ORIGINAL ARTICLE

Skilled Antenatal Care Service Utilization and Its Association with the Characteristics of Women's Health Development Team in Yeky District, South-West Ethiopia: A Multilevel Analysis

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ABSTRACT

BACKGROUND: In response to high maternal and perinatal morbidities and mortalities in Ethiopia, "Women's Health Development Army" was established to enhance utilization of skilled maternity services including antenatal care (ANC). However, its effect on skilled ANC service utilization is not well measured. Our study was aimed to assess skilled antenatal care service utilization and its association with the characteristics of women's health development team (WHDT).
METHODS: A community based cross sectional study was conducted from January to February 2015. A multi-stage cluster sampling technique was applied, and a total of 748 women (15-49 years) who gave birth in one year preceding the study were included in the study. Data were entered into EPI info version 7 statistical software and exported to STATA version 11 for analysis. Bivariate and multilevel mixed effects analysis techniques were applied to check for association of selected independent variables with utilization of skilled ANC.
RESULTS: About 71% women received skilled ANC service at least once. A significant heterogeneity was observed between WHDTs for skilled ANC utilization. Level-1 predictors of skilled ANC utilization were: preference of skilled personnel (AOR=11.0; 95%, CI, 3.02-40.04), awareness about places where to get skilled providers (AOR=51.6; 95% CI, 13.92-,190.97) and listening to radio (AOR=5.7; 95% CI, 1.46-21.94). Distance of WHDT within 2 km radius from the nearest health facility (HF) was the only level-2 significant predictor of skilled ANC service utilization (AOR=8.28; 95%CI, 1.08-62.20).
CONCLUSIONS: Skilled ANC service utilization is the joint effect of individual and WHDT characters. Awareness and perception creation towards skilled maternity service utilization need to be enhanced. Facilities and transport services should be more accessible towards WHDTs.
KEYWORDS: community based, cross sectional study, Ethiopia, multilevel analysis, skilled antenatal care service, women's health development team

INTRODUCTION

According to Ethiopian demographic and health surveys (EDHS) 2011, the maternal mortality ratio and perinatal mortality rate were estimated to as 676/100,000 live births, and 46/1000 total births, respectively, which were among the highest in Sub-Saharan African Countries (1-5). The low antenatal care (ANC) coverage has probably contributed to the high maternal and perinatal deaths in Ethiopia (6-11). Although the World Health Organization (WHO) recommended a minimum of 4 ANC visits to all pregnant women, EDHS 2011 and mini EDHS 2014 reported that only 19% and 32%, respectively, had 4 visits for ANC service, which were the least among the majority of the Sub-Saharan African Countries (3, 6, 12, 13).

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Another challenge in the provision of quality ANC service in Ethiopia has been the time pregnant women receive their first ANC. WHO recommends that the first ANC follow-up should be received in the first trimester. The proportion of women who made the first ANC visit before the fourth month of pregnancy, however, were only 11% and 17% in the 2011 and 2014 surveys, respectively. The median age of pregnancy at the time of the first ANC visit was about 5 months (3, 12, 14-16).

In response to this challenge, the government of Ethiopia has established what is called "Women's Health Development Army (WHDA)" at the community level, since 2011 in several districts across the country. The smallest unit is made up of 6 women (one of the women is a leader, probably trainer and reporter). About 5-6 units form a team, and each team is composed of about 30 households in which all women of child bearing age are included, and the main task is to enhance utilization of skilled maternity service, including ANC. Each WHDA and their team (WHDT) are linked with local health extension workers, the nearby health center and district health office. However, little is known about the association between the establishment of this army and skilled ANC service utilization. No systematic evaluation has been made since its establishment in any part of the country (17).

In other countries, with a similar approach ("The Women's Group"), several studies demonstrated that involving the community in identifying, planning and solving their own problem has positively changed maternal and neonatal health (18-22).

Therefore, measuring the role of activities and characteristics of WHDTs on skilled ANC utilization was a priority area to identify its impact on ANC utilization. The purpose of this study was thus to assess the skilled ANC service utilization and its Association with the characteristics of WHDT.

