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Predictors of antenatal health service utilization among left-behind wives of male outmigrants: Evidence from Patna District, India

Fahad Afzal¹✉, Arindam Das²¹Research Wing-A, IHMR University, Jaipur, Rajasthan, India²Institute of Health Management, IHMR University, Jaipur, Rajasthan, India

ABSTRACT

Objective: To analyze the sociological support system available for left-behind wives of male outmigrants and develop a model that predicts the antenatal care (ANC) services utilization.

Methods: A cross-sectional survey was conducted in rural regions of the Patna district, India. The sample size ($n=328$) was estimated using Cochran's formula. Five parameters of the social support system were identified (autonomy, spousal support, family support, social circle support, and government support). The score for each was calculated as a composite score using multiple variables; these served as independent variables. The respondents were categorized as efficient and non-efficient users of ANC service based on established criteria.

Results: The regression results showed that four out of five social parameters had a significant effect on ANC behavior. Spousal support was the strongest predictor (standardized regression coefficient $\beta=0.57$, OR 1.16, 95% CI 1.08-1.79, $P=0.007$). Government support was found to be the second strongest predictor ($\beta=0.40$, OR 1.49, 95% CI 1.04-2.14, $P=0.027$), followed by family support ($\beta=0.31$, OR 1.36, 95% CI 1.23-2.57, $P=0.034$) and autonomy ($\beta=0.11$, OR 1.32, 95% CI 1.11-2.26, $P=0.030$). The social circle support was found to be non-significant in predicting ANC behavior ($P>0.05$).

Conclusions: The policymakers could focus on the identified predictors to strengthen and modify the existing policies for left-behind wives of male outmigrants. The need of the hour is a strategic intervention for behavioral modification of not only the left-behind wives but also their family members along with reinforcement of the existing social-security net. One strategy we suggest is to launch an awareness campaign focusing on husbands (male outmigrants) and family members.

KEYWORDS: Antenatal health; Reproductive behavior; Antenatal care utilization; South-East Asia; Left-behind wife

1. Introduction

One of the most significant healthcare challenges in India and other developing nations is ensuring adequate maternal and perinatal health. According to the World Health Organization, over 800 females die every day globally due to preventable pregnancy and delivery-related issues[1]. The literature indicates that the left-behind married women (LBMW) married to out-migrants and staying back at their place of origin experience a unique set of sociological factors[2]. In this study, the antenatal care (ANC) behaviors of LBMW are analyzed with the aim of identifying those sociological variables that significantly determine the ANC utilization pattern.

Significance

Left-behind wives of male outmigrants residing in rural backward regions of Southeast Asia are a more vulnerable subsection of women. However, there exists a knowledge gap regarding the antenatal care utilization behavior of such women. The study provides evidence to close these gaps based on empirical data. The major finding of this study is that these women severely underutilize antenatal care (ANC) services, such as iron-folic acid supplementations, ANC checkups, and tetanus vaccination. The predictor analysis revealed that the male outmigrant's support for his left-behind wife plays a positive role. Further, more government support such as financial incentives, institutional delivery, and food provision to pregnant women plays a significant role.

✉To whom correspondence may be addressed. E-mail: syedfahadafzal@gmail.com

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In a national survey (National Family Health Survey-5th round), it was found that 42% of Indian women do not receive the necessary number of antenatal check-ups. Fifty-six percent of pregnant women had not adequately consumed iron folic acid (IFA) supplements and around 8% of pregnant women are not vaccinated for tetanus[3]. These proportions are staggeringly high in the case of Bihar state (one of the members of Empowered Action Group). Most women who give birth do not receive the recommended number of ANC visits, and 82% do not take IFA supplements for the minimum recommended amount of time throughout pregnancy (as per National Family Health Survey-5th round data). Bihar performs below the national average in various reproductive health indicators. The consecutive survey rounds have shown a trend of improvement in various health indicators. Nevertheless, many researchers contend that the pace of improvement is inadequate[4].

Researchers have reported that the increased use of ANC services especially in low- and middle-income nations lowers the maternal mortality rate[5]. Literature suggests the impact of antenatal behavior transcends from the mother to the offspring. According to studies, mothers in low- and middle-income nations who undergo at least one ANC service experience a significant reduction in neonatal mortality (by 39%)[6].

