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Original research

Individual and community-level risk factors of baby postnatal checks within two months among women who gave birth in the last two years in Ethiopia: multilevel analysis of the 2016 Ethiopian Demographic Health Survey

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ABSTRACT

***Background**: Postnatal care constitutes a critical component within the continuum of maternal and child healthcare. Changes occurring during this period significantly influence neonatal well-being, and inadequate care may precipitate adverse outcomes, including morbidity and mortality. Even though studies have conducted so far to identify the magnitude and associated factors of postnatal care checkups in Ethiopia, they are limited to institution-based studies and individual-level risk factors rather than community-level factors. Therefore, this study aimed to identify individual and community-level risk factors of baby postnatal checks within two months among women who gave birth two years prior to the survey in Ethiopia.*

***Method:** Multilevel analysis was applied to the 2016 Ethiopia Demographic and Health Survey data. A total of 7,188 women nested in the 617 clusters were included in the analysis.*

***Results:** The magnitude of women who undergone baby postnatal check within two months of birth was 8.3% (95%CI: 7.3%, 9.5%). Among individual level factors: Women who had 1 to 3 ANC visits (AOR= 2.83; 95% CI: 2.09, 3.83), Four or above ANC visits (AOR = 3.72; 95% CI: 2.76, 5.02), Being Amhara (AOR = 1.50; 95%CI: 1.11, 2.02), Tigrai (AOR = 1.94; 95% CI: 1.36, 2.76), Somalie (AOR = 0.46; 95%CI: 0.27, 0.80), had job (AOR=1.49; 95%CI: 1.24, 1.79), did not perceive distance from the HF (AOR =1.38; 95% CI: 1.14, 1.68), had media exposure (AOR = 1.49; 95% CI: 1.22, 1.82), delivered at HF (AOR = 1.44, 95% CI: 1.16, 1.79), state region (AOR = 1.58, 95% CI: 1.16, 2.15) were significantly associated with baby postnatal checks within two months.*

***Conclusion:** In this study, the prevalence of the baby postnatal check for recently delivered women was low as compared to the results of many previous findings. Women's ANC follow-up history, occupation of the women, ethnicity, media exposure, place of last child delivery, perceived distance to HF, and administrative regions were significantly associated with baby postnatal checks for women who gave their recent birth.*

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INTRODUCTION

Defined as the six-week interval initiating at childbirth, the postnatal period represents a critical phase in the continuum of maternal and child healthcare. Furthermore, it functions as the principal access point for nationwide family postnatal care services.[1]. Postnatal care is delivered to postpartum women and their neonates within the 42-day period following childbirth[2]. The postnatal period represents a decisive developmental window for newborns. Physiological and adaptive transformations occurring during this phase critically determine neonatal well-being. Paradoxically, it remains the most neglected phase for quality service provision. Suboptimal care during this interval heightens the risk of significant morbidity and mortality. Crucially, skilled care coverage is markedly lower postpartum compared to antenatal and intrapartum periods, despite bearing a disproportionate burden of maternal and infant mortality[3].

Globally, neonatal mortality continues to represent a significant public health challenge, constituting nearly half of all deaths among children under five years [4]. An estimated 99% of global neonatal deaths occur in low-resource areas. Neonatal mortality rates in these regions are six times higher relative to high-income countries [5]. According to the World Health Organization (2020), 2.4 million neonatal deaths occurred globally. Nearly half (47%) of all under-five mortality took place during the neonatal period. Sub-Saharan Africa bears the highest global neonatal mortality rate (27 deaths per 1000 live births), accounting for 43% of worldwide neonatal deaths[6].

Despite Ethiopia's remarkable gains in lowering neonatal mortality, the rate remains high, and post-neonatal services are inadequately implemented [7] despite attempts by governments and partners to improve the utilization of maternal and child healthcare services [8]. The 2019 Mini Ethiopian Demographic and Health Survey indicates that mortality proportion in Ethiopia indicate that 1 in 30 children die within the neonatal period, 1 in 21 before reaching their first birthday, and 1 in 17 before their fifth birthday. Neonatal mortality in Ethiopia decreased from 39 per 1,000 live births in 2005 to 29 in 2016, but rose again to 33 per 1,000 in 2019[9].

Different Studies have identified the level of post neonatal checkups in Ethiopia is low and varies through different regions[10, 11] and factors are found to be associated with the frequency of antenatal care visit[11, 12], institutional delivery[12], and perceived distance from the health facility[13], Mothers' education[10, 12], monthly income[11], last pregnancy birth outcome, wantedness[10], Wealth index[12], husband's education[11], community level of

education[12], health service utilization in previous delivery[14], complication during labor and delivery, awareness on postnatal care within one week, maternal employment[15], of the pregnancy were associated with lower odds of delayed post-neonatal checkup.

