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Trends in congenital anomalies and associated factors among newborns in Eastern Ethiopia: an 8-year open cohort analysis of the Kersa Health and Demographic Surveillance System

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ABSTRACT

Objective This study aimed to investigate the trends and factors associated with congenital anomalies (CAs) among newborns in Eastern Ethiopia from 2015 to 2022.

Design Open cohort study.

Setting The Kersa Health and Demographic Surveillance System (KHDSS), which is located in the Kersa district of the Oromia region in Eastern Ethiopia, covering 24 kebeles.

Population Newborns registered at birth in the database of the KHDSS site in Eastern Ethiopia.

Methods The KHDSS tracks demographic and health changes in the community. Newborn data were extracted using a checklist. Trends in CAs over time (in years) were analysed and the associated factors were identified through logistic regression analysis.

Outcome measure Newborn CAs, which are structural or functional abnormalities present at birth, were assessed through thorough physical examinations and detailed interviews conducted by trained data collectors using a standardised questionnaire.

Results Between 2015 and 2022, a total of 27 350 newborns were recorded in the KHDSS, 104 of whom had CAs. The overall rate of CAs was 3.83 per 1000 live births (95% CI 3.19, 4.61). There was a significant increase in the trend of CAs over the study period, with a Mantel-Haenszel χ^2 of 82.76 (p=0.001). Factors associated with CA included maternal age over 35 years (adjusted OR (AOR)=1.68, 95% CI 1.07, 2.62), place of birth (AOR=2.04, 95% CI 1.04, 4.02) and normal birth weight (AOR=0.14, 95% CI 0.04, 0.47).

Conclusion The data from the KHDSS revealed a rising trend in CAs. CA was associated with factors such as the mother's age, place of birth and the baby's birth weight. It is crucial for healthcare providers and stakeholders to consider these factors in efforts to reduce the prevalence of CAs.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This community-based study with a large sample size provides valuable insights into congenital anomalies in newborns.
⇒ The study provides evidence covering a substantial time period.
⇒ Unaccounted and residual confounding factors may have influenced the associations found.
⇒ The study did not specify the specific types of congenital anomalies that were observed.
⇒ The true prevalence may have been underestimated by relying only on physical examinations and maternal interviews for diagnosis.

INTRODUCTION

Congenital anomalies are structural or functional abnormalities that occur during fetal development.[1 2] They can vary in severity, with major congenital anomalies being a leading cause of death in children under 5.[3] Common types of congenital anomalies include neural tube defects, congenital heart disease, cleft lip/palate and limb defects.[4 5] Causes of congenital anomalies include genetic factors, chromosomal disorders, environmental teratogens and nutrient deficiencies. Early detection and intervention is crucial to managing these conditions effectively.[6]

Globally, the prevalence of major congenital anomalies is approximately 6%.[5] More than 90% of congenital anomalies occur in low-income and middle-income countries, and they are a significant contributor to neonatal mortality, with about 240 000 neonates dying each year.[7–9] A systematic review of community-based studies on congenital anomalies in Eastern Africa showed a prevalence of 4.54 per 1000 children. The range of congenital anomalies varied from 3.97 to 6.08 per 1000 children in the studies included in the review.[10] In South Africa, the incidence of congenital anomalies in 2021 was reported at 2.60 per 1000 live births.[11]

Congenital anomalies contribute to 20%–30% of infant mortality[12] and 20% of

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stillbirths.[13] According to the 2015 World Health Statistics, approximately 303 000 newborns die each year globally due to congenital anomalies before reaching 1 month of age.[14] These anomalies can also result in lifelong mental and physical disabilities for those who survived, affecting not only the community but also individuals and families.[15] Families dealing with congenital anomalies may experience psychological challenges such as stress and guilt, as well as economic difficulties and caregiving challenges, due to the high level of care and support required.[16]

A study found that mothers who are under 20 or over 35 years old,[17 18] use medication during early pregnancy,[17 19 20] consume alcohol or chew khat,[19] are exposed to chemicals,[18] have chronic diseases during pregnancy or before conception,[17] have inadequate antenatal care follow-up,[21] and have gestational age below 28 weeks or above 40 weeks are at higher risk of having newborns with congenital anomalies. On the other hand, a history of iron folate use before and during pregnancy and living in urban areas were associated with a lower risk of congenital anomalies.[18]

