Ethical issues in biomedical research in Nigeria: a systematic review

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Abstract: The use of human subjects in research comes with lots of ethical challenges. The purpose of this review is to assess the various ethical issues that have been associated with biomedical research in Nigeria. This article also find out the possible ways of improvement of this scenario. Pubmed/Medline, Google Scholar, JSTOR, and AJOL search were the possible search engine for literature from 2000 to 2020. Key words were used including ethics, ethical issues, biomedical research and Nigeria. Of the 113 publications were found. A total of 18(15.9%) fulfilled the study inclusion criteria and were included in this review. Twelve ethical issues were highlighted including Informed consent (12 studies), autonomy and voluntariness (8 studies), beneficence (8 studies), counseling (5 studies), compensation (4 studies), professional behavior and attitudes (2 studies), confidentiality (2 studies), social, cultural and religious practices (2 studies), scientific integrity (1 study), communitarianism (1 study), equity (1 study), and trust (1 study). Most of the studies were cross sectional and carried out in southern Nigeria. We found that there are ethical issues in biomedical research in Nigeria of which informed consent is most widely studied. Also, participants had varying degree of understanding of their rights as research subjects. As a result, there is need to enhance the capacity of investigators to better understand these issues and also increase their explanatory skill to help participants achieve complete understanding of their various rights and process.

Keywords: Ethics, ethical issues, biomedical research (BR), research, systematic review

Introduction: Ethical issues in biomedical research involving human subjects have received a growing concern since the promulgation of Nuremberg Code as far back as 1947 [1]. Ever since then, adhering to ethical principles has helped to protect the dignity, rights and welfare of research participants and reduce to barest minimum moral doubts that can arise when carrying out any biomedical research involving human subjects. "Ethics" in simple terms is defined as "norms for conduct" that distinguishes between acceptable and unacceptable behavior [2] and in a very common sense, honesty; social responsibility and integrity are considered the basic ethical norms. Any deviations from these norms result to research misconduct comprising of "fabrication, falsification, or plagiarism (FFP). "The ethical justification of biomedical research involving human subjects is the prospect of discovering new ways of benefiting people's health" [3] and to achieve this, many countries and institutions [2,3,4,5] had developed codes and regulations that set out guidelines. These codes must be followed to conduct any biomedical research involving human subjects. Despite these codes, issues of ethics have continued to pose a challenge to biomedical research in developing countries like Nigeria. Nonetheless, deficits in infrastructures,

paucity of funds and poor human research capacities has resulted in most research in Nigeria. These hinder to take rigor and often timely research compared to developed and western countries. Although biomedical studies carried out in these developed countries are not totally free from misconduct and also battles with issues associated with ethics [6], The Trovan study conducted by Pfizer in Kano, Nigeria in 1996 [8] was a wakeup call to Nigeria to led development of the Nigerian Code of Health Research Ethics (NCHRE) by the National Health Research Ethics Committee in Nigeria in 2007 [9]. This NCHRE guide all researchers involved in human subjects' researches in Nigeria. Interestingly, biomedical researchers in Nigeria have identified some of the ethical issues confronting them in the course of their research, however; there has been no effort to review these ethical issues for proper understanding. The growing call for these reviews necessitated the present study to give a general overview of what these ethical challenges are at a glance.

Method: A systematic review of literature on ethical issues in the context of biomedical research in Nigeria was conducted between August 2017 and May 2020 with articles published in the last 20 years (2000 and 2020) using Pubmed/Medline, Google scholar, JSTOR, and AJOL(African journal online). Key words included a combination of the following: ethics, ethical issues, biomedical research and Nigeria. We included only studies reported in English. full text original research articles of studies involving human subjects, addressing issue of ethics in biomedical research, and research done in Nigeria. All review articles, case reports, letters, brief reports, communications, retrospective chart reviews, news articles, articles published before 2000 and articles written in other language were excluded from this study. All publications were retrieved online, and data search ended 2nd May 2020. Data extraction was carried out for each paper highlighting the following: name of first author and year of publication, study design, study location, subject, main study population, journal name, and ethical issue(s) studied/identified. The search strategy and results are provided in figure 1. The authors are aware the elements of an informed consent including voluntarism, information disclosure (counseling), and decision-making capacity (autonomy) [7]; however, we decided to present them individually for clarity and for better understanding of this study.

