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Prevalence and Distribution of Neonatal Congenital Malformations in Al-Najaf, Iraq: A Cross-Sectional Analysis of 2022 Birth Registry Data

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Prevalence and Distribution of Neonatal Congenital Malformations in Al-Najaf, Iraq: A Cross-Sectional Analysis of 2022 Birth Registry Data

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Abstract

Background: Congenital malformations are among the primary causes of neonatal morbidity and mortality worldwide, imposing significant challenges in regions with limited healthcare resources and high birth rates.

Objectives: The goal of this study is to find out how common and spread-out congenital malformations are among newborns in Al-Najaf, Iraq. The results could have a big effect on how healthcare is provided and improve the health of newborns.

Methods: This descriptive cross-sectional study analyzed birth registry data from five major hospitals in Al-Najaf, Iraq, in 2022. We identified neonates diagnosed with congenital malformations from a total cohort of 37,904 live births. Using descriptive and inferential statistics, the study gathered information on the mothers' demographics, the babies' characteristics, and the types of birth defects found.

Results: Prevalence of congenital malformations was 4.3 per 1,000 live births. The central nervous system (CNS) was the most affected, accounting for 32.5% of malformations, followed by cardiovascular anomalies at 28.2%. There was a strong link between birth defects and maternal factors, especially living in a rural area (86.5% of mothers) and being related to the mother (60.7%). Additionally, the majority of affected neonates were born to mothers aged 20 to 25 years. Low birth weight was prevalent among 43.5% of cases, suggesting a potential link with congenital anomalies.

Conclusion: The substantial prevalence of congenital anomalies in Al-Najaf underscores critical public health concerns. The high rates of CNS and cardiovascular malformations, along with cultural practices like consanguinity, suggest a need for urgent, targeted interventions. Genetic counseling, more prenatal care, and public health education are all important ways to lower the risks of congenital malformations and possibly improve the health of newborns in this area.

Keywords: Congenital malformations, Prevalence, Neonatal health, Consanguinity, Iraq

1. Introduction

Prenatal birth defects and structural abnormalities constitute a significant global pediatric health challenge, affecting approximately one in thirty-three live births and resulting in over 3.2 million affected children annually [1, 2]. These conditions impose substantial medical, emotional, and financial burdens on families and strain on healthcare systems [3]. In developing countries such as Iraq, the prevalence of birth defects is heightened by rising birth rates and limited resources, necessitating effective management and comprehensive understanding [4, 5]. In particular, different cultural practices, environmental exposures, and healthcare limitations in Al-Najaf lead to different patterns in the occurrence and treatment of birth defects [6]. Even though prenatal care and genetic testing have come a long way around the world, Iraq still has problems, such as not collecting enough data, not having enough screening programs, and family marriages that raise the risk of genetic abnormalities [7, 8]. For healthcare professionals, particularly those

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in neonatal care, understanding the prevalence and distribution of birth defects is essential for improving clinical outcomes [9].

The incidence of birth defects varies regionally due to genetic predispositions, environmental factors, and disparities in healthcare infrastructure [10]. There are more births in Iraq than in developed countries because of problems with mothers' health, exposure to teratogens, high rates of blood relatives, and limited access to prenatal diagnostics [11, 12]. Identifying these patterns is critical for addressing public health challenges and enhancing healthcare systems [13]. Regional studies also support effective resource allocation for maternal and neonatal health services, thereby reducing mortality and morbidity associated with birth defects [14].

Globally, common birth defects include central nervous system anomalies, cardiac malformations, musculoskeletal disorders, and chromosomal abnormalities such as Down syndrome [15]. In the Middle East, nervous system and cardiac defects are particularly prevalent, indicating a need for improved screening and interventions [16, 17]. However, comprehensive epidemiological data in Iraq remains scarce, underscoring the need for localized studies to determine incidence, types, and risk factors [18].

Neonatal and pediatric nurses play a crucial role in managing birth defects and providing medical care and emotional support to families, thereby mitigating immediate and long-term impacts [19]. They are responsible for early detection, complication management, and coordination with multidisciplinary teams [20]. Effective care delivery requires specialized training, cultural competence, and an integrated approach to family support [21]. In Iraq, nurses face additional challenges, such as limited medical infrastructure, scarcity of specialized care facilities, and training gaps in managing complex birth defects [22–24]. Consequently, research on local epidemiological patterns is vital for developing appropriate care protocols within Iraqi healthcare settings [25, 26].

