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Midwives' Knowledge and Readiness to Practice Antenatal Screening and Genetic Testing in selected Hospitals in Lagos, Nigeria

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ABSTRACT

Background & aim: The burden of congenital malformation can be decreased through two major approaches- primary prevention of those at risk through antenatal screening and improving survival for those affected. This study was conducted to investigate the knowledge and readiness of midwives to practice antenatal screening and genetic testing for congenital abnormalities.

Methods: A cross-sectional study among randomly selected 245 midwives across five maternal and child health government hospitals within Lagos metropolis in 2017. The validated self-administered questionnaire having 3-section; midwife's demographic-characteristics, knowledge and readiness of antenatal screening and genetic testing, with 0.74 reliability coefficient, was used to obtain information within five weeks after obtaining ethical approval. The obtained information was analysed using SPSS version 22.

Results: The study findings revealed that 62.9% of the midwives had inadequate knowledge of antenatal screening and genetic testing for congenital abnormalities. Up to 82.4% were ready to practice antenatal screening and genetic testing for congenital abnormalities. The midwives' level of knowledge was not significantly associated with their readiness to practice antenatal screening and genetic testing for congenital abnormalities ($p=0.74$), meanwhile, professional qualification ($p = 0.003$) and years of experience ($p < 0.001$) were significantly associated with readiness to practice antenatal screening and genetic testing.

Conclusion: The study recommends that midwives should improve their knowledge and skills in genetic testing by attending both local and international training workshops/seminars. Midwives should be provided with the screening devices to facilitate the practice of antenatal screening and genetic testing for congenital abnormalities.

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Introduction

Antenatal screening, particularly for a genetic testing is virtually non-existent in Nigeria and the need cannot be overestimated as many congenital abnormalities can lead to long-term devastating consequences and loss of life.

Globally, an approximate of 295,000 newborns dies within 28 days of birth every year, due to congenital anomalies. And such incidence can contribute to long-term disability, which may have significant impacts on individuals, families, health-care systems, and societies at large (1). However, there are also those who develop severe defects while the foetus is still in utero. These defects and deficiencies could have been caused by a number of reasons. According to Helwick (2) a lot of these defects and deficiencies are serious and could lead to severe mental or physical abnormalities. However, if the parents and the health care professionals especially midwives were aware of the problems that the foetus may be facing, they may be more prepared to deal

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with such abnormalities and be prepared to deal with such situations or conditions after delivery (2). According to World Health Organization (WHO) (3) congenital malformations have been reported to be a major cause of mortality and morbidity in children across the globe. The case fatality rate for most severe abnormalities such as anencephaly, trisomy 13 and trisomy 18 and severe heart defects are virtually 100% by the child first birthday. About 3 – 4 percent of all babies born in the United States have congenital abnormalities that will affect the way they look, develop, or function – in some cases for the rest of their lives (3). In Nigeria, specifically South-eastern part, 2.2% of 5010 infants were presented with congenital anomalies where major anomalies were noted in 93.5% (101/108) infants (4). The varying pattern and prevalence of congenital malformations over time or geographical location may reflect differing methods of detection and frequency due to the complex interaction of known and unknown genetic and environmental factors including socio-cultural, racial, and ethnic variables (5).

The burden of congenital malformation is ancient but not inevitable, it lies on the shoulder of professionals- Surgeons, Clinicians, Epidemiologists, Researchers and especially Midwives -working to improve the outcome and lessen the impacts of congenital defects in the population from an epidemiologic and population-based perspective, which is the focus of this contribution, the burden of congenital malformation can be decreased through two major approaches- primary prevention among those at risk through antenatal screening and improve survival among those who are affected (6). Parents of children with congenital malformation face many problems including multiple surgical intervention, long neonatal hospitalization and often uncertainty about future quality of life (7). The majority of families cope with the situation relatively well and are able to continue their life normally, however coping with a physically or intellectually disabled child is a highly individualized process, and there is evidence to suggest that some families may never adjust fully to this event (8). Considering the importance of knowledge, availability of genetic testing and readiness of midwives to prevent congenital abnormality, we aimed at investigating the knowledge and readiness of midwives to practice antenatal screening and genetic testing for congenital abnormalities in selected hospitals in Lagos State, Nigeria.

