Effect of behavior change communication through women’s groups on maternal health care practices in rural India: A hierarchical modelling approach

Abstract

This study aims to assess the effect of various intervention activities done under self-help groups federations along with other contextual factors on maternal health care behavior of marginalized women rural Uttar Pradesh, India. There is a hierarchical nature of functionality and various intervention activities done through SHG federations. Furthermore, it is assumed that women's characteristics are highly correlated within groups, and groups’ characteristics are highly correlated within villages. This study is part of the larger evaluation and utilizes the information collected from 1505 eligible women, who were currently married, 15-49 years of age, and had given birth in the 12 months prior to the survey, from 346 SHGs of 26 intervention blocks. A hierarchical model is used to account the influences of these clusters as well as the interaction between them. Multilevel analysis results suggest that around 6-15 percent of the variance in the maternal health outcome indicators are explained at the VO level, around 6-12 percent of variance at the block level. Further, women and SHGs level characteristics like education, wealth, caste, FLW contacts, increased exposure to the health intervention activities, groups’ collective action are the important predictors for correct practice around maternal health. In conclusions, SHG federations can be a useful platform for health behaviour change communication along with convergence with the health system to improve maternal health behaviour in rural India.

Introduction

Behavior change communication (BCC) interventions have been tested globally through well-developed theoretical models which have become integral part of many maternal and child health interventions (Mildon & Sellen, 2019; Zongrone et al., 2018). Behavior change communication is one of the strong and synergistic approaches for many successful community-based health interventions to promote healthy practices around maternal and child health (Kennedy, Stickland, Kershaw, & Biadgilign, 2018; Lamstein et al., 2014). This is an interactive process of any intervention with individuals, groups or communities to develop effective communication strategies and systematic information dissemination to help people to promote changes in knowledge, attitudes, norms, beliefs, and behaviors to positively influence the social dimensions of health and well-being. Among the powerful tools employed by BCC programs are mass media, community-level activities, interpersonal communication, and new media. Several studies provided evidence on effectiveness of BCC interventions on health and nutrition outcomes in developing countries (Briscoe & Aboud, 2012; Hoddinott, Ahmed, Ahmed, & Roy, 2017; Lamstein, et al., 2014). A study based on Shivgarh trial published in Lancet (Kumar et al., 2008) reported the effectiveness of a preventive package of intervention for essential newborn care through BCC by community health workers in multiple aspects like birth preparedness, antenatal care, etc. that resulted into reduced neonatal mortality.

Community mobilization through women's self-help groups (SHGs) has emerged as a promising social platform through which health-related BCC interventions can be implemented (Ebert, Bommer, Bogler, Kumar, & Vollmer, 2017; Prost et al., 2013; Rath et al., 2010). Social capital generated through women's participation in community networks known as Self-help Groups (SHGs) improved knowledge of and access to maternal health services. The presence of an SHG in a village is associated with higher odds of mother's delivering in an institution, knowing at least one modern family planning method, and ever using family planning (RS et al., 2019; Saha, Kermode, & Annear, 2015). Recent studies highlighted the importance of imparting a systematic approach using participatory behavior change communication with women's groups as a method to promote maternal, neonatal, and child behaviors in order to further reduce maternal and child mortality (Azad et al., 2010; Nair et al., 2017; Prost, et al., 2013; Saggurti et al., 2018). Few studies conducted in Uttar Pradesh also demonstrated the utility of BCC interventions on maternal and neonatal health behaviors using SHG platforms (Ahmad, Mohanty, Hazra, & Niyonsenga, 2021; Aruldas, Kant, & Mohanan, 2017; Hazra et al., 2019).

