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Antenatal care attendance, a surrogate for pregnancy outcome? The case of Kumasi, Ghana

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Abstract

Objective—Antenatal care (ANC) has been shown to influence infant and maternal outcomes. WHO recommends 4 ANC visits for uncomplicated pregnancies. However, pregnant women in Ghana are required to attend 8–13 antenatal visits. We investigated the association of ANC attendance with adverse pregnancy outcomes (defined as low infant birth weight, stillbirth, preterm delivery or small for gestational age).

Method—A quantitative cross-sectional study was conducted on 629 women, age 19–48 years who presented for delivery at two selected public hospitals and 16 traditional birth attendants from July-November 2011. Socio-demographic and antenatal information were collected using a structured questionnaire. ANC attendance, medical and obstetric/gynecological history were abstracted from maternal antenatal records. Data were analyzed using chi-square and logistic regression.

Results—Twenty-two percent of the women experienced an adverse outcome. Eleven percent of the women attended <4 ANC visits. In an unadjusted model, these women had an increased likelihood of experiencing an adverse outcome (OR = 2.27; 95 CI% = 1.30–3.94; p = 0.0038). High parity was also associated with adverse birth outcomes. Women screened for syphilis or use of insecticide-treated bed nets had a 40% and 36% ($p = 0.0447$ and $p = 0.0293$) reduced likelihood of experiencing an adverse pregnancy outcome respectively. After adjusting for confounders, attending <4 antenatal visits was associated with adverse pregnancy outcome compared with ≥4 ANC visits (Adjusted OR = 2.55; 95% CI = 1.16– 5.63; $p = 0.0202$).

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Conclusion—Attending <4 antenatal visits and high parity were associated with adverse pregnancy outcomes for uncomplicated pregnancies.

Introduction

A forty-five percent prevalence of adverse pregnancy outcomes has been reported in Kumasi [1]. Antenatal care (ANC) is a routine medical service and has been identified as a determining factor in pregnancy outcomes [2, 3]. Regular ANC visits present opportunities for reaching pregnant women with services and interventions that are vital for the well-being of both the mother and neonate. ANC is also integral to identifying women who might be at an increased risk of adverse pregnancy outcomes [4–6]. The services received depend on the number of ANC visits. A study in Mexico found a 76% increased risk of low birth weight associated with premature delivery for women who received fewer clinical services during ANC compared with women who received more clinical services [7].

Most developing countries, including Ghana, have adopted an antenatal delivery model based on the predominant model used in developed countries. This model requires pregnant women to make antenatal visits once a month for the first 6 months and bi-monthly for the next 2 months and then weekly until delivery [3, 7]. While ANC guidelines of other countries differ, for example India requires at least 3 ANC visits [8] and France 7 visits for uncomplicated pregnancies [9], Ghana Health Service guidelines require 8–13 visits. Research has shown that 4 ANC visits for uncomplicated pregnancies did not result in an increase in adverse pregnancy outcomes [10]. Ghana's 8–13 ANC visits could have been influenced by studies that reported improved perinatal health with increased ANC attendance [11] or on the finding that attending >4 antenatal visits increased the likelihood of a pregnant woman delivering with a health professional [12].

In Ghana, 87% of pregnant women attend at least 1 antenatal visit before delivery [13]. However, attendance varies by location. Seventy-three percent of women in urban and 55% of women in rural areas attended ≥4 ANC visits [6]. A study reported a 51% chance of having a low birth weight child for women who had fewer ANC visits compared with those with adequate visits. Additionally, it was suggested that 18% of preterm births could have been prevented if blood pressure, maternal height and weight, urine and blood samples, and pelvic examination were included in the ANC services provided [7]. Some antenatal measures have been shown to be effective. These include screening for and treatment of infections (especially syphilis), malaria, anemia, bacteriuria and proteinuria and detection and management of hypertension [14]. Of all these antenatal measures, only the management of hypertension could justify more than three routine ANC visits [15]. The efficacy of Ghana's 8–13 ANC visits has not been established. Given that WHO recommends four focused antenatal care (FANC) visits for uncomplicated pregnancies, it is unknown whether 8–13 ANC visits for uncomplicated pregnancy in Ghana is still necessary. In this study, we investigated the association of ANC attendance with adverse pregnancy outcomes.