Even though very few studies conducted so far to reveal the magnitude and associated but, there was no study conducted on contextual factors related to a baby postnatal checkup in Ethiopia. Therefore, this study aimed to address contextual risk factors of baby postnatal check within two months among women who gave birth two years prior to the survey in Ethiopia.

METHODS

Study area and data source

The present study utilized nationally representative data from the 2016 EDHS, which was conducted across Ethiopia's administrative framework of 9 state regions and 2 city administrations. The community-based cross-sectional survey provides population-level estimates of key demographic and health indicators at national, regional, and urban-rural strata. Data were collected from 18 January to 27 June 2016.

Sample size and sampling procedures

This analysis utilized individual-level data from reproductive-aged women in the 2016 EDHS. The study population comprised all eligible women residing within 617 EAs. A two-stage stratified cluster sampling design was employed. In stage 1, 617 EAs were systematically selected with PPS. Stage 2 involved random household sampling within selected EAs, yielding 16,650 sampled households. From these households, 7,188 women who gave live birth within 24 months preceding the survey completed interviews, constituting the analytical sample.

Study Variables and Measurements

The dependent variable was baby postnatal check within two months. It was dichotomized based on the woman's response to the question, Do the newborn had received a postnatal checkup within two months? (Yes = 1 and No = 0)

The individual level independent variables were Socio-demographic variables: women's education, Previous number of ANC visits during pregnancy, child birth order, sex of the child, wealth index, ethnicity, religion, Women's occupation, media exposure, perceived distance, delivery place and the community-level independent variables were, type of resident, type of region, poverty and community education level. Community-level variables were

derived by aggregating individual characteristics across clusters. They were computed using the proportion of selected levels of a given variable per cluster. Given the inherent multilevel nature of these aggregated variables, lacking interpretability at the individual level they were categorized into dichotomous groups using median splits. Specifically, values at or below the 50th percentile were classified as "low," while those above the 50th percentile were designated "high." This approach was necessitated by the non-normal distribution of the aggregated data. Community poverty was derived from the combined proportion of households in the two lowest wealth quintiles (poorest and poorer). Clusters were subsequently dichotomized into low (≤50th percentile) and high (>50th percentile) community poverty levels. The other community-level factors were created through cluster aggregation. Media exposure was derived as the proportion of women exposed to ≥1 media channel (radio, television, print) within each enumeration area. Educational attainment was measured as the cluster-level proportion completing primary education or higher. Non-aggregated contextual variables included: urban-rural residence and administrative classification (city administration vs. state region).

Statistical analysis

Distributions and values of all variables were examined to identify implausible entries and missing data. Following data cleaning procedures, analyses were conducted using STATA 17. Categorical variables were described through frequency distributions and percentage values, presented in tabular format with supplementary visual representation, pie-chart. Sampling weights were applied to produce reliable population estimates, accounting for differential selection probabilities and non-response bias.

A multivariable two-level mixed-effects logistic regression model was used to accommodate the hierarchical structure of the 2016 EDHS data. This approach explicitly accounts for clustering effects, with 7,188 women who gave live births within two years preceding the survey (level-1 units) nested within 617 enumeration clusters (level-2 units). The multilevel framework enables quantification of variance components across hierarchical levels while adjusting for individual and contextual determinants.

ICC was used to measure the proportion of total variance attributable to between-cluster differences and PCV was calculated as the percentage reduction in variance from the null model after incorporating

independent variables. Fixed effects were reported using AOR with 95% CI.

Multicollinearity was assessed using VIF, confirming absence of severe collinearity (all VIF < 10) [16, 17]. Model selection employed AIC, with the optimal specification identified as the model minimizing AIC values (Table 3).

Data quality assurance

Standardized survey instruments, developed by the DHS Program using evidence-based methodology, were translated from English into three languages (Amharigna, Afan Oromo, and Tigrigna) to ensure cultural and linguistic appropriateness. Face-to-face interviews achieved a 95% response rate, demonstrating high participant engagement and data completeness.

Bivariable analysis

The proportion of women who had baby postnatal checks within two months was higher among women who had secondary or above. The percentage of baby postnatal check within two months varies depending on women's wealth index. The higher percentage of baby postnatal check within two months was observed among those women who were rich (13.2%). The degree of baby postnatal checks within two months varies by residence, in urban it is almost three times higher than in rural. Similarly, the magnitude of baby postnatal natal checks within two months was higher (18.6%) in the city administration than the state region (Table 2).

