

Quality of Antenatal Care Services in the Birim North District of Ghana: Contribution of the Community-Based Health Planning and Services Program

Sharon Naariyong · Krishna C. Poudel ·
Mosuir Rahman · Junko Yasuoka · Keiko Otsuka ·
Masamine Jimba

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Abstract To compare the quality of antenatal care (ANC) between Community-based Health Planning and Services (CHPS) and non-CHPS areas in the Birim North District of Ghana. A cross-sectional study was conducted in May, 2010. We collected data from 600 women (300 from CHPS areas and 300 from non-CHPS areas) recruited from six CHPS and six non-CHPS areas, using a structured questionnaire. Participants were aged 15–49 years, had at least one child within 18 months old, and resided in the district for at least 2 years before data collection. Outcomes included: (1) index of ANC utilization (dichotomized as full and partial), (2) receipt of anti-malarial drugs, (3) testing for HIV infection, and (4) index of knowledge about pregnancy danger signs (expressed in tertiles). Descriptive statistics and multivariate logistic regression methods were employed in the analysis. Multivariate analysis revealed that participants in the CHPS areas were 2.7 times (95% CI: 1.66–4.35) more likely to have full utilization score, 4.5 times (95% CI: 2.37–8.51) more likely to receive HIV testing, and 3.7 times (95% CI: 1.72–7.94) more likely to receive anti-malarial prophylaxis during the ANC period. However, scoring high on the index of knowledge was not significantly associated with the CHPS exposure (OR: 1.2; 95% CI: 0.69–2.00). The CHPS intervention might be useful to improve the quality of ANC. Therefore, increasing the CHPS intervention coverage in non-CHPS areas might serve as a basis for

improving the quality of ANC in the Birim North and other rural districts of Ghana.

Keywords Maternal health · Quality · Antenatal care · Ghana

Introduction

Antenatal care (ANC) is essential to reduce maternal morbidity and mortality, low birth weight, and perinatal mortality [1]. Although a considerable number of pregnant women are receiving ANC in developing countries, there is little evidence on the content and the quality of ANC in these countries [1]. Moreover, the weak relationship between ANC utilization and maternal health outcomes may be partly due to failure to take into account the content and the quality of ANC [1]. For instance, the number of pregnant women in Sub-Saharan Africa (SSA) who had access to ANC was 67 and 76% in 1990 and 2008, respectively [2]. However, in 2008, recorded maternal deaths were very high in SSA at 820 per 100,000 live births [3].

Donabedian suggested a framework to assess the quality of care. According to this framework, three different components of quality of care are generally assessed: structure, process, and outcome [4]. ‘Structure’ refers to the attributes of the settings where health care occurs; ‘process’ represents what is actually done in giving and receiving care (this is further divided into interpersonal, and technical components); and ‘outcome’ shows the effects of care on the health status of patients and populations [4, 5].

Several previous studies have used the framework of Donabedian to assess the quality of ANC. However, the

S. Naariyong · K. C. Poudel (✉) · M. Rahman · J. Yasuoka ·
K. Otsuka · M. Jimba
Department of Community and Global Health, School of
International Health, Graduate School of Medicine,
The University of Tokyo, 7-3-1 Hongo Bunkyo-ku,
Tokyo 113-0033, Japan
e-mail: krishna@m.u-tokyo.ac.jp; kcpoudel@hotmail.com

selection of the components of the quality of ANC was varied in those studies. For example, one study in Tanzania focused on the structure and process quality components of ANC [5], while another study in India focused only on the process quality component of ANC [1]. Similarly, in another study in Tanzania [6], the focus of the assessment was only on part of the technical process component of the quality of ANC, particularly the knowledge of the mothers on pregnancy danger signs. Since outcome is a consequence of quality of care rather than a component of quality of care, it was not further assessed in those studies.

Although improvement of all the components of quality of care is important, several African countries adopted the focused ANC [7] that was developed by the World Health Organization for implementation in developing countries [8]. This model reduces the number of ANC visits from thirteen to four times and provides focused services that did not result in worse maternal and perinatal outcomes when compared to the traditional western type of ANC [8]. Such focused ANC services are in line with the technical process component of Donabedian's quality of care assessment framework.

