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Antenatal Care Services Utilisation and Prevalence of Anaemia among Pregnant Women in a Municipality of the Upper West Region, Ghana

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Abstract

Background/Objectives: In this paper, we aim to examine the influence of maternal antenatal care services utilisation on the prevalence of anaemia among pregnant women in the Wa Municipality.

Method: The study employed a retrospective cohort design. Probability proportionate to size sampling was used to select the sub-district health catchment facilities while systematic random sampling was used to select respondents. Data was collected from 353 women based on the status of ANC utilization.

Results: The results suggest that only gestational age at registration was a significant predictor of anaemia among women at ANC registration. Additionally, the woman's Hb status at ANC registration, information assistance on family planning at ANC, dietary diversity score were predictors of anaemia at 36 weeks gestation. Beside, Tetanus (TT) intake and religion were not only statistically significant in association with anaemia but predictors as well to anaemia at 28 weeks gestation. Specifically, the prevalence of anaemia among pregnant women at ANC registration, week 28 and week 36 of gestation were found to be 43.7%, 53.4% and 51.4% respectively.

Conclusion/recommendation: The study suggests that if interventions aimed at reducing the burden of prenatal care are not implemented, the benefits of the ANC associated with early and adequate ANC services may not optimally be achieved. Therefore, strategies to improve the uptake of antenatal care services particularly for disadvantaged women should be targeted at specific components of maternal health.

Keywords: Antenatal Care; Utilisation; Services; Prevalence, Anaemia; Pregnancy

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Introduction

Accessibility to good quality antenatal care (ANC) is critical and may ensure favourable maternal and neonatal outcomes if the underlying determinants to the provision and uptake of the antenatal services are well understood and tackled appropriately. Despite the number of interventions and policies implemented by Ghana Health Service and its partners to increase access to quality maternal and child care services over the years in the municipality, there are still some adverse maternal and neonatal outcomes that portray some doubts in terms of quality. More specifically, the Municipal Health Directorate has been vigorously implementing the safe motherhood policy that includes the issues of focused antenatal care and life saving skills over the years. Furthermore, the municipal has benefitted a lot from the JICA Phase I and II projects especially the massive expansion of CHPS compounds and capacity building of health staff aimed at increasing access to maternal and child health services. The major objective of ANC is to prevent and manage health problems, provide appropriate information and advice to improve pregnancy outcomes (WHO, 2016). It is during an antenatal care visit that screening for complications and advice on a range of issues, including birth preparedness, place of delivery, and referral of mothers with complications, occurs. Information on antenatal care is of great value in identifying subgroups of women who do not use such services and is useful in planning improvements in these services (Ghana Statistical Service, 2014). It has been established that it is unlikely that one type of intervention is substantially better than another, but a combination of interventions may yield stronger effect [1]. ANC provides an important opportunity to prevent and manage concurrent diseases through integrated service delivery (WHO, 2009b). In low- and middle-income countries (LMICs),

ANC utilization has increased since the introduction in 2002 of the WHO ANC model, known as focused ANC (FANC) or basic ANC, which is a goal-orientated approach to delivering evidence-based interventions carried out at four critical times during pregnancy (WHO, 2016). However, for the Wa Municipal, ANC 4+ coverage has been below target of 80% for three consecutive years (77% in 2014, 74% in both 2015 and 2016) whilst skilled delivery coverage continues to increase. In 2016, Wa Municipal recorded the highest in the region for skilled delivery coverage of 127.3% (RHD-UWR, 2016). In addition, the municipality recorded 64% first trimester registration at ANC far below the regional target of 80% in 2016.

Anaemia can be a particularly serious problem for pregnant women, which can lead to premature delivery and delivery of low birth weight babies (Ghana Statistical Service, 2014). The anaemia prevalence among women of reproductive age in the Upper West region (UWR) was 36% in 2014 (Ghana Statistical Service, 2014) and only 4 percent away from the WHO high prevalence. In the Municipality, the prevalence of anaemia at 36 weeks gestation in 2016 was 35.4% (RHD-UWR, 2016). Proportionally, the a municipal recorded 0.7 percent still births among all deliveries and the second worst rate in the Upper West Region in 2016. Equally, the Municipality is among the poorly performing districts in terms of low birth weight in the region. In 2016, the Wa Municipal recorded 9.4% in low birth weight, an increase from 2015 of 9.3% (RHD-UWR, 2016). In addition, premature births accounted for the topmost cause of neonatal deaths in 2016 in the Upper West Region. In response, the Ghana Health Services has initiated a number of programs to improve maternal health service utilization, such as the implementation of the safe motherhood initiatives, focused antenatal care (FANC), the national health insurance scheme with the free maternal healthcare policy, the community-based health planning and service (CHPS) initiative skill upgrade of community health officers (CHOs) into midwives, other lifesaving services [2-5]. Despite these interventions, antenatal care services and skilled birth attendance are increasingly below global standards [6]. A key objective of the free antenatal care policy is to eliminate the cost of health care as a barrier to access and use of maternal health care services. The policy also targeted increasing access to skilled birth attendance. While extensive studies exist on the factors influencing skilled maternal service utilization in Ghana, this study focuses on influence of antenatal care services utilisation on the prevalence of anaemia among pregnant women.

