. He thinks it is problem-based and identifies serious issues in communication that impedes the health care quality and promotion of health care as well as suggests accurate health communication interventions, policies and programs for improving the quality of healthcare practices. Health communication exists in various levels of communication.

It can be intrapersonal, interpersonal or even mass communication (which is the focus). Therefore, health communication will be defined as the examination of strategies in communication to inform and influence individual and community decisions that enhance health. The purpose of health communication is to change the behaviours of individuals and communities about issues pertaining to their health, healthcare delivery and policies. Airhihenbuwa (2000) believes that health communication is a social marketing strategy that aims to change the behaviour of people and promote acceptability of a health campaign. This is why Guttman and Salmon [2004], agree that health communication helps in raising awareness of risk from chronic diseases and new infections and helps with the promotion of recommended treatments. Since the objective is to evaluate health communication in mass communication, this paper adopts Kreps (2003) in Cocoran (2007) which included health in the definition of communication and describes health communication as a resource that allows health messages, which may be risk prevention awareness to be used in the education and avoidance of ill health. Using the above definition as a working tool in this paper, health communication examines and evaluates all those strategies, techniques, and skills employed by media practitioners and their organisations in delivering quality health campaign messages aimed at creating awareness in order to change behaviours about people's health, nutrition and to prevent certain diseases and encourage healthy living.

Knowledge, Attitudes and Practices

As posited by Kaliyaperumal (2004), the three topics that a KAP study measures are Knowledge, Attitude and Practice. It is known that the triad of knowledge, attitudes and practices in combination governs all aspects of life in human societies, and all three pillars together make up the dynamic system of life itself. A KAP survey assesses the knowledge, attitude, and practices among individuals in a specific geographical location. A consideration of the three concepts is imperative.

Knowledge

Launiala (2009) submits that in KAP surveys, the knowledge part is normally used to assess the extent of community knowledge about health-related concepts related to local, national and/or international public health programmes. Knowledge is the acquisition, retention, and use of information or skills (Badran, 1995). Gurnucio (2011) advances that knowledge is a set of understandings, knowledge and of "science." It is also one's capacity for imagining, one's way of perceiving. Knowledge of a health behaviour considered to be beneficial, however, does not automatically mean that this behaviour will be followed. Cognition through which knowledge is acquired is a process of understanding and is distinguished from the experience of feeling. Knowledge accrues from both education and experience. Knowledge in health communication refers to the comprehension of diseases, health intervention programmes and policies, and selfcare practices necessary for optimizing health intervention programmes. Knowledge means understanding, awareness of a body of idea gained either by learning or experience. The narrow focus on knowledge can further be explained by the definition of knowledge and the

agreement on whose knowledge counts. Peltó and Peltó (1997) have pointed out that knowledge is based on scientific facts and universal truths (refers to “knowing” about medical information. Agbedia(2013) submits that knowledge is usually assessed in order to see how far community knowledge corresponds to biomedical concepts. Typical questions include knowledge about causes and symptoms of the illness under investigation, method of applying contraceptives, detecting counterfeit pharmaceutical products, how to avoid overdose of medicines. Obviously,

People reported knowledge which deviates from biomedical concepts is usually termed as Beliefs. This has come to be deeply entrenched in the mind of the individual.

Attitude

While Knowledge makes for sensitivity and consciousness, attitude is a way of behaving towards an issue(s) or situation. Attitude has been defined by Launiala (2009) as “a learned predisposition to think, feel and act in a particular way towards a given object or class of objects” (p.12). As such, attitude is a product of a complex interaction of beliefs, feelings, and values. Eagly and Chaiken (2007) in a book entitled *The Psychology of Attitude* offered a formal definition of attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour” (p.12). Attitude refers to their feelings towards this subject, as well as any preconceived ideas that they may have towards it. From a psychological perspective, attitude has three components: cognition, affect, and behaviour (Eagly & Chaiken, 2007). Cognition comprises true and false beliefs about the attitude object; health education may change such beliefs. Thus, there may be overlap between knowledge and attitude.