Ghana is one of the developing countries in Sub-Saharan Africa with high ANC coverage. According to the 2008 Ghana Demographic and Health Survey (GDHS) report, 95% of Ghanaian women had access to ANC at least once, and 78% received the recommended ANC visits for four or more times [9]. Despite the high coverage of ANC, maternal mortality ratio (MMR) remained high in Ghana. In 2008, MMR was 409 per 100,000 live births [3].

Therefore, to improve the quality of ANC, focused ANC services were initiated by the Ghana Ministry of Health in 2006 [10]. Such services include the identification and treatment of anemia and infectious diseases such as malaria and the prevention of mother-to-child transmission of HIV [7, 9]. The other services are tetanus toxoid immunization, educating and advising pregnant women on pregnancy danger signs, and family planning [9].

The Government of Ghana adopted the Community-based Health Planning and Services (CHPS) program in 1999 to provide doorstep health delivery to impoverished rural areas of Ghana [11, 12]. Specifically, with the CHPS program emphasis is on 1-day-a-week clinical sessions at the health facility and 4-days-a-week outreach clinics and household visits [12, 13]. Focused ANC services such as identifying and treating anemia and infections such as malaria, ensuring the prevention of mother-to-child transmission of HIV, providing tetanus toxoid immunization, giving education and advice on pregnancy danger signs, and family planning, blood pressure and weight monitoring, are provided under the CHPS program [9, 12].

Results of previous studies on the impact of CHPS showed that participants in the CHPS areas were five and

four times more likely to receive ANC and postnatal care, respectively, when compared with their counterparts in the non-CHPS areas [14]. Despite the high ANC coverage in CHPS areas compared with non-CHPS areas, MMR is still high in Ghana. It has been suggested that the quality of ANC should be assessed in areas with high ANC coverage and poor maternal health indicators [1, 14–17]. Yet, no scientific study has been conducted to evaluate the quality of ANC in the CHPS intervention program. The objective of this study, therefore, was to compare the technical process quality of ANC between CHPS and non-CHPS areas in the Birim North District of Ghana.

Methods

Study Area

This cross-sectional study was conducted in the Birim North District of Ghana in May 2010. The Birim North District is one of the first three districts in Ghana that started the CHPS program in 1999 [13]. The district is made up of 6 sub-districts and 49 geographical areas. Of the 49 areas in the district, 11 were CHPS areas while 38 were non-CHPS areas [18].

Participants

The participants of this study were 600 mothers (300 from CHPS areas and 300 from non-CHPS areas) aged 15–49 years. The inclusion criteria of participants included having at least one child within 18 months of age, residing in the district for at least 2 years before the data collection period, and willing to participate in the study voluntarily.

The CHPS cluster is composed of six geographical areas with the CHPS program being in operation for at least 4 years prior to the data collection period. Similarly, six non-CHPS geographical areas were selected to form the non-CHPS cluster. Due to time and financial constraints, the six non-CHPS areas were selected conveniently using a distance of at least 25 km from the nearest CHPS areas. Afterwards, systematic random sampling was employed in choosing 50 respondents from each CHPS and non-CHPS area using the list of Expanded Program on Immunization (EPI), which served as the sampling frame.

The EPI list is made up of all children (0–59 months) who have received at least one immunization. The EPI list was used because it is a reliable source for obtaining civil registration information, and it is readily available in Ghana [19]. The EPI coverage according to the 2008 GDHS report was 79% in Ghana [9]. Although EPI does not contain information on enrollment of CHPS versus non-CHPS, CHPS and non-CHPS areas have separate EPI records.

The questionnaire used for data collection was adopted from the protocol of the UNICEF Multiple Indicator Cluster Survey 4 questionnaire for women [20], and the GDHS 2003 women's questionnaire [9]. Five interviewers who had at least senior high school level education were recruited and trained to conduct the interviews. Data were collected at the households of the selected participants through face-to-face interview.

Study Variables

To provide an assessment of the technical process quality of ANC, the following four outcome variables were analyzed: health services received during the ANC period, receipt of anti-malarial prophylaxis/drugs, testing for HIV infection, and participants' knowledge about pregnancy danger signs [1, 5].

