

Original Research Article

Comparative analysis of regression models in predicting Intimate partner violence: a gender specific analysis using NFHS-5 data

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ABSTRACT

Background: Existing regression models for determining intimate partner violence (IPV) against women include characteristics of women and men individually but evidence lacking on couple characteristics and best fit models. We aimed to compare regression models in predicting IPV using characteristics of women and her partner separately and as a dyad.

Methods: We used couple data from National Family Health Survey-5 containing data from both women and her partner. IPV considered as positive response for any of the questions on domestic violence. Multiple logistic regression models were built separately for characteristics of women and men and couple characteristics. Best fit models identified through r-squared value and AIC and BIC statistics.

Results: We included 46445 couple data for final analysis. R-squared value for models including female characteristics were similar to models with couple characteristics and higher than the models with male characteristics. Odds Ratio were also higher for women characteristics compared to their counterparts' characteristics. Family history of IPV among women, women's attitude towards wife beating and controlling behavior of partner were associated with higher IPV.

Conclusions: Individual characteristics of women in a couple alone can be an effective determinant of IPV than the traditional view of power relations between men and women in household.

Keywords: Determinants, Intimate partner violence, Gender characteristics, NFHS

INTRODUCTION

Violence against women (VAW) encompasses any gender-based physical, psychological or sexual acts against women and termed as intimate partner violence (IPV) if the act is by partner in relationship.^{1,2} Among women aged 15-49 years who are in relationship, 27% have experienced some form of intimate partner violence with prevalence varying from 20% in Western Pacific to as high as 33% in African and South-East Asian region.³

Realizing the various health and economic consequences of VAW and gender equality as a fundamental right and path to sustainable world, sustainable development goal 5.2 has set targets to eliminate all forms of violence against women.^{1,4} Though an action plan was approved by all the member Nations in World Health Assembly in 2016 to strengthen health systems in addressing VAW, many countries still lack progress towards achieving SDG targets.^{1,4}

India has many legislative measures in place to address IPV including criminalizing dowry related acts and any mental or physical torture under Indian Penal Code, special Acts to prevent Sati (1987), dowry prohibition (1961) and prevention from domestic violence (2005).⁵ Yet, as per WHO estimates, 33% of Indian women experience IPV in their lifetime which is higher than the overall global and South-east Asia estimates and third highest among the countries in the region.³

Understanding the determinants of IPV is utmost important to take corrective actions and studies have been conducted in various countries using frameworks based on existing contemporary and historical theories. These studies considering individual characteristics of women and men or using multilevel models identified community level factors like area of residence, wealth quintile, religion and individual factors like education, working status, witnessing IPV in family during childhood, exposure to digital tools, controlling behavior of partner, attitude towards gender norms, alcoholism in partner as risk factors of IPV.⁶⁻¹³

Though many studies considered individual and community level factors influencing IPV, very few studies considered characteristics of the couple as a dyad as there may be mediating effects due to the couple level interactions of various characteristics. In addition, there is lack of evidence regarding the best fit models among those considering individual characteristics or multiple level factors.

In low resource settings, conducting separate nationwide research on sensitive topics like IPV is both expensive and resource intense. In such instances, using existing nationwide survey data like NFHS can avoid repetition and over-research of sensitive topics.¹⁴ It also provides sufficiently large samples and adequate information on factors at various levels. To handle such large datasets, Machine learning algorithms are extensively used nowadays and they can also identify intricate patterns in data and provide better insights into complex interactions between various biological, social and environmental factors.^{15,16}

With this background, we aimed to compare and identify best fit models in predicting IPV using characteristics of women and her partner individually and as a dyad.

