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ORIGINAL ARTICLE

Awareness and Knowledge of Birth Defects among Antenatal Clinic Attendees at the University College Hospital, Ibadan, South-West, Nigeria

Sensibilisation et connaissance des malformations congénitales chez les participantes à la clinique prénatale de l'University College Hospital, Ibadan, Sud-Ouest, Nigéria

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ABSTRACT

BACKGROUND: The burden of birth defects is disproportionately higher in developing countries.

OBJECTIVES: This study assessed the knowledge of risk factors and prevention of birth defects among ante-natal clinic attendees at the University College Hospital, Ibadan, Oyo State, Nigeria.

METHODS: This was a cross-sectional study among 415 mothers who presented at the antenatal clinic. A semi-structured questionnaire was used to obtain information on respondents' socio-demographic profile, pregnancy, birth history, knowledge on prevention and risk factors for birth defects. Descriptive statistics was used to present results, independent t-test and ANOVA were used to determine the factors associated with mean of overall knowledge of birth defects. Test statistics was done at a 5% level of statistical significance.

RESULTS: The mean age of the women was 31.7 ± 4.8 years. Overall, 93 (22.4%) of the women were above 35 years, 118 (29.9%) were skilled workers and 343 (84.9%) had tertiary education. More than half (219, 52.8%) of the respondents had good knowledge of birth defects (56.4% had good knowledge of prevention and 66.0% had good knowledge of risk factors). Antenatal clinic attendees in their first trimester had higher mean overall knowledge score (8.3 ± 4.9) compared to those in second (7.9 ± 4.5) and third (7.9 ± 4.9) trimesters but this was not statistically significant (p=0.873). However, respondents in skilled/ semi-skilled occupation (8.62) had a significantly higher mean knowledge score compared with those in unskilled occupation/ unemployed (7.33) (p=0.005).

CONCLUSION: Knowledge of birth defects is relatively low among women. To reduce the occurrence and severity of birth defects, there is a need to educate mothers on the knowledge, prevention and importance of screening for birth defects. WAJM 2021; 38(6): 531–536.

Keywords: Birth defects, Antenatal care, child health, knowledge.

ABSTRAIT

CONTEXTE: Le fardeau des malformations congénitales est disproportionnellement plus élevé dans les pays en développement.

OBJECTIFS: Cette étude a évalué les connaissances sur les facteurs de risque et la prévention des malformations congénitales chez les patientes des consultations prénatales de l'University College Hospital, Ibadan, État d'Oyo, Nigéria.

MÉTHODES: Il s'agissait d'une étude transversale auprès de 415 mères qui se sont présentées à la clinique prénatale. Un questionnaire semi-structuré a été utilisé pour obtenir des informations sur le profil sociodémographique des répondantes, la grossesse, l'histoire de la naissance, les connaissances sur la prévention et les facteurs de risque de malformations congénitales. Des statistiques descriptives ont été utilisées pour présenter les résultats, un test indépendant et une ANOVA ont été utilisés pour déterminer les facteurs associés à la moyenne de la connaissance globale des malformations congénitales. Les statistiques du test ont été effectuées à un niveau de signification statistique de 5 %.

RÉSULTATS: L'âge moyen des femmes était de 31,7 ± 4,8 ans. Dans l'ensemble, 93 (22,4%) des femmes avaient plus de 35 ans, 118 (29,9%) étaient des travailleurs qualifiés et 343 (84,9%) avaient un diplôme de l'enseignement supérieur. Plus de la moitié (219, 52,8%) des répondants avaient une bonne connaissance des malformations congénitales (56,4% avaient une bonne connaissance de la prévention et 66,0% avaient une bonne connaissance des facteurs de risque). Les patientes en consultation prénatale au cours de leur premier trimestre avaient un score de connaissance global moyen plus élevé (8,3 ± 4,9) par rapport à celles des deuxième (7,9 ± 4,5) et troisième (7,9 ± 4,9) trimestres, mais cela n'était pas statistiquement significatif (p = 0,873). Cependant, les répondants exerçant une profession qualifiée/ semi-spécialisée (8,62) avaient un score moyen de connaissances significativement plus élevé que ceux exerçant une profession non qualifiée/chômeur (7,33) (p=0,005).

