Maternal Healthcare Services Utilization Trajectories in Four Regions of Ethiopia: A Latent Class Analysis

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Abstract

Background: Globally, in 2015 as result of complications related to pregnancy, childbirth, or the postnatal period, 303,000 women died. Among these mortality the lion share burden were in sub-Saharan and Southern Asian countries. To avert the preventable maternal mortality, providing the recommended pregnancy care, delivery and postnatal cares in a continuum manner is imperative. This study aims to assess the trajectories and determinants of maternal healthcare services utilization in four major regions of Ethiopia.

Methods: Seven indicator variables were used to construct the maternal healthcare utilization variable. Latent class analysis was used to identify subgroups of maternal healthcare utilization along the continuum of care. Further, ordinal logistic regression was utilized to identify the determinants of the trajectories of maternal healthcare utilization. STATA 14 was used for data management and analysis and 5% level of significance was used to declare statistical significance.

Result: There were 590 mothers who delivered a live-birth in the 12 months period before the interview date. The result of latent class analysis indicates that a little more than two in five of the mothers (43.9%) did not attempt to visit a health facility during pregnancy or for delivery or for postnatal checkup. While women with a good practice of maternal healthcare accounted 6.1%, half (50%) of the women had an inadequate maternal healthcare practice. The trajectory of maternal healthcare utilization has shown a marked difference by region and religious affiliation of women. Whereas older women and women of lowest socio-economic status tend to be in the lowest classes of maternal healthcare utilization, educated women, women of highest socio-economic status and women having a better birth preparedness and complication readiness are found to be in the highest classes of maternal health care service utilization.

Conclusions: Women of lower socio-economic status and women of below secondary level of education should be targeted to intensify awareness of the benefit of maternal healthcare services utilization and plan births and deal with complications that arise with pregnancy and childbirth.

Background

Literature attests that a sizeable reduction in the global maternal morbidity and mortality rates has been observed as a corollary to improvements in access to and delivery of maternal healthcare services. However, pregnancy and child birth still affect the lives of millions of women and families across the world, particularly in middle and low income countries(1). Evidence shows that the levels of maternal mortality differ highly across the different regions of the globe. Maternal mortality ratio (MMR) for 2015 ranged from 12 deaths per 100,000 live births for high income regions to 546 for sub-Saharan Africa which is 46 times higher than the developed region(2,3). Poor maternal health has become a key to the achievement of sustainable development goal (SDG) three that targets to achieve maternal mortality ratio of less than 70 per 100, 000 live-births by 2030(4).

Ethiopia is among the countries with good progress in reducing maternal mortality; however, it is among the top ten countries with higher estimated number of annual maternal deaths. Maternal mortality ratio has dropped from 871 in 2000 to 412 in 2016 per 100,000 live births with visible disparity among the various administrative regions(2,5).The level of antenatal care (ANC) from a skilled provider has nearly doubled over the period 2011-2016 from 34% to 62%; however, it is less than one third of pregnant women that had the recommended four or more ANC visits. Moreover, nearly three quarter of births (73.8%) happen outside health facility away from the reach of skilled providers and only 16.5% of women who delivered recently had a postnatal checkup within 2 days after delivery. In the country, the causes of maternal mortality are direct causes that include obstructed labor, hemorrhage, hypertensive disorders of pregnancy, infection and complication of abortion (5–7).

The provision of life-saving care and utilization of maternal healthcare during pregnancy and at and after birth is crucial to avert the preventable causes of maternal morbidity and mortality. It is also helpful to create a positive pregnancy and child birth experience that lays a foundation for a healthy motherhood (8).A number of factors ranging from individual level through to contextual and community level factors influence maternal healthcare service utilization. Recent evidences indicate that women's education had a positive influence over maternal health service utilization in contrast to uneducated women(9–12).Household

wealth is another determinant factor reported of having a positive influence over maternal health service utilization. Women residing in an affluent household are more likely to utilize maternal health services than women residing in poor households (10–13). Moreover, women residing in an affluent neighborhood and a neighborhood having a good number of literate women are more likely to utilize maternal health service utilization(10).

Demographic factors such as age of the mother and parity were also identified as determinants of maternal health service utilization. Anguwa and colleagues reported that age of a mother predicted a better use of delivery service(9). In contrast, a study from Ethiopia using data from the 2011 Demographic and Health Survey reported that maternal age had no influence on maternal health service utilization. In this study, it is rather parity that predicted all the three type of maternal health service utilization(12). Tura and colleagues using a prospective cohort study have reported that women that were well prepared for birth and its complication have a heightened likelihood of using skilled care than women not well prepared. Furthermore, women having a better knowledge of key obstetric danger signs (know 3-4 danger sings) were better off in utilizing skilled care than women that didn't know any key danger sings (14).