METHODS

A cross-sectional study was done using secondary data from the nationally representative population-based survey conducted across India—the National Family Health Survey-5 (NFHS-5). NFHS provides National, State and District level information on various health indicators of men, women and children and social and lifestyle factors. NFHS used stratified two-stage sampling and collected data from nearly 7.25 lakh women of 15-49 years of age and about 1 lakh men of 15-54 years of age

in about 6.36 lakh households spread over all the 707 districts in 28 States and Union territories.¹⁷

International Institute of Population Sciences (IIPS) was the nodal agency for conducting the survey through 17 field organizations. Household profile was collected from all the selected households while individual questionnaire administered to eligible women and men selected from the household. Data collected include individual characteristics, reproductive health including family planning and contraception, women and child health including feeding practices, knowledge and attitude towards HIV/AIDS, STIs and tuberculosis, household relations including sexual life. Selected eligible women in marriage or union were also interviewed on domestic violence. Data on all the above variables for women and her partner as couple from a household were available in downloadable format in IIPS website which was used for this study.¹⁸ This study was done from March 2025 to July 2025.

Selection criteria of samples

Data were included for all women to whom the domestic violence module was administered during the fifth round of NFHS, as well as their partners. These data were available as separate dataset from the survey organization. We checked for the relationship of the women and their partner with the head of the family and excluded if there is any mismatch in the relationship.

Outcome variable

Intimate partner violence (IPV) was assessed using the following questions on emotional, physical and sexual violence: Did your husband ever do any of the following things? i) Say or do something to humiliate you in front of others, ii) Threaten to hurt or harm you or someone close to you, iii) Insult you or make you feel bad about yourself, iv) Push you, shake you or throw something at you, v) Twist your arm or pull your hair, vi) Slap you, vii) Punch you with his fist or something that could hurt you, viii) Kick you, drag you or beat you up, ix) Try to choke you or burn you on purpose, x) Threaten or attack you with a knife, gun or any other weapon, xi) Physically force you to have sexual intercourse when you did not want to, xii) Physically force you to perform any other sexual acts you did not want to and xiii) Force you with threats or in any other way to perform sexual acts you did not want to.¹⁹ Participants answering “yes” to any of the above questions were taken as having suffered intimate partner violence.

Explanatory variables

Variables at the community, household, couple, and individual levels were considered to build models explaining IPV among women, as depicted in the conceptual framework in Figure 1 alongside the questions used to define various couple-level characteristics.

States in India were classified as regions with North region containing Jammu and Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttarakhand, Haryana and Delhi. Central region containing Rajasthan, Uttar Pradesh, Chhattisgarh and Madhya Pradesh, East region with West Bengal, Jharkhand, Odisha and Bihar, north-east region with Sikkim, Arunachal Pradesh, Nagaland,

Manipur, Mizoram, Tripura, Meghalaya and Assam, West region with Gujarat, Maharashtra, Goa; and South region with Andhra Pradesh, Telangana, Karnataka, Kerala, Tamil Nadu and Puducherry.¹¹ Among the individual characteristics, age group were categorized into five-year categories for women and ten-year categories for men.

