LASU Journal of Medical Sciences
Official Publication of the Faculty of Basic Medical Sciences and Faculty of Basic Clinical Sciences
Lagos State University College of Medicine, Ikeja
www.lasucom.edu.org.
E-mail: lasujms@lasucom.edu.ng

Research Article

Providing Teratology Information Services in Nigeria: The viewpoints of Physicians in Obstetrics and Gynaecology Specialty

Oshikoya Kazeem A.[1], Bamiteko Oluwatosin O.[2], Lawal Mohammed S.[2], Badru Wasiu A.[1], Ishola Ismail O.[2], Oreagba Ibrahim A.[2]

[1]Department of Pharmacology, Therapeutics and Toxicology, Lagos State University College of Medicine, Ikeja, Lagos, Nigeria. [2]Department of Pharmacology, Therapeutics and Toxicology, University of Lagos, College of Medicine, Idiaraba, Lagos, Nigeria

[*]***Author for Correspondence:***
Oshikoya K. A.
Email: kazeemoshikoya@ymail.com, kazeem.oshikoya@lasucom.edu.ng

Keywords:
Teratology, Obstetricians, Drugs, Pregnancy, Nigeria

ABSTRACT

Background: Teratology Information Services (TIS) centre is necessary to provide information on safety and risk of exposures during pregnancy. This survey aimed to evaluate the knowledge of medical professionals in obstetrics and gynaecology in Lagos about teratogenic risk and to seek their opinions about the need for a teratology information service centre in Nigeria.

Materials and methods: A convenience sample of doctors in the field of obstetrics and gynaecology in private and public hospitals in Lagos were surveyed with a self-designed questionnaire. Information was sought on nine categories covering the demography of the participants, and their views on teratogens and teratology information service centre (TISC).

Results: Of the 174 respondents, 100(57.5%) were males. The majority of the respondents (171; 98.3%) believed that their trainings and/or exposures in obstetrics and gynaecology have adequately equipped them to provide good teratology counselling to pregnant women. Resources for teratology information mostly utilized by the respondents are internet (142; 81.6%) and medical journals (139; 79.9%). All the respondents (174; 100%) felt the need for a national teratology information service centre (TISC) in Nigeria and, if established, would consult the centre regularly (160; 92%). The respondents considered women planning pregnancy (174; 100%), breastfeeding (174; 100%), or already pregnant (174; 100%) as those who most need teratology counselling.

Conclusion: Medical professionals in the field of obstetrics and gynaecology in Lagos public and private hospitals felt the need for a national TISC in Nigeria and would consult regularly, if established. However, there is a need to improve their use of appropriate information resources on teratology.

INTRODUCTION

It is an obvious truth that pregnant women often become ill, and ill women may become pregnant. Unfortunately, physicians all over the world are still faced with the problem of how best to treat women during pregnancy. This is because physicians are lacking in the knowledge of safety and efficacy of the diverse medications used during pregnancy and other environmental exposures that pregnant women experience. Only a few medicines are indicated for use in acute and chronic illnesses in pregnancy, and very rarely are new medications developed for this population.[1] Pregnant women are generally excluded, for ethical reasons, from randomised clinical trials in drug development.[2] This further heightened the concerns of physicians about the safety of newly approved and marketed medications on the developing fetus.

Teratogen is broadly defined as an environmental agent capable of causing an abnormal prenatal variation in form or function.[3] However, a lot of individuals often think of medications as the most suspect of teratogenic agents. It is therefore worth to note that teratogens encompass many agents, including medications (e.g., vitamin A derivative; isotretinoin, and thalidomide), infectious (e.g., syphilis, rubella, toxoplasmosis, cytomegalovirus infection), physical (e.g., radiation, heat, uterine constriction), maternal metabolic or genetic disorder (e.g., maternal diabetes, maternal phenylketonuria), and paternal factors (e.g., cumulative exposures resulting in DNA damage and new dominant mutations).[4] The first trimester is the most critical period of organogenesis and the most vulnerable period of teratogenic risk.[5] Although, the majority of exposures that result in birth defects are presumed to occur due to the deleterious effects of agents during organogenesis in early gestation, some teratogens have effects later in pregnancy.

The United States Food and Drug Administration (US-FDA) has classified the risk associated with medicines prescribed in pregnancy as category A (controlled studies in pregnant women fail to demonstrate a risk to the foetus in the first trimester with no evidence of a risk in later trimesters. The possibility of harm appears remote), category B

(presumed safety based on animal studies, with no controlled studies in pregnant women, or animal studies have shown an adverse effect that was not confirmed in controlled studies in women in the first trimester and there is no evidence of a risk in later trimesters), category C (studies in women and animals are not available or studies in animals have revealed adverse effects on the foetus and there are no controlled studies in women. Drugs should be given only if the potential benefits justify the potential risk to the foetus), category D (there is positive evidence of human foetal risk, however, in some cases such as a life-threatening illness the potential risk may be justified if there are no other alternatives), and category X (highly unsafe: risk of use outweighs any potential benefit. Drugs in this category are contraindicated in women who are or may become pregnant).[6] However, these FDA pregnancy risk categories have been seriously criticised since they have the potential to misguide the clinicians regarding the treatment of pregnant women or the assessment of foetal risks in case of an inadvertent exposure.[7-9] Furthermore, the FDA pregnancy risk categories have led to an erroneously increased teratogenic risk perception of supposedly safe medicines among clinicians and pregnant women. [8] Consequently, the FDA pregnancy risk categories are being revised to create a consistent format for providing information about the risks and benefits of prescription drug and/or biological product use during pregnancy and lactation so as to facilitate prescriber counseling for these populations.[10]