CONCLUSION: La connaissance des malformations congénitales est relativement faible chez les femmes. Pour réduire l'occurrence et la gravité des malformations congénitales, il est nécessaire d'éduquer les mères sur les connaissances, la prévention et l'importance du dépistage des malformations congénitales. **WAJM 2021; 38(6): 531–536.**

Mots-clés: Malformations congénitales, Soins prénatals, Santé de l'enfant, Connaissances.

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INTRODUCTION

Birth defects are structural or functional abnormalities that are commonly present from birth.[1] Birth defects are major causes of spontaneous abortions and stillbirths.[2–4] The defects may be clinically obvious at birth or diagnosed only later in life.[1] Serious birth defects are life-threatening or have the potential to cause lifelong disability.[4,5]

Birth defects can be a result of genetic factors, lifestyle choices and behaviours, exposure to certain medicines and chemicals, deficiency of certain nutrients, and infections during pregnancy, or a combination of these factors.[1,6] While the exact causes of some birth defects are often unknown, risky behaviours such as smoking, using illegal drugs, and drinking alcohol while pregnant greatly increases the risk of birth defects.[1,7] Other factors that predispose to birth defects include: exposure to toxic chemicals or viruses, advanced maternal age, untreated viral or bacterial infections including sexually transmitted infections, use of certain high-risk medications such as isotretinoin and lithium and pre-existing medical conditions, such as diabetes mellitus.[1–3,5]

Many birth defects can't be prevented but for some, interventions for prevention and risk reduction such as ensuring adequate nutritional intake and using supplements like folic acid pre-conception till the end of the first trimester of pregnancy exists.[8–11] Also, there are prenatal diagnostic procedures for the early detection of birth defects such as prenatal ultrasound scans and amniocentesis.[12,13]

Birth defects may cause serious psychological stress on nursing mothers due to the potential life-long disability associated with it.[2] According to the World Health Organization factsheet on congenital anomalies, 94% of birth anomalies occur in low and middle-income countries (LMICs). This greater burden of birth defects in LMICs can be associated with late detection by mothers and health care workers.[4,14] Besides the aforementioned, poor knowledge of risk factors, preventive measures and identification of birth defects have also been suggested as contributory factors to the high burden reported in LMICs.[15–17] Multi-pronged interventions to reduce the burden of birth defects have been targeted at mothers and the health system.[15–17] Unfortunately, in Nigeria, there are no specific guidelines for screening of birth defects, implying that the responsibility for its early detection rests on mothers as primary caregivers.[18] Due to the significant consequences of birth defects, our study describes and evaluates the knowledge and awareness of birth defects among antenatal clinic attendees, at the University College Hospital, Ibadan.

METHODS

The University College Hospital, Ibadan, is a federal government-funded hospital with specialists in over 50 different clinical departments and institutes. The hospital serves as a specialist referral center for the care of a wide spectrum of medical conditions including congenital malformations in the South-Western part of Nigeria.

This cross-sectional study was conducted among all consenting women who attended the booking clinic of the antenatal clinic in the Hospital. Two research assistants who had OND qualification collected data over six months (between November 2016 and April 2017). The sample size was calculated using the formula for estimation of a single proportion.[19] A proportion of 56% (pregnant women who were knowledgeable about birth defects in Ghana)[2] was used to obtain a minimum sample size of 378. Information about respondents' socio-demographic profile, previous births, current pregnancy, use of folic acid during pregnancy, knowledge of risk factors and prevention of birth defects was obtained using a semi-structured interviewer-assisted questionnaire (interviewer-administered for the few respondents that were not literate).

Ethical approval for this study was obtained from the University of Ibadan/ University College Hospital (UI/UCH) Ethics Review Committee. Confidentiality of participants' information was maintained by ensuring the anonymity of the respondents. Written informed consent was obtained from the respondents following an explanation of the study.

Each completed questionnaire was cross-checked by the research supervisor on the spot for completeness and accuracy before it was further verified by two of the authors. Data was analyzed using IBM Statistical Package for Social Sciences (SPSS) version 22 software.[20] Descriptive statistics of socio-demographic and obstetric characteristics of respondents, knowledge of prevention of birth defects and knowledge of risk factors for birth defects were presented using frequencies and percentages.