Male migration is one of the driving forces that shape the socioeconomic condition of the origin place. This is reflected in the health behavior of families residing back at home[7]. Studies indicate that one of the most vulnerable groups emerges when elements like spousal absence in the household, patriarchal norms, and poverty overlap[8]. Imran *et al* argue there exists a favorable impact of the husband's out-migration on the reproductive health of LBMW[9], whilst others documented detrimental effects of husbands' absence on one or more aspects of the wife's life quality and health[10]. Several research produced conflicting results with few highlighting the fact that the negative effects of male migration outweigh the positive ones[11]. Reproductive health along with other facets of social life are shaped by several variables[12]. These "variables" have been discussed by earlier studies, namely spousal support, social circle, family support, and autonomy of women.

Only a handful of studies have been done that attempt to explain the antenatal behavior of LBMW in Bihar. One such conducted by Archana reported that roughly 30% of LBMW do not communicate their reproductive health concerns with anybody because of stigmatization and fear of ostracism. The husband's presence in the household encourages problem-solving and increases the use of health services[13]. Another research conducted by Kumar *et al* reported that spousal involvement in health-related issues increases the ANC utilization by such women[14]. In low- and middle-income nations, household members such as mothers-in-law also play a critical role in altering the ANC utilization behavior of women. A study reported that encouragement by mothers-in-law to get ANC check-ups significantly augmented the number of ANC visits by the daughters-in-law[15]. Similarly, evidence from outside households revealed that support from social circles (friends and neighbors)

leads to improved perinatal behavior and more adherence to the recommended ANC guidelines[16]. A study conducted by Saggurti *et al* reported that self-help groups can be utilized as a source of information and mutual assistance to pregnant females in rural areas of India[17]. On the contrary, Singh *et al* reported that adherence to ANC guidelines does not have a significant association with being a member of self-help groups. However, the self-help groups can be used as a channel to spread ANC awareness to expecting mothers[18]. Another crucial element of the sociological support system is the social safety net for pregnant females offered by the state. Many government schemes and programs have been launched across India, Bihar being one of the priority states. Some programs are more effective compared to others. A study conducted by Kumari and Shipra reported that getting enrolled in Janani Suraksha Yojna dramatically increases the odds of adherence to recommended antenatal behavior and having institutional delivery[19]. This is corroborated by a study conducted by Pathak *et al* which indicated that lower utilization of ANC services is associated with lower enrollment in maternity benefit (cast incentive) schemes[20].

The literature review indicated that there are very few analytical studies conducted to identify the determinants of ANC behavior in India. In one such study, demographic predictors were identified by applying regression analysis, namely women's education, age, residence, and economic status[21]. Another study for predicting ANC utilization reported that in case of unwanted pregnancies, a woman is less likely to obtain adequate ANC service[22]. A review of the literature revealed that many studies indicate the association of sociological factors with ANC behavior. However, there is a dearth of recent comprehensive research that analyses the entire social support system and identifies the predictors of ANC behavior of LBMW in Bihar or any other male out-migrant hotspot of India. By and large, the present paper aims to analyze the antenatal behavior of those females who are married to a marginal migrant worker and living at a place of origin without the husband (referred to as LBMW) and relate it with their socio-demographic profiles. There are multiple aspects and components of ANC behavior included in this study, namely pregnancy registration, IFA consumption, tetanus vaccination, ANC checkup frequency, motivator of ANC checkup, *etc.* As for the socio-demographic aspect, variables like age, religion, caste, education, husband's occupation, *etc.* are explored. Further, this study aims to develop a model that could adequately predict the ANC behavior of LBMW based on the mix of social factors experienced by them.

2. Subjects and methods

2.1. Study design

The cross-sectional survey was conducted from December 2022 to March 2023 in rural areas of Patna district in Bihar state. The blocks were selected based on the assumption supported by literature

