

## ASSOCIATION BETWEEN SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES AND AWARENESS-LEVEL RELATED TO ANTENATAL CARE (ANC) SERVICES AMONG REPRODUCTIVE-AGE WOMEN IN SOUTH SIKKIM, INDIA

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**Abstract:** Antenatal care (ANC) services are critical to lowering the global maternal mortality rate since a woman dies every minute from pregnancy-related problems and childbirth. The main problems that prevent women from using ANC services in our nation are a lack of education and awareness among women regarding ANC services. The present investigation aimed to determine the association between socio-economic variables and knowledge and awareness related to ANC services among women in South Sikkim, India. The community-based cross-sectional study included 250 reproductive-aged (15-49 years) women from a remote area in South Sikkim, India. A pre-structured interview schedule was used to collect data on knowledge and awareness of ANC services, as well as socio-economic and demographic factors, through household visits. A total of 79.2% of respondents reported being aware of and knowledge and awareness about ANC related services. Certain socio-economic and demographic variables, such as maternal age, age at marriage, age at first pregnancy, marital status, family size, husband education, husband occupation, family income, and parity, were found to have significant associations with knowledge and awareness levels of ANC related services ( $p < 0.05$ ) in the BLR analysis. Age, age at marriage, parity, and family income were revealed to have a significant association with knowledge and awareness level ( $p < 0.05$ ) in a stepwise multiple logistic regression analysis. Appropriate healthcare initiatives are required to deliver information and health education, enhance their awareness of ANC services, and strengthen community engagement and utilisation.

**Keywords:** Antenatal Care, Demographic Variables, Socio-Economic Variables, South Sikkim, Awareness, Association

### Introduction

The Safe Motherhood Initiative was founded to reduce the global maternal mortality rate (MMR), and existing data shows a significant incidence of maternal and infant mortality every day around the world (World Bank, 2007; Patel et al., 2016; Chweya et al., 2018; UNICEF, 2019; Santora, 2020; Belay et al., 2022). Antenatal Care (ANC) services are regarded as one of the Safe Motherhood Initiatives' pillars for promoting overall reproductive health performance indicators (e.g., MMR, pregnancy outcomes, and childbirth) in communities (Ali et al., 2010; Berhan and Berhan, 2014; Patel et al., 2016; Arya et al., 2017; Konje et al., 2018; Latoff et al., 2020; Belay et al., 2022). Furthermore, ANC services are regarded as the backbone of obstetrical services since they are the means through which maternal

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and pregnancy-related problems are recognized and appropriate management is delivered (Ali et al., 2010; Arya et al., 2017; Chweya et al., 2018; Latoff et al., 2020). The WHO recommends a minimum of four ANC visits throughout the gestation period for healthy pregnancy and childbirth (WHO, 2006; Amoah et al., 2016; Basha, 2019; Belay et al., 2022; Kasagama et al., 2022). Clinical check-ups, a blood test to estimate haemoglobin, measurement of height and weight, examination of the abdomen, a urine test to estimate sugar and albumin, fetal examination via ultrasound, tetanus toxoid vaccination, and supplementation of iron and folic acid tablets are the main obstetrical services available during ANC visits (Adewoye et al., 2013; Munuswamy et al., 2013; Tiwari and Mishra, 2014; Arya et al., 2017; Kumar and Singh, 2017; Ali et al., 2020). Finally, all of these services result in overall good pregnancy outcomes and a lower maternal mortality ratio among pregnant women (Carroli et al., 2001; Matthews et al., 2001; Wehby et al., 2009; Ahmad et al., 2018; Ali et al., 2020; Belay et al., 2022). Several studies have demonstrated that certain socio-economic and demographic characteristics (e.g., maternal age, education, household income, parity, age at marriage, age at pregnancy, occupation, and husband support) may limit women's knowledge and awareness of ANC services (Amoah et al., 2016; Basha, 2019; Belay et al., 2022; Kasagama et al., 2022).