Measuring attitudes is an important part of a standard KAP survey. However, many KAP studies do not present results regarding attitudes, probably because of the substantial risk of falsely generalising the opinions and attitudes of a particular group (Hausmann-Muela et al. 2003). In the layman’s language, the term attitude is usually used to refer to a person’s general feelings about an issue, object, or person (Petty and Cacioppo 2001). Furthermore, attitudes are interlinked with the person’s knowledge, beliefs, emotions, and values, and they are either positive or negative. Peltó and Peltó (1994) have also described causal attitudes or erroneous attitudes, which are considered derivatives of beliefs and/or knowledge.

The act of measuring attitudes using a survey research design has been criticised for many reasons. This is because when confronted with a survey question, people tend to give answers which they believe to be correct or in general acceptable and appreciated. Sensitive topics are particularly demanding. The survey interview context may influence the answer; whether the interview is conducted at a clinic or in a village, whether there are other people present. The question formulation can be manipulative towards a favourable answer. Sometimes, the respondents may be uninformed about the issue and thus find it strange, but their attitudes are nonetheless measured. On occasion, the attitude scales (numbers/verbal) may fail to reflect the respondents’ answers (Peltó & Peltó 1994). Attitude instruments measure the feelings and beliefs of survey participants about a health problem or an intervention information on practice measures and the preventive behaviours that individuals follow to avoid a problem or disease.

The affective component of attitude is the whole gamut of emotions toward every aspect of the attitude object. In summary, attitude toward counterfeit pharmaceutical products and detecting them refers to any preconceived ideas about fake drugs and how to detect it, patients’ feelings/emotions towards the nature of fake drugs, and the

aptness to behave in particular way about detecting it. Hence Drouba (1952 cited in Pelto and Pelto 1994) stated that attitude is a mental disposition of an individual to act for or against a definite object and McDonald (1975 cited in Pelto and Pelto 1994) stated that it is a pre-disposition to act in a positive or negative way towards persons or objects, ideas and events. Attitude is a way of being, a position. Gurnucio (2011) further advances that these are leanings or “tendencies to” it is an intermediate variable between the situation and the response to this situation. It helps explain that among the possible practice’s for a subject submitted to a stimulus, that subject adopts one practice and not another. Attitudes are not directly observable as are practices, thus it is a good idea to assess them. It is interesting to note that numerous studies have often shown a low and sometimes no connection between attitude and practices.

Practice

A third and integral part of KAP surveys is the investigation of health-related practices. Questions normally concern the use of different treatment and prevention options and are hypothetical. KAP surveys have been criticised for providing only descriptive data which fails to explain *why* and *when* certain treatment prevention and practices are chosen. In other words, the surveys may fail to explain the logic behind people’s behaviour (Pelto and Pelto 1994). Another concern is that KAP survey data is often used to plan activities aimed at changing behaviour, based on the false assumption that there is a direct relationship between knowledge and behaviour. Several studies have, however, shown that knowledge is only one factor influencing treatment-seeking practices, and in order to change behaviour, health programmes need to address multiple factors ranging from socio-cultural to environmental, economic, and structural factors (Launiala & Honkasalo 2007).

Practice demonstrates the acquisition of knowledge (increased understanding of a problem/disease) and any change in attitude caused by the removal of misconceptions about problems or disease that translates into preventive behaviours. Thus, that demonstration may reflect a reciprocal relationship between knowledge and attitude. Practice is behaviours or actions that can avert a disease or delay its progression. In averting the danger of using counterfeited pharmaceutical products, practice would involve buying medicines at designated pharmacies, buying from well-known, world class pharmaceutical companies, and constantly checking expiry dates (Launiala 2009). Practices in KAP surveys usually enquire about the use of preventive measures or different health care options. Normally, hypothetical questions are asked, therefore it hardly permits statements about actual practices, rather, it yields information on people’s behaviours or on what they know should be done. Practice refers to the ways in which they demonstrate their knowledge and attitude through their actions. Understanding the levels of Knowledge, Attitude and Practice will enable a more efficient process of awareness creation as it will allow the program to be tailored more appropriately to the needs of the community (Launiala 2009). To sum up what practice entails, Gurnucio (2011) points out that practices or behaviours are the observable actions of an individual in response to a stimulus. This is something that deals with the concrete, with actions. For practices related to health, one collects information on consumption of tobacco or alcohol, the practice of screening, vaccination practices, sporting activities, sexuality and detecting counterfeit pharmaceutical products.