Studies from Nigeria have shown that during antenatal visits pregnant women were prescribed medicines over which some concerns exist for foetal safety.[11, 12] Another study has documented a prevalence of 72.4% among 518 pregnant women surveyed for self-medication in Uyo, South-South, Nigeria.[13] The self-medication included prescription, over-the-counter (OTC), and herbal medicines. Antenatal medication exposures are known to cause birth defects, while there is a paucity of information on the risks and safety of OTC medications and herbal remedies used by pregnant women. Self-medication of pregnant women may result in the use of medication with potential teratogenic risk to their foetus.

In Norway, pharmacists and physicians are amongst the health care providers from whom patients seek advice regarding risk and safety issues of medications during pregnancy. Of the 1373 women surveyed, 48.9% had sought information from their pharmacists and 78% had inquired from their doctors.[11] Studies have shown that the perception of risk of medications during pregnancy is heightened by both pregnant women and their health care providers.[14-16] The heightened perception of risk can lead to unfavorable situations such as depriving women of the benefits of safe medications, suboptimal dosing, or unnecessary termination of pregnancy.[15,17] Evidence abounds to show that provision of proper information to pregnant women could prevent these concerns.[18, 19]

Teratology Information Services (TIS) offer quick evidence-based counselling to those individuals worried about prenatal exposure to drugs, radiation, chemicals or infections during pregnancy or lactation.[20,21] health care professionals constitute most of the individuals seeking TIS and safety of drugs in pregnancy and lactation is the most sought information. [20] The public too are not left out in information seeking in pregnancy and lactation. [21] TIS are available in the developed countries and 22 centres have been identified in 16 countries across Europe, Asia, Middle East and Australia rendering such services. [19] Mother risk clinic in Canada is notable for rendering TIS. The clinic provides health care professionals and the public with information regarding the safety and/or risk of exposures during pregnancy and lactation, mainly through telephone consultations. [20, 21] However, those presenting physically to the Mother risk clinic are counselled and followed up with letters for their doctors.

The primary objective of this survey was to assess the perspectives of doctors in the field of obstetrics and gynecology in public and private hospitals in Lagos, Nigeria on the need for a teratology counselling service centre in the country. The study also assessed the broad knowledge of the doctors about teratology and the roles of a TIS centre in the society

METHODS

Study design

This study was a cross-sectional survey of medical professionals in the field of obstetrics and gynaecology in private and public hospitals in Lagos, Nigeria. Completion of the survey served as consent to participate. The study was approved by the Health Research and Ethics Committee (HREC) of the Lagos University Teaching Hospital (LUTH) and assigned a reference No. ADM/DCST/HREC/203.

Data collection

A survey questionnaire adapted from similar studies from Canada [20, 22], was developed by the authors purposively to ask the respondents some information in nine categories: demography of the respondent; views on teratology information service centre (TISC); perceived important goals of TISC; topics perceived importance for counseling in pregnancy; services perceived important to be rendered by a TISC; the group of people that may require counseling; perceived exposures in pregnancy that require counseling; categories of medication exposure in pregnancy that require counseling; and paternal medication exposure that requires counseling. The questionnaire was pretested among 10 doctors working in the obstetrics and gynaecology units of public and private hospitals. Necessary modifications were made to the questionnaire based on the suggestions of the participants in the pilot study. The participants involved in the pilot study were excluded from the final survey. The questionnaire was self-administered to the doctors in the gynecology department at LUTH, Lagos State University Teaching Hospital (LASUTH), Federal Medical Centre (FMC), Ebute-Metta, five General Hospitals and ten private hospitals in Lagos, between June and August, 2015.

A convenience sample of all the doctors involved in the care of pregnant women in the selected hospitals was surveyed in this study. The sample size was calculated using online software, Raosoft®. [23] Assuming a population of 500 physicians is attending to obstetric and gynaecological cases in public and private hospitals in Lagos, a 70% response rate for this population at 95% confidence interval, will yield a sample size of 197 participants. We, therefore, sampled the opinion of 200 participants for this study. The survey was self-administered by one of the authors, who ensured that the

questionnaire was filled on the spot and returned after completion. Each returned survey was given a number code which was used for identification purposes; therefore, no personal information was included in the electronic database. The data were entered and maintained as a Microsoft Excel© programme until transferred into SPSS©.

Statistical analysis

Data analysis and Statistical tests were performed using SPSS© software version 17. The data were summarized in tables (frequency and percentages) and figures (pictograms). The association between the age, gender, position and year in service of the participants and their resources for teratology information or low responses to drugs exposure in pregnancy that require counselling were determined using Pearson Chi-square at a significance level of $P < 0.05$.

