

Access to quality maternal healthcare services in Ethiopia: A multilevel analysis

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Research Article

Keywords: Antenatal care, intrapartum care, postnatal care, maternal health, quality of care, Ethiopia.

Posted Date: May 19th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1627642/v1>

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Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Public Health on June 19th, 2023. See the published version at <https://doi.org/10.1186/s12889-023-15938-8>.

Abstract

Background

The quality of care a woman receives during antenatal care (ANC), intrapartum care, and postnatal care (PNC) affects the health of the woman and her child and her likelihood of seeking care in the future. This study aimed to assess the recommended interventions received by a mother and/or her newborn during ANC, intrapartum care and PNC, and their determinants in Ethiopia using data from the nationally representative 2019 Mini Demographic and Health Survey.

Methods

We defined quality ANC as having: blood pressure measurement, urine and blood tests, informed of danger signs, iron supplementation, and nutritional counselling; quality intrapartum care as having: a health facility birth, skilled birth assistance, and newborn put to the breast within one hour; and quality PNC as having: PNC within two days; cord examination; temperature measurement, and counselling on danger signs and breastfeeding of the newborn; and healthcare provider's observation of breastfeeding. We used multilevel mixed-effects logistic regression analyses specifying three-level models: a woman/household, a cluster, and an administrative region to determine predictors of each care quality. The analyses employed sampling weights and were adjusted for sampling design.

Results

Thirty-six percent (n=1,048), 43% (n=1,485), and 21% (n=374) women received quality ANC, intrapartum, and PNC, respectively. Private health facilities provided higher-quality ANC and PNC but poor intrapartum care quality, compared to public health facilities. Receiving ≥ 4 ANC contacts and commencing this during the first trimester, higher levels of women's education and household wealth were positive predictors of quality ANC. Government health posts were less likely to provide quality ANC. Richer, urban residing women with education and ≥ 4 ANC contacts were more likely to receive quality intrapartum care. Women who received quality ANC and skilled birth assistance were more likely to receive quality PNC. Adolescent mothers were more likely to receive quality intrapartum care, but were less likely to receive quality PNC than mothers aged 20-49.

Conclusions

We recommend standardizing the components of maternal healthcare provided in all health facilities; and promoting early and ≥ 4 ANC contacts, effectiveness, sensitivity, and vigilance of care provided to adolescent mothers, digital clinical decision support tools, and women's education and economic empowerment.

Background

Reducing the unacceptably high maternal and perinatal morbidity and mortality rates in low-income countries requires considerable investment to increase access to, demand for, and use of skilled maternity care, alongside enhancing the quality of care delivered [1]. In Ethiopia in 2017, 49% of 1010 reported maternal deaths occurred after women arrived at health facilities. Fourteen percent of these maternal deaths were attributed to a lack of supplies and equipment, 11% to delays in patient management at the facility, 6% to healthcare provider error and mismanagement, and 28% to referral delays from other facilities [2]. Therefore, increasing access to, and utilization of, maternal healthcare alone is insufficient to improve maternal health outcomes [3]. The quality of care a woman receives across ANC, intrapartum care, and PNC affects the health of the woman and her child and her likelihood of seeking care in the future [3, 4]. Measuring the quality of existing maternal healthcare and identifying its determinants are essential for planning improvements in current and future care [3].

While there has been a strong focus on improving access to healthcare during pregnancy, labour and delivery, and postnatal periods, there has been less emphasis on ensuring effective coverage or contact with the provision of all the recommended interventions during antenatal, intrapartum, and PNC services. This has resulted in missed opportunities to alleviate maternal and newborn morbidities and mortalities [5]. Reaching the 2030 Sustainable Development Goals (SDGs) target of reducing the global maternal mortality ratio to less than 70/100,000 live births and the global neonatal mortality rates to less than 12/1,000 live births in Ethiopia requires a rapid improvement in maternal healthcare quality [6].

Maximizing the life-saving potential of ANC in low-resource settings requires a focus on quality. For many women around the globe, an ANC visit may be their first adult contact with the healthcare system. ANC, therefore, serves as a gateway to health services both during and beyond maternity care. In addition to diagnosing and managing pregnancy-related complications, ANC provides an opportunity to screen for and treat other chronic conditions and non-communicable diseases [7]. However, in low-income settings, the mere focus on the proportion of mothers receiving four or more ANC contacts as a global benchmark indicator to track maternal health program performance than on the content and process of ANC is limiting the ability to early identify and address complications and maximize health outcomes [8].

Over the last two decades, women have been encouraged to give birth in health facilities to ensure access to skilled personnel and timely referral if required. However, giving birth in a health facility may not guarantee quality care [9]. Disrespectful care has been reported in facilities that not only violate a woman's human rights but are a significant barrier to accessing future intrapartum care services [9, 10]. A negative experience in childbirth is associated with post-traumatic stress disorder, disruption to interpersonal relationships, and dysfunctional maternal-infancy bonding [11, 12].

Women and their newborns require support and careful monitoring after birth. Most maternal and infant deaths occur in the first six weeks after delivery, yet this remains a neglected area of care [13]. Basic care for all newborns should include promoting and supporting early and exclusive breastfeeding if possible, keeping the baby warm, increasing handwashing, and providing hygienic umbilical cord and skincare. Families should be counselled to identify danger signs, understand the care that both the woman and

newborn need, and where to reach services when needed. Promoting a healthy lifestyle and good nutrition, detecting and preventing diseases, supporting women who may be experiencing intimate partner violence, and ensuring access to sexual and reproductive health, including postpartum family planning, are also key to quality postnatal care [13].

Quality prenatal, intrapartum, and postnatal care are vital maternal healthcare services that should be delivered by skilled personnel. Quality ANC, according to the World Health Organization (WHO), includes nutritional counselling and multivitamin supplements, frequent visits (eight or above ANC contacts), blood and urine tests, preventive antibiotics, tetanus toxoid injections, and health education on pregnancy and birth danger signs [14, 15]. Respectful care, clear and compelling communication between the woman and her healthcare provider, the option of a companion during labour and delivery, delivery at a health facility, skilled personnel assistance, appropriate pain relief strategies, mobility in labour where possible, choice of birth position, use of uterotonics, delayed cord clamping (after a minute), immediate kangaroo care and breastfeeding, delayed bathing of the newborn (24 hours), and the care of mother and newborn in a health facility for at least 24 hours after delivery are all components of quality intrapartum care [15, 16]. Immediate PNC within 24 hours of birth and at least three additional PNC visits for the mother and the newborn within 42 days of birth, home visits in the first week after birth, exclusive breastfeeding, cord care, prophylactic antibiotics for the mother, and health education on maternal and newborn health danger signs are all components of quality PNC [15, 17].

Measuring the existing maternal healthcare quality and its determinants at a country level, using the nationally representative demographic and health survey (DHS) data, can identify gaps in care and provide insight into reducing maternal and newborn morbidity and mortality [18, 19]. There is currently no research that provides a comprehensive and standard view of the maternal healthcare quality across ANC, intrapartum care, and PNC services in Ethiopia to inform health service planning and improve outcomes.