Substandard and Fake Drugs

The issue of manufacturing and trading on substandard and fake drugs (counterfeit drugs) is a global public health problem causing death, disability and injury. These products often contain insufficient quantities of active ingredients or with the addition of toxic substances or even without any active ingredient. With these, a consumer

does not receive the complete treatment benefits and will either not recover from or will have a delayed recovery (WHO, 2006). However, there is no universal definition of fake drug as every country has their own meaning. World Health Organization defines a “counterfeited drug” as “a medicine, 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 ingredients or with fake packaging” (WHO, 2006).

In this context, the definition of fake drug as given by the Nigerian Counterfeit and Fake Drugs and Unwholesome Processed Foods (Miscellaneous Provisions) will be used, which is: Any drug product which is purported to be; or any drug or drug product which is so coloured, coated, powdered or polished that the damage is concealed or which is made to appear to be better or of greater therapeutic value than it really is, which is not labelled in the prescribed manner or which label or container or anything accompanying the drug bears any statement, design, or device which makes a false claim for the drug or which is false or misleading; or any drug or drug product whose container is so made, formed or filled as to be misleading; or any drug product whose label does not bear adequate directions for use and such adequate warning against use in those pathological conditions or by children where its use may be dangerous to health or against unsafe dosage or methods or duration of use; or any drug product which is not registered by the Agency in accordance with the provisions of the Food, Drugs and Related Products (Registration, etc) Decree 1993, as amended (WHO, 2008).

Counterfeit Products

Counterfeit products threaten public health and safety, reduce jobs and tax bases, and inhibit corporate innovativeness and profitability. The production, distribution, and consumption of counterfeit pharmaceuticals represent a particularly dangerous public health risk; estimates of the numbers of counterfeit pharmaceuticals range from 10 to 15 per cent of the world drug supply. Counterfeit drugs indirectly and directly adversely affect health. Indirectly, false drugs hasten the illness and death of consumers who do not receive the appropriate active agent or dosage to treat their conditions, and sub-potent pharmaceuticals that do not kill a disease-causing pathogen can eventually lead to the development of drug-resistant strains, making even the authentic drugs useless. More directly, toxic ingredients in counterfeit pharmaceuticals can cause serious health problems (Fenoff & Wilson, 2009). Among the factors that encourage drug faking worldwide is corruption and conflict of interests. Corruption is a driving force for poor regulation, which encourages drug faking/counterfeiting. The Management of NAFDAC has resolved that counterfeit medicines must be brought to the barest minimum in the shortest possible time. They have a clear vision, goals and strategies. Their vision is to safeguard public health by ensuring that only the right quality products are manufactured, imported, exported, advertised, distributed, sold and used in Nigeria (Akunyili., 2005).

The World Health Organization (WHO) defines counterfeit drugs as “drugs that have been deliberately or fraudulently mislabelled with respect to identity and/or source” (Akinyandenu, 2013). Counterfeit medications have been defined as "products deliberately and fraudulently produced and/or mislabelled with respect to identity and/or source to make it appear to be a genuine product" (Chambliss, et al., 2012). Examples include medications that contain no active ingredient, an incorrect amount of active ingredient, an inferior-quality active ingredient, a wrong active ingredient, contaminants, and repackaged expired products (Ziance, 2008). Falsified and substandard medicines provide little protection from disease and, worse, can expose consumers to major harms.

Bad drugs pose potential threats around the world, but the nature of the risk varies by country, with higher risks in countries with minimal or non-existent regulatory oversight (Countering the Problem of Falsified and Substandard Drugs, 2013).

Fight against Fake Drugs by NAFDAC in Nigeria

National Agency for Food and Drug Administration and Control (NAFDAC) is a Nigerian government agency responsible for regulating and controlling the manufacture, importation, exportation, advertisement, distribution, sale and use of food, drugs, cosmetics, medical devices, chemicals and pre-packaged water. Its creation was inspired by a 1988 World Health Assembly resolution requesting countries help in combating the global health threat posed by counterfeit pharmaceuticals and amidst growing concerns about the growing problem of fake and poorly regulated drugs in Nigeria. In December 1992, NAFDAC's first governing council was formed. In January 1993, supporting legislation was approved as legislative Decree No. 15 of 1993, and January 1, 1994, NAFDAC was officially established, as a “parastatal of the Federal Ministry of Health”. NAFDAC replaced an earlier Federal Ministry of Health body, the Directorate of Food and Drug Administration and Control, which had been deemed ineffective, largely due to a lack of laws concerning fake drugs and political issues (National Agency for Food and Drug Administration and Control, 2013).