Results: A total of 113 articles were found following a thorough search of databases listed above criteria. Out of which 18 (15.9%) articles (8 -23) met the inclusion criteria. Out of the 18 articles 10 (55.1%) were carried out in the southern part of Nigeria, while 2(11.1%) where carried out in Northern part of the country. Two of the studies (11.1%) were multi-country in nature, whereas 2(11.1%) where done both in Northern and southern part of the country. Among the studies conducted in southern Nigeria, the southwest leads with 10(60%) followed by the south east 3(30%). In terms of study design, 17(94.4%) of all the studies were cross sectional in nature with just 1(5.6%) cohort study design. Clinical practice represents the highest area of biomedical research identified with about 8 (44.4%) studies, followed by genetics/genomics 5(27.8%). Clinical trials and non specific studies were 2(1.1%). Most of the studies as shown in table 1 were conducted in 2014 (22.2%) followed by 2018 (16.7%). Almost all the studies were adult based. A total of twelve (12) ethical issues associated with biomedical research where identified in this review and presented in table2; they include: Informed consent (11 studies), autonomy and voluntariness (8 studies), beneficence (8 studies), counseling (5 studies),

compensation (4 studies), professional behavior and attitudes (2 studies), confidentiality (2 studies), social, cultural and religious practices (2 studies), trust (2 studies), scientific integrity (1 study), communitarianism (1 studies), and equity (1 study).

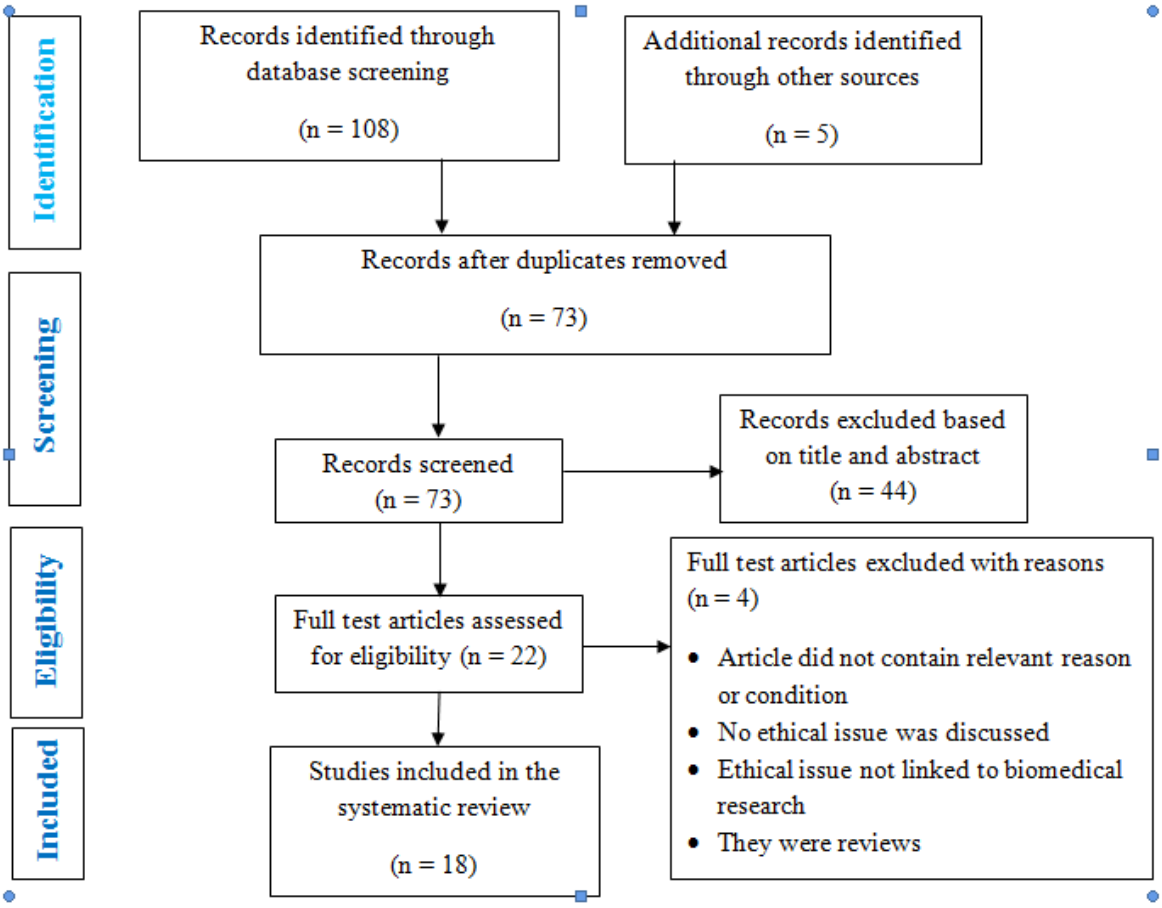

Fig. 1. Flow diagram for the selection of studies on ethical issues in biomedical research in Nigeria