Despite extensive global research, few studies focus on Iraq, particularly Al-Najaf [27–29]. There aren't many in-depth studies of how maternal health, environmental exposures, and sociocultural conditions affect the number of birth defects in this region. This makes it harder for policymakers and healthcare providers to come up with effective ways to stop these defects [30]. Previous Middle Eastern studies have identified risk factors like advanced maternal age, consanguinity, prenatal infections, and inadequate prenatal care, but their specific impact in Al-Najaf remains unclear [31].

This study aims to address these gaps by analyzing birth defect data from Al-Najaf's 2022 birth records. The research will quantify the prevalence of various birth defects, explore associations with maternal health factors, and identify patterns to inform future healthcare strategies. Expected outcomes include targeted interventions, policy guidance, and optimized resource distribution within Iraq's maternal and neonatal healthcare systems. Additionally, findings will enhance nursing education and training programs, equipping healthcare providers with the competencies to effectively cut and tackle birth defects. By revealing the prevalence, types, and distribution of birth defects in Al-Najaf, this research will provide valuable insights for healthcare practitioners, particularly nurses involved in neonatal care. The study's findings are anticipated to improve care quality, patient outcomes, and family support systems while laying the foundation for future research and policy initiatives aimed at advancing newborn health in Iraq.

2. Materials and methods

2.1. Research question

What are the prevalence and distribution patterns of congenital malformations among neonates in Al-Najaf, Iraq, based on the 2022 birth registry data?

2.2. Research objectives

1. To determine the prevalence of congenital malformations among neonates in Al-Najaf during 2022.
2. To analyze the distribution of these congenital malformations by type, maternal demographics, and neonatal characteristics.
3. To identify potential associations between maternal and neonatal factors and the occurrence of congenital malformations.

2.3. Design

This work follows a descriptive cross-sectional method to assess the prevalence and types of congenital malformations among neonates, drawing on data from the 2022 birth registry.

2.4. Setting

Data were collected from five key healthcare facilities in Al-Najaf, Iraq: Al Zahraa Teaching Hospital, Al Furat Al Awsat Hospital, Al Sajjad General Hospital, Al Manathira General Hospital, and Al-Hakim General Hospital. These hospitals are the region's primary

maternal and neonatal care centers and they maintain comprehensive birth registries.

2.5. Sample

The sample comprised 163 neonates diagnosed with congenital malformations out of 37,904 live births recorded across the study sites in 2022. This figure represents a malformation prevalence rate of 4.3 per 1,000 live births. The inclusion criteria were neonates with documented congenital malformations identified at birth and recorded in the hospital registries. Neonates with no malformations or those with incomplete birth records were excluded.

2.6. Techniques of data gathering

A structured review was followed to gather data. These included the birth records and neonatal registries from the selected hospitals. The review focused on the following:

1. **Demographic data**: Maternal age, residence (urban or rural), history of consanguinity, and previous history of congenital malformations in siblings.
2. **Maternal health factors**: Information on any chronic diseases, exposure to teratogenic factors (e.g., fever, drug use, radiation), and the presence of multiparity.
3. **Neonatal characteristics**: Gender, birth weight (categorized into normal, low, very low, and extremely low birth weight), and type of congenital malformation.

2.7. Ethical approval

Ethical approval has been granted by the Ethics Committee of the Faculty of Medicine at the University of Kufa, coded MEC-42. All research activities adhered to the ethical guidelines of the committee, ensuring data confidentiality and compliance with research standards. As this study was a retrospective review of hospital records, no direct patient interaction occurred, thereby minimizing consent-related ethical concerns.

2.8. Procedure

1. **Data Retrieval**: Neonatal records from each hospital's 2022 birth registry were systematically reviewed by trained personnel. All data were de-identified prior to extraction to maintain patient confidentiality. Only records with complete information on maternal and neonatal characteristics and detailed descriptions of congenital malformations were included.
2. **Classification of Malformations**: Congenital malformations were classified based on the affected body system (e.g., central nervous system, cardiovascular system, and musculoskeletal system). Malformation types included CNS anomalies, cardiovascular malformations, musculoskeletal malformations, gastrointestinal malformations, respiratory anomalies, chromosomal abnormalities, and hearing impairments.
3. **Data Verification**: A secondary review was conducted to verify data accuracy and consistency across the five study sites. Discrepancies in the classification or documentation of malformations were reconciled through consultations with senior clinical staff.