According to the National Family Health Survey (NFHS-4, 2015–2016), more than one in seven women in India did not receive ANC during their last pregnancy, with only 16.7% of women in rural India receiving the recommended ANC visits (i.e.,  $\geq 4$  times), at least one tetanus toxoid vaccination, and iron and folic acid tablets (Balagopal, 2018; Rustagi et al., 2021). According to the most recent National Family Health Survey, 2019–2020 (NFHS-5), there is an increase in ANC visits by pregnant women in the majority of states and union territories in India. In comparison to NFHS-4, Sikkim experienced a decrease in the number of mothers seeking ANC in the first trimester in 2019–2020 (Akhil et al., 2021). One of the most important factors in enabling women to be aware of their health state and seek necessary ANC is health awareness (Zhao et al., 2012; Adewoye et al., 2013; Patel et al., 2016; Saah et al., 2021). Several studies have found that a lack of understanding and awareness about ANC services has dramatically impacted utilization among pregnant women in a variety of demographics determinants (Taguchi et al., 2003; Patel et al., 2016; Ahmad et al., 2018; Kumar et al., 2019; Afaya et al., 2020). Similarly, several socio-economic and demographic variables were discovered to have substantial relationships with population knowledge and awareness of ANC service consumption (Matthews et al., 2001; Taguchi et al., 2003; Patel et al., 2016; Belay et al., 2022). As a result, it is critical to evaluate the potential socio-economic and demographic factors affecting women's access to quality ANC services linked to maternal healthcare, pregnancy outcomes, and birthing in the population.

The present study sought to ascertain the level of awareness and knowledge about ANC services among rural women in South Sikkim, India. Furthermore, the study seeks to ascertain the association between certain socio-economic and demographic characteristics and knowledge and awareness of women of reproductive ages related to ANC services. This study will aid in the formulation of health intervention programmes as well as identify gaps where new health policies are required for implementation in order to raise women's awareness on maternal health care.

### **Material and Methods**

The present community-based cross-sectional study included 250 reproductive women living in rural parts of the South Sikkim district of Sikkim, India. The study areas are 17 kilometres from Namchi, the district headquarters of South Sikkim. The district has a total population of 146850 people (76670 males and 70180 females; gender ratio: 915), with a literacy rate of 81.42% (86.52% males and 75.82% females). This district is home to people from Sikkim's three ethnic communities: Lepchas, Bhutias, and Nepalese. This study was conducted on women between the ages of 15 and 49 living in rural locations, and it mostly included a diverse population of Lepchas, Bhutias, and Nepalese ethnic groups. Furthermore, the study areas were identified using the purposive sampling method based on numerical strength, dominance, and easy road accessibility. The standard sample size estimation approach of Lwanga and Lemeshow (1991) was used to calculate the minimal number of research participants required for successfully estimating population knowledge and awareness levels. The estimated sample size  $n = [Z\alpha/2 * \sqrt{p * (1-p)}] / E$ , where,  $n$  = the required sample size,  $Z\alpha/2$  = the critical value of the standard normal distribution at  $\alpha/2$  level of significance (for a 90% confidence level,  $Z\alpha/2 = 1.645$ ),  $p$  = the expected proportion in the population (50%),  $E$  = the desired absolute precision (6%) were utilized. This technique considers an expected population proportion of 50%, an absolute precision of 6%, and a confidence interval of 90%. However, it is widespread practice in many disciplines of health research to choose a sample size estimation confidence level of 90%. A 90% confidence level means that the researcher is 90% positive that the true population parameter—in this case, the percentage of the population that has a particular level of knowledge or awareness—lies within the estimated confidence interval. The projected minimum sample size for the present study was 225 research participants. As a result, 270 homes or subjects were approached in order to reach the minimum sample size, and 20 (7.40%) subjects were eliminated or refused to participate in the present study. As a result, a total sample size of 250 study participants or homes was finally evaluated, with a 92.60% participation rate. The research participants volunteered to participate, and informed consent was obtained from all informants prior to data collection. Household visits and stratified random sample methods were used to

include research participants. Furthermore, to prevent subject selection uncertainty, research subjects with a long history of disease or physical deformity were excluded. The research participants were also given a full explanation of the aims, nature of their involvement, and data collection processes.

Age, age at marriage, age at first pregnancy, marital status, family size, maternal education, husband education, occupation, husband occupation, religion, parity, and family income, as well as the timing of ANC visits, were obtained to determine their relationship with the level of awareness and knowledge of ANC services. Data on family household income was grouped into three categories including low-income (below the 50th–75th percentile, Rs. 4250), middle-income (between the 50th–75th percentile, Rs. 4250–9000), and high-income (above the 75th percentile, > Rs. 9,000).

