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Original article

Inequality in Afghanistan in the use of prenatal healthcare services according to the sex of newborns

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Abstract

Objective: The association between the sex of newborns and the utilization of prenatal healthcare services during pregnancy and childbirth has not been thoroughly studied. This study investigated the association between the sex of newborns and the extent to which women used prenatal healthcare services in Afghanistan.

Materials and Methods: This study used data obtained from a nationally representative demographic and health survey. The participants in this analysis were women who had given birth in the last five years (n=19,126). Four indicators related to prenatal healthcare utilization were used: (1) number of antenatal care (ANC) visits, (2) number of ANC services provided by skilled professionals, (3) quality of ANC services, and (4) institutional delivery. Multivariate linear and logistic regression models were employed to examine the association between the sex of newborns and the use of prenatal healthcare services after adjusting for sociodemographic and decision-making autonomy variables.

Results: There was a significant association between the sex of newborns and use of prenatal healthcare services. Women with female newborns used ANC services fewer times (β =−0.10, 95% CI: −0.17, −0.03), used ANC services provided by skilled professionals fewer times (β=−0.11, 95% CI: −0.18, −0.04), were less likely to receive high-quality ANC (adjusted odds ratio (AOR)=0.78, 95% confidence interval (CI): 0.67, 0.90), and were less likely to deliver their babies at health institutions (AOR=0.83, 95% CI: 0.77, 0.91) than those with male newborns, after adjusting for other variables.

Conclusion: The findings revealed a negative association between female newborns and the utilization of prenatal healthcare services among women of reproductive age in Afghanistan. It is important to pay attention to this issue and ensure that all women have equal access to healthcare services regardless of their newborn's sex.

Key words: prenatal healthcare services, antenatal care, sex of newborn, child, institutional delivery

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Introduction

Gender preferences for children, referred to as parental desires for a specific gender, have been documented in many communities[1–6]. Bias in gender preferences exists in both developed and developing countries. A predominant preference for daughters has been observed in some Latin American, Caribbean, and Southeast Asian countries[5]. However, a predominant preference for sons has been observed in southern, western, and eastern Asia, northern Africa, and sub-Saharan Africa[4, 5]. A preference for sons leads to selective abortion of female fetuses in countries with traditions of preferring sons[4, 5, 7] and this has become a serious concern in some countries. Mothers aged between 15 and 49 years who have a daughter as their firstborn tend to have higher fertility rates, shorter gaps between childbirths, and a greater risk of anemia; this risk of anemia and other outcomes worsen with successive daughters (female births)[8].

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Gender preferences for children are associated with childcare practices in both developed and developing countries. Where the preference for sons is dominant, female children are cared for differently than male children. In particular, breastfeeding for a shorter time[9, 10], less healthcare-seeking behavior for sick children[11–13], fewer parental time investments[14, 15], and the use of fewer resources[4, 16] have been reported for females than for males. These phenomena are particularly observed in households with older female children[12]. Gender-based disparities and a pro-male gap in dietary diversity and food consumption among older children and adolescents have also been reported[17]. This results in gender inequality and higher mortality among female children, particularly in the late neonatal and later phases[10, 18, 19].

Prenatal healthcare is critical to ensure the health and well-being of both mothers and children. Over the last several decades, the provision of antenatal care (ANC) services has increased in low- and middle-income countries. The World Health Organization (WHO) guidelines for ANC have been updated to recommend the use of at least eight ANC services by skilled professionals and the specified quality of services required[20]. However, in some countries, the majority of pregnant women do not receive the recommended number of ANC visits or the quality of services[21, 22]. In addition to the use of ANC, access to other healthcare during pregnancy, including mental healthcare, and preparation for delivery, including defining the place of delivery and securing means of transport, are considered to be included in prenatal healthcare. The extent to which women utilize prenatal healthcare services is influenced by various factors including socioeconomic status, access to healthcare facilities, cultural beliefs, and women's autonomy in decision-making regarding the use of healthcare services[23, 24]. Unfortunately, Afghanistan is among the countries that still struggle with the limited use of prenatal healthcare services and high maternal and child mortalities[25].

A study conducted in Jordan reported that pregnant women who were informed that their baby would be a boy during the prenatal period used ANC services more frequently than those who were informed that their baby would be a girl[3]. This finding suggests potential differences in the number of uses of ANC services among women who were aware of the expected sex of their babies during the prenatal period. However, differences in the quality of services, qualifications of care providers, and facilities based on the sex of the baby have not yet been addressed. This issue has been a concern in many countries, including Afghanistan.