2.9. Stat methods

Data have been processed through descriptive statistics to quantify the prevalence and distribution of congenital malformations. Frequencies and percentages were calculated for categorical variables, such as the types of malformations, maternal age groups, and neonatal birth weights. Cross-tabulations explored associations between congenital malformations and demographic factors, such as maternal age, residence, and consanguinity. Additional statistical tests, such as chi-square tests, were used to figure out how important the links were between birth defects and characteristics of the mother and baby.

Results were presented in tables and figures to illustrate congenital malformations' prevalence and distribution across different demographic and health variables. Data analysis was implemented with SPSS (SPSS V.25), which displayed a significance threshold at $p < 0.05$ for all inferential tests.

3. Results

This study examined records of 163 neonates diagnosed with congenital malformations out of 37, 904 live births in five hospitals in Al-Najaf, Iraq, in 2022.

It was found that 4.3 out of every 1,000 live births had a congenital malformation. The study examined demographic and clinical factors, system-specific malformation distribution, prevalence rates, and maternal and environmental factors associated with these congenital malformations (Tables 1 to 3).

Among the neonates, there was a slight male predominance (53.4%), with 56.4% having a normal birth weight and the remainder distributed across low (35.6%), very low (6.1%), and extremely low (1.2%) birth weight categories. Most mothers were

Table 1. Demographic and clinical characteristics of neonates with congenital malformations (n = 163).

Characteristic	Categories	Frequency (n)	(%)
Sex	Male	87	53.4
	Female	75	46.0
	Intersex	1	0.6
Birth Weight	Extremely Low (<1000 g)	2	1.2
	Very Low (<1500 g)	10	6.1
	Low (<2500 g)	58	35.6
	Normal (2500–4000 g)	92	56.4
	High (>4000 g)	1	0.6
Maternal Age	<20 years	20	12.3
	20–25 years	64	39.3
	26–30 years	36	22.1
	>30 years	43	26.4
Residency	Rural	141	86.5
	Urban	22	13.5
Consanguinity	Yes	99	60.7
	No	64	39.3
Previous Congenital Defects in Siblings	Yes	90	55.2
	No	73	44.8
Delivery Outcome	Alive	150	92.0
	Dead	13	8.0

Table 2. Distribution of congenital malformations by system involved (n = 163).

System	Malformation Type	Frequency (n)	(%)
Central Nervous System (CNS)	Total CNS	53	32.5
	Anencephaly	22	–
	Hydrocephalus	13	–
	Microcephaly	5	–
	Spina bifida	6	–
Cardiovascular System (CVS)	Total CVS	46	28.2
Musculoskeletal System	Total Musculoskeletal	28	17.2
	Congenital anomalies of lower limb	6	–
	Congenital anomalies of upper limb	7	–
Urinary and Genito-Urinary System	Total Urinary & Genito-Urinary	10	6.1
Gastrointestinal (GIT)	Total GIT	8	4.9
	Anal stenosis	1	–
Respiratory System	Total Respiratory	3	1.8
Chromosomal Abnormalities	Down's syndrome	2	1.2
Ear and Hearing System	Hearing impairment	1	0.6
Other Malformations	Not classified under specific systems	12	7.4

ages 20–25 (39.3%) and lived in rural areas (86.5%). Consanguineous marriages were present in 60.7% of cases, and 55.2% of mothers had a history of congenital defects in prior offspring (Table 1).

Central nervous system (CNS) malformations were the most prevalent, representing 32.5% of cases, followed by cardiovascular system (CVS) anomalies at 28.2%. Musculoskeletal problems made up 17.2% of the cases. Less common problems affected the urinary, digestive, respiratory, and chromosomal systems. In 0.6% of cases, hearing problems were observed. The fact that CNS and CVS anomalies are so common suggests that these systems may be vulnerable to genetic and environmental factors in the area (Fig. 1 and Table 2).

The prevalence rate of 4.3 per 1,000 live births out of a total of 37,904 live births aligns with regional data, emphasizing this population's considerable burden of congenital anomalies. Key maternal and environmental factors included consanguineous marriages (60.7%), maternal fever during pregnancy (14.1%), and limited drug exposure (1.8%), with no documented cases of radiation exposure (Table 3). These findings highlight the role of genetic factors, particularly consanguinity, and prenatal influences like maternal fever in congenital malformations. Raising awareness through genetic counseling and educational programs for high-risk populations may reduce these risks.

