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Determinants and barriers to safe abortion care in Nigeria: A mixed method study

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Abstract

Barriers to safe abortion care are major contributors to the high levels of maternal death, ill health, and disability in Nigeria. This study employed a mixed-method approach to investigate the determinants and barriers to safe abortion care in Nigeria. The quantitative aspect of this study used data from the 2019-2020 follow-up survey. These were 1388 women from six Nigerian states who reported an abortion experience in the 2018 baseline cross-sectional survey of Nigeria Performance Monitoring for Action (PMA) datasets. Twenty in-depth interviews were performed with women seeking post-abortion treatment at two teaching hospitals in southwest Nigeria (FETHI and LAUTECH). Approximately 30% of the 1388 abortions performed were unsafe. Younger women were less likely to practice safe abortion care (OR=0.64, $p<0.05$). The odds of safe abortion care increased with education level (OR=1.83, $p<0.05$), (OR=2.62, $p<0.001$), and (OR=3.84, $p<0.001$) for primary, secondary, and higher education. Other are residence, marital, and wealth status. The IDI results revealed that the majority of abortions are performed in a private, unconventional location. Low socioeconomic position, sociocultural norms, and legislative constraints all pose significant challenges to safe abortion care in Nigeria. To enhance access to safe abortion in Nigeria, the government must evaluate socio-legal obstacles. (*Afr J Reprod Health* 2026; 30 [3s]: 26-35).

Keywords: Unsafe Abortion; Hindrances; Legal penalty; Cultural Believe

Résumé

Les obstacles à l'avortement sécurisé sont les principaux facteurs qui contribuent aux taux élevés de mortalité maternelle, de mauvaise santé et d'invalidité au Nigeria. Cette étude a utilisé une approche mixte pour étudier les déterminants et les obstacles aux soins d'avortement sécurisés au Nigeria. L'aspect quantitatif de cette étude s'est appuyé sur les données de l'enquête de suivi de 2019-2020. Il s'agit de 1388 femmes de six États nigériens qui ont signalé une expérience d'avortement dans l'enquête transversale de référence de 2018 sur les ensembles de données du Nigeria Performance Monitoring for Action (PMA). Vingt entretiens approfondis ont été réalisés avec des femmes cherchant un traitement post-avortement dans deux hôpitaux universitaires du sud-ouest du Nigeria (FETHI et LAUTECH). Environ 30 % des 1388 avortements pratiqués étaient dangereux. Les femmes plus jeunes étaient moins susceptibles de pratiquer un avortement sécurisé (RC = 0,64, $p<0,05$). Les chances d'obtenir des soins d'avortement sécurisés augmentaient avec le niveau d'éducation (RC = 1,83, $p<0,05$), (RC = 2,62, $p<0,001$) et (RC = 3,84, $p<0,001$) pour l'enseignement primaire, secondaire et supérieur. (*Afr J Reprod Health* 2026; 30 [3s]: 26-35).

Mots-clés: Avortement médicalisé; Barrières; Sanction légale; Croyance culturelle

Introduction

Abortion is safe according to the World Health Organization (WHO) when the process is carried out in line with the recommended guidelines provided by WHO, appropriate to the pregnancy duration, and by someone who has the required training or skills to handle it in a minimum standard medical environment¹. Access to safe abortion treatment is critical to the health and well-being of pregnant women and their families. Restrictions on abortion

care are seen as a denial of these reproductive rights and a threat to public health^{2,3}. However, when women with unwanted pregnancies face barriers to obtaining safe abortion care, they often resort to unsafe abortion¹. The contribution of unsafe abortions to maternal mortality is becoming more widely acknowledged around the world. Globally, in 2004, about 20 million induced abortions were unsafe⁴, the number increased to 21.6 million in 2008, and now 25 million in 2022¹. In Nigeria, the figure for unsafe abortion is inevitably inaccurate

and not completely reliable due to restrictive laws, and ethical and moral considerations^{5,6}. In 2018, Bell, Omoluabi, OlaOlorun, Shankar, and Moreau reported that the incidence of abortion was 46 abortions per 1000 women of reproductive age in Nigeria, approximately 66.7% of these were unsafe⁷. A recent study by Akinlusi and others put the rate of unsafe abortion at 10% and that 42.4% of the unsafe abortions were conducted in private hospital facilities or by doctors with undisclosed identities⁵.