High-quality antenatal care, skilled birth attendance and proper care for small and sick newborns are crucial in reducing birth defects and neonatal mortality.[22] Certain congenital anomalies can be prevented through measures such as vaccination, folic acid intake and iodine supplementation.[1 23] It is essential to integrate prevention and care for congenital anomalies into existing maternal, reproductive and child health services.[24]

Health and demographic surveillance systems (HDSS) have become a crucial source of representative data for evidence generation, particularly in rural areas and countries with weak vital registration systems. Unlike facility-based studies or demographic and health surveys, HDSS offer longitudinal data on a known and stable target population, allowing for analysis of trends and changes in mortality determinants for tailored interventions. Unfortunately, research on congenital anomalies in Ethiopia is often limited to health facilities and lacks appropriate denominators, reducing applicability.[4 17–20] Therefore, there is a pressing need for a more comprehensive evidence that can illustrate the evolution of congenital anomalies and identify the related factors. This study aims to analyse trends and factors associated with congenital anomalies in the Kersa Health and Demographic Surveillance System (KHDSS) from 2015 to 2022.

METHODS

This paper follows the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology.[25]

Study design and setting

An open cohort study was conducted using data from the KHDSS in Eastern Ethiopia, which is affiliated with the College of Health and Medical Sciences at Haramaya University. The KHDSS is located in the Kersa district of the Oromia region in Eastern Ethiopia. The district consists of 38 kebeles, with 36 being rural and 2 small towns. The KHDSS was established in 12 kebeles in 2007 and later expanded to include an additional 12 kebeles in 2015. A kebele is the smallest administrative unit in Ethiopia, typically consisting of around 1500 households, and is responsible for providing basic services such as education, healthcare, agriculture, water and rural infrastructure. Currently, the KHDSS covers 24 kebeles and collects updated data on demographic and health events every 6 months. Majority of the population in the area are farmers, with some engaged in small trade, government roles or casual labour. Khat is a prominent cash crop in the region, with wheat, barley and vegetables being common crops in highland areas, and sorghum, maize and potatoes in lowland areas.[26] This study analysed the trends and factors associated with congenital anomalies in KHDSS from 2015 to 2022.

Study population and eligibility criteria

The KHDSS is a cohort study that collects health and demographic data to monitor changes in a stable population. It tracks demographic and health events at regular intervals and updates information every 6 months. This study includes all newborns registered in the KHDSS area between 1 January 2015 and 31 December 2022. Temporary visitors or those residing in the area for less than 6 months are not considered residents and thus excluded from the study.

Study variables

This study examines newborn congenital anomalies as the outcome variable, with independent variables including sociodemographic factors (marital status, age, sex, education and occupation of parents), maternal factors (antenatal care, parity, place of delivery) and neonatal factors (gestational age, birth weight).

Measurements and data collection

The KHDSS questionnaire covers a wide range of information, including morbidity surveillance, mortality registration, child immunisation records, economic details, housing conditions, migration history, pregnancy monitoring and pregnancy outcomes. The variables for this study were selected based on a literature review. Data are collected twice a year using Omicron Delta Kappa (ODK) by trained staff through face-to-face interviews, physical examinations and electronic birthweight measurements.[26] Field supervisors ensure data quality by checking Google Maps (GPS) coordinates, response consistency and validity before transferring the data to the Open HDSS database. Any errors are corrected by supervised data collectors. The collected data are initially stored on ODK Aggregate, reviewed by the data manager and then migrated to the final Open HDSS database. The study focused on congenital anomalies as the outcome variable. Congenital anomalies are structural or functional defects present at birth that originate during prenatal development. In this

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Table 1 Sociodemographic, maternal and newborn characteristics of study participants with and without congenital anomalies from the KHDSS in Eastern Ethiopia from January 2015 to December 2022 (N=27 350)