Informed consent (IC) : A total of eleven studies (61.1%)(table 2) investigated the ethical issue of obtaining an informed consent in the research. In their reports, IC was not being observed before treatment [20], respondents were not asked if they wanted to join the study [10], research participants either did not understand that the information given to them were adequate [2,4]. Four studies (36.4%) reported poor understanding of the key elements of the IC process, e.g. the rights of the participants and invitation to joining the research [9,10,14,20]. Participants in four studies reported that they were told the purpose of the study during the informed consent discussion [8,18,21,22]. One study (9.6%) which was based on obtaining assent in children, reported that the health care researchers fail to obtain assent from children during research, but reported obtaining consent directly from their parents [16]. Poor communication, poverty, illiteracy, therapeutic misconception and confusion about the dual roles of the researchers and the health professionals were factors compromising understanding of IC [3,4],

whereas retrospectives, belief that consent from parents are enough and assent was unnecessary [16]. Some researchers opined that medico legal reasons, hospital/unit policy, informing patients about benefits, risks and alternatives and to take decisions about the planned clinical procedures were reasons for obtaining consent before going ahead to carry out any clinical procedure [11]. Participants were divided if they could change their minds after signing a consent form, considers the form a legal document and insist their consent should be sought before enrolling them in any research/trial respectively [14]. As identified in three studies, some subjects only give their consent to participate in research depending on what they are to benefit directly[11,16,19]. Therapeutic options, special ways of minimizing risks of operation and detailed explanation about diagnoses are more frequently asked questions during IC process in clinical practice, whereas taking a course in bioethics and compulsory communication skills are ways of improving IC process generally [11]. Satisfying consent from the patients' perspective is associated with better recall of consent information for clinical procedures [22]. In situations the participants fail to provide IC, they will not likely be threatened [11]. Researchers and participant's practice of IC is independent of their social demographic variables [16]; however educational level [14] and age [9] were seen to play significant role in other studies.

Autonomy and Voluntariness: Eight studies (44.4%) were identified which investigated autonomy and voluntariness in biomedical research (table 2). Respondents from three of the studies clearly reported being told the research they were invited to partake in research voluntarily availed themselves without being pressured [8,18,21]. Five studies reported that decision to participate in the research was a collectively on their husbands [8,12,18,19,21]. Married women were most likely to discuss enrollment decision with someone else before making a decision [8,12,19]. Significant association was seen between women having decision to participate in clinical procedures and obtaining her husband's permission as well as [21]. Voluntary participation in research is a factor of the benefits accruable from such research 10,12,19,23. From four studies, respondents acknowledge knowing their right to either participate or withdraw from the studies at any time [8,9,10,18]. Two of these studies equally reported low understanding of these rights among few research participants [9,10]. One study reported consequences of withdrawing from research after giving consent to include losing all benefits, being seen as an ungrateful person, and seen to be unwise withdrawing while still ill of the same disease of which the research could have helped provide treatment [9].

Counselling: Five studies (27.8%) reported the ethical issue of providing adequate information and counsel to study participants during biomedical research. Three of these studies (60.0%) reported that the study participants were not adequately counseled and are not being well armed with enough information concerning the research they were involved in [9,20,25]. Two studies (40.0%) however, opined that respondents were adequately counseled for the benefits and risks associated with the study they were involved in [18,21]. Significant association was found between having a clinical procedure done on client and having counseled clients on benefits and risks of the procedure [21]. One study also reported that most times counseling was geared toward giving patients an exaggerated hope of success [25].