Method

Participant recruitment and study setting

A quantitative cross-sectional study was conducted to investigate the association of ANC attendance with adverse pregnancy outcome in Kumasi. Kumasi is the capital of the Ashanti Region. It has a population of about 1.7 million people (Kumasi Metro Profile, 2011 estimate; Unpublished; Joana Tawia Burgesson). This study was conducted in two health facilities; the Komfo Anokye Teaching Hospital (KATH) and the Manhyia District Hospital (a tertiary and secondary hospital, respectively). KATH is a referral hospital that provides most of the antenatal, labor and delivery services. It serves the entire Ashanti Region and bordering regions. Manhyia District hospital covers Manhyia North and South and caters to 34.6% of the Kumasi population [16]. Additionally, 16 Traditional Birth Attendants (TBAs) who practiced in the Asokwa health sub-metro provided participants in this study. TBAs are women with practical training in caring for pregnant women and assisting with labor and delivery. They are trained in recognition of the danger signs that prompt referrals of affected pregnant women to the hospitals for further management.

Eligibility criteria and ethical approval

Eligible participants were pregnant women, aged 19 years and older, who resided in Kumasi at the time of conception or moved to Kumasi 1–2 months following conception and presented to the study's hospitals or TBAs for delivery. Women with singleton, spontaneous, vaginal deliveries, without complications (e.g. pre-eclampsia) who presented for delivery at the study sites and selected TBAs from July- November 2011 were eligible for enrollment in this study. The Institutional Review Board of the University of Alabama at Birmingham and the Committee on Human Research, Publications and Ethics, School of Medical Sciences, Kwame Nkrumah University of Science and Technology Kumasi, Ghana approved the study protocol before its implementation.

Study Population

The attending midwives informed potential participants who presented for delivery in either of the 2 health facilities of the study during their admission to the labor ward and the TBAs informed their clients. Informed consent was obtained from the study participants. Participants with incomplete questionnaires or who attended more than 13 ANC visits were excluded. Data from 629 participants were used for these analyses. Trained study personnel administered the questionnaires to the participants 1–2 hours after delivery, in a quiet private area. No identifying information was recorded and confidentiality was assured. All questionnaires were reviewed for completeness.

Data collection

A 92-item structured questionnaire was used to ascertain the following information: 1) socio-demographic characteristics, 2) obstetric and reproductive history, 3) occupation and lifestyle factors, and 4) ANC services and treatment received. The socio-demographic section was adapted from a model questionnaire recommended for use by the Malaria Monitoring and Evaluation Group [17]. It included questions on health insurance and

duration of the insurance. The section on obstetric and reproductive history assessed parity, and prior history of adverse pregnancy outcomes, trimester of first ANC attendance, number of ANC visits, and the duration of pregnancy. The ANC services and treatment section assessed the type of tests (stool, hemoglobin, sexually transmitted infections) performed, provision and use of insecticide treated bed nets, and malaria and helminths chemoprophylaxis. Additionally, select data including hemoglobin concentration (g/dL), tetanus toxoid vaccination, date of first ANC visit, and malaria prophylaxis was abstracted from maternal antenatal records.

Six senior midwives reviewed the entire questionnaire for content validity and cultural sensitivity prior to study commencement. To improve its reliability, the validated questionnaire was pre-tested on five pregnant women who were attending ANC and six new mothers. Following pre-test modifications, twelve new mothers who met the study eligibility requirements pilot tested the questionnaire. The questionnaire was modified accordingly before use.