The objective of any drug regulatory agency is the protection and promotion of public health. The enforcement directorate arm of NAFDAC established under the provisions of the counterfeit and fake drugs (miscellaneous provision) act is charged with the responsibility of enforcing the provisions of the counterfeit and fake drug decree, which includes: Conducting surveillance on companies and persons suspected to be violating NAFDAC regulations and carrying out investigations on such persons and companies, and paying unscheduled visits to all ports of entry and border posts and interrogation of suspects. Sampling of NAFDAC regulated products to the laboratory and compilation of case files, raiding of drug hawkers and destruction of fake and spurious regulated products and coordination of activities of state task force.

Theoretical framework

Technological Determinism Theory

This theory is a reductionist theory that presumes that a society's technology derives the development of its social structure and cultural values. Technological determinism has been defined as an approach that identifies technology, or technological advances, as the central casual element in processes of social change (Croteau & Hoynes, 2013). The term is believed to have been coined by Thorstein Veblen (1857-1929), an American sociologist. The most radical technological determinist in America in the twentieth century was most likely Clarence Ayres who was a follower of Veblen and John Dewey. But also, William Ogburn was known for his radical technological determinism. Most interpretations of technological determinism share two general ideas: that the development of technology itself follows a predictable, traceable path largely beyond cultural or political influence, and that technology in turn has “effects” on societies that are inherent, rather than socially conditioned or produced because that society organizes itself to support and further develop a technology once it has been introduced.

The theory is profoundly relevant as it represents a significant shift in how pharmaceutical products are authenticated. This theory helps to understand how such a technological innovation can reshape traditional verification methods, making the detection of fake drugs more efficient and reliable. By adopting MAS, healthcare

practices in south-East Nigeria can transition to a more technologically advanced system, improving patient safety and trust in the healthcare system. This transformation aligns with the principles of technological determinism, where technology propels societal advancements. The theory suggests that the availability and use of MAS can lead to changes in consumer behaviour. People may become more vigilant and proactive in verifying the authenticity of their medications, thereby reducing the incidence of counterfeit drug consumption. The ease of access to MAS technology empowers consumers to make informed decisions regarding their healthcare. This shift towards greater consumer empowerment and self-efficacy is a direct result of technological advancements driving social change.

The theory underscores the role of technology in driving such policy adaptations to support and enhance technological implementation. Healthcare institutions and policymakers may need to support MAS adoption through training, awareness campaigns, and infrastructural investments. This aligns with the theory's perspective on how technology can lead to institutional changes and reforms. The widespread use of MAS can alter market dynamics by reducing the profitability and prevalence of counterfeit pharmaceuticals. This economic shift is a direct consequence of technological intervention, as posited by the theory. This theory is highly relevant to the study in detecting fake pharmaceutical products in South-East Nigeria. It provides a comprehensive framework for understanding how this technological innovation can drive significant changes in healthcare practices, consumer behaviour, regulatory policies and overall public health. This theory highlights the transformative power of technology in shaping and improving societal structures and outcomes.

Methodology

The study adopted the survey research design. The reason for adopting survey was on the basis of Wimmer and Dominick's (2006) assertion that "surveys can be used to investigate problems in realistic setting and behavioural patterns can be examined where they happen rather than a laboratory or screening room under artificial conditions" (p.161). The population for this study is made up of all residents of the five South Eastern states in Nigeria aged 18 and above from Abia State, Anambra State, Ebonyi State, Enugu State, and Imo State. According to the National Bureau of Statistics, the projected population of the aforementioned states for 2021 are 23,856,937. The sample size for the study was 384. It was arrived at using the predetermined sample size table projected by Krejcie and Morgan. Krejcie and Morgan recommend a sample size of 384 for a population beyond 1,000,000. The study used three sampling techniques namely, purposive sampling technique, random sampling technique and accidental sampling technique. The questionnaire was administered and retrieved by the researcher and with the assistance of three research assistants. Data obtained through the research instruments were collated, presented in frequency tables and analysed on a Four- point Likert scale using weighted mean score.