Although most of these studies cited above used sophisticated statistical analysis to generate evidence on effect of BCC interventions at individual levels but did not consider the variation in the effects that may have at various levels of women participation in SHG activities that affect women's correct health practices related to maternal and child health. Evidences also suggest about several interlinked factors at individual, environmental and contextual detriments influencing health behavior (Zongrone, et al., 2018). Also, the ecological perspective is a useful framework for understanding the range of factors that influence health and well-being. Socio-ecological models are becoming more widely used in health behavior research (Elder et al., 2007; Golden & Earp, 2012). Here, the purpose of referring socio-ecological model in this study is to guide the measurement framework to analyses the effects of various factors as it recognizes multiple level of influence on health behaviors.

This study aims to assess the effect of various program activities conducted through federations of self-help group structure along with other contextual factors on maternal health care practices among rural and marginalized women. We hypothesized that there would be a clustering effect of SHG federations and their various intervention activities on the maternal health care behaviour of women in the communities. Furthermore, it is assumed that women's characteristics are highly correlated within a group, and groups' characteristics are highly correlated within a village or village organizations (VOs) which are village level federation of SHGs. It is reasonable to assume that the maternal health practices among women could vary across SHGs or villages due to various factors such as intensity of the health interventions done by SHGs/VOs, socioeconomic conditions, and contextual factors such as availability of FLWs, anganwadi center, all-weather roads in the village, closeness to health facilities and schools, caste compositions and SHG saturation etc. Hence, there would be a higher chance of clustering in health behaviour as well as associated factors for women/SHGs belonging to a particular village and would have similar characteristics in terms of health practices. Therefore, an attempt has been made to adjust the variations in the contextual factors considering clustering effects while assessing the effect of various intervention efforts on the maternal health care behaviour of the women from SHG households.

Study setting and Interventions

Uttar Pradesh is one of the most populous states of India with huge poverty, geographic variation, heterogeneity in the context. A non-government organization called Rajiv Gandhi Mahila Vikash Pariyojna (RGMVP) mobilized poor and marginalized women in rural areas to form SHGs with an objective of improving socio-economic condition (Raju & Nikhilesh, 2010). The organization adopted three-tier approach and built community institutions across 49 districts of the state. The SHGs, at first tier consist of 10-20 women living in a neighborhood, at the village level SHGs are federated into village organizations (VOs), the second tier, representing 150-200 women. At the third tier VOs are federated into block organizations (BOs) representing 5000-7000 women (Hazra et al, 2015). Micro-finance and social empowerment were the primary activities of the SHGs to which health BCC interventions were layered with a goal to improve reproductive, maternal, neonatal and child health, and nutrition correct (RMNCHN) practices through increased knowledge, improving access and utilization of health services and changing norms.

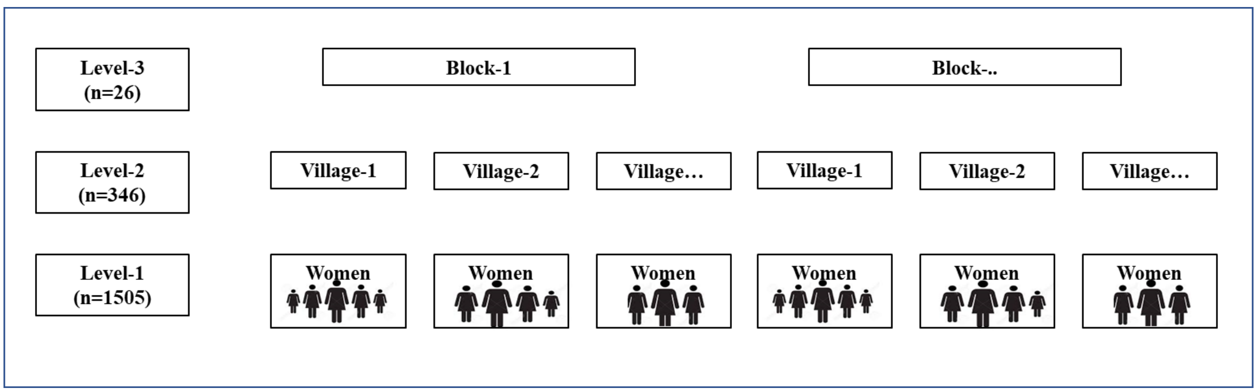
The primary BCC intervention was disseminations of information about correct RMCHN practices through various mechanism at various levels of SHG federations. The foremost mechanism was discussion of RMNCHN issues in SHG meetings by trained peer educators on regular basis. The second approach was community outreach activities including reinforcement of the health messages through home visits of pregnant and lactating women, community meetings, community events such as Godbharai (a ceremony to celebrate pregnancy) and Annprasan Diwas (a ceremony to initiate complementary feeding to a child in the age group of 6-8 months) organized at Anganwadi centers every month. The third mechanism was to engage wider community to make them aware of correct health practices through use of digital media and rallies. The details of the BCC health interventions implemented through SHGs are available in (Hazra, et al., 2019).

