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Original Research Article

The Incidence of Congenital Anomalies among Newborns at Pumwani Hospital, Nairobi, Kenya

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ABSTRACT

Congenital anomalies are an under recognized cause of mortality and disability in children under five years of age in the developing countries. Among Low and Middle Income Countries (LMICs), overwhelming majority of children die of congenital anomalies. The extent of congenital problems in Kenya is not clearly understood and documented. The objective of this study was to examine incidences of neonatal congenital anomalies among newborns at Pumwani Maternity Hospital (PMH) in May 2014 through April 2015.

A descriptive cross sectional study was utilized to review and to extract pertinent data. The data was abstracted from Research Electronic data Capture (RED Cap) and analyzed on R for statistical computing.Out of 6633 new-borns at PMH 129 new-borns had congenital anomalies giving an overall incidence rate of 1.94% of the total admissions (95% confidence interval 1.64, 2.31). Musculoskeletal system was the most common, accounting for 0.95% of total births. The central nervous system and the genital organs were equally affected with 0.12% of total admissions each. Congenital talipes equinovarus was the leading congenital anomaly of the musculoskeletal system (53.97%) followed by polydactyl with 17.46%. More males 79 (61.24%) had congenital anomalies than their female counterparts 48 (37.20%).

The findings highlight the need to step up efforts to fight congenital anomalies in Kenya. Primarily public health needs to focus on preventive interventions for congenital anomalies. Further research is needed to comprehensively document all risk factors in the Kenyan setting to help in make informed health care decisions.

Key Words: Congenital anomalies, neonatal anomalies, Kenya

INTRODUCTION

One of the Millennium Development goals was to reduce child mortality by two thirds by 2015 from that of 1990. Remarkably, the number of deaths of children under 5 years of age fell from 12.7 million in 1990 to 6.3 million in 2013 worldwide (WHO). [1] Not surprising, the percentage of underweight children under 5 years old dropped from 28% to 17% in 2013. Strangely, though, the report shows that while overall mortality of under five years old dropped, mortality rates of Nenatals increased from 37% in 1990 to 44% in 2013. [2] That being the case, reducing neonatal deaths is a recognized public health issue requiring attention and action to reverse it. [3] Congenital anomalies are key cause of childhood mortality, chronic illness and disability accounting for 7% of all deaths in children aged less than five years. [4]

Congenital anomalies are defined by WHO as structural or functional anomalies,

including metabolic disorders that occur during intrauterine life and can be identified prenatally, at the time of birth or later in life. [4] Congenital anomalies are also referred to as congenital malformations, congenital disorders or birth defects. In a congenital malformation, the development of a structure is arrested, delayed or misdirected early in embryonic life and the effect is permanent. [5] The most common major structural abnormalities include congenital heart disease, NTDS, orofacial clefts and limb reduction defects. [6] Congenital anomalies can involve many different organs including the brain, heart, lungs, liver, bones and intestinal tract among other systems of the body. [5]

Although there are some known causes and risk factors for congenital anomalies, approximately 50% of all congenital anomalies cannot be linked to as specific cause. [6] Some of the known types of risk factors include; genetic factors, environmental, social and demographic factors, infection and maternal nutrition status. [6,7] In about 25% of congenital anomalies, the causes seem to be multi-factorial indicating a complex interaction between genetic and environmental risk factors. [8]

Among social and demographic factors, Low income is considered an indirect determinant of congenital anomalies. In such settings women often lack access to sufficient, nutritious food, and may have increased exposure to agents or factors such as infection and alcohol that increase the incidence of abnormal prenatal development. [4] Advanced maternal age increases the risk of chromosomal abnormalities such as Down syndrome, trisomy 13 and trisomy 18. [9] A study conducted among polish population further reported that young maternal age carried a higher risk for NTDs. In addition, the study showed that both young and advanced paternal age is associated with some congenital anomalies. Young paternal age was associated with gastroschisis while advanced paternal age was associated with hypospadias, cleft palate, and cleft lip (with or without cleft palate). [10]