Complications arising from unsafe abortions pose a serious threat to women's health and are the major contributor to countries' high levels of maternal death, ill health, and disability^{8,9}. In 2020, Nigeria was one of the extremely high maternal mortality rate countries after South Sudan and Chad having more than 1047 deaths per 100,000 live births¹⁰. Complications in abortion which is very common with unsafe abortion, cause substantial health issues such as urinary system problems, deformities of their sexual organs such as bifid clitoris, improper position of the labia majora, anterior implantation of the anus, and short vagina¹¹. Despite the enormity of the adverse health effects of unsafe abortion, myriads of barriers still exist in access to safe abortion care in many countries, including Nigeria. The barriers to safe abortion cut across individual socio-economic status, cultural and religious norms, legal restriction, patriarchal traditions, value clarification, and stigmatization of abortion care providers^{6,12-14}. An estimated three million unsafe abortions occur annually among young women ages 15-19 years due to their high vulnerability to unwanted pregnancies¹⁵⁻¹⁷. Legal restrictions to abortion services increase the tendency and the drive toward unsafe abortion among women^{18,19}. Evidence shows that in countries where abortion is restricted, only one in every four (4) induced abortions is safe, compared to countries where the practice is being liberalized accounting for 60% of safe abortion⁶.

According to Harris, Debbink, Martin, and Hassinger, abortion care is one of the highly sensitive and stigmatized practices among medical practitioners in most countries because of legal penalties and societal stigma³. Unlike post-abortion care (PAC) often seen as a lifesaving package to reduce morbidity, abortion care is seen as dirty work because of its association with three traits; physical

(blood, fetal parts); social stigma (other professional stigmatized or discrimination) and moral risk (the risk adverse, psycho-social consequence, status loss^{2,9}. Different studies had also shown that misinterpretation of abortion law by health providers and law enforcement agents limits access to safe abortion which inflicts double and enormous damage on women and girls, particularly those who suffered sexual abuse, and rape¹⁰⁻¹². This is made worse by a lack of understanding of the serious traumatic experience caused by the perpetrator, particularly on victims of repeated sexual abuse^{6,11}. Other barriers are distance to the health facility, the stigmatization of abortion care seekers, and male accompaniment to seek care¹³.

There is a large body of literature on abortion in Nigeria. Most of the studies focused on the incidence of abortion⁶, perceptions about abortion treatment²², severity in abortion complications¹⁹, post-abortion care services⁸, treatment of incomplete abortion²³, and unsafe abortion practices¹⁴. However, little has been done on the determinants and barriers to safe abortion care in Nigeria from a mixed-method approach. Therefore, this study examined the determinants of safe abortion and identified the barriers using a mixed-method design. The findings would not only contribute to the literature on safe abortion but also provide useful insight for policy reforms on safe abortion care in Nigeria.

Methods

Design and data source

This study employed a mixed-method research design. The quantitative design was based on Performance Monitoring for Action (PMA), a cross-sectional baseline survey conducted from April to May 2018 by the Centre for Research, Evaluation Resources and Development (CRERD) with technical support provided by the Bill & Gates Institute for Population and Reproductive Health at Johns Hopkins School of Public Health²⁴. The baseline survey focused on family planning and reproductive health in Nigeria. The participants who had ever experienced abortion were asked if they could be re-contacted for a follow-up survey. The follow-up survey which took place in 2019-2020

included a series of questions about their experience on abortion. This study used data from the follow-up survey of 1388 women in six Nigerian states who reported an abortion experience. The details about the 2019-2020 follow-up survey of PMA Nigeria survey methodology have been published in another article²⁵. The qualitative design which was based on in-depth interviews was conducted to complement the quantitative data. The qualitative data collection took place from October to December 2022.

Setting

The PMA was conducted in seven states in Nigeria (Anambra, Kaduna, Kano, Lagos, Nasarawa, Rivers, and Taraba). The in-depth interviews were conducted in states that were not covered in the PMA survey—two states (Ekiti and Osun). They were purposively selected due to convenience and cost.

Study population

The study population for the quantitative data were women ages 15-49 years who had experienced abortion, identified during the baseline survey. For the in-depth interview, women ages 15-49 years who visit tertiary health facilities for PAC or seek evacuation were eligible for selection.