These perspectives underscore the importance of addressing sex-related factors in promoting the use of prenatal healthcare services. This study investigated the association between newborn sex and the extent to which women used prenatal healthcare services in Afghanistan.

Materials and Methods

Data source and study participants

This study utilized data from the Afghanistan Demographic and Health Survey (AfDHS) conducted in 2015[26]. The AfDHS survey was nationally representative with a two-stage stratified sampling design that included 950 clusters in the first stage and 25,650 households in the second stage across 33 Afghan provinces. Figure 1 shows the selection of the participants for this study. Of the 29,461 women aged 15–49 years from the included households who participated in the survey, 19,806 had given birth in the last five

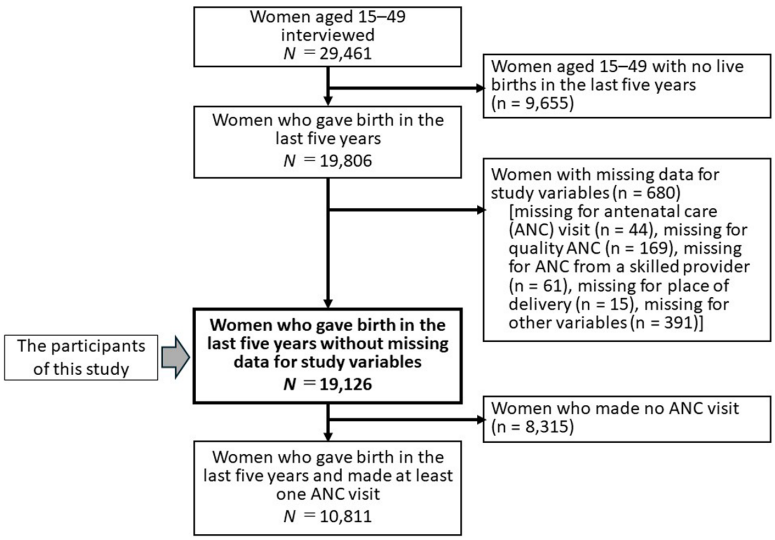

Figure 1 Selection of the study participants from the Afghanistan Demographic and Health Survey conducted in 2015. ANC: antenatal care.

years. After excluding participants without data for ANC visits, quality of ANC, ANC from a skilled professional, sex of the newborn, sociodemographic variables, and decision-making autonomy variables, 19,126 remained and were regarded as participants in this study. These participants were further divided into women who gave birth in the last five years and made at least one ANC visit (n=10,811) or made no ANC visits (n=8,315).

Study variables and measurement

This study examined four prenatal healthcare utilization indicators using separate models. These indicators were: (1) number of ANC visits, (2) number of ANC visits by a skilled professional, (3) quality of ANC, and (4) place of delivery. The number of ANC visits; number of ANC visits provided by a skilled professional, including a doctor, nurse, or midwife; quality of ANC; and institutional delivery were used as outcome indicators. The quality of ANC was evaluated on the basis of seven components commonly provided during pregnancy in healthcare facilities in Afghanistan: blood pressure measurement, blood sample testing, urine sample testing, iron tablet supplementation, tetanus injections, medication for intestinal parasites, and receipt of information on pregnancy complications. A composite variable was created using these components. ANC was classified as low quality if less than six components were provided, and high quality if six or more components were provided. The place of delivery variable was categorized as either home delivery (childbirth at home) or institutional delivery (childbirth at a health facility). Prenatal healthcare use indicators were evaluated for the latest pregnancy of individual women.

The main explanatory variable was the sex of the newborn (male or female). Independent variables were selected based on the literature as well as theoretical and empirical relevance. They were as follows: participant's age (in years; 15–20, 21–30, 31–40, or 41 and above), place of residence (urban or rural), participant's education (no education, primary, secondary, or higher), partner's education (no education, primary, secondary, or higher), household wealth status (low, medium, or high), participant's current working status (no or yes), and participant's decision-making autonomy (no decision-making autonomy, participating in at least one of the four decisions [decisions about own healthcare, a large household purchase, visits to family or relatives, and spending husband's earnings], participating in at least two of the four decisions, participating in at least three of the four decisions, or participating in all four decisions).

