Survey of Risk Factors During Pre- and Post-Conception Periods in Mothers of Babies with Structural Birth Defects Seen at a Tertiary Hospital in Nigeria

Rosemary O. Ugwu* and Augusta U. Eneh

Department of Paediatrics and Child Health, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria

Abstract: *Background:* Although some birth defects have a genetic origin, certain factors in the mother may have a direct effect on fetal development and increase the risk of having a baby with birth defect.

Objectives: To assess the prevalence of risk factors during the pre- and post-conception periods in mothers of babies with birth defects at the University of Port Harcourt Teaching Hospital, Nigeria.

Method: Data from an ongoing study on birth defects at the University of Port Harcourt Teaching Hospital were extracted for neonates seen from January 2006 to December 2011. Sociodemographic data and information on pre-and post-conception exposure of the mothers to risk factors were obtained using a semi-structured questionnaire. Each child was examined to describe the type and extent of defect(s).

Results: Birth defect was identified in 501 (8.9%) out of 5,604 babies admitted within the study period. There were 273 (54.5%) males, 220 (43.9%) females and 8(1.6%) with indeterminate gender. The mean gestational age at delivery was 38.5±2.6 weeks and the mean birth weight was 2846±885g.

The mean maternal age was 29.1±5.2 years with 412 (82.2%) being less than 35 years.

The preconception and post conception risk factors identified include overweight/obesity 256 (51%), alcohol consumption 208 (41.5%), low socioeconomic status 217 (43.3%), non-medical abortion 245(34.7%), use of therapeutic drugs that are teratogenic (27.5%) and local herbs (23.8%). A hundred and twenty-six (17.8%) had a history of repeated miscarriages, 52 (10.4%) had hypertension while 20(4%) had diabetes. In 22 (4.4%) babies, there was a positive family history of a previous birth defect. Seventeen mothers (3.4%) had attempted unsuccessfully to terminate the index baby with birth defect using alcohol-based native herbs. In 198 (39.5%), no risk factors were documented.

Conclusion: Overweight/obesity, low socioeconomic status and alcohol consumption pre- and post-conceptually appears to be major risk factors for the occurrence of birth defects in babies delivered to these rather young women in the Niger Delta. Maternal risk factors should be assessed in order to provide modifications during preconception care for a better pregnancy outcome.

Keywords: Congenital abnormalities, maternal risk factors.

1. INTRODUCTION

Birth defects are structural or functional abnormalities which are present at birth and may constitute a major cause of perinatal and neonatal deaths [1, 2, 3]. Birth defects can be as a result of genetic problems (chromosomal, single gene disorders, multiple gene disorders) or environmental factors (lifestyle choices and behaviors, exposure to certain infections, medications, and environmental toxins/chemicals, and pre-existing maternal medical conditions) or intrauterine environment that cause deformation or disruption of already formed foetal tissues. Prenatal environment can also affect the genetic factors especially in birth defects linked to multifactorial causes [4].

Most birth defects occur in the first three months of pregnancy, when the organs of the foetus are forming. The fetal tissues and organs however continue to grow and develop during the last six months of pregnancy and so, some birth defects can occur later in pregnancy. In developing countries where infections, birth asphyxia and prematurity are still the major causes of neonatal morbidity and mortality [1], little attention is paid to babies with birth defects. Although in some cases, it is difficult to determine the cause of birth defects, certain factors in the mother may have a direct effect on fetal development and increase the risk of having a baby with birth defect. The objective of the study was to assess the prevalence of risk factors during the pre- and post conception periods in mothers of babies with structural birth defects at the University of Port Harcourt Teaching Hospital.