RESULTS

Characteristics of study respondents

Sixty-three percent of women reported no formal education, while nearly one-third (31.7%) completed ≥4 antenatal care (ANC) visits. Approximately two-fifths (41.9%) perceived geographical access to healthcare facilities as a major barrier. At the community level, cluster sizes ranged from 5 to 25 women per enumeration area. Over one-fifth (n = 131) of the clusters were urban and almost five percent of them were found in the city administration (Table 1). The magnitude of women who undergone baby postnatal check within two months of birth was 8.3% (95%CI: 7.3%, 9.5%) (Figure 1).

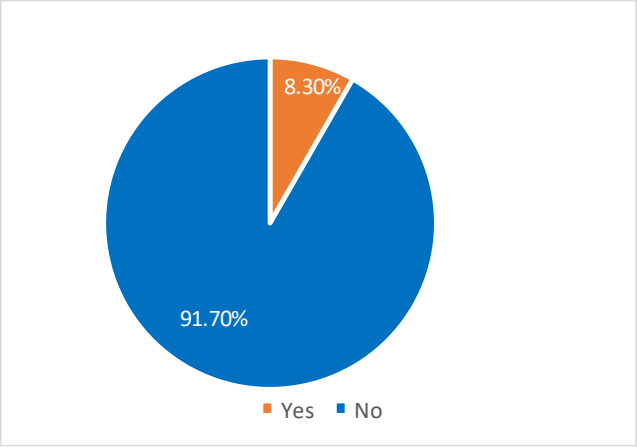

Figure 1: proportion of women who undergone baby postnatal checks within two months in Ethiopia, EDHS, 2016

Table 1: Women and cluster level characteristics of women, baby postnatal checks within two months using 2016 EDHS, Ethiopia

Variables	**Levels**	**Frequency**	**Percent**
Women's education	No education	4,788	63.1
	Primary	2,149	28.3
	secondary or above	649	8.6
Previous number of ANC visit during pregnancy	No visit	2,818	37.2
	1 to 3	2341	30.9
	4 or above	2,411	31.9
Birth order	Three or less	3,716	49.0
	Four or above	3870	51.0
Sex of child	Female	3,646	48.1
	Male	3,940	51.9
Wealth index	Poor	3,303	43.6
	Medium	1,588	20.9
	Rich	2,695	35.5
Ethnicity	Oromo	2,945	38.8
	Amhara	1,899	25.0
	Tigrai	548	7.2
	Somalie	255	3.4
	Others	1,938	25.6
Religion	Christian	4,604	60.7
	Muslim	2,821	37.2
	Others	161	2.1
Women's occupation	No job	4,075	53.7
	Has job	3,511	46.3
Media exposure	No	4,969	65.5
	Yes	2,617	34.5
Perceived distance to health facility	Big problem	4,404	58.1
	Not big problem	3,182	41.9
Place of delivery	Home	4,392	61.1
	Health Facility	2,796	38.9
Residence	Rural	486	78.8
	Urban	131	21.2
Region	State region	584	94.7
	City admin	33	5.3
Community media exposure	Low	259	41.9
	High	358	58.1
Community poverty	High	213	34.5
	Low	404	65.5
Community education	Low	305	49.5
	High	312	50.5

Table 2: Characteristics and percentage distribution of women who gave birth recently, baby postnatal check within two months by selected characteristics using 2016 EDHS, Ethiopia