Methods

Study design and sampling methods

This study is based on a cross-sectional survey conducted in 2017 to evaluate the effect of BCC intervention strategies implemented through women self-help groups in rural Uttar Pradesh. This study is part of the larger evaluation and utilizes the information collected from eligible women, who were currently married, 15-49 years of age, and had given birth in past 12 months prior to the survey from SHG households (at least one woman from the household was an SHG member). The survey was conducted across 57 blocks in 20 districts of Uttar Pradesh. A multi-stage stratified sampling design was adopted to select the study participants. In the first stage, blocks were selected based on the percent of scheduled caste or scheduled tribe (SC/ST) population, a critical parameter for development. In the second stage, Gram Panchayats (GPs), were selected ensuring the inclusion of diverse GPs in terms of the proportion of the population covered by SHG in the sample. Mapping and house listings of the selected GPs were done to identify SHG households with eligible women. For the present study, we have used data from eligible women respondents who were either SHG members themselves or non-members but belonged to SHG households, both from the intervention area. The study has also collected information about the functioning of SHGs and health intervention activities from the leaders of the SHGs from which an eligible woman was interviewed. Similarly, corresponding village-level information on village characteristics and various activities conducted though village organizations. Figure-1 shows about the level structure of the respondents i.e. blocks, village, and eligible women from where information was collected and utilized in the present study.

Figure 1: Hierarchical data structure with sample units at each level, 2017



This study is based on information collected from 1505 eligible women respondent belonged to 346 SHGs from 26 intervention blocks. Table 1 presents statistics for average number of women respondents for the present study sample representing each unit of all three levels. Village unit represents on average 4 women from SHG households with a minimum of one woman and a maximum of 25 women. Likewise, block level unit represent 60 women from SHG households with minimum 3 and maximum 154 women.

Table 1: Sample size for different study participants

Category	Unit	Number of women respondents		
		Average	Minimum	Maximum
Level 1 (women from SHGs)	1,505	na	na	na
Level 2 (Village)	346	4.3	1	25
Level-3 (Block)	26	57.9	3	154

Note: na refers to not applicable

Variables

Dependent variables: For the present study, the key dependent variables include maternal health care indicators related to safe delivery practices such as at least three antenatal tests, key delivery preparedness, institutional delivery, and postnatal check-ups within a week after delivery.

Independent variables: Since information is collected from three levels of respondents, therefore, the list of independent variables/predictors were also at three level. First level predictors include women's sociodemographic characteristics e.g., women's age, education, caste, wealth status, SHG membership, FLW contacts during pregnancy and respective SHGs' characteristics such as SHG functionality strength and intervention activities done through SHGs. SHG functionality strength was measured as a summative index using status of various core activities performed by any SHG such as regular meeting, monthly saving, internal lending, updating of records, bank linkages and attachment with VO. Group's intervention activities included health issues discussed in SHG meetings, daira mapping, distribution of congratulation letter/health leaflets, SHG received supportive supervision from ISC/MS/others, home visit done by SHG members. The detailed description about these intervention activities can be found in a recent study by Hazra et al (2019).