Literature

Efforts to monitor progress in coverage of antenatal care have generally focused on quantifiable issues such as the number and timing of visits and the characteristics of users and non-users of antenatal care [7]. In practice, indicators of use are easier to define measure and interpret than indicators for access. Data on use of antenatal care are widely available from household surveys. Indicators on use of antenatal care services provide no information on the content or quality of the services. Despite the broad consensus on what the content and quality should be, it is generally recognized that the antenatal care services currently provided in many parts of the world fail to meet the standards recommended by WHO [7]. Antenatal care is concerned with adequate care in order to be effective [8]. Measurement for adequacy of ANC often applies indexes that assess initiation of care and number of visits [9-11]. World Health Organization (WHO) recommended that pregnant women in developing countries should seek ANC within the first three months of pregnancy [7]. All pregnant women should have at least four antenatal care (ANC) assessments by or under the supervision of a skilled attendant. These should, as a minimum, include all the interventions outlined in the new WHO antenatal care model and be spaced at regular intervals throughout pregnancy, commencing as early as possible in the first trimester (WHO, 2007). Thus, for a pregnant woman to have attained adequate antenatal care utilization, she should have initiated her first ANC visit within her first trimester and in addition attended three or more subsequent ANC visits. Otherwise if a pregnant woman initiates her first ANC visit after her first trimester or even initiate her first ANC visit within her first trimester and fails to make up to the three minimum subsequent visits, she is considered to have inadequate ANC utilization. Even though the current WHO ANC model guideline stipulates a minimum of eight ANC contact visits with the first equally occurring in the first trimester in order to be considered adequate (World Health Organization, 2016), this study employed the previous WHO ANC model as explained above to determining the adequacy and inadequacy of antenatal care utilization. This is because of the late implementation of the recommendation in Ghana as a policy vis-à-vis the retrospective research study period where eligible study participants consisted of mothers who had delivered within the past twelve months preceding the survey. Elsewhere in the US and other developed countries, guidelines have been developed to provide guidance on adequate initiation of care, number of visits and content of routine care (National Institute for Health and Clinical Excellence, 2008) [12].For example, Kotelchuck's Adequacy of Prenatal Care Utilisation (APNCU) index [13]. Which is considered the standard and most used index for ANC utilisation [14,15]? In addition to measuring the initiation and number of visits, adequacy of content of care should be assessed [16].

The APNCU index attempts to characterize prenatal care (PNC) utilization on two independent and distinctive dimensions – namely adequacy of initiation of PNC and adequacy of received services (once PNC has begun) [17]. The initial dimension "Adequacy of Initiation of Prenatal Care" characterizes the adequacy of the timing of initiation of PNC. The assumption underlying, this scale is that the earlier PNC begins the better. American College of Obstetricians and Gynaecologist (ACOG) recommends PNC begin in the first month of pregnancy; the Institute of Medicine now encourages pre-conceptual care. The month or trimester prenatal care begins is used as a measure to assess the adequacy of timing of initiation of PNC, since it accurately and succinctly describes when PNC begins. The APNCU Index uses this measure to assess Adequacy of Initiation of PNC, though the initiation months are collapsed into four distinct groupings: (1,2) (3,4) (5,6) (7-9 or none) months. The second dimension "Adequacy of Received Services" characterizes the adequacy of received PNC visits during the time period after prenatal care is begun until the delivery. This dimension attempts

to characterize if the woman received the appropriate number of prenatal care visits for the time period they were receiving PNC services. It is based on ACOG standards (one visit per month through 28 weeks, one visit every 2 weeks through 36 weeks, and one visit per week thereafter, adjusted for data of initiation of PNC). This is the newly measured dimension of the APNCU-Index [17]. To assess the Adequacy of Received Services requires four steps: First, it is necessary to determine the number of expected PNC visits for each pregnancy, given the date PNC began and the date of delivery. This can be done easily (by computer or by hand) by noting the number of ACOG recommended visits for a given gestation and then adjusting or reducing, that number based on the date of PNC initiation (assuming missed visits are not made up). For example, in a 40-week pregnancy ACOG recommends 14 visits; if PNC began in month 4 (3 missed visits), then the expected number of visits = 11 (14-3). Second, observed PNC visits are directly obtained from the recorded number of PNC visits noted on the birth certificate (or any other PNC data source). Third, the proportion of observed visits/expected visits is calculated. Fourth, the results are scaled: 0-49% of expected visits = Inadequate; 50-79% = Intermediate; 80-109% = Adequate; 110+% = Adequate Plus. The proposed index uses the popular characterization of PNC as inadequate, intermediate and adequate, but also adds a new fourth category of intensive or adequate plus cares. Inadequate care is defined as PNC begun after the 4th month or fewer than 50% of expected visits were received. Intermediate care is defined as PNC begun by month 4 and between 50-79% of expected visits were received. Adequate care is defined as PNC begun by month 4 and of 80-109% of expected visits were received. Adequate plus (intensive) care is defined as PNC begun by month 4 and 110% or more of expected visits were received. Inadequate care can be subdivided to isolate those with no PNC [17].There is limitations to the APNCU Index. It does not adjust for risk conditions of pregnant woman because the recommended number of visits of the ACOG is for women with uncomplicated pregnancies. It is a measure for adequacy of ANC utilisation, which does not measure the adequacy of ANC content [18]. The Quality of Prenatal Care Questionnaire (QPCQ) is a new self-report instrument that measures overall quality of prenatal care, and quality of care. It has been shown to demonstrate construct validity, internal consistency reliability, and test-retest reliability. It is used to evaluate women's perceptions of quality of prenatal care, to compare quality of care across regions, populations, types of health care provider, and service delivery models, and to assess the relationship between quality of care and a variety of maternal and infant health outcomes [19].