To measure the health services received during the ANC period, participants were asked questions regarding experience of the following services: (1) measurement of body weight, (2) measurement of blood pressure, (3) urine sample testing, (4) blood sample testing, (5) receipt of iron tablets or syrup, and (6) receipt of tetanus toxoid immunization. Binary variables were created for each of the questions. Then, an index of receipt of the various health components of ANC was constructed using the sums of binary input variables. Similar to previous studies [1, 21], components of ANC were considered fully utilized when the woman received all six components of ANC, and partial if a woman had failed to receive any one of the components.

Awareness of the following pregnancy danger signs were used to measure the knowledge of pregnancy danger signs: (1) hemorrhage, (2) high blood pressure, (3) fever, (4) severe abdominal oedema, (5) severe headache, (6) poor vision, and (7) severe waist pains [1, 5, 6]. Binary variables were created for each of the questions into one category as having knowledge and not having knowledge. An index of knowledge score was then constructed using the sums of binary input variables. The scores obtained were recorded as tertiles with categories labeled low, middle, and high knowledge score.

Socioeconomic, demographics, and accessibility variables theoretically and empirically linked to quality of ANC services were included as covariates. These variables included: maternal age, maternal age at marriage, maternal education (no education, primary/non formal education, junior high school or senior high school/training college/university), ethnicity (Akan or others), religion (Christianity or others), marital status (single or ever married), occupation (unemployed, peasant farmer, trader, others), distance from the nearest health facility (≤ 30 min or >30 min), visited by family planning workers (yes or no), and wanted last child (yes or no).

Statistical Analysis

Descriptive statistics for socio-economic and demographic variables, index of utilization score (0–6), index of knowledge score (0–7), receipt of anti-malarial prophylaxis (0–1), and tested for HIV/AIDs (0–1), during the ANC period for participants in both areas were calculated.

Then, multiple logistic regression analysis was carried-out using the following four outcome variables by entering all covariates simultaneously: (1) Index of utilization score (full), (2) Receipt of anti-malarial drugs, (3) Testing for HIV infection, and (4) Index of knowledge score (high).

Cronbach's alpha coefficients were used to assess the internal reliability of indices. Cronbach's alpha of the 6 sub-questions of index of utilization score was 0.71, and for index of knowledge score was 0.63, suggesting high internal consistency: the closer the value of this coefficient to 1.0, the more reliable the composite [22]. The multicollinearity of the variables was checked by examining the variance inflation factors (VIFs), which was <2.0 . Odds ratios were estimated to see the strength of the associations while 95% confidence intervals were estimated for significance testing. Data were analyzed using SPSS Version 16.0 [23]. The Ethical Committee of the University of Tokyo and the Ghana Health Service Ethical Review Committee approved the study.

Results

Background Characteristics

Table 1 shows the background characteristics of the participants in both areas. The mean age of participants was 26.3 (standard deviation [SD] = 6.7) years in the CHPS areas and 25.8 (SD = 5.8) years in the non-CHPS areas. The mean marital age of participants was 20.9 (SD = 3.3) years in the CHPS areas and 21.8 (SD = 4.0) years in the non-CHPS areas. Regarding education of participants, a higher proportion of the participants in both areas had junior high school level education: 36.7% in the CHPS areas and 43.0% in the non-CHPS areas. Similarly, a higher proportion of the participants in both areas were ever married; 75.7 and 76.3% in CHPS and non-CHPS areas, respectively. Of all participants, 55.7% in the CHPS areas and 55.0% in the non-CHPS areas were Akans. A higher proportion of participants in both areas were Christians: 80.7% in the CHPS areas and 82.0% in the non-CHPS areas. Thirty-seven percent and 39.3% of the participants in CHPS and non-CHPS areas, respectively, were traders.

The proportion of participants who wanted their last child was 59.3% in the CHPS areas and 57.7% in the non-CHPS areas. Similarly, the proportion of participants who

lived ≤ 30 min distance from the nearest health facility was 53.7% in the CHPS areas and 79.7% in the non-CHPS areas. However, the proportion of participants who received visits from family planning workers was 53.7% in the CHPS areas and only 2.3% in the non-CHPS areas.

