

# BMJ Open Prevalence and predictors of birth preparedness and complication readiness in the Kassena-Nankana district of Ghana: an analytical cross-sectional study

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## ABSTRACT

**Objectives** To assess birth preparedness and complication readiness (BPACR) and associated factors among mothers who had given birth in the past 12 months prior to the study.

**Design** An analytical cross-sectional study.

**Setting** The study was carried out in the rural areas of Kassena-Nankana district located in the Upper East Region of Ghana.

**Participants** The study population comprised 600 postpartum women who had delivered within the last 12 months prior to the study.

**Primary outcome measure** The primary outcome measure was BPACR.

**Results** The prevalence of BPACR among recently delivered women was very low as less than 15% were able to mention at least three of the five basic components of birth preparedness/complication readiness that were fulfilled. After adjustment for confounding effect using multivariable logistic regression analysis, high educational level (adjusted OR (AOR)=3.40 (95% CI: 1.88 to 6.15)), better knowledge about obstetric danger signs during pregnancy (AOR=4.88 (95% CI: 2.68 to 8.90)), older women ( $\geq 35$  years) (AOR=2.59 (95% CI: 1.11 to 6.02)), women of low household wealth index (AOR=4.64 (95% CI: 1.97 to 10.91)) and women who received lower content of antenatal care services (AOR=3.34 (95% CI: 1.69 to 6.60)) were significant predictors of BPACR.

**Conclusion** This study concludes that BPACR practices were low. High educational attainment of the woman, having adequate knowledge about obstetric danger signs during pregnancy, older women ( $\geq 35$  years) and women of low household wealth index were significant predictors of BPACR. The predictors identified should be given high priority by health authorities in addressing low prevalence of BPACR.

## INTRODUCTION

The WHO estimated that maternal mortality ratio (MMR) in low-income countries in 2017 was 462 per 100 000 live births versus 11 per 100 000 live births in high-income countries.<sup>1</sup> Pregnant women continue to die needlessly

## Strengths and limitations of this study

- Little or no information is currently available on levels of birth preparedness and complication readiness (BPACR) in Ghana and specifically in Upper East Region.
- A major strength of this study is that it involved large sample size and a validated questionnaire of birth preparedness/complication readiness index developed by Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) was used.
- Being a cross-sectional survey study, it was not possible to draw causal conclusions.
- Some responses were self-reported and therefore subjected to information measurement bias.

from preventable causes in sub-Saharan Africa<sup>2-5</sup> and one of the reasons for this situation is inadequacy or lack of birth and emergency preparedness.<sup>6</sup>

The causes of maternal morbidity and mortality has been attributed to delays in seeking care, reaching care and in receiving adequate care when reaching a health facility.<sup>7</sup> This model of delay is based on the assumption that knowledge of danger signs and preparedness for addressing obstetric complications makes it possible to promptly identify and address delay in accessing skilled delivery services.<sup>8</sup>

Enhancing utilisation of maternal health services and increasing access to skilled care during childbirth, particularly for women with obstetric complications is best achieved through improved knowledge of obstetric danger signs, birth preparedness practices and readiness for emergency complications.<sup>9 10</sup> Birth preparedness and complication readiness (BPACR) helps ensure that pregnant women receive skilled delivery care

without delays by encouraging them, their families and communities to effectively plan for births and deal with obstetric complications, if they occur.<sup>11 12</sup> The concept of BPACR for a woman includes identifying a skilled attendant/health facility with delivery services, making transportation plans, saving money and identifying a blood donor.<sup>13</sup>

Several studies across the world suggest that promoting BPACR interventions improves preventive behaviours, improves knowledge of mothers about danger signs and leads to improvement in care-seeking during obstetric emergency.<sup>14–18</sup> Furthermore, evidence from a meta-analysis of 14 randomised studies showed that BPACR interventions, are effective in reducing maternal and neonatal mortality in low-resources setting.<sup>19</sup> The effect of this intervention largely varies<sup>20 21</sup> depending on study setting and population.