Methodology

A retrospective cohort design was adopted. The study used quantitative techniques to collect data on the subject. This research was conducted in the Wa Municipality of the Upper West Region. The Wa Municipality has been subdivided into six (6) Sub-Municipals with a total of 26 government health facilities including Community-based Health Planning and Services (CHPS) and 4 private facilities. However, there were 22 active government and 4 private health facilities that offered Antenatal Care (ANC) [20-25].The study population consisted of all women who had attended antenatal caer in the Municipality and delivered within the past 12 months in a health facility preceding the study. The sample size was calculated using a Two Sample Situations formula as follows:

…… (1)

Where:

D = design effect which is normally 2 as a default value

P1 = the estimated level of an indicator measured as a proportion at the time of the first survey or for the control area, which is current anaemia prevalence of 42% = 0.42

P2 = the expected level of the indicator either at some future date is 21% = 0.21

Zα = the Z-score corresponding to the degree of confidence with which it is desired to be able to conclude that an observed change of size (P1-P2) would not have occurred by chance (α-the level of statistical significance).

Zβ = the z-score corresponding to the degree of confidence with which it is desired to be certain of detecting a change of size (P2 - PI) if one actually occurred (statistical power).

This implies that,

D= 2, Zα= 1.960 at 95% confidence level, Zβ= 1.645 at 0.95 statistical power,

P1= 0.42 and P2= 0.21

Hence …… (2)

……..(3)

Probable loss to follow up of 10% of sample = 16

Hence the sample size per one category = 152+16 = 168

This gave a minimum sample size of 336. However, maximum sample size of 353 women was interviewed where 176 attained adequate ANC and 177 attained inadequate ANC [26].

Inclusion criteria

All women who had attended ANC in Wa Municipality and delivered within 12 months preceding the study in a health facility and possessing a maternal health booklet/records for the index pregnancy.

Exclusion criteria

- Referred women from other district's ANC facilities who came and delivered in the Wa Municipality or women who attended ANC elsewhere for the most part of their pregnancy
- Women who never attended ANC
- Women with no maternal health records or booklet for their index pregnancy

Sampling procedure

The entire six (6) sub-districts of Wa Municipality were represented with the corresponding sub-district health

catchment facilities selected using probability proportionate to size sampling technique based on the total ANC registrants gotten from the current twelve monthly aggregate from the DHIMS 2 database. This was to determine the individual facility catchments from which the respondents would be chosen in the sub-district. In all, 14 of the municipality's 45 facilities were selected to have provided ANC services from across government and non-governmental health institutions within the period under study. Systematic random sampling was then used to draw respondents from the facilities ANC register based on the status of ANC utilization until the estimated sample size of 353 was achieved. Selected participants were then linked-up and followed to their households at the community level for the interview [27, 28].

Data collection tools and procedure

The tools used to collect the data were a pre-coded structured and semi-structured questionnaire and an observation checklist. The questionnaire had 59 items captioned under seven sub-titles; Status of ANC services utilization, Personal information/ demographic characteristics, Records review of maternal ANC booklet or card, Anthropometric and biochemical assessment, Content and quality of ANC services, Maternal behaviours and health status during last pregnancy, Socioeconomic household wealth index of respondent. The Data was collected through face-to-face interviews with respondents using a pre-coded structured and semi-structured questionnaire, after getting consent. Information on the seven sub-titles on the questionnaire that needed to be answered by the respondents were duly captured whereas those that were needed from the maternal ANC booklet/ card were also reviewed accordingly and captured. Observational information was further probed to ensure consistency of findings before recording. Pre-testing of the questionnaire was done by randomly selecting women from the ANC register of a few health facilities in the Wa Municipality and tracing them to their households for the interview. The main purpose of the pre-test was to ensure readability and comprehension of the questions and the feedback was used to correctly revise the questionnaire to provide the desired answers. This guaranteed the validity of the tool which was used for the data collection in the study. The trained research assistants thus gained the competency and administered the questionnaires the right way and this guaranteed reliability of the research tool.