Materials and Methods

A descriptive cross sectional survey conducted among midwives in government hospitals in Lagos State built mainly for maternal and child care. Two-stage sampling was applied. Five hospitals were purposively selected; (1) Lagos Island Maternity Hospital (MCC) from Zone A; this is the first state owned maternity built during the colonial era and it is located in the heart of Lagos Island, (2) General Hospital Ikorodu (MCC) from Zone B; the hospital is located at Otunba Benson Road, Ijede Ikorodu, founded in 1983, (3) General Hospital Isolo (MCC) from Zone C; the hospital is located at 120, Mushin Road Isolo in Isolo Local Government Area (4) General Hospital Ifako-Ijaiye (MCC) from Zone D; the hospital is located at 14 College Road, Iju Ifako - Ijaye, (5) General Hospital, Ajegunle (MCC) from Zone E; the hospital is located at 6, Cardoso Street Ajeromi-Ifelodun. Using Yemane formulae for sample size determination, for a total number of 631 midwives and 5% margin of error, a sample of 245 midwives was selected utilizing simple random sampling method to select midwives in each purposively selected hospital with MCC who met the inclusion criteria such as having midwifery qualification, season experienced and reported for duty.

Data collection tool was a structured self-administered questionnaire developed from reviewed literature. *Part I:* covered midwives' demographic data (8-items), such as age, professional qualification, year of experience, marital status, current professional status/cadre. Part II: this part was designed to assess midwives' knowledge of antenatal screening of congenital abnormality (21-items), Part III: covered midwives' readiness to practice antenatal screening for genetic testing (6-items) and Part IV: this part sought available methods on antenatal screening for congenital abnormality (25-items). With the assistance of the experienced midwives, other researchers and Maternal and child Health experts as well as nursing and pregnant women was sought when

developing the questionnaire for the clarity of items, contents for comprehensibility, appropriateness of language and sensibility of questions to ensure the validity of the instrument. After the reviewing of the questionnaire by experts, a pilot study was carried out on 40 midwives who were randomly selected in Orile-Agege General Hospital, for test- retest method within the interval of 2-week, the Pearson correlation was 0.74 to ascertain the reliability of the instrument.

The ethical approval for the study was obtained from the ethical review committee of Lagos State University Teaching Hospital, Lagos. Official permission to administer the questionnaire on midwives at selected secondary health institutions in Lagos State was obtained from the Health Service Commission with reference number HSC/ DNS/ 364/ VOL. II/89. Informed consent was obtained from midwives themselves who were active participants. They were assured of absolute confidentiality of all information supplied and no identifier was permitted. Four 2nd year students from School of Midwifery, Igando, Lagos were recruited as research assistants. They were co-opted and trained on how to assign, allocate and fill the questionnaires to facilitate data collection for period of two days at their school conference hall. The shifting nature of nursing job was taken into consideration when distributing the questionnaires. Each of the Maternal and Child Centres was visited during the shift from 10am-6pm in order to cover the two shifts. The prepared questionnaires were distributed to midwives on duty who have indicated willingness to participate in the study. The questionnaires were collected immediately from the respondents while the contact mobile numbers of those who indicated willingness to return at a later day were obtained, they were followed up and all the questionnaires were retrieved. After data collection, knowledge of midwives was assessed with 21 questions and their scores recorded. A cut off point was set at mean score (12.1). Midwives with the score equivalent to mean score and above were regarded as having adequate knowledge and those with score below mean score as having inadequate knowledge of antenatal screening. Midwives' readiness to practice genetic testing during antenatal was assessed with two questions and categorized as 'ready' and not 'ready' while 25 questions were used to determine available screening methods for congenital abnormality. Descriptive statistics on SPSS version 22 was used to present the available screening methods across the selected hospitals.

Results

A total of 540 subjects participated in this study, 270 of whom were female and the rest were male. The mean ages of the employed women and their hu the results reveal that most of the midwives sampled (37.6%) were aged between 31 and 40years and the mean age was 41.1 ± 9.9.