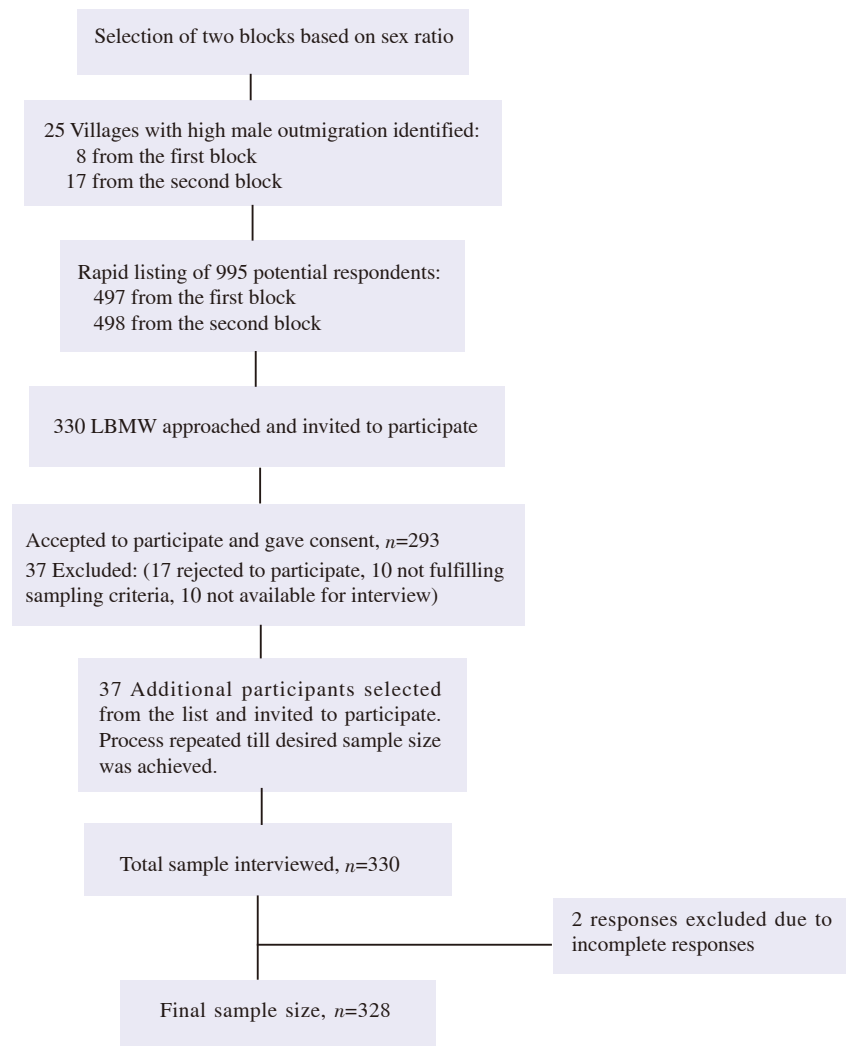


Figure 1. Flowchart of sample screening and selection. LBMW: left-behind married women.

i.e., regions with higher male outmigration have a higher sex ratio (in terms of females per thousand males)[23]. Patna district has 23 administrative blocks out of which two blocks with the highest sex ratio were selected. In total, 25 villages were selected from the two blocks. The villages having high male outmigration rates were selected purposively. The village selections were done with the help of block officials, namely, Block Community Mobilizers and Block Health Managers. An overview of sample selection is depicted in Figure 1.

2.2. Data collection tool

A questionnaire containing questions regarding various aspects of reproductive health was designed with a focus on the last completed full-term pregnancy. The questionnaire also contained questions relating to demographics and the social support system of the women. Pretesting for validity was conducted in a separate block of Patna. Required adjustments in the tool were made. The internal consistency was found to be adequate (Cronbach's alpha=0.78). The data collection was done digitally using Open-Data Kit (ODK) programming.

2.3. Sampling

Initially, the calculated sample size was 330, determined using Cochran's formula. The prevalence of married women currently of reproductive age married to out-migrants in Bihar was considered 11% at a confidence level of 95% with a margin of error of 5%, and a non-response of 10%[24]. Design-effect was applied to prevent under-sampling (coefficient=2). Rapid listing in the selected villages was conducted to identify the women fulfilling the sampling criteria. Out of the listed women, 330 women were selected by systematic random sampling. The number of women selected from a village was calculated using the probability-proportional-to-size (PPS) approach. Two responses were discarded; hence, the final sample size was 328 women.

2.4. Selection criteria

Married woman in the age group 15 to 49 years with a husband working outside the Patna district were included. As the study involved questions regarding the last full-term pregnancy, to prevent recall bias, only those women who delivered in the last five years

Table 1. Scoring method for each parameter of the sociological support system.