Ghana is one of the sub-Saharan African countries with a high MMR of 314 maternal mortalities per 100 000 live births as of 2016.<sup>1</sup>

Though the benefits of BPACR have been documented in several countries, little or no information is currently available on levels of BPACR in Ghana and specifically in Upper East Region where the prevalence maternal death is relatively higher than the national average. The aim of the present paper, therefore, was to assess BPACR and associated factors among mothers who had given birth in the past 12 months prior to the study in the Upper East Region of Ghana. Hopefully, the findings of the study may be useful in the design of effective programmes and interventions to improve maternal and neonatal health.

## METHODS AND ANALYSIS

### Study setting

The study was carried out in the Kassena-Nankana municipality which is 1 of the 13 districts in the Upper East Region of Ghana. The municipality has an estimated population of 116700 with a population density of 102 persons per square kilometre which is served by 1 municipal hospital, 2 health centres and 19 functioning community-based health planning and services zones (KNMA, 2010). Agriculture is the mainstay of the local economy and accounts for about 68% of the employable population.

### Study design, population and sampling

A community-based cross-sectional study design was used. The primary study population comprised women of reproductive age (15–49 years) who delivered within the last 12 months.

A sample size of 630 was estimated using single population proportion formula with the assumption of 95% confidence level, 5% margin of error and proportion of women who had adequate birth preparedness/complication readiness (BPCR) being 50%. The sample size factored in a design effect of 1.5 and an additional 10%

to take care of non-responses, damaged or incomplete questionnaires.

A two-stage probability proportionate to size sampling methodology was used to select 30 clusters from the list of communities in the district. In the first stage, all communities with their respective populations in five randomly selected submunicipalities were first fed into an Emergency Nutrition Assessment for SMART 2011 software to randomly generate the clusters within which the households were selected. In the second stage, households, were selected using systematic random sampling. All the households in each cluster were serially numbered. To get the sampling interval, the total number of households in a cluster was divided by the sample size of 21. The first household was then randomly selected by picking any number within the sample interval. Subsequent selections were made by adding the sampling interval to the selected number in order to locate the next household to visit. If the selected household does not have a target respondent, then next household was selected using the systematic sampling procedure. This process continued until the required sample size was obtained. A total of 20 eligible respondents, one per household were selected from each cluster.

### Data collection

A pretested structured interview questionnaire adapted from JHPIEGO, monitoring BPACR<sup>11</sup> was used for data collection. Using face-to-face interviews with respondents in their houses data were collected on socio-demographic characteristics, reproductive history, pregnancy complications, knowledge of danger signs and BPACR.

### Study variables

The primary outcome measure was BPACR. A brief description of the measurement of key study variables is as follows:

#### Measurement of BPCR

In this study, BPACR was defined as a woman having fulfilled at least three of the following practices in the most recent pregnancy: identified health facility for place of delivery, saved money for the purpose of pregnancy and childbirth, decided to deliver by skilled provider, made advance arrangement for transport to skilled care health facility in case of emergency and had made provision for delivery kit/materials. A woman who planned for birth in less than three of the five components was classified as ‘not adequately birth prepared and ready for complication’.

#### Socio-economic and demographic factors

Socio-economic and demographic information was collected on mothers’ age, ethnicity, religion, marital status, parity and highest level of education attained by the mothers. Household wealth index was used as proxy measure of household socio-economic status (SES). Using the principal components analysis method,<sup>22</sup> the SES of the sampled households was calculated by considering

specific variables such as: source of drinking water, toilet facility, flooring of the house, roofing, walls and ownership of the household assets (eg, electricity, bicycle, television and radio). Household wealth index was classified as low (that is less than median score) and high (at least median score).

