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Birth preparedness and complication readiness assessment among antenatal and postnatal mothers at government hospital, in urban Bengaluru

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Abstract: *Background:* Maternal mortality remains a significant public health challenge, particularly in developing countries like India. Birth Preparedness and Complication Readiness (BPACR) is a critical component of antenatal care recommended by the World Health Organization (WHO) to reduce maternal mortality. The maternal mortality ratio (MMR) of Karnataka is 92 per 100,000 live births in SRS 2016-18. Since Karnataka had the highest MMR ratio among the southern states of India the present study was thus conducted to determine the BPACR among antenatal and postnatal women and assess the factors related to it. *Methods:* A community-based cross-sectional study was conducted at a government hospital in Bengaluru. A sample of 105 antenatal mothers in their third trimester and postnatal women (age ≥ 18 years) attending the hospital was included. Data were collected using a pretested questionnaire that assessed various indicators related to BPACR, including knowledge of danger signs, health service utilization, and preparation for childbirth. *Results:* The study found a high BPACR index of 78%, with 17% of women exhibiting good BPACR. Knowledge of danger signs during pregnancy was high (95.2%), but lower for labor (51.4%) and postpartum (44.7%) periods. Fewer women knew about danger signs in neonates (46.6%). Regarding preparedness, 97.1% of women had identified transport arrangements, while only 25.7% knew about the need for blood transfusion during delivery. Awareness regarding the Karnataka Mathrushree Scheme was low at 25.7%. *Conclusion:* The study highlights a relatively high level of BPACR among antenatal and postnatal mothers in urban Bengaluru. Strengthening education and counseling during antenatal care, involving family members, and community awareness campaigns can improve BPACR and ultimately contribute to safer motherhood.

Keywords: Birth preparedness, Complication readiness, Maternal mortality, Antenatal care, Postnatal care.

Introduction

The WHO estimates that approximately 800 women die every day worldwide (2020) due to preventable causes related to pregnancy and childbirth [1]. Almost all maternal deaths (95%) occur in developing countries and one-third of them occur in South Asia [1].

India has miles to go to reduce maternal mortality ratio (MMR) as according to Sustainable Development Goal 3 (SDG3.1), we have to achieve an MMR of less than 70 per 100,000 live births by 2030 from the level of 113 per 100,000 live births for the last 3 years reported by Sample Registration System (SRS) [2-3]. Maternal health care is one of the important pillars of the RMNCH+A (Reproductive Maternal Neonatal Child and Adolescent Health) Strategy which mainly focuses on antenatal care and "at-risk" case management under the National Health Mission (NHM) program [4]. High levels of maternal mortality ratio (MMR) (130 per 100,000 live births), perinatal (23 per 1000), and neonatal (24 per 1000) mortality rates remain major public health challenges in India [5-6].

Pregnancy and childbirth are often addressed as normal phenomena, and the complications also tend to go unnoticed. Skilled care before, during, and after childbirth can save the lives of women and newborn babies [1, 7]. The World Health Organization (WHO) recommends that pregnant women should receive focused `antenatal care' (ANC) in which birth preparedness and complication readiness (BPCR) is a key component [8]. It is one of the key interventions to reduce maternal mortality. It is defined as preparing for birth and being ready for any obstetric emergency [9-10]. BPACR tool has been developed by the Johns Hopkins Bloomberg School of Public Health [9, 11-12]. The concept came into existence since the introduction of the safe motherhood initiative; however, it is still new in India.

BPACR is the intervention for planning of normal birth and anticipating the actions needed in case of complications. As per the Sample Registration System (SRS) report (2021), the MMR of Karnataka is 92 per 100,000 live births in SRS 2016-18 [3]. Since Karnataka had the highest MMR ratio among the southern states of India the present study was thus conducted to determine the BPACR among antenatal and postnatal women and assessing the factors related to it and also the knowledge of Mathrushree scheme in Bengaluru.

Material and Methods

Study design and setting: This community-based cross-sectional study was conducted between May and July 2023. Ethical clearance was taken from the institutional ethics committee and carried out in the wards and OPD of the Obstetrics and Gynecology department of Government Hospital, Bengaluru. A 500-bed government hospital in the heart of Bengaluru, India. KC General Hospital is one among the oldest hospitals in the city. It was established in 1910. Since then, it has been one of the preferred hospitals by people. It serves as a zonal referral hospital for a catchment area of around 1 million people. The hospital has a bed capacity of 600 with approximately 500 outpatients (OP) seeking medical services daily.

Study population: The study was carried out among antenatal mothers in their third trimester of pregnancy and postnatal women (age≥ 18 years) up to postnatal day 7 attending the outpatient department (OPD) or admitted to the hospital.