There were more females (96.7%) than males, indicating that there were fewer male midwives in the country. Most (80.0%) practiced Christianity and 85.7% were married. Many (56.3%) of the respondents were Registered Nurses/Registered Midwives only while Registered Midwives only made up 9.0%. The highest category of year of experience was 6 to 10years with 32.7%. In the distribution of cadre, there were more Senior Nursing Officer (24.1%) among the respondents while Assistant Chief Nursing Officer was the least with 8.6% (Table 1).

About half of midwives had practical training in antenatal screening method (55.1%) of which they had correct understanding of antenatal screening, about 9 in ten said that the first step in any screening is counselling, 43.7% knew that the two types of antenatal screening were Invasive and Non-invasive, 53.9% of the respondents said that ultrasonography is usually done in first trimester, 72.2% said that there is no negative implication of antenatal test, 65.7% agreed that the best time to have amniocentesis done is first or second trimester, 85.7% agreed that antenatal screening is used to categorise pregnancy in high and low risk group for various condition, the respondents agreed that the conditions that can be screened for during antenatal were Rh factor, Anaemia and Amniocentesis with 58.4%, 31.0% and 10.6% respectively (Table 2a).

Approximately half (55.5%) had correct understanding of congenital abnormality as a true defects that have a genetic component, 64.9% understand that congenital abnormality occurs as a result of defect in chromosome, 91.4% agreed that Down syndrome is one of the congenital abnormality, 79.6% agreed that

Table 1. Demographic Characteristics of the Respondents (n= 245)

Category	Frequency (%)
Age group (years)	
Mean = 41.1 ± 9.9	
21 – 30	42 (17.1)
31 – 40	92 (18.0)
41 – 50	67 (18.0)
Above 50	44 (18.0)
Gender	
Male	8 (3.3)
Female	237 (96.7)
Religion	
Christianity	196 (80.0)
Islam	49 (20.0)
Marital status	
Single	28 (11.4)
Married	210 (85.8)
Separate	6 (2.4)
Widow	1 (0.4)
Professional Qualification	
BNSc	51 (20.8)
RM only	22 (9.0)
RN & RM	138 (56.3)
RM with other certificate	34 (13.9)
Years of Experience	
1 – 5	34 (13.9)
6 – 10	80 (32.7)
11 – 15	40 (16.3)
16 – 20	79 (32.2)
Above 20	12 (4.9)
Cadre	
NO II	37 (15.1)
NO I	35 (14.3)
SNO	59 (24.1)
PNO	55 (22.4)
ACNO	21 (8.6)
CNO	38 (15.5)

Footnote: BNSc – Bachelor of Nursing Science, RM – Registered Midwife, RN – Registered Nurse, NO – Nursing Officer,
SNO – Senior Nursing Officer, PNO – Principal Nursing Officer, ACNO – Assistant Chief Nursing Officer,
CNO – Chief Nursing Officer

Table 2a. Respondents' Knowledge of Antenatal Screening for Congenital abnormality (N = 245)

Statement	Frequency (%)
Practical training in antenatal screening method	
Yes	135 (55.1)
No	110 (44.9)
Understanding of Antenatal screening	
Correct	132 (53.9)
Incorrect	113 (46.1)
First step in any screening is counselling	
Yes	214 (87.3)
No	31 (12.7)
Two types of antenatal screening	
Correct	107 (43.7)
Incorrect	138 (56.3)
Ultrasonography is usually done in how many trimester	
1st	132 (53.9)
2nd	81 (33.1)
3rd	32 (13.0)
Usefulness of antenatal screening	
Correct	140 (57.1)
Incorrect	105 (42.9)
Any negative implication of antenatal test	
Yes	68 (27.8)
No	177 (72.2)
The best time to have amniocentesis done is either 1st or 2nd trimester	
Yes	161 (65.7)
No	84 (34.3)
Antenatal screening is used to categorise pregnancy in high and low risk group for various condition	
Yes	210 (85.7)
No	35 (14.3)
Conditions that can be screened for during antenatal	
Rh factor	143 (58.4)
Anaemia	76 (31.0)
Amniocentensis	26 (10.6)