While previous studies conducted in Ethiopia and elsewhere focus solely on components of maternal healthcare services utilization, this study however attempts to explore the trajectories of maternal healthcare service utilization of women for their recent pregnancy. This shift in perspective, from component to trajectory analysis, has an advantage in that it addresses the challenge of maternal healthcare services utilization holistically than a compartmentalized manner. Therefore, this study aims to explore the trajectories of maternal healthcare services utilization and assess its determinants in four regions of Ethiopia for recent births in four regions of Ethiopia.

Methods

Study setting, design and period

Selected districts from the four major regions of Ethiopia; namely, Oromia, Amhara, Tigray and Southern Nations, Nationalities and Peoples (SNNP)were used as a study setting. A total of 10 Zones, 4 from Tigray, 2 from Amhara, 2 from Oromia, and 2 from SNNP regional states, were included in the study covering 51 districts. The current work utilized baseline data gathered via Dagu Project, an intervention project that attempts to investigate impact of Optimizing Health Extension Project (OHEP) on the health service utilization for mothers and children below the age of five years. The baseline data collected for maternal healthcare practices was utilized for the purpose of the current study. The baseline data was collected during the months of December 2016 to February 2017(15).

Population

Mothers who had a live-birth in the last 12 months before date of the survey were considered to assess the trajectory of maternal healthcare utilization and its determinants. All women of reproductive age who had given birth in the last 12 months, available at the household during the interview and agreed to participate were included in the study.

Sampling technique and sample size

A two-stage stratified cluster sampling was applied in the selected districts. In the first stage, 200 enumeration areas (EAs) were selected with probability proportional to size from the 51 districts. Each enumeration area forms one cluster and these clusters constitute the primary sampling unit. In the second stage, a systematic random sampling technique was employed to select 30 households from within each EA from a listing of households done by enumerators. In each EA, 30 households were selected and interviews were conducted totaling 6,000 households. All women of age 15 to 49 years found in the selected households were included in the study. Data for all women of reproductive age who had given birth in the last 12 months was extracted from the main study data and utilized for the present study.

Measurements

Maternal health service utilization is the outcome variable of the present study. Seven indicator variables were used to construct maternal healthcare utilization. The items were at least one antenatal care (ANC) attendance at health facility, antenatal care visit of 4+, delivery at health facility, professional assistance at delivery, and attendance of postnatal care measured using visit on first day or first week or late beyond the first week of birth.

Combinations of socio-demographic and socioeconomic variables were utilized as predictor variables for maternal healthcare utilization. In the list of socio-demographic variables, marital status (Currently in union/Not in union), family size (Small[<=4]/Medium[5-6]/Large[>6]), parity ([<4]/[4-7]/[8+]), and age of the mother at delivery ([15-24]/[25-34]/[35+]) were included. Among potential socioeconomic and cultural determinant variables, maternal educational achievement (Illiterate/Primary/Secondary+), household relative wealth index, administrative region and religion of the mother were considered.

Finally, other determinants such as knowledge on obstetric danger signs and birth preparedness and complication readiness were also considered in the analysis. **Knowledge on obstetric danger signs**–mothers were given scores based on their awareness of danger signs on the following 10 items: severe headache, blurry vision, reduced or absent fetal movement, high blood pressure, edema of the face/hands, convulsions, excessive vaginal bleeding, severe lower abdominal pain, fever and anemia. The scores thereafter were classified to categories as those having poor knowledge (score less than or equal to 2 and coded as 1) and average level of knowledge (score 3-6 and coded as 0). **Birth Preparedness and Complication Readiness (BPCR)**: scores of mothers based on their response to preparation on financial, transport, food, identification of birth attendant, and identification of facility were used to measure BPCR. Accordingly, mothers who fulfilled at least 3 of the 5 items were considered as 'well prepared' which is coded as 1 and otherwise 'not well prepared' and coded as 0.

Data collection and processing

Data was gathered using a structured questionnaire originally designed in English language and translated to local languages (Afaan Oromo, Amharic, and Tigrigna). CSPro software was used to design a computer assisted personal interview (CAPI) tool and tablets were used to gather the information from field. Internet file streaming system (IFSS) was used to sync data from the tablets to a central server using a 3G modem. One advantage of using CAPI is that it saves time of data processing as data are entered during field interview. In addition, by keeping the sequence and checking the logical consistency of the data collected, CAPI has a benefit of ensuring data quality. Finally, the collected data was exported to STATA for further processing and analysis.