#### *Determination of awareness-level*

A set of questions was used to assess the awareness levels (knowledge is also considered a level of awareness) of rural reproductive women in South Sikkim about ANC services. Questions about the meaning of ANC, tetanus toxoid vaccination, iron and folic acid, height and weight measurement, fetal examination/ultrasound, urine test, and blood test during pregnancy were used to assess knowledge and awareness of ANC services. Each parameter received one point for the right answer and zero points if they responded that they didn't know and the answer was incorrect. A woman who can answer 60% of the overall questions related to knowledge and awareness levels is deemed to have appropriate knowledge and awareness, whereas a woman who can answer less than 60% is considered to have inadequate knowledge and awareness of ANC related services in the population.

#### *Statistical Analysis*

The data was coded and entered into MS Excel before being analyzed with the Statistical Package for Social Sciences (SPSS, 16.0). The findings were given as frequencies and percentages and were analyzed using cross-tabulations of dependent and independent variables. Pearson's chi-square ( $\chi^2$ ) analysis was used to see if there were any statistically significant relationships between socio-economic and demographic characteristics and ANC visits. A binary logistic regression (BLR) study was used to determine the relationships between ANC service awareness levels and socio-economic and demographic characteristics. The BLR approach allows the determinant variables to be controlled by comparing them to a reference category. Those research participants who had adequate or inadequate awareness of ANC services that could be connected with determinant characteristics were used to generate the dependent variable in a regression model. In addition, stepwise multiple logistic regressions with forwarding conditional model analysis were used

to determine the most successful predictor factors among the variables evaluated in the BLR study. In the stepwise multiple logistic regression model analysis, the predictor variables that showed significant connections in the univariate BLR analysis were examined to predict the most effective factors. The determinant variables (e.g., age, age at marriage, age at first pregnancy, marital status, family size, education, husband’s education, occupation, husband’s occupation, religion, parity, family income, and frequency of ANC visits) were entered into the BLR model analysis as a set of dummy variables, and the outcomes were determined by comparing with the reference group. A p-value of less than 0.05 was considered statistically significant.

**Results**

The association of knowledge and awareness levels of ANC related services with socio-economic and demographic variables is depicted in Table-1. The results of the present investigation showed that a total of 79.2% of women were aware of and had adequate knowledge of ANC services, and 20.8% of women were not aware of and did not have adequate knowledge about ANC related services (Table 1). The results of the Chi-square ( $\chi^2$ ) analysis indicated that certain socio-economic and demographic variables showed significant differences in knowledge and awareness levels of ANC services, including maternal age ( $\chi^2=67.72$ ;  $p<0.05$ ), age at marriage ( $\chi^2=6.38$ ;  $p<0.05$ ), age at first pregnancy ( $\chi^2=5.64$ ;  $p<0.05$ ), marital status ( $\chi^2=12.81$ ;  $p<0.05$ ), family size ( $\chi^2=31.80$ ;  $p<0.05$ ), maternal education ( $\chi^2=59.75$ ;  $p<0.05$ ), husband education ( $\chi^2=34.48$ ;  $p<0.05$ ), husband occupation ( $\chi^2=13.93$ ;  $p<0.05$ ), parity ( $\chi^2=44.07$ ;  $p<0.05$ ), family income ( $\chi^2=31.54$ ;  $p<0.05$ ) and ANC visits ( $\chi^2=54.16$ ;  $p<0.05$ ) (Table 1).

**TABLE - 1: FREQUENCY DISTRIBUTION OF SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES WITH AWARENESS LEVELS OF ANC SERVICES AMONG WOMEN IN SOUTH SIKKIM [NOTE: VALUES ARE IN PARENTHESIS INDICATES PERCENTAGES]**

Variables	Frequency (95%CI)	Percent	AWARENESS		Chi-value	d.f.	P-value
			Yes 198 (79.2)	No 52 (20.8)			
<b>Age Group</b>							
15-24 years	41(29.42-55.62)	16.4	41 (100)	0 (0.0)	67.72	2	0.001
25-34 years	95(76.86-116.13)	38.0	93 (97.9)	2 (2.1)			
35-49 years	114(94.04-136.95)	45.6	64 (56.2)	50 (43.8)			
<b>Age at Marriages</b>							