Variable	Characteristics	Congenital anomalies	
		Yes (%)	No (%)
Age of the mother (in years)	<20	10 (0.31)	3208 (99.59)
	20–34	58 (0.34)	17 128 (99.66)
	≥35	36 (0.52)	6910 (99.48)
Maternal educational status	No formal education	73 (0.40)	18 894 (99.6)
	Elementary	30 (0.4)	7263 (99.6)
	Secondary and above	1 (0.1)	1089 (99.9)
Maternal marital status	Married	86 (0.4)	22 993 (99.6)
	Divorced	2 (0.8)	247 (99.2)
	Single	16 (0.4)	3869 (99.6)
	Widowed	0 (0)	137 (100)
Maternal occupational status	Farmer	3 (0.4)	834 (99.6)
	Housewife	83 (0.4)	22 157 (99.6)
	Student	7 (0.4)	1936 (99.6)
	Unemployed	8 (0.5)	1540 (99.5)
	Others	3 (0.4)	779 (99.6)
Educational status of the father	No formal education	70 (0.4)	18 522 (99.6)
	Elementary (1–8)	33 (0.4)	7595 (99.6)
	Secondary and above	1 (0.1)	1129 (99.9)
Occupational status of the father	Farmer	80 (0.4)	20 519 (99.6)
	Merchant	1 (0.2)	406 (99.8)
	Employed	1 (0.1)	709 (99.9)
	Student	13 (0.3)	4079 (99.7)
	Unemployed	7 (0.6)	1098 (99.4)
	Other	2 (0.5)	435 (99.5)
Family size	≤2	0 (0)	104 (100)
	3–5	10 (0.3)	2885 (99.7)
	≥6	94 (0.4)	24 257 (99.6)
Parity	Primipara	27 (0.4)	6345 (99.6)
	Multipara (2–5)	45 (0.4)	12 630 (99.6)
	Grand multipara (>5)	32 (0.4)	8271 (99.6)
Antenatal care	Yes	44 (0.5)	9712 (99.5)
	No	60 (0.3)	17 534 (99.7)
Place of delivery	Home	77 (0.4)	20 010 (99.6)
	Health centre	16 (0.3)	6062 (99.7)
	Hospital	10 (0.9)	1098 (99.1)
	Other*	1 (1.3)	76 (98.7)
Newborn sex	Male	51 (0.4)	14 335 (99.6)
	Female	53 (0.4)	12 911 (99.6)
Birth weight	Very low	3 (2.1)	142 (97.9)
	Low	16 (1)	1621 (99)
	Normal	72 (0.3)	23 924 (99.7)
	High	13 (0.8)	1559 (99.2)
Gestational age (in weeks)	<37	2 (0.8)	258 (99.2)
	37–42	94 (4)	25 140 (99.6)
	>42	8 (0.4)	1848 (99.6)

*Private health facilities, trained traditional birth attendants and health post.
KHDSS, Kersa Health and Demographic Surveillance System.

study, the diagnosis of congenital anomalies was based on physical examination and interviews with the mother or the caregiver. If a congenital anomaly was reported, detailed information on functional and structural abnormalities was collected through physical examinations and interviews conducted by trained data collectors using a standard questionnaire within 4 weeks of delivery. The congenital anomaly variable was categorised as 'congenital anomaly' or 'no congenital anomalies', with 'congenital anomaly' assigned a value of '1' and 'no congenital anomalies' a value of '0'. We measured the newborn's birth weight using a WHO-recommended calibrated digital scale with a precision of 10 g within the first hour of life. The newborn was placed on a scale on a stable surface covered with a cleaned cloth; the scale was zeroed before placing the undressed baby on it. The weight was recorded in grams once the scale stabilised. For analysis, birth weight was categorised into four groups according to the WHO classification: normal birth weight (≥2500–<4000 g), low birth weight (1500–<2500 g), very low birth weight (<1500 g) and big birth weight (4000 g).