Second level predictors include information on various activities performed by village organizations (which is next level of groups' federation which provides supportive supervision to SHGs) and other village characteristics. Various activities at VO level include discussion on health issues in their review meetings in past 3 months, sharing the list of health facilities for delivery to SHGs, peer educators called ISC or health Sakhi attended the VO meeting at least once in last 3 months, linkages with health services (e.g. VO members participation in VHND, FLWs or ISC/MS came to VO to discuss health issues, VO shared target women list with FLWs, VO had interaction with VHSC), and VO level collective action e.g. demanding various facilities or raising issues with panchayat or other authorities. Further, village level infrastructures were assessed through village development index based on the availability of all-weather road, availability of services (ICDS/AWC) in the village, availability of ASHA/AWW in the village, availability of PHC/CHC within 3 km, and availability of primary/middle school within 1 km distance.

The third level predictors were mostly macro level characteristics of the intervention blocks from where respondents were interviewed. Three characteristics included proportion of SC/ST population at the block level, proportion of population of the block belonged to SHGs households, and the duration of SHG presence in the block were included to see how these factors affect women's maternal health behaviour.

Statistical analysis

Observations from the same cluster are generally more similar to each other compared to the observations from different clusters which violates the assumption of independence of all observations. In this study, a three-level hierarchal model called multilevel logistic regression was used to address the effect of clustering by allowing multiple levels of random effects, or residuals specific to the clusters in the model. In general linear models, observations are considered independent of each other, whereas hierarchical models allow us to take into account the influences of the clusters as well as the interaction between them. Therefore, the intraclass correlations (ρ) were computed to assess the proportion of the variance explained by the grouping structure in the population, i.e., the proportion of group-level variance compared to the total variance. The intraclass correlation ρ can also be interpreted as the expected correlation between two randomly drawn units that are in the same group (Hox, Moerbeek, & Van de Schoot, 2017).

Results

Variable descriptions and characteristics of the study sample

Based on the hypothesized framework of the effect of health intervention activities done through self-help groups' federations on maternal health care practices, variables for three levels were identified and mentioned in Table-2A. It also presents the descriptive statistics for the various women/SHGs, village, and block level correlates of maternal health care practices of the rural women from SHG households. Descriptive statistics suggest that nearly 43 percent of respondents were 15-24 years old while the rest were in the age group 25-49 years. About one-fourth of women were not having any formal education while the next one-fourth of women were educated for at least 12 years of schooling. Around 40 percent of women belonged to schedule caste or scheduled tribes' households and one-third of them from poorest/poor households. Women's contact with frontline workers (FLWs) was fairly good in the intervention area, e.g., 58 percent of women had contacts/interaction for 7 or more times while about 10 percent of women had no contacts with any FLWs.

Table 2A. Women/SHG level characteristics and summary statistics (N=1505)

Predisposing factors	Variable description	Category	Proportion (in %)
Age of the women		15-24	43.4
		25-49	56.6
Women's education	Years of schooling completed by the respondent.	No formal education	26.7
		Up to 7 years	20.1
		8-11 years	28.4
		12 or more years	24.9
Caste	Social caste categorized as schedule caste/schedule tribes vs. other caste.	Other caste	58.5
		SC/ST	41.5
Wealth quintile	The household wealth index was developed through principal component analysis using information on 26 household assets measured for six categories, five housing characteristics and one on asset ownership. Wealth quintiles were developed based on equal proportions of the population into five categories.	Lowest/low	34.9
		Middle	21.1
		High/highest	44.0
FLW contacts during pregnancy	Number of time either FLW visited women's home or women met FLW to discuss or provide health related information during women's pregnancy	None/<3 contacts	9.9
		3-6 contacts	31.6
		7 or more contacts	58.5
SHG membership	Whether respondent herself was a member of any self-help groups	Non-members	51.8
		Member	48.2
Health issues discussed in SHG meetings	Discussion on MNH issues in group meeting by a trained community health volunteer, who engaged all the members to participate in discussion, and highlighted the importance of the correct health practices.	No	33.3
		Yes	66.7
Daira Mapping done by SHG	SHG members identified target women (i.e., women who were pregnant, recently delivered, or lactating mothers)	No	74.2
		Yes	25.8
SHG distributed congratulation letter or health leaflets	The letters and leaflets had pictorial information regarding maternal and newborn health practices, given to the family members of the pregnant and recently delivered women	No	90.7
		Yes	9.3
SHG received supportive supervision from ISC/MS	SHG during group meetings received information on correct MNH practices by the trained facilitators	No	65.8
		Yes	34.2
Home visits done by SHG members	SHG members or Swasthya Sakhi made home-visit to provide information to women as well as their family members about correct MNH practices	No	90.5
		Yes	9.5
Received advices on delivery care* from SHG members /VO/SS	Women received advices either from SHG members or VO members or Swasthya Sakhi	No	71.0
		Yes	29.0
Accompanied by SHG members during ANC visits	Women were accompanied by SHG members for ante-natal check-ups during their pregnancy	No	84.5
		Yes	15.5