2. METHOD

This was a prospective cross sectional survey of all babies with structural birth defects admitted into the

*Address correspondence to this author at the Department of Paediatrics and Child Health, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria; Tel: +234 803 668 8692; E-mail: rossaire2003@yahoo.com

E-ISSN: 2311-8687/16

Table 1: General Characteristics of the Neonates with Birth Defects

Characteristics	No. Admitted No.(%)	No. with Birth Defects No.(%)	% of Total Admitted	*p*-Value
Total	5604	501 (8.9)		
Male	3126 (55.8)	273 (54.5)	8.73	
Female	2470 (44.1)	220 (43.9	8.91	0.83
Indeterminate	8 (0.1)	8 (1.6)		
Male: Female	1.3:1	1.2:1		
Inborn	3592(64.1)	162 (32.3)	4.51	
Outborn	2012(35.9)	339 (67.7)	16.85	0.00
Low birthweight	1543(27.5)	180 (35.9)	11.67	
Normal birth weight	4061 (72.5)	321 (64.1)	7.90	0.00
Preterm	1307 (23.3)	67 (13.4)	5.13	
Term	4297 (76.7)	434 (86.6)	10.10	0.00

Special Care Baby Unit (SCBU) of the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria between January 2006 and December 2011 (a six-year period) in order to identify the risk factors in the mother. Data was part of a larger study on birth defect surveillance going on in the hospital. The survey was approved by the Ethics Committee of the hospital and consent was obtained from the parents after duly explaining the nature of the study to them.

All the babies with visible birth defects admitted within the study period were identified and included in this study. Sociodemographic data and information on the three months pre-and post conception exposure of the mothers to risk factors were obtained using a semi-structured questionnaire. Obstetric and clinical data were collected through interviews with mothers (in the immediate postpartum) as well as consulting of medical records of the mother. Maternal factors assessed include age, parity, maternal medical illnesses, and obstetric complications, types of drugs taken three months before and after conception, alcohol consumption and tobacco use. Body mass index of the mother was based on the height and maternal report of weight prior to pregnancy. The socioeconomic status was determined using the level of education attained and the occupation of the mothers [5]. The gestational age of the child was calculated from the first day of last menstrual period (LMP) of the mother. Where this is not available, the Dubowitz score [6] was used to determine or validate the reported gestational age. A complete physical examination of the babies was done on admission into the unit by at least two of the attending Consultant Neonatologist. The details of each child's anomaly were documented in the questionnaire designed for the surveillance. Plain/contrast radiographs, echocardiography and ultrasonography were done when necessary for some babies.

The birth defects were classified into single system abnormalities (minor or major), multiple abnormalities (if major anomalies involve more than 2 systems), syndromes or genetic disorders. Major birth defects were defined as malformations that are generally life threatening or lead to developmental or physical disabilities or that require specific surgical or medical management [7, 8] Minor anomalies were described as features that vary from those that are most commonly seen in the normal population but which does not impair the child's development or well being [7-9] Syndromes were characterized based on the presence of a constellation of major and minor anomalies that occur together in a predictable fashion presumably due to a single underlying etiology that create a recognizable phenotype and which point to a specific syndrome diagnosis or known association.

3. RESULTS

Birth defect was identified in 501 (8.9%) babies out of the 5,604 babies admitted within the period. There were a total of 16,734 live deliveries and 162 babies with birth defects delivered in the hospital within the same period giving an incidence rate of 9.7/1000 live births There were 273 (54.5%) males, 220 (43.9%) females and 8(1.6%) with indeterminate gender. The incidence of birth defects was significantly more in babies who were delivered outside the hospital, term babies and low birth weight babies (Table **1**).

The mean birth weight of the babies was 2846± 885g (range 750g–6800g), mean length was 46.8±16.5cm **(**range 34-62cm), and the mean

occipitofrontal circumference was 34.6 ±17.6cm **(**range 20-52cm). There were 11 sets of twins and 3 sets of triplets. In 3 sets of the multiple births, the birth defect was concordant (both twins had the same birth defect), while in 11 sets, only one of a set of twin/triplet had the birth defect. In 22 (4.4%) babies, there was a positive history of a previous birth defect in the family. Eight (36.4%) of them had similar malformations with a previous family member.