<18 years	115(94.94-138.04)	46.0	83 (72.2)	32(27.8)	6.38	1	0.012
≥ 18 years	135(113.19-159.79)	54.0	115(85.2)	20(14.8)			
<b>Age at First Pregnancy</b>							
<18 years	56(42.30-72.72)	22.4	38 (67.8)	18 (32.2)	5.64	1	0.018
≥ 18 years	194(167.66-223.30)	77.6	160 (82.5)	34 (17.5)			
<b>Marital Status/Living With Spouses</b>							
Spouse	239(209.67-271.31)	95.6	194 (81.2)	45 (18.8)	12.82	1	0.000
Widow/ Separated	11(5.49-19.68)	4.4	4 (36.4)	7 (63.6)			
<b>Family Size</b>							
Small	86(68.79-106.21)	34.4	79 (91.8)	7 (8.2)			
Medium	134(112.27-158.71)	53.6	106 (79.1)	28 (20.9)	31.79	2	0.000
Large	30(20.24-42.83)	12.0	13 (43.3)	17 (56.7)			
<b>Education</b>							
No Formal	51(37.97-67.06)	20.4	22 (43.2)	29 (56.8)			
Primary	56(42.30-72.72)	22.4	42 (75)	14 (25)	59.75	3	0.000
Secondary	121(100.40-144.58)	48.4	112 (92.6)	9 (7.4)			
Tertiary	22(13.79-33.31)	8.8	22 (100)	0 (0.0)			
<b>Husband Education</b>							
No Formal	43(31.12-57.92)	17.2	22(51.2)	21 (48.8)			
Primary	61(46.66-78.36)	24.4	44 (72.2)	17 (27.8)	34.47	3	0.000
Secondary	115(94.94-138.04)	46.0	102 (88.7)	13 (11.3)			
Tertiary	31(21.06-44.00)	12.4	30 (96.7)	1 (3.3)			
<b>Occupation</b>							
Housewives	202(175.10-231.86)	80.8	161 (79.7)	41 (20.3)	0.16	1	0.688
Others	48(35.39-63.64)	19.2	37 (77.1)	11 (22.9)			
<b>Husband Occupation</b>							
Farmer	61(46.66-78.36)	23.8	55 (90.2)	6 (9.8)	13.93	2	0.001
Govt-Employee	99(80.46-120.53)	38.7	67 (67.7)	32 (32.3)			
Others	90(72.37-110.63)	35.2	76 (84.4)	14 (15.6)			

Religion							
Hindu	178(152.81-206.15)	69.5	142 (79.7)	36 (20.3)	1.062	2	0.449
Buddhist	55(41.43-71.59)	21.5	41 (74.5)	14 (25.5)			
Christian	17(9.90-27.22)	6.6	15 (88.3)	2 (11.7)			
Parity							
1	85(67.89-105.10)	33.2	78 (91.7)	7 (8.3)	44.07	2	0.001
2	97(78.66-118.330)	37.9	85 (87.6)	12 (12.4)			
3>	68(52.81-86.21)	26.6	35 (51.5)	33 (48.5)			
Family income group							
High income	53 (39.70-69.32)	21.2	49 (92.5)	4 (7.5)	24.87	2	0.001
Middle income	72 (56.34-90.67)	28.8	66 (91.6)	6 (8.4)			
Low income	125 (104.05-148.93)	50.0	83 (66.4)	42 (33.6)			
Timing of ANC visits							
≤3 visits	86 (68.79-106.21)	34.4	85 (42.9)	1 (1.9)	54.15	1	0.001
>4 visits	113 (93.13-135.86)	45.2	113(45.2)	51(98.1)			

**Binary logistic regression analysis and association of socio-economic and demographic variables with knowledge and awareness levels related to ANC services**