Beneficence: Eight studies (44.4) documented the issue of beneficence in biomedical research. Four of these eight studies (50%) reported appropriate

knowledge of benefit associated with participating in research among the respondents [9,12,18,21]. There were three studies (37.5%) that identified poor knowledge and poor understanding of risks associated with participating in biomedical research among respondents [8,10,18]. However, there was one study (12.5%) reported that the poor knowledge of benefits [10] and good knowledge of risks [22] among research subjects. One study reported immediate benefit as one major reason respondents considers before deciding whether or not to participate in the research [23]. Five studies (62.5%) enumerated some of the benefits in participating in research to include obtaining free medical tests, free checkup (to know their oral health, sugar, cholesterol and blood pressure level as well as their genotype), improved knowledge of their health conditions as well as improvement in health delivery of their communities [9,10,12,19,23]. One study (12.5%) identified risk in biomedical research participation to include: diminishing of the immune system, general drug side effects, death on discontinuation and inefficacy of the drug and compliance issues [9].

Confidentiality: Two studies (11.1%) reported the issue of confidentiality in biomedical research. In one of the studies respondents were satisfied on how their information was handled by the researchers [20] whereas in the second study respondents are not aware of how their records would be kept [10].

Communitarianism: One study (5.6%) reported communitarianism as an issue in biomedical research. Proper engagement of the community where the research was carried out or where the participants were recruited in research. In this study individual autonomy becomes inappropriate in the face of communitarianism as participants stressed respect for the decision of the community elders, community leadership approval and opinions with compliance with traditional practices and norms, recognition of the influence of the existing societal authority structures in decision makings over research participation to protect the community from harm and exploitation [23].

Scientific integrity: One study reported (5.6%) issue of integrity in biomedical research. In this study, chance of getting caught and penalties for scientific misconduct was reported to be low [13]. Knowledge gaps in research ethics and pressure to publish enough papers for promotion are common predisposing factors to misconducts among biomedical researchers, resulting in research fabrication, falsification, and plagiarism [13].

Professional behaviour and attitudes: Two studies (11.1%) reported issue of professional behavior and attitudes in biomedical research. In one of the study (50%) professionals observed professional boundaries with patients during treatment [20] and the other explained respondents were not being pressured to garner consent during treatment [21].

Compensation: Four studies (22.2%) reported compensation as an issue of ethics in biomedical research. While three studies (75%) highlighted need to compensate research participants and even pay those with higher value than others more money [15, 17, 25], one study (25%) reported not giving any incentives [21]. In some instances, private firms like clinics indicated willingness to work with research teams if they would be allowed to distribute the study stipend to referred participants [17].

Cultural, social and religious practices: In two studies (11.1%) the issue of culture,

Table 1: General characteristics of the studies reviewed

Author	Year of publication	Study location	Study design	Subject	Main Study Populations	Journal name
8	2006	Multicountry USA Nigeria	Cross sectional	Genetic	Adult African enrolled in genetic studies of hypertension	Am J Public Health
9	2007	Nigeria	Cross sectional	HIV and AIDS (Clinical Trial)	ADULT enrolled in an antiretroviral trial	Indian Journal of Medical Ethics
10	2009	Southwestern and Northern Nigeria	Cross sectional	Clinical practice (Oral health)	Adult dental subjects in an ongoing oral health research	BMC Med Ethics
11	2010	Southwestern Nigeria	Cross sectional	Clinical practice (Surgical intervention)	Adult Surgeons and trainees	JMed Ethics
12	2012	IBADAN, Nigeria	Cross sectional	Genetic	Adult participants enrolled in a study examining the relationship of serum lipid to genetic variants	Dev World Bioeth
13	2013	Southern Nigeria	Cross sectional	Non- specific	Adults in the medical and dental schools	J Empir Res Hum Res Ethics
14	2013	Jos Nigeria	Cross sectional	Clinical practice (Oral health)	Adult dental patients and dental professionals	J Educ Ethics Dent
15	2014	North-Eastern (Maiduguri), South-Western (Ibadan) and South-South (Calabar)) Nigeria	Cross sectional	Obtaining study approval	Adult health research ethical committee	*S Afr J BL*
16	2014	Abakaliki, Nigeria	Cross sectional	Non-specific	Adult medical specialists and trainees	Adolesc Health Med Ther
17	2014	Multicountry USA Ibadan Nigeria	Cohort	Genomic	Adult and Children	BMC Med Ethics
18	2014	Ibadan Nigeria	Cross sectional	Genetic	Adult breast cancer women enrolled in a genetic epidermiological study	*BMC Medical Ethics*
19	2015	Lagos, Nigeria	Cross sectional	Clinical Trial	Adult participants enrolled in a study of an anti malarial drug	Indian Journal of Medical Ethics
20	2015	Enugu, Nigeria	Cross sectional	Clinical practice	Adult patients who underwent radiological examination	BMC Med Ethics