RESULTS

A total of 174 doctors responded to the questionnaire. More males (100; 57.5%) than females (74; 42.5%) participated in the study. The positions of the respondents in obstetrics and gynaecology specialty are medical officers (37; 21.3%), resident (37; 21.3%), senior resident (26; 14.9%), and consultants (74; 42.5%). The mean and standard deviation (mean± SD) age of the participants was 38.3 ± 8.6 year, while their years of experience and years in current service were 11 ± 2.6 years and 3.7 ± 0.7 years, respectively. Majority of the respondents (171; 98.3%) believed their trainings and/or exposures in obstetrics and gynaecology have adequately equipped them to provide good teratology counselling to a pregnant woman. One respondent each felt the need for more training and/or exposure in genetics (1), nutrition and diet (1), infectious diseases (1), maternal and foetal medicine (1), pharmacogenomics (1), and drug bulletin and news updates (1), in order to provide adequate teratology counselling in pregnancy.

Respondents often source information about teratology from online (142; 81.6%), medical journals (139; 79.9%), drug information leaflets (132; 75.9%), drug formulary (81; 46.5%), and reference books (45; 25.9%). Based on these results, respondents appear to use more than one resource for information on teratology. Teratology information is sourced when necessary (54; 31.0%), regularly (50; 28.7%), occasionally (37; 21.3%), or very rarely (33; 19.0%). Analysis of the age, gender, position and year in service of the respondents and their resource for teratology information (Table 1) showed statistically significant differences between resource for information and age ($P < 0.001$), position ($P < 0.001$) and year in service ($P = 0.039$). This suggests that respondents younger than 40 years old, who are consultants and senior residents, or young in service, tend to use all the information resources better than others. However, no statistically significant difference existed between the gender of the respondents and their resource for teratology information ($P = 0.567$).

All the respondents (174; 100%) opined that a national teratology information service centre (TISC) should be established in Nigeria. The participants would consult the centre regularly (160; 92%), occasionally (11; 6.3%), when necessary (2) or very rarely (1) for advice. The perceived members of teratology information service provider are physicians (172; 98.9%), pharmacists (142; 81.6%), nurses (115; 66.1%), clinical pharmacologists (96; 55.2%), environmental toxicologist (88; 50.6%), stakeholders (40; 22.9%), geneticists (37; 21.3%), dieticians (20; 11.5%), psychologists (12; 6.9%), sociologists (12; 6.9%), statisticians (12; 6.95), and epidemiologists (2; 1.2%).

All the respondents perceived the goals of a TISC as to correct risk misperceptions and reassure pregnant women (174; 100%), to prevent unnecessary pregnancy terminations because of high risk perception (174; 100%), to prevent malformations caused by exposure to teratogens (174; 100%), to support adequate pharmacotherapy in pregnancy and lactation (174; 100%), to educate other health professionals on teratology (174; 100%), to counsel on exposures in lactation (174; 100%), to prevent fetal alcohol syndrome specifically (174; 100%), and to prevent congenital malformations (174; 100%).

All the respondents opined that pregnant women should be counselled on several topics as presented in Figure 1. The least response was to nausea and vomiting in pregnancy (73; 42.0%). Telephone counselling (174; 100%), education for other health providers (174; 100%), and sending materials by mail to physicians (174; 100%) were the three most important services expected of the respondents from a TISC (Figure 2).

The respondents considered women planning pregnancy (168; 96.5%), breastfeeding (174; 100%), and pregnant (174; 100%) as those who most need teratology counselling (Figure 3). The exposures in pregnancy (Figure 4) that require counselling were perceived highest as general anesthesia (174; 100%), radiation (174; 100%), and febrile infections (174; 100%).

In Table 2, there are statistically significant differences between the response to the five drugs and age ($P < 0.001$), gender ($P = 0.033$), position ($P < 0.001$), and year in service ($P = 0.004$).

Table 1: The degree of association between the age, gender, position and year of service of the respondents and their resources for teratology information

Parameters assessed		Resources for tetralogy information					
		Online Information	Published literature	Reference books	Drug formulary	Drug information leaflets	P-value
Age	23-27	23 (13.2)	23 (13.2)	23 (13.2)	23 (13.2)	23 (13.2)	< 0.001
	28-32	18 (10.3)	18 (10.3)	18 (10.3	18 (10.3)	18 (10.3)	
	33-37	53 (30.5)	53 (30.5)	4 (2.3)	40 (23.0)	53 (30.5)	
	38-4	26 (3.4)	6 (3.4)	0 (0.0)	0(0.0	6 (3.4)	
	43-47	42 (24.1)	39 (22.4)	0 (0.0	)0 (0.0)	32 (18.4)	
	48-52	0 (0.0)	0 (0.0)	0 (0.0	0 (0.0)	0 (0.0)	
	53-57	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Gender	Males	80 (46.0)	84 (48.3)	74 (42.5)	28 (16.1)	43 (24.7)	0.567
	Females	61 (35.1)	56 (32.2)	57 (32.8)	17 (9.8)	38 (21.8)	
Position	Consultant	60 (34.5)	60 (34.5)	14 (8.0)	41 (23.6)	60 (34.5)	< 0.001
	Senior resident	27 (15.5)	27 (15.5)	9 (5.2)	17 (9.8)	27 (15.5)	
	Resident	21 (12.1	21 (12.1)	16 (9.2)	17 (9.8)	21 (12.1)	
	Medical officer	34 (19.5)	31 (17.8)	6 (3.4)	6 (3.4)	24 (13.8)	
Years in Service	15	1 (0.6)	1 (0.6)	0 (0.0	1 (0.6)	1 (0.6)	0.0396
	14	2 (1.1)	2 (1.1)	0 (0.0)	1 (0.6)	2 (1.1)	
	12	4(2.3)	4 (2.3)	1 (0.6	3 (1.7)	4 (2.3)	
	8	2 (1.1)	2 (1.1)	1 (0.6)	1 (0.6)	2 (1.1)	
	7	16 (9.2)	16 (9.2)	4 (2.3)	9 (5.2)	16 (9.2)	
	5	24 (13.8)	24 (13.8	)3 (1.7)	16 (9.2)	24 (13.8)	
	4	11 (6.3)	11 (6.3)	6 (3.4)	8 (4.6)	11 (6.3)	
	32	6 (14.9)	26 (14.9)	8 (4.6)	19 (10.9)	26 (14.9)	
	2	12 (6.9)	12 (6.9)	7 (4.0)	8 (4.6)	12 (6.9)	
	1	11 (6.3)	11 (6.3)	10 (5.7)	10 (5.7)	11 (6.3)	
	0.5	32 (18.4)	29 (16.7)	4 (2.3)	4 (2.3)	22 (12.6)	