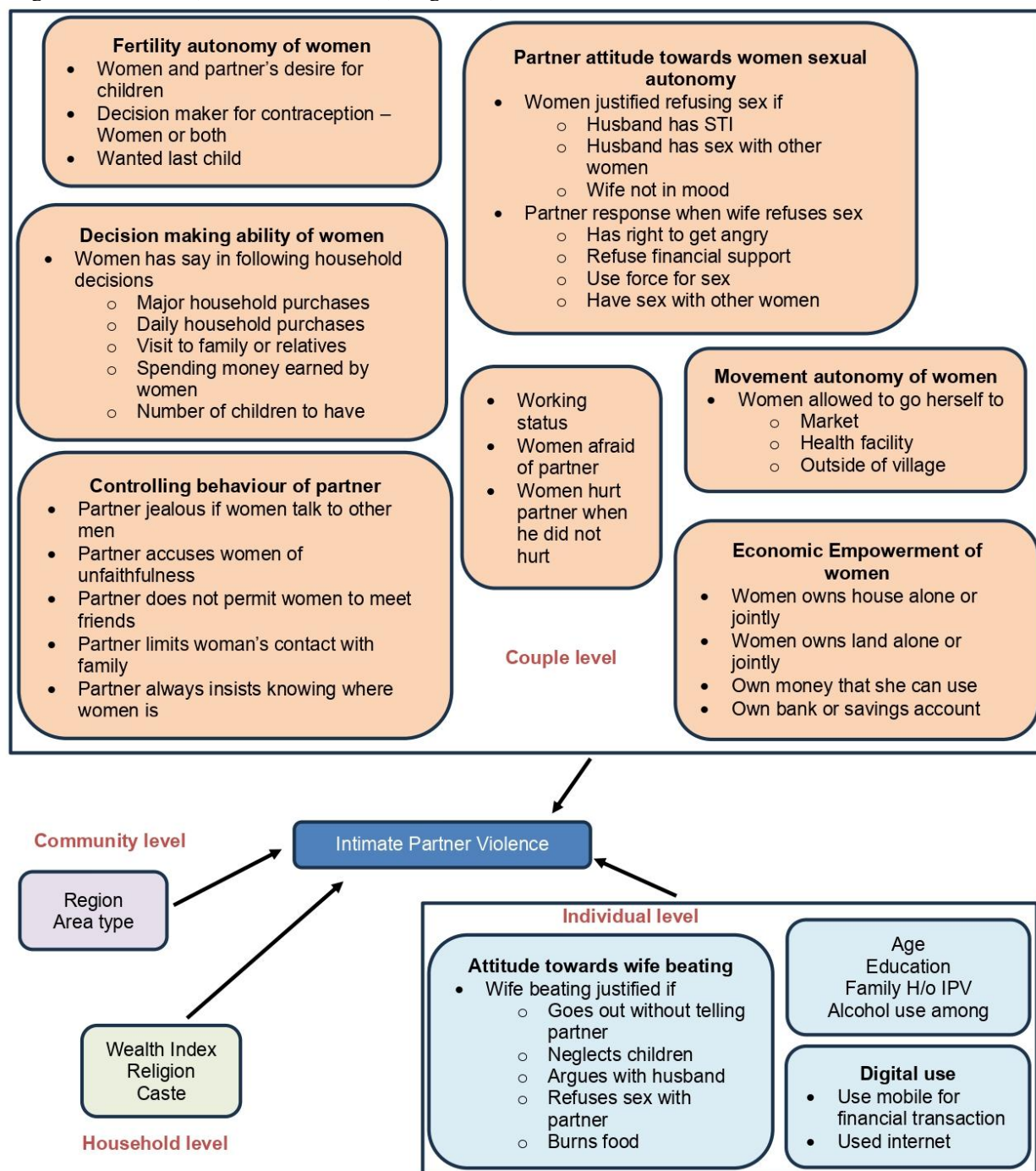


Figure 1: Conceptual framework for determinants of intimate partner violence at various levels.

Data analysis plan

Data coding and composite variable creation were performed using Microsoft Excel, followed by statistical

analysis in Jamovi (version 2.6.19). Socio-demographic characteristics of the participants were described as frequencies and proportions. Four logistic regression models were constructed with IPV as the outcome

variable. Model 1 incorporated community, household, and couple-level determinants. Individual-level characteristics were analyzed as couple dyads, including educational attainment (concordant levels, female-higher, or male-higher), digital media use (concordant use, female-only, male-only, or non-use), family history of IPV (both, either, or neither), attitudes toward wife-beating (both justify, male-only, female-only, or neither), and spousal age difference. Model 2 included determinants at community, household and couple level and the individual characteristics of women alone while model 3 was built by including individual characteristics of men alone with community, household and couple characteristics. Model 4 included only select variables which were determined by change in the r-square value of the logistic regression model by removing variables in a step-wise manner. Best fitting model among the above 4 was reported by comparing the Nagelkerke's R^2 , McFadden's R^2 , AIC and BIC of the model. Adjusted odds ratio with 95% confidence interval were reported for factors found significant in the above models.

Ethical considerations

Permission to utilize the dataset was obtained from the International Institute for Population Sciences (IIPS). Because the study relied on secondary data, there was no direct contact or potential harm to study participants. Ethical clearance was waived by the Institutional Ethics Committee of Madras Medical College.