Further, the study considered some information related to intervention activities conducted through SHGs to see differentiation in the utilization pattern by women from SHG households. Around 48 percent of women from the SHG households were themselves an SHG member. Two-third women belonged to those SHGs in which health issues were discussed by trained community volunteer for highlighting the importance of the correct RMNCH practices. Around one in four women belonged to those SHGs that conducted 'Daira mapping' as a part program activity, to identify target women who were either pregnant or recently delivered in their neighborhood. Around 9 percent women reported that their SHG made home-visit to provide information to women as well as their family members about correct MNH practices. Similar proportion of women were from SHGs that distributed health leaflets to the family members of the pregnant and recently delivered women. Also, around one-third women received advices either from SHG members or VO members or Swasthya Sakhi while 15 percent women reported that they were accompanied by SHG members for ante-natal check-ups during their pregnancy.

Village and block level characteristics of the study area

Table 2B presents village and block level characteristics of the study area. Village-level characteristics include activities done through groups' federation called village organization (VO) along with other facilities available at village level to define the village development status. About one-fourth VOs had shared the list of health facilities for delivery-related services with SHGs. In two-third of VOs, peer educators called ISC or 'Swasthya Sakhi' attended VO meeting held recently. Further, an index for VOs involvement in making collective demand for certain services/entitlements from panchayat or health facilities was created using 9 different items. Estimates suggest that around one-third VOs scored higher scores for their collective actions. At VO level, a composite index was created for the linkages with health services using VO involvement for certain activities like members participation in VHND, FLWs discussed health issues in meetings, sharing beneficiaries list with FLWs, and VO interaction with Village Health and Sanitation Committee. Results indicate that only 22 percent VOs scored high meaning they were carrying out 3-4 activities. Further, village development score was computed based on the availability of services/facilities at village level like all-weather roads, ICDS/AWC, ASHA/AWW, PHC/CHC within 3 km, primary/middle school within 1 km. About 80 percent VOs were found to be associated with higher village development score.

Table 2B: Village and block level characteristics of the study area and outcome variables