Statistical analysis

The descriptive characteristics of the participants who had given birth in the last five years with or without ANC visits, were summarized. The characteristics of participants with at least one ANC visit according to the sex of the newborn were compared using Pearson's χ^2 test. Four prenatal healthcare use variables among participants with at least one ANC visit by the sex of the newborn were compared using the Mann–Whitney U-test for continuous variables (number of ANC visits and number of ANC visits from a skilled professional) and the chi-square test for categorical variables (high-quality ANC and institutional delivery). Associations between the sex of newborn and prenatal healthcare use variables among participants who made at least one ANC visit, with and without adjustment for other variables, were examined using linear regression analysis for continuous outcome variables and logistic regression analysis for categorical outcome variables. The adjusted variables were age, place of residence, education, current working status, decision-making autonomy of participants, education of partners, and household wealth status. The beta coefficient (continuous outcome indicators) or odds ratio (OR; binary outcome indicators) was calculated. Multicollinearity between independent variables was assessed using the variance inflation factor (VIF). All variables with a VIF ≤ 3 were retained in the model. Statistical significance was set at $P<0.05$. The data were analyzed using Stata version 15.1 (StataCorp, LLC, College Station, TX, USA).

Ethical considerations

The authors obtained permission to use the AfDHS data to analyze the anonymized data derived from the DHS platform website (https://www.dhsprogram.com/). The AfDHS program was approved by the institutional review board of the Afghanistan Ministry of Public Health.

Results

Table 1 shows the characteristics of the participants with and without ANC visits. In both groups, more than half were women with male children, those aged between 21 and 30 years, those living in rural areas, those without educational experience, and those who were unemployed. Those not involved in any decision-making process comprised the largest proportion in both groups. Concerning wealth status, women in high-wealth tertile households comprised the largest proportion of the group with at least one ANC visit, whereas women in low-wealth tertile households comprised the largest proportion of the group without any ANC visits. Women with at least one ANC visit were more likely to live in urban areas, have higher levels of education for themselves and their partners, and were less likely to be in the workforce than women without any ANC visits. Regarding women's decision-making autonomy, a higher percentage of the highest scores was observed among the group with at least one ANC visit than among those without any ANC visits.

Table 2 shows the relationship between the sex of new-

Table 1 Characteristics of women who delivered babies in the last five years with or without antenatal care visits (Afghanistan Demographic and Health Survey 2015) (n=19,126)

Variable	Women who delivered babies in the last five years and made at least one ANC visit		Women who delivered babies in the last five years and made no ANC visit		*P*-value
	n	%	n	%	
Overall	10,811	100.0	8,315	100.0	
Sex of the newborn					0.067
Male	5,708	52.8	4,279	51.5	
Female	5,103	47.2	4,036	48.5	
Age, years					0.093
15–20	1,120	10.4	861	10.4	
21–30	6,110	56.5	4,599	55.3	
31–40	2,984	27.6	2,331	28.0	
41 or more	597	5.5	524	6.3	
Place of residence					<0.001
Urban	3,167	29.3	1,426	17.1	
Rural	7,644	70.7	6,889	82.9	
Education					<0.001
No education	8,609	79.6	7,656	92.1	
Primary	985	9.1	371	4.5	
Secondary or higher	1,217	11.3	288	3.5	
Partner education					<0.001
No education	5,387	49.8	5,476	65.9	
Primary	1,663	15.4	985	11.8	
Secondary or higher	3,761	34.8	1,854	22.3	
Currently working					<0.001
No	9,857	91.2	7,375	88.7	
Yes	954	8.8	940	11.3	
Wealth tertile					<0.001
Low	3,926	36.3	4,062	48.9	
Medium	2,251	20.8	1,940	23.3	
High	4,634	42.9	2,313	27.8	
Decision-making autonomy					<0.001
No decision-making autonomy	3,746	34.6	3,807	45.8	
Participating in at least 1/4 of decisions	1,705	15.8	1,007	12.1	
Participating in at least 2/4 decisions	1,186	11.0	794	9.5	
Participating in at least 3/4 decisions	1,271	11.8	778	9.4	
Participating in all 4 decisions	2,903	26.8	1,929	23.2	

Data are in n%; ANC: antenatal care; and *P*-value for c^2 test.

borns among participants with at least one ANC visit and their sociodemographic characteristics. No significant differences were observed in relation to the sex of the newborns, except for the education of the women's partners.