A wide range of environmental factors such as exposure to teratogens has also been implicated in the occurrence of birth defects. Environmental pollution can in principle cause congenital anomalies through preconceptional mutagenic action (maternal or paternal) or postconceptional teratogenic action (maternal. [11] Congenital anomalies caused by postconceptional teratogenic exposure, depends on the precise timing of exposure in embryonic and fetal development. [11] Maternal exposure to certain pesticides and other chemicals, certain medications, alcohol, tobacco, psychoactive drugs and radiation exposure during pregnancy increases the risk of giving birth to a newborn with congenital anomalies. [4] Prescription of iatrogenic drugs, especially in the first trimester during pregnancy is associated with causation of several types of congenital limb anomalies. [9,10] Women who smoke during pregnancy are more likely to have infants with congenital anomalies such as congenital heart defects, musculoskeletal defects, orofacial defects and gastrointestinal defects. [5,12] Working or living near, or in, waste sites, smelters or mines may also be a risk factor especially if the mother is exposed to other environmental risk factors or nutrition deficiencies. [4]

Maternal disease such as syphilis, rubella and maternal illness like diabetes mellitus are a significant cause of congenital anomalies. [13,14] In diabetic mothers, developmental morphologic dating shows that the significantly more common congenital malformations in infants occur before the seventh week of gestation. [15] Rubella infection is in existence among the Kenyan population and efforts to address rubella infection are needed. [16] Nutritional status of the mother has also been show to play a role in development of congenital anomalies. Inadequate folic acid consumption is linked to development of some congenital anomalies. [17] Deficiency

of iodine can also lead to development of congenital anomalies. [18]

The disease burden of Congenital anomalies is relatively high especially in LMICs where over 90% of all congenital anomalies births occur and 95 % of children who die from birth defects are also from these countries. [3,19,20] It is estimated that every year 7.9 million children are born with serious birth defects, 3.3 million children under the age of five die from congenital anomalies, and 3.2 million who survive may be disabled for life. [13] Approximately 270,000 of under five deaths caused by Congenital anomalies are estimated to be during the first 28 days of life. The [8] long-term disabilities caused by Congenital anomalies not only have significant effects on the child's wellbeing and development, but also on families, societies and health systems. [8] In Africa, some of the rare studies on congenital anomalies have reported an incidence between 1.5% and 2.5% in Egypt and East Africa (Kenya and Uganda) respectively. [8]

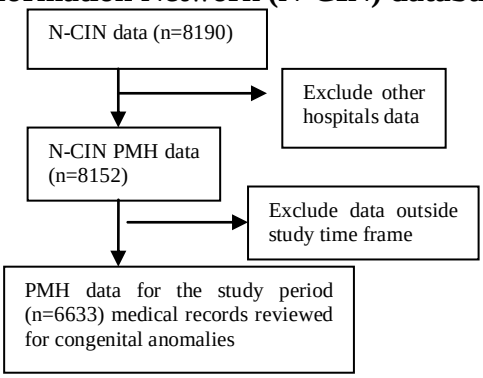
While these findings focus most of the findings are global or regional, there is no known documented study on prevalence of congenital anomalies in Kenya. Specifically, the purpose of this study was to establish prevalence of congenital anomalies among newborns at Pumwani Maternity Hospital located in Nairobi-considered the largest in Kenya. The findings of this study are important for public policy on reducing child morbidity and mortality in Kenya and provide information necessary for resource allocation.

Findings from this study can inform the government on important interventions that need to be put in place, that is; prevention and care services based on types of congenital anomalies occurring in local setting. Additionally, findings of this descriptive study provide the basis for analytical studies to examine causes and possible remedies of congenital anomalies.

MATERIALS AND METHODS

This was a descriptive cross-sectional study on newborns admitted in at Pumwani Maternity Hospital (PMH)-a leading maternity hospital in Nairobi-between May 2014 and April 2015. The study involved a review of medical records in the N-CIN database for routinely collected data from PMH which has been an ongoing project. To be included in the study a newborn had to be admitted and discharged at PMH within the twelve month period. All new born not admitted and discharged outside the twelve months or admitted and discharged in other healthcare facilities or home deliveries were excluded in the selection.