Predisposing factors	Variable description	Category	Proportion (in %)
Village level characteristics			
VO shared the list of health facilities for delivery to SHG	VO prepare a list of hospitals where women can access services for child delivery, emergency care in case of complications etc., and the list is shared with respective SHGs	No	72.6
		Yes	27.4
ISC or Swasthya Sakhi attended the VO meeting in last 3 months	Peer educators appointed for disseminating health messages attended VO meetings at least once in past 3 months	No	30.6
		Yes	69.4
VO collective action	**A composite additive index (range: 0-9) based on nine variables with response (yes=1/no=0):** • Demanded for family planning services or functioning of FLWs • Raised issues with panchayat/BDO/BO: on domestic violence • Raised issues with panchayat/BDO/BO: Social justice • Raised issues with panchayat/BDO/BO: Food grain funds • Raised issues with panchayat/BDO/BO: BPL card /MNREGA • Raised issue with BO to demand facility from panchayat/PHC • Organized events in last 6 months to orient family or community on health/education/employment/WASH • Came together to help women having health emergency • Came together to help women who experienced domestic violence	Low = 0-4	70.4
		High = 5-9	29.6
VO linkages with health services	**A composite additive index (range: 0-4) based on four variables with response (yes=1/no=0):** • VO members participated in VHND, • FLWs or ISC/MS came to VO to discuss health issues, • VO shared target women list with FLWs, • VO interacted with Village Health and Sanitation Committee.	Low = 0-2	77.8
		High = 3-4	22.2
Village development score (additive score)	**A composite additive index (range: 0-5) based on five variables with response (yes=1/no=0):** • Availability of all-weather road in the village, • Availability of services (ICDS/AWC/) in the village, • Availability of FLWs in the village, • Availability of PHC/CHC within 3 KM from the village, • Distance to primary/middle school less than 1 km	Low = 0-2	19.3
		High = 3-5	80.7
Block level characteristics			
SC population in the block	Proportion of schedule caste population at block level reported in Census 2011	< 25 percent	60.7
		≥ 25 percent	39.3
SHG saturation in the block	Proportion of population belonged to households having at least one SHG member	< 30 percent	58.5
		≥ 30 percent	41.5
Duration of SHG presence in the block	Duration of the presence of SHGs in the block where respondent resided	< 10 years	53.2
		≥ 10 years	46.8
Outcome Indicators			
At least 3 ANC tests	Woman received at least 3 ANC check-ups such as blood test, blood pressure measurement and abdominal examination during her ANC visits; categorized as: Yes-1, No-0	Yes	71.3
Delivery preparedness	refers to three advance preparation before delivery which includes-saved money to meet expenses, identified health facilities for delivery, and arranged transportation in advance. categorized as: Yes-1, No-0	Yes	21.5
Institutional delivery	whether last delivery was conducted in any health facility; categorized as: Yes-1, No-0	Yes	89.7
PNC within 7 Days	whether women received postnatal check-ups (PNC) within 7 days of delivery. categorized as: Yes-1, No-0	Yes	36.9

Table 3 presents levels of various indicators of maternal health care among women from SHG households across socio-demographic subgroups and by exposure to different program activities by SHG federations. Overall, around 71% women from SHG households received three or more antennal tests (i.e blood test, blood pressure measurement and abdominal examination) during their last pregnancy. Although the level of institutional delivery among these women was around 90% but only one-fifth of these women had actually done key advance preparation for institutional delivery which includes saved money to meet expenses, identified health facilities for delivery, and arranged transportation in advance. Around one-third women had received postnatal check-ups within 7 days of her last delivery any doctor or frontline worker. Findings indicate that socio-demographic differential existed in terms of maternal health care practices. For example, 3 women with no or less formal education were in disadvantaged group compared to women with 12 or more years of education (3+ ANC: 60% vs 78%; institutional delivery: 82% vs 95%; PNC within 7 days: 31% vs 49%). Likewise, women poorest/poor assets quintile status were in disadvantaged group compared to women from high/highest assets quintile (3+ ANC: 63% vs 77%; institutional delivery: 85% vs 93%; PNC within 7 days: 26% vs 43%). Further, it was observed that women who had more contacts with FLWs during their pregnancy were more likely for better maternal health care practices, such as, 3+ ANC tests (none/<3 contacts: 51% vs 7 or more contacts=71%); institutional delivery (none/<3 contacts: 85% vs 7 or more contacts=92%); postnatal check-up within 7 days (none/<3 contacts: 30% vs 7 or more contacts=42%).