Variables	Levels	Baby postnatal check		Crude OR (95%CI)
		No (%)	Yes (%)	
Women's education	No education	93.4	6.6	1
	Primary	90.8	9.2	1.65(1.34, 2.03)
	secondary or above	81.6	18.4	2.78(2.15, 3.60)
Previous ANC visit	No visit	97.2	2.8	1
	1 to 3	91.3	8.7	3.60(2.66, 4.86)
	4 or above	85.5	14.5	5.86(4.38, 7.82)
Birth order	Three or less	90.2	9.8	1.37(1.14, 1.64)
	Four or above	93.0	7.0	1
Sex of child	Female	91.3	8.7	1
	Male	92.0	8.0	0.90(0.75,1.06)
Wealth index	Poor	95.6	4.4	1
	Medium	91.7	8.3	1.71(1.30, 2.27)
	Rich	86.8	13.2	2.61(2.08,3.28)
Ethnicity	Oromo	95.0	5.0	1
	Amhara	88.3	11.7	1.93(1.41, 2.66)
	Tigrai	81.9	18.1	2.49(1.70, 3.65)
	Somalie	95.7	4.3	0.26(0.15, 0.47)
	Others	92.1	7.9	0.95(0.70, 1.29)
Religion	Christian	90.0	10.0	1.91(0.79, 4.67)
	Muslim	94.0	6.0	1.11(0.45, 2.76)
	Others	97.3	2.7	1
Women's occupation	No job	93.0	7.0	1
	Has job	90.1	9.9	1.77(1.47, 2.13)
Media exposure	No	94.1	5.9	1
	Yes	87.0	13.0	2.33(1.92, 2.82)
Perceived distance to HF	Big problem	94.3	5.7	1
	Not big problem	88.0	12.0	1.89(1.55, 2.29)
Place of delivery	Home	94.6	5.4	1
	Health Facility	84.3	15.7	2.84(2.34, 3.46)
Residence	Rural	93.1	6.9	1
	Urban	81.7	18.3	2.57(1.96, 3.37)
Region	state region	92.1	7.9	1
	city admin	76.7	23.3	2.96(2.10, 4.16)
Community media exposure	Low	95.0	5.0	1
	High	88.6	11.4	2.78(2.14, 3.61)
Community poverty	High	94.5	5.5	1
	Low	89.7	10.3	2.28(1.75, 2.97)
Community education	Low	94.3	5.7	1
	High	88.1	11.9	2.65(2.04, 3.44)

Multilevel multivariable logistic model

Table 3 indicates the results of multilevel analyses assessing contextual factors. The analytical approach first evaluated whether random effects at the cluster level were justified by fitting a null model (intercept-only model) to predict baby postnatal checks within two months. There was a significant between cluster variation (ICC = 0.294, σ^2u_0 = 1.372, P < 0.001), confirming substantial heterogeneity across clusters. The variance of the random intercept model decreased compared to the random effect of the intercept empty model, decreasing from (ICC = 29.4%) to (ICC = 13.7%) following inclusion of individual- and cluster-level covariates.The combined model showed that 61.9% of the variance in baby postnatal

checks within two months was explained by both women and community-level explanatory variables. Multicollinearity diagnostics confirmed no severe correlations (all VIF < 10). Model was selected by Akaike's Information Criterion (AIC), with the final model (AIC = 3960) demonstrating optimal fit among candidate specifications (Table 3).

Table 3: Multivariable two-level mixed-effects logistic regression, baby postnatal checks within two months by selected characteristics using 2016 EDHS, Ethiopia

Characteristics	Levels	Null model	Model II, AOR (95%CI)	Model III, AOR (95%CI)	Model IV, AOR (95%CI)
Women's education	No education		1		1
	Primary		1.14 (0.92, 1.40)		1.12 (0.90, 1.39)
	secondary or above		1.33 (1.02, 1.75)		1.25 (0.95, 1.66)
Previous ANC visit	No visit		1		1
	1 to 3		2.79 (2.05, 3.78)		2.83(2.09, 3.83)
	4 or above		3.76 (2.78, 5.07)		3.72(2.76, 5.02)
Birth order	Three or less		1		1
	Four or above		1.05 (0.86, 1.28)		1.05 (0.86, 1.29)
Sex of child	Female		1		1
	Male		0.91 (0.77, 1.08)		0.91(0.77, 1.09)
Wealth index	Poor		1		1
	Medium		1.24 (0.93, 1.64)		1.33(0.99, 1.77)
	Rich		1.17 (0.91, 1.54)		1.32(0.98, 1.77)
Ethnicity	Oromo		1		1
	Amhara		1.45 (1.08, 1.97)		1.50(1.11, 2.02)
	Tigrai		1.76 (1.24, 2.50)		1.94(1.36, 2.76)
	Somalie		0.44 (0.26, 0.77)		0.46(0.27, 0.80)
	Others		1.07 (0.80, 1.42)		1.15(0.86, 1.54)
Religion	Christian		1		1
	Muslim		1.12(0.86, 1.44)		1.11(0.86, 1.42)
	Others		1.05(0.43, 2.57)		1.10(0.45, 2.68)
Women has occupation	No occupation		1		1
	Has occupation		1.47 (1.22, 1.76)		1.49(1.24, 1.79)
Media exposure	No		1		1
	Yes		1.48 (1.20, 1.81)		1.49(1.22, 1.82)
Perceived distance to HF	Big problem		1		1
	Not big problem		1.37 (1.12, 1.66)		1.38(1.14, 1.68)
Place of delivery	Home		1		1
	Health Facility		1.46(1.17, 1.82)		1.44(1.16, 1.79)
Residence	Rural			1	1
	Urban			1.06 (0.74, 1.51)	0.84(0.59, 1.12)
Region	State region			1	1
	City admin			1.94 (1.39, 2.71)	1.58(1.16, 2.15)
Community media exposure	Low			1	1
	High			1.90 (1.43, 2.52)	1.18(0.87, 1.60)
Community poverty	High			1	1
	Low			1.04 (0.74, 1.46)	0.92(0.70, 1.19)
Community education	Low			1	1
	High			1.72(1.30, 2.29)	1.11 (0.82, 1.50)
Random effect measure	ICC	0.294	0.163	0.232	0.137
	PCV	Reference	53.3%	27.8%	61.9%
Model fitness	AIC	4266	3999	4178	3960
	BIC	4280	4088	4213	4104
	Deviance	4262	3972	4168	3918