Table 3 presents the mean number of ANC visits, number of ANC services provided by skilled professionals, and percentage of high-quality ANC and institutional deliveries according to the sex of the newborns among participants with at least one ANC visit. Women with female newborns showed a significantly lower mean number of ANC visits and ANC services provided by skilled professionals. They also showed a lower proportion of high-quality ANC visits and deliveries at institutions.

Table 4 shows associations between the sex of the newborn and prenatal healthcare use indicators among the participants who made at least one ANC visit with and without adjustment of other variables. The statistically significant associations between the sex of the newborn and the utilization of prenatal healthcare services were observed. After adjustment with other variables, having a female newborn was correlated with fewer ANC visits during pregnancy (β=−0.10, 95% confidence interval (CI): −0.17, −0.03), fewer ANC services provided by skilled professionals (β=−0.11, 95% CI: −0.18, −0.04), less likely to be cared for by high-quality ANC (adjusted odds ratio (AOR)=0.78, 95% CI: 0.67, 0.90), and less likely to deliver at institutions (AOR=0.83,

Table 2 Characteristics of the participants by sex of the newborn among women who delivered babies in the last five years and made at least one antenatal care visit (Afghanistan Demographic and Health Survey 2015) (n=10,811)

Variable	n (%)	Percentage by sex of the newborn		*P*-value
		Male (n=5,708)	Female (n=5,103)	
Overall	10,811 (100.0)	52.8	47.2	
Age, years				
15–20	1,120 (10.4)	54.5	45.5	0.127
21–30	6,110 (56.5)	53.3	46.7	
31–40	2,984 (27.6)	51.0	49.0	
41 or more	597 (5.5)	53.8	46.2	
Place of residence				
Urban	3,167 (29.3)	53.0	47.0	0.771
Rural	7,644 (70.7)	52.7	47.3	
Education				
No education	8,609 (79.6)	53.0	47.0	0.540
Primary	985 (9.1)	51.2	48.8	
Secondary or higher	1,217 (11.3)	52.6	47.4	
Partner education				
No education	5,387 (49.8)	52.5	47.5	0.008
Primary	1,663 (15.4)	56.2	43.8	
Secondary or higher	3,761 (34.8)	51.7	48.3	
Currently working				
No	9,857 (91.2)	52.5	47.5	0.074
Yes	954 (8.8)	55.6	44.4	
Wealth tertile				
Low	3,926 (36.3)	52.6	47.4	0.242
Medium	2,251 (20.8)	54.3	45.7	
High	4,634 (42.9)	52.2	47.8	
Decision-making autonomy				
No decision-making autonomy	3,746 (34.6)	53.2	46.8	0.623
Participating in at least 1/4 of decisions	1,705 (15.8)	53.1	46.9	
Participating in at least 2/4 decisions	1,186 (11.0)	51.9	48.1	
Participating in at least 3/4 decisions	1,271 (11.8)	54.2	45.8	
Participating in all 4 decisions	2,903 (26.8)	51.9	48.1	

Data are in n%; ANC: antenatal care; and *P*-value for c^2 test.

95% CI: 0.77, 0.91) than having a male newborn. Women with female newborns were 22% less likely to receive high-quality ANC and 17% less likely to deliver at institutions than those with male newborns.

Other factors related to the number of ANC visits during pregnancy and the number of ANC visits by skilled professionals were older age, urban residence, higher education level of women and their partners, household wealth, and greater decision-making autonomy among women. The use of high-quality ANC services was associated with older age, secondary or higher education of women and their partners, not being in the workforce, household wealth, and limited decision-making autonomy. Institutional delivery was associated with younger age, urban residence, higher educational levels of women and their partners, not being in the workforce, and household wealth.

Discussion

This is the first study to reveal the association between the sex of newborns and the utilization of prenatal healthcare services during pregnancy in Afghanistan, including the number of ANC visits, ANC provided by skilled professionals, high-quality ANC, and institutional delivery. Our study determined a substantial negative association between female sex and the utilization of prenatal healthcare services. Women who delivered female babies used ANC services fewer times and received ANC services from skilled pro-

Table 3 Utilization of prenatal healthcare services by sex of the newborn among women who delivered babies in the last five years and made at least one antenatal care visit (Afghanistan Demographic and Health Survey 2015) (n=10,811)