Data processing and analysis

Data from the HDSS database were exported to SPSS V.26 for analysis. This study aimed to track changes in congenital anomalies over time (measured in years) by analysing data from 1 January 2015 to 31 December 2022. Descriptive statistics and χ^2 test were used to compare observed and expected trends in congenital anomalies each year. The Mantel-Haenszel χ^2 test was used to assess linear trends in the proportion of newborns with congenital anomalies. Participant characteristics such as the mother's age, place of delivery, father's educational and occupational status, antenatal care, birth weight and mother's educational status were considered in the analysis. Binary logistic regression analysis was conducted to select explanatory variables for the final model with a p value of 0.25 and a 95% CI. In the multivariate analysis, only variables or categories with a p value less than 0.25, as identified in the bivariate analysis, were included to control for confounders. Factors associated with congenital anomalies were identified using multivariable logistic regression analysis, and adjusted ORs (AOR) with 95% CI were calculated. A p value of <0.05 was considered

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Table 2 Trends in congenital anomalies adjusted for birth year from the KHDSS in Eastern Ethiopia from January 2015 to December 2022

Birth year	CA	Non-CA	Proportion	CI lower	CI upper	Mantel-Haenszel (OR)
2015	4	3066	0.001302932	0.000214	0.002391	1
2016	5	3170	0.001574803	0.000305	0.00286	1.209925
2017	5	846	0.005875441	0.001934	0.010941	4.5101
2018	11	4429	0.002477477	0.000757	0.004197	1.905086
2019	14	3664	0.003806417	0.001452	0.006938	2.932127
2020	48	4153	0.011425851	0.00702	0.016256	8.803371
2021	8	4417	0.00180791	0.000344	0.003553	1.389308
2022	9	3501	0.002564103	0.001034	0.00462	1.97218
Total	104	27246	0.003817074	0.002115	0.005401	χ^2=82.76 (p=0.0001)

CA, congenital anomaly; KHDSS, Kersa Health and Demographic Surveillance System.

statistically significant. Multicollinearity was assessed using variance inflation factor for all independent variables. The model's goodness of fit was evaluated using the Hosmer and Lemeshow test, with a p value >0.05 indicating a good fit.

Patient and public involvement

None.

RESULTS

Sociodemographic, maternal and neonatal characteristics

In this study, the data of a total of 27350 newborns from the KHDSS data set were analysed. Among the mothers, 17186 (62.84%) were in the 20–34 years age group, while 6946 (25.39%) were above 35 years old. Majority of the mothers (18967, 69.34%) had no formal education. Additionally, 24351 (89.03%) community members in the study area had a family size of six or more. In this study, 12630 (46.34%) mothers were multipara at the time of giving birth, 17534 (64.33%) did not receive antenatal care and 20010 (73.44%) gave birth at home. Among the newborns studied, 23996 (87.73%) had a normal birth weight (table 1).

Trends and tests for linear trend of congenital anomalies

The Mantel-Haenszel test was used to determine linear trend. Between 2015 and 2022, there were 27350 newborns recorded in the KHDSS, with 104 of them having congenital anomalies. The overall rate of congenital anomalies was 3.83 per 1000 live births (95% CI 3.19, 4.61). The proportion of congenital anomalies among newborns increased from 0.0013 (95% CI 0.0002, 0.002) in 2015 to 0.0025 (95% CI 0.001, 0.004) in 2022. The trend in congenital anomalies was statistically significant, with a Mantel-Haenszel χ^2 of 82.76 (p=0.001), and the number of congenital anomalies varied over the 8-year period (table 2).