Study flowchart for exclusion and inclusion from Neonatal-Clinical Information Network (N-CIN) database



Data collection and management

Data were abstracted from an existing electronic database: N-CIN for newborns admitted at PMH. The database contains data routinely abstracted from neonatal medical records by a data entry clerk ontoa Research Electronic Data Capture tool (RED Cap). RED Cap is a secure web application which is designed to build and manage online surveys and databases for research studies. [21] Data are collected electronically and stored in password-protected computers. Patient confidentiality is maintained by not collecting any identifiable data and each record is given a unique study identification number at the time of data entry. Range and consistency checks are built into the application to ensure quality of the collected

data. Data validation for error checking is done at the point of entry through the use of the statistical software package 'R'. The collected data is then safely stored at the main servers at Kenya Medical Research Institute (KEMRI)-Wellcome Trust Research Programme (KWTRP) for cleaning prior to analysis. Six thousand six hundred and thirty three (6633) medical records for newborns admitted at PMH were extracted from the database for the purpose of this study.

Newborn diagnoses extracted from N-CIN database were coded according to International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) Version for 2010, chapter XVII (Q00-Q99) on congenital malformations, deformations and chromosomal abnormalities. The ICD-10 coded diagnoses were then mapped to their corresponding diagnosis. The diagnosis of Congenital anomalies considered were those recorded in any of the diagnostic fields, that is, either as admission diagnosis or discharge diagnosis in the medical records. Congenital anomalies were classified according to ICD-10 classification.

Cases of congenital anomalies were defined as structural or functional abnormalities presenting at the time of birth or few days after birth. Newborns with diagnosis recorded as congenital abnormalities in any of the diagnostic fields were classified as having multiple congenital anomalies together with the diagnosis recorded as multiple congenital anomalies and assigned Q89.7 in the ICD-10 classification.

Sampling and sample size

Medical records for newborns admitted at PMH were reviewed from an existing database: N-CIN. Through a computerized randomization a full data- set of the case records has been routinely entered in 60% of all the neonatal inpatient records and a selected number of variables (minimum data-set) are entered for the remaining 40% of records since March 2014. Between May 2014 and April 2015, 6633 newborns were discharged from the NBU. All the 6633 medical records were reviewed. Sample size calculation was done to determine the level of precision that could be achieved with the available number of records. It was determined that, 3012 records would allow the estimation of prevalence of congenital anomalies with a level of precision of 0.005 assuming a prevalence of 2% and an error rate of 0.05. Therefore, the 6633 records available from the database were sufficient to give a good estimate of prevalence of congenital anomalies.

Statistical data analysis

Simple descriptive analyses were performed on the data extracted from the database. The analysis of data was done on "R" for statistical computing version 3.2.0 with the aim of assessing prevalence of congenital anomalies in newborns admitted at PMH.

Newborn and maternal variables linked with development of congenital anomalies in literature were extracted from the data. Newborns variables identified included gender, gestation age, birth weight and outcome at discharge. Newborns with gestational age less than 37 weeks at birth were identified as preterm while those with gestational age greater and equal to 37 weeks were identified as term. Newborns classified as low birth weight were those with birth weight less than 2.5 kg while newborns with weight greater or equal to 2.5 kg were of normal weight. The newborn variables were presented as a percentage of total number of newborns with diagnosis of congenital anomalies.

Maternal variables included maternal age, gravidity, and history of abortion, maternal infection, antenatal visit and mode of delivery. From literature, mothers with age equal and above 35 years are considered at risk of giving birth to congenitally malformed newborns compared to mothers who are less than 35 years. Mothers with 1 or more abortion

documented were identified as having had history of abortion. In order to determine maternal exposure to infection during pregnancy, VDRL test was used. Those with a positive VDRL test were considered as having been exposed to infection. Antenatal visits were used to identify number of mothers attending the recommended number of visits. The results were given as a percentage of the total number of newborns with congenital anomalies.

Congenital anomalies identified were grouped according to body system affected based on ICD-10 classification. Distribution of congenital anomalies was given as a percentage of total number of newborn admitted. The body system groups included central nervous system, musculoskeletal system, genital organs, cleft lip and cleft palate, urinary system, circulatory system, chromosomal abnormalities, respiratory system and other congenital anomalies. Other congenital anomalies group included diagnosis recorded as multiple congenital anomalies and congenital abnormalities, since they could not be grouped under any specific body system.

Further analysis was done to document the specific types of congenital anomalies under each body system affected. The specific types were presented as a percentage of the total number of cases under each system

RESULTS

Table 1: Characteristics and outcome of newborns admitted at Pumwani Maternity Hospital with congenital anomalies.