There were not considerable differences observed in the level of maternal health care practices by women’s membership status. However, the health behaviour change intervention activities done by SHGs to which women were associated were positively affecting their health behaviour. There were 5 to 9 percent point differences in healthy practices by women if health issues were discussed in their SHG meetings. Delivery preparedness was relatively higher among women who received congratulatory letter/health leaflets (yes: 28.6% vs no: 20.8%) or if someone from SHGs visited women’s home to provide information about correct health practices (yes: 27.3% vs no: 20.9%). It was also observed that if SHGs received supportive supervision from the peer educator called ISC/MS, then there was higher chance of correct practices such as 3+ ANC tests (yes= 76.8% vs no=68.4%); delivery preparedness (yes=25.1% vs no=19.7%); institutional delivery (yes= 93,2% vs no=87.9%); postnatal check-up within 7 days (yes= 39.9% vs no=35.3%). Further, higher proportion of women who received advices by SHG members or peer educators on delivery care, were practicing correct maternal health practices such as as 3+ ANC tests (yes= 80.1% vs no=69.5%); delivery preparedness (yes=34.8% vs no=17.4%); institutional delivery (yes= 92.5% vs no=88.6 %); postnatal check-up within 7 days (yes= 43.6% vs no=36.2%). Some of the practices by women like 3+ ANC tests and institutional delivery were proportionately higher among those who were accompanied by SHG members during their ANC visits to the health facilities.

Some of the village level health activities through village organization were found to be affecting maternal health care practices. It was observed that if VO had shared list of health facilities available for institutional delivery to SHGs or if peer educator like ISC and Swasthya Sakhi attended VO meetings, then SHG women under these VOs were practicing better health behaviour. Further, it was also observed more women from VOs having higher linkages with health services like participation in VHND or interaction with Village Health and Sanitation Committee, FLWS attended VO meetings etc., were found to practice better maternal health care compared to the VOs with low linkages, e.g., 3+ ANC tests (high= 79.0% vs low=69.1%); delivery preparedness (high=26.6% vs low=20.1 %); institutional delivery (high= 94.9% vs no=88.2 %); postnatal check-up within 7 days (high= 45.2% vs no=34.5%). Also, villages with high development scores in terms of availability of all-weather roads, ICDS/AWC, FLWs in the village and PHC within 3 km, were relatively better especially in ANC and delivery preparedness. Some of the block level characteristics SHG saturation and duration of SHGs' presence in the blocks were found to be affecting positively the maternal health practices of the women from SHG households.

Table 3. Maternal health care practices among rural women from SHG households, Uttar Pradesh, 2017

Sample characteristics at various level		**At least 3 ANC tests**	**Delivery preparedness**	**Institutional delivery**	**PNC within 7 days**	**Sample**
Women/SHG characteristics:		(%)	(%)	(%)	(%)	(n)
Age of the women	15-24	72.3	19.1	91.3	36.9	653
	25-49	70.5	23.4	88.5	36.9	852
Women's education	No formal education	60.4	17.9	81.8	31.3	402
	Up to 7 years	71.0	19.5	88.4	31.7	303
	8-11 years	75.8	24.9	93.4	35.3	425
	12 or more years	78.1	23.2	94.9	48.8	375
SHG membership	Non-members	72.6	21.0	91.9	40.4	780
	Member	69.9	22.1	87.3	33.1	725
FLW contacts during pregnancy	None/<3 contacts	51.0	15.4	84.6	30.2	149
	3-6 contacts	67.0	19.5	88.0	30.5	476
	7 or more contacts	71.1	23.6	91.5	41.5	880
Caste	Other caste	73.0	21.3	91.4	41.3	881