Data processing and analysis

The quantitative data were manually entered using the Statistical Package for Social Science (SPSS) version 21. Data were cleaned by running preliminary frequencies of all the variables to check for entry inaccuracies. All incorrectly coded data were double-checked with the questionnaire after which all wrong entries were corrected. Descriptive statistics are performed and results were presented in percentages, frequencies and tables. Chi-square tests were used to measure associations between the dependent and independent variables and logistic regressions were also used to determine the actual predictors of the independent variables to the dependent variables of interest. The logistic regression adjusted odds ratio (AOR) and 95% confidence intervals were used to assess the strength of association for all the statistically significant associations with a p-value <0.05.

Variables definitions

The dependent variables were status of antenatal care services utilization, haemoglobin (Hb) status at ANC registration, Hb status at 28 weeks gestation, Hb status at 36 weeks gestation, birth weight and gestational age at delivery while the independent variables are socio-demographic and socio-economic characteristics, components of received ANC including general score of services received, maternal reproductive health and obstetric profile, maternal knowledge and behavioural risk factors. However, there are instances where some of these dependent variables also tend to be predictors amongst themselves. All the dependent variable is anaemic or not anaemic at ANC registration, 28 weeks gestation, 36 weeks gestation. The independent variables, antenatal care use (adequate or inadequate), socio-demographic characteristics like maternal age at ANC registration, educational status, religion, marital status, occupational status and wealth index. Components of received ANC involved weight checking, height measurement, blood pressure taken, blood and urine sample examination, received education on possible danger signs/complications of pregnancy, received TT injection, SP and monthly iron supplementation, fundal height measurement and palpation. Others include receiving information assistance on childhood diseases, maternal and child nutrition, breastfeeding, antenatal and delivery care, vaccinations and immunizations, and family planning as well as the number of TT and SP doses received. The overall Score for services received and Score for received information was categorised as low or high for each whereas that of the TT and SP received was categorised as adequate or inadequate. Maternal reproductive health and obstetric profile included high or low risk gravidity, high or low risk parity, adequate or inadequate birth spacing, late or early gestational age at registration and number of ANC Attendance. On maternal knowledge and behavioural risk factors, characteristics such as knowledge on making 4+ ANC visits including ANC Services importance, smoking exposure, alcohol intake, episodes of malaria infection, dietary diversity score [29, 30].

Empirical Results and Discussion

Relationship of factors with anaemia at ANC registration

The results indicated that of all the suspected factors, marital status, age of mother at registration and gestational age at registration were the only statistically significant in association with anaemia at ANC registration (Table 1). With marital status ($\chi2$ (1, N = 343) = 9.194, p = 0.002) unmarried women were wholly likely to be anaemic at ANC registration (100.0%) than married counterparts were. Concerning maternal age at registration ($\chi2$ (2, N = 343) = 7.729, p = 0.021) women under 20 years and 35+ years were more likely to be anaemic at ANC registration (69.2%) and (45.1%) respectively than women aged 20 – 34 years. For gestational age at registration ($\chi2$ (1, N = 343) = 20.850, p < 0.001) women with late gestational age at registration of ANC were more likely to be anaemic (56.3%) than those who register early with their pregnancies (**Table 1**).

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Determinants of anaemia at ANC registration (logistic regression)

The results showed that of all the associated factors, only gestational age at ANC registration was significant as a predictor (Table 2). Early ANC registrants were about 60.9% more likely to be protected from being anaemic at registration compared to late ANC registrants (**Table 2**).

Relationship of socio-demographic, obstetric and ANC records, received ANC services and behavioural/lifestyle factors with anaemia at 28 weeks gestation

Table 3 The results indicated that of all the suspected factors, only occupation and Hb status at ANC registration were statistically significant in association with anaemia at 28 weeks gestation (Tables 3). With occupation ($\chi 2$ (2, N = 133) = 6.544, p = 0.038) government/private employed women were more likely (81.8%) to be anaemic at 28 weeks gestation than women who are self-employed (56.9%) and unemployed (42.0%). Likewise with Hb status at registration ($\chi 2$ (1, N = 133) = 19.934, p < 0.001) women who were anaemic at ANC registration were more likely (76.5%) to also be anaemic at week 28 of gestation (**Table 3**).

Determinants of anaemia at 28 weeks of gestation (logistic regression)

The results (Table 4) show that anaemic women at ANC registration were about 6.6 times [(AOR, 6.549; 95% CI (2.706 – 15.848), p<0.001] more likely to be at risk of also being anaemic at 28 weeks of gestation compared to those not anaemic at registration. Women who did not receive information on vaccinations at ANC were about 79.8% less likely to be protected from being anaemic at week 28 of gestation compared to those who received the information. Also, women who had inadequate sulphadoxine pyrimethamine (SP) doses intake were about 79.2% less likely to be protected from being anaemic at week 28 of gestation compared to those with adequate intake. Women with less than two doses of tetanus toxoid (TT) immunization were 2.7 times [(AOR, 6.549; 95% CI (2.706 – 15.848), p<0.001] more likely to be at risk to being anaemic at week 28 of gestation compared to those who received two or more doses. By religion, Moslem women were about 71.7% more likely to be at risk of being anaemic at week 28 of gestation compared to their Christian counterparts (**Table 4**).

