Comparing Relative Effect of Human Resource and Economic Resource on Utilization of Maternal Health Care Services in India: A Multilevel Analysis

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Abstract
One of the mandates of Sustainable Development Goals is to ensure healthy lives and promote well-being for all ages. World Health Organization suggest that out of 99 percent of deaths occurred in developing country, India alone contributed about a quarter of maternal deaths. Therefore, at present time focus should be given on the individual status as reflected by their education and income/occupation, which has been acted as the fundamental determinant of utilization of basic services. Using the cross-sectional data of the third round of 'District Level Household Survey' (2007-08) and multilevel logistic regression analysis this study has examined the relative effect of human resources (mother's education) and economic resources (household wealth) on the utilization of maternal health care services (Full antenatal care services, skilled birth attendant and postnatal checkups) in India. The result of the second order predictive quasi-likelihood model shows the significant amount of variation in utilization of maternal health care services across communities and districts ofIndia. Comparison between estimates of education adjusted and economic adjusted model have also been done. The study found that adjustment of education reduces the effect of household wealth for each quintile, which results in flattening of the effect of household wealth on the likelihood of the maternal health care services. This accumulated research has led to the firm conclusion that the level of mother's education has been found more pronounced relative to the economic status of the utilization of maternal healthcare services in India.

Keywords : *Multilevel regression, Maternal Health Care Services, Predictive quasi-likelihood, Variance partition coefficient.*

I.   Introduction

One of the mandates of Sustainable Development Goals (SDG-3) is to ensure healthy lives and promote well-being across developing countries. Estimates from the World Health Organization (WHO) suggested that approximately 289,000 women died every year from pregnancy or childbirth-related complications around the world, of which 99 percent of deaths had been occurred in developing countries. In which, India alone contributed about a quarter of maternal deaths(WHO, 2014). In terms of incidence, an estimated 80, 000 Indian women, either pregnant or new mothers died every year from preventable causes- including hemorrhage, eclampsia, sepsis and anemia(UNICEF, 2014). Maternal deaths have both direct and indirect causes. Leading causes of maternal deaths in India are similar to most developing countries such as infection, hemorrhage, obstructed labour, abortion and hypertension during pregnancy (Say et al., 2014). Maternal deaths also cause the considerable social and personal distress in families, because women have the major responsibility in most family matters, including raising children (Mekonnen & Mekonnen, 2003). It is widely accepted that the use of maternal health care services helps in reducing maternal as well as child morbidity and mortality. The safe motherhood initiative strongly emphasizes ensuring the availability and accessibility of skilled care during pregnancy and childbirth. Antenatal care services (ANC); institutional delivery and post-natal checkups (PNC) are some of the important elements, which avoided most of the maternal deaths due to preventable obstetric complications. Notably, the countries, with higher proportion of institutional births significantly decreases the likelihood of maternal mortality (WHO, 2007).

The utilization of maternal health care services during pregnancy and delivery has been considered as the important factor which significantly reduced the loss of a fetus death, pregnancy complication, maternal and new born deaths (Benhadi, Wiersinga, Reitsma, Vrijkotte, & Bonsel, 2009; Jablensky, Morgan, Zubrick, Bower, & Yellachich, 2005; Kerber et al., 2007; Lawn, Cousens, Zupan, & Team, 2005). WHO recommended a minimum of four ANC visits, two tetanus (TT) injection and 100 iron folic tablets (IFA) during pregnancy and skilled care before, during and after childbirth to save the lives of women. Despite the nationwide interventions and programme, little improvement has been seen in the statistic related to maternal health care servicesin India since last two decades.According to District Level Household Survey (DLHS), only 10 percent of women attended the recommended ANC services during pregnancy and about 52 percent birth attended by skilled health personnel. Moreover, only 18 percent of women aged 15-49 year were received full ANC(at-least 3 ANC visit, 2TT and 100 IFA tablets during pregnancy) (DLHS-3, 2010). The proportion of women who delivered their babies under the supervision of skilled birth attendant is one of the indicators whichmeeting the fifth Millennium Development Goals (MDG).