### Assessment of obstetric danger signs

Problems with a pregnancy assessed in this study were bleeding, headache, swelling of feet, hands and face; pallor, fever, abdominal pain and vomiting too much. The major danger signs of labour were severe vaginal bleeding, prolonged labour, convulsions and retained placenta.<sup>11</sup> Severe vaginal bleeding, foul-smelling vaginal discharge and high fever during the first 7 days after childbirth were considered as key danger signs of the postpartum period.<sup>11</sup> For danger signs of neonates we considered convulsion, difficult/fast breathing, very small baby, lethargy/unconsciousness and unable to suck/drink during first 7 days of life.<sup>12</sup> Women who were able to mention at least three of each type of danger signs were classified to be knowledgeable in that area.

### Assessment of frequency and content of ANC services

The frequency of antenatal care (ANC) visits was assessed by asking study participants how often they patronised prenatal care services during pregnancy. ANC visits of less than four were classified as adequate while at least four visits were regarded as adequate attendance. The content of care received during ANC visits was assessed by asking study participants whether specific services including taking of weight and height, measurement of blood pressure and taking blood or urine samples were carried out for them during ANC visits. A composite index comprising 10 of these essential services received during ANC was created by assigning a score of 1 for having received a particular service and 0 for not receiving the service. The services were: measurement of blood pressure in the first, second and third trimesters (1 mark for each assessment), height and weight in the first trimester (1 score for each); examination of urine and blood taken (2 marks), received tetanus toxoid injection given at least one time (1 mark), woman attended at least three health and nutrition education sessions (1 score), received at least two doses of sulfadoxine and pyrimethamine taken in the presence of a health worker (1 score), measurement of fundal height against the age of gestation, fetal heart beat and fetal movement count monthly (1 score).

The mean and maximum scores were 6 and 10, respectively. Scores in the range of 0–5 were classified as ‘poor content and, of 6–10, as ‘good content’.

### Data quality control measures

To ensure the quality or validity of data collected, six field research assistants and two supervisors were trained and used for the data collection. The research assistants were carefully recruited based on their experience in previous studies. During the training, the research assistants

were taken through the questionnaire, sampling techniques and anthropometric measurement. Before the commencement of the actual data collection, the questionnaire was pretested to identify gaps and ability of the tool to collect the desired information.

Data were checked for incompleteness, inconsistency at both field and office levels. Each data collector checked the questionnaires for completeness before leaving each study participant. The questionnaire was reviewed daily by supervisors.

### Data analysis

The analysis of data considered the complex design of multi-stage cluster surveys. Therefore, the data were coded for statistical analysis using SPSS Complex Samples module for windows V.18.0. This was done in order to make statistically valid population inferences and computed SEs from sample data. Design weights were added to each region (ie, total population divided by number of respondents) to perform weighted analysis.

The association between dependent variables and independent variables was determined using multivariable logistic regressions modelling, which included all potential socio-economic, and demographic confounders that were significant at  $p$  values  $<0.05$  in the bivariate analysis. The associations between the dependent and each independent variable were presented as adjusted ORs (AOR) with 95% CIs. A CI was considered statistically significant when the interval between the upper and lower values did not include one.

### Patient and public involvement

The current study did not involve patients and/or public.

## RESULTS

### Socio-demographic characteristics of study participants

The distribution of socio-demographic characteristics of study participants are shown in [table 1](#). The mean age of the respondents was  $25.8 \pm 5.9$  years with the minimum and maximum ages of 16 and 45 years, respectively, and 48.8% of them were under 25 years of age.

Majority (89.8%) of the respondents were Christians with only 3.0% being Moslems. About half (50%) of the respondents were of the Kassena tribe. One-third (33%) of the respondents have basic (primary or JHS) education with 28% of them having no formal education. Nearly 90% of the respondents were married and farming and trading were the main sources of income.