Sampling technique and sample size: The sample size was calculated using the formula,

$$n = \frac{\left(Z_{1-\alpha/2}\right)^2 P(1-P)}{d^2}$$

Where, Z is the value of area under the two-tailed normal curve and α, the level of significance was taken as 0.05. 'p' = 41% is the prevalence rate of the BPACR index based on a study from Delhi by Acharya AS [13]. 10% absolute allowable error in the estimated sample size n=96 and a drop-out rate of 10% in the total sample size n=105.

Inclusion and exclusion criteria: The study included antenatal mothers in their third trimester of pregnancy and postnatal women up to postnatal day 7 attending the hospital. The individuals who did not give consent were excluded from the study.

Data collection: The study participants were included by random selection. Ethical clearance was taken from the Institutional Ethical Committee, and written informed consent was obtained from the participants before including them in the study. Each woman was interviewed separately for about 15 to 20 minutes, and confidentiality was maintained.

Data were collected using a pretested questionnaire using the interview method. Data collected included information about the sociodemographic details of the study participants and various indicators regarding BPACR. Socioeconomic status and Education details were obtained using the modified Kuppusamy scale and later grouped together. Using the John Hopkins Bloomberg School of Public Health tool [9] for BPACR, a modified tool was developed after a pilot study was used for data collection. The tool comprised 21 indicators [Table 2], with components related to knowledge of danger signs, urgency in seeking care, pregnancy registration and visits, available governmental services, and pregnancy preparation including saving money and transport arrangements.

Study Instruments: The study tool consists of a questionnaire.

a) Part I - Demographic details.
b) Part II - BPACR tool.

This questionnaire was pretested by doing a pilot study. The entire questionnaire was converted to a local language and also modified in order to meet the study objective.

BPACR tool: A score of one was given for each indicator. With relation to the indicators related to danger signs, a score of 1 was given if the woman answered >4 danger signs. Later BPACR score was determined by Σ Indicators 21 × 100. Based on the BPACR score they were classified as,

1. Good BPACR: >90%
2. Moderate BPACR: 61%-90%
3. Poor BPACR: ≤ 60%

The BPACR index was determined as an average of the BPACR score of all the study participants [14].

Statistical Analysis: Data was collected using EpiCollect 5 forms. EpiCollect offers a free, form-based data collection tool (for surveys, questionnaires, etc.). Provides for the creation of a project at epicollect.net, designing forms, loading the project into the app, collection of multiple data entries (with GPS and photos), and viewing all data collected from multiple phones. It is used for managing and collecting information for supply chain management and is compiled in Microsoft Excel. Qualitative variables like gender, religion, and education, were presented in frequency, and percentage. The data were analyzed using statistical software, Epi info version 7.2.

Results

I) *Characteristics of the study population:* This study was carried out on 105 women to assess their BPACR. Antenatal mothers in their third trimester (T3) of pregnancy and postnatal women up to postnatal day 7 were included in this study. The socio-demographic profile is shown in Table 1. The majority of them are from 20 to 30 years (75%) of age group, have done their education above high school (64%),are homemakers by occupation (89%), belong to lower middle-class socioeconomic status (89%), avail from urban Bengaluru (98%), family type is nuclear family (92%). Coming to the natal status, 91% were antenatal mothers and 62% were primigravida.

Table-1: Distribution of sociodemographic variables of the study participants (n=105)

Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	< 20 years	3	2.8
	20-30 years	79	75.2
	>30 years	23	22
Education	Illiterate	5	4.7
	Below high school	33	31.5
	Above high school	67	63.8
Occupation	Housewife	93	88.5
	Skilled & Semi-skilled	12	11.5
	Professional	0	0
Socio economic status	Upper	0	0
	Middle	94	89.5
	Lower	11	10.5
Residence	Rural	2	2
	Urban	103	98
Family type	Nuclear	97	92.3
	Joint	8	7.7
Natal status	ANC	95	90.5
	PNC	10	9.5
Gravida	Primigravida	65	62
	Multigravida	37	35.2
	Grand multipara	3	2.8

II) *Components of Birth Preparedness and Complication Readiness:* It was assessed through the modified BPACR tool [Table 2]. The BPACR index was found to be 78%. Around18 (17%) of women had a good BPACR, 85 (81%) were moderate, and 0nly 2(2) had a poor BPACR. The BPACR assessment included indicators related to knowledge of danger signs in pregnancy, labor, and in the neonate, use of health services, and preparation for childbirth. It was observed that 47 (44%) and 54 (51.4%) mothers did not know any danger signs occurring in the postnatal period and labor, respectively. Knowledge regarding danger signs in pregnancy was found to be 100 (95.2%), excessive vomiting, headache, and swelling of limbs was the most known complication. The knowledge regarding danger signs during labor was found to be lowest at 54 (51.4%), with bleeding and Severe abdominal pain being the most known. The overall knowledge of danger signs in the postpartum period was found to be 38 (9.5%), of which many knew about postpartum hemorrhage. Knowledge regarding danger signs in a neonate was 47 (44%). Inadequate breast milk and Poor sucking was the most known danger sign. Knowledge regarding the Karnataka Mathrushree Scheme was found to be only in 27 (25.7%).