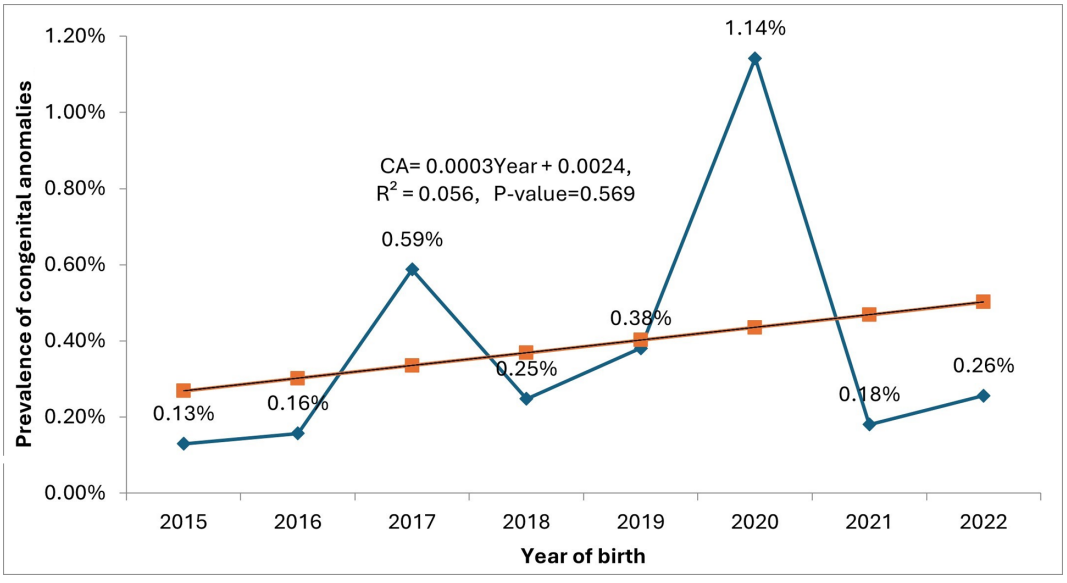

Figure 1 Trends in congenital anomalies (CAs) in newborns from the Kersa Health and Demographic Surveillance System in Eastern Ethiopia from January 2015 to December 2022.

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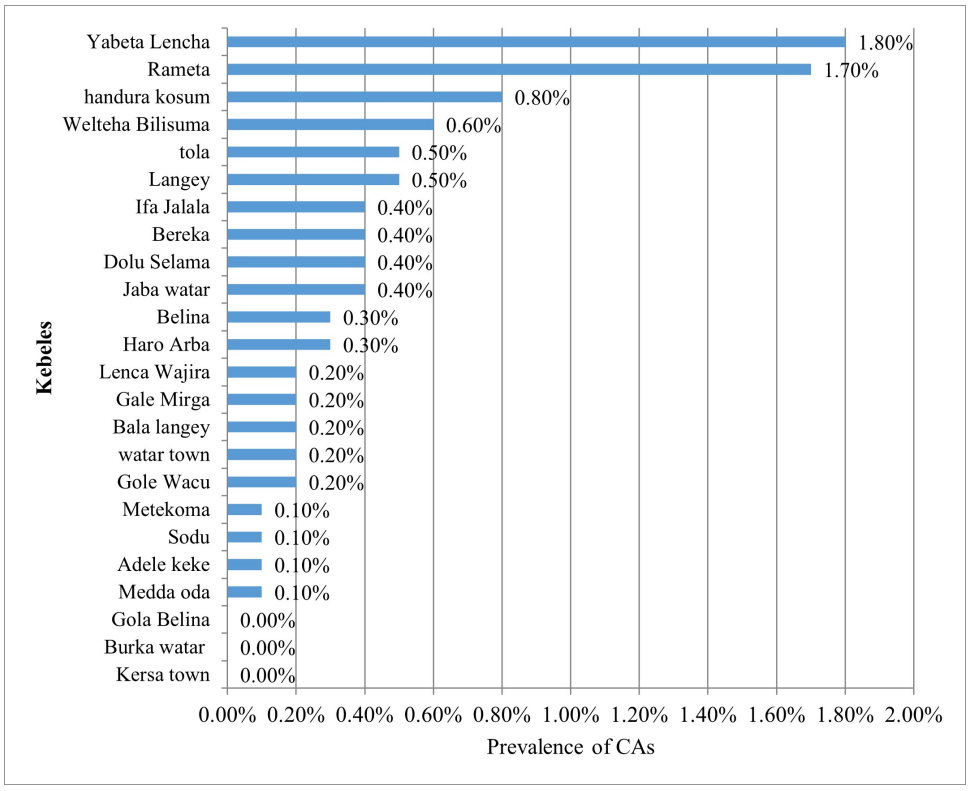

Figure 2 Prevalence of congenital anomalies (CAs) in newborns by Kebele.

Trend analysis of congenital anomalies

The trend analysis shows a high prevalence of congenital anomalies in 2020, with a lower prevalence in 2015. The number of delivery was found to be highest in 2018 (4440) and 2021 (4425) (figure 1).

Prevalence of congenital anomalies in each kebele

The prevalence of congenital anomalies was found to be highest in two kebeles (1.80% in Yabeta Lencha and 1.70% in Rameta), whereas zero prevalence was observed in the kebeles of Burka Watar, Gola Belina and Metakoma (figure 2).