Variables	Score
Autonomy	
Household leader	LBMW=1; Any other member=0
Engage in economic activity	Yes=1; No=0
Decision maker regarding child/children's health	Only LBMW=2; LBMW and husband jointly=1; Any other member=0
Decision maker regarding routine expenditure	Only LBMW=2; LBMW and husband jointly=1; Any other member=0
Receive a share in the remittance amount	Yes=1; No=0
Freedom to spend your money as you wish	Yes=1; No=0
Permission needed to meet with your friends	Yes=1; No=0
Permission needed to meet your parents and siblings	Yes=1; No=0
Spousal support	
Frequency of sending remittance	Weekly/Monthly=1; Less frequent than monthly=0
Frequency of home visit by husband	Thrice per year or more=2; Twice per year =1; Once or no visit=0
Comfortability score of discussing reproductive health issues with husband	Low (1 to 20)=1; Medium (21 to 40)=2; High (41 to 60)=3
The overall impact of migration of husband	Positive impact=1; Negative/No effect=0
Conflicts with your husband regarding any financial matter	No=1; Yes=0
Family support	
Conflicts with any household member regarding any financial matter	Yes=1; No=0
Comfortability score of discussing reproductive health issues with family members	Low (1 to 30) = 1; Medium (31 to 60) = 2; High (61 to 90) = 3
Family members take care of household affairs in absence of women	Yes=1; No=0
Social circle support	
Member of a self-help group	Yes=1; No=0
Comfortability score of discussing reproductive health issues with friends/neighbors	Low (1 to 20)=1; Medium (21 to 40)=2; High (41 to 60)=3
Government support	
Women registered as Below Poverty Line	Yes=1; No=0
Family registered in Ayushman Bharat	Yes=1; No=0
Received compensation from Janani Suraksha Yojana	Yes=1; No=0
Availed benefit from Pradhan Mantri Matru Vandana Yojana	Yes=1; No=0
Availed benefit from Pradhan Mantri Surakshit Matritva Abhiyan	Yes=1; No=0
Availed benefit from Anemia Mukht Bharat	Yes=1; No=0
Availed benefit from Mahatma Gandhi National Rural Employment Guarantee Scheme	Yes=1; No=0
Availed benefit from Arakshit Rozgar Mahila ka Adhikar	Yes=1; No=0
Availed benefit from Anganwadi Beneficiary Scheme	Yes=1; No=0

LBMW: left-behind married women.

from the date of the interview were included. Any women with any serious non-reproductive diseases were excluded from the study (such as blindness, neurological disorder, *etc.*). The exclusions were based on the judgment of field investigators.

2.5. Identification of predictors and study indicators

The three most pivotal components of ANC services are IFA supplementation, tetanus vaccination, and ANC check-ups. The respondents were categorized into two groups, efficient users and non-efficient users of ANC services based on their antenatal health behavior. Three following criteria were defined for considering a respondent as an efficient user: (i) the respondent had consumed IFA supplementation for at least 100 days; (ii) the respondent had two shots of tetanus vaccination; (iii) at least three ANC check-ups. The respondents who fulfilled all three criteria were considered efficient users. Those who failed to fulfill either one or more criteria were considered inefficient users. This served as a dependent variable for regression analysis.

Five parameters were identified that form the sociological support system for the LBMW, namely autonomy, spousal support, family support, social circle support, and government support. For each parameter scoring index was developed, and a new variable was calculated based on composite scoring criteria (Table 1). These scores of each parameter were utilized as independent variables.

The primary indicator of antenatal behavior is overall ANC

utilization, whereas pregnancy confirmation method, registration, place of delivery (institutional delivery) and anthropometric measures during ANC checkup were secondary indicators.

2.6. Statistical analysis

Adopting from the past studies on migrant women, we analyzed if any background variable has an association with the efficient utilization of ANC behavior[25]. ANC utilization was measured as a bivariate variable. The *Chi*-square test was conducted to find the association between demographic variables and ANC utilization. In the case of lower cell frequency, Yate's adjustment (collinearity correction) was applied. Whereas the *Chi*-square was substituted with Fisher's exact test in case of lower cell count for binary variables and adjusted *Chi*-square values were used (as needed). The statistical significance was at *P* value less than 0.05 (corresponding to a 95% confidence level). Statistical analysis was conducted on SPSS (version 22.0.0.0, Manufacturer: IBM Incorporation, U.S.A.). Background characteristics were tested using the *Chi*-square test and Fisher's exact test. Binary logistic regression was performed for predictor analysis and model development.