In summary, congenital malformations are notably prevalent in Al-Najaf, with CNS and CVS anomalies being the most common. These findings underscore the importance of targeted public health strategies and preventive measures, particularly in

Table 3. Maternal and environmental factors associated with congenital malformations (n = 163).

Factor	Category	Frequency (n)	(%)
Chronic Diseases	None	151	92.6
	Yes	12	7.4
Teratogenic Factors	Fever	23	14.1
	Radiation	0	0.0
	Drug exposure	3	1.8
Abortions	Previous history	0	0.0

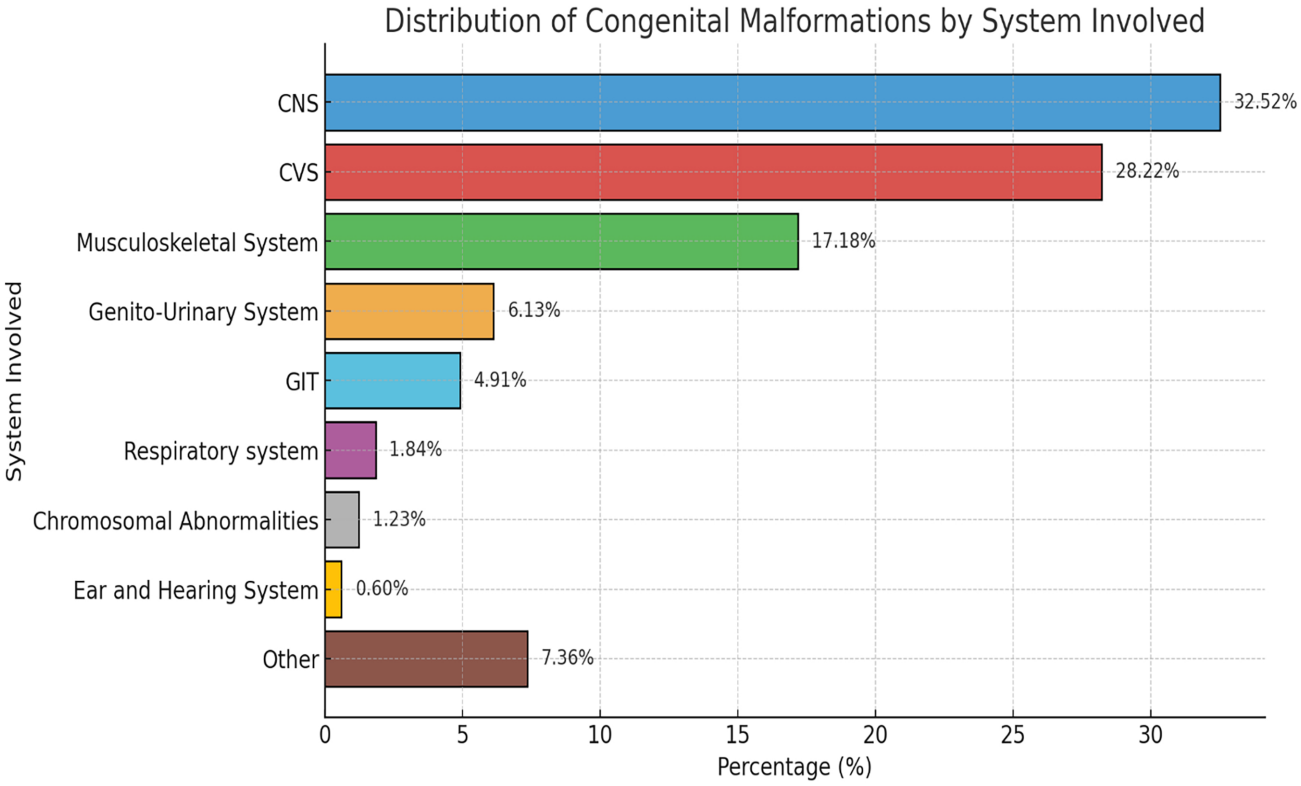

Fig. 1. Distribution of Congenital Malformations by System Involved.

communities with high consanguinity rates. The data provide a foundation for healthcare policymakers to develop interventions to mitigate the impact of congenital anomalies on neonatal health in this region.