Ten questions assessed knowledge about the prevention of birth defects and seven questions assessed the knowledge about risk factors for birth defects. To compute the knowledge scores, one point was awarded for each correct answer and zero for those whose responses were incorrect or did not know the answer. The scores were summed up to obtain the knowledge scores for the risk factor and prevention of birth defects prevention domains respectively. The overall knowledge score was obtained by summing up scores from the two domains, the calculating the mean score and standard deviation for both knowledge domains of all respondents'. Knowledge scores below the arithmetic mean scores were categorized into "poor knowledge" while respondents that had the arithmetic mean scores and above were categorized as having "good knowledge" Independent t-test and ANOVA were used to determine the socio-demographic and obstetrics factors associated with the overall knowledge of birth defect. Test statistics was done at a 5% level of statistical significance.

RESULTS

A total of 415 pregnant women attending the antenatal clinic agreed to participate in the study. The mean age of the women was 31.7 ± 4.8 years. More than half, 228 (54.9%), of the women were above 30 years, 118 (29.9%) were skilled workers and 343 (84.9%) had tertiary education (Table 1). About one-third of the respondents, 123 (29.6%), were primigravidae. A majority, 350 (84.3%), of the respondents reported using folic acid during pregnancy. Only 35 (10%) of them started before they conceived, while 276 (78.9%) started in their first trimester, 36 (10.2%) in the second trimester and 3 (0.9%) in the third trimester. (Table 2).

Table 1: Socio-demographic characteristics of the participants

Variables	Frequency(N=415)	Percentage (%)
Age		
≤ 35 years	322	77.6
>35 years	93	22.4
Occupation (n=395)*		
Skilled	118	29.9
Semi-skilled	124	31.4
Unskilled	119	30.1
Unemployed	34	8.6
Highest educational level (n=404)*		
No formal education	1	0.2
Primary education	6	1.5
Secondary education	54	13.4
Tertiary	343	84.9
Husband's highest educational level (n=402)*		
No formal education	0	0.0
Primary education	2	0.5
Secondary education	48	11.9
Tertiary	352	87.6

Table 2: Socio-demographic and Obstetric Characteristics of the Participants

Variable	Frequency (N=415)	Percentage (%)
First pregnancy		
Yes	123	29.6
No	292	70.4
Number of previous pregnancies (n-292)		
1 pregnancy	111	38.0
≥ 2 pregnancies	181	62.0
Number of previous childbirths		
1 childbirth	128	52.2
≥ 2 childbirths	117	47.8
Current gestational age		
1st trimester	63	15.2
2nd trimester	248	59.8
3rd trimester	104	25.1
Folic acid use in index pregnancy		
Yes	350	84.3
No	65	15.7
Time folic acid was commenced (n=350)		
Pre-conception	35	10.0
First trimester	276	78.9
Secoond trimester	36	10.2
Third trimester	3	0.9

**Due to missing information*

Awareness and Knowledge of Respondents on the Prevention and Risk Factors for Birth Defects

Almost three-quarter of respondents, 296 (71.3%) have heard (were aware) about birth defects. More than half (210; 60%) of the respondents were aware that birth defects are preventable. A majority, however, could not correctly identify ways of preventing birth defects (Table 3).

Regarding the awareness of risk factors for birth defects, more than two-thirds of ANC attendees at the ante-natal clinic reported that; drinking alcohol (304; 73.3%), smoking cigarette (300; 72.3%) and use of medicines that are not prescribed (284; 68.4%) are risk factors for birth defects (Table 3). Furthermore,146 (35.2%), 76 (18.3%) and 56 (13.5%) respondents reported that; use of estrogen-containing creams, mild exercises and sexual intercourse in pregnancy respectively, were risk factors for birth defects (Table 3).

More than half of the respondents, 219 (52.8%) had an overall good knowledge of birth defects with 234 (56.4%) having good knowledge of birth defects prevention and 274 (66.0%) having good knowledge of risk factors for birth defects (Table 4).