4. STRUCTURAL BIRTH DEFECTS IN THE BABIES

The systems most commonly involved were the digestive system in 196 (39.1%) and the central nervous system in 110 (22%). Major defects were the commonest birth defects in 444 (88.6%), while minor birth defects occurred in 57 (11.4%). Table **2** shows the system involved and the types of the malformations seen.

Table 2: Types of Birth Defects Seen According to Systems Involved

Birth defect	No. (%)	Birth defect	No. (%)
	Digestive system 196 (39.1)		
*Neonatal Intestinal Obstruction	105(20.9)	†Anterior abdominal wall defect	50 (10)
Cleft lip/palate	24 (4.8)	Oesophageal atresia± TOF[#]	9 (1.8)
Inguinoscrotal hernia	4 (0.8)	Macrostomia	2 (0.4)
Biliary atresia	1 (0.2)	Ranula cyst	1(0.2)
	Central nervous system 110 (22.0)		
Neural tube defects	93 (18.6)	Hydrocephalus	14 (2.8)
Microcephaly	3 (0.6)		
	Cardiovascular system38 (7.6)		
Ventricular septal defects	16 (3.2)	Atrial septal defects	8 (1.6)
Transposition of the great arteries	6 (1.2)	Patent ductus arteriosus	6 (1.2)
Tricuspid atresia	2 (0.4)		
	Musculoskeletal system36 (7.2)		
Talipes	13 (2.6)	Polydactyly	10 (2.0)
Genu recurvatum	4 (0.8)	Amniotic constriction bands	3 (0.6)
Syndactyly	2 (0.4)	Sacrococcygeal teratoma	1 (0.2)
Sternal cleft	1 (0.2)	Phocomelia	1 (0.2)
Preauricular tags	1(0.2)		
	Urogenital system 28 (5.6)		
Posterior urethral valve	12 (2.4)	Hypospadias	6 (1.2)
Ectopia vesicae/Cloacal exstrophy	6 (1.2)	Clitoral enlargement	2 (0.4)
Epispadias	1 (0.2)	Ovarian cyst	1 (0.2)
	Genetic Disorders 26 (4.8)		
Down Syndrome	15 (3.0)	Trisomy 13	2 (0.4)
Trisomy 18	5 (1.0)	Polycystic kidney disease	2 (0.4)
Achondroplasia	2 (0.4)		
	Non-genetic Syndromes 18 (3.6)		
Beckwith Wiedemann Syndrome	6 (1.2)	Pierre Robin Syndrome	3 (0.6)
Prune Belly Syndrome	2 (0.4**)**	Foetal alcohol syndrome	2 (0.4)
Rubella Syndrome	2 (0.4)	Thrombocytopenia absent radius	1 (0.2)
Pentalogy of Cantrel	1 (0.2)	Sirenomelia	1 (0.2)
	Eye 9 (1.8)		
Cyclops	2 (0.4)	Ectropion	6 (1.2)
Cataract	1 (0.2)		
	Haematological system 6 (1.2)		
Cystic hygroma	2 (0.4)	Haemangioma	4 (0.8)
	Respiratory system4 (0.8)		
Diaphragmatic hernia	2 (0.4)	Choanal atresia	1 (0.2)
Laryngeal web	1(0.2)		
	Multiple abnormalities 30 (6.0)		

*The neonatal intestinal obstruction include jejunoileal atresia (40), imperforate anus (29), dueodonal atresia (18), Hirschsprung disease (9), Pyloric web (6), Gastric mucosal web (1), Ladd bands (1), and Annular pancreas (1).

†The anterior abdominal wall defects include omphalocoele (33) and gastroschisis (17).

#TOF = Tracheo-oesophageal fistula.

5. MOTHER'S SOCIODEMOGRAPHIC PARAMETERS

The mean maternal age was 29.1± 5.2 years (range 17-43years). Majority, 412(82.2%) of the mothers were less than 35 years while 89(17.8%) were 35 years and above (Table **3**). All mothers of babies with chromosomal abnormalities were however above 35 years. No consanguineous union was reported.