2.7. Ethics statement

The study was ethically approved by the Institutional Review Board of IIHMR University-Jaipur Campus, India (approval No.

IIHMR-U/IRB/2022/2). As the study involved questions relating to the reproductive habits of women, a female field investigator was hired to interact. Investigators were briefed regarding the ethics and sensitivity of the topic. Any information relating to the identification of the respondents is kept strictly confidential. Names of the blocks or respondents' names are not disclosed to maintain confidentiality. The present study was conducted as per the guidelines laid down in the Declaration of Helsinki.

3. Results

3.1. Characteristics of responders

Two responses were discarded which did not fall under the sampling criteria. Hence, the analysis is based on 328 responses. The final number of respondents was equal from both blocks, *i.e.*, 164 respondents in each block. The overall sociodemographic distribution of the respondents is depicted in Table 2.

Most of the respondents were in peak reproductive age. The median age of respondents was 25 years (interquartile range=5). Slightly over half of all the respondents (52.7%, $n=173$) had up to two children and 38.5% ($n=126$) respondents had three or four children. About 8.8% ($n=29$) of respondents had more than four children. The average number of children per woman was 2.5 (± 1.3). The majority of the respondents (72%, $n=236$) were living in a joint family. Demographic data revealed that most of the respondents (94.8%, $n=311$) follow Hinduism and most of the respondents (93.3%, $n=306$) were from reserved categories of social groups, namely scheduled castes, scheduled tribes, and other backward classes. Slightly over half of the total respondents (50.9%, $n=167$) were illiterate. About one-fourth of the respondents (25%, $n=82$) were educated till secondary level.

The data revealed that the husbands of respondents were currently working in various states. The majority (18.3%, $n=60$) of the respondents' husbands were working in Delhi followed by Gujarat (17.7%, $n=58$), Tamil Nadu (15.5%, $n=51$), and Karnataka (12.2%, $n=40$). Only 7% ($n=23$) of the respondents' husbands were intra-state migrants. The majority of the respondents' husbands were marginal workers and most of them were working as factory laborers (41.2%, $n=135$), and about 29.0% ($n=95$) were working as construction laborers. About 29.8% ($n=98$) were working in other sectors, such as driver, painter, owned business, *etc.* It was found that no background variable has a bearing over antenatal behavior except literacy level (Table 3).

3.2. ANC behavior

Data revealed that the majority (79.3%, $n=260$) of the respondents came to know about being pregnant within the first three months

Table 2. Sociodemographic distribution of the respondents.

Characteristics	Number	Percentage
Age		
15-24 years	128	39.0
25-34 years	180	54.9
35 years or above	20	6.1
Religion		
Hindu	311	94.8
Muslim	17	5.2
Social groups/Caste		
Schedule caste	184	56.1
Schedule tribe	42	12.8
Other backward class	80	24.4
General caste	22	6.7
Respondent's educational status		
Illiterate	167	50.9
Literate	161	49.1
Husband's occupation		
Labor in factory	135	41.2
Labor in construction	95	29.0
Other occupations	98	29.8
Family type		
Nuclear family	92	28.0
Joint family	236	72.0
Number of children		
Up to two children	173	52.7
Three to four children	126	38.5
Five or more children	29	8.8

of pregnancy. It is worth mentioning that only 58.5% ($n=192$) respondents had a pregnancy confirmation test by urine examination. It was found that pregnancy registration was strikingly high, and about 95.1% ($n=312$) of all the respondents had their last pregnancy registered. The majority of the registration was facilitated by Accredited Social Health Activists (ASHAs) and Auxiliary Nurse and Midwife (ANMs), *i.e.*, 37.2% ($n=122$) and 20.4% ($n=67$), respectively.

The data analysis revealed that a markedly high proportion (94.2%, $n=309$) of respondents received ANC. However, the lower proportion (29.6%, $n=97$) of respondents had at least four ANC check-ups. The respondents who have ANC check-ups up to three counts were in the majority (64.6%, $n=212$). About 5.8% ($n=19$) of the respondents had no ANC check-up in the last completed pregnancy. The analysis of those who had ANC check-ups revealed that most respondents visited public health centers (89.3%, $n=276$), whereas private health centers accounted for 10.7% ($n=33$). Further, the breakdown revealed that the primary health center catered to 52.1% ($n=161$) of all ANC needs. Respondents having ANC check-ups were asked about who the primary motivator in their family or social circle for ANC check-ups is. The majority of the respondents (44.3%, $n=137$) reported that ASHA motivated them, followed by those who got motivated by their husband (16.2%, $n=50$) and mother-in-law (15.9%, $n=49$). Further analysis of respondents having ANC check-ups revealed that only 44.7% ($n=138$) had their first check-up in the first trimester of the pregnancy. The respondents who did not opt for a government facility for ANC check-ups were asked about the reasons behind

Table 3. Background characteristics of the respondents.