Factors associated with congenital anomalies

In bivariable binary logistic regression, seven variables had a p value less than 0.25 in the bivariate analysis and were identified as potential factors for multivariable binary logistic regression. These variables included antenatal care follow-up status, educational status of the father and the mother, place of birth, age of the mother, occupational status of the mother and birth weight. The AOR was calculated to determine the relative contribution of each factor to congenital anomalies. The analysis revealed that newborns with normal birth weight had an 86% lower risk of developing congenital anomalies compared with those with low birth weight (AOR=0.14, 95% CI 0.04, 0.47). Additionally, newborns born to mothers older than 35 years had a 68% higher odds of having congenital anomalies compared with those born to mothers aged 20–24 (AOR=1.68, 95% CI 1.07, 2.62). Furthermore, newborns born in hospitals had a 2.04 times higher odds of having congenital anomalies compared with those born at home (AOR=2.04, 95% CI 1.04, 4.02). The model was found to fit the data well based on the Hosmer and Lemeshow test (p=0.100) (table 3).

DISCUSSION

This study analysed the data of 27 350 newborns from the KHDSS in Eastern Ethiopia and revealed a prevalence of congenital anomalies of 0.38%. The study also observed a significantly increasing trend in congenital anomalies from 2015 to 2022 (Mantel-Haenszel χ^2=82.76, p=0.001). Factors such as maternal age over 35 years, place of birth and birth weight showed statistically significant associations with congenital anomalies.

The prevalence of congenital anomalies in newborns was 3.83 per 1000 live births, which is lower than the rates reported in studies from China[27] and worldwide.[28] This difference may be due to variations in inclusion criteria. In China, all births, including live births, early fetal losses, stillbirths and early neonatal deaths, are recorded. Additionally, differences in screening criteria may also contribute to the discrepancy. Physical examination and interviews are used for diagnosis, but only around 30% of congenital malformations can be reliably diagnosed this way.[29 30] In this study, stillbirths and terminated pregnancies were not included, the assessment only covered the first few weeks of life, and physical examination and interviews were used for diagnosis, limiting the prevalence rate estimates.

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Table 3 Bivariable and multivariable logistic regression analyses to identify factors associated with congenital anomalies in newborns from the KHDSS, Eastern Ethiopia, from January 2015 to December 2022

Variables	Characteristics	Congenital anomalies		COR (95% CI)	P value	AOR (95% CI)	P value
		Yes (%)	No (%)				
Age of the mother	<20	10 (0.31)	3208 (99.59)	1.61 (0.95, 2.73)	0.076	0.79 (0.39, 1.58)	0.510
	20–34	58 (0.34)	17 128 (99.66)	1			
	≥35	36 (0.52)	6910 (99.48)	1.56 (0.98, 2.48)	0.063	1.68 (1.07, 2.62)	0.023*
Place of delivery	Home	77 (0.4)	20 010 (99.6)	1		1	
	Health centre	16 (0.3)	6062 (99.7)	0.69 (0.40, 1.18)	0.171	0.68 (0.39, 1.18)	0.174
	Hospital	10 (0.9)	10 98 (99.1)	2.39 (1.29, 4.43)	0.011*	2.04 (1.04, 4.02)	0.039*
	Other	1 (1.3)	76 (98.7)	3.42 (0.47, 24.44)	0.225	3.34 (0.45, 24.65)	0.236
Educational status of the father	No formal education	70 (0.4)	18 522 (99.6)	1		1	
	Elementary (1–8)	33 (0.4)	7595 (99.6)	1.15 (0.76, 1.74)	0.510	2.44 (0.76, 7.88)	0.133
	Secondary and above	1 (0.1)	1129 (99.9)	23 (0.03, 1.69)	0.150	0.32 (0.01, 1.45)	0.826
Occupational status of the father	Farmer	80 (0.4)	20 519 (99.6)	1		1	
	Merchant	1 (0.2)	406 (99.8)	0.63 (0.09, 4.55)	0.648	0.49 (0.66, 3.64)	0.485
	Employed	1 (0.1)	709 (99.9)	0.36 (0.05, 2.60)	0.313	0.48 (0.06, 3.64)	0.480
	Student	13 (0.3)	4079 (99.7)	0.82 (0.45, 1.47)	0.501	1.01 (0.53, 1.88)	0.997
	Unemployed	7 (0.6)	1098 (99.4)	1.64 (0.75, 3.55)	0.214	1.93 (0.86, 4.34)	0.111
	Other	2 (0.5)	435 (99.5)	1.18 (0.29, 4.81)	0.818	3.34 (0.45, 24.65)	0.236
Antenatal care	Yes	44 (0.5)	9712 (99.5)			1	
	No	60 (0.3)	17 534 (99.7)	0.76 (0.51, 1.12)	0.158	0.69 (0.46, 1.03)	0.069
Birth weight	Very low	3 (2.1)	142 (97.9)	1			
	Low	16 (1)	1621 (99)	0.48 (0.14, 1.66)	0.231	0.48 (0.14, 1.67)	0.248
	Normal	72 (0.3)	23 924 (99.7)	0.15 (0.05, 0.47)	0.001*	0.14 (0.04, 0.47)	0.001*
	High	13 (0.8)	1559 (99.2)	0.44 (0.12, 1.56)	0.150	0.42 (0.12, 1.50)	0.183
Educational status of mother	No formal education	73 (0.40)	18 894 (99.6)	1			
	Elementary	30 (0.4)	7263 (99.6)	1.07 (0.70, 1.64)	0.759	0.52 (0.16, 1.71)	0.284
	Secondary and above	1 (0.1)	1089 (99.9)	0.24 (0.03, 1.71)	0.154	0.93 (0.01, 4.15)	0.986