Primary Exposure

Information on primary exposure (number of antenatal visits made by each of the participants) was abstracted from the maternal antenatal record. Participants with incomplete ANC attendance information and/or ANC attendances not recorded on their maternal antenatal record were excluded.

Primary Outcome

Adverse pregnancy outcome is defined as: 1) low birth weight baby i.e. birth weight < 2,500 g; 2) preterm delivery (< 37 weeks of gestation); 3) stillbirth occurring within 12 hours prior to or 12 hours after delivery [18]; and 4) small for gestational age (sex-specific birth weight at or below the 10^{th} percentile for the weight-for-gestational age of an international reference population) [19].

Data analysis

The data were single-entered in a Microsoft Access 2010 database and imported into SAS for analyses. Basic descriptive statistics were computed as frequency distributions (character variables), means and standard deviations (numeric variables). Association of socio-demographic variables and ANC attendance was examined using chi-square or Fisher's exact tests. Participants were grouped based on ANC attendance (i.e. <4, 4–7 or 8–13 visits). Associations of adverse pregnancy outcomes with mean parity, antenatal services and tests received during ANC visits were calculated using independent *t*-test. Correlation analyses were performed to identify possible multicollinearities. Unadjusted and adjusted odds ratios (ORs) and 95% Confidence Intervals (CIs) for the association between ANC components and ANC attendance with adverse pregnancy outcomes were estimated by logistic regression. Two multivariable models were used to assess the association of ANC attendance and adverse pregnancy outcomes. In the first multivariable model, all the variables in the unadjusted model were included irrespective of their level of significance. The second multivariable model was adjusted for insurance and duration of insurance, marital and employment status. The change-in-estimate criteria were used to select potential

confounders. A variable was considered a confounder if the change in estimate from the crude and adjusted model was at least 10 percent[20]. Stratum specific estimates to assess effect modification by level of education and income were obtained. All tests were two-tailed and *p*-values ≤ 0.05 were considered statistically significant. All analyses were performed using SAS® 9.2 (SAS Institute, Cary, NC, USA).

Results

Participant's characteristics and ANC attendance

Participation rate was 99.7%. Mean age ± standard deviation (SD) was 28±5.7 years and ranged from 19 to 48 years. Mean ± SD ANC attendance was 7.2± 3.0 visits, ranging from 0 to 13 visits. Approximately 11% of participants attended fewer than 4 ANC visits, the WHO recommended minimum standard for uncomplicated pregnancy, while 42.1% attended Ghana's recommended minimum of 8 ANC visits. Sixty-eight percent of women who attended <4 ANC visits were less than 26 years old (25.4 years). They were also likely to have only a primary level of education or no formal education, be self-employed with a monthly income of less than GH¢500.00 (US$ 333.3). Fifty-eight percent of the self-employed were traders while 30.5% were hairdressers or seamstresses. Fifty-four percent of the women who attended <4 ANC visits, had 2–5 children. ANC attendance did not vary by religious affiliations. Sixty-one percent of the participants initiated ANC during their first trimester and 32.9% initiated ANC during their second trimester, while only 5.9% enrolled in ANC during their third trimester (Table 1).

ANC attendance and services provided

Some of the services obtained during ANC visits included malaria and intestinal helminths prophylaxis, tetanus vaccination, nutritional supplementation and screening for anemia, intestinal helminths and sexually transmitted infections (STIs). Approximately 9% of the women did not receive malaria prophylaxis. Of the women who did not receive malaria prophylaxis, 15.9% attended < 4 ANC visits compared with 9.1% who attended ≥8 ANC visits. Nine percent of women reported not receiving nutritional support or being informed of healthy eating habits during pregnancy. Seventeen percent (12/69) of these women attended <4 ANC visits compared with 8.0% who attended ≥8 ANC visits and this was statistically significant (p ≤0.05). Thirty-five percent of the women (24/69) who attended <4 ANC visits were also statistically less likely to receive a complete series of tetanus vaccination (p ≤0.05). While screening for intestinal helminths and anemia was high among the study participants, women who attended <4 ANC visits received less screening. Thirty percent of women who attended <4 ANC visits were not screened for helminths and 11.6% were not screened for anemia. Overall, regardless of number of ANC visits attended, screening for STIs was low, except for HIV. Twenty-one percent of study participants were screened for gonorrhea, 27.7% for syphilis and 0.9% for chlamydia (Table 2).