Data quality assurance

Data collectors who had at least a first degree were recruited. Health Officers trained in integrated community case management and community based newborn care were employed as team leaders. The data collection was carried out using 15 data collection teams. Each data collection team had two enumerators, one health examination observer and re-examiner and a team leader. Training on the purpose of the survey and the content of the questionnaire was given for data collection team for duration of 10 days. The questionnaires were pretested; a number of training interviews were performed. During fieldwork, the supervisors carried out at least two re-interviews per cluster, and observed each interviewer in his or her team during each day of data collection. These re-interviews and observations were used as a means of providing feedback to interviewers, ensure consistency between interviewers, and continuously improve the quality of the work. Verbal consent was obtained from all study participants. Ethical approval was sought from Jimma University Faculty of Public Health. Ethical approval was also secured from the Ethiopian Public Health Institute and Regional Health Bureaus in Amhara, Oromia, SNNP, and Tigray regions.

Data analysis

Latent class analysis (LCA) helps in successfully combining the maternal healthcare utilization indicator variables and produce groups of individuals having similar behavior. The indicators refer to different times of pregnancy and child birth. This enables us

to look at the service utilization path that mothers have taken during their recent pregnancy. A combination of parsimony, statistical criteria and interpretability play a role in the selection of an appropriate number of classes and evaluation of the model. The log likelihood, degrees of freedom, G^2, Akaike Information Criteria (AIC), and Bayesian Information Criteria (BIC)were compared to identify the optimal model(16). The model produces class membership for each subject and membership probabilities for the classes as a byproduct of the analysis. The class membership variable was used as an outcome variable for further analysis. Ordinal logistic regression was utilized to determine the determinants of the trajectory of maternal healthcare utilization. The assumption of proportional odds was also checked and a generalized ordinal logistic regression model was fit to remedy the violation of the assumption. STATA 14 was used for data management and analysis and 5.0% level of significance was used to declare statistical significance.

Results

Household characteristics

Household socio-demographic and economic characteristics were depicted in table 1 below. From a total of 590 mothers who delivered in the last 12 months, majority of them were from Oromia regional state (51.4%). Two in five were Orthodox Christians (40.7%), and 53.0% of the women were in the age range between 25 and 34 years. Majority of respondents (56.1%) had less than four children whereas 6.6% had more than eight children. Two hundred twenty respondents constituting of 37.3% lived in small family size households. With respect to marital status, almost all (96.6%) were in union during the time of the interview. More than half (55.2%) of the mothers had no formal schooling and only a handful of them had a secondary and above level of education (10.0%). An almost equal proportion of women lived in households having poorest to richest wealth quintiles (Table 1).

Table 1: Socio-demographic and economic characteristics of the women, 2016

Characteristics and categories		No.	Percent
Region	Amhara	153	25.9
	Oromia	303	51.4
	SNNPR	77	13.0
	Tigray	57	9.7
Religion	Orthodox	240	40.7
	Protestant	149	25.2
	Muslim	188	31.9
	Other	13	2.2
Age	15-24	202	34.2
	25-34	313	53.0
	35+	75	12.7
Parity	<4	330	56.1
	4-7	219	37.2
	8+	39	6.6
Family size	Small	220	37.3
	Medium	194	32.9
	large	176	29.8
Maternal education	No education	326	55.2
	Primary	205	34.8
	Secondary+	59	10.0
Marital status	In union	566	96.6
	Not in union	20	3.4
Socio-economic quintile	Lowest	123	20.8
	Fourth	113	19.2
	Middle	116	19.7
	Second	112	19.0
	Highest	126	21.3
Total		590	100.0

Majority of the respondents (62.2%) had an at least one visit for ANC services at health facility (skilled ANC) while 29.5% utilized the minimum 4+ ANC. Less than half (47.3%) of respondents had a delivery care service assisted by health professionals and 44.9% gave birth at health facility. On the other hand, only few (6.8%) of the women received postnatal care within the first 24 hours. Women who received PNC service within 2-6 days and 7-42 days were also very low (8.0% and 4.6%, respectively) (Figure 1).

Figure 1: Maternal healthcare service utilization indicators, 2016

We found that only one fourth (25.4%) of the mothers had an average awareness about danger signs. Less than a quarter of the mothers (23.2%) were well prepared during the last pregnancy (Table 2).