Variable	All	Sex of the newborn		*P*-value
		Male	Female	
Overall (n)	10,811	5,708	5,103	
Number of ANC visits (geometric mean (95% CI))	2.42 (2.39, 2.45)	2.45 (2.41, 2.49)	2.38 (2.34, 2.42)	0.017
Number of ANC by skilled professionals (geometric mean (95% CI))	2.44 (2.41, 2.47)	2.48 (2.44, 2.52)	2.41 (2.36, 2.45)	0.006
High-quality ANC (%)				
No (less than 6 components); n=10,010	92.6	52.4	47.6	0.002
Yes (6 or more components); n=801	7.4	58.2	41.8	
Institutional delivery (%)				
No (home); n=3,587	33.2	50.2	49.8	<0.001
Yes (hospital); n=7,224	66.8	54.1	45.9	

Statistical tests used: Mann–Whitney U-test for the number of ANC visits and number of ANC by a skilled professional, c^2 test for high-quality ANC and institutional delivery. ANC: antenatal care; CI: confidence interval.

fessionals less often than those who delivered male babies. Women with female babies were less likely to receive high-quality ANC and deliver them at health facilities. Other factors related to the preferred use of prenatal healthcare services included urban residence, higher education of women and their partners, and household wealth. Working women were less likely to use high-quality ANC services and less likely to deliver at health facilities than women without occupations. Compared to women aged 15–20 years, older women used ANC more frequently and used high-quality ANC. Regarding institutional delivery, older women were less likely to deliver at health facilities than were women aged 15–20 years. Regarding women's decision-making autonomy, greater autonomy was related to the frequent use of ANC services and ANC provided by skilled professionals.

A study from Jordan that analyzed 484 pregnant women reported that women informed about female fetal sex had a significantly lower mean number of prenatal care visits and a lower proportion of adequate prenatal care than women informed about male fetal sex[3]. Another study from Jordan reported that male fetal sex was associated with greater birth weight in newborns[27]. The present study addresses this sex-related issue using a large dataset of 10,811 women from a population-based survey in Afghanistan.

Ultrasound imaging before 24 weeks of pregnancy is recommended by the WHO[28], and this imaging examination is available in prenatal healthcare for pregnant women in Afghanistan. Importantly, this examination is available free of charge at government hospitals in Afghanistan in addition to examinations at other facilities that require payment. Therefore, many pregnant women undergo this examination during pregnancy. A strong interest in pregnant women and their families in Afghanistan to know the sex of their babies motivates them to obtain information about the sex of the fetus by ultrasound examination, although the primary purpose of ultrasound imaging examination was to assess fetal growth.

Gender disparities in childcare practices have been widely reported[4, 10, 12, 15, 17, 18]. It is noteworthy that there are sex-related differences in the use of prenatal healthcare services before delivery, in addition to sex-related differences in childcare after childbirth. This analysis was performed on women who had used ANC services at least once. The assumption was that pregnant women who used ANC services at least once were likely to have an opportunity to know the expected sex of their newborns. Some women and families may obtain information about fetal sex before delivery, leading to differences in the use of healthcare services during pregnancy. Although the sex of the newborn did not directly reflect whether women knew about fetal sex before delivery, a statistically significant relationship between the sex of the newborn and the use of ANC services presented a robust relationship worth noting.

In Afghanistan, boys usually stay with their families as they grow up, whereas girls are expected to move into their husbands' households. Consequently, inheritance primarily passes down through male descendants. This cultural dynamic emphasizes the preference for male children in Afghan society[29, 30]. In Afghan families, boys are highly celebrated as their birth is considered more important than that of girls. The value placed on boys is due to their perceived contribution to their family income. Agriculture is a major source of livelihood for Afghans and physical strength is highly valued. The physical strength of male workers is considered an important asset. Consequently, women are often expected to have male children. In certain regions, a pervasive social norm places pressure on women to bear male children. In some cases, women undergo repeated pregnancies until they give birth to a male child. By contrast, female children are undervalued and not granted the same op-

Table 4 Associations between sex of the newborn and the utilization of prenatal healthcare services among women who delivered babies in the last five years and made at least one antenatal care visit before and after adjustment by sociodemographic variables (Afghanistan Demographic and Health Survey 2015) (n=10,811)