### Utilisation of antenatal care services

Almost all (99.7%) of the women interviewed had received ANC at least one time from a skilled provider during their last pregnancy. More than half (56.0%) of the ANC attendees initiated ANC attendance in the first trimester of pregnancy. Almost 9 in 10 (87.0%) women had four or more ANC visits during the last pregnancy as recommended by the WHO. Of the 600 deliveries

**Table 1** Socio-demographic characteristics of respondents

Characteristic	Frequency (n)	%
<b>Age groups (years)</b>		
Under 25 years	293	48.8
25–34 years	237	39.5
At least 35 years	70	11.7
Total	600	100.0
<b>Educational level</b>		
No education	170	28.3
Primary school	199	33.2
Junior High School (JHS)	162	27.0
Secondary school	64	10.7
Tertiary	5	0.8
Total	600	100.0
<b>Religion</b>		
Christianity	539	89.8
Islam	18	3.0
African traditional religion	43	7.2
Total	600	100.0
<b>Marital status</b>		
Single	56	9.3
Married	539	89.8
Divorced	5	0.8
Total	600	100.0
<b>Main occupation of mother</b>		
None	181	30.2
Self-employment	412	68.7
Salary worker	7	1.2
Total	600	100.0
<b>Ethnicity</b>		
Buli	12	2.0
Kassena	302	50.3
Nankana	281	46.8
Other	5	0.8
Total	600	100

recorded, 84.3% were conducted in health institutions with about 85.0% of the deliveries conducted by a skilled provider (table 2).

#### Levels of birth preparedness and complication readiness

BPACR practices by respondents were generally unsatisfactory. Only 30.5% of the respondents had identified a health facility to go during delivery or in case of complications. Arrangement for transport in case of labour or complications during labour was reported in less than 18% and 32.7% of respondents reported having saved money towards delivery of the newborn. The most common birth preparedness practice observed was buying of antiseptics and clothes (74.8%). However,

**Table 2** Utilisation of antenatal care (ANC) services

Variable	Frequency (n)	%
<b>Frequency of ANC visits</b>		
Less than 4	50	8.3
At least 4	517	86.2
Do not know	33	5.5
Total	600	100.0
<b>Gestation of pregnancy at first ANC</b>		
Beyond first trimester	250	41.7
Within first trimester	336	56.0
Do not Know	14	2.3
Total	600	100.0
<b>Place of delivery</b>		
Home	94	15.7
Institutional	506	84.3
<b>Presence of SBA at delivery</b>		
Skilled	509	84.8
Unskilled	91	15.2
Total	600	100.0

only 74 (12.3%) of them mentioned identifying skilled provider as way of preparing for birth and its complications. Of the five birth preparedness practices considered in this study, only 14.7% of respondents were classified as adequately birth prepared (table 3).

#### Factors associated with birth preparedness and complication readiness

Table 4 shows the association between selected socio-demographic and obstetric characteristics with adequate birth preparedness. The main independent predictors of adequate birth preparedness were maternal knowledge of at least three danger signs of pregnancy and newborn danger signs. Women who had no formal education or up to primary education were less likely to be adequately prepared than women who had attained educational level above primary level ( $p=0.002$ ). Women with adequate BPACR were mostly married ( $p=0.001$ ).

Multivariable logistic regression was used to adjust for confounders including age, marital status, education, occupation, household wealth index, frequency and content of ANC visits, gestational age at first ANC and knowledge of obstetric danger signs during pregnancy. After adjusting for confounding effects, factors associated with BPACR are shown in table 5.

Mothers with better knowledge about obstetric danger signs during pregnancy were more likely to have adequate birth preparedness (AOR=4.88 (95% CI: 2.68 to 8.90)). Surprisingly, women who received lower content of ANC services were 3.3 times more likely to have adequate birth preparedness, compared with women who received high content of ANC services (AOR=3.34 (95% CI: 1.69 to 6.60)).