Table 3: Mother's Sociodemographic Characteristics

Characteristics	No.(%)
a. Age (years)	
< 20 years	6(1.2)
20–24 years	100(20.0)
25–29 years	162(32.3)
30–34 years	144(28.7)
≥ 35 years	89(17.8)
b. Body Mass Index (Kg/m^2)	
Underweight (< 19)	12(2.4)
Normal (19-25)	233(46.5)
Overweight (> 25 < 30)	122(24.4)
Obese (≥ 30)	134(26.8)
c. Parity	
1	154(30.7)
2	145(28.9)
3	81(16.2)
≥4	121(24.2)
d. Socioeconomic Status	
Low	217(43.3)
Middle	162(32.3)
High	122(24.4)
e. Intake of alcohol	
Yes	208(41.5)
No	293(58.5)
f. Alcohol type	
Beer	95(45.7)
Spirit*	52(28.3)
Wine	17(8.2)
Palmwine	5(2.4)
Mixed	32(15.4)
g. Smoking habit	
Yes	10(2)
No	491(98)

(*Spirits were often taken alone or mixed with local roots and herbs).

The mean maternal height was 161.1±6.3cm (range 146cm–180cm) while the mean maternal weight was 69.6±14.8 (range 45–115Kg). Mean body mass index (BMI) was 26.7±5.2Kg/m^2 (range 17.9–44.9Kg/m^2). Based on the level of education and occupation, 217(43.3%) were of low socioeconomic status. Two hundred and eight (41.5%) of the mothers reported taking alcoholic beverage regularly (≥3 drinks per week) within three months before conception and three months after conception. Seven (1.4%) mothers used tobacco during pregnancy in the form of cigarette or snuff, while 3 (0.6%) used Indian hemp. In contrast, 56(11.2%) fathers smoked tobacco, 10(2%) smoked marijuana and 7 (1.4%) used Indian hemp.

6. OBSTETRIC HISTORY

Four hundred and thirty-five (86.8%) mothers had their pregnancy supervised, while 66 (13.2%) had no antenatal care. In 17 (3.4%), the birth defect was diagnosed prenatally. The mean gestational age at booking was 19.96±6.82 weeks (range 6–36 weeks). A hundred and eight (24.8%) had their pregnancy supervised from the first trimester, 248 (57%) from the second trimester and 79 (18.2%) from the third trimester.

The mean gestational age at delivery was 38.5±2.6 weeks **(**range 28–43 weeks). Three hundred and twenty-two (64.3%) were delivered by spontaneous vertex, 154 (30.8%) by caesarean section, 20 (4.0%) by breech extraction, and 5 (0.9%) by vacuum extraction.

In 154 (30.7%), the index baby with birth defect was the mother's first pregnancy. Forty-six mothers (6.5%) had a history of infertility, 126(17.8%) had a history of repeated miscarriages while 245(34.7%) had a non-medical abortion prior to the delivery of the child with a birth defect. Of those that had an abortion, 17(6.9%) was by use of drugs like mesprogene, Andrews liver salt, lime and "kaikai" (locally brewed spirit), and high dose "white quinine", 217(88.6%) was by cervical dilatation and curettage and 11(4.5%) used native herbs. Seventeen mothers (3.4%) had attempted unsuccessfully to terminate the index baby with birth defect using alcohol-based native herbs.

7. MATERNAL MEDICAL ILLNESSES AND OBSTETRIC COMPLICATIONS

The commonest maternal medical illness was acute malaria 161(32.1%) while the commonest obstetric complication was pregnancy-induced hypertension 42(8.4%). Two hundred and sixty-eight (53.5%) mothers reported neither medical illness nor obstetric complications (Table **4**).