Table 2: Knowledge of danger signs and birth preparedness and complication readiness of women, 2016

Characteristics and categories		No.	Percent
Knowledge of danger signs			
	Average	150	25.4
	Poor	440	74.6
BPCR			
	Not well prepared	453	76.8
	Well prepared	137	23.2
Total		590	100.0

In LCA, to select the number of classes for the model, we specified and run models of a 2-class, and repeated the procedure with 3 classes, 4 classes, 5 classes and 6 classes. From the results, information about fit including log likelihood, degrees of freedom, G^2, AIC, BIC, and CAIC were compared to identify the optimal model. As can be seen in Table 3, the AIC is the least for the model with five classes. For this reason and ease of model interpretation, the model with five classes was selected as an optimal model (Table 3).

Table 3: Summary of information for selecting number of latent classes for maternal healthcare utilization, 2016

No. of classes	Log likelihood	df	AIC	BIC	G^2
2	-1565.7	112	157.2	222.8	127.2
3	-1546.8	104	135.5	236.2	89.5
4	-1541.5	96	140.8	276.5	78.8
5	-1519.7	88	113.2	284.0	35.2
6	-1519.3	80	128.5	334.4	34.5

With the five latent class model, the analysis identified five different types of trajectories of maternal healthcare service utilization. The first groups of women *[Tr1]* had a less than average likelihood of antenatal care utilization. For this group of women, the uptake of the delivery and postnatal care is not entirely absent but very much unlikely (43.9%). The second groups of women *[Tr2]* are antenatal care utilizers but less likely to proceed to delivery and postnatal care utilization (9.5%). Another course of maternal healthcare utilization *[Tr3]* is an uptake of insufficient number of ANC and a good level of delivery care; however, they are unlikely to appropriately utilize postnatal care (24.4%).The fourth group of women *[Tr4]* utilize antenatal and delivery care but the likelihood of utilizing postnatal care is very slim (16.1%). The final groups of women *[Tr5]* are those that utilize all the maternal healthcare services with higher probabilities (6.1%).The trajectories exhibit a fundamental feature of an ordinal measurement ranging from non-utilizers *[Tr1]* to beneficial utilizers *[Tr5]* of maternal healthcare services (Figure 2).

Figure 2: Trajectories of maternal healthcare utilization among mother who delivered recently, 2016

Table 4 showed percent distribution of maternal healthcare utilization across predictor variables. Women residing in Oromia had an unusually higher rate of non-utilizers (56.4%) and SNNP had the highest rate of beneficial utilizers (15.6%). It is also noted that women of non-Orthodox Christian religious affiliation had the higher rate of utilization as compared to Orthodox Christian women. Similarly, older women (61.3%) and women with high parity had a higher tendency of not utilizing maternal healthcare service. On

the contrary, women of an above secondary level of education had a higher level of beneficial utilization (15.3%) than otherwise. Finally, poorest women (68.3%) were characterized as non-utilizers while women with worst readiness for birth and its complication (49.2%) were highly likely not to utilize maternal healthcare service (Table 4).

Table 4: Percent distribution of maternal healthcare utilization over potential predictors, 2016

Characteristics and categories		Tr1	Tr2	Tr3	Tr4	Tr5
Region	Amhara	30.1	4.6	34.0	24.8	6.5
	Oromia	**56.4**	12.2	18.8	9.2	3.3
	SNNPR	32.5	9.1	23.4	19.5	**15.6**
	Tigray	29.8	8.8	29.8	24.6	7.0
Religion	Orthodox	29.6	5.4	32.9	24.6	7.5
	Protestant	**53.0**	16.8	10.7	13.4	6.0
	Muslim	**53.7**	9.0	25.0	8.0	4.3
	Other	**61.5**	7.7	15.4	7.7	7.7
Age	15-24	41.6	8.9	23.8	20.8	5.0
	25-34	41.2	10.5	26.2	14.4	7.7
	35+	**61.3**	6.7	18.7	10.7	2.7
Parity	<4	37.0	8.8	25.8	20.9	7.6
	4-7	50.7	11.0	23.7	10.0	4.6
	8+	**61.5**	7.7	17.9	10.3	2.6
Family size	Small	35.5	8.2	28.6	21.8	5.9
	Medium	45.9	10.3	20.6	15.5	7.7
	large	52.3	10.2	23.3	9.7	4.5
Maternal education	No education	49.1	8.9	24.5	12.9	4.6
	Primary	42.4	12.2	22.9	16.6	5.9
	Secondary+	20.3	3.4	28.8	32.2	**15.3**
Marital status	In union	44.2	9.5	24.0	16.3	6.0
	Not in union	40.0	10.0	30.0	10.0	10.0
Socio-economic quintile	Lowest	**68.3**	6.5	12.2	8.9	4.1
	Fourth	42.5	13.3	23.9	15.9	4.4
	Middle	44.8	15.5	24.1	12.1	3.4
	Second	41.1	6.3	31.3	15.2	6.3
	Highest	23.0	6.3	31.0	27.8	**11.9**
Knowledge of danger signs	Average	31.3	12.0	30.7	18.7	7.3
	Poor	48.2	8.6	22.3	15.2	5.7
BPCR	Not Well prepared	**49.2**	9.7	21.6	13.7	5.7
	Well prepared	26.3	8.8	33.6	24.1	7.3
Total		**43.9**	**9.5**	**24.4**	**16.1**	**6.1**