Relationship between Socio-demographic/Obstetric Characteristics and Overall Knowledge of Birth Defects

Respondents who were above 35 years (8.07) and those with tertiary education (8.20) had higher knowledge score compared to respondents who were 35 years or younger (7.96) and who attained below tertiary education (7.54) respectively. Knowledge score was also higher among respondents who had been previously pregnant (8.17) and those in the first trimester of pregnancy (8.25). A significant difference in mean was observed between those in skilled/ semi-skilled occupation (8.62) compared to those in unskilled occupation/ unemployed (7.33) ($p = 0.005$) (Table 5).

DISCUSSION

This study was conducted among women attending the antenatal clinic of a tertiary health facility in Southwest Nigeria to assess their knowledge of birth defects and its associated factors. Almost 71.3% of the respondents have heard about birth defects. The proportion of women who were aware of birth defects in this study was higher than the 25.6% level of awareness reported by Lawal, *et al* among the women, some of whom were selected from the same tertiary facility we conducted our study in.[18] The lower awareness from Lawal and colleagues can be attributed to access to information on the need for birth defect scan in their respondents attending ANC in UCH but not in the other facilities they used.[18]

Table 3: Knowledge of Birth Defects Prevention

Variable (N=415)	Yes n (%)	No n (%)	Don't Know n (%)
Awareness of birth defects			
Have you heard of birth defects	296 (71.3)	119 (28.7)	NA
Ways of preventing birth defects			
Attending antenatal care	254 (61.2)	24 (5.8)	137 (33.0)
Avoiding the use of herbal concoction in pregnancy	231 (55.7)	32 (7.7)	152 (36.6)
Having preconception care	212 (51.1)	33 (8.0)	170 (41.0)
Using folic acid before pregnancy is obvious	193 (46.5)	52 (12.5)	170 (41.0)
Avoiding exposure to X-rays in pregnancy	177 (42.7)	54 (13.0)	184 (44.3)
Preparing food with iodized salt	159 (38.3)	65 (15.7)	191 (46.0)
Using iron tablets in pregnancy	142 (34.2)	48 (11.6)	225 (54.2)
Preventing marriage between cousins	97 (23.4)	113 (27.2)	205 (49.4)
Reducing food intake during pregnancy	50 (12.0)	196 (47.2)	169 (40.7)
Avoiding sexual intercourse in the afternoons	46 (11.1)	187 (45.1)	182 (43.9)
Risk factors for birth defects			
Drinking alcohol during pregnancy	304 (73.3)	34 (8.2)	77(18.6)
Smoking before and during pregnancy	300 (72.3)	38 (9.2)	77 (18.6)
Using medicines that are not prescribed	284 (68.4)	38 (9.2)	93 (22.4)
Using toning/bleaching creams	146 (35.2)	92 (22.2)	177 (42.7)
Pregnant women who are ≥40 years	140 (33.7)	90 (21.7)	185 (44.6)
Mild exercise	76 (18.3)	216 (52.0)	123 (29.6)
Sexual intercourse	56 (13.5)	231 (55.7)	128 (30.8)

Table 4: Knowledge of Birth Defects

Variable	Frequency	Percentage (%)
Knowledge of prevention of birth defect		
Good	234	56.4
Poor	181	43.6
Median knowledge score (IQR) = 4.2 (7.0)		
Knowledge of risk factors of birth defect		
Good	274	66.0
Poor	141	34.0
Median knowledge score (IQR) = 3.8 (4.0)		
Overall knowledge of birth defect		
Good	219	52.8
Poor	196	47.2
Mean knowledge score ± SD = 8.0 ± 4.7		

While all the respondents from our study were from the University College Hospital (UCH), Ibadan, Lawal, *et al* recruited only 26% of their 714 respondents from UCH, Ibadan and this sub-population according to Lawal, *et al* had a significantly higher level of awareness in their study.[18] Similarly, a study conducted by Anzaku, *et al* in the antenatal clinic in Jos among 543 women showed that 50.6% of the women were aware of birth defects. The difference in the level of awareness can be attributed to the facilities (tertiary) they used and the fact that information on routine scanning for birth defects was provided at booking or through media advertisement.[15]