Table 2: Categories of medications on which information regarding pregnancy exposure may be required

Class of drug	Frequency of "yes" response (%)
Immunomodulators	174(100.0)
Antiretroviral and other antiviral	174(100.0)
Chemotherapy of microbial or parasitic diseases	170(97.7)
Anticonvulsants	169(97.1)
Analgesics and opioids	152(87.4)
Vaccines	144(82.8)
Contraceptives, hormones and hormone antagonists	143(82.2)
Anticoagulants	143(82.2)
Eye medications	135(77.6)
Hypnotics and sedatives	126(71.4)
Endocrine drugs	123(70.7)
Antihistamines and anti-allergy	123(70.7)
Antidepressants	117(67.3)
Anticholinergic and bronchodilator inhaler	113(65.0)
Central nervous system stimulants	108(62.1)
Dermatologic medications	105(60.4)
Steroids	95(54.6)
Bisphosphonate derivatives	94(54.0)
Retinoic acid derivatives	89(51.2)
Cough and cold medicines	78(44.8)
Proton pump inhibitors	65(37.4)
Cardiovascular drugs	
ACE-inhibitors	165(94.9)
Antiplatelet agents	162(93.1)
Calcium channel blockers	153(88.0)
Diuretics	145(83.4)
HMG-CoA reductase inhibitors (statins)	133(76.5)
Anti-arrhythmic	131(75.3)
Beta-blockers	121(69.6)
Alpha-2 adrenergic agonists	116(66.7)
Phosphodiesterase-5 inhibitors	106(60.9)
Acetylsalicylic acid derivatives	106(60.9)