Measures of associations (Fixed part)

This study utilized a two-level multivariable logistic regression model. Fixed effects estimates revealed that antenatal care utilization, ethnicity, maternal employment status, media exposure, perceived distance to healthcare, place of delivery, and region of residence were significantly associated with baby postnatal checks within two months.

After adjusting for covariates, women with 1–3 ANC visits (AOR = 2.83; 95% CI: 2.09, 3.83) and ≥4 ANC visits (AOR = 3.72; 95% CI: 2.76, 5.02) demonstrated significantly increased odds of infant postnatal checks within two months compared to those with no ANC visits. Similarly, compared to women of Oromo ethnicity, those identifying as Amhara (AOR = 1.50; 95% CI: 1.11, 2.02) or Tigray (AOR = 1.94; 95% CI: 1.36, 2.76) had higher odds, while Somali women (AOR = 0.46; 95% CI: 0.27, 0.80) had significantly lower odds of postnatal infant checks within this period.

Employment status was significantly associated with baby postnatal checks within two months: employed women had higher odds of having baby postnatal a check within two months compared to unemployed women (AOR = 1.49; 95% CI: 1.24, 1.79). Similarly, women who did not perceive distance to healthcare access (i.e., reported no challenge with health facility distance) demonstrated increased odds (AOR = 1.38; 95% CI: 1.14, 1.68) relative to those who perceived distance as a barrier. After covariate adjustment, media exposure was associated with 49% higher odds of baby postnatal checks within two months (AOR = 1.49; 95% CI: 1.22, 1.82). Most substantially, facility-based deliveries conferred 44% higher odds of baby postnatal checks within two months compared to home deliveries (AOR = 1.44; 95% CI: 1.16,1.79). Compared to women residing in city administrations, those in state regions demonstrated significantly higher odds of infant postnatal checks within two months (AOR = 1.58; 95% CI: 1.16, 2.15).

DISCUSSION

In this study, the magnitude of baby postnatal check within two months and its associated factors among recently delivered women was assessed. Accordingly, 8.3% (95%CI: 7.3%, 9.5%) of recently delivered women undergone baby postnatal check within two months of birth. This result is comparable with the study conducted in Eastern Ethiopia in which 7.6% (95%CI: 5.9, 8.8%) of the reproductive age women received postnatal check after their most recent birth [18]. However, the result is lower than the finding of the study conducted in Tigray in which 34.3% of mothers utilized early post-natal care within 2-7 days [19]. Similarly, in the Northern part of Ethiopia,

the magnitudes of postnatal check in the study of Debretabor-57.5% [20], Shebe Sombo-58.5% [21], Goba Woreda-42.2% [22], and Pakistan-73% [23] were found to be higher than the current one. The observed difference could be due to the difference in the study period, socio-demographic characteristics of the study population, and the difference in postnatal periods for which postnatal check was measured. In this regard, the study in Tigray was more recent than this study. The study in Debretabor considered only those women who were urban residents. Moreover, the majority of the previous studies did not measure baby postnatal checks separately. Besides, the difference might be from the expected variation between national and local level estimates.

The odds of baby postnatal check were 2.8 times (AOR=2.83(95% CI:2.09, 3.83) more likely for mothers who had one to three ANC visits compared to those women who had no history of antenatal care. In another way, those women who had ANC visits of 4 or above were 3.72 times more likely undergone baby postnatal check compared to those women who had no visit. This result is supported by the studies conducted in Tigray [19], Shebe Sombo [21], Goba woreda [22],Yirgalem [24], Ethiopia [25], Zambia [26], and Sub-Sahara African countries [27]. The possible reason might be that women could get adequate counselling on the pregnancy, delivery and postnatal related complications at their ANC clinic and this could lead to utilization of baby postnatal check services.