Birth defects can be prevented and more than half of the respondents from this study knew this. Regarding knowledge on preventing birth defects, 61.2% of the respondents from our study agreed that attending ANC could go a long way in preventing birth defects. This can be attributed to the fact that women attending ANC at the study site routine have anomaly scan done and would have been provided with information on the role of routine anomaly scan in detection of birth defect. Bello, *et al* also reported that the majority of the women attending ANC facilities in Ghana reported that regular check-up throughout the pregnancy period could prevent birth defects.[2] Attending ANC alone does not prevent birth defects because, some birth defects could have occurred even before women commenced antenatal care. However, some other defects especially those that are associated with environmental toxin exposure could be prevented if mothers are informed early enough during their ANC visits.[21–23]

Our study showed that women were able to identify drinking alcohol (73.3%) and smoking (72.3%) during pregnancy as risk factors for birth defects. Similar findings have been observed in other studies.[2,24] However, less than half (38.3%) were aware that consuming meals prepared with iodized salt and the use of folic acid before pregnancy were important ways of preventing the risk for birth defects. A similar finding on the knowledge of the importance of eating iodized salt in pregnancy (42.2%) was reported by Bello, *et al*.[2] This underscores a need for preconception care services, which has been reported to be low in Nigeria.[25,26] Preconception care will provide the opportunity to educate couples that are planning to conceive on the appropriate steps that help in reducing the risk of birth defects. Also, a third (33.7%) of the women from our study identified maternal age as a risk factor for birth defects. Lawal, *et al*. and studies on specific birth defects such as down syndrome in developed countries have also reported similar findings.[10,18,24,27] Gaps in ante-natal care with regards to education on birth defects had been identified in studies conducted in Ghana and Nigeria.[2,18] This could account for the low level of awareness of certain risk factors from this study.

Table 5: Relationship between Socio-demographic and Obstetric Characteristics with Overall Knowledge Score of Birth Defects

Variable	n (Mean Score±SD)	p-value
Age (n=415)		
≤ 35 years	322 (7.9 ± 4.6)	0.884
> 35 years	93 (8.1 ± 4.8)	
Occupation (n=395)		
Skilled & semi-skilled	242 (8.7 ± 4.7)	0.005*
Unskilled & unemployed	153 (7.3 ± 4.5)	
Highest educational level (n=404)		
Secondary school & below	61 (7.5 ± 4.4)	0.306
Tertiary	343 (8.2 ± 4.7)	
Gestational Age‡		
1st trimester	63 (8.3 ± 4.9)	
2nd trimester	248 (7.9 ± 4.5)	0.873
3rd trimester	104 (7.9 ± 4.9)	
First pregnancy		
Yes	123 (7.6 ± 4.6)	0.256
No	292 (8.2 ± 4.7)	
Number of previous pregnancies (n-292)		
1 pregnancy	111 (8.2 ± 4.7)	0.898
≥ 2 pregnancies	181 (8.1 ± 4.7)	
Number of previous childbirths (n=245)		
1 childbirth	128 (8.1 ± 4.8)	0.661
≥ 2 childbirths	117 (8.3 ± 4.5)	

*‡- difference of means for 3 groups (ANOVA); *-significant association*

Albeit, our study showed that more than half (56.4%) of the women had overall good knowledge of birth defects. Bello, *et al* also reported that a higher proportion of women attending antenatal clinics in three referral hospitals in Accra, Ghana had good knowledge about birth defects.[2] The level of knowledge documented in these studies could be attributed to the increased access to various prevention and diagnostic services expected at tertiary hospitals. Our study also found a significant association between class of occupation of the women attending ANC and their knowledge score. This was similar to the findings of Salunkhe *et al.* who reported a higher proportion of good knowledge on birth defect among women attending ANC at a tertiary hospital in India. They also reported a higher mean knowledge score among women who were private and government employees (higher occupational class). However, their finding was not statistically significant in contrast to our study.[16]

Although not statistically significant, this study reported higher mean knowledge scores among women in the first trimester of pregnancy, higher level of education, older women, women with a previous pregnancy and those with two or more previous childbirths While studies from Ghana and India reported no association with education and age,[2,16] some others have reported association with age and educational status.[18,28] The higher proportion of women in the first trimester with a higher level of knowledge could be due to the women's background knowledge of birth defects because of their level of education. Women in the second and third trimester who presumably had more sessions of ANC visits and possibly more health education had lower knowledge scores. This could be an indication that the health education they were exposed to did not significantly increase their level of knowledge on birth defects. The content of health education provided during ANC could therefore be modified to go beyond increasing their awareness by providing more informa-tion on the causes, other risk factors and ways of preventing birth defects.