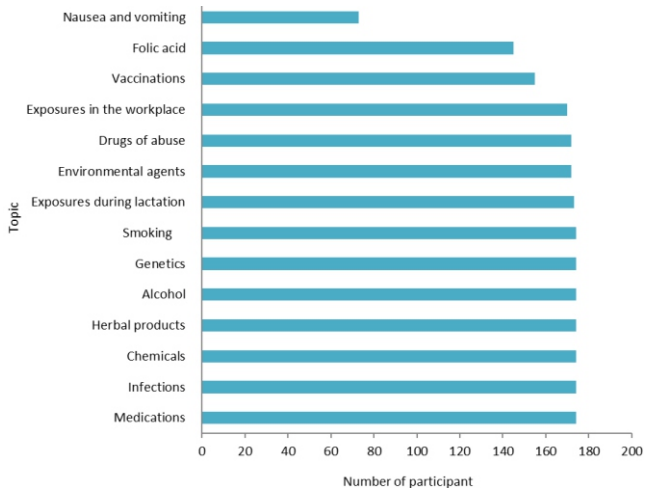

Figure 1: Topic for counselling in pregnancy

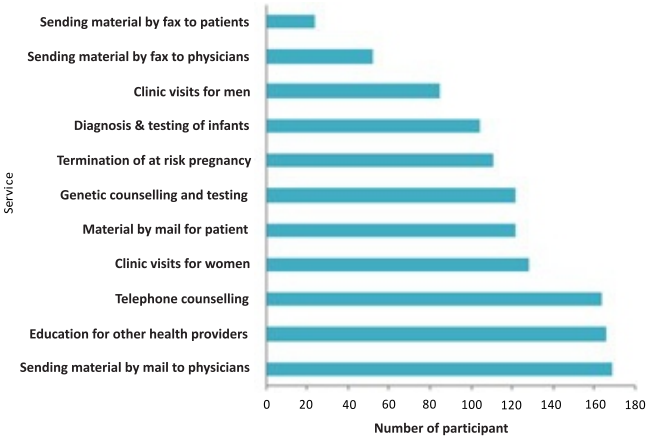

Figure 2: Important services expected from teratogen information services centre

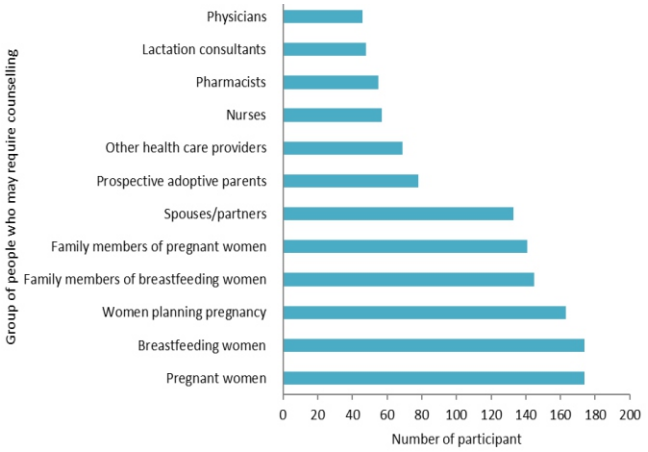

Figure 3: Group of people who may require counselling on teratology

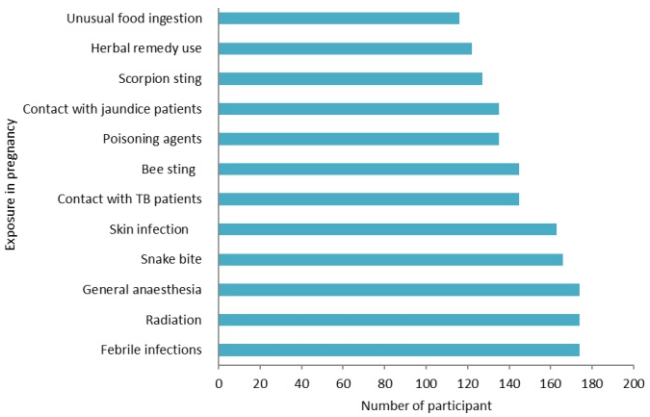

Figure 4: Exposures in pregnancy that would require counselling

DISCUSSION

Previous studies in this domain are lacking in the developing countries while the existing studies in the developed countries are focused on pharmacists [22] and pediatricians. [24] The lack of appropriate data from doctors in obstetrics and gynaecology to compare with our findings would require caution in interpreting some of our results.

The majority of the respondents in this study were residents and medical officers. They are part of the high proportion of respondents who believed that trainings and/or exposures in obstetrics and gynaecology had adequately equipped them to provide good teratology counselling to a pregnant woman. This is contrasting to the internal medicine and family practice residents at a public hospital in Chicago, United States, who performed poorly in providing preconception counseling to women of reproductive age. [25] In the United States study, over 40% of the residents would be unable to provide a healthy woman with information on rubella immunization or counselling on sexually transmitted diseases. When counselling a diabetic woman seeking pregnancy, 74% would fail to discuss congenital anomalies and 45% would not have considered discontinuing oral hypoglycemic if she became pregnant. [25] Furthermore, 58% would have neglected to review or change hypertension medications in a newly diagnosed pregnant woman. [25] At the University of Alabama in Birmingham, United States, ability of a resident to describe genetics, normal foetal development, and teratology as well as apply this knowledge to preconception and genetic counseling is one of the core curricula of residency training in obstetrics and gynaecology. [26] It is believed that these important topics are an integral part of the curriculum of the Nigerian and West African postgraduate colleges for obstetrics and gynaecology and may be more didactic than in any other specialty. Thus, this may have enhanced the ability of the residents and consultants among the participants in this study to counsel pregnant women about teratology.

A recent study from Norway ranked physicians higher than pharmacists amongst health care providers from whom patients seek advice regarding risk and safety issues of medications during pregnancy.[27] This suggests that much is expected from doctors with regards to counselling on safe medicine use in preconception periods and in pregnancy. To meet this obligation, the respondents need to update their knowledge regularly on new drugs and teratology. Knowledge acquired during teaching may be notoriously brief but can be reinforced and sustained by constant reading. It is therefore not surprising to observe that the respondents frequently use online, medical journals, and drug information leaflets as resources for teratology information. A similar trend in the use of resources for information is seen among family doctors surveyed for their perception and utilization of information from a teratogen information service in Canada. They relied on Compendium of Pharmaceuticals and Specialties (CPS), textbooks, journals and their colleagues for teratology information. [28] The official drug labelling (or package inserts) rarely provides up-to-date information regarding teratogenic risks in human pregnancies. The respondents, therefore, need to be encouraged to use drug formulary and reference teratology books, which are more reliable and informative than some of the other resources. The respondents also may not be aware of other multiple resources available that can assist in assessing reproductive toxicities from drug exposures. These resources include the online REPRORISK system, which is available from Micromedex, and contains four teratogen information databases: REPROTEXT, REPROTOX (www.reprotox.org), Shepard's Catalog of Teratogenic Agents [29], and Teratogen Information System (TERIS). [30] Unfortunately, we did not ask the respondents about these resources. This is, however, one of the limitations of this study. These periodically updated, scientifically reviewed resources critically evaluate the literature regarding drug exposures in human and animal pregnancies. There was a significant association between resource for teratology information and age, position and year in the service of the respondents. This suggests that young, junior and old doctors in employment are less likely to use teratology information resources. An educational intervention may be required to encourage this group of clinicians to use appropriate teratology information resources.