New-born Variables (n=129)	Number of cases	percentage%
Sex		
Male	79	61.24
Female	48	37.20
Ambiguous genitalia	1	0.78
Missing data	1	0.78
Birth weight		
Low birth weight	39	30.23
Normal birth weight	87	67.44
Missing birth weight	3	2.33
Gestational age at birth		
Term	11	8.53
Preterm	8	6.20
Missing gestational age	110	85.27
Outcome		
Alive	108	83.72
Dead	13	10.08
Referred	8	6.20

Table 2: Characteristics of mothers with newborns admitted at Pumwani Maternity Hospital with congenital anomalies.

Maternal variables (n=129)	Number of cases	Percentage (%)
Mode of delivery		
Caesarean section	47	36.43
Delivery breech	2	1.55
Spontaneous vaginal delivery	80	62.02
Maternal age		
< 35 year s	19	14.73
≥ 35 years	1	0.78
Age missing	109	84.49
Antenatal clinics (ANC) visits documented		
Yes	17	13.18
No	112	86.82
Number of ANC visits		
Recommended number of ANC	0	0.00
Missing data	17	13.18
Gravidity		
≥ 3	2	1.55
< 3	15	11.63
Missing data	112	86.82
History of abortion (n=129)		
Abortion 1 and above	2	1.55
Abortion 0	16	12.40
Missing data	111	86.05
Infection exposure		
VDRL positive	0	0.00
Maternal VRDL negative	15	11.63
Missing data	114	88.37

Newborn and maternal Characteristics

Among the 129 newborns with diagnosis of congenital anomalies 79 were male (61.24% of all newborns admitted with congenital anomalies) while 48 were female (37.20%), one had ambiqous genitalia and 1 newborn had gender missing from the data. Thirty nine (39), accounting for 30.23% of newborns admitted with congenital anomalies were born weighing less than 2.5 kg, that is had low birth weight, while 87 (67.44%) were born with normal birth weight. Eleven (11) newborns were born at term while 8 newborns were premature and 110 newborns had the gestational age missing. Of the newborns admitted with congenital anomalies 10.08% died while 6.20% were referred. Out of the 8 newborns referred, omphalocele and congenital hydrocephalus had 2 cases each while congenital heart disease, spina bifida, multiple congenital anomalies and Down syndrome had 1 case each. The newborn characteristics and outcome are shown on table 1. Over 80% of data on maternal characteristics was missing except data on mode of delivery. Eighty (80) newborns (62.02%) were born through normal

delivery, while 47 newborns (36.43%) were born through caesarian section. None of the mothers with available data had VDRL positive and only 2 had a history of abortion among the admitted newborns. Characteristic of the mothers to newborns admitted with diagnosis of congenital anomalies are shown in table 2.

Distribution of congenital anomalies

Out of the 6633 medical records reviewed of newborns admitted at PMH during the study period, 129 were diagnosed with congenital anomalies giving an overall prevalence of 1.94% (95% confidence interval 1.64, 2.31) among newborns admitted. Malformations of the musculoskeletal system were the most common while the central nervous system and the genital organs were equally malformed. The prevalence of musculoskeletal malformations was 0.95% of total admissions. The central nervous system had prevalence equal to that of genital organs of 0.12% of the total admissions. The malformation of the circulatory system was 0.08% of the total admissions. Chromosomal abnormalities and cleft lip and palate malformations had equal prevalence of 0.05% of the total admissions. The urinary system had the least number of malformations with only 0.02% followed by malformations of the respiratory system with 0.03%. Other congenital abnormalities had a prevalence of 0.59% of the total admissions. These results are shown in table 3.