Multivariable analysis

In the multivariable analysis, maternal healthcare utilization was modeled as a function of cultural, knowledge of danger signs and birth preparedness, socio-demographic and economic factors. However, religion and socio-economic status of households

violated the assumption of proportional odds, thus a generalized ordinal logistic regression was fit. The result is shown in Table 5below.

Table 5: Result of generalized ordered logit model for maternal healthcare utilization, 2016

Characteristics and categories		No.	COR	AOR (95% CI)†			
				None (Tr1)	Only ANC (Tr2)	Incomplete ANC and DC (Tr3)	ANC and DC (Tr4)
Region	Amhara [Ref]	153	1.00	1.00	1.00	1.00	1.00
	Oromia	303	0.31***	0.27***(0.16,0.46)	0.19***(0.11,0.31)	0.31***(0.17,0.56)	0.25***(0.10,0.64)
	SNNP	77	1.04	1.01 (0.58,1.75)			
	Tigray	57	0.96	0.80 (0.43,1.47)			
Religion	Christian [Ref]	389	1.00	1.00	1.00	1.00	1.00
	Others	201	0.51***	1.61**(1.01,2.56)	1.87***(1.17,2.99)	0.88 (0.49,1.60)	1.67 (0.65,4.30)
Age	15-24 [Ref]	202	1.00	1.00			
	25-34	313	0.96	1.04 (0.70,1.56)			
	35+	75	0.45***	0.39**(0.19,0.80)			
Parity	<4 [Ref]	330	1.00	1.00			
	4-7	219	0.53***	0.77 (0.47,1.27)			
	8+	39	0.36***	0.91 (0.36,2.31)			
Family size	<=4 [Ref]	220	1.00	1.00			
	5-6	194	0.69**	0.91 (0.58,1.42)			
	7+	176	0.49***	1.03 (0.56,1.87)			
Maternal Education	None [Ref]	326	1.00	1.00			
	Primary	205	1.27	1.06 (0.72,1.56)			
	Secondary+	59	4.10***	2.09**(1.14,3.84)			
Marital status	In Union [Ref]	566	1.00	1.00			
	Not in Union	20	1.12	0.68 (0.28,1.64)			
SES	Poorest	123	0.46***	0.43***(0.24,0.74)	0.52**(0.29,0.92)	0.95 (0.48,1.90)	1.25 (0.44,3.57)
	Poor	113	1.18	1.24 (0.75,2.03)			
	Middle [Ref]	116	1.00	1.00	1.00	1.00	1.00
	Rich	112	1.38	1.12 (0.67,1.85)			
	Richest	126	3.12***	2.24***(1.35,3.72)			
Knowledge on danger signs	No [Ref]	150	1.00	1.00			
	Yes	440	1.67***	1.28 (0.88,1.85)			
BPCR	No [Ref]	453	1.00	1.00			

Characteristics and categories	No.	COR	AOR (95% CI)[†]			
			None (Tr1)	Only ANC (Tr2)	Incomplete ANC and DC (Tr3)	ANC and DC (Tr4)
Yes	137	4.20***	3.40***(1.78,6.50)			

*** P<1%   ** P<5%

†Only results of region, religion and SES are displayed in 4 different columns as these are the only variables that violated the assumptions of ordinal logistic regression. For the rest of the variables, the assumption is fulfilled and the estimates are the same across the cumulative logits.