RESULTS

Among the 57693 couples' data available, domestic violence module was not applied to 11205 women (not selected: 9775, Women selected but not interviewed due to lack of privacy: 1430) and 42 couples excluded due to mismatch in the relationship variable. Community and individual level characteristics of the 46445 couples included in the final analysis are given in Table 1. Among the couples, three-fourths were from rural area and three-fourths practiced Hindu religion. While, 17% women were <25 years, only 4% of partners were <25 years. More than one-fourth of women were not educated while 16% of partners were not educated. Only one-third of women were working opposed to 90% of partners (Table 1).

Justification of wife-beating in selected circumstances was higher among women (36.8%) compared to their partners (29.9%). Nearly one-fifths of both women and their partners had witnessed interparental violence during childhood. Though more than 40% women had power in household decisions, only about 11% had expressed autonomy in decisions regarding fertility. Nearly 45% women experience controlling behavior by partner and only one-fifth have absolute autonomy in free movements outside. Digital usage including internet was observed in less than 10% of women and nearly one-fifth of partners (Table 1).

Table 1: Community level and individual level characteristics of women and her partner in National Family Health Survey-5 (n=46445).

Characteristics	Frequency	Percentage
Community level		
Region		
North	6174	13.3
Central	12757	27.5
South	7514	16.2
East	7314	15.7
North-east	7349	15.8
West	5337	11.5
Type of Area		
Rural	35034	75.4
Urban	11411	24.6
Household level		
Wealth Index		
Poorest	10093	21.7
Poorer	10462	22.5
Middle	9721	20.9
Richer	8776	18.9
Richest	7393	15.9
Religion		
Hindu	35266	75.9
Christian	3449	7.4
Muslim	5404	11.6
Others	2326	5.0
Caste		
OBC	17750	38.2

Continued.

Characteristics	Frequency	Percentage
SC/ST	18143	39.1
Others	10552	22.7
Individual level		
Age group of women		
15-19 years	731	1.6
20-24 years	5314	11.4
25-29 years	9564	20.6
30-34 years	10020	21.6
35+ years	20816	44.8
Age group of partner		
15-24 years	1747	3.8
25-34 years	14280	30.7
35-44 years	18141	39.1
45+ years	12277	26.4
Education of women		
No education	13032	28.1
Primary	6748	14.5
Secondary	21846	47.0
Higher	4819	10.4
Education of partner		
No education	7573	16.3
Primary	7112	15.3
Secondary	25277	54.4
Higher	6483	14.0
Attitude of women towards wife beating		
Justifies	17083	36.8
Not justifies	29362	63.2
Attitude of partner towards wife beating		
Justifies	13907	29.9
Not justifies	32538	70.1
Alcohol usage by husband		
Yes	12618	27.2
No	33827	72.8
Women witnessed IPV in family during childhood		
Yes	8417	18.1
No	36633	78.9
Don't know	1395	3.0
Partner witnessed IPV in family during childhood		
Yes	8696	18.7
No	35786	77.1
Don't know	1963	4.2
Digital use among Women		
Yes	4004	8.6
No	42441	91.4
Digital use among partner		
Yes	8717	18.8
No	37728	81.2
Mass media use among Women		
Yes	34571	74.4
No	11874	25.6
Mass media use among partner		
Yes	38594	83.1
No	8751	16.9
Decision making power of women		
Autonomous	19912	42.9
Not autonomous	26533	57.1

Continued.

Characteristics	Frequency	Percentage
Fertility autonomy of women		
Autonomous	5436	11.7
Not autonomous	41009	88.3
Partner attitude towards sexual autonomy of women		
Yes	7990	17.2
No	38455	82.8
Movement autonomy of women		
Autonomous	9814	21.1
Not autonomous	36631	78.9
Controlling behavior of partner		
Yes	20482	44.1
No	25963	55.9
Economic empowerment of women		
Not empowered	1970	4.2
Empowered	39533	85.1
Highly empowered	4942	10.6
Working status of women		
Working	13860	29.8
Not working	32585	70.2
Working status of partner		
Working	42243	91.0
Not working	4202	9.0

Table 2: Prevalence of intimate partner violence among women in National Family Health Survey-5 (n=46445).