Variables	Efficient utilization of ANC services, <i>n</i> (%)		χ^2	<i>P</i> -value
	Yes (<i>n</i> =25)	No (<i>n</i> =303)		
Age [†]				
15-24 years	120 (93.8)	8 (6.2)	2.117	0.347
25-34 years	161 (89.4)	19 (10.6)		
35 years or above	19 (95)	1 (5)		
Religion [‡]				
Hindu	23 (7.4)	288 (92.6)	0.437	0.378
Muslim	2 (11.8)	15 (88.2)		
Social groups [†]				
Schedule caste	13 (7.1)	171 (92.9)	5.220	0.074
Schedule tribe	1 (2.4)	41 (97.6)		
Other backward class	9 (11.3)	71 (88.8)		
General caste	2 (9.1)	20 (90.9)		
Respondent's educational status				
Illiterate	160 (95.8)	7 (4.2)	8.226	0.005
Literate	140 (86.9)	21 (13.1)		
Husband's occupation				
Labor in factory	9 (6.7)	126 (93.3)	1.333	0.513
Labor in construction	6 (6.3)	89 (93.7)		
Other occupations	10 (10.2)	88 (89.8)		
Family type				
Nuclear family	6 (6.5)	86 (93.5)	0.220	0.818
Joint family	19 (8.1)	217 (91.9)		
Number of children [†]				
Up to two children	10 (5.8)	163 (94.2)	2.155	0.340
Three to four children	13 (10.3)	113 (89.7)		
Five or more children	2 (6.9)	27 (93.1)		

[†]Chi-square with Yate's adjustment. [‡]Fisher's exact test. ANC: antenatal care.

this. The data revealed 'the perception of sub-standard quality' and 'unavailability of medications at government facilities' were the most reported reasons, both reported by 72.7% (*n*=24) respondents.

Of the total sample, about two-thirds of respondents (65.5%, *n*=215) reported that they consumed IFA supplementation during the last pregnancy. The IFA was available in tablet as well as syrup form. IFA tablets were more prevalent. Analysis of those who consumed IFA revealed that the majority (82%, *n*=177) of the respondents consumed less than 100 days. A longer adherence to IFA consumption was reported relatively low *i.e.*, 12.6% (*n*=27) of the respondents consumed between 100-180 days, and a strikingly smaller proportion of respondents (5.1%, *n*=11) consumed for at least 180 days. Most of the respondents (86.9%, *n*=187) obtained IFA supplementation from government facilities, whereas merely 13% (*n*=28) bought IFA from private health facilities and pharmacy stores.

It was found that 39.3% (*n*=129) of respondents received one shot of tetanus vaccination. The proportion of respondents having two shots of tetanus vaccination was 43.6% (*n*=143). It is noteworthy that 13.4% (*n*=44) of the respondents did not receive vaccination even once, and about 3.7% (*n*=12) of respondents' vaccination status was unknown. Respondents were asked about various component services during ANC check-ups. About 84.5% (*n*=261) of the respondents stated that their weight was measured during the check-

up process, whereas blood pressure measurement was reported by 59.9% (*n*=185). About 84.1% (*n*=260) reported having the abdomen examined and 87.7% (*n*=271) reported ultrasonography done.

3.3. Social–support system of LBMW

The sociological support system is considered a bundle of five social parameters. Data revealed that social support for the respondents varied from household to household. Some have more family support, some have more spousal support, some have a strong social circle, whereas some lack in all parameters.

The most important indicator of autonomy is financial liberty. Data revealed that about 36% (*n*=118) of females were engaged in financial activity. About 88% (*n*=289) of respondents were getting a share in the remittance sent by the husband to the household. It is noteworthy to mention that getting a share in the remittance or having independent income does not automatically translate into empowerment or financial liberty. This is corroborated by the fact that out of the total sample, only 64% (*n*=210) of respondents had the freedom to spend money as per their wish. About one-fourth of all respondents reported conflict with their husbands and other household members regarding financial issues. However, only 13% (*n*=42) reported their overall relationship with their husband was unsatisfactory.