We have observed that the effect of region, religion, and socio-economic status is asymmetrical and not the same across each of the cumulative logits. The results suggest that maternal healthcare utilization has shown a marked difference between the different regions. Women residing in Oromia region were heavily disadvantaged even at higher extreme maternal healthcare utilization as opposed to women residing in Amhara region. Moreover, it was found that non-Christian women were highly likely in utilizing at least ANC (AOR=1.87 with a 95% CI (1.17, 2.99)). However, the difference vanishes at the higher order beneficial maternal healthcare utilization as attested by the non-significant odds ratio of religion of the mother.

When socio-economic status of women was considered, women residing in the poorest households were disadvantaged (AOR=0.43 with a 95% CI (0.24, 0.74)) as compared to women living in households with a middle level of socioeconomic status in utilizing maternal healthcare services. There was also disparity in maternal healthcare utilization beyond ANC between these groups of women (AOR=0.52 with a 95% CI (0.29, 0.92)). Nonetheless, no difference was observed between the two groups of women in terms of utilization of beneficial maternal health services. On the other hand, women living in richest households were more than twice likely (AOR=2.24 with a 95% CI (1.35,3.72)) to utilize any type of maternal healthcare including beneficial services as compared to women living in households with middle level socioeconomic status.

Age, parity, and family size were also introduced into the model as predictors. The results show that parity and family size did not stimulate maternal healthcare utilization; in contrast, it was found that older women (age 35 years or older) as compared to youths (15-19 years) were 61% less likely (AOR=0.39 with a 95% CI (0.19, 0.80)) to utilize maternal healthcare services of any kind or that comprise the beneficial services. While knowledge of danger signs did not encourage women to utilize maternal healthcare services, birth preparedness and complication readiness of women contributed highly to their actual maternal healthcare use. Well prepared women for birth and its complication were more than three times likely (AOR=3.40 with a 95% CI (1.78, 6.50)) to have utilized maternal healthcare services consisting ANC to most beneficial services. It was also observed that women having an educational achievement of secondary level of education and beyond were highly advantaged in utilizing maternal healthcare services and the result is symmetrical across the cumulative logits (AOR=2.09 with a 95% CI (1.14, 3.84)).

Discussion

ANC serves as a tool to reduce maternal and perinatal morbidity and mortality by identifying women with an increased risk of pregnancy complication earlier during pregnancy and ensuring referral to an appropriate level of care (8). It is an entry point to maternal healthcare service utilization whereby the subsequent maternal health service utilizations largely depend on(12,17). Our finding suggests that a sizable number of women (43.9%) had a poor utilization of ANC that necessitates the need to induce demand for ANC utilization in the communities and particularly among women.

There were a few early quitters (9.5%) that included mothers that had a good ANC follow up but delivered outside a health facility unassisted by trained health personnel and missed the benefit of postnatal care. For these women, somehow ANC is not being translated to delivery and postnatal care utilization. Many factors might contribute to this gap including lack of awareness of the signs of labor, deficiency of exposure to information on delivery care, absence of problem during the current pregnancy, and absence of complications during previous births(18,19). Unassisted delivery carries a substantial risk in that unskilled attendants

can hardly predict and manage serious complications which will lead to deaths of mothers during and after child birth (20).Thus, promotion and comprehensive education on the early signs of labor and birth preparedness and complication readiness need to be provided during the ANC sessions to translate the ANC uptake to delivery care and improve the overall maternal healthcare service utilization.

Our analysis also revealed that the magnitude of utilization of all the packages of maternal healthcare service is extremely low (6.1%). We also noted that in all the five identified trajectories, the utilization of early postnatal care is exceedingly poor. Furthermore, regardless of the route of progression, a large portion (40.5%) of the mothers proceeded up to delivery care very well and failed to have had a postnatal care. This finding suggests that an improvement in the utilization of postnatal care alone will contribute to an approximately 43% increase in uptake of beneficial maternal healthcare services.

The trajectories have shown spatial variation across regional states. The multivariable analysis indicated that women residing in Oromia regional states were highly likely to follow the least favorable trajectory of maternal healthcare service utilization. The finding is consistent with demographic and health survey report of 2016, a period closer to our baseline data collection time (5). Spatial specific planning, implementation, and monitoring and evaluation of activities might help reduce the inequalities in maternal healthcare service utilization across regional states.

Religion is considered to have an influence over maternal healthcare utilization in some recent studies (10–12,19). However, the relationship is best understood with the present study as our finding shows the point where religion stimulates and fails to stimulate maternal healthcare utilization. Christian women barely attempt to utilize any maternal healthcare services as compared to Non-Christian women. However, the two groups of women followed similar trajectories beyond ANC utilization, that is, Non-Christian women didn't maintain the advantage they had at an early stage of the trajectory beyond antenatal care utilization.