Research linked with the socioeconomic status and use of maternal health care services, has been accumulating for over two decades. For much of this time, the focus should be given to the individual social status as reflected by their education, income and occupation which acting as a fundamental determinant for the use of maternal health care services. Number of studies conducted around the world including India, shows the positive association between mother's educationand household economic status with the utilization of maternal health care services (Avishek Hazra ; Dhak, 2013; Gitimu et al., 2015; Ramesh, 1997; A. Singh, Kumar, & Pranjali, 2014; Aditya Singh; L. Singh, Rai, & Singh, 2012). Recently, some researchers have stressed on the multidimensional nature of socioeconomic status, and have attempted to disentangle the relative effect of these two variables on the utilization of maternal health care services. Justification for analyzing the separate effect of various socioeconomic indicators includes the recognition that different indicators may operate through different pathways. But perhaps most importantly has been an acknowledgement that analyzes the relative effect of human resources (such as education) against economic resources (as reflected by wealth status) which has important policy implications, particularly in the context of developing countries (Luftz, 2009; Sen, 1999).

Earlier studies on the subject were based on individual level education and wealth status. However, this study makes an effort to analyze the relative contribution of women's education and economic status on the utilization of maternal health care services at individual, community and district level by using multilevel model. Without a multilevel model, it was difficult to obtain whether the relative effect of education and material resources observed across communities and districts merely reflected the combined individual effects, or whether there is an additional, independent effect of higher community and population levels of education or wealth improving the utilization of maternal health care services.

II. Methods

2.1 Data

The study used the data from the third round of District Level Household Survey (DLHS), which has been conducted during 2007-2008. DLHS is a nation-wide cross-sectional survey which has covered 601 districts from 34 states and union territories of India. It is one of the largest demographic surveys with seven lakh household as a sample size and provide estimates on maternal and child health, family planning and other reproductive health indicators. This survey adopted a multistage stratified sampling design with appropriate sampling weights; the main instrument for collection of the data was a set of structured questionnaires (IIPS, 2010). Total of 6, 43,944 ever married women aged 15-49 years and 166260 unmarried women aged 15-24 years have been interviewed in this survey. As the purpose of this study was to analyze the utilization of maternal health care services, which was related to mother's characteristic, therefore, out of 643941 ever married women (age group 15-49 years) who reported to have a live/still birth, total of 213075 women were extracted for the analysis.

2.2 Variables Description

2.2.1 Outcome Variables

The key outcome variables of the study were three basic components of maternal health care services. First is 'full ANC' which refers to a minimum of four ANC visits, at least two Injections during the pregnancy and received IFA tablets for 100 days or more for any pregnant women. Second is 'safe delivery' which is defined as either institutional delivery or home delivery assisted by skilled health personnel. Third is 'PNCservices' which indicates whether the women received checkups for her own health within 14 days after delivery. All the outcome variables were dichotomous in nature.

2.2.2 Exposure Variables

At the individual level, the exposure variables were mother's education and household wealth quintiles, however to access the effect of education and wealth at community and district level, women's mean year of schooling and household mean wealth quintile were taken as independent variables.

The survey had asked a question to women for the highest years of schooling. At the individual level, mother's education has been categories in 5 group (no education; incomplete primary; complete primary; incomplete secondary; secondary and above). However, at the community (<4 years; 4-8 year; >8 years) and district level (<4 years; 5-6 years; >6 years)women's mean years of schooling were categorized in 3 groups.