4. Discussion

This study used information from Al-Najaf's birth registry for 2022 to examine the rate and distribution of congenital malformations. It found that there were 4.3 per 1,000 live births, with most of the problems occurring in the cardiovascular (28.2%) and nervous systems (32.5%). These results align with regional Middle Eastern data, underscoring congenital malformations as a significant public health issue in Al-Najaf [32, 33]. This high rate shows a big effect on newborn illness and death, underlining the need for targeted prenatal screening and public health actions to deal with maternal and environmental risk factors [18, 34].

The high rate of CNS malformations is typical around the world, especially in places where access to prenatal care and folic acid is hard to come by. Notable CNS conditions include anencephaly and hydrocephalus, which may stem from nutritional and genetic factors [35, 36]. Heart problems were more common in this developing area than in other places, which suggests that genes and the environment may have an effect on heart development [37]. Musculoskeletal malformations, observed in 17.2% of cases, suggest a need for expanded neonatal orthopedic and rehabilitative care [38]. Despite being less common, genitourinary, gastrointestinal, respiratory, chromosomal, and hearing problems are still very important for the health of newborns [25, 29].

A The critical finding was the high consanguinity rate among affected cases (60.7%), which exceeded global averages and reflected the cultural prevalence of intra-familial marriages [29, 33]. It is known that

being related to someone with an autosomal recessive disorder increases the chance of having a congenital malformation. This is likely because over half of mothers (55.2%) had congenital defects in their own children, which suggests a genetic link [24]. Anomalies are less likely to happen in mothers who are 20 to 25 years old, but this group of people, along with being related, may make them more common. Additionally, the predominance of rural residency (86.5%) among mothers highlights disparities in healthcare access, including prenatal care and genetic risk education [11, 20, 22, 37].

Maternal fever, a teratogenic factor, was reported in 14.1% of cases, posing risks for neural tube defects, while drug (1.8%) and radiation exposures were minimal, suggesting limited influence from these factors [2, 5]. Low birth weight (LBW, VLBW, ELBW) affected 43.5% of neonates, possibly linked to congenital anomalies or maternal health issues, with a noted association between LBW and congenital malformations due to intrauterine growth restrictions [18, 25]. Although 92.0% of neonates survived at data collection, the 8.0% mortality rate highlights the severity of certain conditions, necessitating improved neonatal care capabilities [40]. These findings are consistent with previous research in comparable socioeconomic settings, where CNS and CVS malformations are among the most common anomalies, and consanguinity contributes significantly to genetic disorders [28, 31, 35]. This alignment with existing literature strengthens the data's validity, emphasizing ongoing challenges in reducing congenital malformations in developing regions [23–25, 40].

The high prevalence of congenital anomalies in Al-Najaf demands immediate attention from healthcare providers and policymakers. These findings underscore the critical role of nurses in early detection, parent education, and multidisciplinary management of congenital anomalies. Integrating culturally appropriate genetic counseling into prenatal care is essential to address consanguinity risks. Enhanced prenatal care access in rural areas would facilitate early detection, while folic acid supplementation could reduce neural tube defect rates. Public education on consanguinity risks and strengthened healthcare infrastructure to manage congenital cases are also critical.

4.1. Limitations of the study

In this study, the reliance on hospital registry data may exclude congenital malformations resulting in miscarriage, stillbirth, or unrecorded home births. The cross-sectional design restricts causal inference. In other words, future longitudinal studies are necessary to examine a broader range of environmental and genetic variables.

4.2. Recommendations for future research

Further studies should explore genetic and environmental determinants of congenital malformations in Al-Najaf. Identifying specific genetic mutations prevalent in the population would enable targeted interventions. Additionally, evaluating the effectiveness of public health and prenatal care initiatives over time would provide insights for continuous improvement.

5. Conclusion

This research in Al-Najaf, Iraq, reveals concerning patterns in congenital malformations, primarily involving CNS and CVS anomalies. High consanguinity rates highlight cultural factors impacting neonatal health. Improved prenatal care, genetic counseling, and public education are urgent needs. This study provides crucial data for healthcare decision-makers, setting a foundation for targeted interventions to improve maternal and neonatal health outcomes. Continued research is essential to track and reduce congenital malformations in this region.

Conflict of interest

None

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None

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