Relationship between women socio-demographic, obstetric and ANC records and anaemia at 36 weeks of gestation

Using the same independent variables as in Tables 6 above

Table 1. Relationship of factors with anaemia at ANC registration.

Variable	Hb at registration, n (%)	Normal	Test statistic (n = 343)	χ2	p-value
	Anaemic		df		
Ethnicity					
Major	135 (44.1)	171 (55.9)	1	0.172	0.679
Minor	15 (40.5)	22 (59.5)			
Religion					
Muslim	128 (44.4)	160 (55.6)	1	0.371	0.543
Christian	22 (40.0)	33 (60.0)			
Education					
No education	49 (39.2)	76 (60.8)	2	1.809	0.405
Low education	64 (47.4)	71 (52.6)			
High education	37 (44.6)	46 (55.4)			
Marital status					
Married	143 (42.6)	193 (57.4)	1	9.194	0.002
Not Married	7 (100.0)	0 (0.0)			Fishers=0.003
Occupation					
No occupation	56 (43.4)	73 (56.6)	2	0.498	0.779
Self employed	83 (44.9)	102 (55.1)			
Gov't/Private employee	11 (37.9)	18 (62.1)			
Wealth index					
Low	74 (49.7)	75 (50.3)	1	3.768	0.052
High	76 (39.2)	118 (60.8)			
Birth spacing					
Inadequate	40 (43.0)	53 (57.0)	1	0.027	0.87
Adequate	110 (44.0)	140 (56.0)			
Age of mother at registration					
Under 20 years	18 (69.2)	8 (30.8)	2	7.729	0.021
20 – 34 years	109 (41.0)	157 (59.0)			
>= 35 years	23 (45.1)	28 (54.9)			

Author's Computation

Table 2. Multiple logistics regression of predictors of anaemia at ANC registration.

Variables in the Equation						
				Exp (B)	95% C.I.for EXP(B)	
	B	Wald	Sig.		Lower	Upper
Unmarried	Reference					
Married	-20.635	0	0.999	0	0	
Maternal age >= 35 years at registration (Reference)						
Maternal age < 20 years at registration	0.541	0.922	0.337	1.717	0.57	5.178
Maternal age 20-34 years at registration	-0.028	0.008	0.93	0.972	0.521	1.813
Late gestational age at ANC registration (Reference)						
Early gestational age at ANC registration	-0.938	16.561	0	0.391	0.249	0.615
High wealth index (Reference)						
Low wealth index	0.247	1.122	0.289	1.28	0.811	2.022
Constant	20.691	0	0.999			

*Cox and Snell R square= 0.093 *Nagelkerke R square= 0.124
*Model Chi-square= 33.296 *Hosmer and Lemeshow's test = 0.941

Table 3. Relationship of factors with anaemia at 28 weeks gestation.

Variable	Hb at 28 weeks gestation, n (%)		n = 133 (Test statistic)		
	Normal	Anaemic	df	χ2	p-value
ANC utilization					
Inadequate	21 (41.2)	30 (58.8)	1	0.984	0.321
Adequate	41 (50.0)	41 (50.0)			
Ethnicity					
Major	53 (44.9)	65 (55.1)	1	1.217	0.27
Minor	9 (60.0)	6 (40.0)			
Religion					
Muslim	56 (50.0)	56 (50.0)	1	3.263	0.071
Christian	6 (28.6)	15 (71.4)			
Education					
No education	24 (53.3)	21 (46.7)	2	1.568	0.457
Low education	22 (40.7)	32 (59.3)			
High education	16 (47.1)	18 (52.9)			
Marital status					
Married	62 (47.3)	69 (52.7)	1	1.773	0.183
Not Married	0 (0.0)	2 (100.0)			Fishers=0.499
Occupation					
No occupation	29 (58.0)	21 (42.0)	2	6.544	0.038
Self employed	31 (43.1)	41 (56.9)			
Gov't/Private employee	2 (18.2)	9 (81.8)			
Wealth index					
Low	25 (48.1)	27 (51.9)	1	0.073	0.787
High	37 (45.7)	44 (54.3)			
Birth spacing					
Inadequate	15 (40.5)	22 (59.5)	1	0.76	0.383
Adequate	47 (49.0)	49 (51.0)			
Age of mother at registration					
Under 20 years	2 (20.0)	8 (80.0)	2	3.221	0.2
20 – 34 years	52 (48.1)	56 (51.9)			
>= 35 years	8 (53.3)	7 (46.7)			
Gestational age at registration					
Early	42 (50.0)	42 (50.0)	1	1.049	0.306
Late	20 (40.8)	29 (59.2)			
Hb at ANC registration					
Anaemic	12 (23.5)	39 (76.5)	1	19.934	0

Normal	48 (64.0)	27 (36.0)			
No. of ANC attendance					
Less than 4 visits	7 (50.0)	7 (50.0)	1	0.072	0.788
4+ visits	55 (46.2)	64 (53.8)			
Knowledge of 4+ ANC visits					
No	18 (47.4)	20 (52.6)	1	0.012	0.912
Yes	44 (46.3)	51 (53.7)			

Table 4. Multiple logistics regression of predictors of anaemia at 28 weeks of gestation.