The BLR model was fitted to find out the odds for the socio-economic and demographic variables for knowledge and awareness of ANC services among women of South Sikkim (Table 2). The results indicated that most of the socio-economic and demographic variables were significantly associated with knowledge and awareness levels ( $p < 0.05$ ) related to ANC services, except women’s education, women’s occupation, and religion ( $p > 0.05$ ). The results of the BLR model showed that the age group of 25-34 years (Odds: 0.03; 95% CI: 0.01-0.12), age at marriage (i.e., <18 years) (Odds: 2.22; 95% CI: 1.19-4.42) and age at first pregnancy (i.e., <18 years) (Odds 2.23; 95% CI: 1.12-4.37) were significantly associated with knowledge and awareness level of ANC services ( $p < 0.05$ ). The BLR results further showed that women belonging to spouse marital status (Odds: 0.13; 95% CI: 0.04-0.47), small family size (Odds: 0.07; 95% CI: 0.24-0.20) large family size (Odds: 0.20; 95% CI: 0.09-0.47) were found to have a significantly lower effect on knowledge and awareness level on ANC services ( $p < 0.01$ ). The BLR analysis showed that women belonging to the low-family income group (Odds: 0.16; 95% CI: 0.06-0.48), and middle-family income groups (Odds: 0.18; 95% CI: 0.72-0.45), 3rd parity (Odds: 0.95; 95% CI: 0.04-0.25) and 2nd parity (Odds: 0.15; 95% CI: 0.07-0.32) and no formal education of women’s husband (Odds: 28.64; 95% CI: 3.58-229.25) and

‘Government employee’ husband occupation (Odds:2.59; 95% CI: 1.28-5.27) had a significant association with knowledge and awareness level related to ANC services among women of South Sikkim ( $p<0.05$ ) ( Table 2).

**Stepwise multiple logistic regression analysis and association of socio-economic and demographic variables with knowledge and awareness levels related to ANC services**

The results of the stepwise multiple logistic regression with forwarding conditional model analysis undertaken to ascertain the most independent predictor variables for the knowledge and awareness level related to ANC services are depicted in Table - 3. The inclusion of the predictor variables was done based on the criterion that those socio-economic and demographic variables showed significant associations in the univariate BLR analysis ( $p<0.05$ ). In the first stepwise multiple logistic regression analysis, the women belonging to the age group of 25-34 years had 0.028 times (95% CI: 0.06-0.20) lower odds of having less knowledge and awareness level of ANC related services. In the second stepwise multiple logistic regression, the women belonging to the age group of 25-34 years and parity 1 and parity 2 were found to have 0.035 times (95% CI: 0.08-0.16) and 0.541 times (95% CI: 0.17-1.68) and 2.633 times (95% CI: 0.89-7.75) significant risks in terms of knowledge and awareness level related to ANC- related services, respectively ( $p<0.05$ ). Similarly, in the third step-wise multiple logistic regression, 25-34 years, 1st parity, 2nd parity, low-income group and the middle-income group had 0.035 times (95% CI: 0.08-0.16), 0.35 times (95% CI: 0.11-1.22), 0.35 times (95%CI:0.11-1.22), 1.59 times (95% CI: 0.49-5.18), 1.14 times (95% CI: 0.26-4.97) and 4.66 times (95% CI: 1.35-16.08) had significant risks in terms of knowledge and awareness level related to ANC related services, respectively ( $p<0.05$ ). Finally, the last step-wise multiple logistic model showed that age (i.e. 25-34 years) (Odds: 0.03; 95% CI: 0.01-0.15), age at marriage (i.e. <18 years) (Odds: 0.34; 95% CI: 0.14-0.80), 1st parity (Odds: 0.24; 95% CI: 0.06-0.85) and 2nd parity (Odds: 1.35; 95% CI: 0.42-4.41) and middle-income group (Odds: 0.87; 95% CI; 0.19-3.88), and low-income group (Odds: 4.06; 95% CI: 1.16-14.23) had significant risks in terms of knowledge and awareness level on ANC services ( $p<0.05$ ) .