Baby postnatal check was associated with the ethnicity in this study. When compared to Oromo, those women who were Amhara in ethnicity had 50% more odds of baby postnatal checks whereas Tigre had 94% increased odds of baby postnatal checks. There is related evidence with this finding in the study of Nepal [28]. Although, there is paucity of supporting literature, the possible reason could be from the difference in cultural norms and practices and socio-demographic status including difference in availability and accessibility of infrastructures in different ethnicities. For instance, Somali and Afar women prioritize traditional postpartum practices over formal healthcare, perceiving PNC as unnecessary unless complications arise [29]. The other might be women often rely on extended family and traditional birth attendants, reducing institutional PNC uptake.

Women who have occupation were 1.49 times more likely undergone baby postnatal checks than their counterparts. Similarly, in the study of Malawi, partner's occupation was the factor that can affect postnatal care utilization [30]. In the meta-analysis of African studies, the occupation of the women was one of the determinants of postnatal care utilization [27]. This might be due to improved level of awareness and education

for those women who have an occupation. Besides, women who have occupation relatively might not have financial difficulty to afford direct and indirect costs of health care.

The odds of baby postnatal check within two months of delivery was 1.49 times (AOR = 1.49; 95%CI: 1.22, 1.82) more likely for women who have media exposure than their counter parts. This is consistent with the study in Zambia [26], Nigeria [31] and the review of African and global studies [27, 32]. The observed association can be explained by the fact that media exposure can lead to information access and contribute for knowledge gain. Furthermore, the health messages that are disseminated through different media platforms probably contribute for the behavioral change, including postnatal care utilization behavior.

The odds of baby postnatal check was 1.3 times more likely (AOR=1.38(95%CI:1.14, 1.68) for women who perceived the distance to health facility as not big problem compared to their counterparts. This is in line with the study of Tigray [19], analysis by Tadele et al. [25], and meta and multilevel analysis of African surveys [27]. This might be attributed to the relationship between easy accessibility of health facilities in terms of walking distance and increased contact of women with health workers. It is expected that health care seeking behavior is increased when there is no difficulty to access the health facility.

Place of delivery was one of the factors associated with baby postnatal checks. Accordingly, women who delivered at health facility had 44% increased odds of baby postnatal checks compared to those who gave birth at home. This finding is similar with other study findings in Debre-tabour [20], Goba woreda [22], Yirgalem town [24], Ethiopia [25], Pakistan [23], and Malawi [30]. This can be explained by increased exposure to and experience of health care for health facility-delivered women than home-delivered women. From the beginning, women who give birth at health facility might have identified the benefits of health services utilization, including the baby postnatal check-ups.

Region was another community-level factor that showed a significant association with the baby postnatal checks. Recently delivered women who reside in city administration were 1.5 times (AOR=1.58(95%CI:1.16, 2.15) more likely took their baby for postnatal checks compared to those women in state region. This result is supported by another study from Ethiopia in which women in Addis Ababa had more postnatal visits than women in the rest regions of the country [25]. It is also in line with the study in Pakistan [23]. This might be attributed to the difference in accessibility of health facilities, educational

status, improved level of knowledge, attitude, and income level between women in city administrations and women in other remote regions of the country.

A key strength of this study lies in its specific focus on quantifying the prevalence of postnatal baby checks and identifying individual- and community-level factors associated with them, utilizing advanced analytical methods. This distinct approach differentiates the study from the majority of prior research, which predominantly examines combined mother-baby postnatal checks. A primary limitation is the reliance on secondary data from a cross-sectional survey, which constrains the depth of information available and impedes the establishment of causal relationships between the identified factors and the outcome.

CONCLUSION

In this study, the magnitude of the baby postnatal check for recently delivered women was low as compared to the result of many other studies. Women's ANC follow-up history during the pregnancy, occupation of the women, ethnicity, media exposure, place of last child delivery, perceived distance to HF and administrative regions were significant factors that can affect baby postnatal checks for women who gave their recent birth. Hence, the health workers should strengthen the antenatal care services including the appropriate counselling of the women on the risk of neonatal death early in the period after delivery. On this regard, institutional delivery should be encouraged as it is one of the factors affecting the baby postnatal services. The government should work on the expansion of infrastructures particularly in distant places to make the postnatal care services accessible for the babies and women. The media coverage needs to be extended to reach the women in the remote areas and postnatal care-related messages ought to be disseminated. On top of this, the economic activities, including the job opportunities for women needs attention to improve women's health-seeking behavior.