Results and Discussion Objective one: Attitudes of South East residents towards the utilisation of the Mobile Authentication Service for detecting counterfeit pharmaceutical products Table 1 Attitudes of South East residents towards the utilisation of the Mobile Authentication Service

| Items | SA | A | D | SD | WS | WMS | Result |
|---|----|-----|-----|----|------|------|-----------------|
| The Mobile Authentication service is useful in detecting fake drugs | 64 | 183 | 128 | 17 | 1078 | 2.85 | Accepted |

| | | | | | | | |
|-------------------------------|----|-----|-----|----|------|-----|-----------------|
| Mobile Authentication Service | 35 | 171 | 100 | 86 | 1112 | 2.4 | Rejected |
|-------------------------------|----|-----|-----|----|------|-----|-----------------|

is easy to use

| | | | | | | | |
|---|----|----|-----|-----|-----|------|-----------------|
| I encourage friends and family to use Mobile Authentication Service | 48 | 25 | 206 | 113 | 961 | 2.09 | Rejected |
|---|----|----|-----|-----|-----|------|-----------------|

A response result of 2.85 is accepted as shown in table 4.14 above. The table shows that respondents agreed with this finding the Mobile Authentication Service useful in detecting counterfeit drugs. A negative response result of 2.4 shows that the respondents was not in agreement to the assertion that the Mobile Authentication Service is easy to use. Respondents also did not inform friends and family about MAS and ask them to use the service and a rejected result of 2.09 has attested to this.

Objective two: Practices of South East residents in the application of the Mobile Authentication Service for detecting counterfeit pharmaceutical products

Table 2 Practices of South East residents in the application of Mobile Authentication Service

| Items | SA | A | D | SD | WS | WMS | Result |
|---|----|-----|-----|----|------|-------------|-----------------|
| Mobile Authentication Service has enabled respondents detect fake drugs | 70 | 182 | 105 | 35 | 1031 | 2.72 | Accepted |
| Have gone through various steps in utilization of MAS | 93 | 168 | 97 | 34 | 1104 | 2.9 | Accepted |
| Seeking assistance from pharmacists in utilizing MAS | 98 | 157 | 106 | 31 | 1106 | 2.92 | Accepted |

Table 2 shows a response result of 2.8 which is positive. This indicates that respondents could detect counterfeit drugs using the Mobile Authentication Service. It also showed a value of 2.92 which is accepted to indicate that respondents sought for assistance from pharmacists in the utilization of the mobile authentication service.

Table 3 Frequency of utilizing Mobile Authentication Service for detecting fake drugs

| Options | Frequency | Percentage |
|----------------------|-----------|------------|
| All the time | 73 | 18 |
| Any time I feel like | 150 | 39 |
| Rarely | 169 | 44 |
| Total | 378 | 100 |

Respondents used the Mobile Authentication service for detecting counterfeit drugs. This is indicated in data found in table 4.16, 18% of respondents used the service always 39% used it any time they felt like, 44% rarely used it.

Objective three: Constraints affecting the utilisation of the Mobile Authentication Service in detecting counterfeit pharmaceutical products by residents of South East Nigeria

Table 4 Responses to challenges associated with Utilization of MAS

| Options | No. of respondents | Weighted Score | WMS | Decision |
|---------|--------------------|----------------|-----|----------|
|---------|--------------------|----------------|-----|----------|

| | | | |
|-------------------|------------|-------------|-----------------|
| Strongly Agree | 214 | 856 | Accepted |
| Agree | 104 | 312 | |
| Disagree | 58 | 116 | |
| Strongly Disagree | 0 | 0 | |
| Total | 378 | 1284 | |

A weighted mean score of 3.39 as found in table 4.17 indicates respondents were of the opinion that there were challenges associated with the utilization the Mobile Authentication service.

Table 5 Nature of Challenge Associated with the Utilisation of Mobile Authentication Service

| Options | No or Respondents | Percentage |
|-----------------------------|-------------------|------------|
| Service is infective | 53 | 14 |
| Delayed response | 176 | 46 |
| I do not know how to use it | 63 | 16 |
| Drugs do not carry MAS | 86 | 24 |
| Total | 378 | 100 |

The table above shows that 14% of the respondents experienced the challenge of ineffective service, 46% experienced delayed response in the utilization of the Mobile Authentication Service, 16% noted that they don't know how to use MAS and 24% identified that most drugs do not carry MAS.