Despite the inclusion of teratology and genetics in the curriculum in obstetrics and gynecology residency training in the developed countries, TISCs are still established internationally. [20] This suggests that residency training may not just be enough to make young doctors an authority in this subspecialty. The need for doctors to further improve their knowledge of teratology is evident in an international survey that reported doctors to be among the highest ranked health professionals seeking help from the TISCs in Europe, South America, Asia and Australia [20] as well as among the wider variety of health professionals that utilized the North American TISC. [20, 22, 31] It is, therefore, not surprising to observe that all the respondents supported the need to establish a national TISC in Nigeria. It is encouraging that over 90% of the respondents would, if established, consult the TISC regularly. This attitude, however, differs from the believe of the respondents that training in the field of obstetrics and gynecology had adequately equipped them to appropriately counsel their patients on teratology. An observational study of the real life counselling of patients on this subject would have given us the true picture of the knowledge of the physicians on this topic. This is one of the limitations of a questionnaire survey that should be addressed in future studies.

Almost all the respondents correctly identified the entire pre-determined topics, except nausea and vomiting, as counsel able in pregnancy. All, but nausea and vomiting, are well recognized internationally as important topics for counselling in pregnancy. [20] However, more time is spent in counselling callers to the international TISCs on medications and exposures during lactation [20, 22, 31] as they remain the two major topics that callers often sought help.

Hancock *et al*. [20] reported from their global survey that staffing of TISCs varied from country to country in terms of the number and background of the staffs. However, physicians, pharmacists and geneticists are three important groups of staffs that are indispensable at all the TISCs surveyed in the global study. All the categories of staffs listed in our survey tool have been identified in the global survey of TISCs to be functionally relevant in teratology; a complex field that draws on expertise of various professionals. Unfortunately, only nurses, clinical pharmacologist, and environmental toxicologists were recognized by over 50% of the respondents to be relevant for the TIS job. Almost all the respondents considered doctors and pharmacists to be very important for the TIS job. This agrees with the findings of Hancock et al. [20] where doctors or pharmacists were often the telephone counsellors at all the TISCs globally.

Previous studies have recognized few of the goals of a TISC as correcting risk misperceptions and reassuring pregnant women, preventing unnecessary pregnancy terminations because of high risk perception, preventing malformations caused by exposure to teratogens, supporting adequate pharmacotherapy in pregnancy and lactation, educating other health professionals on teratology, counselling on exposures in lactation, preventing fetal alcohol syndrome, and preventing genetic malformations.[20] It is quite impressive that all the respondents were able to identify these goals correctly in this survey. Understanding the scope of the TISCs may encourage the respondents to seek their services. However, the respondents lowly rated doctors, pharmacists and other healthcare professionals among the group of people who may require counselling on teratology. In a pilot study of teratogen information service for pharmacists at the Motherisk Program in Canada, guidance was provided to the pharmacists in over 90% of pregnancy related calls and in about 80% of breastfeeding inquiries.[22] Most of the calls were on medications not classified or ambiguous with regards to risk classification in pregnancy and breastfeeding. All the pharmacists who used the Motherisk helpline found it helpful in counseling their patients as well as validating their own risk perception. Einarson *et al*.[28] evaluated how doctors perceive and utilize information from a teratogen information service at the Motherisk Program, Canada and found that help was often sought about drug, chemical, radiation, infection and disease exposure in pregnancy. Over 90% of the doctors passed on the information received to their patient word for word.

Prescribing medications for pregnant women can be

very challenging for any clinician because new medicines are very rarely developed for this population. [1] The fact that pregnant women are generally excluded from randomised clinical trials, information is lacking on the safety of most available medicines for use in pregnancy. [2] This may have accounted for the high percentage of the respondents who would seek information on pregnancy exposure to the variety of pre-determined medicines evaluated in this study.

The desire of the respondents to seek information on pregnancy exposure to the medicines illustrated in this study may also be due to their erroneous perception of the teratogenic risks of the medicines. Studies have shown that many clinicians relied on drug information leaflets for teratogenic information. [28] Unfortunately, most drug safety labeling for pregnancy was based on FDA pregnancy risk categories which have been widely criticized for the inadequacies and overrating of the toxicity of some medicines in pregnancy.[7-9] However, the information need of the respondents on anticonvulsants, antipsychotics, antidepressants, and stimulants are very important since they are linked to adverse pregnancy outcomes.[32-38] Current evidence suggests that valproate use in the first trimester predisposes to a high risk of congenital malformations, an effect that is probably dose-related.[32] Maternal prenatal exposure to valproate has been reported to impair the fluency and originality of their babies as they grow compared with the children of those exposed to carbamazepine and lamotrigine. [33] Phenytoin and phenobarbital exposures in pregnancy have resulted in adverse cognitive outcomes of some children. [32]

Second-generation antipsychotics (SGAs), such as aripiprazole, clozapine, olanzapine, and risperidone, are increasingly being used to treat psychiatric conditions in pregnancy because of their higher efficacy and fewer extrapyramidal adverse effects compared with first generation antipsychotics (FGAs). [34] However, the SGAs, particularly risperidone and paliperidone, have been associated with hyperprolactinemia; therefore, should be used with caution in pregnancy.[35] Information regarding foetal safety of antipsychotics is contradictory and inconclusive. Some studies have reported a significant increased risk for major congenital malformations [34], while others suggested no such risk. [36] The use of antipsychotics during pregnancy has been viewed by the respondents as appropriate because there has been no sufficient evidence of a significant increase in malformation rates. This is further corroborated by evidence from a recent publication. [36] Although, a recent systematic review and meta-analysis of safety of SGAs in pregnancy suggested an increased risk of major congenital malformations and preterm birth following SGAs exposure during first-trimester, confounding factors, such as patient utilisation of health care resources during pregnancy, underlying mental illness being treated, and maternal pre-pregnancy weight, that could influence the risk rates were not put into consideration in all the studies analysed. [34] Furthermore, only a few publications analysed in the systematic review reported the specific pattern of malformations associated with SGAs, thus making it difficult to identify the unequivocal risk posed by SGAs in pregnancy. A large study in the United States examined the risk of congenital malformations associated with first-trimester exposure to both FGAs and SGAs. [36] Evidence from the study suggested that antipsychotics, except risperidone, use in early pregnancy did not significantly increase the risk for congenital malformations, particularly cardiac malformations.[36] Further studies were, however, suggested to validate the malformation risk associated with risperidone. It is important to emphasize that a lack of evidence of a significant increased risk for major congenital malformations in the previous smaller studies and the recent large study should not be misconstrued as a complete safety of antipsychotics in pregnancy. When treating psychiatric disorders in pregnancy, respondents should weigh the potential teratogenicity of antipsychotics against the risks of leaving the patient untreated. Such decision should be based on the need of individual patients.