Table 3: Prevalence of congenital anomalies by body system affected according to the ICD-10 classification in newborns admitted at Pumwani Maternity Hospital.
Total number of admissions (n=6633)

Congenital anomalies	Number of cases	Proportion (%)	95 % Confidence interval
Newborns with congenital anomalies	129	1.94	(1.64, 2.31)
Musculoskeletal system malformations	63	0.95	(0.74, 1.22)
Other malformations	39	0.59	(0.42, 0.81)
Malformations of genital organs	8	0.12	(0.06, 0.25)
Malformations of central nervous system	8	0.12	(0.06, 0.25)
Malformations of circulatory system	5	0.08	(0.03, 0.19)
Cleft lip and cleft palate	3	0.05	(0.01, 0.14)
Chromosomal abnormalities	3	0.05	(0.01, 0.14)
Malformations of respiratory system	2	0.03	(0.01, 0.12)
Malformations of urinary system	1	0.02	(0.00, 0.10)

Types of congenital anomalies

Congenital talipes equinovarus (club foot) was the most prevalent congenital anomaly with 34 cases (53.97%) among the congenital malformations of the musculoskeletal system. Polydactyl with 11 cases (17.46%) was the second most prevalent congenital anomaly of the musculoskeletal system. Spina bifida was the leading congenital anomalies of the central nervous system with 3 cases (37.50%). Microcephaly and congenital hydrocephalus had equal number of cases (2 cases each). Undescended testicle and hypospadias were the leading among the genital organs malformations with 3 cases each while imperforate hymen and ambiguous genitalia had 1 case each. Table 4 shows the types of congenital anomalies of the musculoskeletal system, central nervous system and the genital organs.

Cleft lip with palate had 2 cases with cleft palate alone having 1 case and no case of cleft lip alone. Among the malformations of the circulatory system there was 5 cases of congenital heart defect being the only defect of the circulatory system. Down syndrome with 3 cases was the only chromosomal abnormality detected. Choanal atresia and congenital laryngomalacia were the congenital anomalies of respiratory system found with one case each. Epispadias was the only malformation of the urinary system recorded with only 1 case. The result of other systems malformations are shown in table 5.

Table 4: Types of congenital anomalies of the musculoskeletal system, central nervous system and the genital organs in newborns admitted at Pumwani Maternity Hospital.

Congenital anomalies of musculoskeletal system (n=63)	Number of cases	Percentage (%)
Congenital talipes equinovarus	34	53.97
Polydactyl	11	17.46
Other musculoskeletal deformities	9	14.29
Omphalocele	2	3.17
Congenital deformities of chest	2	3.17
Reduction defects of upper limbs	2	3.17
Reduction defects of lower limbs	1	1.59
Reduction defects of unspecified limbs	1	1.59
Other malformations of limbs	1	1.59
Congenital anomalies of the central nervous system (n=8)		
Spina bifida	3	37.50
Microcephaly	2	25.00
Congenital hydrocephalus	2	25.00
Other malformation of spinal cord	1	12.50
Congenital anomalies of genital organs (n=8)		
Undescended testicle	3	37.50
Hypospadias	3	37.50
Ambiguous genitalia	1	12.50
Imperforate hymen	1	12.50

Table 5: Types of congenital anomalies affecting other body systems in newborns admitted at Pumwani Maternity Hospital

Congenital anomalies of circulatory system (n=5)	Number of cases	Percentage (%)
Congenital heart disease	5	100
Cleft lip and Palate (n=3)		
Cleft lip with palate	2	66.67
Cleft palate	1	33.33
Chromosomal abnormalities (n=3)		
Down syndrome	3	100
Congenital anomalies of respiratory system (n=2)		
Choanal atresia	1	50
Congenital laryngomalacia	1	50
Congenital anomalies of the urinary system (n=1)		
Epispadias	1	100
Other congenital anomalies (n=39)		
Other congenital anomalies	39	100

DISCUSSION

This study found 129 congenital anomalies among the 6633 newborns admitted at PMH giving a prevalence of 1.94% of total newborn admissions (95% confidence intervals 1.64, 2.31). The musculoskeletal system was the most affected, accounting for 0.95% of the total admissions. The central nervous system and the genital organs were equally malformed. These findings show that congenital anomalies are prevalent in the Kenyan population and although they are considered rare, with accumulation of data overtime it is possible to report on rare conditions. Hence the government should aim to put in place surveillance programs for congenital anomalies.