Parity was shown to have negatively influenced the uptake of maternal health care services (11,12,19). Contrary to these reports, in our work, it is rather age of the mother that had a significant association with the type of the trajectory. Consistent with a finding reported in a study conducted by Rurangirwa and colleagues (21), older women (35+ years) were very much unlikely to seek maternal healthcare and take the least ideal trajectory. Contrarily, Agunwa *et al.* (9) reported that age positively predicted delivery care. In our study, it may rather be the cumulated experience of older women in pregnancy and child birth that led them to select an unsatisfactory utilization of maternal healthcare service.

Maternal educational achievement is another factor that dictates the trajectory that mothers had taken during their last pregnancy and child birth. It serves as a stimulant for an uptake of maternal healthcare services when women have an educational level beyond primary school. The finding is consistent with reports of previous studies conducted in Ethiopia (18,22) and other African countries (9–11). Better educated women had a relatively enhanced autonomy over their health seeking behavior than less informed women. Education may also play a role by providing better access to information that in turn would help expand choices of women. However, there are studies that are methodologically different from our study and reported a null finding(17,21). These studies considered only a segment from the spectrum of maternal healthcare service utilization while our study looked at the continuum of care.

Table 5: Result of generalized ordered logit model for maternal healthcare utilization, 2016

While women residing in the poorest households intended to follow the undesired route, women of the richest households tend to seek a better utilization of maternal healthcare services. In the study area, the presence of a significant pro-rich inequality in maternal healthcare service utilization have been reported (13).Likewise, studies done in Ethiopia and Ghana corroborate with our finding (10,12). This may be due to the fact that women of the richest households have a better access to resources that would enable them purchase the services even from private health facilities.

Recognition of danger signs by the women during pregnancy, delivery and postnatal period and BPCR are crucial for timely action, management of complications and child birth. The level of both knowledge of obstetric danger signs and BPCR are unsatisfactorily low in the present study. Regardless, it was found that women who had a good BPCR had an improved level of maternal healthcare utilization than those who were not. A prior arrangement made on part of the mother such as identification of

the birth attendant and facility gives expectant mothers an impulse to utilize delivery and postnatal care (23,24). Our finding agrees with previous studies that reported BPCR predicted better use of maternal healthcare services (14,25).

The present study attempted to consider an approach that has not been considered in previous researches of maternal healthcare service utilization. Our approach considered combining all the maternal healthcare service utilization indicators to explore the trails of service utilization that mothers had taken during their most recent pregnancy. On the other hand, our study entirely depended on retrospective responses of mothers about their most recent pregnancy and events surrounding the pregnancy. Thus, as with all observational studies, the responses are not immune to recall errors that might add due to memory lapses or event omissions. A follow up study is commendable to study such events with minimized recall errors.

In conclusion, five different trajectories were identified and the magnitude of a beneficial utilization was very small. The magnitude of discontinuation after uptake of ANC pales in comparison to the rate of withdrawal towards the end of the continuum of care. Additionally, it has been observed that an equally appalling situation prevails at the start of the continuum of care. Spatial differentiated plan needs to be introduced to improve the uptake of maternal healthcare service. The less affluent, the uninformed and older women shall be given an awareness raising health education. Finally, given its strength of association, women, their families and communities need to be encouraged to effectively plan their births and learn to deal with complications.

Abbreviations

AIC: Akaike Information Criteria; ANC: Antenatal Care; AOR: Adjusted Odds Ratio; BIC: Bayesian Information Criteria; BPCR: Birth Preparedness and Complication Readiness; CAPI: Computer Assisted Personal Interview; COR: Crude Odds Ratio;), EA: Enumeration Areas; IFSS: Internet file streaming system; LCA: Latent Class Analysis; LSHTM: London School of Hygiene and Tropical Medicine; OHEP: Optimizing Health Extension Project; SDG: Sustainable Development Goal; SNNPR: Southern Nations, Nationalities and Peoples ; Tr: Trajectory

Declarations

Ethics approval and consent to participate

Verbal consent was obtained from all study participants as approved by ethics committee. Ethical approval was obtained from the Ethiopian Public Health Institute (SERO-012-8-2016; Version 001), and research permit was obtained from the Regional Health Bureaus in Amhara, Oromia, SNNP, and Tigray. Ethical approval was also obtained from the London School of Hygiene & Tropical Medicine (LSHTM) and Jimma University Ethical Review Board. Children with overt medical problem were advised to get service in a nearby health facility. In addition, the field staff provided support in getting such care. Assent and consent from the parents were optioned for the women less than 18 years.