Sampling procedure

A multi-stage cluster sample design was used in the PMA2020 household survey to provide a probability sample of eligible women from the seven states. The women between the ages of 15 and 49 who are either regular household members or who spent the night before the interview were considered. Out of the 13,921 respondents, only 1388 were found to have had abortion experience. Thus, a total of 1388 respondents were found suitable for this analysis. The in-depth interview participants were selected using an on-the-spot systematic selection protocol for every third PAC client at Federal Teaching Hospital Ido-Ekiti (FETHI) and Ladoke Akintola University Teaching Hospital (LAUTECH), Osogbo. Evidence from other studies shows that the majority of PAC patients are referrers from other health facilities to tertiary hospitals.^{6,26} Twenty women were successfully interviewed. Each

interview took an average of 15-25 minutes. The sampling was stopped when data saturation was reached at 20. The characteristics of the 20 participants are presented in Table 1.

Data collection

The quantitative data collection involved the use of a structured interviewer-administered questionnaire that examined the socio-demographic characteristics of respondents, the experience of abortion, where the abortion was carried out, what was done to remove the pregnancy, and reasons for the choice and other variables. Women were questioned individually if they had ever taken any action to "regulate their period when they were worried that they were pregnant" or "remove a pregnancy when they were pregnant or worried, they were pregnant." When a woman said she only did one thing to end the pregnancy, the survey gathered details on the location and method utilized. When women said they did more than one thing, the survey recorded information on the method and sources used the first and last time.

The IDIs were conducted with a 15-item interview guide to examine the barriers to safe abortion care, on the following headings, economic barriers, cost of abortion, distance to health facilities; social context, stigmatization of abortion, cultural perceptions, denial at health facilities, and fear of legal penalty, among others.

Variables and measures

Abortion was the outcome variable. This study classified abortion based on the location and methods used as either safe or unsafe. Respondents who used abortion services at a clinic or health facility such as government hospitals, government health centers, family planning clinics, mobile clinics (public), private hospitals, private doctors, and mobile clinics (private), were categorized as "safe" otherwise it is unsafe. Also, the method used in carrying out the abortion was used to categorize safe and unsafe abortion care. Those who used surgical operation, emergency contraceptives, and those who got recommendations from health workers to use injectables and mifepristone pills are regarded as safe and coded 1 while anything contrary

Table 1: Background information of IDI Participants

ID	AGE	Marital status	State	ID	AGE	Marital status	State	ID	AGE	Marital status	State
IDI-1	23	S	EK	IDI-6	40	M	OS	IDI-11	21	S	EK
IDI-2	31	M	EK	IDI-7	32	S	OS	IDI-12	23	S	OS
IDI-3	24	S	EK	IDI-8	34	M	OS	IDI-13	20	S	OS
IDI-4	32	M	OS	IDI-9	21	S	OS	IDI-14	19	S	EK
IDI-5	39	M	OS	IDI-10	24	S	EK	IDI-15	19	S	OS

ID	AGE	Marital status	State
IDI-16	18	S	EK
IDI-17	18	S	EK
IDI-18	21	S	EK
IDI-19	24	S	OS
IDI-20	38	M	EK

to this is coded “0” unsafe such as traditional methods, use of lemon/lime, salt/potash, alcohol. Responses to the location and method were aggregated to a binary outcome coded 1 for safe abortion, and 0 for unsafe abortion. The explanatory variables which are the potential determinants included socio-demographic characteristics of respondents which include age (<19, 20-29, 31-39, 40-49); marital status (single, married, separated/widowed); education (none, primary, secondary, higher); household wealth index (poor, medium and rich); and place of residence (rural and urban), details of variable measurement is published²⁴.

Data analysis

The analysis was conducted using Stata version-17 software. The descriptive analysis presents the frequency distribution of respondent’s background characteristics, abortion experience, methods used, and reasons for the use and non-use of a health facility for abortion care. The factors influencing safe abortion were modeled using binary logistics regression and the significant variables were discussed at a p-value less than 0.05.

The qualitative data: The interviews were recorded and transcribed. The transcriptions were reviewed against the recordings for accuracy. The data were analyzed using content and thematic analysis. The contents were reviewed to identify reported barriers to abortion care. The responses were disaggregated using a thematic approach under the following

heading; legal restrictions, poor economic status, cost of services, and cultural and religious barriers.