*AOR significant at p<0.05.
AOR, adjusted OR; COR, crude OR; KHDSS, Kersa Health and Demographic Surveillance System.

The study found an increase in the prevalence of congenital anomalies from 2015 to 2022, peaking at 1.4% in 2020. This increase aligns with a study in China showing a significant increase in the rate of live births of infants with congenital anomalies born before 28 gestational weeks.[27] The study also indicated that the prevalence of chromosomal abnormalities, which can cause congenital anomalies in newborns, has been increasing in recent years.[31] Factors such as increasing maternal age[32 33] and increased exposure to environmental factors are believed to contribute to this upward trend in the prevalence of congenital anomalies. The critical role of folic acid supplementation in preventing neural tube defects is well established.[34] However, low coverage of folic acid supplementation[35] and contraceptive utilisation, along with high fertility rates,[36] may also contribute to an increase in congenital anomalies. Improving the accessibility of maternity care mainly preconception[37] and antenatal care[38] could reduce the rates of congenital anomalies.

The increased prevalence of congenital anomalies in 2020 may be attributed to the impact of the COVID-19 pandemic on healthcare services, particularly maternal healthcare.[39] Strengthening maternal health services during epidemics can help reduce neonatal morbidity.[40] One possible contributing factor could be the distance of residency from health facilities, as previous studies in Ethiopia have shown that kebeles far from healthcare facilities have limited access to maternity care.[41] Consanguinity may also be a significant factor in the high rates of malformations and should be considered in genetic counselling.[42] Despite the lower overall number of deliveries, two kebeles (Yabeta Lencha and Rameta) showed higher rates of congenital anomalies, highlighting the need for further research to investigate the underlying causes of this disparity.

In this study, neonates born to mothers over 35 years old were 1.68 times more likely to have congenital anomalies compared with those born to mothers aged 20–34

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years. Similar findings have been reported in studies from different countries, indicating a higher risk of congenital anomalies with increasing maternal age.[17 18 43] The increased risk of congenital anomalies after 35 years of age may be attributed to the higher likelihood of chromosomal anomalies and accumulated environmental exposures over time.[43] Therefore, it is crucial to improve screening services for pregnant women over 35 years old to mitigate the risk of congenital anomalies and the associated complications.