**TABLE - 2: BINARY LOGISTIC REGRESSION ANALYSIS OF AWARENESS OF ANC SERVICES AND SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES AMONG WOMEN OF SOUTH SIKKIM [® REFERENCE CATEGORY]**

Variables	B	SE	Wald	d.f.	P	Odds	95% CI	
<b>Age (years)</b>								
15-24 years	-20.956	6277.08	0.000	1	0.997	0.00	0.000	0.000
25-34 years	-3.593	0.74	23.62	1	0.000	0.03	0.12	0.117
35-49 years ®	1							



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Age at marriage								
<18 years	0.796	0.319	6.214	1	0.013	2.22	1.19	4.42
≥18 years®	1							
Age at first pregnancy								
<18 years	0.802	0.343	5.467	1	0.019	2.23	1.12	4.37
≥18 years®	1							
Marital status//Living With Spouses								
Spouse	-2.021	0.648	9.718	1	0.002	0.13	0.04	0.47
W i d o w / Separated®	1							
Family size								
Small	-2.692	0.540	24.877		0.00	0.07	0.24	0.20
Medium	1.599	0.425	14.143	1	0.00	0.20	0.09	0.47
Large®	1							
Education								
No Formal	21.479	8569.159	0.000	1	0.998	2.129	0.00	0.00
Primary	20.104	8569.159	0.000	1	0.998	0.00005	0.00	
Secondary	18.682	8569.159	0.000	1	0.998	0.00001	0.00	
Tertiary®	1							
Husband's Education								
No Formal	3.355	1.061	9.991	1	0.002	28.64	3.58	229.25
Primary	2.450	1.056	5.385	1	0.20	11.59	1.46	91.81
Secondary	1.341	1.058	1.606	1	0.205	3.82	0.48	30.43
Tertiary®	1							
Occupation								
Housewife	-0.155	0.385	0.161	1	0.688	0.86	0.40	1.82
Others®	1							
Husband's occupation								
Farmer	-0.524	0.519	1.019	1	0.313	0.59	0.21	1.64
Government Employee	0.953	0.362	6.941	1	0.008	2.59	1.28	5.27
Others®	1							
Religion								
Hindu	0.643	0.776	0.687	1	0.407	1.90	0.42	8.69
Buddhist	0.940	0.814	1.335	1	0.248	2.56	0.56	12.63
Christian®	1							

Parity								
1®	1							
2	-1.899	0.392	23.419	1	0.000	0.15	0.15	0.32
3>	-2.352	0.463	25.783	1	0.000	0.95	0.04	0.25
Family income Group								
High®	1							
Middle	-1.717	0.467	13.539	1	0.000	0.18	0.72	0.45
Low	-1.824	0.553	10.867	1	0.001	0.16	0.06	0.48
Frequency of ANC visits								
≥4®	1							
≤3	-6.904	1260.346	0.00	1	0.996	0.01	0.000	0.000

**TABLE - 3: STEP-WISE MULTIPLE BINARY LOGISTIC REGRESSION ANALYSIS OF SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES WITH KNOWLEDGE AND AWARENESS LEVEL OF ANC SERVICES AMONG WOMEN OF SOUTH SIKKIM**

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B) Lower	95% C.I. for EXP(B) Upper	
Step 1	Age			23.622	2	0.000			
	15-24 years	-20.956	6277.087	0.000	1	0.997	0.00	0.00	
	25-34 years	-3.593	0.739	23.622	1	0.000	0.028	0.06	0.20
	35-49 years®						0.78		
Step 2	Age			20.147	2	0.000			
	15-24 years	-20.639	6211.604	0.000	1	0.997	0.00	0.00	
	25-34 years	-3.411	0.760	20.147	1	0.000	0.035	0.08	0.16
	Parity			13.721	2	0.001			
	2	-0.614	0.581	1.119	1	0.290	0.541	0.17	1.68
	3>	0.968	0.551	3.090	1	0.079	2.633	0.89	7.75
	1 ®						0.622		
Step 3	Age			19.116	2	0.000			
	15-24 years	-20.622	6077.827	0.000	1	0.997	0.000	0.00	
	25-34 years	-3.339	0.764	19.116	1	0.000	0.035	0.08	0.16
	Parity			11.248	2	0.004			
	2	-1.040	0.632	2.708	1	0.100	0.35	0.11	1.22
	3>	0.468	0.601	0.606	1	0.436	1.59	0.49	5.18
	Income Group			10.240	2	0.006			
	Middle	0.131	0.751	0.031	1	0.861	1.14	0.26	4.97
	Low	1.540	.631	5.958	1	0.015	4.66	1.35	16.08
High®						0.325			