METHODS

Study design and setting

A community based cross-sectional study was conducted over January-February 2015 by including women of reproductive age (15-49 years) at Yeky district, Sheka Zone, South West Ethiopia. The district is located at about 562 kms far from the capital, Addis Ababa. In 2014, the total number of women aged 15-49 years in the district was estimated to be 39,680. About 96% of its inhabitants are living in rural area, and agriculture is the main means of livelihood.

Study population and sampling technique

Women aged 15-49 years who gave birth in one year preceding the study in the randomly selected seven *kebeles* were included in the study, irrespective of their birth outcome. This study excluded women who were seriously ill, could not respond to questions, could not hear or speak and had severe psychiatric problems during the time of data collection.

Sample size was calculated using single population proportion formula and Epi-Info version-7 statistical software based on the following assumptions: margin of error of 5%, level of significance of 5%, design effect of 2, non-response rate of 10%, confidence level of 95% and proportion for at least one skilled antenatal care of 35.9% (12). Accordingly, the total sample size was 778.

Sample size for rural and urban stratum was calculated using proportionate allocation to the size of population in the respective areas. The "*kebeles*" are the lower administrative units with a size of about 1000 households (5000 population) which are further structured into WHDTs.

Cluster sampling technique was used to select the study population. The *kebeles* with their WHDT (clusters) were selected randomly. Accordingly, seven (five rural and two urban) *kebeles* with a total of 380 WHDT were selected, and 748 eligible mothers were identified and interviewed.

Data collection

The data collection was done using a structured and pretested interview questionnaires through a house-to-house visit. The questionnaires were developed based on the standard demographic and health survey (DHS) questionnaires, initially in English, and then translated into the local language, then back to English to check for consistency. Socio-demographic, accessibility, perceived needs (benefits) and WHDT related

characteristics were included in the questionnaires.

The questionnaires were pretested with 80 eligible women from two *kebeles* of another district having similar socio-cultural characteristics with the study area. A total of 35 qualified data collectors and 14 supervisors (5 data collectors and 2 supervisors for each *kebele*) were deployed. Data collectors were teachers and 12th grade complete students, who were living in the study area. Supervisors were all female experienced diploma mid wife nurses.The principal investigator followed up the whole data collection process for completeness, validity and reliability.

Data management and analysis procedures

After appropriate coding, the data were entered into EPI Info Version 7 statistical software and exported to STATA version 11 for analysis. The predictors of skilled ANC service utilization were assessed separately using multilevel binary logistic regression analysis to determine the direct effect of individual and group-level (WHDT) explanatory variables on individual outcome variables, and to determine if the explanatory variables at the group level served as moderators of individual-level relationships.

Frequencies and cross tabulations were made using our independent predictor variables. The multilevel analysis was started from the intercept only (null) model to test the null hypothesis that there was no variation in skilled ANC service utilization between WHDTs.

Characteristics of the women were considered as individual level (level-1 predictors) and characteristics of the WHDTs were taken as group level (level-2 predictors). For our dependent variable, we estimated two models: the null model (intercept only model), an empty model with no independent variables and a full model that contains both level-1 and level-2 predictors.

The full model was a random intercept model. The null model was used to estimate the overall log of odds of the outcome variables across all individual and group level variables. It was also used to check the significance of association of the outcome variables with all individual and group level variables (fixed effects) and to estimate the intra-class

correlation coefficient (Rho). Intra-class correlation coefficient (ICC) is an extent of the between classes variation influencing individual level outcomes (random effects).

The ICC informs the researcher whether the variation in the scores is primarily within or between groups. Binary dependent variables in multilevel logistic distributions lack inherent scales since mean and level-1 residual variance are unknown. Distribution of level-1 residual variance is standardized and fixed in the logistic distribution with mean of 0 and variance of $\pi^2/3 \approx 3.29$. Accordingly, for a two-level logistic random intercept model with an intercept variance of $\sigma^2 u0$, the intra-class correlation coefficient (ρ) is:

$$\rho = \sigma^2 u0 / \sigma^2 u0 + 3.29.$$

The Bivariate and multilevel mixed effects logistic regression analysis were made on the full random intercept model. At Bivariate analysis, fixed estimate variables with p-values of less than 0.25 and performance level of WHDTs were employed for the multi-level analysis.