Although, the selective serotonin-reuptake inhibitors (SSRIs) are relatively safe antidepressants in pregnancy, the data concerning the possible consequences related to exposure to this class of medicines via the placenta and breastmilk on neonatal adaptation and long-term neurocognitive infant's development are still controversial. [37] There are a number of reports suggesting an association between placental exposure to SSRIs and adverse but self-limiting effects on neonatal adaptation. [38]

CONCLUSIONS

Medical professionals in the field of obstetrics and gynaecology in Lagos public and private hospitals felt their training and exposures have adequately prepared them to provide teratology counselling for pregnant women. They, however, felt it was necessary to have a national teratology information service centre in Nigeria and, when established, would consult regularly. Educational intervention may be required to encourage the respondents to use appropriate information resources on teratology. Further studies assessing the role of clinical pharmacist in establishing teratology information service centre and supporting physicians in utilising the services of the centre would be addressed in the future.

DISCLOSURE

The authors declare no conflicts or financial interest in any product or service mentioned in the manuscript, including grants, equipment, medications, employment, gifts, and honoraria.

REFERENCES

1. Fisk NM, Atun R. Market failure and the poverty of new drugs in maternal health. PLoS Med 2008; 5: e22
2. Gagne JJ, Maio V, Berghella V, Louis DZ, Gonnella JS. Prescription drug use in pregnancy: a population-based study in Regione Emilia-Romagna, Italy. Eur J Clin Pharmacol 2008; 64: 1125-32.
3. Parisi MA, Spong CY, Zajicek A, Guttmacher AE. We don't know what we don't study: the case for research on medication effects in pregnancy. Am J Med Genet C Semin Med Genet. 2011; 157: 247-250.
4. Robinson A, Linden MG. Clinical Genetics Handbook. Blackwell Scientific Publications; Boston: 1993. pp. 491-511.
5. Mitchell AA, Gilboa SM, Werler MM, Kelley KE,