Variable	Number of ANC visits (continuous)		Number of ANC from skilled professionals (continuous)		High-quality ANC (binary)		Institutional delivery (binary)	
	Crude Coef (95% CI)	Adjusted Coef (95% CI)	Crude Coef (95% CI)	Adjusted Coef (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Sex of the child (ref, male)								
Female	−0.09 (−0.16, −0.01)*	−0.10 (−0.17, −0.03)**	−0.10 (−0.17, −0.02)**	−0.11 (−0.18, −0.04)**	0.79 (0.68, 0.91)**	0.78 (0.67, 0.90)**	0.86 (0.79, 0.93)***	0.83 (0.77, 0.91)***
Age, years (ref, 15–20)								
21–30	0.10 (−0.02, 0.23)	0.15 (0.03, 0.27)*	0.09 (−0.04, 0.21)	0.14 (0.02, 0.26)*	1.34 (1.03, 1.75)*	1.45 (1.11, 1.90)**	0.80 (0.69, 0.92)**	0.84 (0.72, 0.97)*
31–40	0.09 (−0.04, 0.23)	0.18 (0.05, 0.31)**	0.09 (−0.04, 0.23)	0.19 (0.05, 0.32)**	1.21 (0.91, 1.61)	1.42 (1.06, 1.90)*	0.68 (0.59, 0.79)***	0.77 (0.66, 0.91)**
41 or more	0.07 (−0.12, 0.27)	0.26 (0.07, 0.44)**	0.06 (−0.14, 0.26)	0.27 (0.08, 0.46)**	1.49 (1.02, 2.18)*	1.86 (1.26, 2.75)**	0.60 (0.49, 0.74)***	0.81 (0.65, 1.02)
Place of residence (ref, urban)								
Rural	−0.75 (−0.83, −0.67)***	−0.47 (−0.56, −0.38)***	−0.81 (−0.89, −0.73)***	−0.50 (−0.59, −0.40)***	0.95 (0.82, 1.12)	1.13 (0.94, 1.37)	0.33 (0.30, 0.37)***	0.64 (0.56, 0.72)***
Education (ref, no education)								
Primary	0.51 (0.38, 0.64)***	0.32 (0.20, 0.45)***	0.53 (0.40, 0.66)***	0.32 (0.19, 0.45)***	1.10 (0.86, 1.42)	1.07 (0.83, 1.39)	1.90 (1.63, 2.21)***	1.36 (1.15, 1.60)***
Secondary or higher	1.03 (0.92, 1.15)***	0.69 (0.56, 0.81)***	1.09 (0.97, 1.21)***	0.70 (0.57, 0.82)***	1.72 (1.42, 2.10)***	1.57 (1.26, 1.96)***	3.14 (2.68, 3.69)***	1.81 (1.52, 2.16)***
Partner education (ref, no education)								
Primary	0.29 (0.19, 0.40)***	0.15 (0.04, 0.25)**	0.34 (0.23, 0.45)***	0.19 (0.08, 0.29)**	1.00 (0.79, 1.26)	0.95 (0.76, 1.20)	1.70 (1.51, 1.92)***	1.41 (1.24, 1.59)***
Secondary or higher	0.52 (0.44, 0.60)***	0.24 (0.16, 0.33)***	0.59 (0.51, 0.67)***	0.29 (0.21, 0.38)***	1.66 (1.42, 1.93)***	1.46 (1.24, 1.73)***	2.54 (2.31, 2.79)***	1.74 (1.57, 1.93)***
Currently working (ref, no)								
Yes	0.07 (−0.06, 0.20)	−0.06 (−0.18, 0.07)	0.10 (−0.03, 0.23)	−0.02 (−0.15, 0.11)	0.79 (0.60, 1.05)	0.73 (0.55, 0.98)*	0.76 (0.67, 0.88)***	0.76 (0.66, 0.89)***
Wealth tertile (ref, low)								
Medium	0.16 (0.06, 0.26)**	0.13 (0.04, 0.23)**	0.22 (0.12, 0.32)***	0.19 (0.09, 0.28)***	1.42 (1.16, 1.74)**	1.32 (1.08, 1.61)**	1.90 (1.70, 2.11)***	1.79 (1.61, 2.00)***
High	0.64 (0.56, 0.72)***	0.25 (0.16, 0.35)***	0.73 (0.65, 0.81)***	0.32 (0.22, 0.41)***	1.41 (1.19, 1.67)***	1.29 (1.06, 1.57)*	4.46 (4.05, 4.92)***	3.03 (2.71, 3.40)***
Decision-making autonomy (ref, no decision-making autonomy)								
Participating in at least 1/4 decisions	0.36 (0.25, 0.47)***	0.31 (0.21, 0.42)***	0.21 (0.10, 0.32)***	0.16 (0.05, 0.27)**	0.66 (0.52, 0.84)**	0.66 (0.52, 0.84)**	0.89 (0.79, 1.01)	0.89 (0.79, 1.02)
Participating in at least 2/4 decisions	0.41 (0.28, 0.53)***	0.30 (0.17, 0.42)***	0.35 (0.22, 0.48)***	0.23 (0.11, 0.36)***	0.87 (0.68, 1.12)	0.86 (0.66, 1.11)	1.10 (0.95, 1.26)	1.05 (0.90, 1.21)
Participating in at least 3/4 decisions	0.46 (0.33, 0.58)***	0.36 (0.24, 0.48)***	0.45 (0.32, 0.57)***	0.34 (0.22, 0.47)***	0.64 (0.49, 0.85)**	0.63 (0.48, 0.83)**	1.01 (0.88, 1.16)	0.99 (0.86, 1.14)
Participating in all 4 decisions	0.73 (0.63, 0.82)***	0.62 (0.52, 0.71)***	0.74 (0.65, 0.84)***	0.62 (0.53, 0.72)***	1.14 (0.96, 1.36)	1.09 (0.91, 1.30)	1.14 (1.03, 1.26)*	1.10 (0.98, 1.23)