One study focused on the quality of ANC and PNC in 20 sub-Saharan African countries, including Ethiopia. This research, based on a secondary analysis of DHSs data, revealed that while 51% of mothers received four or more ANC visits with at least one visit from skilled personnel, only 5% received eight ANC interventions (blood pressure measurement, urine and blood test, iron supplementation, tetanus protection, counselling on pregnancy complications, HIV testing and results, and three doses of intermittent preventive treatment of malaria in pregnancy). While 65% of births in this study were attended by skilled personnel, no data is provided concerning the interventions provided during intrapartum care. Only 3% of women received all seven PNC interventions (newborn weighed at birth, early initiation of breastfeeding, no pre-lacteal feed, BCG and polio vaccines, and PNC for mother and newborn within two days of birth) [5].

While no research has examined the quality of care across the three packages of maternal healthcare, two studies by Bayou et al. (2016) and Gebrekirstos et al. (2021) have assessed adequate ANC among slum residents in Addis Ababa, and Southern Ethiopia. These authors defined quality ANC as

commencing ANC during the first trimester, four or more ANC contacts, weight, height and blood pressure measurements, urine and blood tests, tetanus injection, iron supplementation, and counselling on pregnancy complications. In this study, only 11% and 23% had adequate ANC in Addis Ababa and Southern Ethiopia, respectively [20, 21]. Based on the then most recent (2007–16) DHS and Multiple Indicator Cluster Surveys data in 91 low and middle-income countries, Arsenault et al. (2018) described quality ANC according to the receipt of three essential services (blood pressure measurement, urine examination, and blood testing) among women who had at least one visit with a skilled ANC provider [22].

Our study aimed to assess the quality of antenatal (ANC), intrapartum care, and PNC services and to identify their multifaceted determinants in Ethiopia using data from the 2019 Ethiopia Mini DHS (MDHS). We therefore comprehensively assessed the recommended interventions during ANC, intrapartum care, and PNC services a mother and/or her newborn received and the associated socio-demographic determinants at a national level in Ethiopia using the 2019 Ethiopia MDHS data.

Methods

Data and study sample

We used the 2019 Ethiopia Mini Demographic and Health Survey (EMDHS) data conducted by the Ethiopian Public Health Institute (EPHI) from March 21, 2019, to June 28, 2019, with permission from the DHS program. The main objectives of the 2019 EMDHS were to collect nationally representative high-quality data house to house and provide up-to-date estimates on key demographic and health indicators in Ethiopia: breastfeeding; maternal and child health (ANC, delivery, and PNC); infant, child, and neonatal mortality levels; child nutrition; and other health issues relevant to the achievement of the SDGs [23].

The 2019 EMDHS used the sampling frame of all census enumeration areas (EAs) created for the 2019 Ethiopia Population and Housing Census (EPHC) and conducted by the Central Statistical Agency (CSA). The census frame was a complete list of 149,093 EAs created for the 2019 EPHC. An EA is a geographic area covering an average of 131 households. The 2019 EMDHS sample provides estimates of key indicators for the country as a whole, for urban and rural areas separately, and each of the nine regions and the two administrative cities [23].

The 2019 EMDHS employed a two-stage cluster sampling technique. In the first stage, 305 EAs (93 in urban areas and 212 in rural areas) were selected with probability proportional to EA size and with independent selection in each sampling stratum. A household listing operation was then carried out in all selected EAs from January through April 2019. In the second stage of selection, a fixed number of 30 households per cluster were selected with an equal probability of systematic selection from the newly created household listing. All women aged 15–49 years, who were either permanent residents of the selected households or visitors and who slept in the household the night before the survey, were eligible to be interviewed. In the interviewed households, 9,012 eligible women were identified for individual

interviews; interviews were completed with 8,885 women, yielding a response rate of 99% [23]. We used information on 3,979 women surveyed with the most recent live births within five years preceding the 2019 EMDHS for the analyses.

Outcome measures

The outcome measures used in this study were the antenatal, intrapartum, and maternal and/or newborn postnatal quality of care indicators defined by the World Health Organization (WHO) [14, 17, 24, 25]. Specifically, the quality of ANC was defined as: blood pressure measurement; urine tests for detecting bacteriuria and proteinuria; blood tests for infection and anaemia; informed of danger signs of pregnancy; provision of iron supplements; and provision of nutritional counselling. A woman would need to receive all six of these interventions to be considered to have received good quality ANC [14, 25].

Quality intrapartum care was defined as receiving all three of the following interventions: a health facility birth; skilled personnel assisted birth; and the newborn put to the breast within one hour of birth [24, 25]. In the context of a shortage of skilled personnel in low-resource settings, the over-medicalization of normal childbirth can overburden front-line health workers, resulting in poor birth outcomes. Therefore, it is crucial that intrapartum clinical interventions are implemented only when there is clear evidence that they can improve outcomes and minimize potential harms [26]. The non-clinical aspects of labour and childbirth care, including emotional support through labour companionship, effective communication, and respectful care, are essential components of the care experience that should complement any necessary clinical interventions to optimize the quality of care provided to the woman and her family [24].

Quality PNC was defined as the receipt of all six of the following components of PNC: postnatal check for the mother and/or newborn within two days of birth at home or health facilities; cord examination for the newborn; temperature measurement for the newborn; counselling on danger signs of newborn health; counselling on breastfeeding; and healthcare provider's observation of breastfeeding [17, 25].

Other measures

Information about the individual mothers included their age at birth (i.e., 10–19, 20–34 years, and 35–49 years), an education level (i.e., no formal education, primary school education, secondary school, and tertiary), preceding birth interval (i.e., < 24 months, and \geq 24 months), and household wealth index (i.e., richest, richer, middle, poorer, and poorest).

Information about the birth included type of healthcare provider (i.e., doctor, nurse, midwife, others), the place where care was received (public sector, private sector, NGO, home), area of residence (i.e., urban or rural: urban areas include all capitals of administrative regions, zones, and districts; rural areas are all areas that are not urban.), as well as cities (i.e., Addis Ababa and Dire Dawa) and administrative regions (i.e., Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, South Ethiopia, Gambela, and Harari).

Statistical analyses

Multilevel mixed-effects logistic regression models were used to determine the association between study characteristics and measures of quality of maternity care services. Three-level models were specified. The level-one variables refer to individual women/household level determinants, including socio-demographic and economic characteristics. At level two, we adjusted for clustering (EA) and included a primary sampling unit for analyses. While at level three, we adjusted for an administrative region where two cities and nine administrative regions were included for the analyses (Fig. 1). Using the statistical software Stata, all analyses employed sampling weights and were adjusted for sampling design (i.e., clustering and stratification). Statistical significance was set at $p < 0.05$.

Results

Of the women who attended ANC for their most recent live births within five years preceding the 2019 Ethiopia DHS, 88% reported blood pressure measurement, 79% reported blood tests to screen anaemia or infections, 77% received iron supplementation, 74% reported urine examination, 71% received nutritional counselling, and 60% were informed of pregnancy-related complications. All six of the recommended interventions were received by 36% of women during their ANC visits (Table 1). The majority (53%) of the six recommended interventions during ANC visits were provided in private clinics and NGOs, while only 18% were provided in government health posts (Fig. 2).