The proportion of participants who received ANC at least four times was 75.4% in the CHPS areas and 72.3% in the non-CHPS areas. Similarly, 96.3% of the participants in the CHPS areas and 90.3% of the participants in the non-CHPS areas, respectively, received ANC from a medically trained provider.

Health Services Received During the ANC Period

Table 2 shows the distribution of mothers who received specific health services during the ANC period in the two areas. Rates of full utilization of health services received during ANC, scored by the index of utilization on a scale of 0–6, were higher among participants in the CHPS areas than among those in the non-CHPS areas (74.0% scoring the upper range in the CHPS area vs. 45.0% in the non-CHPS area).

Regarding the receipt of the recommended two or more doses of anti-malarial prophylaxis during the ANC period, 86.5% in the CHPS areas and 76.8% in the non-CHPS areas, respectively, received such recommended doses. The proportion of participants who received HIV counseling and testing was higher in the CHPS areas at 88.9 and 86.5% respectively, compared with only 72.7 and 65.7%, respectively in the non-CHPS areas.

Knowledge About Pregnancy Danger Signs

Table 3 presents the participants' knowledge about pregnancy danger signs in the two areas. The overall index of knowledge score on a scale of 0–7 and expressed in tertiles indicates that while only 22.9% of participants in the non-CHPS areas reported scoring the upper range (a high score) on the overall index of knowledge score, 33.9% of participants in the CHPS areas reported a high knowledge score. Similarly, only 22.1% of participants in the non-CHPS areas reported a mid-level score on the overall index of knowledge score, compared with 37.4% of participants in the CHPS areas who reported a mid-level knowledge score. Furthermore, 55.0% of participants in the non-CHPS areas reported a low score on the overall index of knowledge score, compared with only 28.7% of participants in the non-CHPS areas who reported a low knowledge score.

Multivariate Analysis

The results of the multivariate logistic regression analyses are presented in Table 4. Regarding the main outcome

measures of technical process quality, full utilization score of ANC services was found to be 2.73 times (95% confidence interval [CI] 1.68–4.43) higher among participants in the CHPS areas as against participants of the non-CHPS areas. Receipt of anti-malarial drugs during ANC was significantly associated with CHPS exposure (OR: 3.73; 95% CI: 1.73–8.04).

Similarly, participants who were in the CHPS areas were 4.49 times (95% CI: 2.37–8.51) more likely to receive HIV testing during the ANC period compared with participants of the non-CHPS areas. However, scoring high on the overall index of knowledge was not significantly associated with CHPS exposure (OR: 1.17; 95% CI: 0.69–2.00).

Discussion

This study revealed that participants in the CHPS areas were more likely to receive better technical process quality of ANC services compared with their non-CHPS counterparts. Previous studies have shown that CHPS is consistently associated with an increase of receiving ANC [12]. However, those studies did not address quality of ANC services [14]. The results of this study, therefore, offer a novel insight into the value of the CHPS initiative, indicating that pregnant women can benefit from better technical process quality of ANC services under the CHPS initiative than that found in non-CHPS areas in the Birim North District of Ghana.

The better technical process quality of ANC in the CHPS areas observed in this study can be attributed to the design of the CHPS intervention. The health worker of the CHPS intervention is available at all times because s/he lives with the residents 24 h a day. The 24 h a day presence of the health worker, combined with the 4-days-a-week home visits s/he undertakes effectively eliminates the travel distance barrier that has been reported to negatively affect ANC use in Ghana and other developing countries [24, 25]. In the non-CHPS areas, in contrast, health services are delivered only at the health facility [11, 12, 14].

However, regression estimates suggest that the CHPS intervention was not associated with higher scores on the index of knowledge. This is in line with a previous analytic study of physician-patient communication which found no association between patients' recall of specific items of information given by the physician for the management of the patients' health [26]. It is also possible that clients were not informed of pregnancy danger signs because of the short interaction time available between clients and providers, poor knowledge of the importance of counseling on pregnancy danger signs among the providers, and poor counseling techniques of the providers, as has been reported in another previous study [6].