Down syndrome is trisomy 21, 85.3% agreed that Amniocentesis is also referred to as amniotic fluid test, 66.1% agreed that the best time to have amniocentesis done is 16 – 22weeks of conceived, 82.9% agreed that genetic testing is also known as DNA testing, 46.1% said that New-born screening testing is the type of genetic testing they know and 62.9% agreed that blood and mucus is sample used for genetic testing (Table 2b). 62.9% of the midwives had insufficient knowledge of Genetic Testing for Congenital abnormality (Figure 1).

Table 2b. Respondents' Knowledge of Genetic Testing for Congenital abnormality (N = 245)

Statement	Frequency (%)
Understanding of term congenital abnormality	
Correct	136 (55.5)
Incorrect	109 (44.5)
Congenital abnormality occurs as a result of defect in	
Gene	59 (24.1)
Chromosome	159 (64.9)
Blood	23 (9.4)
Amniotic fluid	4 (1.6)
Down syndrome as one of the congenital abnormality	
Yes	224 (91.4)
No	21 (8.6)
Down syndrome is trisomy 21	
Yes	195 (79.6)
No	50 (20.4)
Amniocentesis is used for sex determination	
Yes	83 (33.9)
No	162 (66.1)
Amniocentesis also referred to as amniotic fluid test	
Yes	209 (85.3)
No	36 (14.7)
The best time to have amniocentesis done is 16 - 22weeks	
Correct	162 (66.1)
Incorrect	83 (33.9)
Genetic testing is also known as DNA testing	
Correct	203 (82.9)
Incorrect	42 (17.1)
Types of genetic testing you know	
Newborn screening testing	113 (46.1)
Anaemia testing	92 (37.6)
Forensic testing	40 (16.4)
Sample used for genetic testing are	
Mucus and urine	16 (6.5)
Blood and Mucus	154 (62.9)
Blood and urine	75 (30.6)

The result showed that 48.2% of midwives prepared for the practice in terms of using the available screening equipment, 82.4% were willing to offer antenatal screening to pregnant mothers, and 83.3% encouraged pregnant mothers to go for antenatal screening (Table 3).

Table 3. Respondents' Readiness to Practice Genetic Testing

Statement	Frequency (%)
Attendance of training / workshop on screening for abnormality	
Yes	42 (17.1)
No	203 (82.9)
Facility preparedness in terms of making screening equipment available	
Yes	118 (48.2)
No	127 (51.8)
Willingness to offer antenatal screening to pregnant mothers	
Yes	202 (82.4)
No	43 (17.6)
Encouraging pregnant mothers to go for antenatal screening	
Yes	204 (83.3)
No	41 (16.7)
Availability of necessary equipment to render the antenatal screening tests	
Yes	113 (46.1)
No	132 (53.9)

82.4% of the midwives reported their readiness to practice genetic testing (Figure 2).

Under non-invasive techniques, response to foetal visualization comprises of ultrasound 94.3%, foetal echocardiography 60.0%, Magnetic Resonance Imaging (MRI) 43.3%, Radiography 64.9%, Screening for neural tube defects (NTDs) 33.9% and Measurement of maternal serum alpha-fetoprotein (MSAFP) 29.8%. The response to screen for foetal down syndrome comprises of 24.9% MSAFP, 32.3% maternal unconjugated estriol, 38.4% maternal serum beta-human chorionic gonadotropin (HCG), 30.2% inhibin, 23.7% separation of foetal cells from the mother's blood and 24.5% assessing foetal-specific DNA methylation ratio (Table 4).