Table 1

Quality antenatal care during pregnancy of the most recent live birth within five years preceding the survey, Ethiopia MDHS 2019 (n = 2,923).

Intrapartum care interventions	Frequency	Percent	(95% CI.)
Health facility birth	2,018	58.9	(53.3, 64.3)
Skilled personnel assisted birth	2,120	61.8	(56.3, 67.1)
Newborn put to the breast within 1hr of birth	2,464	71.9	(68.9, 74.6)
Received the three recommended interventions during the intrapartum care	1,485	43.3	(38.6, 48.2)

Of the women who received intrapartum care during labour and delivery for their most recent live births within five years preceding the 2019 Ethiopia DHS, 59% gave birth in health facilities. Of these women, 62% had skilled personnel-assisted birth, and 72% had their newborn put to their breast within one hour of birth. All three of these recommended interventions were received by 43% of women during intrapartum care (Table 2). The majority (75%) of all the three recommended interventions during intrapartum care were provided in government health centres, while 65% were provided in private health facilities (Fig. 3).

Table 2

Three recommended interventions during intrapartum care for the most recent live birth within five years preceding the survey, Ethiopia MDHS 2019 (n = 3,428).

Intrapartum care interventions	Frequency	Percent	(95% CI.)
Health facility birth	2,018	58.9	(53.3, 64.3)
Skilled personnel assisted birth	2,120	61.8	(56.3, 67.1)
Newborn put to the breast within 1hr of birth	2,464	71.9	(68.9, 74.6)
Received the three recommended interventions during the intrapartum care	1,485	43.3	(38.6, 48.2)

Among mothers and/or their newborns who received PNC at home or in health facilities for the most recent live births within five years preceding the 2019 Ethiopia MDHS, 87% received maternal and/or newborn PNC within two days of birth; a healthcare provider counselled the mother on breastfeeding in 63% of births; a healthcare provider observed the newborn breastfeeding in 59% of births; a healthcare provider measured the newborn's temperature in 51% of births; a healthcare provider examined the newborn's cord in 49% of births, and a healthcare provider counselled the mother on newborn danger signs in 39% of births. All six of the recommended interventions were received by 21% of women and/or their newborns during the postnatal care (Table 3). Private health facilities provided the majority of all the six recommended PNC interventions (44%), while government health posts provided only 9% (Fig. 4).

Table 3

Quality maternal and/or newborn PNC for the most recent live birth within five years preceding survey, Ethiopia MDHS 2019 (n = 1,785).

PNC interventions	Frequency	Percent	(95% CI.)
Maternal and/or newborn PNC within two days of birth	1,559	87.3	84.7, 89.6
The health provider examined the newborn cord	877	49.2	44.7, 53.6
The health provider measured newborn temperature	902	50.6	46.4, 54.7
Health provider counselled mother on newborn's health danger signs	691	38.7	34.4, 43.2
Health provider counselled on breastfeeding	1,124	63.0	59.1, 66.7
The health provider observed breastfeeding	1,046	58.6	54.8, 62.4
Received all the six components of PNC	374	20.9	18.0, 24.2

Of the women who received ANC for their most recent live births within five years preceding the survey, 63% commenced ANC during the first trimester, 58% received at least four ANC visits, while 3% attended their ANC in private clinics/NGO health facilities and 66% in government health centres (Table 4). Of the women who received intrapartum care during labour and delivery for their most recent live births within five years preceding the survey, 47% had received at least four ANC visits, and 29% had received the six recommended interventions during ANC visits (Table 5). Among mothers with the most recent live births within five years preceding the survey and who received maternal and/or newborn PNC services, 90% had skilled personnel assisted birth; 87% had a preceding birth interval of 24 or more months; 41% had commenced ANC during the first trimester, and 40% had received the six recommended interventions during ANC visits (Table 6).

Table 4

Determinants of receipt of all the six recommended interventions during ANC visits for the most recent live birth within five years preceding survey, Ethiopia MDHS 2019 (n = 2,923).

Study variables	Total number of women (%)	Women who received all the six interventions during ANC (%)	Unadjusted Odds Ratio (95% CI.)	p-value	* Adjusted Odds Ratio (95% CI.)	p-value
First trimester ANC	1,831 (62.6)	565 (30.9)	1.00	< 0.001	1.00	0.009
No	1,092 (37.4)	483 (44.2)	2.66 (2.21, 3.19)		1.30 (1.07, 1.59)	
Yes						
Number of ANC visits	1,225 (42.0)	304 (24.8)	1.00	< 0.001	1.00	< 0.001
1-3	1,688 (58.0)	739 (43.8)	2.23 (1.85, 2.68)		1.88 (1.54, 2.29)	
≥4						
Mother's level of education	1,282 (43.9)	377 (29.4)	1.00	< 0.001	1.00	0.012
No education	1,153 (39.5)	416 (36.1)	1.82 (1.50, 2.21)	< 0.001	1.31 (1.06, 1.63)	0.002
Primary education (1-8)	487 (16.7)	255 (52.3)	3.51 (2.69, 4.59)		1.58 (1.18, 2.12)	
Secondary or higher						
Place where the woman received ANC	559 (19.4)	98 (17.6)	1.00	< 0.001	1.00	< 0.001
Government H. post Hospital (public/private)	342 (11.9)	159 (46.3)	3.49 (2.37, 5.14)	< 0.001	2.19 (1.44, 3.32)	< 0.001
Government H. centre	1,902 (65.9)	43 (52.9)	2.58 (1.92, 3.46)	< 0.001	2.12 (1.57, 2.89)	< 0.001
Private clinic/NGO HF	82 (2.8)		5.52 (3.00, 10.30)		3.54 (1.87, 6.72)	

* Odds ratio adjusted for all study variables listed in the table.

Study variables	Total number of women (%)	Women who received all the six interventions during ANC (%)	Unadjusted Odds Ratio (95% CI.)	p-value	* Adjusted Odds Ratio (95% CI.)	p-value
Household wealth quintile	399 (13.7)	84 (20.9)	1.00	< 0.001	1.00	0.002
Richest	587 (20.1)	160 (27.2)	0.37 (0.27, 0.51)	< 0.001	0.56 (0.39, 0.82)	0.028
Richer	589 (20.1)	206 (34.9)	0.34 (0.24, 0.47)	< 0.001	0.64 (0.43, 0.95)	< 0.001
Middle	578 (19.8)	198 (34.3)	0.23 (0.16, 0.32)	< 0.001	0.47 (0.31, 0.71)	< 0.001
Poorer	770 (26.4)	401 (52.0)	0.12 (0.08, 0.17)	< 0.001	0.34 (0.21, 0.55)	< 0.001
Poorest						
Mother's place of residence	2,052 (70.2)	664 (32.4)	1.00	< 0.001	1.00	0.201
Rural	871 (29.8)	384 (44.1)	2.44 (1.56, 3.80)		0.74 (0.46, 1.18)	
Urban						

* Odds ratio adjusted for all study variables listed in the table.

Table 5

Determinants of receipt of the three recommended interventions during intrapartum care for the most recent live birth within five years preceding survey, Ethiopia MDHS 2019 (n = 3,428).