Table 1 Background characteristics of participants in CHPS and non-CHPS clusters (n = 600)

Variable	CHPS (N = 300)		Non-CHPS (N = 300)	
	n	%	n	%
Age, mean (SD) ^a	260	26.3 (6.75)	256	25.8 (5.79)
Age at marriage, mean ± SD ^b	220	20.9 (3.25)	217	21.8 (4.03)
Maternal education				
No education	74	24.7	64	21.3
Primary/non-formal	82	27.3	75	25.0
Junior high school	110	36.7	129	43.0
Senior high school/higher	28	9.3	31	10.3
Missing data	6	2.0	1	0.3
Ethnicity				
Akan	167	55.7	165	55.0
Others	133	44.3	135	45.0
Religion				
Christianity	242	80.7	246	82.0
Others	58	19.3	54	18.0
Marital status				
Single	73	24.3	71	23.7
Ever married	227	75.7	229	76.3
Occupation				
Unemployed	88	29.3	90	30.0
Peasant farmer	74	24.7	55	18.3
Trader	111	37.0	118	39.3
Others	21	7.0	36	12.0
Missing data	6	2.0	1	0.3
Wanted last child				
Yes	178	59.3	173	57.7
No	122	40.7	127	42.3
Distance from the nearest health facility				
≤30 min	161	53.7	239	79.7
>30 min	139	46.3	61	20.3
Received visits from family planning workers				
Yes	161	53.7	7	2.3
No	139	46.3	293	97.7
ANC visits ^c				
Sufficient ^d	218	75.4	196	72.3
Insufficient ^e	71	24.6	75	27.7
ANC provider qualification ^f				
Medically trained provider	289	96.3	271	90.3
Non-medically trained provider	11	3.7	29	9.7

CHPS community-based health planning and services

SD standard deviation

^a Of total, 40 participants and 44 participants in the CHPS and the non-CHPS clusters, respectively, did not know their age

^b Of total, 73 participants and 71 participants in the CHPS and the non-CHPS clusters, respectively, were single, and there were 7 and 12 missing data on this variable in the CHPS and the non-CHPS clusters, respectively, that were not included in the analysis

^c Of total, there were 11 and 29 missing data on this variable in the CHPS and the non-CHPS clusters, respectively, that were not included in the analysis

^d Sufficient: four minimum ANC visits for each pregnancy according to the recommendations by the World Health Organization and the Ghana Ministry of Health

^e Insufficient: less than four ANC visits

^f Medically trained provider: doctor, nurse/midwife, community health officer; Non-medically trained provider: traditional birth attendant, community volunteer, relative/friend and no one/other

Table 2 Health services received during the ANC period (n = 560)

Health services received during ANC period	CHPS (N = 289)		Non-CHPS (N = 271)		P value
	n	%	n	%	
Weight measured ^b					
No	2	0.7	7	2.6	0.077
Yes	280	99.3	259	97.4	
Blood sample tested ^b					
No	3	1.1	69	25.9	<0.001
Yes	279	98.9	197	74.1	
Urine sample tested ^b					
No	2	0.7	31	11.7	<0.001
Yes	280	99.3	235	88.3	
Blood pressure measured ^b					
No	3	1.1	13	4.9	0.008
Yes	279	98.9	253	95.1	
Received iron tablets/syrup					
No	62	21.5	48	17.7	0.265
Yes	227	78.5	223	82.3	
Received Tetanus Toxoid immunization					
No	21	7.3	38	14.0	0.009
Yes	268	92.7	233	86.0	
Overall index of utilization score (0–6) ^a					
Full	214	74.0	122	45.0	<0.001
Partial	75	26.0	149	55.0	
Received anti-malarial drugs/prophylaxis					
No dose	19	6.6	48	17.7	<0.001
One dose	20	6.9	15	5.5	
Two or more doses	250	86.5	208	76.8	
Received drugs for intestinal worms					
No	116	40.1	112	41.3	0.775
Yes	173	59.9	159	58.7	
Counseled for HIV infection					
No	32	11.1	74	27.3	<0.001
Yes	257	88.9	197	72.7	
Tested for HIV infection					
No	39	13.5	93	34.3	<0.001
Yes	250	86.5	178	65.7	

ANC antenatal care

HIV/AIDS human immune deficiency virus/acquired immune deficiency virus

CHPS community-based health planning and services

^a Full: if a woman received all six components of ANC, Partial: if a woman failed to receive any one of the components of ANC

^b There were 7 and 5 missing data on these variables from the CHPS and the non-CHPS clusters, respectively, that were not included in the analysis

As expected, maternal senior high school or higher level education had a positive association with full utilization scores, receipt of HIV testing during the ANC period, and scoring higher on the index of knowledge score. There are a number of explanations for why education is a key determinant of better quality of ANC health service use. Education is likely to enhance female autonomy so that women develop greater confidence and capability to make decisions about their own health [27, 28]. It is also likely that educated women seek higher quality services and have greater ability to use health care inputs that offer better care [29].