**Table 3** Birth preparedness and complication readiness (BPACR)

	Frequency (n)	%
<b>Identified a trained birth attendant</b>		
No	526	87.7
Yes	74	12.3
Total	600	100.0
<b>Identified a health facility</b>		
No	417	69.5
Yes	183	30.5
Total	600	100.0
<b>Arranged for transport</b>		
No	493	82.2
Yes	107	17.8
Total	600	100.0
<b>Saved money</b>		
No	404	67.3
Yes	196	32.7
Total	600	100.0
<b>Bought antiseptics and clothes</b>		
No	151	25.2
Yes	449	74.8
Total	600	100.0
<b>Classification of BPACR</b>		
Inadequate (<3 preparations)	512	85.3
Adequate (met ≥3 preparations)	88	14.7

Women who had attained educational level above primary level were 3.40 times more likely to be adequately prepared than women who had no formal education or up to primary education (AOR=3.40 (95% CI: 1.88 to 6.15)). Women who were classified as having low household wealth index were 4.6 times more likely to have adequate birth preparedness, compared with women of high household wealth index (AOR=4.64 (95% CI: 1.97 to 10.91)). Older women (≥35 years) were 2.59 times more likely to have adequate birth preparedness than their colleagues who were under 25 years (AOR=2.59 (95% CI: 1.11 to 6.02)).

## DISCUSSION

Though the benefits of BPACR have been documented in several countries, little or no information is currently available on levels of BPACR in Ghana and specifically in Upper East Region. This study therefore assessed BPACR and associated factors in the Kassena-Nankana district of Ghana.

### Prevalence of BPACR

One of the main findings that emerged from this study is that less than 15% of the mothers were adequately

prepared for delivery and complication readiness. The poor BPACR practices reported in our study corroborated with the findings of an earlier study conducted in Southern Ghana which showed the proportion of well-prepared pregnant women was 19%.<sup>23</sup> Similar studies conducted in Ghana further revealed that most pregnant women go for delivery unprepared though they may have knowledge about BPACR.<sup>24 25</sup> The finding is also consistent with other studies conducted elsewhere including Nigeria, Ethiopia and Tanzania,<sup>20 26 27</sup> where BPACR practices were poor among rural women.

The low proportion of adequate BPACR suggests that education on birth preparedness and complications is not being given during ANC since majority of the respondents (86.2%) had attended at least four ANC visits during their last pregnancy.

Inadequate BPACR has the potential to adversely affect the maternal and child health outcomes, as women will be ill-prepared to use skilled birth attendants at delivery or respond to complications in a timely manner.

Implementation of a BPACR programme should therefore be an essential part of antenatal education to increase the BPACR rate above the existing result, since BPACR intervention can increase preparation for birth and complications.<sup>28</sup>

Most pregnant women are reported not knowledgeable about BPACR for obstetric emergencies, despite having awareness on the danger signs of pregnancy.<sup>29–31</sup>

As reported in other studies,<sup>32 33</sup> the most common birth preparedness practice observed in our study was buying antiseptics and clothes. However, studies conducted in Burkina Faso and in Ethiopia however, found that most women had identified skilled birth attendants and health facility as the main birth preparedness practices.<sup>34 35</sup>

### Factors associated with adequate BPACR

In this study, women who knew and could mention at least three pregnancy danger signs were five times more likely to have adequate birth preparedness. It is expected that knowledge of danger signs leads to greater anticipation and preparation to mitigate effects of pregnancy and childbirth complications by preventing delay in deciding to seek care and delay in reaching a health facility.

The recognition of obstetric danger signs is a push factor among pregnant women to seek healthcare for obstetric emergencies and seeking preventive care or health promotion during pregnancy and childbirth. Naturally, a lack of awareness of obstetric danger signs will be associated with inadequate preparedness for normal birth or complication readiness.<sup>10 36</sup>

The positive association between knowledge of key danger signs during pregnancy or during the postpartum period with birth preparedness among women has been reported in earlier studies.<sup>32 37–41</sup> A lack of awareness of obstetric danger signs may thus lead to a lack of preparedness for normal birth or complication readiness in case of obstetric complications that require emergency healthcare.<sup>42 43</sup>

**Table 4** Association between selected socio-demographic and obstetric characteristics and birth preparedness and complication readiness (bivariate analysis)