The overall prevalence of congenital anomalies was found to be 1.94% of the total admissions. This is comparable to findings by some other studies elsewhere. A study done in a tertiary care hospital in Eastern India recorded a prevalence of 2.22% [22] while another done in a government hospital in India recorded a prevalence of 1.64%. [6] Another study in Entebbe, Uganda recorded a prevalence of 20.3 per 1 000 births. [13] Another hospital based study done in Egypt recorded a prevalence of 2.06%. [23]

Lower prevalence than that of this study has also been documented. One study conducted in two leading hospitals in Nigeria, recorded an incidence of 0.2% and 0.4%. [24] Another 3 year hospital based study in South Africa recorded a prevalence of 11.87 per 1000 live births. [25] Other studies with lower prevalence are population based. [9, 18]

The prevalence of this study was lower than that of the hospital based study done in Kenya and other parts of the African continent. [6,12,13,25] The difference in

findings can be attributed to the different study design, diagnostic approach and regional variation, and as such true comparison is hard to make. The study done in Kenyatta National Hospital in Kenya documented a prevalence of 2.8% of all live births and considered still births. [5] while that conducted in Bugando medical center, Mwanza, Tanzania documented a prevalence of 29% but had a comprehensive diagnostic approach which included echocardiography, X-ray, cranial and abdominal ultrasound. [8] The studies in other parts of African continent could have documented a higher prevalence possibly due to regional variation, environmental factors, socio-economic factors as well as genetic factors among other factors. A study done in Zagazig university hospital in Egypt recorded an incidence of 2.5% and had a through diagnostic approach similar to that used in the study conducted in Tanzania. Another retrospective study involving a review of medical records in Mount-Lebanon, which was a similar design to this study, documented a prevalence of 2.4%. [26] Although the study done in Mount- Lebanon included still births and had a different setting from Kenya, the findings were only slightly higher.

This study found malformations of the musculoskeletal system to be the most common, while the central nervous system and the genital organs were equally malformed. Other studies have reported findings similar to this. A hospital based study in Kenya found musculoskeletal system to be the most malformed with 33.9% of all major malformations followed by central nervous system with 28.6%. [5] Another hospital based study in Egypt found musculoskeletal system to be the most involved (23%) followed by central nervous system with 20.3%. [27] The study conducted in Tanzania however, found central nervous system to be the most affected (29.8%) followed by musculoskeletal system (22.9%). Congenital talipes equinovarus was the highest malformation followed by polydactyl among musculoskeletal anomalies which matches the finding of a study done in Uganda which found club foot to be leading followed by polydactyl among musculoskeletal malformations. [28]

Prevention interventions

The wide range of causes of birth defects means that a portfolio of prevention approaches is needed. [29] Experience from high-resource countries shows that up to 70% of congenital anomalies can be prevented, and that affected children can be offered life-saving care that can reduce the severity of their disabilities and improve the functional outcomes since effective evidence-based interventions exists. [30] Most birth defects of environmental origin can be prevented by public health approaches, including prevention of sexually transmitted infections, legislation controlling management of toxic chemicals, vaccination against rubella, for children and women and fortification of basic foods with micronutrients (iodine and folic acid). [29] Improving diet of women throughout the reproductive years, controlling preconception, as well as gestational diabetes through counseling, weight management and diet should be integral parts of primary prevention measures for Congenital anomalies.

Interventions such as preconception use of folic acid , before and during the first 28 days after conception reduces a woman's risk of having a foetus or infant with NTDs as well as cardiac and craniofacial abnormalities [31, 32] This is not a common practice in Kenya where folate is given during ANC visits. This means that the crucial period when folate consumption is critical could have elapsed by the time the expectant mother comes for ANC visits. Some of the developed countries (Australia, United States of America and Canada) have seen fortification of basic food stuffs made a national policy. [33] In the United States of America reduction in number of cases of NTDs was observed immediately after mandatory folic acid fortification. [34] Such an intervention could see Kenya make progress in prevention of congenital

anomalies especially NTDs which has high disease burden. Folic acid supplementation has been proven to reduce risk of NTDs. [35]

Increased access and use of family planning services should be encouraged in all women of reproductive age. Through family planning, there will be decreased proportion of older parents. This will translate to a fall in birth prevalence of newborns with Down syndrome and other chromosomal disorders which are associated with advanced maternal age. [36]

Prevention of congenital anomalies in the developing world requires: good epidemiological data on the prevalence and type of congenital abnormalities and genetic disorders, educating health professionals on the goals and methods of preventing congenital anomalies at low cost but with maximum impact and expansion of family planning and improvement of antenatal care combined with education campaigns to avoid the risks of birth defects. [17] In Kenya, however, there is little that has been done when it comes to prevention of congenital anomalies and there is need to put in place measures to reduce the adverse effects of congenital anomalies.