Respondents were asked to rate the comfortability of discussing

Table 4. Predictors of efficient ANC service utilization by left-behind married women.

Parameters	β	Odds (Exp. β)	95% CI	P value
Spousal support	0.57	1.16	1.08-1.79	0.007
Government support	0.40	1.49	1.04-2.14	0.027
Family support	0.31	1.36	1.23-2.57	0.034
Autonomy	0.11	1.32	1.11-2.26	0.030
Social circle support	0.27	0.31	0.66-2.61	0.435
Constant	-6.43	0.22	-	0.004

CI: confidence interval. ANC: antenatal care.

Table 5. A binary logistic regression for association of factors with ANC behavior.

Parameters	β	Odds (Exp. β)	95% CI	P value
Age	0.41	1.515	0.606-3.788	0.375
Religion	0.22	1.243	0.243-6.366	0.794
Caste	0.42	1.527	0.320-7.288	0.596
Respondent's educational status	1.53	4.632	1.727-12.423	0.002
Husband's occupation	-0.02	0.979	0.707-1.356	0.900
Family type	0.60	1.827	0.629-5.309	0.268
Number of children	0.45	1.563	0.708-3.452	0.269
Constant	-6.38	0.001	-	0.170

CI: confidence interval. ANC: antenatal care.

various reproductive health-related topics with household and social circle members (one being extremely uncomfortable and five extremely comfortable). Analysis of cumulative scores revealed that overall respondents were most comfortable with their mother and sister (3.8 ± 0.8), followed by their husband (3.7 ± 0.9). It was found that they feel most uncomfortable while discussing reproductive issues with neighbors (2.6 ± 1.0). Analysis of the average score of each topic revealed that the most easily discussed topic is contraceptive (3.4 ± 0.8), whereas the most uncomfortable topic to discuss is infertility (28.0 ± 1.1).

There were a few health schemes rolled out for the upliftment of rural and underprivileged families. Slightly over half of the respondents (52%, $n=172$) reported receiving financial assistance for delivery under Janani Suraksha Yojna. For safeguarding the health and nutritional status of pregnant women and children, the Bihar Anganwadi Beneficiary Scheme is also operationalized. Data revealed Bihar Anganwadi Beneficiary Scheme is the most utilized government scheme. About 72% ($n=235$) of respondents benefited from this scheme.

The majority of respondents (52.7%, $n=173$) were not a member of self-help groups. About 23% ($n=108$) stated that they received help from self-help groups in one or more forms. Analysis of those who received help showed that the most common help respondents received was information regarding various reproductive issues and schemes (72%, $n=78$), followed by assistance during ANC check-ups or delivery (47%, $n=51$). Only 10% ($n=11$) of respondents received financial support.

The regression results showed that four out of five social parameters had a significant effect in predicting ANC behavior. 'Spousal support' is the strongest predictor (standardized regression coefficient [$\beta=0.57$, odds ratio (OR) 1.16, 95% confidence interval (CI) 1.08-1.79, $P=0.007$]. The government supports an individual by creating a social-security net which is a bundle of social upliftment schemes and programs. This was found to be the second strongest

predictor ($\beta=0.40$, OR 1.49, 95% CI 1.04-2.14, $P=0.027$), followed by 'family support' ($\beta=0.31$, OR 1.36, 95% CI 1.23-2.57, $P=0.034$) and 'autonomy' ($\beta=0.11$, OR 1.32, 95% CI 1.11-2.26, $P=0.030$). The 'social circle support' was found to be non-significant in predicting ANC behavior ($P>0.05$) (Table 4). Omnibus tests revealed that the generated model is adequately able to explain the association of the variables and fits the data ($P=0.02$). Further, the Hosmer-Lemeshow test was performed to check the model failure, which revealed the model is statistically unlikely to fail ($P=0.24$). The model variance was calculated using Nagelkerke R-square, which revealed a strong association between predictors and the outcome variable.

It is worth mentioning that binary logistic regression of ANC behavior with background characteristics was also conducted to check the association of the background variables with ANC behavior, the findings of which are presented separately in Table 5.