Discussion of findings

In ascertaining the attitudes of South East residents towards the Mobile Authentication Service, items 18, 19, and 20 on the questionnaire were designed. Data to this effect is found in table 4.14. In table 4.14, a positive response results with the value at 2.75 is accepted. This means that responded agreed with the finding the Mobile Authentication Service useful in detecting the counterfeit drugs. Data in table 4.14 also shows a negative response result of 2.4, this indicates that respondents rejected the assertion that the Mobile Authentication Service is easy to use. Data available in table 4.14 shows that respondents do not inform friends and family about MAS and as well don't encourage them to use the service.

Conversely, it is evident that South East residents have negative attitudes towards the Mobile Authentication Service of NAFDAC because they believe it is useful in detecting counterfeit drugs, they know the steps involved but believe it is difficult to use and as such, they don't tell others about it, which means silently rejecting the innovation of Mobile Authentication Service. The literature is not silent on the concept of attitude in KAP studies. While Knowledge makes for sensitivity and consciousness, attitude is a way of behaving towards an issue(s) or situation. Essentially, the findings have provided dimensions that reveal how South East Residents behaved towards the Mobile Authentication Service. Attitude has been defined by Launiala (2009) as "a learned predisposition to think, feel and act in a particular way towards a given object or class of objects" (p.12). As such, attitude is a product of a complex interaction of beliefs, feelings, and values. Attitude refers to their feelings towards this subject, as well as any preconceived ideas that they may have towards it. South East residents felt that the Mobile Authentication Service is practical for detecting counterfeit pharmaceutical products but their feeling towards the service as a tool which they can benefit from in saving themselves and family from the scourge of counterfeited drugs is negative as seen in the negative result of 2.4.

From a psychological perspective, attitude has three components: cognition, affect, and behaviour (Eagly & Chaiken, 2007). Cognition comprises true and false beliefs about the attitude object; health education may change such beliefs. Thus, there may be overlap between knowledge and attitude. In connection with data obtained on the attitudes of South East residents towards the Mobile Authentication Service by NAFDAC, there appears that a belief in the efficacy of the service did not lead to its utilisation. Measuring attitudes is an important part of a standard KAP survey. However, many KAP studies do not present results regarding attitudes, probably because of the substantial risk of falsely generalising the opinions and attitudes of a particular group (Hausmann-Muela et al. 2003). The aforementioned idea is applicable in the present study. There is a generalization of the attitudes of South East residents given the substantial acceptance of the Mobile Authentication Service as an effective tool for detecting fake pharmaceutical products yet the respondents don't have the expected attitude towards it.

In the layman's language, the term attitude is usually used to refer to a person's general feelings about an issue, object, or person (Petty & Cacioppo 2001). Furthermore, attitudes are interlinked with the person's knowledge, beliefs, emotions, and values, and they are either positive or negative. Conversely, the dichotomy between positive and negative is absolutely visible in the finding of this study. The beliefs, emotions, and values South East residents have of the Mobile Authentication Service is positive. Peltó and Peltó (1994) have also described causal attitudes or erroneous attitudes, which are considered derivatives of beliefs and/or knowledge.

The affective component of attitude is the whole gamut of emotions toward every aspect of the attitude object. In summary, attitude toward counterfeit pharmaceutical products and detecting them refers to any preconceived ideas about fake drugs and how to detect it, patients' feelings/emotions towards the nature of fake drugs, and the aptness to behave in particular way about detecting it. Hence, Drouba cited in Peltó and Peltó (1994) stated that attitude is a mental disposition of an individual to act for or against a definite object and McDonald cited in Peltó and Peltó (1994) stated that it is a pre-disposition to act in a positive or negative way towards persons or objects, ideas and events. Attitude is a way of being, a position. Gurnucio (2011) further advances that these are leanings or "tendencies to." It is an intermediate variable between the situation and the response to this situation. It helps explain that among the possible practices for a subject submitted to a stimulus, that subject adopts one practice and not another. Attitudes are not directly observable as are practices, thus it is a good idea to assess them. Data examined has shown that South East residents have not been positively disposed to the Mobile Authentication Service to the point that they told friends and family members about the service. This reinforces the degree of mental disposition respondents have of the service. The aforementioned review connects to the finding under consideration. The attitudes of South East residents reflected how they felt about the Mobile Authentication Service. There was a strong indication that respondents were not favourably disposed to the Mobile Authentication Service.