Consent for publication

Not applicable

Availability of data and materials

The datasets analyzed in the current study available at the data repository centre of the EPHI. The corresponding author may be contacted for data request.

Competing interests

The authors declare that they have no competing interests.

Funding

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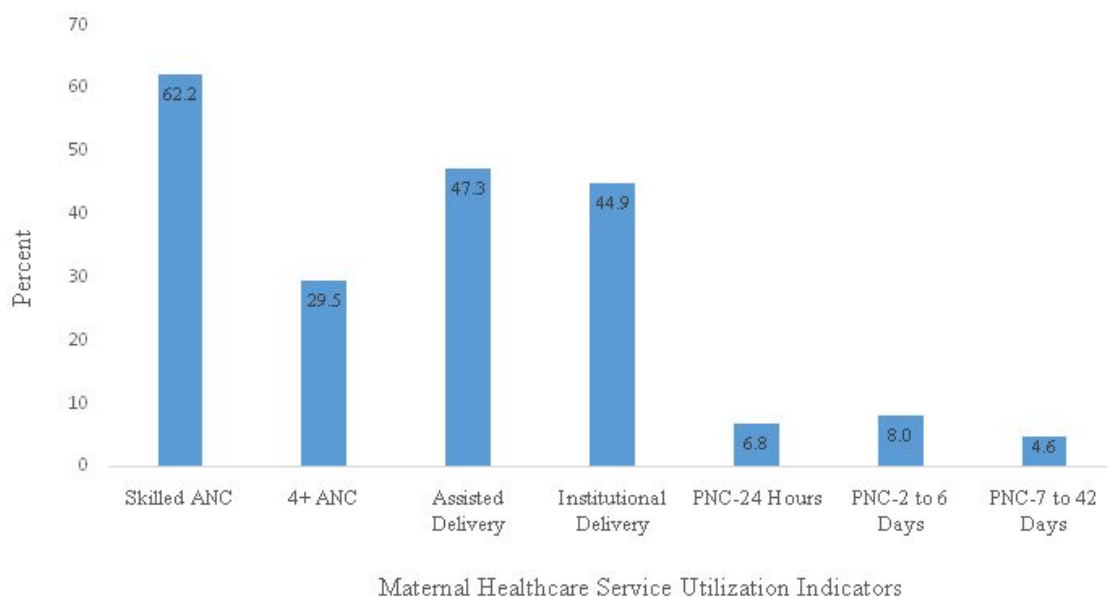
Figures

Figure 1

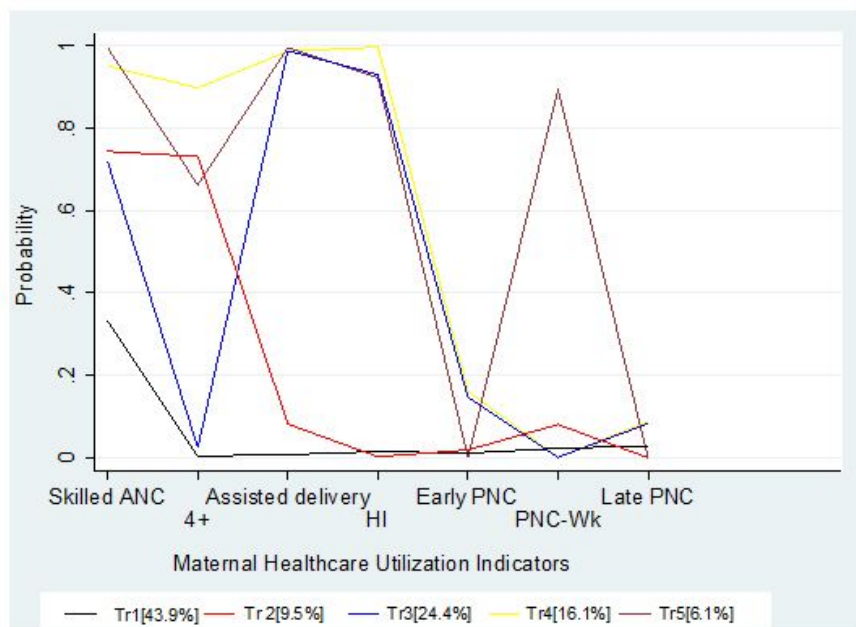Maternal healthcare service utilization indicators, 2016.

Figure 2

Trajectories of maternal healthcare utilization among mother who delivered recently, 2016.