The adjusted odds ratios of the level-2 variances were utilized to decide the presence of association between the dependent and independent variables for which their respective 95% confidence levels and p-values were determined.

Ethical considerations

Ethical clearance was secured from the Institutional Review Board (IRB) of Hawassa University, College of Medicine and Health Sciences. Permission letters were also obtained from zonal and district health offices before data collection. During data collection, study participants were asked for verbal consents and were informed to interrupt the interview at any time on their desire. To ensure confidentiality, code numbers were used to show results, and all questionnaires were kept locked. The privacy of the study participants was also maintained by interviewing them individually.

Operational definitions

Skilled ANC service utilization: antenatal care service use by mothers at least once at health center, hospital and or private clinic during the pregnancy of their last birth.

Women's health development team (WHDT):
A team composed of six (6) 1 to 5 reproductive age women networking (each team with about 30 households) aimed at enhancing skilled maternity service utilization and other socio-economic activities.

Best performing WHDTs: WHDTs graded as "A" as if all households have achieved 91%-100% of all the seventeen health extension packages.

Good performing WHDTs: WHDTs graded as "B" as if all households have achieved 81%-90% of all the seventeen health extension packages.

Poor performing WHDTs: WHDTs graded as "C" as if all households have achieved less than 80% of all the seventeen health extension packages.

Self sustained WHDTs: availability of enough production (food or cash crops) for feeding population in the village (WHDT).

RESULTS

Socio-demographic characteristics

A total of 748 women aged 15-49 years who gave birth in one year preceding the study were interviewed. The response rate was 96.1% for the planned sample and 100% for the interviewed participants. The majority of the respondents (84.5%) were rural dwellers. Most participants (97.6%) were ever married (married or divorced). At the time of data collection, the majority (32.9%) were between 25-29 years old, and 6.7% were teenagers with the mean age of 25.8 ± 5.3 years and with a range of 16-46 years.

The majority of the study participants were Protestant Christians (62.3%) and house wives (92.1%). Keffa, Amhara and Bench were the dominant ethnic groups accounting for 27.5%, 19.1% and 17.9%, respectively. Regarding the educational level, 45.7% did not attend any formal education, and 5.2% attended secondary and above level of education.

About 60% of the respondents households had about 10 USD or less average monthly income. About 35% and 19% of the respondents

listen to radio and watch television, respectively (Table 1).

Obstetrics and perceived needs (benefits) related characteristics

Three hundred fifty (46.8%) mothers were teenagers when they gave birth to their first baby. The mean and SD age at the first birth was 19.9 ± 2.6 years. More than half (53.9%) of the respondents were para II - IV.

Six hundred sixty-five (88.9%) respondents had visited health facilities for ANC services at least once for the their last birth. Among these, 436(65.6%) had received ANC services 4 and above times.

From the total respondents, 531(71%) [P (95%CI)= 71% (67.8%, 74.3%)] received skilled ANC at least once for their last birth. The majority of the respondents (65.6%) received their first ANC for their last birth between 4-6 months while 172 (25.9%) had received before 3 months.

Regarding their reasons to visit HFs during pregnancy of their last birth, 611(91.9%), 583(87.7%) and 82(12.3%) respondents reported to check their own general health, for their fetal wellbeing and to know the fetal position, respectively, while 40 (6%) and 16 (2.1%) respondents reported that it was for vaccination and to deliver HIV free baby for the future, respectively. Twenty four (3.6%) respondents reported that their reason to visit HFs was to get delivery services in the health facilities in the future.

Regarding their sources of knowledge to seek ANC, 414 (62.3%) respondents reported that it was from health extension workers (HEWs) that they obtained awareness. Of those who did not have any ANC visit for the their last birth, 71.1% reported that it was because they were not aware of the importance of ANC follow up, while 13.3% and 12% reported that it was because the HF was too far and lack of transport, respectively. The majority (66.2%) of the respondents preferred skilled personnel for their ANC services, and 518 (69.3%) respondents had awareness on places where to get skilled providers.