Variable	N	Adequately birth prepared?		Test statistic
		No, n (%)	Yes, n (%)	
<b>Educational level</b>				
Low (up to primary level)	369	328 (88.9)	41 (11.1)	$\chi^2=9.6$ , p=0.002
High (above primary level)	231	184 (79.7)	47 (20.3)	
<b>Marital status</b>				
Single	61	60 (98.4)	1 (1.6)	Fisher's exact test=9.2, p=0.001
Married	539	452 (83.9)	87 (16.1)	
<b>Antenatal care content</b>				
Low	60	42 (70.0)	18 (30.0)	$\chi^2=12.4$ , p<0.001
High	538	468 (87.0)	70 (13.0)	
<b>Household wealth index</b>				
Low	482	401 (83.2)	81 (16.8)	$\chi^2=9.0$ , p=0.003
High	118	111 (94.1)	7 (5.9)	
<b>Knowledge of 3 danger signs during pregnancy</b>				
No	382	343 (89.8)	39 (10.2)	$\chi^2=16.7$ , p<0.001
Yes	218	169 (77.5)	49 (22.5)	
<b>Knowledge of 3 newborn danger signs</b>				
No	282	267 (94.7)	15 (5.3)	$\chi^2=37.1$ , p<0.001
Yes	318	245 (77.0)	73 (23.0)	

Low awareness of danger signs coupled with inadequate birth preparedness can significantly contribute to the delay in seeking skilled care. From the evidence provided

in this and other studies, a comprehensive sustainable education should be given to mothers during antenatal sessions on BPACR by community-level health service

**Table 5** Factors associated with birth preparedness and complication readiness (multivariable regression analysis)

Variable	Wald	Sig.	Adjusted OR	95% CI
<b>Educational level</b>				
Low (up to primary level)	Reference	Reference	Reference	Reference
High (above primary level)	16.32	<0.001	3.40	2.88 to 6.15
<b>Age of mother (years)</b>				
Under 25	Reference	Reference	Reference	Reference
25–34	0.22	0.64	1.15	0.65 to 2.03
At least 35	4.92	0.03	2.59	1.12 to 6.02
<b>Classification of household wealth index</b>				
High	Reference	Reference	Reference	Reference
Low	12.35	<0.001	4.64	1.97 to 10.91
<b>Knowledge of least 3 pregnancy danger signs</b>				
No	Reference	Reference	Reference	Reference
Yes	26.71	<0.001	4.88	2.68 to 8.90
<b>Antenatal care content</b>				
High	Reference	Reference	Reference	Reference
Low	12.06	0.001	3.34	1.69 to 6.60

providers. Steps should also be taken to raise community awareness about birth preparedness, such as having plans to deliver in health facilities and arrangement for emergency transport.

However, other studies conducted in Ethiopia and in India found no significant association between key danger signs and birth preparedness after multivariate analyses.<sup>44 45</sup>

One other independent predictor of adequate birth preparedness was content of ANC services received which surprisingly was negatively associated with adequate BPACR. Women who received lower content of ANC services were 3.3 times more likely to have adequate birth preparedness, compared with women who received high content of ANC services. A possible explanation may be that women who received higher content were less knowledgeable in obstetric danger signs of pregnancy. Though women may have received sufficient ANC services, education on the danger signs during pregnancy could have been overlooked by service providers. A number of studies have indeed reported of the poor or inadequate education on danger signs provided by midwives to mothers who seek ANC services in eastern Uganda.<sup>46</sup>

In this study and in others, attendance of ANC of four or more times was not associated with being well birth prepared in the present study<sup>37 47</sup> though results of some studies showed that having frequent access to ANC services positively associated with BPACR.<sup>20 39 48–52</sup>

ANC attendance gives an opportunity for a woman to be counselled and make an appropriate plan for childbirth.<sup>53</sup> It is therefore expected that pregnant women who frequently attend ANC sessions will be more likely to be prepared for birth and its complications than those who do not attend ANC. This assumption will hold if educational lessons are given to women at ANC. In the absence of that, ANC attendance will not associate with BPACR as observed in this study. Indeed, one recent study in southwest Ethiopia reported that three-fourth of pregnant women were not counselled on all components of BPACR.<sup>33</sup> Therefore, it is possible that an increase in frequency of ANC visits per se may not result in better BPCR. Increased BPCR awareness in women could be promoted by healthcare workers during ANC visits