The wealth index at individual level was calculated using wealth score, which already have been computed and given in the DLHS-3 dataset. The wealth score has been generated through a principle component analysis conducted on a set of variables based on household assets (including radio, refrigerator, bicycle, television, motorbike/scooter, car, pump, sewing machine, mobile, phone, landline telephone, fan, almirah, clock, table, chair, sofa, bed sheet and animals), household quality (including wall, roof and floor) and services (including electricity, drinking water, toilet facility). The lowest 20% households were coded as poorest, the next 20% as poor and so on. Using wealth score at individual level, mean wealth score were generated at community and district level. Further based on mean wealth score, community and district were categorized in five categories i.e., the lowest 20% were considered as poorest, next 20% as poor and so on. The wealth status at community level and district level were also categorized in similar way as individual levels i.e., (poorest, poor; middle; rich; richest).

2.2.3 Control Variables

Many socioeconomic, demographic and residence related variables affect the utilization of maternal health care services in India. Therefore, study included birth order (1; 2; 3; 3+), mother's age at birth of last child (13-24 year; 25-34 year; 34+ year), mother's occupation (not working; paid job; cultivator/farmer; laborers), sex of head of household (male; female), caste (scheduled caste; scheduled tribes; others), religion (hindu; muslim; others), place of residence (rural; urban), possession of BPL card (no; yes) as control variables.

Possession of BPL card has been taken as the proxy for below or above poverty line households as per the national planning commission poverty threshold according the 61st round of the national sample survey and the criteria used for this threshold was monthly per capita consumption expenditure below Indian rupees 356.35 for rural areas and Indians rupees 538.60 for urban areas (T. R. Jat, N. Ng, & M. San Sebastian, 2011). Percentage of scheduled caste/tribespopulation (0-25 percent; 26-50percent; >50 percent) at community and district level has also been included.

2.3 Analytical model

The association between outcome variables and exposure variables at different level has been examined through multilevel logistic regression model. Before moving to multilevel logistic regression model, a set of analysis such as bi-variate technique (including chi-square test) and multivariate logistic regression model has been employed to see the unadjusted effects of exposure variables on outcome variables at 95% confidence interval (CI). A three-level regression model has been applied for analysis, where, individuals (women) (level-1) were nested within communities (level-2) and communities were nested within district (level-3). The intuition behind taking the multilevel logistic regression technique was the hierarchical structure of the dataset.

For each outcome variables (Full ANC, SBA and PNC) two models was estimated. First was the intercept-only model or empty model (null model) which contains no co-variate but it decomposed total variation for community and district. However, the second model is full model, which includes all variables of individual, community and district level. Empty model allowed us to justify the existence of a possible contextual dimension for the phenomenon.

Firstly, a null model or empty model has been run by taking only outcome variable (for example -full ANC). Further, key exposure variables of individual level, community level and district level had been entered in the multilevel framework. The result of fixed effect model (measure of association) has been presented in terms of odds ratio (OR) at 95% C.I. and random effects model (measure of variation) has been presented in terms of variance partition coefficient (VPC)(T. R. Jat et al., 2011). All the variables were tested for multicollinearity before enteredin regression model.

In three levels, logistic regression model the VPC is calculated as

$$VPC(district) = \frac{\sigma d^2}{(\sigma d^2 + \sigma c^2 + \sigma e^2)}$$

$$VPC(community) = \frac{[\sigma d^2 + \sigma c^2]}{[\sigma d^2 + \sigma c^2 + \sigma e^2]}$$

$$\sigma e^2 = \frac{\pi^2}{3} = 3.29$$

Where σc^2 represent community level variance and σd^2 represent district level variance.
Second order predictive quasi likelihood (PQL2) method of estimation was used for the analysis.
The baseline three level multilevel models is of the form –

$$logit[U_{ijk}] = \theta_0 + \emptyset_j + \varphi_k + \beta_1[E_{ijk}] + \beta_2(W_{ijk}) + \beta_3(E'_{jk}) + \beta_4(W'_{jk}) + \beta_5(E''_k) + \beta_6(W''_k) + \beta_u(X) + \epsilon_{ijk}$$

Subscript i indicate the women and j and k indicate community and district level respectively. *U* is the outcome variable measuring the utilization of maternal health care services. *E, E'* and *E''* indicate women education level at individual, community and district level respectively. *W, W'* and *W''* indicates wealth at individual, community and district level respectively. *X* is a vector of variables observed at the mother or community or district level which can affect the association between two. θ_0, $\emptyset_j$ and φ_k are residual at individual, community and district level and ϵ_{ijk} is a regression error term.
All the statistical computation has been done in STATA 12.0 and MLWIN 12.6 software.