Biological, antenatal components and ANC attendance with pregnancy outcomes

Adverse birth outcome was not significantly associated with number of tests performed or number of doses of malaria prophylaxis taken. Mean ANC attendance was higher for women without an adverse birth outcome compared with women with an adverse outcome (7.2 vs.

6.5 respectively; $p = 0.0101$). Parity significantly influenced adverse pregnancy outcome. Women with 3 or more children (assessed as a continuous variable) were more likely to experience an adverse outcome compared with women with <3 children ($p = 0.0112$). The duration of ANC attended also impacted pregnancy outcome. Women without adverse outcomes attended ANC for a longer period (in months) than women with adverse outcomes ($p = 0.0184$) (Table 3).

Overall, 22% of the study participants experienced an adverse outcome. Of this number, 37.7% of the women attended <4 ANC visits compared with women who attended 4 or more visits ($p = 0.0053$). Approximately 16% of the women who experienced a preterm birth attended <4 ANC visits compared with 5.7% of women with 8 or more ANC visits (p=0.0196). Twenty percent of women who gave birth to low birth weight children also attended <4 ANC visits compared with 9.4% for those who attended ≥8 ANC visits. Though not statistically significant, the proportion of women with children small for their gestational age was highest among women who attended <4 ANC visits compared with women who attended ≥4 ANC visits (Table 1).

In bivariate logistic analyses, parity was associated with a woman experiencing an adverse pregnancy outcome. The odds of experiencing an adverse outcome increased with increasing order of parity. Women with >5 children were 4 times more likely to experience an adverse outcome compared with women with one child (OR = 3.78; CI = 1.54–9.28; $p = 0.0036$). Having severe anemia or not receiving tetanus vaccine were marginally significant factors affecting pregnancy outcomes (p= 0.0784, p= 0.0660 respectively). Screening for syphilis or use of an insecticide-treated bed net had a protective effect on adverse pregnancy outcome. Women who were screened for syphilis were 40% less likely to experience an adverse outcome, while women who used an insecticide-treated bed net were 34% less likely to experience an adverse outcome ($p = 0.0447$; $p = 0.0293$ respectively) (Table 4).

After adjusting for insurance, duration of insurance, marital and employment status, attending <4 ANC visits was significantly associated with adverse birth outcome (OR =2.55; 95% CI = 1.16–5.63; $p = 0.0202$) (Table 4). Significant confounding was found between parity >5, initiating ANC at 3rd trimester, and adverse pregnancy outcome. Evidence of confounding was also present between severe anemia and adverse pregnancy outcome.

Discussion

In this study less than 4 ANC visits and high parity were associated with adverse pregnancy outcomes. However, there seem to be an overall increase in ANC attendance and a lower prevalence of adverse pregnancy outcomes from 44.6% reported by Yatich *et al.* [1] to 22%. Pallikadavath *et al*, distinguished between antenatal visit and antenatal “check-up”. According to the authors, antenatal check-up meant that a pregnant woman visited a health provider and received antenatal services such as blood pressure measurement, abdominal, internal/pelvic examination, blood and urine testing, stool examination, tetanus toxoid vaccination and iron and folic acid supplementation. Antenatal visit on the other hand did not necessarily mean ANC services were received [8]. Improper classification of these visits could have inflated attendance rate without a corresponding increase in services received and