Ethical considerations

The Johns Hopkins Bloomberg School of Public Health provided ethical approval in 2019, as well as the National Health Research Ethics Committee of Nigeria, details of the ethical protocol are available on the website (datalab.pmadata.org). For the qualitative data collection, each participant received a brief description of the study, and verbal consent to participate in the study was confirmed before the interview. This was in line with the approval from the Human Research and Ethics Committee of the Federal Teaching Hospital Ido (FETHI) on 25th October 2022 with the ethical approved number: *ERC/2022/10/11/857B*.

Results

Description of the participants and prevalence of safe abortion.

The participants' ages in the qualitative data ranged from 15 to 49 years with an average age of 25 years. Seventy percent of the participants were single while the remaining were married. About 55% of them were undergraduates or women with higher levels of education while 45% had secondary education or lesser education; 12 of the participants were referrers while 8 were self-reported cases.

Table 2 presents the socio-demographic characteristics of the respondents and their abortion

Table 2: Background characteristics and pattern of safe abortion among the respondents

Characteristic	n	%
Age		
15-19	231	16.7
20-29	401	28.9
31-39	317	22.8
40-49	439	31.6
Education		
Never	236	17.0
Primary	191	13.7
Secondary	496	35.7
Higher	193	13.9
Not listed	273	19.7
Marital Status		
Married	741	53.4
Separated	51	3.7
Single	596	42.9
Residence		
Urban	673	48.5
Rural	715	51.5
Wealth Index		
Poor	708	51.0
Middle	246	17.7
Rich	435	31.3
Currently Using any Contraceptive		
No	780	56.2
Yes	239	17.2
No Response	370	26.6
What Did to Remove Pregnancy		
Did multiple things	294	21.2
Did only one thing	1094	78.8
Abortion Type (based on Method used)		
Unsafe	422	30.4
Safe	966	69.6
Total	1,388	100

Source: Baseline Survey, Nigeria PMA-2018-20

experience. The age distribution showed that 31.6% were within ages 40-49, about 29% were within ages 20-29, and 16.7% were within age 15-19 years. The educational attainment showed that the majority 35.7% had secondary education, and about 14% of them had primary or higher education while only 17% reported no education. More than half of the women were married (53.4%). Slightly above half of the sampled women lived in rural areas (51.5%), and 51% were classified as poor while 17.7% were

classified as middle class and about 31% were rich. Only 18% of them were currently using any methods of contraception. In their experience with abortion, 78.8% did only one thing while 21.2% of them did multiple things. About 70% reported safe abortion, whereas close to one-third (30.37%) of them reported unsafe abortion.

Determinants of safe abortion care

Table 3 presents the binary logistic regression analysis of the odds of safe abortion among the sampled women. It was found that young adults (15-24) were less likely to seek safe abortion compared to older women (OR=0.64, $p<0.01$). The rural dwellers were less likely to seek safe abortion care compared to those living in the urban centers (OR=0.63, $p<0.01$). Similarly, education is found to contribute to higher odds for safe abortion compared to no education having the following odds ratio; primary (OR=1.83, $p<0.01$), secondary (OR=2.62, $p<0.01$), and higher (OR=3.84, $p<0.01$). In addition, women in rich households are more likely to seek safe abortions compared to those in poor or middle-class households.

Barriers to safe abortion care

Furthermore, in the qualitative analysis, the sampled patients elaborated on different barriers to safe abortion in Nigeria. The aggregated content analysis of the in-depth interviews was presented in three themes as follows: economic barriers, social and cultural norms, and, legal restrictions.

Economic barriers

Most of the respondents revealed that women who seek abortion do not visit government hospitals or high-profile health facilities because they presume it will be more expensive.