Table 4: Maternal Medical Illnesses and Obstetric Complications

Medical illness /Obstetric complications	No. (%)
None	268(53.5)
Acute malaria	161(32.1)
Pregnancy induced hypertension	42(8.4)
Urinary tract infection	15(3.0)
Polyhydramnios	14(2.8)
Gestational diabetes mellitus	13(2.6)
Human immunodeficiency virus disease	12(2.4)
Prepregnancy hypertension	10(2.0)
Respiratory tract infection	10(2.0)
Oligohydramnios	10(2.0)
Hepatitis	7(1.4)
Prepregnancy diabetes mellitus	7(1.4)
Threatened abortion	6(1.2)
Peptic ulcer disease	5(1.0)
Goitre	4(0.8)
Mental illness	4(0.8)
Asthma	4(0.8)
Epilepsy	2(0.4)
Severe malaria with severe anaemia	2(0.4)
Vaginal candidiasis	2(0.4)
Chicken pox	2(0.4)
Sickle cell disease	1 (0.2)

Table 5: Drugs Taken by the Mothers in the Pre and Post Conception Periods

Drugs	Preconception No. (%)	Post Conception No. (%)
Antimalarial	120(24)	265 (52.9)
Herbs/root (mostly alcohol-based)	70(14)	119 (23.8)
Alcohol	66(13.2)	159 (31.7)
Folic acid/fersolate)	52(10.4)	379 (75.6)
Antibiotics	35(7)	64 (12.8)
Supplements	18(3.6)	50 (10)
Antihypertensives	10(2)	34 (6.8)
Analgesics	10(2)	12 (2.4)
Metformin	5(1)	2(0.4)
Antiretrovirals	4(0.8)	8 (1.6)
Fertility drugs	0(0)	7 (1.4)
Antacid	0(0)	6 (1.2)
Carbamazepine	2(0.4)	2 (0.4)
Contraceptive	2(0.4)	0 (0)
Antithyroid drugs	2(0.4)	0 (0)
Insulin	0(0)	12 (2.4)
None	363(72.4)	95 (19)

8. DRUGS TAKEN BY THE MOTHERS IN THE PRE AND POST CONCEPTION PERIODS

The commonest drug or substance consumed in the preconception period were antimalarials, and alcohol (alone and mixed with herbs) while in the postconception period, folic acid/fersolate, antimalarials, alcohol and herbs top the list (Table **5**). A hundred and thirty-eight (27.5%) women were exposed to therapeutic drugs (purchased over the counter) with known teratogenic potential especially before conception and/or during the first trimester of pregnancy (Angiotensin converting enzyme inhibitors 18; B-blockers 12; metformin 5; antithyroid 2; tetracycline 7; streptomycin 10; gentamicin 15; ciprofloxacin 11; non steroidal anti-inflammatory drugs 12; fertility drugs 7; contraceptives 2, antacids 2; mefloquine 10; fansidar 23; carbamazepine 2). Two (0.4%) mothers were exposed to multiple X-rays in the immediate post-conception period before they realized they were pregnant. Overall, in 198 (39.5%) mothers, no risk factors were documented, while 303 (60.5%) mothers had one or more risk factors.

9. OUTCOME

Eighty-nine (17.8%) babies had surgery. Eight (1.6%) were abandoned in the hospital, 14(2.8%) were taken away by parents against medical advice while 183 (36.5%) died. The overall mortality among the 5,604 babies admitted within the study period was 1,045(21.3%), thus babies with birth defects constituted (17.5%) of the overall neonatal mortality. The difference in the mortality rates between babies with birth defects and the overall admission was significant (p=0.00).

10. DISCUSSION

The prevalence of birth defects in this study was 8.9%. Globally, the prevalence of congenital abnormalities vary greatly from country to country. It was reported to be as low as 0.73% in Taiwan [10], 2.9% in Korea[11] and 4.3% in Sri-Lanka [12]. In the US the reported prevalence was 2-3% [13]while in Europe [14], it was 2% and in China [15] it was 1.56%. The global birth prevalence of all birth defects ranges from 39.7/1000 to 82/1000 live births [16].

The most common systems involved were digestive (39.1%) and central nervous (21.9%) systems. This was similar to the findings in the other reported studies [17- 19]. It however differed from a Libyan study which found fewer digestive system malformations [20], an Indian [21] and South African [22] studies which found the central nervous system followed by musculoskeletal system to be most affected. Another Indian study [23] and Saudi Arabia study [24] found congenital malformations of the cardiovascular to be the commonest. The commonest major birth defects were neonatal intestinal obstruction (23.6%), neural tube defects (20.9%) and anterior abdominal wall defect (11.3%). This was similar to the findings in other studies [19, 25].