Statistical tests used: linear regression analysis for continuous variables (number of ANC visits and number of ANC by a skilled professional), logistic regression analysis for categorical variables (high-quality ANC and institutional delivery). The results were presented by the beta-coefficient for linear regression analysis and by odds ratio for logistic regression analysis. Variables used in the adjustment were age, place of residence, education, partner education, current work status, wealth tertile, and decision-making autonomy; Values are presented as beta-coefficient (continuous outcome variables) or odds ratio (binary outcome variables); ***P<0.001; **P<0.01; *P<0.05. ANC: antenatal care; OR: odds ratio.

portunities and privileges as their male counterparts. This cultural bias is a form of gender inequality that can have far-reaching consequences for girls and women in these societies. However, this complex problem requires a multifac-

eted approach to address and overcome.

Regarding sociodemographic factors other than the sex of newborns that influenced the use of prenatal healthcare services, some are common in other countries, whereas others may reflect particular situations in Afghanistan. Women's educational attainment is a significant socioeconomic factor that promotes the use of prenatal healthcare services[23, 24, 31–35]. Educated women often have access to written information and can read and interpret the content. Those with higher educational levels demonstrated increased knowledge of healthcare. The deterioration of educational opportunities for girls and future mothers could result in serious consequences for the underutilization of prenatal healthcare services and negative health outcomes for mothers and children. Wealth status is a crucial determinant of prenatal health services utilization[22–24, 31–35]. Even when services at public facilities are provided free of charge, the cost of transportation to health facilities and opportunity costs for male family members to care for women are important for economically disadvantaged households. Urban residence is consistently positively associated with better use of prenatal healthcare services[23, 24, 31–35]. This study found an independent positive association between urban residence and prenatal care service use. In addition to sex preferences and socioeconomic status, potential advantages in the quantity and quality of services, better road conditions, and better awareness of the benefits of prenatal care services in communities in urban areas are expected to underlie this phenomenon. Some rural community members perceive prenatal health services as necessary only if obstetric complications occur[36].

In terms of the age of the women and the use of prenatal healthcare services, the present results are consistent with those of previous reports from Afghanistan[37–39]. Women of advanced age used ANC services more frequently than younger women, as in other studies in Afghanistan[37, 38]. The younger women, with limited experience and education, were not ready to use prenatal healthcare services under their preferred conditions. Women of advanced age were less likely to deliver at health facilities, which is similar to the findings of another study in Afghanistan[39]. Considering Afghan women's situation, women of advanced age are more likely to care for older children at home. This reduces the likelihood of institutional delivery; however, older women should be encouraged to deliver at their institutions. Current work status was negatively associated with the use of prenatal care services, as reported in other studies[38, 39]. A qualitative study reported the reasons for the lower use of services by working women in Indonesia, as attending health services during the daytime may lead to a loss of income[31]. In contrast, other studies in certain African countries have reported the opposite; women in the workforce are more likely to use prenatal services[24, 40]. In the case of Afghanistan, women in the workforce in 2015 might have been busy with daily duties at work and home, which resulted in decreased use of prenatal care services compared to women not enrolled in the workforce.