Abbreviations

AOR: Adjusted odds Ratio; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; EAs: Enumeration Areas; ICC: Intraclass Correlation Coefficient; PCV: Proportion Change Variance

Declarations

Ethics approval and consent to participate

This study received ethical clearance from the Ethiopian Health and Nutrition Research Institute Review Board, the National Research Ethics Review Committee under the Ministry of Science and Technology, the ICF International Institutional Review Board, and the Centers for Disease Control

and Prevention (CDC). Written informed consent was obtained from all participants in accordance with the procedures outlined in the EDHS 2016 publications (https://www.dhsprogram.com/pubs/pdf/FR328/FR328.pdf). Data access requires online registration via http://dhsprogram.com/data, followed by submission of a research project request specifying the proposed analytical objectives and methodology.

Consent to publish

Not applicable

Availability of data and materials

The 2016 Ethiopian Demographic Health Survey (EDHS) data can be accessed from the DHS measure upon request.

Competing interests

The authors declare no competing interests.

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Author contributions

The authors have confirmed as follows: study conception and design: MA. Emiru, Tolossa.T, Melesse GT, Gebre.DS, Shama.AT and Desalegn.M; data analysis and interpretation of results: Emiru.MA, kajela.L and Lema.M; draft manuscript preparation: Emiru.MA., Shama.AT, Dereje Chala and Tolossa T. All authors reviewed the results and approved the final version of the manuscript and act as guarantors.

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REFERENCES

1. World Health Organization, *WHO technical consultation on postpartum and postnatal care*. 2010, World Health Organization.
2. Seid, A. and M. Ahmed, *Determinants of postnatal checkup for newborns in Ethiopia: Further analysis of 2016 Ethiopia demographic and health survey.* BMC Pregnancy and Childbirth, 2020. **20**(1): p. 1-7.
3. World Health Organization, *Every newborn action plan: progress report, May 2015*. 2015.
4. World Health Organization, *World Health Organization 2018.* 2018.
5. Lawn, J.E., et al., *4 million neonatal deaths: when? Where? Why?* The lancet, 2005. **365**(9462): p. 891-900.
6. World Health Organization, *Fact sheets on Newborn Mortality*. 2022.
7. Fenta, S.M., H.B. Biresaw, and K.D. Fentaw, *Risk factor of neonatal mortality in Ethiopia: multilevel analysis of 2016 demographic and health survey*. Tropical Medicine and Health, 2021. **49**(1): p. 1-11.
8. Fetene, S.M. and T. Gebremedhin, *Uptake of postnatal care and its determinants in Ethiopia: a positive deviance approach*. BMC Pregnancy and Childbirth, 2022. **22**(1): p. 1-9.
9. Hailegebreal, S., et al., *Spatial distribution and associated factors of antenatal care utilization in Ethiopia in 2019: Spatial and multilevel analysis.* 2021.
10. Alemu, T., et al., *Early Postnatal Care Utilization and Associated Factors Among Mothers Who Gave Birth in The Last Twelve Months in Lemmo District, Hadiya Zone, Southern Ethiopia.* Primary Health Care: Open Access, 2021. **11**(5): p. 1-7.
11. Zeleke, L.B., et al., *Individual and community level factors associated with unintended pregnancy among pregnant women in Ethiopia.* Scientific Reports, 2021. **11**(1): p. 1-9.
12. Adane, B., et al., *Factors associated with postnatal care utilization among postpartum women in Ethiopia: a multi-level analysis of the 2016 Ethiopia demographic and health survey.* Archives of Public Health, 2020. **78**(1): p. 1-10.
13. Belihu, T.M. and A.T. Deressa, *Postnatal Care within One Week and Associated Factors among Women Who Gave Birth in Ameya District, Oromia Regional State, Ethiopia, 2018: Cross Sectional Study.* Ethiopian Journal of Health Sciences, 2020. **30**(3).