III. Results

3.1 Bivariate Result
Table 1 show that only 10 percent of the women used full ANC, 49 percent of women delivered their child under supervision of skilled health personnel whereas only 47 percent women went for postnatal checkups within two weeks after their most recent delivery. Result further shows that utilization of maternal health care services increased sharply with increasing mother's education and economic status at all levels (individual, community and districts level). Finding reveals that utilization of maternal health care services is lower than the average (10%) in rural area (8%) and scheduled castes/tribes (7%-8%). Also, women having higher birth order (3%-8%), belongs to poorest to middle wealth quintile (2%-8%) and belongs to later age cohort (>=35 years)(7%) are less likely to utilize the recommended maternal health care services. This analysis also indicates that women who delivered their child in early ages and belongs to BPL families, worked as cultivators/farmers laborers are also disadvantageous position to access maternal health care services. There is a slight variation in utilization of post-natal checkups by sex of child as it is little higher for male child compared to female child. Post-natal checkup also significantly affected by the place of the delivery. If delivery has been done in health institution then attendance for post-natal checkups is about 79 percent. Furthermore, level of utilization of maternal health care services has been found low at communities and districts with high percentage of scheduled caste and tribe's population.
With the help of chi-square statistics; all the variables have been found significantly associated with utilization of maternal health care services. Moreover, household socio-economic status has been found the strongest factor associated with maternal health care services however mother's education has been found as the second most influential factor associated with maternal health care services.

Table 1 Percentages of currently married women who received maternal health care services during their last pregnancy by background characteristic in India, 2007-08

BackgroundVariables	Full Ante Natal Care	Birth attendant by SBA	PNC Within 2 weeks
Individual level			
Mothers Education*			
No education	3.2	30.93	31.62
Incomplete Primary	7.5	43.89	43.82
Complete primary	8.1	50.35	47.09
Incomplete Secondary	14.5	64.7	59.71
Secondary & above	26.9	85.25	78.27
Caste*			
Scheduled Caste	8.8	47.69	45.87
Scheduled Tribes	7.4	37.39	36.51

Other	13.2	57.45	54.28
Religion*			
Hindu	11.6	52.7	49.34
Muslim	11.1	48.26	50.27
Other	10.9	54.86	51.98
Birth order*			
1	16.2	67.87	61.22
2	14.5	58.42	55.75
3	8.5	44.18	43.67
3+	3.3	22.78	30.87
Wealth Index*			
Poorest	2.5	23.51	24.94
Poor	4.1	33.95	33.13
Middle	8.5	48.2	45.76
Rich	14.3	64.04	59.66
Richest	25.2	85.02	79.26
Possession of BPL card*			
No	11.9	54.05	52.03
Yes	9.9	45.61	44.1
Mother's age at last birth (in years) *			
13-24	11.4	55.05	51.97
25-34	12.1	51.14	49.04
>=35	6.8	35.9	35.42
Age at marriage (in years) *			
Less than 15	2.9	30.99	29.68
15-24	12.1	54.53	51.97
25-34	27.7	81.52	76.22
>=35	26.6	81.38	75.82
Occupation of mother*			
Not working	13.47	59.1	54.66
Paid job	19.49	68.22	64.93
Cultivator/farmer	4.47	33.41	34.79
Laborer	7.15	38.52	39.68
Sex of Child*			
Male	--	--	50.33
Female	--	--	49.07
Delivery conducted*			
Skilled	--	--	79.09
Unskilled	--	--	17.52
No of ANC			
< 4	--	--	34.4
> = 4	--	--	78.81
Place of delivery*			
Institutional	--	--	83.16
Home	--	--	20.35
Community Level			
Mothers education*			
< 4 years	4.45	35.59	35.62
4-8 years	15.31	65.77	60.5
>8 years	32.48	90.67	84.2
Wealth Quintile*			
Poorest	2.3	22.81	24.42
Poor	4.5	37.38	35.91
Middle	10.35	53.74	50.47
Richer	14.74	65.77	61.11
Richest	26.11	84.81	79.47
Residence*			
Rural	8.04	43.18	41.86
Urban	20.16	75.69	70.07
% Scheduled caste/tribesPopulation*			
0-25	13.41	57.08	54.4
26-50	10.12	51.92	48.31
> 50	8.55	42.85	41.55
District Level			
Mothers education*			
0-4 years	60.34	39.67	37.58
5-6 years	10.08	64.09	51.31