Study variables	Total number of women (column %)	Women who received the three interventions during intrapartum care (%)	Unadjusted Odds Ratio (95% CI.)	p-value	*Adjusted Odds Ratio (95% CI.)	p-value
Four or more ANC visits	1,828 (53.3)	562 (30.7)	1.00	< 0.001	1.00	< 0.001
No	1,600 (46.7)	923 (57.7)	2.16 (1.81, 2.57)		1.80 (1.50, 2.17)	
Yes						
Received quality ANC for last birth	2,429 (70.8)	907 (37.3)	1.00	< 0.001	1.00	0.058
No	1,000 (29.2)	578 (57.8)	1.64 (1.35, 1.98)		1.22 (0.99, 1.49)	
Yes						
Mother's level of education	1,650 (48.1)	521 (31.6)	1.00	< 0.001	1.00	< 0.001
No education	1,287 (37.5)	638 (49.6)	1.88 (1.55, 2.27)	< 0.001	1.57 (1.29, 1.93)	< 0.001
Primary education (1–8)	492 (14.4)	325 (66.1)	3.12 (2.37, 4.10)		2.00 (1.49, 2.67)	
Secondary or higher						
Mother's age at birth (years)	501 (14.6)	244 (48.8)	1.00	0.016	1.00	0.012
12–19	2,474 (72.2)	1,085 (43.9)	0.75 (0.59, 0.95)	< 0.001	0.73 (0.57, 0.93)	0.007
20–34	453 (13.2)	156 (34.4)	0.52 (0.38, 0.71)		0.63 (0.45, 0.88)	
35–49						

* Odds ratio adjusted for all study variables listed in the table.

Study variables	Total number of women (column %)	Women who received the three interventions during intrapartum care (%)	Unadjusted Odds Ratio (95% CI.)	p-value	*Adjusted Odds Ratio (95% CI.)	p-value
Household wealth quintile	788 (23.0)	526 (66.8)	1.00	< 0.001	1.00	0.159
Richest	624 (18.2)	317 (50.9)	0.55 (0.40, 0.76)	< 0.001	0.78 (0.55, 1.10)	< 0.001
Richer	677 (19.7)	274 (39.9)	0.28 (0.20, 0.40)	< 0.001	0.45 (0.31, 0.66)	0.017
Middle	687 (20.1)	132 (20.2)	0.37 (0.26, 0.52)	< 0.001	0.62 (0.42, 0.92)	< 0.001
Poorer	652 (19.0)		0.17 (0.11, 0.24)		0.32 (0.21, 0.50)	
Mother's place of residence	2,462 (71.8)	934 (37.9)	1.00	< 0.001	1.00	0.034
Rural	966 (28.2)	551 (57.0)	3.84 (2.39, 6.16)		1.66 (1.04, 2.64)	
Urban						
* Odds ratio adjusted for all study variables listed in the table.						

Table 6

Determinants of receipt of all the six recommended interventions during maternal and/or newborn PNC for the most recent live birth within five years preceding survey, Ethiopia MDHS 2019 (n = 1,785).

Study variables	Total number of women (column %)	Women who received all the six interventions during PNC (%)	Unadjusted Odds Ratio (95% CI.)	p-value	*Adjusted Odds Ratio (95% CI.)	p-value
First trimester ANC	1,057 (59.2)	181 (17.1)	1.00	< 0.001	1.00	< 0.001
No	728 (40.8)	193 (26.5)	1.72 (1.32, 2.26)		2.20 (1.56, 3.11)	
Yes						
Received quality ANC for last birth	1,065 (59.7)	151 (14.2)	1.00	< 0.001	1.00	< 0.001
No	720 (40.3)	223 (30.9)	2.59 (1.98, 3.40)		2.52 (1.79, 3.55)	
Yes						
Skilled personnel assisted birth	184 (10.3)	12 (6.6)	1.00	< 0.001	1.00	< 0.001
No	1,601 (89.7)	362 (22.6)	4.34 (2.26, 8.35)		5.55 (2.54, 12.17)	
Yes						
Mother's age at birth (years)	262 (14.7)	24 (9.3)	1.00	< 0.001	1.00	0.002
12–19		302 (23.2)	2.85 (1.78, 4.55)	0.002	5.44 (1.90, 15.56)	0.006
20–34	1,302 (72.9)	48 (21.6)	2.44 (1.38, 4.32)		4.72 (1.56, 14.27)	
35–49	221 (12.4)					
Mother's level of education	652 (36.5)	133 (20.5)	1.00	0.179	1.00	0.145
No education		120 (16.3)	0.80 (0.59, 1.12)	0.019	0.74 (0.50, 1.11)	0.568
Primary education (1–8)	738 (41.4)	121 (30.5)	1.54 (1.07, 2.22)		1.17 (0.69, 1.98)	
Secondary or higher	395 (22.1)					

* Odds ratio adjusted for all study variables listed in the table.

Study variables	Total number of women (column %)	Women who received all the six interventions during PNC (%)	Unadjusted Odds Ratio (95% CI.)	p-value	*Adjusted Odds Ratio (95% CI.)	p-value
Preceding birth interval	169 (13.4)	53 (31.6)	1.00	0.005	1.00	< 0.001
<24 months	1,096 (86.7)	237 (21.6)	0.54 (0.35, 0.83)		0.41 (0.26, 0.66)	
≥ 24 months						
Household wealth quintile	611 (34.2)	161 (26.4)	1.00	0.501	1.00	0.263
Richest	373 (20.9)	64 (17.1)	0.85 (0.52, 1.37)	0.652	1.47 (0.75, 2.86)	0.255
Richer	325 (18.2)	62 (18.9)	0.89 (0.54, 1.47)	0.373	1.50 (0.74, 3.04)	0.894
Middle	294 (16.5)	35 (19.2)	0.79 (0.47, 1.32)	0.497	0.95 (0.46, 1.97)	0.530
Poorer	182 (10.2)		0.82 (0.46, 1.46)		1.30 (0.57, 2.95)	
Poorest						
Mother's place of residence	1,126 (63.1)	214 (19.0)	1.00	0.855	1.00	0.708
Rural	659 (36.9)	159 (24.2)	1.05 (0.62, 1.79)		0.87 (0.41, 1.82)	
Urban						

* Odds ratio adjusted for all study variables listed in the table.