The risk of delivering a child with birth defect has been known to increase with advancing maternal age, (rising exponentially after a woman reaches the age of 35 years) [26, 27]. This may be linked to the increased incidence of aneuploidies with maternal age which results from nondisjunction that occurs in the period of meiosis during maternal oogenesis. This will lead to increased fetal chromosomal abnormalities. In this survey however, birth defects occurred more in babies of young mothers between 20 and 30 years as was also reported by Taksande *et al,* [23]. Both lower and higher maternal age may pose increased risks for birth defects however, it seems that while young maternal age increases the risk of some congenital anomalies, advanced maternal age increases the risk of chromosomal abnormalities [26- 28]. All mothers of babies with chromosomal abnormalities in this survey were above 35 years. Also majority of the babies with congenital anomalies were of the first order (30.7%), and second order (28.9%). Some studies [21, 23] have reported a higher incidence of malformation among the mothers of gravida 4 or more thus indicating that as the birth order increases, the incidence of congenital anomalies also increases. This was not the case in this study.

Neural tube defect (NTD) was one of the commonest birth defect. Taking folate supplements prior to conception and during pregnancy has been found to decrease the risk of NTDs [29]. Although 86.8% of the mothers had antenatal care, majority of the pregnancies were supervised from the second trimester. Majority of the mothers did not receive pre-pregnancy folic acid, and even when started in pregnancy, was usually after the first trimester (after the NTD must have developed).

Family or personal history of birth defects or other genetic disorders are also known to increase an individual's risk of having a child with birth defect [30]. In 4.4% of the cases, there was a positive family history of a birth defect. Culturally, many families conceal their family history of any birth defects which will make it very difficult to fully determine familial factors that may increase the risk for genetic problems in a future pregnancy. Consanguinity (marriage between two closely related individuals) increases the prevalence of congenital anomalies especially those that are genetically determined [31, 32]. There was no consanguinity reported in the mothers and this may have contributed to the low level of genetic disorders seen in the study. In contrast, in studies done in United Arab Emirates and Saudi Arabia where consanguineous marriages are common, there was a high prevalence of genetic disorders [17, 19, 33, 34].

Although some birth defects are inherited, others are a product of some therapeutic drugs taken during pregnancy which have teratogenic potential. These drugs were usually purchased over the counter. In this study 27.5% of mothers were exposed to drugs known to have adverse foetal outcome. Carbamazepine affects folate metabolism and fetal development and is linked to development of cleft lip/palate and NTDs [35] Administration of angiotensin converting enzyme inhibitors during the second and third trimesters can result in a number of fetal adverse effects, including growth retardation, renal failure and persistent ductus arteriosus [36]. It is difficult to fully determine the extent to which ingestion of a particular medication will cause congenital abnormalities as many women take medications during pregnancy which they may not readily recall after delivery. Moreover, the content of many local herbs are not known. It was observed that 3.4% of the women used alcohol-based herbs to attempt termination of index pregnancy which may also have increased the risk of structural birth defects. In this study, forty-six (6.5%) mothers had a history of infertility and took some fertility drugs in order to achieve conception. It is not fully understood whether these birth defects were caused by the infertility treatment itself or the underlying reason for the infertility.

Another major factor linked to abnormal prenatal development is maternal malnutrition (either overnutrition or undernutrition). Maternal obesity is associated with an increased risk of birth defects especially NTDs [37- 39]. Over 50% of the mothers in this survey were either overweight or obese. Prentice

and Goldberg [38] suggested that folic acid loses its protective benefit in overweight and obese mothers.