Variables in the Equation						
				Exp (B)	95% C.I.for EXP(B)	
	B	Wald	Sig.		Lower	Upper
Normal at registration (Reference)						
Anaemia at ANC registration	1.879	17.37	0	6.549	2.706	15.848
Information given on vaccinations at ANC (Reference)						
No information given on vaccinations at ANC	-1.6	4.958	0.026	0.202	0.049	0.826
Adequate SP intake	Reference					
Inadequate SP intake	-1.569	5.129	0.024	0.208	0.054	0.81
TT2+ intake (Reference)						
Less than TT2 intake	0.994	4.329	0.037	2.703	1.059	6.898
Religion (Reference Christian)						
Muslim	-1.262	4.172	0.041	0.283	0.084	0.95
Constant	0.104	0.026	0.873	1.11		

*Cox and Snell R square= 0.262 *Nagelkerke R square= 0.349
*Model Chi-square= 38.199 *Hosmer and Lemoshow test = 0.159

Table 5. Relationship of factors with anaemia at 36 weeks gestation.

Variable	Hb at 36 weeks gestation, n (%)		n = 133 (Test statistic)		
	Normal	Anaemic	df	χ2	p-value
Wealth index					
Low	26 (36.6)	45 (63.4)	1	6.798	0.009
High	60 (56.6)	46 (43.4)			
Hb at registration					
Anaemic	23 (28.8)	57 (71.3)	1	24.739	0
Normal	62 (66.7)	31 (33.3)			
Dietary Diversity score					
Low	27 (36.0)	48 (64.0)	1	8.255	0.004
High	59 (57.8)	43 (42.2)			
Information received on family planning					
No	35 (62.5)	21 (37.5)	1	6.347	0.012
Yes	51 (42.1)	70 (57.9)			
No. of TT received					
Less than TT2 intake	57 (43.8)	73 (56.2)	1	4.406	0.036
TT2+ intake	29 (61.7)	18 (38.3)			

Author's Computation

including anaemia at week 28 of gestation in running the cross-tabulation analysis, Hb status at ANC registration, dietary diversity score, information assistance on family planning and number of TT doses received were the only statistically significant in association with anaemia at 36 weeks gestation. With wealth index ($\chi2$ (1, N = 177) = 6.798, p = 0.009) women from households with low wealth index were more likely (63.4%) to be anaemic at 36 weeks of gestation than women from households with high wealth index. Also for Hb status ($\chi2$ (1, N = 177) = 24.739, p < 0.001) women who were anaemic at ANC registration were more likely (71.3%) to also be anaemic at week 36 of gestation. Concerning dietary diversity score of foods intake ($\chi2$ (1, N = 177) = 8.255, p = 0.004) women with low DDS are more likely (64.0%) to be anaemic at 36 weeks of gestation. On family planning education ($\chi2$ (1, N = 177) = 6.347, p = 0.012) women who received information assistance were more likely (57.9%) to be anaemic than those who did not. Also, with tetanus toxoid immunization ($\chi2$ (1, N = 177) = 4.406, p < 0.036) women received less than two doses were more likely (56.2%) to be anaemic at 36 weeks of gestation (**Table 5**).

Determinants of anaemia at 36 weeks of gestation (logistic regression)

The results showed that women anaemic at ANC registration were about 6.3 times [(AOR, 6.266; 95% CI (3.039 – 12.923), p<0.001] more likely to be at risk of also being anaemic at 36 weeks of gestation compared to those not anaemic at registration. Also, women who did not receive information on family planning at ANC were about 62.4% more likely not to be protected from being anaemic at 36 weeks of gestation compared to those who received the information. Likewise, women with a lower dietary diversity score (DDS) were about 3.8 times [(AOR, 3.755; 95% CI (1.801 – 7.828), p<0.001] more likely to be at risk of being anaemic at 36 weeks of gestation than those with a higher score. The findings indicated that of all the suspected factors, marital status, age of mother at registration and gestational age at registration were the only ones statistically significant in association with anaemia at ANC registration However, only gestational age at ANC registration was a significant predictor to anaemia at ANC registration. Likewise, Hb status at ANC registration, information given on vaccinations at ANC, SP intake, TT intake and religion were not only statistically significant in association with but predictors as well to anaemia at 28 weeks gestation. Similarly, Hb status at ANC registration, information assistance on family planning at ANC, dietary diversity score and number of TT doses received were not only statistically significant in association with but predictors as well to anaemia at 36 weeks gestation except TT intake. It therefore implies that from the findings of this study suggested that, the determinants of anaemia are Hb status at ANC registration, gestational age at ANC registration, information given on vaccinations at ANC, information given on vaccinations at ANC, SP intake, TT intake, religion, information assistance on family planning at ANC and dietary diversity score (**Table 6**).