The results of the present study showed that women who were classified as having low household wealth index were 4.6 times more likely to have adequate birth preparedness, compared with women of high household wealth index. In meeting the key components of BPACR, those that have implication for money may have to do with saving money for the purpose of pregnancy and childbirth and perhaps buying delivery kit/materials. All things being equal, one would expect that women of high household wealth index will rather find it easy to meet BPACR but the opposite appears to have happened in our study sample.

This might be due to the fact that rich women might not see the need to plan for certain practices like pre-identifying a health facility or skilled birth attendant because of their perceived ability to access any health facility including

private ones which might be expensive to the poor. It is also possible that rich women may have their own means of transport and so will not plan for transportation. In this case, they are most likely be classified as not being prepared for transport arrangement, and this will affect their overall BPACR score. Such a situation can therefore confound the relationship between wealth and BPACR. This study was conducted among women who have recently delivered and have experienced all these practices, compared with pregnant women who may not be sure of what would actually occur towards the time of delivery.

Our finding is however, inconsistent with that of other studies where women in the third, fourth or fifth wealth quintiles were more likely to be prepared as compared with women in the lowest quintiles.<sup>33 49 54 55</sup> This means the odds of being well prepared for birth and its complications was significantly higher among women from high SES than those from low SES. In this case, the likely reasons could be that rich women having high income will be enabled to prepare for birth and its complications. In a recent study in Ghana, it was reported that most of the respondents were not sufficiently prepared for delivery due to poverty and low educational status.<sup>56</sup>

This study also observed that women who had attained educational level above primary level were 3.4 times more likely to be adequately prepared than women who had no formal education or only up to primary school level. This observation is in consonance with findings of similar studies where educational level was found to be positively and significantly associated with BPACR.<sup>54 55 57 58</sup>

Higher educational achievement has been shown to positively influence women with regards to positive health seeking behaviour including increased utilisation of maternal health services.<sup>59–62</sup> This might be related to the fact that educated women have decision-making power to make their own decisions in matters related to their health and are most likely to have fewer financial constraints in accessing healthcare.

In this study population, older women ( $\geq 35$  years) were 2.6 times more likely to have adequate birth preparedness than their colleagues who were under 25 years of age. This finding is consistent with other studies.<sup>63</sup> A possible explanation for this relationship may be that older women would have experienced complications on their previous pregnancies, thereby trying to prevent any such problems for the current pregnancy. However, some studies reported that younger women ( $< 35$  years) had higher odds of BPCR practice than women above 35 years of age.<sup>64–66</sup>

In some studies BPACR status was not significantly associated with maternal age<sup>47</sup>

### Limitations of the study

There are some limitations of the study which need to be considered. The analytical cross-sectional study design limits the ability to draw any causal conclusions since the problem of bias cannot be ruled out completely.

## CONCLUSION

The prevalence of BPACR among recently delivered women was low as less than 15% were able to mention at least three of the five basic components of BPCR. Though knowledge of obstetric danger signs was equally low, it associated positively with BPACR. These findings lend support to reinforce health education on BPACR during pregnancy. Further implication of the findings is that the predictors identified should be given high priority by health authorities in addressing low prevalence of BPACR.

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**Patient consent for publication** Not required.

**Ethics approval** The study protocol was approved by the School of Allied Health Sciences, University for Development Studies, Ghana. Ethical clearance was obtained from the Institutional Review Board of the Tamale Teaching Hospital, Ghana (Ref no. TTH/10/11/15/02). Informed written consent was obtained from the literate participants. In situations, where the participants could not write or read, verbal informed consent was sought after providing the needed information and explanation.

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**Data availability statement** All data relevant to the study are included in the article or uploaded as supplemental information.

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