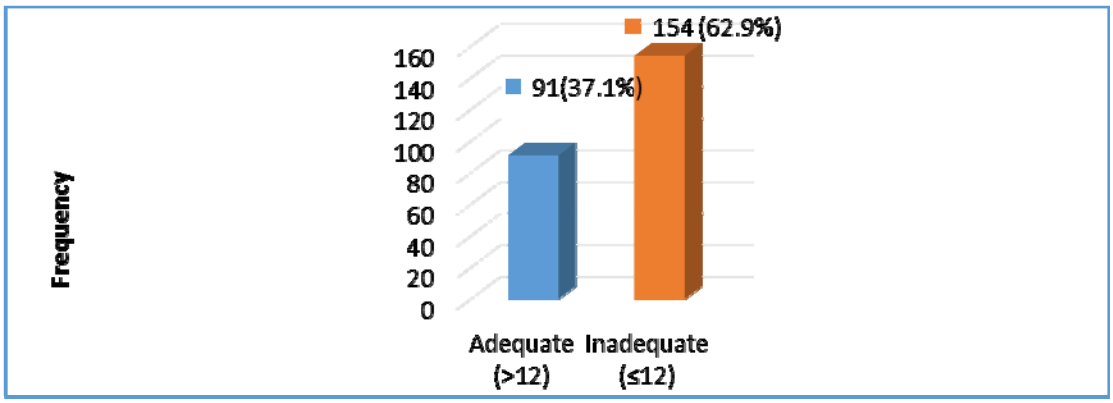

Figure 1. Midwives' Knowledge Level

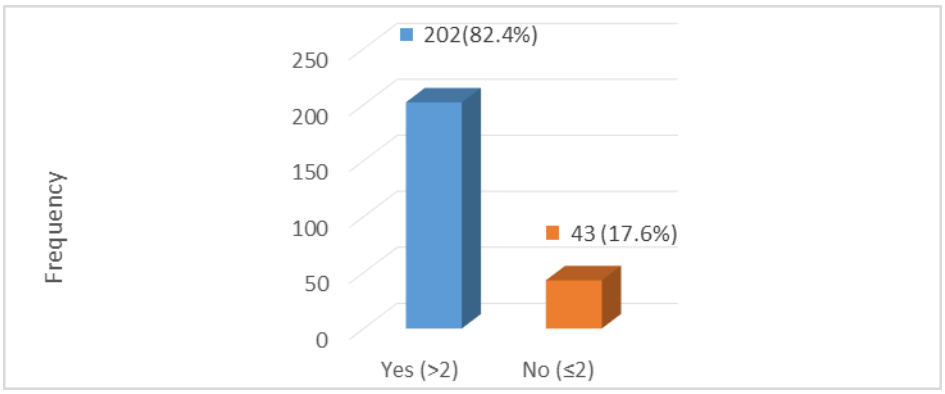

Figure 2. Respondents' Readiness to Practice Genetic Testing

Table 4. Available Non-Invasive Screening Technique/Device Screening Technique (N =245)

	Frequency (%)		
Fetal visualization	**Yes**	**No**	**Don't Know**
Ultrasound	231 (94.3)	12 (4.9)	2 (0.8)
Fetal echocardiography	147 (60.0)	82 (33.5)	16 (6.5)
Magnetic Resonance Imaging (MRI)	106 (43.3)	127(51.8)	12 (4.9)
Radiography	159 (64.9)	80 (32.7)	6 (2.4)
Screening for neural tube defects (NTDs)	83 (33.9)	155 (63.2)	7 (2.9)
Measurement of maternal serum alpha-fetoprotein (MSAFP)	73 (29.8)	157 (64.1)	15 (6.1)
Screen for fetal Down syndrome			
Measurement of MSAFP	61 (24.9)	139 (56.7)	45 (18.4)
Measurement maternal unconjugated estriol	79 (32.3)	127 (51.8)	39 (15.9)
Measurement maternal serum beta-human chorionic	94 (38.4)	122 (49.8)	29 (11.8)
gonadotropin (HCG)	74 (30.2)	126(51.4)	45 (18.4)
Measuring inhibin			
Separation of fetal cells from the mother's blood	58 (23.7)	147 (60.0)	40 (16.3)
Assessing fetal-specific DNA methylation ratio	60 (24.5)	145 (59.2)	40 (16.3)

Invasive technique, the response to embryoscopy was 53.9% and fetoscopy 54.3%. Fetal visualization comprises of Amniocentesis

50.6%, chorionic villus sampling (CVS) 47.3%, percutaneous umbilical blood sampling (PUBS) 32.7%, percutaneous skin biopsy 21.6% and pre-implementation biopsy blastocysts obtained by in vitro fertilization 19.6%.