>6 years	23.58	93.41	70.02
Wealth Quintile*			
Poorest	2.82	27.86	28.03
Poor	4.75	43.65	36.42
Middle	10.92	54.62	53.56
Richer	17.06	66.64	63.36
Richest	24.38	74.98	74.07
% Scheduled caste/tribes Population*			
0-25	13.57	54.05	52.6
26-50	10.37	54.46	50.88
> 50	8.47	42.14	39.43
Total	**10.2**	**48.76**	**46.51**
Note: * for chi-square significant			

3.2 Binary logistic and Multilevel Model

Multilevel modeling can only be adopted when our data justifies the criteria in context of variation within communities and districts. Table 2 shows the considerable variation in utilization of maternal health care services across the communities and districts. About 53 percent (across communities) and 39 percent (across districts) of the total variation has been found on the utilization of full ANC. About 51 percent (across communities) and 38 percent (across districts) of the total variance has been found on the presence of skilled health personnel at the time of delivery. However, about 51 percent (across communities) and 13 percent (across districts) variations have been seen on utilization of post-natal checkups.

Table 2 Parameter coefficients for the multilevel model for indicators of the maternal health care services, in India, 2007-08

Random Effects	Full ANC	SBA	PNC
Community (PSU) Random Variance (SE)	0.98(0.028)	2.59(0.153)	2.59(0.153)
VPC (PSU)	53%	51%	51%
District Random Variance (SE)	2.82(0.172)	0.88(0.015)	0.88(0.015)
VPC(District)	39%	38%	13%

An unadjusted (obtain from multivariate model) and adjusted result (obtained from multilevel models) have been shown together in Table 3, in which first column shows the unadjusted relationship between each explanatory withoutcome variables (full ANC, SBA, PNC). An unadjusted model shows that, women's increasing education significantly increases the likelihood of full ANC, SBA and PNC substantially at all level. For instance, at individual level, the utilization of full ANC increases by 3 times (OR=3.12, p<0.05), delivery under the presence of skilled health personnel increases by 60 percent [OR=1.64, p<0.05] and post-natal checkups increases by 57 percent (OR=1.57, p<0.05). Similarly, at community level, at least 8 years of women's schooling increases the likelihood of all maternal health care services ((full ANC; OR=2.31, p<0.05)(SBA; OR=1.50, p<0.05) (full ANC; OR=1.28, p<0.05)). Further, result shows that, women's year of schooling also increases the utilization of recommended maternal health care services at district level (Table 3). Likewise, to education, economic status of household also significantly increases the probability of maternal health care services at individual, community and district level. For example, at individual level, full ANC has been increased by 7 percent to 77 percent from poor to richest category, SBA has been increased by 14 to 58 percent from poor to richest category however and however PNC has been increased by 4 to 44 percent from poor to richest category. Moreover, significant uptake of maternal health care services has been seen at community and district level with increased economic status (Table 3). Furthermore, many socioeconomic variables have been found to be associated with utilization of maternal health care services, such as mother 's age at last birth, working status, birth order, possession of BPL card, religion and caste of household (control variables are not shown in Tables).