In this study, belonging to the Akan ethnicity was associated with having a lower score on the index of knowledge

about pregnancy danger signs. A possible explanation for this is that, the health education is given in the official language of Ghana, which is English. Further, the information, education and communication materials used for the health education are all in English. It is possible that the Akans, who use their own language for everyday life, could not fully understand the education about pregnancy danger signs they received in English. Previous studies also found that ethnicity played an important role regarding knowledge and attitude towards various maternal health care services in Africa [13, 29].

The influence of being ever-married and the utilization of ANC, PNC, facility delivery, and family planning are

Table 3 Distribution of participants knowledge about pregnancy danger signs (n = 560)

Knowledge about danger signs	CHPS (N = 289)		Non-CHPS (N = 271)		P value
	n	%	n	%	
Heavy bleeding/hemorrhage					
No	175	60.6	180	66.4	0.150
Yes	114	39.4	91	33.6	
High blood pressure					
No	212	73.4	201	74.2	0.827
Yes	77	26.6	70	25.8	
Fever					
No	126	43.6	171	63.1	<0.001
Yes	163	56.4	100	36.9	
Severe abdominal oedema					
No	204	70.6	207	76.4	0.121
Yes	85	29.4	64	23.6	
Severe headache					
No	174	60.2	172	63.5	0.427
Yes	115	39.8	99	36.5	
Blurred/poor vision					
No	174	60.2	205	75.6	<0.001
Yes	115	39.8	66	24.4	
Severe waist pains					
No	162	56.1	179	66.1	0.015
Yes	127	43.9	92	33.9	
Overall index of knowledge score (0–7)***					
Low	83	28.7	149	55.0	<0.001
Medium	108	37.4	60	22.1	
High	98	33.9	62	22.9	

CHPS community-based health planning and services
 *** Scores obtained recoded as tertiles, with categories labeled low knowledge, medium knowledge, and high knowledge

well documented [13, 25]. Our results also support the hypothesis indicating that ever-married women are more likely to have a high score on the index of knowledge compared to single women. It is possible that because married women are usually living with their husbands, they are able to get help from their husbands for attending ANC [30], while it is not possible for single mothers. Further, previous studies have reported that unmarried pregnant women are less likely to use ANC services due to a lack of economic and social support from parents, guardians and spouses [31].

In this study, women who reported wanting their last child were less likely to test for HIV infection as against women who did not. This might be because these women were having sex exclusively with their regular partner (such as a husband), and thus did not perceive a need to test their HIV status as has been reported in a previous study [32].

In this study, experience of visits by family planning workers was found to be an important determinant of having a high score on the index of knowledge quality. This result is also consistent with the results of a previous study [13]. It is likely that the family planning workers give

explanations about pregnancy danger signs as part of the education on the timing and use of modern contraceptive methods.

Our findings should be interpreted considering some limitations. First, cross-sectional analysis does not allow us to draw robust conclusions on the effects of the identified covariates. CHPS was initiated in the study area 10 years prior to the study date and baseline data for the intervention area was not available. Therefore, it was difficult to make a valid before-and-after comparison with regard to maternal health services and indicators.

Second, self reporting might have caused a social desirability bias. Third, there might be some chance of recall bias among respondents. Fourth, in a setting where interactions can take place at various social gatherings such as funeral ceremonies and markets places, contamination is possible. Fifth, although this study makes important contribution to the technical components of the quality of ANC, it did not address the structure and interpersonal process quality components. Therefore, future studies should include an assessment of these components. Lastly, further studies should explore the cost differences.