Discussion of Results

From the findings of this study, the determinants of anaemia are Hb status at ANC registration, gestational age at ANC registration, dietary diversity score, SP intake, TT intake, religion and information assistance given on family planning and vaccinations at ANC. Worldwide prevalence of anaemia is highest in preschool children (47.4%) and women who are pregnant (41.8%). However during pregnancy, the prevalence of anaemia exceeds 50% in gravidae from Africa [30]. And this is consistent with the findings of this study where 43.7% of the respondents were anaemic at ANC registration, with 53.4% and 51.4% also anaemic at week 28 and week 36 of gestation respectively. Even though the prevalence in both third and second trimesters of this study were higher than in the first trimester elsewhere in Uganda, a study revealed anaemia prevalence was highest (24.3 %) during the third trimester as compared to the first trimester (14.6 %) and second trimester (20.7 %). In general, as pregnancy progresses, the prevalence of anaemia increases (Gonzales et al., 2012). Haemodilution in pregnancy increases to peak during the second trimester, which may explain the high prevalence of anaemia during this period. However, the increased incidence of anaemia during the third trimester may also indicate poor antenatal care and nutrition [30]. These findings agree with that of [31]. Also consistent with this study is that of Saaka et al (2017) who observed that compared to women in the first trimester, women in the third trimester were 2.2 times more likely of being underweight (AOR = 2.19, CI: 1.02, 4.70) [32]. Even though this study's anaemia prevalence is not twice it in the 3rd trimester.

According to Ikeanyi & Ibrahim (2015), over two thirds of mothers in their study had their anaemic state corrected at term suggesting that quality care and good compliance improve maternal health [33]. Whereas contrary to this study, over half (51.4%) were found to be anaemic at week 36 gestation in this study. Equally, the results from this findings showed that women anaemic at ANC registration were about 6.3 times [(AOR, 6.266; 95% CI (3.039 – 12.923), p<0.001] more likely to be at risk of also being anaemic at 36 weeks of gestation compared to those not anaemic at registration. This possibly suggests poor quality service delivery by health providers and/or poor compliance by clients [30, 31] observed that gestational age was the greatest predictor of maternal thinness [32]. It was found in this study that women who prepare to attend ANC early were about 60.9% more likely to be protected from being anaemic at registration compared to their late counterparts. This observation was further corroborated by Anlaakuu and Anto (2017) in their study who noted visiting ANC early in pregnancy reduced the likelihood of being anaemic and that early and regular antenatal visits are essential [30]. As this could allow for the correction of anaemia

Table 6. Multiple logistics regression of predictors of anaemia at 36 weeks of gestation.

Variables in the Equation						
					Exp (B)	95% C.I.for EXP(B)
	B	Wald	Sig.		Lower	Upper
Normal at registration (Reference)						
Anaemia at ANC registration	1.835	24.695	0	6.266	3.039	12.923
Received information on family planning at ANC (Reference)						
No received information on family planning at ANC	-0.979	6.53	0.011	0.376	0.177	0.796
High DDS (Reference)						
Low DDS	1.323	12.455	0	3.755	1.801	7.828
Constant	-1.046	10.521	0.001	0.351		
Author's Computation						

Author's Computation

*Cox and Snell R square= 0.230 *Nagelkerke R square= 0.307

*Model Chi-square= 45.230 *Hosmer and Lemoshow test = 0.696

that might exist even before the pregnancy [33].

In a study in southern Nigerian sub regions, Ikeanyi & Ibrahim (2015) observed that the women whose anaemia persisted to term possibly did not comply with the prenatal care intervention which is common in their setting especially when most of the subjects remain asymptomatic in mild to moderate anaemic states (Ikeanyi & Ibrahim, 2015). This could have possibly accounted for the finding in this study setting as well, since the anaemia prevalence at week 28 of gestation had shot up by 9.7% from registration. It indicated that anaemic women at ANC registration were about 6.6 times (AOR, 6.549; 95% CI (2.706 – 15.848), p<0.001] more likely to be at risk of also being anaemic at 28 weeks of gestation compared to those not anaemic at registration. This is in consonance with another study where women in the second and third trimesters were 3.09 and 3.68 times respectively more likely to be anaemic than those who were in the first trimester [33]. Very few studies have investigated the effect of improved diets in reducing the risk of maternal anaemia and adverse pregnancy outcomes in a LMIC setting [34]. And those that did came up with inconsistent findings showing positive as well as no effects [34]. However, from this study, women with a lower dietary diversity score (DDS) were about 3.8 times [(AOR, 3.755; 95% CI (1.801 – 7.828), p<0.001] more likely to be at risk of being anaemic at 36 weeks of gestation than those with a higher score. This conform to another study in rural Ethiopia where women with inadequate or low dietary diversity score (DDS) had a 2-fold higher risk [adjusted RR (ARR: 2.29; 95% CI: 1.62, 3.24] of anaemia than their counterparts in the adequate or high DDS group [30]. The role of good nutrition and balanced dieting in the prenatal period will help in ameliorating anaemia in pregnancy [34]. Many women of childbearing age have a dietary intake of absorbable iron which is too low to offset losses from menstruation and the increased requirement associated with gestation (Scholl, 2011). According to Saaka et al (2017), coping strategy index (CSI) and household hunger scale (HHS) associated negatively with dietary diversity score (r = −.17, p < .001) and (r = −.14, p = .004) respectively for pregnant women in rural areas of Northern Ghana [34]. In that regard, there has been a proposal by WHO for an increased iron supplementation, especially to vulnerable groups like pregnant women, especially through food based approaches such as food fortification and dietary diversification.