Table 3: Estimated odds ratio (OR) of receiving full antenatal care, safe delivery and post-natal checkups in women of reproductive age group in India, 2007-08

Variables	Full ANC (OR)				Skilled Delivery (OR)				Post-natal care (OR)			
	Unadjusted (OR)	Model 1(a) Education Adjusted(OR)	Model 2(a) Economic Resource Adjusted (OR)	Model 3(a) Mutually Adjusted (OR)	Unadjusted (OR)	Model 1(b) Education adjusted (OR)	Model 2(b) Economic Resource adjusted (OR)	Model 3(b) Mutually adjusted (OR)	Unadjusted (OR)	Model 1(c) Education adjusted (OR)	Model 2(c) Economic Resource adjusted (OR)	Model 3 (c) Mutually adjusted (OR)
Individual Level												
Mother's Education												
No education®												
Incomplete primary	1.62*	1.36*		1.30*	1.22*	1.21*		1.17*	1.15*	1.15		1.14*
Complete primary	1.57*	1.53*		1.40*	1.23*	1.28*		1.21*	1.04**	1.11		1.08*
Incomplete secondary	2.21*	1.94*		1.66*	1.44*	1.49*		1.40*	1.18*	1.25		1.21*
Secondary & above	3.12*	3.08*		2.41*	1.64*	1.74*		164*	1.31*	1.57*		1.43*
Wealth Index												
Poorest®												
Poor	1.07		1.33*	1.21*	1.14*		1.24*	1.19*	1.04		1.05**	1.02*
Middle	1.35*		1.86*	1.55*	1.52*		1.42*	1.31*	1.11*		1.18*	1.09*
Richer	1.55*		2.59*	1.88*	1.37*		1.61*	1.47*	1.18*		1.32*	1.16*
Richest	1.77*		4.54*	2.66*	1.58*		1.83*	1.69*	1.44*		1.83*	1.44*
Community Level												
Mother's education												
< 4 years®												
4-8 years	1.42*	1.29*		1.14*	1.16*	1.28*		1.12*	1.05**	1.06**		1.02
>8 years	2.32*	1.52*		1.29*	1.50*	1.63*		1.49*	1.28*	1.23*		1.16**
Wealth Quintile												
Poorest®												
Poor	1.20*		1.26*	1.22*	1.24*		1.27*	1.23*	1.04**		1.04	1.04
Middle	1.57*		1.53*	1.42*	1.42*		1.46*	1.38*	1.03		1.12*	1.11*
Richer	1.51*		1.67*	1.50*	1.46*		1.59*	1.50*	0.96		1.16*	1.14*
Richest	1.70*		2.04*	1.61*	1.61*		1.76*	1.61*	1.12*		1.26*	1.14**
District Level												
Mother's education												
0-4 years®												
5-6 years	1.17*	1.70*		1.23	0.98	1.22**		1.18***	0.92*	1.21		0.89
>6 years	1.76*	3.56*		2.16*	1.70*	1.55*		1.91*	0.87*	1.99*		1.08
Wealth Index												
Poorest®												
Poor	1.22*		1.13	1.32	1.29*		1.25**	1.29**	0.95**		0.88	1.00
Middle	2.20*		2.14*	2.21*	1.39*		1.47*	1.47*	1.58*		1.54*	1.79*
Richer	2.42*		3.16*	2.80*	1.46*		1.55*	0.45*	1.69*		1.90*	2.18*
Richest	2.35*		3.34*	2.85*	1.30*		1.42*	1.60***	2.13*		2.79*	3.07*

An education adjusted model for full ANC, SBA and PNC has been shown through model 1a, 1b and 1c respectively in table 3. The result highlighted that while controlling all variables (excluded wealth) in model 1a, women's education solely increases the likelihood of full ANC more than threetimes (OR=3.08, p<0.05). Similarly, odds of presence of skilled health personnel during delivery and post-natal checkups also increases by 74 percent (OR=1.74, p<0.05) and 57 percent (OR=1.57, p<0.05) respectively, when only affected by women's education. Furthermore, in education adjusted model, effect of women's education at community level (OR=1.29) has been found less compared to the effect at individual (OR=1.36) and district level (OR=3.56).