Table 1: Selected socio-demographic individual level characteristics of women who gave birth in one year preceding the study, Yeky District, 2015. (N = 748)

Background characteristics	Number (%)	Background characteristics	Number (%)
Residence: Urban	116 (15.5)	**Household monthly average income in birr:**	
Rural	632 (84.5)	≤ 200	448 (59.9)
		201-1000	217 (29)
		> 1000	83 (11.1)
Current age in years:		**Who usually makes decisions on the mother's health care? (Autonomy):**	
≤ 19	50 (6.7)		
20-24	241 (32.2)		
25-29	246 (32.9)		
30-34	121 (16.2)	Woman ± husband	251 (33.6)
≥ 35	90 (12)	Husband ± others	497 (66.4)
Ethnicity:		**Age when married first in years (n=736):**	
Keffa	206 (27.5)		
Amhara	143 (19.1)	≤ 15	137 (18.6)
Bench	134 (17.9)	16-19	420 (57.1)
Sheka	95 (12.7)	≥ 20	179 (24.3)
Menja	70 (9.4)		
Sheko	34 (4.5)		
Mejengir	18 (2.4)		
Dawuro	18 (2.4)		
Others	30 (4)		
Religion:		**Parity:**	
Protestant	466 (62.3)	1	224 (29.9)
Orthodox	183 (24.5)	2-4	403 (53.9)
Muslim	92 (12.3)	5 and above	121 (16.2)
Others	7 (0.9)		
Marital status:		**Maternal education:**	
Single	18 (2.4)	No formal education	342 (45.7)
Married	715 (95.6)	Primary education(1-8)	367 (49.1)
Divorced	15 (2)	Secondary education and above	39 (5.2)
Husband education (n= 715):		**Listen to radio:**	
No formal education	188 (26.3)	Yes	259 (34.6)
Primary education(1-8)	451 (63.1)	No	489 (65.4)
Secondary education and above	76 (10.6)		

Most of the study participants (70.8%) had awareness on danger symptoms of pregnancy, and 96 (18.3%) respondents reported that they faced at least one complication during previous pregnancies or child births. Half of the respondents (50%) were from good performing

WHDTs; 302 (40.4%) were from best performing and the remaining 72 (9.6%) were from poor performing WHDTs. WHDTs with the majority (40.8%) of the respondents were far from their nearest HF with skilled care by more than 5 kms while WHDTs with 213 (28.5%) respondents were within 2 kms radius of their nearest HF with skilled care. The main source of income for the WHDTs with most respondents (78.1%) was farming. WHDTs with 388 (51.9%) respondents had main roads heading to the nearest health center or hospital while the remaining did not have main roads (Table 2).

Table 2: Utilization of skilled antenatal care services using selected individual and group level characteristics in Yeky district, 2015.

Characteristics	Category	N	Number (percent) of women reporting skilled ANC services:
Residence	Urban	116	113 (97.4)
	Rural	632	418 (66.1)
Maternal education	Formal education	406	323 (79.6)
	No formal education	342	208 (60.8)
Husband education	Formal education No	527	394 (74.8)
	formal education	188	112 (59.6)
ANC in previous pregnancy	Yes	359	253 (70.5)
	No	165	93 (56.4)
Complications during previous pregnancies	Yes	96	65 (67.7)
	No	428	281 (65.7)
Preferred ANC services	Yes	495	449 (90.7)
	No	253	82 (32.4)
Have awareness on places to get skilled providers for ANC	Yes	518	470 (90.7)
	No	230	61 (26.5)
Listen to radio	Yes	259	232 (89.6)
	No	489	299 (61.1)
Average distance of WHDT from the nearest HF with skilled care (KMs)	≤ 2	213	203 (95.3)
	3-5	230	143 (62.2)
	> 5	305	185 (60.7)
Self-sustained WHDT	Yes	592	442 (74.7)
	No	156	89 (57.1)
Main road	Yes	388	308 (79.4)
	No	360	223 (61.9)
Performance level of WHDT	Best performing	302	228 (75.5)
	Good performing	374	242 (64.7)
	Poor performing	72	61 (84.7)
	Total	748	531 (71)

Multilevel mixed effects logistic regression analysis

The results showed that there was significant heterogeneity between WHDTs with regard to skilled ANC utilization. The estimated between-clusters variance for skilled ANC utilization was 4.98 with 95% confidence intervals of 3.01- 8.25, demonstrating significant variation among the 261 WHDTs for skilled ANC utilization. Accordingly, the ICC in the null model for skilled ANC utilization was 60.2%. In other words, 60.2% of the total variance for skilled ANC utilization was due to variation between clusters (WHDTs) (Table 3).