For cytogenetic investigations, 20.4% had detecting chromosomal aberrations, 18.0% had

fluorescent in situ hybridization, 14.3% had molecular genetic techniques, 11.4% had linkage analysis using microsatellite markers, 13.9% had restriction fragment length polymorphisms (RFLPs) and 13.9% single nucleotide polymorphisms (SNPs) – DNA chip, dynamic allele-specific hybridization (DASH) (Table 5).

Table 5. Available Invasive Screening Technique/Device Screening Technique (N =245)

Invasive Screening Technique/Device	Frequency (%)		
	Yes	No	Don't Know
Embryoscopy	132 (53.9)	78(31.8)	35 (14.3)
Fetoscopy	133 (54.3)	81 (33.0)	31 (12.7)
Fetal tissue sampling			
Fetal visualization			
Amniocentesis	124 (50.6)	86 (35.1)	35 (14.3)
Chorionic villus sampling (CVS)	116 (47.3)	92 (37.6)	37 (15.1)
Percutaneous umbilical blood sampling (PUBS)	80 (32.7)	129 (52.7)	36 (14.6)
Percutaneous skin biopsy	53 (21.6)	153 (62.5)	39 (15.9)
Preimplantation biopsy of blastocysts obtained by in vitro fertilization	48 (19.6)	155 (63.3)	42 (17.1)
Cytogenetic investigations			
Detecting chromosomal aberrations	50 (20.4)	149 (60.8)	46 (18.8)
Fluorescent in situ hybridization	44 (18.0)	149 (60.8)	52 (21.2)
Molecular genetic techniques	35 (14.3)	158 (64.5)	52 (21.2)
Linkage analysis using microsatellite markers	28 (11.4)	159 (64.9)	58 (23.7)
Restriction fragment length polymorphisms (RFLPs)	34 (13.9)	155 (63.2)	56 (22.9)
Single nucleotide polymorphisms (SNPs) - DNA chip, dynamic allele-specific hybridization (DASH)	34 (13.9)	153 (62.4)	58 (23.7)

Table 6. Association between Midwife's (Level of knowledge, Professional qualification and Years of experience) and Readiness to practice antenatal screening and genetics testing for congenital abnormality

H_0	Readiness to Practice			d.f	X^2 Value	p-value	Remark
	No	Yes	Total				
Knowledge							
Adequate	15	76	91	1	0.11	0.74	Not Significant
Inadequate	28	126	154				
Total	43	202	245				
Professional qualification							
BNSc	14	37	51	3	13.21	0.003	Significant
RM only	4	18	22				
RN & RM	25	113	138				
RN	0	34	34				
Total	43	202	245				
Years of experience							
1 – 5	0	34	34	4	23.34	<0.001	Significant
6 – 10	14	66	80				
11 – 15	2	38	40				
16 – 20	23	56	79				
> 20	4	8	12				
Total	43	202	245				

*Note Fisher's Test was recorded for small cell

It was revealed that the result of the association between the midwives readiness to practice antenatal screening and genetic testing was not significantly associated with their level of knowledge (p = 0.74) meanwhile, professional qualification (p = 0.003) and years of experience (p < 0.001) were significantly associated with readiness to practice antenatal screening and genetic testing. Therefore, level of knowledge of antenatal screening and genetic testing among the midwives has no significant influence on their readiness to practice antenatal screening and genetic testing in their various health facilities but professional qualification and years of experience were significantly associated with readiness to practice antenatal screening and genetic testing for pregnant woman (Table 6).

Discussion

The findings revealed that less than half of the midwives had adequate knowledge of antenatal screening whereas more than half had practical training in antenatal screening methods this could be as a result of infrequent practice of the method and unavailability of devices required for its practice. The finding correlates with Edward and Msemo (9) who reported inadequate knowledge on the part of midwives as regards antenatal screening for congenital abnormality. That is, generally, the midwives in Nigeria have not been able to develop more understanding of antenatal screening for congenital abnormality.