21	2016	Osun, Lagos Nigeria	Cross sectional	Clinical practice(tubal litigation)	Adult patients who underwent female surgical sterilization	Journal of Basic and Clinical Reproductive Sciences
22	2017	Enugu, Nigeria	Cross sectional	Clinical practice (surgical Intervention)	Adult surgical patients who were booked for elective major surgical procedures	BMC Med Ethics
23	2018	Southwestern Nigeria	Cross sectional	Genomic	Adults	PLoS ONE (Public Library of Science)
24	2018	Gombe, Jos Nigeria	Cross sectional	HIV and Clinical Practice (Surgical intervention)	Adult health professionals	*S Afr J Bioethics Law*
25	2018	Nigeria	Cross sectional	Clinical practice (assisted reproductive technologies)	Adult conference attendees	*Afr J Reprod Health*

Table 2: Identified ethical issues in biomedical research in reviewed studies

ETHICAL ISSUES	AUTHORS	Number of study/frequency
Informed consent	8,9, 10,11,14,15,16,18,19, 20,24	11(61.1%)
Autonomy/voluntariness	8,9,10, 12,18,19, 21,23	8 (44.4%)
Beneficence	8, 9, 10, 12,18,19,21,23	8(44.4%)
Counseling	9, 18, 20, 21,25	5(27.8%)
Professional behavior and attitudes	20,21	2(44.4%)
Equity	20	1(11.1%)
Confidentiality	10,20	2(44.4%)
Communitarianism	23	1(11.1%)
Cultural, religious and social practices	17, 23	2(44.4%)
Trust	17, 23	2(44.4%)
Compensation	15, 17, 21, 25	4(22.2%)
Scientific integrity	13	1(11.1%)

social and religious practices among some ethnic groups and tribes were reported by biomedical researchers. Cultural beliefs in voodoo or juju which vary within religious groups among the Yorubas resulted in participants withdrawing from studies and also led to delays and difficulties in re-contacting study participants [17,23]. Two (11.1%) of the articles under review expressed fear of misuse of the research samples as emphasized by Olaitan et al. who puts it that they feared that their saliva and/or blood could be used for evil rituals [17].

Equity: Equity as an ethical issue in biomedical research was reported by one study (5.6%) which observed that equity was practiced during a medical procedure [20].

Trust: Two studies (11.1%) reported that the trust as an issue in biomedical research. Regardless of age, respondents identified trust in the researcher and research institution as an important factor when deciding to participate in genomic research and also whether the community will agree to the research [17, 23]. Trust in community leaders also will enable respondents commit their blood samples without fear it would be used for money making rituals or voodoo practices to harm individuals[17,23]. Trust in community leaders enables the respondents allow them make decision on behalf of their community concerning their participation in the study [23].

Discussion: The present study tried to identify all the various ethical issues in biomedical researchers. Informed consent (IC) was most studied {11/18, 61.1%} among biomedical researchers (BR) in Nigeria and in most studies subjects reported the purpose of the study during the informed consent discussion. The importance of IC in research involving human subjects has become so important that it's now the basis upon which researchers or even physicians are allowed to carry out any treatment or procedures or even trials on the subjects. This also may explain why IC was described as the foundation of the subject-researcher relationship[26]. Interestingly, all researchers have to follow the regulations of obtaining IC which has been made mandatory by all regulations and guidelines governing the conduct of clinical research[7]. Poor understanding of the IC process and poor knowledge of the right of the subjects could be attributed to the way the information was presented to them [27]. The low level of literacy, religious and cultural hindrances, pressure of work as well as uneducated and unsophisticated patient population has been attributed to pose serious challenges to conveying adequate information to subjects in developing countries like Nigeria [26]. Problem of obtaining assent in children as reported by one study is similar to a work done by [28] who at the end reported that examination of guidelines in obtaining assent in children shows there is still confusion regarding the concept of assent. Interestingly, this does not replace the fact that ethics of human research as stressed by most international guidelines requires that the principle of assent must also be applied in pediatric research [4,5]. The findings in this review about IC are similar to that reported in a WHO sponsored review [31].