Table 4 Associations between CHPS exposure and health services received during the ANC period (N = 560)

Variable	Index of utilization score (Full)	Receipt of anti-malarial prophylaxis	Tested for HIV infection	Index of knowledge score (High)
CHPS established				
No	1.00	1.00	1.00	1.00
Yes	2.73 (1.68–4.43)***	3.73 (1.73–8.04)*	4.49 (2.37–8.51)***	1.17 (0.69–2.00)
Maternal education				
No education	1.00	1.00	1.00	1.00
Primary/non-formal	1.08 (0.64–1.82)	1.87 (0.88–3.97)	1.48 (0.81–2.72)	0.50 (0.26–0.94)*
Junior high school	1.31 (0.79–2.16)	1.31 (0.67–2.59)	1.55 (0.87–2.76)	1.12 (0.64–1.94)
Senior high/higher	5.38 (2.13–13.62)***	2.63 (0.78–8.85)	2.79 (1.09–7.11)*	2.20 (1.04–4.64)*
Ethnicity				
Others	1.00	1.00	1.00	1.00
Akan	1.00 (0.67–1.49)	1.06 (0.60–1.87)	1.18 (0.74–1.86)	0.46 (0.30–0.71)***
Religion				
Others	1.00	1.00	1.00	1.00
Christianity	0.95 (0.57–1.58)	1.41 (0.72–2.76)	1.38 (0.78–2.42)	1.46 (0.82–2.60)
Marital status				
Single	1.00	1.00	1.00	1.00
Ever married	1.23 (0.79–1.93)	1.71 (0.95–3.10)	0.77 (0.45–1.32)	3.44 (1.89–6.27)***
Occupation				
Unemployed	1.00	1.00	1.00	1.00
Peasant farmer	1.11 (0.64–1.90)	1.06 (0.50–2.26)	0.97 (0.52–1.80)	1.36 (0.73–2.54)
Trader	0.88 (0.55–1.40)	1.18 (0.61–2.27)	1.07 (0.61–1.86)	1.53 (0.90–2.60)
Others	0.98 (0.47–2.03)	1.17 (0.41–3.28)	0.47 (0.22–1.02)	2.03 (0.95–4.35)
Wanted last child				
No	1.00	1.00	1.00	1.00
Yes	0.82 (0.56–1.20)	1.32 (0.77–2.26)	0.62 (0.40–0.97)*	0.96 (0.63–1.45)
Distance from nearest health facility				
>30 min	1.00	1.00	1.00	1.00
≤30 min	1.16 (0.75–1.78)	1.21 (0.65–2.24)	0.60 (0.35–1.01)	0.68 (0.44–1.07)
Received visits from family planning workers				
No	1.00	1.00	1.00	1.00
Yes	0.95 (0.54–1.62)	0.95 (0.39–2.32)	0.54 (0.26–1.11)	2.28 (1.31–3.97)**
ANC visits				
Insufficient ^a	1.00	1.00	1.00	1.00
Sufficient ^b	1.32 (0.86–2.02)	1.22 (0.68–2.20)	1.43 (0.88–2.32)	1.25 (0.76–2.05)

CHPS community-based health planning and services

ANC antenatal care

HIV/AIDS human immune deficiency virus/acquired immune deficiency syndrome

*** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$

^a Sufficient: four minimum ANC visits for each pregnancy according to the recommendations by the World Health Organization and the Ghana Ministry of Health

^b Insufficient: less than four ANC visits

In conclusion, women in the CHPS areas were more likely to receive better technical process quality of ANC services in the Birim North District than were their non-CHPS counterparts. It seems that the CHPS intervention might be useful to improve the technical process quality of

ANC in the CHPS areas of the Birim North District. Therefore, increasing the CHPS intervention coverage in non-CHPS areas might serve as a basis for improving the quality of ANC in the Birim North and other rural districts of Ghana.

In this study, only 22.9% and only 33.9% of the participants in the non-CHPS and CHPS areas, respectively scored high on the overall index of knowledge about pregnancy danger signs. Therefore, the reasons for the low knowledge about pregnancy danger signs in the study area should be investigated and improved. Finally, although longitudinal studies will be needed to draw the decisive conclusion, our results suggest that the CHPS intervention might be useful to improve the technical process quality of ANC in the Birim North District of Ghana.

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