Factors associated with the receipt of all six recommended interventions during ANC

Mothers who had their first ANC contact during the first trimester were 30% more likely (AOR = 1.30; 95% CI = 1.07, 1.59) to receive all the six recommended interventions during ANC visits, compared to women who had no or late ANC contact. Mothers who had four or more ANC visits for the last birth were 88% (AOR = 1.88; 95% CI = 1.54, 2.29) more likely to receive all the six recommended interventions during ANC visits than women who had fewer ANC contacts. Receipt of all the six recommended interventions during ANC was 11 percentage points and 33 percentage points higher among mothers with primary education and secondary or higher education levels, respectively, compared with mothers with no education. With increasing levels of mother's education, the likelihood of receiving all the six recommended interventions during ANC significantly increased; mothers with secondary or higher education were 58% (AOR = 1.58;

95% CI = 1.18, 2.12) more likely to receive all six recommended interventions, compared to mothers who had no formal education. Mothers who received ANC for their last birth from government health posts were less likely to receive all the six recommended interventions; mothers who received their ANC at private clinics and/or NGOs, at hospitals, and at government health centres were 3.54 times (AOR = 3.54; 95% CI = 1.87, 6.72), 2.19 times (AOR = 2.19; 95% CI = 1.44, 3.32) and 2.12 times (AOR = 2.12; 95% CI = 1.57, 2.87) more likely to receive the six recommended interventions during ANC than mothers who received ANC at government health posts, respectively. Receipt of all the six recommended interventions during ANC visits was 39 percentage points higher among the richest mothers compared with poorest mothers. With decreasing indices of households' wealth index, the likelihood of receiving all six recommended interventions during ANC visits also significantly decreased; mothers from households with the poorest wealth indices were 66% (AOR = 0.34; 95% CI = 0.21, 0.55) less likely, compared to mothers from households with the richest wealth indices. (Table 4).

Factors associated with the receipt of all three recommended interventions during intrapartum care

Mothers who had four or more ANC visits for the last birth were 80% (AOR = 1.80; 95% CI = 1.50, 2.17) more likely to receive all the recommended three interventions during intrapartum care than mothers who had no or fewer ANC contacts during pregnancy. The likelihood of receiving all the three interventions during intrapartum care increased with mother's education; mothers with secondary or higher education levels were two times (AOR = 2.00; 95% CI = 1.49, 2.67) more likely than mothers who had no formal education. The likelihood of receiving all the three recommended interventions during intrapartum care decreased with increasing maternal age; advanced age mothers (35–49 years) were 37% less likely than teenage mothers (AOR = 0.63; 95% CI = 0.45, 0.88). With decreasing indices of households' wealth index, the likelihood of receiving all three interventions during intrapartum care also decreased; where mothers from households with the poorest wealth indices being 68% (AOR = 0.32; 95% CI = 0.21, 0.50) less likely, compared to mothers from households with the richest wealth indices. Mothers residing in an urban area were 66% (AOR = 1.66; 95% CI = 1.04, 2.64) more likely to receive all three interventions during intrapartum care than rural mothers (Table 5).

Factors associated with the receipt of all six recommended interventions during maternal and/or newborn PNC services

Mothers who had commenced ANC contact during the first trimester were 2.2 times (AOR = 2.20; AOR = 1.56, 3.11) more likely to receive all six interventions during PNC services, compared to women who had had no or late ANC contact. Mothers who had received the six recommended interventions during ANC for pregnancy of last birth were 2.52 times (AOR = 2.52; 95% CI = 1.79, 3.55) more likely to receive all the six recommended interventions during maternal and/or newborn PNC than mothers who had received less or no interventions during their ANC. Mothers who received skilled personnel-assisted birth were 5.55 times (AOR = 5.55; 95% CI = 2.54, 12.17) more likely to receive all six interventions during the PNC than mothers who did not receive skilled personnel assistance during labour and delivery. Mothers aged 20–34 years

and the elderly (35–49 years) were 5.44 times (AOR = 5.44; 95% CI = 1.90, 15.56) and 4.72 times (AOR = 4.72; 95% CI = 1.56, 14.27) more likely to receive all the six recommended interventions during PNC, respectively than adolescent mothers. Mothers with 24 or more months of preceding birth intervals were 59% (AOR = 0.41; 95% CI = 0.26, 0.66) less likely to receive all six interventions during maternal and/or newborn PNC services than mothers with shorter preceding birth intervals.

Discussion

Our study revealed that among mothers who accessed maternal healthcare for their most recent live birth in Ethiopia, only 36% received all six recommended interventions during their ANC. Forty-six percent received all three recommended interventions during the intrapartum care, and 21% received all six recommended interventions during the maternal and/or newborn PNC.

Our study showed that commencing ANC early (during the first trimester) and having four or more ANC contacts significantly improved the likelihood of receiving all the six recommended interventions during ANC. Antenatal care is the routine care of pregnant women provided between conception and the onset of labour, and is an opportunity to provide care to prevent and manage existing and potential causes of maternal and newborn morbidity and mortality. The timing of the first ANC contact is paramount for ensuring optimal health outcomes for a woman and her child, and it is recommended that the first ANC contact takes place within the first trimester (i.e., gestational age of < 12 weeks) [14, 27]. The early and more frequently a mother seeks routine care during pregnancy, the more she receives recommended interventions during pregnancy intended to improve maternal and newborn health outcomes. The critical interventions during pregnancy: dietary interventions (counselling about healthy eating, nutrition education and screening, and keeping physically active during pregnancy); iron and folic acid supplementation; calcium supplementation (for those with low dietary calcium intake); vitamin A supplementation (in vitamin A deficiency endemic areas); blood testing to screen anaemia, gestational diabetes mellitus, HIV/AIDS and syphilis; urine testing to screen asymptomatic bacteriuria; early clinical screening (high caffeine intake, tobacco, drug use, intimate partner violence, tuberculosis screening in high prevalence areas, and ultrasound scan) are all recommended to be commenced or provided during the first visit and in the first trimester [14].

Significant and positive associations exist between increasing the mother's education level or household's wealth quintile and receiving the six recommended interventions during ANC. The knowledge and skills attained through education positively affect a person's cognitive functioning, make one more receptive to health education messages, or enable one to communicate with and access appropriate health services. It captures the long-term influences of both early life circumstances on adult health and the influence of adult resources (e.g., through employment status) on health [28]. Household income is a proximate indicator of access to scarce material resources or a standard of living that allows a mother to directly access health services, which may improve health [28]. In a study based on pooled DHS data (2013–2018) from nine East African countries by Bobo et al. (2021), secondary or higher maternal education level and highest household wealth index improved the likelihood of a mother receiving all the

six recommended interventions during ANC visits by 28%, and 26% compared to no education, and poorest household wealth index, respectively [29].

In Ethiopia, government health posts appear to be providing poor quality ANC. This might be due to lack of access to adequate equipment and supplies, lack of readiness, and lack of required expertise and skills among health providers in the health posts at village levels. These healthcare facilities are nearest to communities in need. The assessment of a health facility's readiness and their health providers' knowledge of maternal and immediate newborn care to perform specific functions may assist in identifying those facilities in need of strengthening. A systematic review by Negero et al. (2021) revealed that in primary care settings in LLMICs, community-based or onsite health workforce interventions involving both skilled and lay personnel were more effective in improving Sexual, reproductive, maternal, and newborn health (SRMNH) care quality along the continuum than those involving either skilled or lay personnel alone [30]. These workforce interventions include education and training, policy, management and leadership strategies, partnership, and results-based financing initiatives. The regular deployment of experienced personnel, equipment, and supplies from higher levels of care (health centres and hospitals) to the nearby health posts to reach out to less advantaged mothers and sharing skills and expertise is critical. A study in a rural district of Nepal showed that facility readiness to provide quality maternal and newborn care in rural districts was low, but changes including regular monitoring, improving staffing and supply chains, supportive supervision, and refresher training initiatives improved maternal and newborn healthcare quality [31]. In our study, private health facilities had higher odds of providing quality ANC and PNC. This corroborates with two studies conducted in Addis Ababa, Ethiopia, and Southern Ethiopia, where clients at private health facilities were two times more likely to receive all the recommended ANC components than those of public health facilities [20, 21]. The limited availability of equipment, medications and trained staff due to underfunding and poor management, the redirection of highly skilled staff to private health facilities, and lack of timeliness and hospitality pose a threat to optimal care at public health facilities [32].