Like education adjusted model, another model which has been adjusted for economic status for full ANC, SBA and PNC has been given through model 2a, 2b and 2c respectively in table 3. Model 2a reveals that, at individual level, economic status solely increases the likelihood of full ANC by 33 percent from poor (OR=1.33, p<0.05) to four times in richest category (OR=4.54, p<0.05). Further, economic adjusted model 2b shows that, likelihood of skilled birth attendant has also been increased when moving from poor (OR=1.25, p<0.05) to richest (OR=1.83, p<0.05) category. Additionally, present analysis also reveals that in economic adjusted model 2b, wealth status at individual level (OR=4.54, p<0.05) was significantly different than community level (OR=2.04, p<0.05) and district level (OR=3.34, p<0.05) respectively.

Furthermore, the simultaneous adjustment (mutually adjusted) model has been shown by model 1c, 2c and 3c in Table 3. Analysis reveals that in mutually adjusted model, an effect of both, education and economic status has been reduced at every level (individual, community and district level). For example, at individual level, utilization in full ANC has been found higher due to effect of economic status (OR=2.66, p<0.05) relative to mother's education (OR=2.41, p<0.05). Further, while comparing model 1a with model 3a, odds of utilization of full ANC has been found threetimes higher (OR=3.08, p<0.05) in model 1a, however, it has been seen twotimes higher in model 3a (OR=2.41, p<0.05). Similarly, comparing the mode 2a with model 3a, odds of utilization of full ANC has been increases by more than fourtimes in model 2a (OR=4.54, p<0.05) however, increases more than twotimes in model 3a (OR=2.66, p<0.05). Similar pattern has been seen for utilization of full ANC at community and district level. Furthermore, result also reveals the similar pattern of utilization of other two health services (skilled health personnel at time of delivery and post-natal checkups) at individual, community and district level.

3.3 Discussion

Education and economic resources is the very basic and primary indicator of development of any nation. In India, inadequate admittance of maternal health care services are the serious problems. The use of maternal health care services is not only depend upon the availability and accessibility of services but it also depends on different socio-economic status of household which women belongs too (Pandey, Roy, Sahu, & Acharya, 2004).WHO recommended full ANC(at least 4 ANC, 2 TTinjection and intake of 100+ IFA tablets) to an expecting womanduring their pregnancy, for her good health as well as for the expecting baby.. Findings of this study indicated that the mother's education as well as economic status has a significant impact on the utilization of maternal health care services in India, independent of the mother's age at last birth, cast, religion, sex of child, occupation of mother and other factors. To the best of our knowledge this is the first study which shows the relative contribution of human resources (such as mother's education) and economic resources (wealth quintile), on accomplishment of maternal health care services at different level, in a very more comprehensive way in India. Multilevel model accesses the independent effect of two predictors (education and economic recourse), which were glaring within community and district. Inclusion of community and district level effects determines the extent of contribution of average level of education and wealth on use of maternal health care services. Finding of this study is consistent with the study conducted in India (Tej Ram Jat, Nawi Ng, & Miguel San Sebastian, 2011).

Advantage of multilevel framework was that, it told about important factors, which are associated with maternal health care services at individual level, community level and district level in India. Multilevel model also demonstrated the significant variation at community and district level in use of maternal health care services. This complete picture of relative effect of education and economic resources also helped for informing policy implication to improving the health status of women in the least developed countries.