The study revealed that majority of the midwives were ready to practice genetic screening for the pregnant women and as part of their readiness, majority were willing to offer antenatal screening and encouraged pregnant mothers to go for antenatal screening. Also, the study showed that despite their readiness, only few of the health facilities possess the necessary equipment for the screening for abnormality. This is similar to Martin et al; Lea and Heather; Lawson et al who reported that midwives' focus on giving information may inhibit them in daily practice from establishing a real dialogue during antenatal screening and as primary maternity care providers, midwives should offer the current antenatal screening options to all women through informed choice discussions. In addition, the study in United State reported that fetal aneuploidy screening was offered to all patients and this was done for the detection of Down syndrome, also majority offer NIPT as a first-line screening method for the risk assessment of trisomy 21, rather than serum-based traditional screening such as quad or first trimester screening (10),(11),(12),(13).

The study findings revealed that under non-invasive techniques, ultrasound, fetal echocardiography and radiography were the majorly available screening techniques while screening for neural tube defects (NTDs), measurement of maternal serum alpha-fetoprotein (MSAFP), measurement of maternal unconjugated estriol, measurement maternal serum beta-human chorionic gonadotropin (HCG), measuring inhibin, separation of fetal from mother's blood and assessing fetal specific DNA methylation ratio on down syndrome were less available.

In invasive technique, the following were averagely available, embryoscopy, fetoscopy, Amniocentesis and chorionic villus sampling while percutaneous umbilical blood sampling (PUBS), percutaneous skin biopsy, pre-implementation biopsy blastocysts obtained by in vitro fertilization, detecting chromosomal aberrations, fluorescent in situ hybridization, molecular genetic techniques, linkage analysis using microsatellite markers, restriction fragment length polymorphisms (RFLPs) and single nucleotide polymorphisms (SNPs) – DNA chip, dynamic allele-specific hybridization (DASH) were less available screening techniques. Therefore, unavailability of the majority of the antenatal screening techniques is a likely consequence accounting for perinatal death occurrence in the country. This is contrary to the findings of Teresa (2015) who reported that congenital abnormalities account for 20-25% of perinatal deaths and the only option open to women who wished to know whether their fetus had Down syndrome was to have an invasive test (14). Even the available ones, pregnant women were not ready for the screening as reported by Martin et al (10) that prior to counselling on screening, over 56% of the 123 women were undecided about invasive testing.

Finally, the midwives' level of knowledge of antenatal screening for congenital abnormality

was not significantly associated with their readiness to practice antenatal screening and genetic testing. This could be as a result of high preparedness and eagerness to practice antenatal screening and genetic testing among the midwives if there is availability of equipment despite their insufficient knowledge of antenatal screening for congenital abnormality.

The study was limited to resourceful online limited materials and textbooks, and shifting nature of the nurse/midwife schedule of work.

Conclusion

In conclusion, the midwives had inadequate knowledge but are ready to practice antenatal screening and genetic testing for congenital abnormality despite their inadequate knowledge and little or non-attendance of seminar/workshop on antenatal screening and genetic testing for congenital abnormality due to obstacles such as lack of equipment, shortage of experience midwives and lack of information on genetic and antenatal screening.

In the light of this study results, it is recommended that: a) midwives should endeavour to improve their knowledge on antenatal screening and genetic testing for congenital abnormalities through attending both local and international training workshop/seminar. b) midwives should be encouraged to go for upgrading/advance studies to enhance their evidence based practice on antenatal screening and genetic testing for congenital abnormalities, c) government or employer of midwives should make available the equipment that will facilitate readiness to practice antenatal screening and genetic testing for congenital abnormalities in their facilities, d) government or employer of midwives should provide incentives to motivate attendance of training workshop / seminar for antenatal screening and genetic testing for congenital abnormalities.

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Conflicts of interest

Authors declared no conflicts of interest.

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