might have diluted the risk. In this study, ANC attendance assumes that antenatal services were offered. It is evident that irrespective of the number of times a woman attends ANC, early initiation of visits (<24 weeks of pregnancy), malaria and helminths prophylaxis, nutritional supplements, and screening and treatment of STIs are required for a favorable pregnancy outcome. Early initiation of antenatal care is the only means by which adequate services can be obtained. Late antenatal enrollment means missed opportunities for services with increased likelihood for adverse outcomes. In our study, 61.2% of the women initiated antenatal during their first trimester, 32.9% during the second trimester and only 5.9% during the third trimester. This is impressive compared to a study in rural India where only 38% of women initiated ANC during their first trimester [8]. The fact that there is still a 20% prevalence of adverse pregnancy outcomes even among those with the expected maximum of 8–13 ANC visits suggests that the main risk factors cannot be addressed by ANC attendance alone. Findings from a Finnish study suggested that adverse pregnancy outcomes appear to be related to deficient prenatal care and that ANC attendance was non-linearly related to adverse pregnancy outcome [21]. While we suggest that more studies on the efficacy of Ghana's required 8–13 ANC visits be done, we also think the emphasis should be on early ANC initiation and the services provided. Only early ANC initiation can ensure that all prophylactic treatments and tests are offered and that a normal outcome occurs.

Standard ANC protocol requires that women be screened for STIs during the first and third trimesters of their pregnancy. The results of this study suggest the contrary. Apart from HIV, women were not routinely screened for other STIs. Cervical chlamydia and gonorrhea were the least likely to be screened for (0.9% and 21.0% respectively) while screening for syphilis was less than 28%. There is a need for routine testing for syphilis as the syphilis sero-positivity rate in sub-Saharan Africa ranges from 2.2% to 17% [22, 23]. With this high sero-prevalence rate, there is a corresponding high potential for congenital syphilis [18, 24]. Lower genital tract infections have been shown to contribute to adverse pregnancy outcomes [25, 26]. These infections can ascend the reproductive tract and while in the amniotic fluid trigger a pro-inflammatory cytokine cascade that results in the initiation of labor and consequently preterm delivery [27]. In a prospective observational study in the U.S., lower genital tract infections were found to be associated with preterm birth among African Americans [27]. *Chlamydia trachomatis,* the STI that received the least ANC screening in this study, was associated with low birth weight in some studies and preterm birth in other studies, while in another study, gonorrhea was associated with preterm birth [24, 27]. The results of this study suggest that screening for syphilis has a protective effect against adverse pregnancy outcomes, indicating that those who screened positive were treated. It is highly recommended that women of reproductive age be routinely screened against lower genital tract infections prior to becoming pregnant and also during pregnancy.

High parity (≥5 parity) is common in developing countries, although dependent on the culture and socioeconomic status of the family. The risk of experiencing an adverse outcome increases with parity. Our findings support the report by Muktar *et al.* that the rate of stillbirth rises with increasing birth order [28]. How parity affects birth outcomes is not clear but has been attributed to placental and maternal age related chromosomal anomalies [28]. This study also corroborates earlier studies in rural north India and Indonesia where an

association between parity and reduced use of ANC was reported. The studies found that women who had a previous uncomplicated pregnancy felt little need to seek care coupled with practical issues of caring for children while attending a healthcare facility [8, 29]. A higher proportion of women with <4 ANC visits had 2–5 children, and were two times more likely to experience an adverse birth outcome. Increasing awareness of the dangers associated with inadequate ANC attendance could reduce the complacency by multiparous pregnant women.

While other studies have investigated factors associated with adverse birth outcomes, to our knowledge, this is the first study to investigate the association of pregnancy outcomes and frequency of ANC attendance in this community. The results of this study serve as a representation of the pregnant women population in Kumasi since KATH serves the whole of Kumasi metropolis.