This study also found a correlation between birth weight and newborn congenital anomalies. The findings of this study are consistent with research conducted in different parts of the world.[44] Monitoring birth weight is a simple way to assess prenatal health in a population.[45] Women born with low birth weight are more likely to give birth to low birthweight infants, perpetuating a cycle of malnutrition and poverty across generations.[46] Maternal malnutrition, particularly micronutrient deficiencies, is believed to be a significant factor in intrauterine growth restriction.[47] Another study reported that 71.04% of patients with congenital anomalies had a birth weight less than 2.5 kg.[48] The relationship between birth weight and congenital malformations is complex and influenced by factors such as maternal medical conditions, including hypertension, diabetes and infections. Previous studies in Ethiopia have identified factors such as maternal age under 20 years, interpregnancy interval under 24 months, low body mass index, gestational age under 37 weeks, maternal educational status and parity as associated with low birth weight and lack of antenatal care follow-up.[7 49 50] Enhancing women empowerment through education and socioeconomic status and quality maternal care can help decrease the likelihood of low birth weight and congenital anomalies.[49]

This study found that hospital deliveries are linked to congenital anomalies; however, this association may not be directly related to the risk of hospitals causing congenital anomalies. Women with complicated pregnancies are more likely to give birth in hospitals, as hospitals have specialists and equipment to monitor and treat complications.[51] Maternal history of congenital anomalies, parental consanguinity and history of medical disorders were important factors associated with congenital anomalies,[52] which may also influence the decision to opt for hospital deliveries.

Congenital anomalies can lead to long-term disability, creating physical, financial and emotional burden to families. In high-income countries, approximately 70% of congenital disorders can be prevented or effectively treated.[53 54] However, low-income countries require a comprehensive set of interventions to address these issues. Prevention strategies include vaccinations, folic acid or iodine supplementation and adequate prenatal care. Preconception and periconception healthcare, including genetic screening and counselling, is crucial to identifying and managing congenital anomalies. Screening during the neonatal period is also essential for early detection and treatment.

It is crucial to improve the quality of antenatal care to reduce the incidence of congenital anomalies. By providing high-quality antenatal care, healthcare professionals and stakeholders can advise pregnant women on maintaining proper nutrition, following recommended supplementation, monitoring maternal weight regularly and taking necessary actions for high-risk individuals.[55] Prenatal screening using ultrasound can help diagnose congenital anomalies before birth. This screening is a common practice in routine prenatal care and has been used for many years. Detecting these anomalies early on can lead to better management of the pregnancy and the baby's health.[56 57] In Ethiopia, widespread ultrasound-based screening for congenital anomalies is not currently in place, and implementing such screening could significantly enhance the management of these conditions.

Community-based HDSS provide valuable longitudinal data on a stable population, improving representativeness. Research on congenital anomalies in Ethiopia is often limited to health facilities, lacking representative samples. This study examined congenital anomalies in newborns within the community with a large sample size, aligning with WHO recommendations to strengthen surveillance systems. However, the study is observational and cannot establish causality. There may be unaccounted confounding factors contributing to congenital anomalies, and the types of anomalies observed were not specified. Relying solely on physical examinations and maternal interviews for diagnosis may have underestimated the true prevalence of congenital anomalies. Incorporating genetic tests and ultrasound alongside physical examinations and interviews could enhance the assessment of congenital anomalies for more effective intervention strategies.

CONCLUSION

The data from the KHDSS revealed a rising trend in congenital anomalies. This trend was associated with factors such as the mother's age, place of birth and the baby's birth weight. It is crucial for healthcare providers and stakeholders to focus on developing strategies that consider these factors to reduce the prevalence of congenital anomalies effectively.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The Kersa HDSS has received ethical clearance from the national ethical review committees of the Science and Technology Minister of the Federal Democratic Republic of Ethiopia (ref no: EPHA/OG/1861/15) and the Institutional Health Research Ethical Review Committee (IHRERC) of the College of Health and Medical Sciences, Haramaya University (ref no: IHRERC/271/2014). Data anonymity was maintained throughout the research process. All study participants provided informed written consent before being included in the HDSS. The study protocol was approved by the Institutional Research Ethics Review Committee (IRERC) at the College of Health and Medical Sciences. A support letter was issued by Haramaya University College of Health and Medical Sciences to the Kersa HDSS administrative office and an agreement was reached between the investigators and the organisation. Personal information such as name of mother, father, and children was not collected during data extraction. The extracted data will only be shared with third parties upon reasonable and legal request.

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Data availability statement Data may be obtained from a third party and are not publicly available. The authors are unable to share the data but can be obtained from the Kersa HDSS Agency for Shared Services in Education and Research according to the institution's data request and sharing policy.

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