.... those who go for unsafe abortions, don't want to spend money, some people think the cost of medical services can be expensive. Now it is for their benefit they can seek their care from where they can afford like using traditional herbs, potash, and lime which is risky to their life. But some people don't give this a thought, they are pressed to remove the pregnancy (Married, 24 years old, IDI-3)

Table 3: Logistic regression on factors influencing safe abortion among the sample women

Safe Abortion	Odd Ratio	p-value	95% conf. interval]
Current of Age			
Old Adults (25-49)	1.00		
Young Adults (15-24)	0.64*	0.026	0.42-0.94
Residence			
Urban	1.00		
Rural	0.63	0.006	0.45-0.88
Currently Using any methods of Contraceptives			
Yes	1.00		
No	0.94	0.695	0.70 - 1.26
Educational Attainment			
None	1.00		
Primary	1.83*	0.036	1.04 - 3.24
Secondary	2.62***	0.000	1.55 - 4.42
Higher	3.84***	0.000	2.09 - 7.05
Marital Status			
Married	1.00		
Separated	2.02*	0.014	1.15 - 3.56
Single	1.17	0.404	0.80 - 1.73
Wealth index			
Poor	1.00		
Middle	1.43	0.087	0.94 - 2.18
Rich	1.87**	0.002	1.25 - 2.82

Source: Author Analysis from Nigeria PMA, 2020.

Most of the young girls who were victims of rape and sexual abuse are faced with poor economic status and cannot afford the cost of abortion in a clinical arena. They seek alternative and cheaper care.

.....When I got to know that I was pregnant for four weeks, I was afraid because it was about two months after that terrible experience of robbery in our compound.....my parents didn't have huge money the doctor charged us when we got back home my friend took me to one madam house, I don't know if she is a nurse, she gave me that terrible tablet.... (Unmarried woman, 18, IDI-17)

Yes, sometimes money may not be forthcoming to get what you can use. (Unmarried woman 24, IDI-10)

Another, participant who used health insurance revealed that the cost of post-abortion care is not as expensive as presumed by many people, she reported that those without health insurance unlike herself can access PAC. Some of the respondents reported that

the cost of care should not be a problem compared to the risk involved in an unsafe abortion.

Ahh no, I am using NHIS but if at all I am not using it, because there are many people here too that are not using NHIS that is they are using ordinary green cards and they can afford the money here talk less of me, so their money is not too high, money is not up to life. (Married woman, 39, IDI-5)

The same respondents further explained that there is emotional and safety of life when government hospitals are used because the doctors and nurses are well trained;

...but you know many people joke with their life. so, assuming they didn't joke with their life Federal Medical Centre is not a heaven or it's not a place that you cannot go there if you have money. Even if you don't have money, they will first attend to you, they can be writing your bill down but your life will be most important to the nurses and doctors that are there, I believe money can disturb someone not to come to the hospital. (Married woman, 39, IDI-5)

Social and cultural norms and religion

The social stigma attachment to abortion either safe or unsafe is a major barrier. Some of the respondents reported that these barriers led many young girls to suicide if they could not secure safe care. Some of the respondents reported social/cultural barriers such as religious perception of abortion as evil; and stigmatization of people associated with abortion ranging from the patients to the health workers.

..... Yes social stigma, probably when you meet your relative there (at the hospital), ...to go to hospital where I will see relative, I will never..., so that is the reason people can just go for unsafe methods that can kill them or damage their womb. (Married woman, 39, IDI-5).

If people are aware of your abortion, they can spoil your name. I know of a nurse who said she cannot do it because of her religious beliefs Unmarried, 24, IDI-19)

Shame and denial at hospitals can push some people to seek abortion from unsafe channels. (Unmarried, 24, IDI-19)

However, other respondents reported that no religion or culture is against saving a life.

“The reason why I say that is because when someone is bleeding and does not go for medical care; it means one is killing herself gradually. When you seek medical advice, they will know the next thing to do even though before the flow might be much like that, no cultural norms can go against saving a life, I don't think so”. (Married woman, 31, IDI-2)

“No, you can't say people should not come to the hospital because of one belief....I personally do not agree with that,..... So, nobody plans for it, but if this incident of rape happens no religion can stop me”. (Married woman, 39, IDI-5)

Legal restriction

Some of the respondents reported legal restrictions It is possible, like in our place they don't allow abortion and any hospital that wants to do it must do it secretly or else they can get such medical

practitioners arrested”. (unmarried woman, 24, IDI-3)

.....some unlicensed doctors normally do it compared to government hospitals because they know that government hospitals cannot do it because of legal restrictions, where the person would be asked to bring a guarantor to sign because of any negative effect that can result in aftermath. (Unmarried woman, 24, IDI-3 FETHI, Ekiti)

“...the real problem of safe abortion is the legal restriction, when you need the service and the hospital is not willing to help you, for me it is an act of wickedness. I don't have the mind to abort, but the thing has happened, even though I have promised I would never abort in my life it has happened. I know the stress I pass through I nearly die but I thank God. (Married woman, 31, IDI-2, FETHI, Ekiti).