Table-2: Distribution of Status of birth preparedness and complication readiness among the study population (n=105) [Components of BPACR tool*= Yes\No]

Sl no	Components of the BPACR tool	Yes n (%)	No n (%)
1	Knowledge regarding danger signs during pregnancy	100 (95.2)	5 (4.8)
2	Knowledge regarding danger signs during labor	54 (51.4)	51 (48.6)
3	Knowledge regarding danger signs during postpartum	47 (44.7)	58 (55.3)
4	Knowledge regarding danger signs in neonate	49 (46.6)	56 (53.4)
5	Urgency in seeking hospital care for danger signs	103 (98)	2 (2)
6	Registration of pregnancy	105 (100)	0
7	Planning 4 or more ANC visits	105 (100)	0
8	ANC visits in first trimester	105 (100)	0
9	TT first dose	105 (100)	0
10	100 iron and folic acid consumed	105 (100)	0
11	Awareness regarding the possible need for blood transfusion during delivery	27 (25.7)	78 (74.3)
12	Saved money for childbirth	27 (25.7)	78 (74.3)
13	Identified mode of transport	102 (97.1)	3 (2.9)
14	Ideal postnatal visits	101 (96.1)	4 (3.9)
15	Immunization	105 (100)	0
16	Need for the birth companion	105 (100)	0
17	Knowledge regarding JSSK	101 (96.1)	4 (3.9)
18	Knowledge regarding transport service under JSY	101 (96.1)	4 (3.9)
19	Knowledge regarding the Karnataka Mathrushree Scheme	27 (25.7)	78 (74.3)
20	House visits from ASHA	56 (53.3)	49 (46.7)
21	Planning birth with a skilled provider	103 (98)	2 (2)

BPACR: Birth preparedness and complication readiness, *ANC:* Antenatal care, *JSSK:* Janani Shishu Suraksha Karyakram, *JSY:* Janani Suraksha Yojana, *ASHA:* Accredited Social Health Activist

Table-3: Association of Socio-demographic characteristics of the study participants and High (n=18) and Low (n=87) levels of Birth preparedness of the study population

Variables	BPACR grade		P value	OR (95% CI)
	High n (%)	Low n (%)		
Age (years)				
< 20 years	0 (0)	3 (3.5)	0.7	-
20-30 years	15 (83.3)	64 (73.5)	0.7	0.6 (0.1, 2.4)
>30 years	3 (16.7)	20 (23)	1	1
Education				
Illiterate	1 (5.5)	4 (4.5)	0.1	0.4 (0.1,1.4)
Below high school	8 (44.5)	25 (28.8)	0.7	0.6 (0.06, 6.1)
Above high school	9 (50)	58 (66.7)	1	1
Occupation				
Housewife	16 (88.8)	77 (88.5)	1	1
Skilled & Semi-skilled	2 (11.2)	10 (11.5)	0.7	1 (0.2, 5.2)
SES				
Middle	17 (94.5)	77 (88.5)	1	1
Lower	1 (5.5)	10 (11.5)	0.7	2.2 (0.2, 18.4)
Residence				
Rural	0 (0)	2 (2.2)	0.7	-
Urban	18 (100)	85 (97.7)	1	1
Family type				
Nuclear	15 (83.3)	82 (94.3)	1	1
Joint	3 (16.7)	5 (5.7)	0.2	0.3 (0.06, 1.4)
Natal status				
ANC	11 (61.2)	84 (96.5)	1	1
PNC	7 (38.8)	3 (3.4)	0.00002*	0.05 (0.01, 0.2)
Gravida				
Primi	5 (27.7)	60 (69)	1	1
Multi	12 (66.83,)	25 (28.7)	0.001*	0.1 (0.05, 0.5)
Grand	1 (5.5)	2 (2.3)	0.6	0.1 (0.01, 2.1)

* p-value: <0.05 (Significant)

[SES= Socio economic status; High BPACR grade = Good BPACR: >90%; Low BPACR grade = Moderate + Poor BPACR: 61%-90% and ≤ 60%]

Discussion

Our study was conducted in a secondary care center in Karnataka on 105 antenatal and postnatal women. The BPACR index was found to be 78%, among them 17% of women had a good BPACR. Similar to a study done by Akshaya et al [8] in Karnataka, the BPACR index was found to be 79.3%. However, most of the studies showed a higher level of BPACR, a study in Ethiopia (72%), Thailand (78.6%), the study by Kamineni et al (71.5%), and Haryana (66.93%) [15-18].