Some limitations exist for this study. Improper timing of hemoglobin measurement may lead to erroneous classification of anemia. Mean hemoglobin levels were considered in order to minimize possible misclassification of anemia. Factors such as spousal violence, the sex of the infant and paternal anthropometric measurements also have been suggested as influencing birth outcomes such as low birth weight [30]. However, these factors were not considered in this study. The study design also limits our interpretation of causality. Some of the information collected was based on recall and thus was subject to recall bias. However, the exposure variable (number of ANC attended) was abstracted from the maternal antenatal record. We could not identify and adjust for all possible confounders such as environmental and genetic factors. Also, we could not report effect modification of level of education and income due to small cell counts in some strata and the absence of the maximum likelihood estimate for these variables. These limitations should be taken into consideration when interpreting the results of this study.

Conclusion

Attending less than 4 antenatal visits and high parity were associated with adverse pregnancy outcomes. There was no significant difference in adverse pregnancy outcomes after 4 ANC visits for uncomplicated pregnancies. While ANC attendance could serve as a predictor for pregnancy outcomes, it may not reflect services obtained during antenatal visits. For ANC to be meaningful and effective, emphasis should be on the timing of first ANC visit. More studies are needed to examine ANC content and adequacy of the services provided given the high ANC attendance rate but yet high prevalence of adverse pregnancy outcomes in the study population. In light of this finding, Ghana could consider implementing the Focused Antenatal Care (FANC) as recommended by WHO.

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Table 1

Participants characteristics and adverse pregnancy outcomes by antenatal attendance pattern of pregnant women in Kumasi, 2011

Characteristics	Number of ANC Attended								
	N = 629		<4		4–7		8–13*		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value
Age (years), mean (SD)	28 (5.7)		25.4(6.7)		28.4(5.6)		28.2(5.4)		
Age group									**<.0001**
≤25	238	37.8	47	68.1	94	31.9	97	36.6	
26 – 35	326	51.8	13	18.8	167	56.6	146	55.1	
> 35	65	10.3	9	13.0	34	11.5	22	8.3	
Level of education									**<.0001** **
Primary level/None	197	31.3	39	56.5	97	32.9	61	23.0	
Junior secondary	270	42.9	21	30.4	136	46.1	113	42.6	
Senior secondary	93	14.8	8	11.6	35	11.9	50	18.9	
Vocational/University	69	11.0	1	1.5	27	9.2	41	15.5	
Marital status									**0.0003**
Single	103	16.4	24	34.8	41	13.9	38	14.3	
Married	445	70.8	36	52.2	211	71.5	198	74.7	
Living as married	81	12.9	9	13.0	43	14.6	29	10.9	
Employment ***									**0.0003** **
Unemployed	131	20.9	25	36.2	55	18.6	51	19.3	
Employed	62	9.9	2	2.9	22	7.5	38	14.4	
Self-employed	435	69.3	42	60.9	218	73.9	175	66.3	
Religion									0.7319 **
Christianity	461	73.3	46	66.7	216	73.2	199	75.1	
Islam	160	25.4	22	31.9	75	25.4	63	23.8	
None	8	1.3	1	1.5	4	1.4	3	1.1	
Income (Cedis)									**0.0110** **
< 500	378	60.1	54	78.3	172	58.3	152	57.4	
500 – 2000	174	27.7	10	14.5	87	29.5	77	29.1	
> 2000	26	4.1	1	1.5	8	29.5	17	7.2	