Step 4	Age			19.482	2	0.000			
	15-24 years	-20.847	5924.970	.000	1	0.997	0.00	0.000	
	25-34 years	-3.420	0.775	19.482	1	0.000	0.03	0.01	0.15
	Age at marriage	-1.097	0.446	6.049	1	0.014	0.34	0.14	0.80
	Parity			13.315	2	0.001			
	1	-1.451	0.658	4.861	1	0.027	0.24	0.06	0.85
	2	0.304	0.602	0.254	1	0.614	1.35	0.42	4.41
	Income Groups			10.034	2	0.007			
	Middle-income group	-0.141	0.764	0.034	1	0.854	0.87	0.19	3.88
	Low-income group	1.402	0.639	4.817	1	0.028	4.06	1.16	14.23
	High-income group						2.42		
a. Variable(s) entered on step 1: AGE.									
b. Variable(s) entered on step 2: PARITY.									
c. Variable(s) entered on step 3: INCOME GROUP.									
d. Variable(s) entered on step 4: AGE AT MARRIAGE.									

### Discussion

Several studies have demonstrated that raising public awareness of regular ANC services improves both maternal and pregnancy-related disorders in the community (Carroli et al., 2001; Nisar and White, 2003; Shafqat et al., 2015; Uwambaye et al., 2020). According to the present study’s findings, 79.2% of women in South Sikkim, India, have enough understanding and awareness of ANC services (Table 1). Furthermore, while nearly all women supported ANC services, 20.8% of rural women in South Sikkim were unaware of the proper use and requirements of fetal inspection, urine testing, and blood testing during pregnancy (Table 1). Furthermore, the WHO has suggested iron and folic acid supplements to minimize the relative risks of pregnancy and delivery outcomes (Kawai et al., 2011; Butler et al., 2015; Ahmad et al., 2018). Furthermore, the findings of the present study demonstrated that younger women (aged 15–24 years) had lower awareness of ANC services than older women (aged 35–49 years) ( $p < 0.05$ ) (Table 2). Furthermore, the stepwise multiple binary logistic regression analysis revealed that risks increased by 0.028 times among women aged 25 to 34 years in terms of knowledge and awareness of ANC services (Table 3). This might be explained by younger women being more exposed to the media and, consequently, being more aware of maternal healthcare (Sserwanja et al., 2011). The present study’s findings are also consistent with previous findings from Egypt (Rassad and Essa, 2010), Nepal (Sanjel et al., 2011), Maharashtra, India (Patel et al., 2016), and Uganda (Sserwanja et al., 2022). Women

who marry before the age of 18 had a 2.22 times higher chance of knowing about and being aware of ANC related services (Table 2).

The BLR analysis revealed that pregnancy at the age of 18 years (odds: 2.23 times) was associated with considerably greater chances of knowing and being aware of ANC services (Table 2). The present study found that marital status has a beneficial influence on the level of knowledge and awareness of ANC related services. Furthermore, BLR research revealed that married women or those living with partners are more likely than single women to be aware of ANC related services (odds: 0.13 times). Similar findings have been reported in Southern Tigray, Ethiopia (Kassyou, 2008), Ethiopia (Abosse et al., 2010), Mt. Cameroon (Anchang-Kimbi et al., 2014), South Sudan (Arop, 2015), Punjab, India (Kaur et al., 2018), an urban slum in Delhi (Bharti and Sherin, 2019), Burundi (Bharti and Sherin, 2019). (Habonimana and Batura, 2021). The present study found that family size was substantially connected to knowledge and awareness of ANC related services ( $p < 0.05$ ) (Table 1). Furthermore, BLR analysis revealed that women with small family sizes (odds: 0.07 times) and medium family sizes (odds: 0.20 times) faced significantly lower risks in terms of knowledge and awareness of ANC related services (Table 2). The present study found that the husband's education was significantly related to his knowledge and awareness of ANC related services. Furthermore, BLR analysis revealed that women whose husbands had no formal education (odds: 28.64 times) were at considerably higher risk of ANC related service knowledge and awareness ( $p < 0.01$ ) (Table 2). Several studies have revealed similar conclusions regarding community knowledge of ANC services (Gupta and Ghai, 2007; Rassad and Essa, 2010; Siddique et al., 2018; Tiruaynet and Muchie, 2019; Afaya et al., 2020). Several researchers have suggested that maternal education is the most important factor in population utilization of child and maternal health-related services (Gupta and Ghai, 2007; Rassad and Essa, 2010; Siddique et al., 2018; Tiruaynet and Muchie, 2019).