4. Discussion

The sample is predominantly composed of socio-economically backward women from rural areas. No background characteristic was found to have any effect on ANC behavior except education level. It is noteworthy to mention that past studies have indicated education as a pivotal factor for the autonomy of females which ultimately gets reflected into the health-seeking behavior[26,27]. It was found that the majority of the respondents were either educated till secondary level or completely illiterate. This underscores a polarized phenomenon of women's education, which needs to be analyzed in future research. The findings also show that about 95% of the households received remittance but only 88% of the respondents actually got a share in remittance amount. Previous research found that increased remittance received by households does not always signify an improvement in the status of women in the family or community. This is because other family members (like

in-laws) may assume the position of financial decision-maker for the received remittance in the absence of the husband[28]. The majority of results (relating to ANC behavior) were in line with the National Family Health Survey-5th findings of Bihar[3]. However, there is a trend of underperformance in most of the key antenatal indicators, namely IFA consumption, tetanus vaccination, and ANC check-up counts. This reinforces the overall literature claim that migration leads to poor reproductive health behavior.

We found very limited studies that explore the direct impact of social circles (friends and neighbors) on antenatal behavior. These studies indicated a positive association between a social circle and adequate antenatal behavior[29]. However, in the present study, we found no such association. The reason could be the prevalent patriarchal norm in rural areas that limits the household's females to making friends[30]. Another logical explanation is that the advice received by the social circle gets overruled by the advice received by household members or the migrant husband.

It is well documented in the literature that rural and backward populations face many challenges in seeking health in India[31]. This is partly corroborated by the present study's findings. It is critical to point out that the findings of our study are corroborated by a survey conducted by Fulpagare *et al* in three states of India, including Bihar. The study reports government support and social scheme entitlements do play a positive role in ANC service utilization by pregnant females but does not analyze the effect of autonomy and spousal support[32]. This knowledge rift is filled by the present study. Further, another study reported that women of lower wealth quintile have higher odds of non-conformance to healthy reproductive practices[33]. In the present study, we found the same. The LBMW were mostly from low socioeconomic sections and many ANC utilization indicators (namely, IFA consumption, ANC visit count, *etc.*) were showing a lack of adherence in these women.

There are some limitations in the study. Due to a lack of funding, we narrowed research by enquiring only about the last full-term pregnancy. It is important to point out that the ideal recommendation for IFA consumption during pregnancy is 180 days. However, the present study considers the minimum recommended number of consumption days, *i.e.*, 100 days as per the Ministry of Health and Family Welfare, India[34]. Further, instead of a minimum of four, only three ANC check-ups were considered. This was done because the number of efficient users fulfilling the more stringent criteria was not adequate for finding the correlation and subjecting data to statistical operation. By doing so, the accuracy of the regression results was ensured. The model developed is applicable for predicting the behavior of LBMW of similar socio-demographic conditions within India. The model has the potential to explain the ANC behavior of LBMW in other nations of the Indian subcontinent, but this needs to be verified in future research by taking a larger sample size.

In conclusion, the present study revealed a lagging-behind trend of ANC utilization behavior of LBMW staying in rural areas of Patna, Bihar. There are four factors that determine ANC services utilization, namely autonomy, spousal support, family support, and government support. Using these predictors, we proposed a model that could

be employed to predict the ANC behavior of LBMW (having comparable background characteristics) staying in other parts of India. The developed model is novel as there is no such analysis done in past studies to the best of our knowledge. The policymakers could focus on the identified predictors to strengthen and modify the existing policies for LBMW or develop a new policy. The study suggests that the need of the hour is a strategic intervention for behavioral modification of not only the LBMW but also their family members along with strengthening of the existing social-security net. One such intervention could be the motivation of the family members for proactive involvement during the pregnancy period of LBMW which can be achieved by mobilizing ASHA workers and village Self-help Group (SHG) members. The male outmigrants (when they visit back to their hometown) should be counseled by a local community leader or a health worker in a dedicated face-to-face interaction. Male outmigrants shall be educated about the importance of ANC services highlighting the role of husband's support in ensuring LBMW's high adherence to healthy ANC practices. We strongly believe these interventions will contribute to the reduction of negative pregnancy outcomes.

Conflict of interest statement

The authors have disclosed no conflicts of interest.

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Authors' contributions

The survey was conducted by Fahad Afzal. Both authors, Fahad Afzal and Arindam Das contributed equally in analysis and preparation of the manuscript.

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