Characteristics	N = 629		Number of ANC Attended <4		4–7		8–13*		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value
Don't Know	51	8.1	4	5.8	28	9.5	19	7.2	
Health insurance	612	97.3	63	91.3	287	97.3	262	98.9	**0.0026**
Duration of insurance**									**<.0001****
3 months	70	11.4	21	33.3	41	14.3	8	3.1	
6 months	109	17.8	9	14.3	63	22.0	37	14.1	
9 months	63	10.3	8	12.7	24	8.4	31	11.8	
More than 1 year	366	59.8	24	38.1	158	55.1	184	70.2	
Don't know	4	0.7	1	1.6	1	0.4	2	0.8	
Parity									**0.0231**
1	220	35.0	27	39.1	88	29.8	105	39.6	
2 – 5	386	61.4	37	53.6	194	65.8	155	58.5	
> 5	23	3.7	5	7.3	13	4.4	5	1.9	
Outcomes									
Overall	141	22	26	37.7	62	21.0	53	20.0	**0.0053**
Preterm	51	8.1	11	15.9	25	8.5	15	5.7	**0.0196**
Low birth weight	61	9.7	14	20.3	22	7.5	25	9.4	**0.0051**
Stillbirth	44	7.0	5	7.3	19	6.4	20	7.6	0.8736
SGA§	42	6.7	8	11.6	19	6.4	15	5.7	0.2077
Trimester of ANC initiation									**<.0001**
1st trimester	385	61.2	17	24.6	157	53.2	211	79.6	
2nd trimester	207	32.9	30	43.5	128	43.4	49	18.5	
3rd trimester	37	5.9	22	31.9	10	3.4	5	1.9	

*Ghana mandated number of ANC visits;

**Fisher's exact test;

***One missing

****N=612 for those with health insurance;

§Small for gestational age

Bold = statistically significant

Table 2

Antenatal services provided during antenatal care visits by attendance in Kumasi, Ghana, 2011

			Number of ANC Attended						
	N = 629		<4		4–7		8–13		
Variables	**N***	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**p-value**
Prophylaxis/treatment									
Malaria									0.0514
Yes	573	91.2	58	84.1	275	93.2	240	90.9	
No	55	8.8	11	15.9	20	6.8	24	9.1	
Intestinal helminths									0.0712
Yes	150	23.9	18	26.1	81	27.5	51	19.3	
No	478	76.1	51	73.9	214	72.5	213	80.7	
Nutritional supplement									**0.0388**
Yes	571	90.9	57	82.6	271	91.9	243	92.1	
No	57	9.1	12	17.4	24	8.1	21	8.0	
Tetanus vaccination									**<.0001**
Yes	534	85.0	45	65.2	254	86.1	235	89.0	
No	94	15.0	24	34.8	41	13.9	29	11.0	
Screenings									
Intestinal helminths									**0.0275**
Yes	490	76.8	48	69.6	220	74.6	217	82.2	
No	148	23.2	21	30.4	75	25.4	47	17.8	
Anemia									**0.0001**
Yes	608	96.8	61	88.4	290	98.3	257	97.4	
No	20	3.2	8	11.6	5	1.7	7	2.7	
Screen STIs* **									
Gonorrhea	113	21.0	9	19.2	51	20.6	53	21.8	0.8951**
Syphilis	149	27.7	8	17.0	70	28.2	71	29.2	0.2242
HIV	505	93.9	44	93.6	229	92.3	232	95.5	0.3499
Chlamydia	5	0.9	0	0.0	2	0.8	3	1.2	0.6951
Other ANC services									

			Number of ANC Attended						
	N = 629		<4		4–7		8–13		
Variables	**N***	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**p-value**
Use of Insecticide bed net									0.6927
Yes	245	38.4	25	36.2	109	37.0	106	40.2	
No	393	61.6	44	63.8	186	63.1	158	59.9	

* One missing data

** Fisher's exact test;

*** N = 547 those who reported being tested for STIs.

Bold = statistically significant

Table 3

Mean procedures, tests, prophylaxis, parity and ANC attendance by pregnancy outcome