A limitation to this study was its inability to assess the content and quality of information on birth defects provided to the mothers. Furthermore, the modality by which the health education sessions are disseminated and the effect on the knowledge of birth defects was also not assessed. This study however underscores the need for increased access to information on birth defects to women of reproductive age.

In conclusion, this study has shown that knowledge on prevention and risk factors of birth defects was average and being a skilled and semi-skilled worker was the only socio-demographic profiles of the women that was a significant determinant of their knowledge on birth defects. There is therefore a need to increase women's knowledge on birth defects. This could be done by educating mothers on the prevention, con-sequences and importance of screening for birth defects, this education can be provided to women at ANC clinics. Birth defects can also be prevented by adequately educating young women on the various ways to prevent birth defects even before conception. This can be done during marital counselling and inculcated as preconception care in the sexual and reproductive health component of school curricula. This education can also be deployed to the public through mass media, faith-based organizations (FBOs) and community-based organizations (CBOs).

DECLARATION

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Competing Interests

The authors have no competing interests.

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REFERENCES

1. Center for Disease Control and Prevention (CDC). What are Birth Defects? | CDC [Internet]. [cited 2021 Jan 7];Available from: https://www.cdc.gov/ncbddd/birthdefects/facts.html
2. Bello AI, Acquah AA, Quartey JNA, Hughton A. Knowledge of pregnant women about birth defects. *BMC Pregnancy and Childbirth* [Internet] 2013 [cited 2021 Jan 7];13(1):45. Available from: https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/1471-2393-13-45
3. Christianson A, Howson CP, Modell B. Global Report on Birth Defect: The Hidden Toll of Dying and Disabled Children. New York: 2006.
4. World Health Organization. Birth defects Report by the Secretariat. 2010.
5. Christianson RE, Van Den Berg BJ, Milkovich L, Oechsli FW. Incidence of Congenital Anomalies among White and Black Live Births with Long-Term Follow-Up. *Am J Public Health.* 1981; **71:** 1333–1341.
6. Minnesota Department of Health. Update on Overall Prevalence of Major Birth Defects – Atlanta, Georgia, 1978–2005 [Internet]. [cited 2021 Jan 8];Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5701a2.htm
7. Center for Disease Control and Prevention (CDC). Update on overall prevalence of major birth defects – Atlanta, Georgis, 1978–2005. MMWR Morb Mortal Wkly Rep [Internet] [cited 2021 Jan 8];57(1):1–5. Available from: https://data.web.health.state.mn.us/birth_metadata
8. Center for Disease Control and Prevention (CDC). Folic Acid Helps Prevent Some Birth Defects | CDC [Internet]. [cited 2021 Jan 8];Available from: https://www.cdc.gov/ncbddd/folicacid/features/folic-acid-helps-prevent-some-birth-defects.html
9. Center for Disease Control and Prevention (CDC). Commit to Healthy Choices to Help Prevent Birth Defects | CDC [Internet]. [cited 2021 Jan 8]; Available from: https://www.cdc. gov/ncbddd/birthdefects/prevention.html
10. Bannink F, Larok R, Kirabira P, Bauwen L, van Hove G. Prevention of spina bifida: Folic acid intake during pregnancy in Gulu district, northern Uganda. *Pan Afr Med J.* 2015; **20:** 1–9.
11. Conlin ML, Maclennan AH, Broadbent JL. Inadequate compliance with periconceptional folic acid supplementation in South Australia. *Aust New Zeal J Obstet Gynaecol.* 2006; **46:** 528–533.