In order to provide an answer to this research question, questionnaire items 21, 22, and 23 were designed. Corresponding data is found in section 4.1. Tables 4.15 and 4.16 showed response of 2.8, which indicated that respondents could detect counterfeit drugs using the Mobile Authentication Service. Data found in table 4.15 reveal that respondents have gone through the various steps in the utilization of the Mobile Authentication Service. This was indicated with an accepted response value of 2.9. Respondents used the Mobile Authentication service for detecting counterfeit drugs. This is indicated in data found in table 4.15. A little over 50% of respondents used the service. Out of that, 18% used it any time they felt like. Table 4.14 also shows a value of

2.92 which is accepted to indicate that respondents sought for assistance from pharmacists in the utilization of the mobile authentication service.

Therefore, in terms of practice, the answer to the research question is that South East residents use of the service in detecting counterfeit pharmaceutical products. The steps in utilizing the service were put in practice and respondents agreed to sourcing for help in utilizing the service. The nexus between this finding and the social cognitive theory used as a framework for this thesis can be established. McCormick and Martinko (2004), based on their studies, introduce some basic assumptions of Bandura's social cognitive learning theory. They claimed that: "People can learn by observing others; Learning is an internal process that may or may not result in a behaviour change; Learning can occur without a change in behaviour (Observation without imitation)"

To that end, Green and Peil (2009) highlight the following as the basic phenomena of the social cognitive theory: Acquiring new behaviour from model; increased frequency of learned behaviour after model is reinforced for same behaviour; decreased frequency of learned behaviour after observing punished model; and return of inhibited response after observing model behaviour that have adverse consequences (Green & Peil, 2009). New behaviours adopted can be equated with practices. Put in the context of the finding under discussion, the utilisation of the Mobile Authentication Service can happen as a result of socialization and reinforcement of learned behaviour. In tying this finding to the conceptual literature, it is imperative to add the third and integral part of KAP surveys which is the investigation of health-related practices. Questions normally concern the use of different treatment and prevention options and are hypothetical. Contextually, this is applicable as table 4.15 makes it clear that South East respondents have gone through the various steps in the utilization of the Mobile Authentication Service. This was indicated with an accepted response value of 2.9. Practice demonstrates the acquisition of knowledge (increased understanding of a problem/disease) and any change in attitude caused by the removal of misconceptions about problems or disease that translates into preventive behaviours. Thus, that demonstration may reflect a reciprocal relationship between knowledge and practice.

Practice refers to behaviours or actions that can avert a disease or delay its progression. In averting the danger of using counterfeited pharmaceutical products, practice would involve buying medicines at designated pharmacies, buying from well-known, world class pharmaceutical companies, and constantly checking expiry dates (Launiala 2009). This is where the utilisation of the Mobile Authentication Service also can be reinforced. Due to the persistent counterfeiting off pharmaceutical products, there seems to be an emerging technology to counter the act. Utilising the Mobile Authentication Service contributes to averting the danger of consuming fake drugs. Additionally, Practices in KAP surveys usually enquire about the use of preventive measures or different health care options. Practice refers to the ways in which individuals demonstrate their knowledge and attitude through their actions. Understanding the levels of Knowledge, Attitude and Practice will enable a more efficient process of awareness creation as it will allow the program to be tailored more appropriately to the needs of the community (Launiala 2009). To sum up what practice entails, Gurnucio (2011) points out that practices or behaviours are the observable actions of an individual in response to a stimulus. This is something that deals with the concrete, with actions.

For practices related to the Mobile Authentication service, evidence points to actual utilization of the service. Respondents alluded to utilizing the service. To assess the extent of practice, there was a clear observation that respondents often requested the assistance of pharmacist in the utilization of the service.