Outcome	Frequency	Percentage
Ever experienced any type of intimate partner violence	13909	29.9
Physical violence	12291	26.5
Emotional violence	5503	11.8
Sexual violence	2393	5.2

Table 3: Logistic regression models of determinants of intimate partner violence among women aged 15 to 45 years, India.

Variables	Categories	Model I		Model II		Model III		Model IV	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Region (Ref: North)	North-East	1.40	1.26-1.57	1.46	1.31-1.63	1.42	1.28-1.58		
	East	1.44	1.30-1.60	1.49	1.35-1.65	1.48	1.34-1.63		
	Central	1.32	1.20-1.45	1.36	1.23-1.49	1.41	1.29-1.55		
	West	1.29	1.16-1.44	1.34	1.21-1.50	1.50	1.35-1.66		
	South	1.20	1.08-1.34	1.31	1.18-1.45	1.90	1.72-2.10		
Area type (Ref: Rural)	Urban	1.13	1.06-1.20	1.12	1.05-1.19	1.07	1.01-1.14		
Wealth Index (Ref: Richest)	Richer	1.13	1.03-1.24	1.13	1.03-1.24	1.22	1.12-1.33		
	Middle	1.21	1.10-1.33	1.21	1.10-1.33	1.34	1.23-1.47		
	Poorer	1.33	1.20-1.47	1.34	1.22-1.48	1.47	1.33-1.62		
	Poorest	1.36	1.22-1.52	1.39	1.25-1.55	1.50	1.35-1.67		
Religion (Ref: Hindu)	Christian	0.62	0.56-0.69	0.62	0.55-0.69	0.62	0.56-0.69		
	Muslim	1.15	1.06-1.24	1.14	1.05-1.23	1.14	1.05-1.23		
	Others	0.77	0.68-0.88	0.78	0.69-0.88	0.77	0.68-0.87		
Caste (Ref: OBC)	SC/ST	0.95	0.90-1.01	0.96	0.91-1.02	0.99	0.94-1.05		
	Others	0.95	0.89-1.02	0.95	0.89-1.02	0.95	0.89-1.01		
Husband is alcoholic (Ref: No)	Yes	2.01	1.91-2.12	1.99	1.89-2.10	2.13	2.02-2.24	1.94	1.84-2.04
Fertility autonomy of wife (Ref: Not autonomous)	Autonomous	1.02	0.94-1.09	1.05	0.97-1.13	1.01	0.94-1.09		
Husband attitude towards wife sexual autonomy (Ref: negative)	Positive	0.96	0.90-1.02	0.97	0.91-1.03	0.96	0.91-1.02		
Controlling behaviour of partner (Ref: No)	Yes	3.00	2.86-3.15	3.02	2.88-3.17	3.32	3.17-3.48	3.16	3.02-3.31

Continued.