In our study, frequent ANC visits (four or more ANC) improved the likelihood of receiving all the three recommended interventions during intrapartum care. This might be because the more frequently a mother encounters the healthcare system during pregnancy, the better her healthcare-seeking behaviour, birth preparedness, and complication readiness planning will be. This is also likely to lead to an increased demand for quality intrapartum care. A study based on Bangladesh DHS 2014 data showed that there was a significant and positive impact of having four or more ANC visits during pregnancy on receiving skilled personnel assisted birth and health facility delivery services [33]. Significant and positive associations exist between the increasing level of a mother's education, her household wealth index, and urban residence and receipt of all the three recommended interventions during intrapartum care. Teenage mothers had higher odds of receiving the three recommended interventions during intrapartum care than mothers aged 20–49 years. This may be because healthcare providers were more vigilant during the birth of an adolescent's baby since adolescent pregnancy is significantly related to adverse maternal and/or perinatal outcomes, including eclampsia, puerperal endometritis, systemic infections, preterm delivery, small for gestational age birth, stillbirth, and neonatal death. Preventing these poor health outcomes

through increased use of skilled ANC, intrapartum, and PNC services for adolescents is recommended [34–36].

Our study also revealed that commencing ANC contacts early (during the first trimester), receiving all the six recommended interventions during ANC visits and skilled personnel-assisted birth improved the likelihood of receiving all the six interventions during PNC. Commencing ANC early, receiving the recommended interventions during ANC visits, and skilled personnel assistance at birth implies that the mother is more likely to be informed about complications that may occur after delivery and thus recognize the importance of seeking optimal care during postnatal care. Fekadu et al. (2019) showed that Ethiopian mothers who had four or more ANC contacts and received more content of care during ANC visits had higher odds of receiving PNC services [37]. Further, teenage mothers were disproportionately less likely to receive the recommended interventions during PNC than mothers aged 20–49 years. The significantly lower quality care during PNC services for adolescent mothers might be due to the providers' lack of knowledge about vulnerable groups of women and their associated judgmental attitudes, particularly towards unmarried adolescents. An adolescent mother's emotional or intellectual immaturity, low education, or inexperience could also hinder seeking optimal care after birth. Therefore, it is necessary to provide adolescent-friendly services to teenage mothers and their newborns after birth [38, 39]. Adolescent mothers have until recently been overlooked in global health and social policy [40].

Our study has revealed that there is much opportunity for improving the quality of antenatal, intrapartum, and PNC services in Ethiopia. Unfortunately, Ethiopia is presently facing significant challenges to healthcare delivery brought on by the COVID-19 pandemic and the conflict in northern Ethiopia. Quality maternal healthcare services that respond to the local need and meet emerging challenges, including nomadic-pastoralists, Covid-19, and conflicts, are critical. Mobile clinics and hospitals and mobile health (mHealth) digital solution services should be available near needy communities. Universal coverage of maternal healthcare quality should be promoted, including for the most vulnerable: poor, uneducated, rural women, and adolescent mothers. The resilience and strength of the healthcare system in Ethiopia should be increased by optimizing the health workforce, equipment and supplies, and improving lower-level health facility capability. The use of digital clinical decision support tools by health providers, guaranteeing sustainable finances for maternal and perinatal healthcare, and accelerating progress in maternal healthcare quality through evidence, advocacy, and accountability are needed [41–46]. In addition to evaluating the receipt of the recommended interventions during care services, assessing mothers' experiences and perceptions of the care services is also important and is likely to have a major effect on satisfaction and uptake of services [47].

This study had several limitations. We used the recommended components of maternal healthcare services mentioned in the WHO's guidelines to measure the quality of each maternal healthcare, which may not equate with the experience of care by the mother, i.e., client satisfaction. The mother reported the responses to the survey questionnaire with regard to her most recent live birth within five years preceding the survey, with potential recall bias and lack of ability to identify between the different care providers (e.g., doctors, nurses). Due to the lack of data availability, some recommended components of each care

service, including ANC contact schedules, ultrasound scan during the first 24 weeks of gestation, the experience of care (respectful care), effective communication, a companion of choice during labour and delivery, and delayed umbilical cord clamping were missing.

Conclusions

This study shows that the recommended health care interventions women and their newborns receive during antenatal, intrapartum, or PNC services in Ethiopia are inadequate. Policy-makers, managers, and healthcare providers in Ethiopia should increase the quality of care provided to mothers and/or their newborns during antenatal, intrapartum, and PNC services as per the WHO's guidelines. Investment in human resources for health, equipment, and supplies is required alongside efforts to standardize and improve the quality of care at private and public health facilities in Ethiopia. In addition to strengthening health systems, community-based initiatives such as women's groups to raise awareness of the importance of early and frequent ANC contacts and linking pregnant mothers to the healthcare system are needed. There is a need to promote education for girls and women and enable women's economic empowerment. We also recommend that the DHS program incorporate pertinent questions to assess and promote other critical interventions, including early ultrasound scan during the first 24 months of pregnancy, delayed umbilical cord clamping, and care experience, including respectful care during care services.

Abbreviations

ANC

Antenatal care

PNC

Postnatal care

SRMNH

Sexual, reproductive, maternal, and newborn health

WHO

World Health Organization

Declarations

Ethics approval and consent to participate

This study used data from the DHS program upon permission to use, which are in the public domain and are de-identified.

Consent for publication

Not applicable

Availability of data and materials

This study was based on analyses of an existing dataset in the DHS repository that is freely available online with permission to use and with all identifier information removed (<https://dhsprogram.com/data/>).

All methods were carried out in accordance with the relevant guidelines and regulations (declaration of Helsinki).

Competing interests

The authors declare that they have no competing interests

Funding

None

Authors' contributions

MG and AD conceived the research question and developed the study proposal; MG and DS led the statistical analyses with input from AD. MG and AD led the writing of the manuscript, and all authors provided input and feedback. All authors read and approved the final manuscript.

Acknowledgments

We would like to thank the Measure DHS, ORC Macro, Calverton, MD, USA, for permission to access the Demographic and Health Survey data for this analysis.