Furthermore, family income was found to be strongly connected to knowledge and awareness of ANC related services ( $p < 0.05$ ). Similarly, the BLR analysis revealed that women from low-income families (odds: 0.16; 95% CI: 0.06-0.48) and middle-income families (odds: 0.18 times) were at higher risk in terms of knowledge and awareness of ANC related services (Table 2). Furthermore, the findings of the stepwise multiple regression analysis revealed that low-income group women were 4.06 times (95% CI; 0.19-3.88) more likely to be unaware of ANC services (Table 3). Several studies have found that women with greater earnings are more aware of ANC and use it earlier in Turkey (Celik and Hotchkiss, 2000), China (Berhan and Berhan, 2014), Nepal (Pandey and Karki, 2014), Bangladesh (Siddique et al., 2018), Western Ethiopia (Tiruaynet and Muchie, 2019), and Pakistan (Ali et al., 2020). Similarly, the present research reveals that parity was strongly associated with ANC awareness ( $p < 0.05$ ). Further BLR analysis revealed that women with 3rd

parity (odds: 0.95 times) and 2nd parity (odds: 0.15 times) had significantly lower risks in terms of ANC knowledge and awareness levels (Table 2). Similarly, the stepwise multiple logistic regression analysis revealed that risks increased by 0.35 and 1.59 times, respectively, among women in the first and second parity groups ( $p < 0.05$ ) (Table 3). Furthermore, reproductive women with fewer children were less aware of ANC services than women with a large number of children ( $p < 0.05$ ). Women who had more children were more conscious since they had previous delivery experience (Hazarika, 2010; Arop, 2015; Gitonga, 2017; Habonimana and Batura, 2021). Furthermore, the present study found statistically in significant relationship between women's work, religion, and timing of ANC visits and services ( $p > 0.05$ ) (Table 1). However, the findings contradict with previous research from Ghana (Arthur, 2012), Central Nepal (Pandey and Karki, 2014), South Sudan (Arop, 2015), Sub Saharan Africa (Owili et al., 2016), and Kenya (Gitonga, 2017), which found that age at marriage, age at pregnancy, occupation, and religion are all significantly associated with ANC awareness.

### **Conclusion and Recommendations**

Lastly, the present study found that the majority of women in South Sikkim had sufficient knowledge and awareness of ANC related services. The study also discovered that maternal age, age at marriage, age at first pregnancy, marital status, family size, husband education, husband's occupation, parity, and family income were all significantly related to ANC service knowledge and awareness levels. According to the results of stepwise multiple binary logistic regression analyses, age, parity, family income, and age at marriage were the most significant predictors of knowledge and awareness levels about ANC services among women in South Sikkim. Women aged 25 to 34 years, with first or second parity, and living in low or middle-income households had significantly lower levels of ANC knowledge and awareness. The present study also emphasizes the importance of targeted interventions to increase knowledge and awareness of ANC services among women in South Sikkim, particularly those from low and middle-income families, as well as those who are younger and have lower parity. The findings of the investigation could aid in the development of appropriate strategies and policies to improve maternal and child health outcomes in the region.

Health policymakers ought to focus on the factors that influence how well-informed and aware women are of ANC services. It is necessary to enhance educational and awareness initiatives on the significance of ANC services, the suggested frequency of ANC visits, and the potential advantages of receiving prompt medical attention. In order to make sure that every pregnant woman, especially those who are expecting for the first time, is aware of ANC services, early marriage should be discouraged and healthcare professionals should launch a door-to-door ANC awareness drive. So that women from low-income families

or groups can access and become aware of ANC services at the community level, the government should enhance the implementation of free ANC care facilities in the village area. Improving the quality and accessibility of ANC services is critical to ensuring that pregnant women receive adequate healthcare. Healthcare systems should be strengthened to ensure that quality ANC services are available, accessible, and of high quality, particularly in remote and underserved areas. Further more research studies should be conducted to investigate the causes of low knowledge and awareness of ANC services among vulnerable populations, and to assess the effectiveness of interventions aimed at improving access to and utilization of ANC services.

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