		Pregnancy Outcome		
Antenatal care parameters*		**Adverse**	**No adverse**	***p-value***
Number of ANC attended	Mean(SD)	6.5 (2.9)	7.2 (2.8)	**0.0101**
Number of tests received**		2.5 (0.6)	2.6 (0.6)	0.2136
Months before enrollment		3.4 (1.8)	3. 3.2 (1.6)	0.1610
Hemoglobin concentration (g/dL)		11.1 (1.4)	11.2 (1.3)	0.3059
Number of IPT***		2.1 (1.0)	2.1 (1.1)	0.9574
Parity		2.8 (1.8)	2.4 (1.6)	**0.0112**
Number of months ANC attended		5.4 (1.9)	5.8 (1.6)	**0.0184**

* ANC services and information collected during visits abstracted from maternal antenatal records

** Malaria, stool and STIs tests;

*** IPT-Intermittent preventive therapy for malaria

Variables in this table are treated as continuous variables

Bold = statistically significant

Table 4

Association of antenatal care components and antenatal attendance with adverse pregnancy outcomes, Kumasi 2011

	Crude		Model1		Model 2	
	OR (95% CI)	**p-value**	**OR* (95% CI)**	**p-value**	**OR** (95% CI)**	**p-value**
Prophylaxis						
Malaria	0.56 (0.26–1.22)	0.1460	0.71 (0.29–1.73)	0.4492	0.73 (0.30–1.80)	0.4900
Antihelmintics	0.89 (0.58–1.37)	0.2710	0.88 (0.54–1.43)	0.6037	0.83 (0.50–1.39)	0.4816
Nutritional supplement/advice	1.26 (0.68–2.35)	0.4642	1.22 (0.56–2.65)	0.6259	1.26 (0.56–2.81)	0.5775
Tetanus vaccination	1.58 (0.97–2.58)	0.0660	1.33 (0.73–2.43)	0.3548	1.35 (0.71–2.56)	0.3568
Use of treated bednets	0.66 (0.45–0.99)	**0.0293**	0.74 (0.48–1.14)	0.1707	0.77 (0.49–1.20)	0.2462
STIs Screening						
Gonorrhea	1.08 (0.66–1.78)	0.7559	1.59 (0.87–2.92)	0.1353	1.51 (0.81–2.82)	0.1984
Syphilis	0.60 (0.38–0.99)	**0.0447**	0.55 (0.30–1.01)	**0.0531**	0.59 (0.32–1.11)	0.1003
HIV	0.63 (0.29–1.35)	0.2335	0.59 (0.27–1.33)	0.2052	0.73 (0.30–1.78)	0.4914
Parity						
1	ref					
2–5	1.58 (1.04–2.42)	**0.0332**	1.46 (0.91–2.33)	0.1164	1.43 (0.85–2.40)	0.1755
>5	3.78 (1.54–9.28)	**0.0036**	2.30 (0.63–8.43)	0.2077	2.15 (0.57–8.09)	0.2573
Hemoglobin concentration						
< 8 g/dL	1.80 (0.94–3.45)	0.0784	1.60 (0.71–3.56)	0.2547	1.56 (0.66–3.71)	0.3123
8 – 11 g/dL	1.05 (0.70–1.56)	0.8209	0.93 (0.59–1.46)	0.7513	0.97 (0.60–1.54)	0.8807
>11 g/dL	ref					
Trimester of initiation of ANC						
1st trimester	ref					
2nd trimester	1.17 (0.78–1.75)	0.4545	1.03 (0.63–1.69)	0.9053	0.94 (0.56–1.57)	0.8155
3rd trimester	1.61 (0.78–3.31)	0.1929	0.92 (0.34–2.54)	0.8748	0.66 (0.21–2.06)	0.4779
Number of ANC visits						
< 4	2.27 (1.30–3.94)	**0.0038**	2.48 (1.17–5.25)	**0.0179**	2.55 (1.16–5.63)	**0.0202**
4–7	ref					
8–13	0.95 (0.63–1.42)	0.7966	1.08 (0.67–1.73)	0.7544	1.02 (0.62–1.66)	0.9518

*All variables in the crude model included;

** Adjusted for insurance and duration of insurance, marital and employment status

Bold = statistically significant