Table 3: Parameter coefficients of the intercept only (null) model in using skilled antenatal care services, Yeky district, 2015

	Skilled ANC service
Level 2 variance: VAR (_cons)	4.985* (3.011, 8.253)
Intra- cluster correlation coefficient, Rho	0.6024
Deviance (-2 log likelihood)	706

***Significant

As shown in the multilevel analysis, preference of skilled personnel, awareness about places where to get skilled services and listening to radio were the level-1 significant predictors of skilled ANC utilization while distance of WHDT within 2 kms radius from the nearest HF with skilled care was the only level-2 significant predictor of skilled ANC utilization.

Accordingly, women who preferred skilled personnel for ANC were 11 times more likely to utilize skilled ANC as compared to those who did not prefer skilled personnel (AOR =11; 95% CI, 3.02, 40.04). Women who were aware of places where skilled ANC would be received were 51.6 times more likely to utilize skilled ANC as compared to those women who were not aware of the places (AOR =51.6; 95% CI, 13.92, 190.97).

The odds of utilizing skilled ANC was 5.7-fold higher in women who listened to radio as compared to those women who did not listen to radio (AOR=5.7; 95% CI, 1.46, 21.94). The study also showed that women from WHDTs within 2 kms radius of the nearest HF providing skilled care were 8.2 times more likely to utilize skilled ANC as compared to women from WHDTs within 5 kms and above radius of the nearest HF providing skilled care (AOR = 8.2; 95% CI, 1.08, 62.20) (Table 4).

Table 4: Bivariate and multilevel analysis by predictors of skilled antenatal care service utilization

Characteristics	N	Crude OR (95% CI)	Adjusted OR (95% CI)	P value (AOR)
Residence: Urban	116	34.39 (6.35, 186.24)	1.01 (0.04, 28.72)	0.995
Rural	632	1	1	
Maternal education:				
Formal education	406	2.65 (1.59, 4.42)	1.32 (0.49, 3.58)	0.581
No formal education	342	1	1	
Husband education:				
Formal education	527	2.00 (1.15, 3.51)	1.61 (0.60, 4.35)	0.348
No formal education	188	1	1	
*ANC follow up for previous pregnancy:				
Yes	359	6.11 (2.86, 13.04)	0.87 (0.30, 2.49)	0.792
No	165	1	1	
Complications during previous pregnancies or births:				
Yes	96	1.78 (0.80, 3.95)	1.12 (0.32, 3.89)	0.856
No	428	1	1	
Skilled personnel preferred for ANC services: Yes	495	54.25 (24.43, 120.46)	11.00 (3.02, 40.04)	0.000
No	253	1	1	
Awareness on places to get skilled providers for ANC:				
Yes	518	58.03 (27.51, 122.41)	51.55 (13.92, 190.97)	0.000
No	230	1	1	
Listen to radio:				
Yes	259	7.19 (3.69, 14.00)	5.66 (1.46, 21.94)	0.012
No	489	1	1	
WHDT characters: Distance of WHDT from nearest HF with skilled care (KMs): ≤ 2	213	19.22 (6.53, 56.57)	8.18 (1.08, 62.20)	0.042
3-5	230	1.01 (0.50, 2.03)	0.51 (0.15, 1.67)	0.264
> 5	305	1	1	
Self sustained WHDT:				
Yes	592	2.67(0.95, 7.51)	0.37 (0.08, 1.83)	0.225
No	156	1	1	
Main road to nearest HF				
Yes	388	3.92(1.67, 9.21)	0.81 (0.22, 3.01)	0.747
No	360	1		
Performance level of WHDT:				
Best Performing	302	0.63(0.18, 2.16)	0.46 (0.04, 5.02)	0.527
Good performing	374	0.34(0.11, 1.09)	0.21 (0.02, 2.15)	0.188
Poor performing	72	1	1	
Random part of the model:	VAR (cons) i.e. Level-2 variance		6.11 (2.79, 13.40)	
	Rho, intra-class correlation coefficient.		0.65	
	Deviance (-2 log likelihood), G²		278	