Variables	Categories	Model I		Model II		Model III		Model IV	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Decision making ability of wife (Ref: Not autonomous)	Autonomous	0.81	0.77-0.85	0.78	0.75-0.82	0.77	0.73-0.80		
Movement autonomy of wife (ref: not autonomous)	Autonomous	0.90	0.84-0.96	0.88	0.83-0.94	0.88	0.82-0.93		
Empowerment of wife (Ref: Not empowered)	Highly empowered	1.07	0.94-1.22	1.05	0.92-1.21	1.06	0.93-1.20		
	Empowered	1.03	0.92-1.15	1.01	0.90-1.13	1.01	0.91-1.13		
Women afraid of partner (ref: never)	Sometimes	2.26	2.12-2.41	2.26	2.12-2.41	2.38	2.24-2.54	2.34	2.20-2.50
	Most of the time	3.53	3.23-3.85	3.55	3.25-3.88	4.00	3.67-4.36	3.69	3.38-4.03
Women hurt partner when he is not hurting (ref: no)	Yes	5.97	5.18-6.87	5.97	5.18-6.87	6.88	6.00-7.90	6.00	5.22-6.90
Couples education (ref: men higher)	Same education	0.96	0.91-1.01						
	Women higher	0.91	0.84-0.98						
Working status of couples (ref: partner only working)	Women only working	1.24	1.07-1.43						
	Both Working	1.31	1.24-1.38						
	Both not working	0.92	0.83-1.01						
	Both justifies	1.91	1.77-2.05						
Wife beating justified among couples (ref: both not justifies)	Woman only justifies	1.77	1.66-1.87						
	Partner only justifies	1.13	1.05-1.21						
Family history of IPV among couples (Ref: Absent in both)	Present in partner only	1.29	1.21-1.38						
	Present in women only	3.32	3.11-3.55						
	Present in both	3.35	3.03-3.71						
Digital use among couples (Ref: Both not use)	Partner only uses	0.86	0.80-0.93						
	Women only uses	0.84	0.73-0.96						
	Both uses	0.73	0.64-0.84						
Difference b/n husband and wife age (Ref: Less than 0)	0 to 5 years	1.10	1.00-1.21						
	6 to 10 years	1.06	0.95-1.17						
	More than 10 years	1.03	0.91-1.17						
Mass Media use among couples (Ref: Both No)	Both use	0.93	0.85-1.01						
	Anyone uses	0.98	0.90-1.06						
Age group of women (Ref: 15-19 years)	20-24 years			1.56	1.26-1.93				
	25-29 years			1.83	1.49-2.26				
	30-34 years			1.95	1.58-2.40				
	35+			2.04	1.66-2.51				
Education of women (Ref: No education)	Primary			0.95	0.88-1.02			0.89	0.83-0.96
	Secondary			0.86	0.80-0.91			0.73	0.69-0.77
	Higher			0.67	0.60-0.75			0.51	0.46-0.56
Working status of women (Ref: No)	Yes			1.26	1.20-1.33			1.26	1.20-1.32
Wife beating justified by women (Ref: No)	Yes			1.74	1.66-1.83			1.79	1.71-1.87
Family history of IPV in women (Ref: No)	Yes			3.20	3.03-3.39			3.26	3.09-3.45
Digital use among women (Ref: No)	Yes			0.90	0.81-0.99				
Mass Media Use among women (Ref: No)	Yes			1.02	0.96-1.08				
Age group of Partner (Ref: 15-24 years)	25-34 years					1.41	1.24-1.60		
	35-44 years					1.60	1.41-1.82		
	45+					1.79	1.57-2.04		
Education of partner (Ref: No education)	Primary					0.94	0.87-1.01		
	Secondary					0.86	0.81-0.92		
	Higher					0.73	0.66-0.81		

Continued.

Variables	Categories	Model I		Model II		Model III		Model IV	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Working status of partner (Ref: No)	Yes					1.08	1.00-1.17		
Wife beating justified by partner (Ref: No)	Yes					1.15	1.09-1.21		
Family history of IPV in partner (Ref: No)	Yes					1.27	1.20-1.34		
Digital use among partner (Ref: No)	Yes					0.92	0.86-0.99		
Mass media use among partner (Ref: No)	Yes					0.96	0.90-1.03		
Nagelkerke's R square		0.329		0.332		0.278		0.320	
McFadden's R square		0.216		0.218		0.178		0.209	
AIC		44543		44411		46665		44849	
BIC		44954		44761		47006		44963	

Among the participants, nearly 30% have experienced any form of IPV with physical form being the most common (26.5%). Table 3 shows logistic regression models for determinants of IPV. Among the 4 models, model II including the community level and couple level characteristics with individual characteristics of women alone had better pseudo r-square, AIC and BIC values and model IV including selected couple-level and individual characteristics without community level characteristics is equally effective in explaining IPV. Alcohol use by partner and women afraid of her partner have 2 times higher odds of IPV among women while women experiencing controlling behavior have 3 times higher odds of IPV. Though women having higher education has 50% reduction in IPV, working women have 26% increase risk of IPV compared to not working women. Women alone in a couple justifying wife beating (OR: 1.77, 95% CI- 1.66-1.87) have higher odds of IPV opposed to partner alone justifying wife beating (OR: 1.13, 95% CI- 1.05-1.21). Women alone witnessing family IPV (OR: 3.32, 95% CI- 3.11-3.55) has higher odds of IPV opposed to partner alone witnessing family IPV (OR: 1.29, 95% CI- 1.21-1.39) compared to both not witnessing (Table 3).