Louik C, Hernandez-Diaz S. Medication use during pregnancy, with particular focus on prescription drugs: 1976-2008. Am J Obstet Gynecol. 2011; 205: 51. e1-8.
6. U.S. Food and Drug Administration. Requirements on content and format of labelling for human prescription drug and biological products. Federal Register 2006; 71: 3921-3997.
7. Doering PL, Boothby LA, Cheok M. Review of pregnancy labeling of prescription drugs: Is the current system adequate to inform of risks? Am J Obstet Gynecol 2002; 187:333-339.
8. Law R, Bozzo P, Koren G, Einarson A. FDA pregnancy risk categories and the CPS: do they help or are they a hindrance? Can Fam Physician. 2010; 56: 239-241.
9. Public Affairs Committee of the Teratology Society. Teratology Public Affairs Committee position paper: pregnancy labeling for prescription drugs: ten years Later. Birth Defects Res (Part A) 2007; 79: 627-630
10. U.S. Food and Drug Administration. Content and format of labeling for human prescription drug and biological products; requirements for pregnancy and lactation labeling. Federal Register 2014; 79: 72064-72103.
11. Oshikoya KA, Akionla IO, Senbanjo IO, Oreagba IA, Ogunleye OO. Medicines used in pregnancy, childbirth and lactation in a teaching hospital in Lagos, Nigeria. Sri Lanka J Obstet Gynaecol 2012; 34: 84-9.
12. Abubakar K, Abdulkadir R, Abubakar SB, Jimoh AO, Ugwah-Oguejiofor JC, Danzaki AM. Drug Utilization Pattern in Pregnancy in a Tertiary Hospital in Sokoto, North West. J Health Sci 2014; 4: 99-104.
13. Abasiubong F, Bassey EA, Udobang JA, Oluyinka, Akinbami S, Udoh SB, Idung AU. Self-Medication: potential risks and hazards among pregnant women in Uyo, Nigeria. Pan Afr Med J. 2012; 13: 15.
14. Nordeng H, Ystrøm E, Einarson A. Perception of risk regarding the use of medications and other exposures during pregnancy. Eur J Clin Pharmacol 2010; 66: 207-14.
15. Sanz E, Gomez-Lopez T, Martinez-Quintas MJ. Perception of teratogenic risk of common medicines. Eur J Obstet Gynecol Reprod Biol 2001; 95: 127-31.
16. Pichereau J, Pathak A, Lacroix I, Montastruc JL, Damase-Michel C. Perception of teratogenic and foetotoxic risk by health professionals: a survey in Midi-Pyrenees area. 27th French pharmacovigilance meeting, Montpellier. 10-12 April 2006. Fundamental Clin Pharmacol 2006; 20: 178 [Abstract 203].
17. Koren G, Bologa M, Long D, Feldman Y, Shear NH. Perception of teratogenic risk by pregnant women exposed to drugs and chemicals during the first trimester. Am J Obstet Gynecol 1989; 160: 1190-4.
18. De Santis M, Straface G, Cavaliere AF, Cinque B, Carducci B, Caruso A. Teratological risk evaluation and prevention of voluntary abortion. Minerva Ginecol 2006: 58: 91-9.
19. Bonari L, Koren G, Einarson TR, Jasper JD, Taddio A, Einarson A. Use of antidepressants by pregnant women: Evaluation of perception risk, efficacy of evidence-based counseling and determinants of decision making. Arch Women Ment Health 2005; 8: 214-220.
20. Hancock RL, Ungar WJ, Einarson A, Koren G. International practices in the provision of teratology information: a survey of international teratogen information programmes and comparisons with the North American model. J Evaluation Clin Pract. 2010; 16: 957-63.
21. Moretti ME, Koren G. Motherisk: The Toronto model for counseling in reproductive toxicology. In: Koren G, ed. Maternal-fetal toxicology – A clinician's guide. 3rd ed. Marcel Dekker, Inc. NY; 2001:767-788.
22. Tan MP, Koren G. Teratogen information service for pharmacists: a pilot study. J Popul Ther Clin Pharmacol 2011; 18: e377-e389.
23. Raosoft®. Online sample size calculator. Available at http://www.raosoft.com/samplesize.html (Accessed June 7, 2015).
24. Chung BHY, Ip P, Chow CB, Chin R, Lau YL, Koren G. Teratology and developmental pharmacology: why should paediatricians care? HK J Paediatr (new series) 2011; 16: 264-272.
25. Conway T, Hu T, Mason E, Mueller E. Are primary care residents adequately prepared to care for women of reproductive age? Family Planning Perspectives 1995; 27: 66-70.
26. University of Alabama at Birmingham, United States. Department of Obstetrics and Gynecology Residency. Program, goals and objectives. Available at https://www.uab.edu/medicine/obgynresidency/program-goals-a-objectives (Accessed November 26, 2015).
27. Nordeng H, Ystrøm E, Einarson A. Perception of risk regarding the use of medications and other exposures during pregnancy. Eur J Clin Pharmacol 2010; 66: 207-14.
28. Einarson A, Park A, Koren G. How physicians perceive and utilize information from a teratogen information service: The Motherisk Program. BMC Med Educ. 2004; 4: 6.
29. Shepard TH. Catalog of teratogenic agents. 10th ed. Baltimore: Johns Hopkins University Press, 2001.
30. Friedman JM, Polifka JE. Teratogenic effects of drugs: a resource for clinicians (TERIS). 2d ed. Baltimore: Johns Hopkins University Press, 2000.
31. Hancock RL, Ungar WJ, Einarson A, Goodstadt M. & Koren G. Providing information regarding exposures in pregnancy: a survey of North American Teratology Information Services. Reproductive Toxicology 2008; 25: 381-387.
32. Harden CL, Meador KJ, Pennell PB, Hauser WA, Gronseth GS, French JA, *et al*. Practice parameter update: management issues for women with epilepsy-focus on pregnancy (an evidence-based review): teratogenesis and perinatal outcomes. Neurology. 2009; 73: 133-141.
33. McVearry KM, Gaillard WD, VanMeter J, Meador KJ. A prospective study of cognitive fluency and originality in children exposed in utero to carbamazepine, lamotrigine, or valproate monotherapy. Epilepsy Behav. 2009; 16: 609-616.
34. Terrana N, Koren G, Pivovarov J, Etwel F, Nulman I. Pregnancy Outcomes Following In Utero Exposure to

Second-Generation Antipsychotics: A systematic review and meta-analysis. J Clin Psychopharmaco 2015; 35: 559-565.
35. Bostwick JR, Guthrie SK, Ellingrod VL. Antipsychotic-induced hyperprolactinemia. Pharmacotherapy 2009; 29: 64-73.
36. Huybrechts KF, Hernández-Díaz S, Patorno E, Desai RJ, Mogun H, Dejene SZ, Cohen JM, Panchaud A, Cohen L, Bateman BT. Antipsychotic use in pregnancy and the risk for congenital malformations. JAMA Psychiatry 2016; 73: 938-946.
37. Gentile S. The safety of newer antidepressants in pregnancy and breastfeeding. Drug Saf. 2005; 28: 137-152.
38. Tuccori M, Testi A, Antonioli L, Fornai M, Montagnani S, Ghisu N, Colucci R, Corona T, Blandizzi C, Del Tacca M. Safety concerns associated with the use of serotonin reuptake inhibitors and other serotonergic/noradrenergic antidepressants during pregnancy: a review. Clin Ther. 2009; 31 (Pt 1): 1426-1453.
39. Humphreys C, Garcia-Bournissen F, Ito S, Koren G. Exposure to attention deficit hyperactivity disorder medications during pregnancy. Can Fam Physician. 2007; 53: 1153-1155.