Women's decision-making autonomy makes a difference in the use of prenatal healthcare[41–44]. This study showed that women practicing autonomous decision-making used ANC services more frequently and used ANC services provided by skilled professionals than women who did not make autonomous decisions. In Afghanistan, women typically require permission from their husbands before leaving home for any reason, which affects their ability to access healthcare services independently[38]. It is concerning that stricter rules have recently been applied. Similar cultural contexts have been observed in other Asian, Middle Eastern, and African countries[41–44]. Limitations on women's autonomy result in limited access to healthcare resources and support, even though women themselves are aware of the necessity of using such services.

There is great concern regarding the extreme underuse of prenatal healthcare in Afghanistan. Approximately 45% of pregnant women did not use ANC services. Even among those who used ANC at least once, the average number of ANC visits were 2.4. The percentages of pregnant women who used ANC four or more times and eight or more times were only 17% and 1%, respectively[38, 45]. The results of the analysis of 2015 data showed that the underuse of ANC is associated with lower educational attainment, lower household wealth status, rural residence, and less autonomy in decision-making. There are serious concerns regarding the recent deteriorating situation for women in Afghanistan. In the current social and political environment, opportunities for education, employment, travel, and maternal and child healthcare for women are severely limited[46]. Fundamental strategies for improving access to prenatal healthcare are essential for securing the health of women and children.

Our study has several strengths. First, it used a nationally representative dataset, and the findings can be extended to the entire population of the country. Second, the sample size was large, allowing for the analysis of inequalities in prenatal care utilization. One of the limitations of this study was the lack of information regarding whether the women knew about fetal sex before delivery or the history of ultrasound imaging examinations during pregnancy. Although some women who used ANC services might not have known the expected sex of their newborns, the results suggest that women who might have had information about the female sex of their newborns used fewer prenatal care services during pregnancy.

Another limitation was the exclusion of 45% of pregnant women who did not use ANC at all, from the analysis. The fact that the quality of ANC was evaluated using only seven specified components, and the retrospective nature of the

information collection, increases the probability of classification bias.

The influence of the sex of the newborn on the utilization of prenatal healthcare services highlights the need to address gender-based inequities in healthcare utilization to improve maternal and child health outcomes in Afghanistan. Concerning policy implications for sex-related differences in care-seeking behaviors for newborns[12], the study findings suggest that efforts are needed to achieve the following: (1) improve recognition of the importance of seeking and attending prenatal healthcare services regardless of the sex of the newborn at the community level; (2) improve access to prenatal healthcare services physically and culturally, particularly for women in households with predominantly female children; (3) formulate healthcare policies to implement guidelines that emphasize equitable care for all pregnant women, regardless of the sex of children; and (4) address cultural and gender disparities in prenatal and childcare in culturally appropriate ways. However, the recent critical situations that Afghan women have encountered, represented by strict restrictions on autonomous behaviors and a scarcity of available good quality health services, are serious concerns for progress. Further studies should reveal details of sex-based disparities in the use of prenatal care and childcare in Afghanistan and other countries with different demographic, cultural, religious, and developmental backgrounds.

Conclusion

This study revealed a significant association between the utilization of prenatal healthcare services and the sex of newborns in Afghanistan, indicating that women who carried female children were less likely to use adequate ANC services than women who carried male children. The study also showed that women with female newborns were less likely to receive high-quality ANC and deliver at health facilities than those with male newborns. This evidence highlights the need to raise awareness and take measures to ensure that all women have access to healthcare services, regardless of the sex of her child. This can help to create an inclusive and equitable healthcare system that benefits all women, newborns, and families.

Conflict of interest: The authors declare that they had no conflict of interest for this study.

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Data availability statement: The Afghanistan Demographic and Health Survey (AfDHS) 2015 data used in this study is publicly accessible and can be downloaded from the official DHS program website. (https://www.dhsprogram.com/what-we-do/survey/survey-display-471.cfm)

Authors' contributions: KD, KN, SA, and KS conceptualized the study. KD and SA obtained and collated the data under the supervision of KN. All authors contributed to the analysis and interpretation of the results. SH supervised the interpretation of data and its implications in the context of the country. KD, KN, and SA prepared the draft manuscript, and all authors reviewed the manuscript, provided input, approved the final version, and agreed on the journal to which this manuscript has been submitted.

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