The primary purpose of the analysis was to examine the extent of change of effects of education and economic resources when both have been taken independently and simultaneously. While comparing model 1 with model 3 it

has been seen that, inclusion of wealth in model 3 (either a, b or c) reduces the effect of maternal education with more amounts when compare to model 1 (either a or b or c) for all services at all levels.

Result of this study also shows that communities where women resides and having 4 or more year of schooling was more likely to avail the full antenatal care services and other services. Likewise, an increase in mean wealth quintile at community level also had a positive effect on use of maternal health care services. This result was consistent with the result of another study (Tej Ram Jat et al., 2011). Furthermore, the result shows the strong effect of wealth quintile at district level relative to individual and community level. District level wealth quintile was indicated the average absolute standard of living for the population at district and thus a more valid measure of overall development, whereas relative wealth quintile shows the distribution of material resources.

Previous research on the effect of secondary education on utilization of maternal health care services at district level is very limited. This analysis also revealed that important role of some factors other than education and economic resources for utilization of maternal health care services. At individual level women age at last birth, caste, birth order and religion was found significantly associated with likelihood of use of full ANC, SBA and PNC. Moreover, at community and district level percent of scheduled tribes/castes population was positively associated with use of full ANC (not shown in table). It was worth to mention that place of residential also explained the disparity in use of full ANC, SBA and PNC (not shown in table).

IV.   Conclusions

In this research work, beyond the individual level factors, effect of community and district level factor has also been included to see the relative effect of education and economic resources on the utilization of maternal health care services. Study found the profound variation at communities and districts level in India. At individual level, women's education and economic status has been found to be as equally important factors associated with utilization of maternal health care services. However, at community level, women's education increases likelihood of maternal health care services more efficiently than the economic status. Whereas, at district level, economic status has been found as an important determinant relative to education to utilize recommended maternal health care services.

It has been found that assess of maternal health care services affected maternal and child health. Many maternal and perinatal deaths have been occurred among women who were not utilized maternal health care services. Nevertheless, true progress has been made globally in terms of increasing access and use of recommended services. So, it is important to promote antenatal care services among pregnant women. A special focus should be given to women of scheduled caste and scheduled tribes group, by increasing their access and use of maternal health care services. Along with individuals, it is very important to promote the access and use of maternal health care services at community and district level for more effective results, and this can be done by providing good health facilities to women and promoting education among individuals, which has direct effect on family as well as communities.

This study has drawn some limitation might be of data quality. First, as the District Level Household Survey was a cross sectional survey therefore relation can be determining between predictor variables and explanatory variable but couldn't make any conclusion about causality. Second, some information like distance of health facility from place of residence was not available in dataset but it was very important indicator and must influence the pattern of health care services utilization. Third, as this data set was based on the self-reported system of respondents, therefore no another validation had been done to cross check the gathered information. It was assuming that in case of maternal health care related issue biases are very less, as this were not sensitive issues like sexual behaviors and domestic violence.

Abbreviations
SDG-Sustainable Development Goals
WHO- World Health Organization
MCH- Maternal and Child Health
DLHS- District Level Household Survey
ANC-Ante Natal Care
SBA- Skilled Birth Attendant
PNC- Post Natal Care
IFA-Iron Folic Acid
TT Injection-Tetanus Toxoid Injection
VPC- Variance Partition Coefficient

Ethical approval and consent to participate
This analysis is based on a secondary dataset with no identifiable information on the survey participants. This dataset is available in public domain for research use hence no approval was required from any institutional review board as there is no question of human subject protection arise in this case.

Authors' contributions

SS conceived the idea. SS, AKU and SKS designed the experiment, analyzed it, interpreted the results and drafted the manuscript. All the authors read and approved the final manuscript.

Data Availability

DLHS-3 data is available on the website for public use.

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Conflict of interest
The authors declared that they have no conflict of interest.

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