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Figures

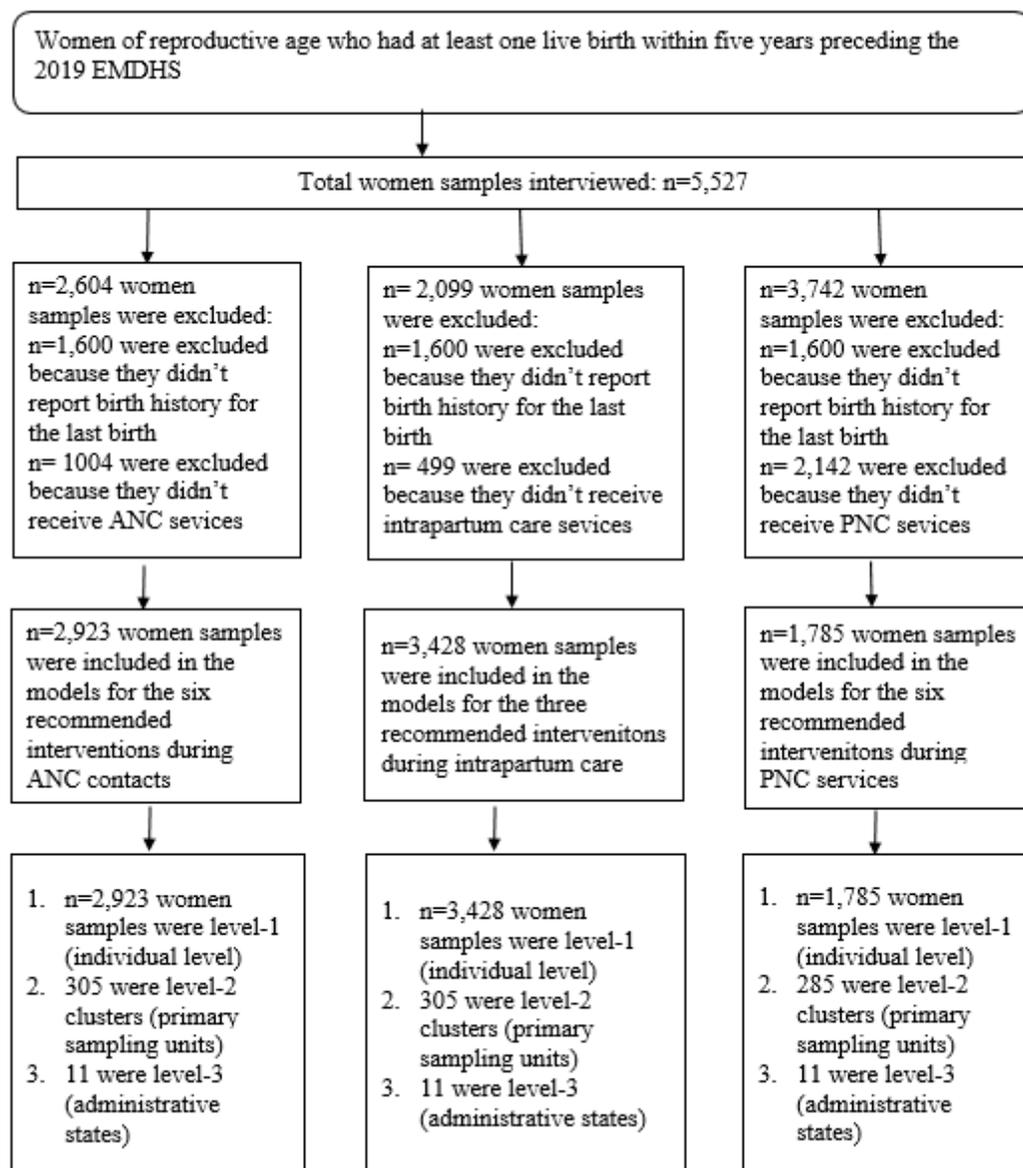


Figure 1

Schematic presentation showing included samples for quality ANC, intrapartum, and PNC analyses, Ethiopia MDHS 2019.

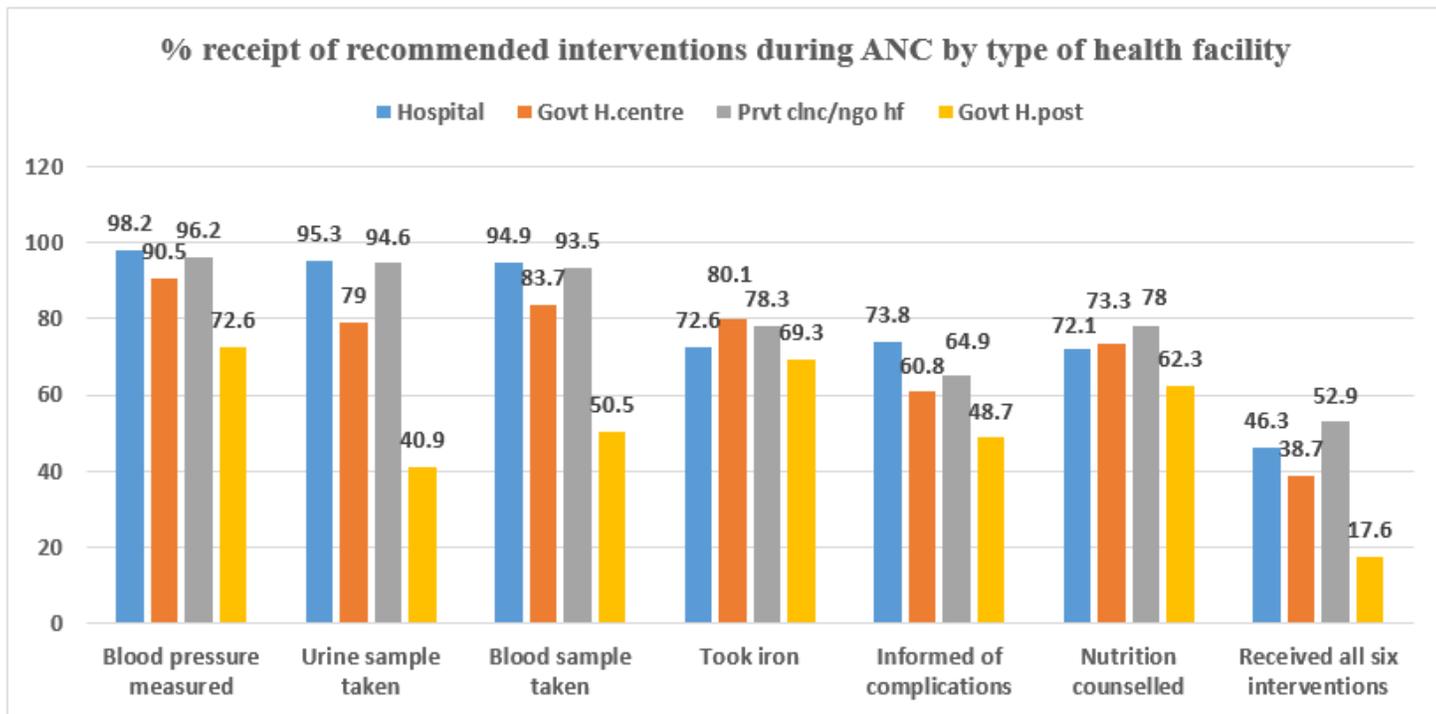


Figure 2

The proportion of mothers receiving the recommended interventions during ANC by type of health facility provided, Ethiopia MDHS 2019.