In order to implement effective prevention and care services and evaluate possible teratogens, there is need for comprehensive data on congenital anomalies. [37] Prevalence studies of congenital anomalies are, therefore, important to establish baseline rates, to document changes over time and to identify clues to aetiology. Prevalence studies are also important for health services planning and evaluating antenatal screening in population at high risk. [9, 10]

Early detection is very important. Preconception screening can help in identifying newborns at risk of being born with congenital anomalies and appropriate management can be planned. This is particularly useful in countries where consanguineous marriage is common and also is important and can help offer appropriate care according to risk. [4] Screening of newborns for congenital anomalies facilitates early detection and should be incorporated in ANC units especially in developing countries. [38] Physical examination is feasible for instance in all health setting and allows the identification of many visible birth defects. [29]

Effective life-saving treatment is available for several birth defects and is an appropriate measure to reduce mortality and morbidity from congenital anomalies. There is evidence to show that many structural birth defects such as NTDs, oral cleft lip and palate and congenital heart defects are amenable to cost-effective surgery and can improve long-term prognosis if the surgery is performed early in life. [7,20,39] Early treatment can also be administered in children with functional problems including single-gene defects. The outcome of infants born with severe congenital anomalies is highly dependent on level of development of health care services. [36]

Several studies have implicated maternal age above 35 years, inadequate consumption of folic acid, gravida above 3 and history of abortion to be associated with development of congenital anomalies. [8] Prematurity, low birth weight, caesarean section and consanguinity marriage has also been shown to influence development of congenital anomalies. [22] A study conducted in Mount-Lebanon showed a marked association between increased rate of congenital anomalies with parental consanguinity and alcohol consumption of the mother during pregnancy. [25] Association between the risk factors implicated by other studies, in development of congenital anomalies, could not be established since this study used secondary data and only had few cases of congenital anomalies. No information on socio-economic status as well as environmental risk factors was captured in the database.

Study limitations

International Statistical Classification of Diseases and Related Health Problems 10th Revision ICD-10 chapter on

Congenital anomalies does not include birth defects such as inborn errors of metabolism and blood disorders which by WHO's definition fall under congenital anomalies. Therefore the prevalence of congenital anomalies reported by this study could be lower compared to similar hospital based studies.

In Kenyan hospitals there is poor diagnostic capability for congenital anomalies. This is made worse by lack of birth defects registries and consequently, cases of congenital anomalies are not well captured in the normal hospital medical records. This is a potential limitation to this study as some of the congenital anomalies may have been left out as a result, leading to underestimation of the prevalence of congenital anomalies.

This study was a one hospital based study, focusing only on newborns admitted at PMH and such the finding cannot be generalized to depict the prevalence of the entire population. PMH is also a referral maternity hospital and many high risk pregnancies are likely to be conducted or referred to PMH in which case the prevalence could be higher than the true prevalence of the disease. There was a lot of missing data on maternal characteristics in which case the true characteristic of the population may be biased. This can be attributed partly to poor documentation of data in the medical records.

CONCLUSION

The disease burden from congenital anomalies is high, especially in LMICs. This poses a challenge for the attainment of MDG 4, which many countries including Kenya will not attain by the end of 2015. Diseases burden associated with congenital anomalies, needs to be addressed alongside other ongoing effort to reduce childhood mortality.

In Kenya, there is need for the government to step up efforts to combat the disease burden of congenital anomalies. Primarily, interventions aimed to prevent congenital anomalies are needed. Interventions such as fortification of basic foods, family planning and folic acid supplementation can be adopted since they are cost effective. Early treatment and diagnostic capacity needs also to be given attention as well as training of health workers. There is also need of setting up genetic centers to help offer genetic counseling as a key component of reducing prevalence of congenital anomalies. This study has shown the need for the concerned ministries to create public awareness and put in place policies to address disease burden from congenital anomalies among the Kenyan population. This will help reduce childhood mortality and consequently help achieve set goals. Further, research needs to be done to comprehensively document all risk factors associated with congenital anomalies in the Kenyan setting to help in putting in place the appropriate interventions.

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