Low socioeconomic status has been found to be an indirect determinant of delivery of a child with birth defect. Congenital anomalies have been reported to be more frequent among resource constrained families and countries [40, 41]. It has been estimated that about 94% of severe birth defects occur in middle- and low-resource countries [16], where mothers are more susceptible to macronutrient and micronutrient malnutrition and may have a poor lifestyle, and more likely to be living in an area that promotes behaviors like smoking, alcohol and drug abuse and which contains hazardous substances all of which may cause abnormal fetal development [40, 41]. Over 40% of mothers were in the low socioeconomic class.

Alcohol use in pregnancy is a well-known cause of congenital abnormalities. In this survey, 41.5% of the mothers were taking alcohol regularly before and after conception. Even moderate amounts of alcohol in pregnancy can cause developmental problems in the unborn baby and problems with thinking and memory as well as behavioural issues later in life. These conditions however are not obviously apparent at birth and may be missed as birth defects. In mothers who are consuming alcohol-based herbs, it is often difficult to determine whether teratogenicity is as a result of the alcohol or the herbs whose active ingredients are not often known.

Smoking during pregnancy has been linked to fetal growth restriction, premature birth, increased risk of stillbirths and cleft lip and/or palate [42]. Smoking may also cause neurobehavioural problems and problems with the development of the brain, cardiovascular system, and respiratory system. This is true whether the mother smokes herself or is exposed to tobacco smoke. Paternal smoking prior to conception has also been linked with an increased risk of congenital abnormalities and childhood cancers in offspring [43]. Paternal smoking not only causes oxidative damage and DNA mutations in the germ line of the father, which can be inherited by the offspring, but also exposes the foetus to passive tobacco smoke which can also make the foetus more susceptible to damage from carbon monoxide. Smoking during pregnancy in form of tobacco, marijuana (Indian hemp) or cocaine was documented in 2% of the mothers and 14.6% of the fathers.

Important infections in the mother that can affect the developing baby during pregnancy include chickenpox, hepatitis B, Human immunodeficiency virus (HIV), syphilis, herpes simplex virus, rubella, parvovirus B19, toxoplasmosis and cytomegalovirus [16]. Majority of these intrauterine infections even when asymptomatic interfere with normal metabolism and cell movement which will lead to birth defects. Seven (1.4%) mothers had Hepatitis, 12 (2.4%) had HIV while 2 (0.4%) had chicken pox and 2 babies were diagnosed with congenital rubella syndrome although the mothers could not recall having had fever with rash during pregnancy.

A number of pre-existing chronic illnesses in the mother like diabetes mellitus, hypertension and epilepsy are linked with an increased risk of congenital abnormalities or fetal growth restriction [16]. Maternal diabetes has been linked with development of cleft lip and palate as well as heart defects. Thyroid disorders can cause foetal hypothyroidism and mental retardation. In some maternal conditions, the risk lies with the drugs used for treatment, rather than the illness itself.

Mortality was 36.5% which represented 17.5% of the overall neonatal mortality within the study period. Iroha *et al,* [18] and Swain *et al,* [21] documented that the contribution of such malformations to neonatal mortality was 11.9% and 12.8% respectively. This shows that birth defects contribute a significant burden to neonatal mortality. This may be because some of the defects are either not compatible with life or are life threatening while some are not surgically correctable.

CONCLUSION

While most mothers have risk factors for delivering a child with birth defects, others have no identifiable risk factors. Overweight/obesity, low socioeconomic status and alcohol consumption appear to be major risk factors for the occurrence of birth defects in babies delivered to these rather young women. Although not all birth defects can be prevented, the chances of having a well formed baby can be greatly improved by adequate management of any chronic maternal health conditions as well as adopting healthy lifestyle behaviors before conception. This is important because many birth defects happen very early during pregnancy, sometimes before a woman even knows she is pregnant. In order to improve the chances of a healthy pregnancy outcome, a woman's risk factors related to a variety of health issues (lifestyle, medications, and exposures) should be assessed in order to provide modifications during preconception care for a better outcome.

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Received on 26-04-2016 Accepted on 09-05-2016 Published on 15-07-2016

DOI: http://dx.doi.org/10.12974/2311-8687.2016.04.01.5