This research question sought to investigate the constraints to the maximum utilization of the Mobile Authentication Service of NAFDAC. In addressing the research question, items 25 and 26 on the instrument for data collection were used. Data obtained and presented in table 4.17 reveal a weighted mean score value of 3.39. This value indicates that respondents were of the opinion that there were challenges and constraints associated with the utilization of the Mobile Authentication Service. Consequently, table 4.17 highlighted the nature of constraints associated with the utilisation of the Mobile Authentication service. The table revealed that 14% of the respondents experienced the challenge of ineffective service, majority of respondents (46%) experienced delayed response to text at the point of purchase, which more or less defeats the purpose of the MAS. 16% noted that they don't know how to use MAS and 24% identified that most drugs do not carry Mobile Authentication Service scratch panel. In order to establish the nexus between this finding and existing literature, the attempt here is to trace the steps or methods adopted by NAFDAC in curbing the menace of counterfeit drugs. As summarized, before the advent of technology, NAFDAC had registration numbers embossed on medicines. Medicines with NAFDAC registration numbers were automatically authentic. With the emergence GSM technology and other advancements in technology facilitated by the Internet, anti-counterfeiting methods developed and used by the agency included TRUSCAN, Blackeye, and Radio Frequency Identification (RFID).

All of these confirm the postulation by Bansal et al., (2013) who affirm that technological advancements on the globe has significantly increased the sophistication of pharma counterfeiting which in turn compelled NAFDAC to adopt these technological measures in combatting counterfeited drugs. Ayodokun (2016) opines that the decision to develop and launch MAS was to leverage on the exponential growth of GSM subscribers in the country. Mobile Authentication Service Involves consumers' use of mobile phones to verify the source of medicines at the point of purchase in pharmaceutical outlets (Oyetunde et al 2019). Essentially, consumers send a direct message to a short code 38353 and receive an instant reply from NAFDAC indicating whether the product about to be purchased is authentic or fake.

NAFDAC news (2013) posits that the agency has deployed the use of SMS text messaging technology to authenticate medicine at the point of purchase, thus placing the power of detecting counterfeit medicines in the hands of consumers, this study however found out that poor network service has hindered the adequate accomplishment of this feat. Invariably, the public is involved in the war against counterfeit medicines and the responsibility of choosing authentic medicines is right in their hands but the findings of this study has established that this right of authenticating drugs given to the masses by NAFDAC has been greatly jeopardized by poor network service from service providers. MAS is supposed to give on the spot confirmation of authenticity but when network service is poor and a sent request does not give an immediate reply, the aim is not achieved because consumers can choose to go ahead and buy not minding if it is genuine or not. Findings from the study also found out that most drugs do not have the MAS scratch-off panel used in identifying authentic drugs especially the retailed/dispensed drugs in medicine stores, thus authenticating such drugs becomes an extremely difficult task even when the person is knowledgeable about MAS.

Conclusion

Within the precinct of practice, it can be concluded that not everything which is touted as beneficial is adopted by those it is meant for. A fair number of respondents have been revealed to utilize the Mobile Authentication Service for detecting counterfeit pharmaceutical products. Despite the plethora of problems associated with

counterfeit pharmaceutical products, it would have been expected that there will be a hundred per cent compliance to the utilization of the Mobile Authentication Service as rolled out by NAFDAC. This was, however, not the case. This leads us to conclude that acceptable practices are not guaranteed to take place despite repeated campaigns that may have created awareness for the audience. Still within the realm of practice, there are bound to be challenges that impinge on successful utilization of innovations that are meant to curb societal issues. This was also seen in the utilization of the Mobile Authentication Service.

Recommendations

The following recommendations have been made based on the findings of the study.

1. To ensure that South East Residents develop a positive attitude towards the Mobile Authentication Service of NAFDAC, the Agency must constantly and consistently improve on how the service works. There is need to involve pharmaceutical companies, the masses, and other stake holders in formulating policies and laws that will encourage and enhance positive attitudes towards the Mobile Authentication Service.
2. To encourage South East residents in the use of the Mobile Authentication Service, NAFDAC must intensify its campaign on how the service is used. This campaign should be aimed at improving the utilisation of the Mobile Authentication Service for detecting counterfeit pharmaceutical service. The government should make laws and policies enforcing the use of MAS so that more people will utilize the service.
3. NAFDAC in conjunction with GSM companies, tech companies must as a matter of urgency improve on the technology responsible for making MAS effective. NAFDAC should establish a strategy to reduce number of dispensed drugs. MAS charges should be subsidized to carry all drug manufacturers along. An all-round improvement in the workings of the service is essential in order to handle the constraints faced by South East residents in the utilization of the Mobile Authentication Service.

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