*Antenatal care follow up for previous pregnancy just before the last birth

DISCUSSION

In this study, a multilevel modeling technique allowed us to assess variation in the dependent variable at several levels. Specifically, the utilization of skilled ANC by individual women was dependent on the joint effect of individual and WHDT level factors.

The ICC indicated that the contribution of the unobserved group (WHDT) level characteristics to skilled ANC utilization was more than three-fifths higher. In the random intercept model as well, variance among WHDT was statistically significant indicating how important controlling confounding variables at different levels, which may have false associations with the dependent variable. Previous studies based on similar analysis also showed similar findings (23-28).

Having awareness about health facilities where to get skilled ANC was an important positive predictor for skilled ANC service utilization in our study. Studies done in North West Ethiopia and Pakistan showed similar associations (23, 29). Other studies also revealed that exposure to mass media has significant effect towards positive attitudinal changes in using skilled maternity services (4, 30-33).

The result of our study consistently depicted that those women who preferred skilled personnel for their ANC were more likely to utilize skilled ANC than those who did not prefer skilled providers.This implicates that attitudinal changes towards seeking skilled ANC services through repeated and multisectoral community and facility based educations could bring positive effects on skilled ANC service utilization, which was also well noted by previous investigators elsewhere in the country (23, 34, 35).

The independent association of distance of WHDT within 2 kms radius from the nearest HF with skilled ANC utilization may indicate the significance of geographic accessibility of HFs for better utilization of maternity care. Previous studies have shown that distance from HFs and lack of transport are important deterring factors that hinder mothers from seeking skilled maternity services including ANC (14, 36-43).

Regarding maternal and husband education, Both primary and above level of maternal or husband education were not significantly associated with skilled ANC utilization during multi level mixed effects analysis. This finding was contradictory with most researches done, which indicated positive and highly significant associations (4, 13, 23, 33, 37, 44).

In our study, the effect of education could probably be controlled by the effects of perception and awareness related variables. This could also be due to the low sample size to detect the effect of education. The Bivariate and multilevel mixed effects analysis did not show statistically significant association between performance level of WHDTs and skilled ANC utilization of their respective women.

This implicates that it was not the performance level of WHDTs that brought difference between WHDT groups by skilled ANC utilization. Rather, the difference was due to accessibility of health facilities, presence of mass media like local FM radios and variation in awareness creation activities about the importance of skilled ANC services. Our finding could also imply the need for reevaluating the measurement tools for classifying WHDTs by performance.

Self-sustainability of WHDTs with food or cash crops was not also significantly associated with skilled ANC utilization. Its effect might be controlled by distances of WHDTs from the nearest HF. Most supported WHDTs were from urban and semi-urban areas very close to the nearest HFs with skilled care. On the other hand, women very far from HFs with skilled services might not be aware of the importance of skilled ANC and facilities where they could get skilled care, which is in agreement with one study done in North West Ethiopia (23).

More proportion of the between WHDT variance by skilled ANC utilization was explained by the random intercept model. The between WHDT variance significantly increased.

This study has several limitations. Some respondents might not properly identified the skilled personnel (doctors, midwives, nurse) and HEWs. Some women might have difficulty of recalling the ANC related events. In a cross-sectional study, it could also be difficult to exhaust all possible associated factors.

In conclusion, skilled ANC utilization was the joint effect of individual and WHDT level characteristics. Individual level predictors were stronger than group level predictors. There was no statistically significant association between performance level of WHDTs and skilled ANC utilization.

Community awareness and perception creation activities towards skilled ANC utilization need to be strengthened. Moreover, HFs and transportation services need to be more accessible for the community. Implementation and evaluation strategies of "WHDTs" activities need to be revised.

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