Malaria chemoprophylaxis for endemic malaria induced anaemia is one of the most important prenatal interventions widely given to prenatal attendees. It is evident that hematinics combined with malaria chemoprophylaxis offers a better prenatal preventive intervention for anaemia in pregnancy, 75% of the pregnant women studied had access to intermittent preventive treatment of malaria and among the women attending the antenatal clinic that received sulphadoxine-pyrimethamine (SP), about 78% of them took two doses of SP. The prevalence of clinical malaria was statistically higher in women who did not receive intermittent preventive treatment with SP during pregnancy (44.7% vs. 31.3%, P = 0.0001) and among women who had one dose of the drug instead of two doses (40.0% vs. 28.7%, P = 0.0001)(Peter, 2013). However, in this study 92.1% of the respondents received at least a dosage of SP with as many as 82.4% receiving at least two doses. Similar to Anorlu et al. (2006); Asa et al.(2008), Kagu et al.(2007); and Aduloju et al. (2016) findings, women in this study who had inadequate SP intake were about 79.2% less likely to be protected [(AOR, 0.208; 95% CI (0.054 – 0.810), p=0.024] from being anaemic at week 28 of gestation compared to those with adequate intake. Also concerning religion, this study indicated that Moslem women were about 71.7% more likely to be at risk of being anaemic at week 28 of gestation compared to their Christian counterparts. This study conforms to another study which equally showed religion to be significantly associated with the prevalence of anaemia in pregnancy (P < 0.05) where 94.3% of Hindus were suffering from anaemia when compared with 84.9% and 82.2% of Moslem and Buddhist women, respectively [28]. Meanwhile a different study elsewhere depicted religion to not be associated with anaemia in the pregnant women (p > 0.05) [30]. Nevertheless, religion by itself may not be the cause for this finding as in the case of this study, but probably it works through different dietary patterns, food taboos, and so on [28]. Especially in a municipal where majority of the respondents are Moslems.

Again from this study, received TT as an associated factor showed that women with less than two doses of tetanus toxoid (TT) immunization were 2.7 times [(AOR, 6.549; 95% CI (2.706 – 15.848), p<0.001] more likely to be at risk to being anaemic at week 28 of gestation compared to those who received two or more doses. Even though TT by itself may not duly influence anaemia as evidenced with little or no available literature (Stratton et al., 1994), a cross-tabulation analysis in this study between TT received and ANC utilization was highly significant (p<0.001) indicating a reverse causality. It showed that women with inadequate ANC utilization were more likely (82.5%) to receive less than two doses of TT compared to those with adequate utilization. It therefore could imply that the accompanying full benefits of adequate ANC utilization including lower anaemia risk will be more in those with adequacy than others with inadequacy of ANC utilization. According to this study, women who did not receive information on vaccinations at ANC were about 79.8% less likely to be protected from being anaemic at week 28 of gestation compared to those who received the information. In addition, women who did not receive information on family planning at ANC were about 62.4% less likely to be protected from being anaemic at 36 weeks of gestation compared to those who received the information. It is however unclear the modalities through which these two received information tend to significantly influence anaemia in pregnancy as there is no significant association with status of ANC utilization to possibly suggest a reverse causality. Moreover, there seems to be little or no supporting literature regarding these two predictors on anaemia in pregnancy.

Conclusion and Recommendation

The prevalence of anaemia at ANC registration, week 28 and week 36 of gestation were 43.7%, 53.4% and 51.4% respectively. The study findings again indicated that marital status, age of mother at registration and gestational age at registration contributed to the prevalence of anaemia at ANC registration. Likewise, Hb status at ANC registration, information given on

vaccinations at ANC, SP intake, TT intake and religion contributed to the prevalence of anaemia at 28 weeks gestation. Hb status at ANC registration, information assistance on family planning at ANC, dietary diversity score and number of TT also contributed to anaemia at 36 weeks gestation. The results suggest that only gestational age at registration was a significant predictor of anaemia among women at ANC registration. Additionally, the woman's Hb status at ANC registration, information assistance on family planning at ANC, dietary diversity score were predictors of anaemia at 36 weeks gestation. Beside, Tetanus (TT) intake and religion were not only statistically significant in association with anaemia but predictors as well to anaemia at 28 weeks gestation. Specifically, the prevalence of anaemia among pregnant women at ANC registration, week 28 and week 36 of gestation were found to be 43.7%, 53.4% and 51.4% respectively. The study suggests that if interventions aimed at reducing the burden of prenatal care are not implemented, the benefits of the ANC associated with early and adequate ANC services may not optimally be achieved. Therefore, strategies to improve the uptake of antenatal care services particularly for disadvantaged women should be targeted at specific components of maternal health.

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