These variations could be attributed to different levels of female literacy and empowerment, spouse's education and occupation, knowledge of key danger signs, preference for institutional delivery, and methodological differences in BPCR assessment. The relatively high BPCR in the

present study could be due to a better knowledge of danger signs, high female literacy, an increase in institutional deliveries, and higher service utilization [19]. The significant influence of women's literacy level on BPCR practice is highlighted by many studies from India and also from African countries [20-23]. However, in a study by Timša Let al, women's education level did not show a significant association with BPCR [24]. Many studies have reported that optimal BPCR practice is associated with a woman and spouse's working status, religion, multiparity, and an adequate number of ANC visits [20, 25]. Overall, high utilization of available maternal health care services and preference for institutional delivery is the possible explanation as seen in our study [19].

The knowledge about complications in the process of childbirthis treated as an integral part of assessing a woman's complication readiness. Our study found maximum knowledge of danger signs during pregnancy 100 (95.2), while minimum during postpartum 47 (44.7).A study by Viyusha T found maximum knowledge of danger signs during pregnancy was 87 (21.8%), while the minimum knowledge during labor was 17 (4.3%). Postpartum hemorrhage was seen in 189 (47.3%), Bleeding in 208 (52%), and poor feeding in 306 (76.5%) were the most known complications [26]. A study from Bangladesh found that around 32.3% and 24.3% could not elicit any danger signs in pregnancy and labor, respectively. Abdominal pain (42%) and convulsion (34.5%) were the most common danger signs known in pregnancy and delivery [27]. In Nigeria, Knowledge of danger signs in pregnancy was high (62.5%) and bleeding was the most recognized symptom (62.5%) [28].

In a study from Karnataka, the majority of the women knew (80%) at least one danger sign [8]. Bleeding was the most known complication, according to a study from Delhi (27.8%) [13]. A higher number of mothers lacked knowledge of any danger signs in pregnancy (42%) and labor (48%) according to a study from Telangana [17]. While a study from Delhi, 2012, with 41% birth preparedness found only 48.9% of women saved money for childbirth, and only 44% had identified transport. Another study found a BPACR of 79.3%, where 80% of women knew about danger signs, 52.2% had saved money, and 71.7% made transport arrangements [8]. According to a study from Nigeria, around 48.4% were well prepared but 57% of women had saved money, and one-third around 34.3% had made transportarrangements [19]. Nimavat et al. in their study from Gujarat found that 60% had saved money while only 38% of women identified a mode of transport [28].

In our study, only 26% of women knew about the need for blood transfusion, less than half of women saved money (26%), and 97% of women had made transport arrangements. Similar to a study by Viyusha T where only 9.5% of women knew about the need for blood transfusion, less than half of women saved money (45%), and 63% of women had made transport arrangements [26]. Adequate knowledge of danger signs aids in early recognition of potentially life-threatening complications and may avert unnecessary delays in seeking healthcare. ANM and ASHAs should be encouraged to educate the mother and also her family members about the danger signs.

The study also found only 27%, less than half of them had knowledge regarding community services like the Mathushree scheme (27%). Awareness campaigns should be conducted to explain the various monetary benefits of the Mathushree scheme. ANM and ASHA should involve the family members, especially the spouse while educating women about these factors during ANC. Special care has to be given to economically poor and young women. Studies have shown that involving the family members, especially the spouse, ensures the implementation and sustainability of BPCR [29] Existing evidence suggests that culture has a strong influence on women's use of available healthcare services [30]. WHO recommends that the culture and its dynamism need to be recognized, and incorporated into MCH services. Qualitative research and encouraging community participation while designing the intervention would be of great use in exploring and addressing the cultural factors.

Limitation: The findings of our study should be considered within the context of two

limitations. First, the small sample size affects the generalizability of the results. The study's cross-sectional design prevents the inference of causal relationships and limits the generalizability of the findings. Secondly, it was done in a hospital setting where patients are considered to have adequate knowledge due to regular follow-up.

Conclusion

In our study, the BPACR index was found to be 78%, and 18% of women had a good BPACR. The high level of the BPACR index was attributed to a high level of awareness regarding government-sponsored schemes and the danger signs of pregnancy. This highlights the efforts and services provided by healthcare providers and workers. However, the knowledge regarding the Karnataka Mathrushree Scheme was found to be low which indicates a timely intervention regarding new schemes.

Recommendations: BPACR assessment should be frequently conducted by primary care physicians to assess the performance of baseline health care workers regarding increasing levels of awareness among beneficiaries. Addressing the need for intense Information, Education, and Communication activity focused on the Mathrushree scheme among pregnant women, their family members, and primary health workers. Antenatal care with proper and adequate counselling regarding safer birth planning is needed which will ultimately result in safer motherhood and childhood.

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