12. Carlson LM, Vora NL. Prenatal Diagnosis: Screening and Diagnostic Tools. *Obs Gynecol Clin North Am.* **44:** 245–256.
13. Lloyd-Puryear MA, Tonniges T, Van Dyck PC, Mann MY, Brin A, Johnson K, *et al.* American Academy of Pediatrics Newborn Screening Task Force recommendations: How far have we come? *Pediatrics.* 2006: **117:** 194–211.
14. World Health Organization (WHO). Congenital anomalies [Internet]. [cited 2021 Jan 8];Available from: https://www.who.int/en/news-room/fact-sheets/detail/congenital-anomalies
15. Anzaku AS. Assessing folic acid awareness and its usage for the prevention of neural tube defects among pregnant women in Jos, Nigeria. *J Basic Clin Reprod Sci.* 2013; **2:** 13.
16. Salunkhe J, Naregal P, Hiremath P, Mohite V. (PDF) Knowledge of Pregnant Women About Congenital Anomalies: A Cross-Sectional Study at Krishna Hospital Karad Krishna Institut. Indian J Res [Internet] 2016;5(8):161–4. Available from: https://www.researchgate.net/publication/320585935_Knowledge_ of_Pregnant_Women_About_Congenital_ Anomalies_A_CrossSectional_Study_ at_Krishna_Hospital_Karad_Lecturer_ Psychiatric_Nursing_Krishna_Institute_of_nursing_Sciences_Karad_Clinical_ Instructor_C
17. Timmermans S, Jaddoe VWV, Mackenbach JP, Hofman A, Steegers-Theunissen RPM, Steegers EAP. Determinants of folic acid use in early pregnancy in a multi-ethnic urban population in The Netherlands: The Generation R study. *Prev Med (Baltim).* 2008; **47:** 427–432.
18. Lawal TA, Yusuf OB, Fatiregun AA. Knowledge of birth defects among nursing mothers in a developing country. Afr Health Sci. 2015; **15:** 180–187.
19. Kirkwood BR, Sterne JAC. Essential medical statistics [Internet]. Second. Oxford University Press; 2003. Available from: http://onlinelibrary.wiley.com/doi/10.1002/sim.1961/full
20. IBM Corp. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
21. Baldacci S, Gorini F, Minichilli F, Pierini A, Santoro M, Bianchi F. Review of epidemiological studies on individual and environmental risk factors in the aetiology of congenital heart defects. *Epidemiol Prev.* 2016; **40:** 185–196.
22. Baldacci S, Gorini F, Santoro M, Pierini A, Minichilli F, Bianchi F. Environmental and individual exposure and the risk of congenital anomalies: A review of recent epidemiological evidence. *Epidemiol Prev.* 2018; **42:** 1–34.
23. Nicoll R. Environmental contaminants and congenital heart defects: A re-evaluation of the evidence [Internet]. *Int J Environ Res Public Health.* 2018 [cited 2021 Apr 27];15(10). Available from: https://pubmed.ncbi.nlm.nih.gov/30257432/
24. Hackshaw A, Rodeck C, Boniface S. Maternal smoking in pregnancy and birth defects: a systematic review based on 173 687 malformed cases and 11.7 million controls. *Hum Reprod Update.* 2011; **17:** 589–604.
25. Olowokere AE, Komolafe A, Owofadeju C. Awareness knowledge and uptake of preconception care among women in Ife Central Local Government Area of Osun State Nigeria. *J Community Med Prim Heal Care.* 2015; **27:** 83–92.
26. Ezegwui HU, Dim C, Dim N, Ikeme AC. Preconception care in South Eastern Nigeria. *J Obstet Gynaecol (Lahore).* 2008; **28:** 765–768.
27. Levis DM, Harris S, Whitehead N, Moultrie R, Duwe K, Rasmussen SA. Women's knowledge, attitudes, and beliefs about Down syndrome: A qualitative research study. *Am J Med. Genet Part A* [Internet] 2012 [cited 2021 Jan 8];0(6):1355–62. Available from: /pmc/articles/PMC4706760/?report=abstract
28. Masoumeh P, Vahid K, Samira K, Hamid A, Khosheh K. Knowledge of pregnant women about congenital anomalies: A cross-sectional study in north of Iran. *Indian J Heal Sci* [Internet] 2015 [cited 2021 Jan 8];8(1):41. Available from: http://www.ijournalhs.org/text.asp?2015/8/1/41/158230.