Discussion

Results in this study provide insight into the determinants and barriers to safe abortion care in Nigeria. The study found that among women who had induced abortion, 30% had unsafe abortion. This finding relates to Akinlusi's findings that 42.5% of unsafe abortions were reported in health facilities⁵. Similarly, Bell, Omoluabi, OlaOlorun, Shankar, and Moreau in inequalities in the incidence and safety of abortion in Nigeria found that the incidence of abortion rate was 46 per 1000 women and 66.6% had unsafe abortions⁷. These increasing rates of unsafe abortion dragging between 30% in this current study as well as 42.5%, and 66.6% by different authors in the same country, require serious attention from major policymakers and government agencies to address the public health issue in the community. Moreover, the variation in these statistics may not be far from socio-cultural barriers to safe abortion care as well as restrictive legislation against the practice of abortion leading many women into unsafe methods of terminating unwanted pregnancies.

The factors associated with safe abortion are age, marital status, wealth status, and place of residence. This study found that younger women were less likely to practice safe abortion care compared to older women. This study found that safe abortion care increases as the level of education

increases from primary to higher education. This is supported from Bell, Omoluabi, OlaOlorun, Shankar, and Moreau's study which found that young women with secondary or higher education and women in urban areas are the most likely to use safe abortion care⁷. In the qualitative results, a higher proportion (70%) of the self-reported PAC referrer patients are young women compared to 30% adults. This is suggestive of a high rate of unsafe abortion among young adults. This finding found support from the work of Bessa, Drezett, Adami, Araújo, Bezerra, and Abreu that young women or adolescent girls constitute a considerable proportion of annual global deaths caused by abortion³³.

In 2018 a study conducted in Afghanistan on the factors that influence access to the use of PAC services, participants identified the cost of abortion, distance to the health facility, stigmatization, shame, need for male accompaniment to seek care, perceived and actual quality of care as most common barriers²¹. This is similar to the barriers reported in this study. The barriers constrain most women to rely on convenient options that have privacy or self-medication which increase their exposure to the risks of unsafe abortion such as maternal mortality, and pregnancy complications. Many women seek alternative care to government hospitals where they can get cheap and affordable medical bills but fail to consider the consequences of using unqualified medical personnel. These costs of accessing safe abortion care may be too expensive for many young women because of poor socio-economic status. According to Giuffrida, Kulkarni, Nagle, Wali, and Casey., help-seeking barriers are multiphasic in nature, at the individual level, barriers include being a member of an oppressed or minority group²¹.

Similarly, the legal restriction of safe abortion has caused more harm than benefits to many women. Nigeria law prohibits abortion under the Panel Code Act (PCA) and Criminal Code Act (CCA) with the combined reading of sections 228-230 of CCA and equivalent provision of PCA (Section 232-235) allowing abortion only for the preservation of the mother's life. This provision of the law fails to recognize safe abortion as a right to reproductive health and denies it as a threat to their right²⁸. The law should consider some unusual circumstances, such as sexual violence during insurgency, armed robbery rapes, and other unusual

scenarios, that require access to safe abortion under the law, not only the health status of the mother^{14,18,20,29}. Another special circumstance is the mental state of raped women resulting in pregnancies. Most young girls in this condition suffer emotional stress, and stigmatization leading to school dropout^{30,31}.

Conclusion and recommendations

Although, most of the respondents had access to safe abortion in the study population, but a considerable number made up of younger women of low socioeconomic status were at a higher risk of unsafe abortion care. The results demonstrate that safe abortion care is significantly low because of legal, economic, religion and social constraints. Policy and program strategies aimed at improving safe abortion and reducing unsafe abortion should address these bottlenecks. Strengthening youth-friendly clinics may enhance contraceptive use among young adults, thereby mitigating their heightened risk of unsafe abortion.

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Authors contribution

Sunday Abatan conceived, and designed the study, analyzed the data, and contributed to writing all the sections of the manuscript. Professor Soladoye Asa supervised and vetted the whole process of the study and contributed to writing all the sections of the manuscript. Both Sunday Abatan and Soladoye Asa mentioned in the article approved the manuscript for publication.

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