DISCUSSION

This cross-sectional study on best-fit models determining IPV using secondary data of couples participated in NFHS-5 shows that after adjusting for community level and household level factors, model with individual characteristics of women alone is more effective in determining IPV compared to models with individual characteristics of partner or characteristics of women and partner as dyad.

In model I of our study, individual characteristics were considered as dyad and the results were similar to other studies using pooled data from African countries with increased risk of IPV when women alone justify IPV compared to men alone justifying, men had higher education and women alone were working, reduced IPV

with increasing spousal age gap while no significant association between media exposure and IPV.^{20,21} Another study using dyadic approach revealed men alone justifying IPV has increased odds of IPV than women alone justifying which contradicts the finding from our study.²²

Our study considered factors at multiple levels like community, household, couple and individual level and our results match similar studies using multilevel factors with women education, alcohol use by husband, wealth status, controlling behavior of partner and interparental violence significantly increased IPV though the odds of IPV for alcohol use was comparatively lower in our study which may be because of inclusion of couple level characteristics like controlling behavior of partner, decision making ability of women, etc., in our study.^{23,24} Justification of wife beating by men and higher wealth quintile had higher risk of IPV which is different from our study.²⁴

Witnessing interparental violence increased risk of IPV by more than 3 times in the model with female characteristics in our study similar to the findings from study in Uganda, Phillipines and study using pooled data of 23 countries.²⁵⁻²⁷ In our study, model with female characteristics and model with dyad characteristics showed 1.7 times more risk of IPV among women justifying IPV similar to the study using pooled data from 23 African countries.²⁸

Women belonging to OBC had lesser IPV than SC/ST in a study using the same NFHS-5 data but in our study, there was no significant difference with caste which may be due to the additional couple level characteristics considered in our study. Similarly, odds ratio for factors like education of women and partner and controlling behavior of partner were better in our study while for working status of women, the odds were similar.⁷ Increased risk of IPV among women experiencing Controlling behavior of partner was observed in a study using NFHS-4 data and studies in other countries like Myanmar and Nigeria.^{10,12,29}

Regarding education, studies show different trends in different countries. Considering the education of couples, results from our study matches findings from Angola and Honduras while findings from south and south-east Asia and Africa were not significant.³⁰ Considering only education of women, most of the countries in the above study including Burundi, Kenya, Zimbabwe, Nepal, Honduras, Egypt and Jordan had similar findings similar to our study with higher education reducing the odds of IPV.³⁰ This may be due to differences in the power relations between men and women in various countries.

Our study considered all the possible community, household and couple level characteristics in the models considered which would have eliminated the effect of any unidentified confounding variables which is reflected by the better odds ratio for certain variables in our study compared to other similar studies considering lesser number of factors than our study. Another strength of our study is the generalizability of our finding as the data considered included representative samples from all the states.

Certain limitations of our study are the secondary nature of the data used and the primary purpose of the survey was to estimate various health indicators based on which the sample size was estimated which would have affected the internal validity of findings but the sample size was relatively larger and it is reflected in the narrow CI. Similarly, states would not have equally representative sample and so the generalizability to local context should be done with caution. Another limitation is inherent to the study design as cause-effect relationship cannot be established.

CONCLUSION

Though considering community level, household level and couple level factors with individual characteristics of the couple as a dyad would yield more finer details, characteristics of the women in the couple alone can be used effectively to predict IPV. Overall, education of women emerged as an important factor in largely reducing odds of IPV. Childhood experience of parental IPV and justification of IPV by women increases the risk of IPV so does alcohol use and controlling behavior by partner. Improving women education and social empowerment of women can help reduce IPV. Addressing alcohol use among partner and improving couple engagements can also reduce IPV. At policy level, model with the selected factors can be effectively used to identify high risk women at point of contact with the health system and can be targeted for further evaluation and interventions.

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