The concept of voluntarism is one of the core elements of informed consent and has being elaborated in various codes of biomedical ethics and regulations [4,5] hence the fact that it is reported as one of the ethical issues of BR in Nigeria is not a surprise. Subject participation in research is voluntary and devoid of any form of pressure. This is evidence that the researchers in sub-Saharan Africa especially in Nigeria are not left out on issue of allowing individuals to judge freely, independently, without coercion when making decision about joining any research. This can equally be due to ability of research staffs to explain in detail study objectives during consent discussion and could also reflect the educational level of the subjects [18]. The report of right to either participate or withdraw from the studies at any time as reported in this review could mean that they were giving information about withdrawal from the studies during consent and can still recall the information. Failure to make such explanations and ensure understanding by subjects could be responsible for those studies whose subjects had low understanding of their right to withdrawal. The findings from this review is similar to two studies conducted in Thailand [29]and Uganda [30] respectively where they also reported subjects making enrollment decision themselves and having good knowledge on

their right to withdrawal at any time. Dissimilarly, one of the studies reported various forms of pressure on the study participants [29]. The report of subjects seeking external permission from spouses before making decisions is a typical culture and family setting in Nigeria. It is also worthy to note that voluntary participation in research cannot be diminished by the need for spousal permission [8,12,18]. The concept of voluntarism reported in this review is similar to a WHO sponsored systematic review on informed consent [31].

The process of decision making is one of the essential elements of a valid informed consent that requires adequate information detailing the research goal, its benefits, risk among other information about any research is disclosed to the subject. Counseling to inpatients clinical research offers patients alternatives to clinical procedures thus offering a wide range of choice to them. In most of the time this information is brought to the subjects by the research team during the consent process. Failure on either the part of the research team or the subjects (probably as a result of differences in educational background, social economic status, age and health status) in passing and /or comprehending this information could be the reason for the findings in this review where some study subjects reported having poor information and counseling while others have enough information on the benefits and risks associated with the research, they were invited to be a part. On the other hand, it is not clear to what extent the information should be provided on various aspects of research such as benefits and risks and it's mostly dependent on the investigator [7]. The importance of given early attention to providing adequate information and counseling in clinical practice or research was noted in a study [25].

Biomedical researchers have a moral duty in promoting the course of action believed to be in the interest of the patient. Most research subjects in sub-Saharan Africa and Nigeria places immediate individual gain and sometimes community benefit first before making decision to participate as evident in one of the findings in this study [23,32]. In the present review, there were almost equal number of studies that reported subjects having adequate knowledge of the risks and benefits that go with the studies and those who do not have this knowledge. Moreover, among the participants that were aware of potential risks and side-effects, some were not able to name at least one risk and, although they understood the benefits of participating in a study, they were less aware of the uncertainty of these benefits. This is corroborated in a similar systematic review study [31]. The findings could be attributable to the ethical principle of counseling the subjects during the consent process, thus, there is need to give priority to it since literacy level of participants, duration of explanation of IC and the research team explanatory skills have a triple effect on participants understanding [31,32]. Some benefits and risks in participating in research have been listed in previous section. Benefit could either be financial or medical benefit (see ethical issue of compensation). According to Article 8, Declaration of Helsinki, 2001, interests in science and society should not take precedence to considerations related to the well-being of the human subject [33].

Researchers have almost absolute responsibility to protect subject's confidentiality by managing private information in such a way as to protect the subject's identity. This issue of confidentiality should be addressed before any research with human subject begins. Hence, the discordant report from the two

studies in this review that reported on the issue of confidentiality clearly shows the need to openly address research participants on how their personal responses and information would be handled so as to build trust among them and enable them be blunt to truth in their participation. Confidentiality is closely related to right to privacy and a patient's Bill of rights document published in 1975 by the American Hospital Association (AHA) clearly affirm the patient's right to privacy [34]. A similar systematic review on ethics in medical research equally highlighted the importance of Confidentiality [35].

When research is focused on ethnically or culturally distinct population, community engagement is one surest way to drive research in such population. '*Community engagement (CE) has been broadly defined as a process of working collaboratively with a group or groups of people on a shared goal or common interest'* [36]. During CE communities are educated about the research and information is exchanged between the research team and potential research participants about the research process over a period of time. Most times outcome of research is equally communicated through same means, thus CE can occur before, during and after a research project [37]. The attendant effect of CE is increase in awareness and decrease in clashes between the community and the research team leading to greater research outcomes. Thus, the report of communitarianism seen in one study in this review as one of the ethical issues in biomedical research shows Nigerian communities are increasingly becoming aware the role communities and its leaders play in research. Community engagement in BR can better be understood in similar work [38].