14. Abuka Abebo, T. and D. Jember Tesfaye, *Postnatal care utilization and associated factors among women of reproductive age Group in Halaba Kulito Town, Southern Ethiopia.* Archives of public health, 2018. **76**(1): p. 1-10.
15. Wudineh, K.G., et al., *Postnatal care service utilization and associated factors among women who gave birth in Debretabour town, North West Ethiopia: a community-based cross-sectional study.* BMC pregnancy and childbirth, 2018. **18**(1): p. 1-9.
16. Belsley, D.A., E. Kuh, and R.E. Welsch, *Regression diagnostics identifying Influential Data and Sources of Collinearity*. Second ed. 2004, Hoboken, New Jersey & Canada: A John Wiley & Sons, Inc., Publication.
17. Forthofer, R.N., E.S. Lee, and M. Hernandez, *Biostatistics: A Guide to design, analysis, and discovery*. second ed. 2007, Burlington, San Diego and California (USA) , London (UK): Elsevier Academic press.
18. Tesfaye, G., et al., *Magnitude and correlates of postnatal care utilization among reproductive aged women in a rural district in eastern Ethiopia: A cross-sectional study.* Midwifery, 2019. **70**: p. 22–30.
19. Gebreslassie Gebrehiwot T, et al., *Prevalence and Associated Factors of Early Postnatal Care Service Use Among Mothers Who Had Given Birth Within the Last 12 Months in Adigrat Town, Tigray, Northern Ethiopia, 2018.* International Journal of Women's Health 2020. **2020**(12): p. 869-879. https://doi.org/10.2147/IJWH.S266248.
20. Wudineh, K.G., et al., *Postnatal care service utilization andassociated factors among women who gave birth in Debretabour town, North West Ethiopia: a community- based cross-sectional study.* BMC Pregnancy and Childbirth, 2018. **18**: p. 508. https://doi.org/10.1186/s12884-018-2138-x.
21. Gelan M, Sinaga M, and Chemir F, *Postnatal Care Service Utilization and Associated Factors among Mothers Who Delivered in Shebe Sombo Woreda, Jimma Zone, Ethiopia.* Int J Womens Health Wellness, 2018. **4**: p. 078. doi.org/10.23937/2474-1353/1510078.
22. Lamore Y, *Postnatal Care Service Utilization and Associated Factors among Women in Goba Woreda, Bale Zone, Ethiopi.* Clinics Mother Child Health, 2021.
23. Saira, A., et al., *Factors associated with non-utilization of postnatal care among newborns in the first 2 days after birth in Pakistan: a nationwide cross-sectional study.* Global Health Action 2021. **14**(1): p. https://doi.org/10.1080/16549716.2021.1973714.
24. Dona, A., et al., *Factors influencing utilization of early postnatal care services among postpartum women in Yirgalem town, Sidama Regional State, Ethiopia.* SAGE Open Medicine, 2022: p. https://doi.org/10.1177/20503121221088098.
25. Tadele, A. and M. Getinet, *Determinants of Postnatal Care Checkups in Ethiopia: A Multi-Level Analysis.* Ethiop J Health Sci., 2021. **31**(4): p. 753. doi:http://dx.doi.org/10.4314/ejhs.v31i4.9.
26. Bwalya, B.B., M.C. Mulenga, and J.N. Mulenga, *Factors associated with postnatal care for newborns in Zambia: analysis of the 2013-14 Zambia demographic and health survey.* BMC Pregnancy and Childbirth, 2017. **17**: p. 418. DOI 10.1186/s12884-017-1612-1.
27. Tessema, Z.T., et al., *Determinants of postnatal care utilization in sub-Saharan Africa: a meta and multilevel analysis of data from 36 sub-Saharan countries.* Italian Journal of Pediatrics, 2020. **46**(175): p. https://doi.org/10.1186/s13052-020-00944-y.
28. Pandey, J.P., et al., *Maternal and Child Health in Nepal: The Effects of Caste, Ethnicity, and Regional Identity: Further analysis of the 2011 Nepal Demographic and Health Survey. Calverton, Maryland, USA: Nepal Ministry of Health and Population, New ERA, and ICF International.* Available at https://www.dhsprogram.com/pubs/pdf/FA73/FA73.pdf[accessed on 21/7/2022], 2013.
29. Njenga, A., *Somali Refugee Women's Cultural Beliefs and Practices Around Pregnancy and Childbirth.* Journal of Transcultural Nursing, 2022. **33**(4): p. 484-490.
30. Sagawa, J., et al., *Determinants of postnatal care serviceutilization among mothers of Mangochidistrict, Malawi: a community-based cross-sectional study* BMC Pregnancy and Childbirth, 2021. **21**: p. 591.https://doi.org/10.1186/s12884-021-04061-4 [accessed Jul 21 2022].
31. Agho, K.E., et al., *Population attributable risk estimates for factors associated with non-use of postnatal care services among women in Nigeria* Bmj open, 2016. **6**(7): p. e010493.doi:10.1136/bmjopen-2015-010493.
32. Mukonka, P.S., et al., *Household factors associated with use of postnatal care services.* African Journal of Midwifery and Women's Health, 2018. **12**(4): p. https://doi.org/10.12968/ajmw.2018.12.4.189.