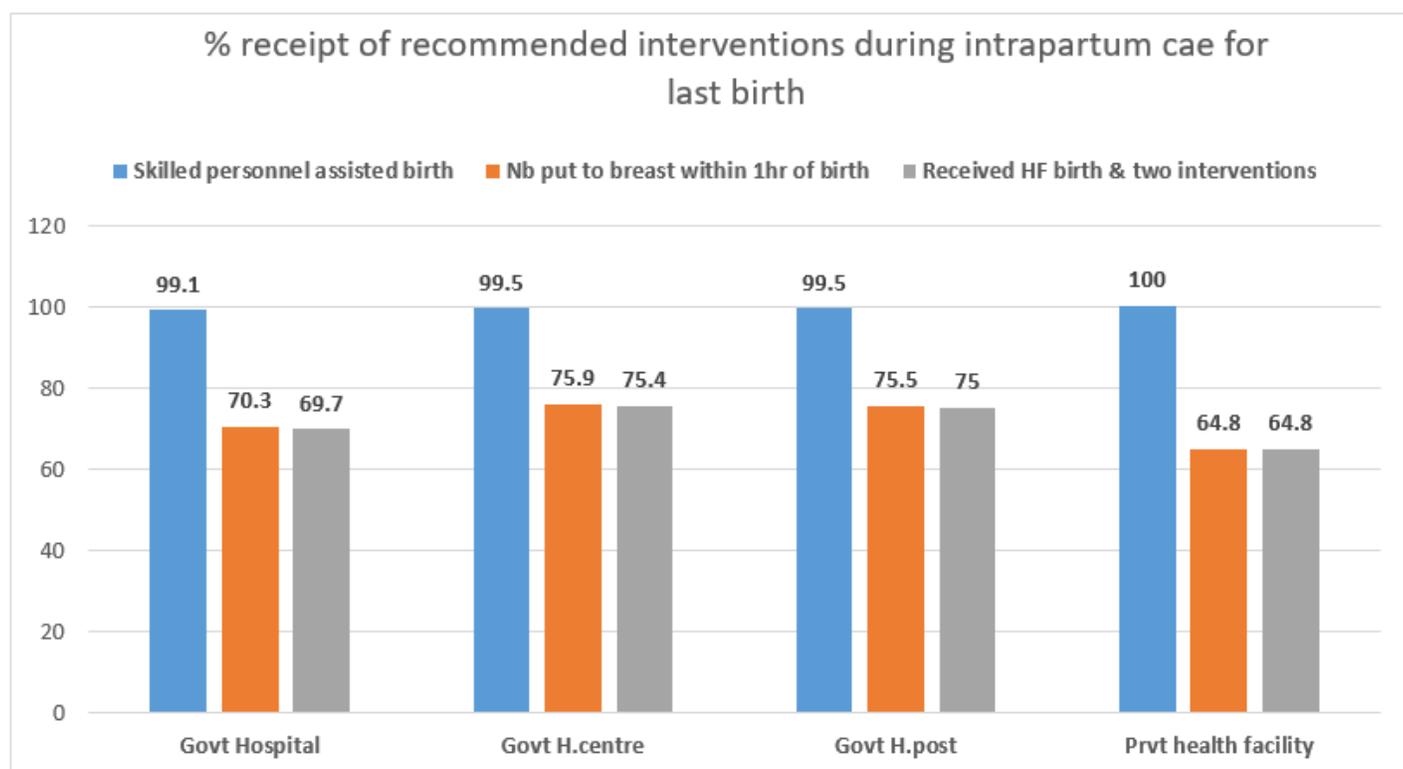


Figure 3

The proportion of mothers receiving the recommended interventions during intrapartum care by type of health facility provided, Ethiopia MDHS 2019.

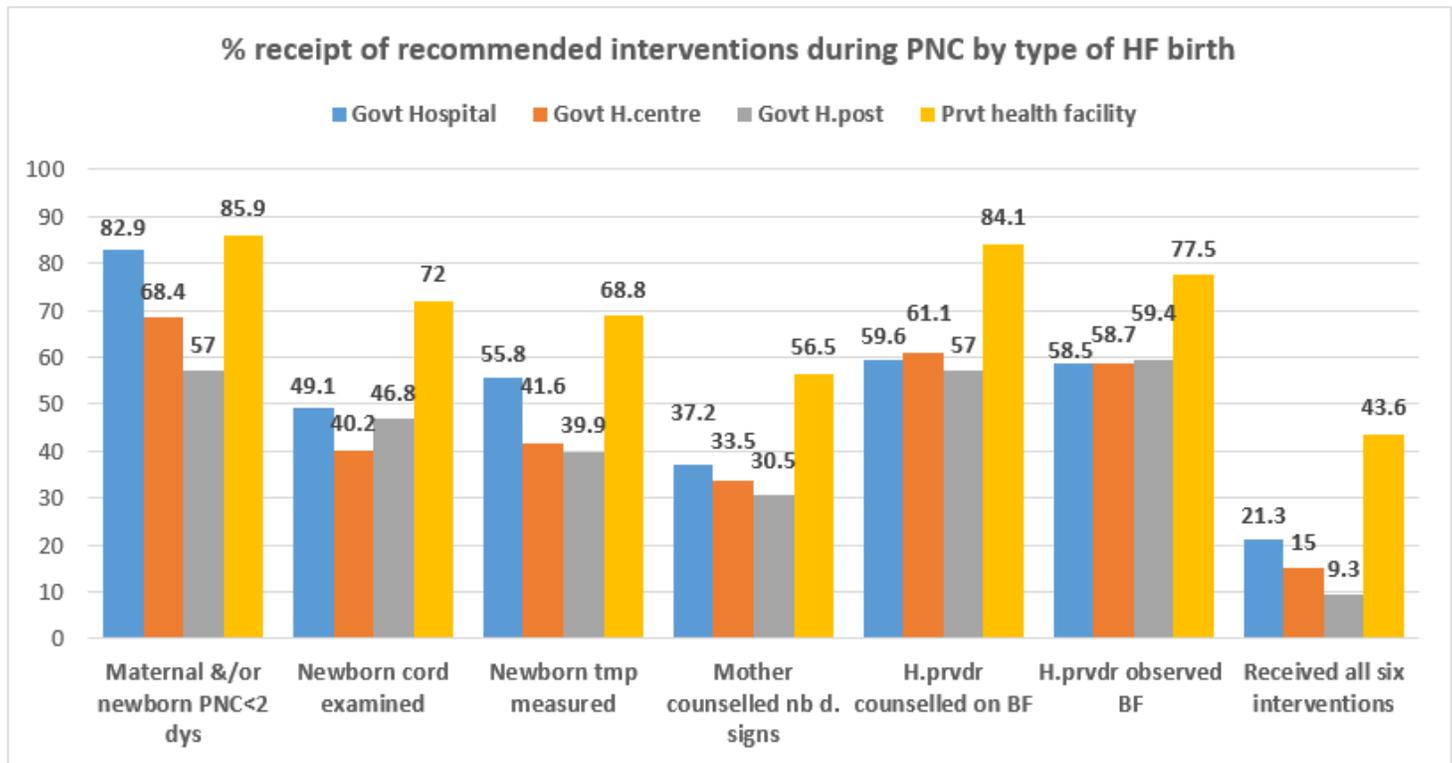


Figure 4

The proportion of mothers and/or their newborns receiving the recommended interventions during PNC by type of health facility where the birth occurred, Ethiopia MDHS 2019.