A study in this review reported the issue of misconduct among biomedical researchers in Nigeria. In a recent similar systematic review work in China on issue of research integrity, high level of misconduct was equally reported among their medical researchers [39]. A national survey of scientific misconduct in United States reported low level of misconduct among her professionals [40]. Falsification, fabrication, and plagiarism as well as improper authorship and duplicate submission are some highlighted research misbehaviors common among biomedical researchers [13,39]. This is largely as a result of inadequate knowledge and mentorship for ethical conduct of research as well as the culture of mounting pressure on researchers to publish more papers as a means of securing promotion. The way out is to strengthen research integrity training, increase the severity of penalties for scientific misconduct, improve the scientific evaluation system, develop the governance system and increase institutional effectiveness as regards to rules and procedures for reducing scientific misconduct [13,39,40].

Professionals in the health care industry are bound to some form of code of conduct peculiar to each profession. Since these ethical procedures are linked to improving patient satisfaction, they should not be ignored by health care professionals in service delivery. Through good communication, patient care skills and professional conduct must remain sensitive to the needs of the patients even when recruiting them as research subjects in clinical research or trial [41]. The report of two studies in this review of professionals observing professional boundaries with their patients during treatment and also not pressurizing their patients show these professionals still work within the tenets of their code of conduct and this is similar to another study report [41]. Nonetheless, there is still need for

training in ethical conduct and professionalism for health professionals in Nigeria and increasing institutional effectiveness in monitoring the enforcement of these conducts.

Though issue of compensation is related to the principle of beneficence and has been widely accepted as a common practice in BR, it was still usually not made compulsory for researchers [15]. Compensation in research needs to be regulated since it can also act as a barrier to voluntary participation in research [42]. According to Grady [43] '*Compensation may be handed out as refunds for expenses incurred by participants; for time, effort and inconvenience; injury or harm associated with research participation or as incentives to stimulate participants to follow the study protocol to completion'.* The need to regulate this practice has been reported as a result of its associated ethical concerns of exploitation, coercion, and undue influence [44]. Compensation can be financial or medical benefit. Financial incentives such as transport and refreshment allowances were advised when there was no direct benefit to the research participant [15]. In this review, four studies reported the issue of compensation to research participants. It is becoming increasingly clear that most times research participants tie their level of involvement to the amount of compensation they will receive at the end of the process. Not compensating your subjects especially when there is need for such may dampen their spirit which inadvertently will affect the overall outcome of the study as seen in this report where some private firms tied their willingness to participate to the study stipend that would be given. However, the report of incentives not offered to the participants in one of the studies could be due to the nature of the research and the statutory, policy, and legislative requirements guiding the practice as the study claimed [21]. Compensation as an ethical issue is contained in similar studies [45,46].

Two studies from this review identified ethical issue of culture, social and religious practices in BR. This probably may be due to the fact Nigerians value their cultural and religious practices that even in most places where the people are known Christians or Muslims[17]. The leaders or custodians of these cultures commonly referred to Oba among the Yorubas, Igwe among the Ibos or Emir among the Hausas have overwhelming influence on people's decision. The practice of voodoo among the Yoruba's has caused lots of apprehension and fear which has affected research uptake among the populace and could account for the fear reported among the subjects in the two studies mentioned. The influence of socio-cultural variables in BR is explained in a study [47].

Equity is an expression of social justice and it has to do with fair distribution of benefits from health. Observing equity in BR as reported in one study in this review [20] is one sure way of improving research outcomes.

Limitations: This study was done in Nigeria alone. This is the first limitation of this study. It does not represent the Africa. Hence similar studies should be carried out covering sub-Saharan Africa and the global community of Africa. .It should be noted that only English articles have been searched in this study. Also, only four search platform has been searched in this study e.g. Pubmed/Medline, Google Scholar, JSTOR, and AJOL. Only eighteen articles have been discussed in this study and twelve ethical issues were discussed. Therefore, further study is needed with large number of populations with more search engines and large number of articles.

Conclusion: We found that there are ethical issues in biomedical research in Nigeria of which informed consent is most widely studied. However, participants had varying degree of understanding of their rights as research subjects. As a result, there is need to enhance the capacity of investigators to better understand these issues and also increase their explanatory skill to help participants achieve complete understanding of their various rights and process. This shall assist both the investigators and participants towards a better research approach.

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