	SC/ST	68.9	21.8	87.3	30.6	624
Wealth quintile	Lowest/low	63.4	19.6	85.0	25.9	525
	Middle	73.3	20.8	89.9	41.5	318
	High/highest	76.6	23.4	93.4	43.4	662
Health issues were discussed in SHG meetings	No	65.9	18.0	85.8	31.3	501
	Yes	74.0	23.3	91.6	39.6	1004
Daira Mapping done by SHG	No	70.7	20.4	89.6	35.9	1117
	Yes	72.9	24.7	89.9	39.7	388
SHG distributed congratulation letter/health leaflets	No	71.1	20.8	89.5	36.7	1365
	Yes	73.6	28.6	91.4	38.6	140
SHG received supportive supervision from ISC/MS	No	68.4	19.7	87.9	35.3	991
	Yes	76.8	25.1	93.2	39.9	514
Home visits done by SHG members	No	71.0	20.9	89.4	36.9	1362
	Yes	74.1	27.3	92.3	36.4	143
Received advices on delivery care* by SHG members/VO/SS	No	69.5	17.4	88.6	36.2	1068
	Yes	80.1	34.8	92.5	43.6	437
Accompanied by SHG members during ANC visits	No	69.6	20.9	88.9	36.7	1272
	Yes	80.7	24.9	94.0	37.8	233
Village Organization characteristics:						
VO shared the list of health facilities for delivery to SHG	No	68.6	20.0	87.7	35.3	1093
	Yes	78.4	25.5	94.9	41.0	412
ISC or Swasthya Sakhi attended the VO meeting in last 3 months	No	68.1	22.8	86.6	31.5	461
	Yes	72.7	21.0	91.1	39.3	1044
VO collective action	Low (0-4)	71.2	21.2	88.4	35.0	1060
	High (5-9)	71.5	22.2	92.8	41.3	445
VO Linkages with Health services	Low (0-2)	69.1	20.1	88.2	34.5	1171
	High (3-4)	79.0	26.6	94.9	45.2	334
Village development score (additive score)	Low (0-2)	65.3	16.8	88.0	36.4	291
	High (3-5)	72.7	22.7	90.1	37.0	1214
Block characteristics:						
Proportion of SC population at block level	Less than 25 percent	72.6	23.1	91.5	40.3	914
	25 percent or more	69.2	19.1	87.0	31.6	591
Population covered by SHGs at block level	Less than 30 percent	67.2	18.6	87.5	33.4	880
	30 percent or more	77.1	25.6	92.8	41.8	625
Duration of SHG formation in the block	Less than 10 years	68.2	16.5	88.1	33.5	801
	10 years or more	74.9	27.3	91.5	40.8	704
Total		**71.3**	**21.5**	**89.7**	**36.9**	**1505**

Results from multivariable multilevel analysis

Three-level multilevel logistic regression models were used to analyze the effect of women's characteristics and SHGs' program activities along with activities done through village organizations and community level factors on maternal health care practices. Four models were used to examine the effects for each delivery care practices which are at least 3 ANC tests, key delivery preparedness, institutional delivery, and postnatal check-ups within 7 days of delivery. Through caterpillar plots in Figure-1, we have plotted residuals for each cluster in ascending order with 95% confidence intervals for each maternal health care practices which presents between-cluster variability i.e., clustering effects at village and blocks levels. Hence, the patterns of the plots justified the need to adjust clustering effects through hierarchal model to assess the effects of various factors at different levels.

Table 4 presents the results of multilevel logistic regression models in terms of between clusters variations in the odds of following correct maternal health care practices through intra-class correlations (ICCs) through naïve model. Also, the results from the models for adjusted odds ratios for various factors at different levels are presented through full models. The naïve models presents the intra-class correlation for various outcomes at village/VO and block levels each. Results of the multilevel analyses suggested that around 6-15 percent of the variance in the maternal health care practices could be explained at VO level, and around 6-12 percent of variance at block level. Overall, we found that there were some levels of clustering in maternal health care practices at village and block level which we attempted to adjust while estimating the effect of various factors through multilevel models.

Further, women’s characteristics like education status, wealth status, caste, FLW contacts during pregnancy, increased exposure to the health intervention activities conducted through SHGs, groups’ collective action were the important predictors for correct practice around maternal health. Additionally, village and VO level characteristics like VO activities around health intervention affects the likelihood for correct practice around maternal health. Women from the blocks with higher proportions of SC/ST population are less likely to go for at least 3 ANC tests, delivery preparedness, and reversible FP method use. Distance from the district headquarters negatively affects the uptake of 3+ ANC tests.

Figure-1: Caterpillar plots for residuals for maternal health care behaviors at VO and bock level

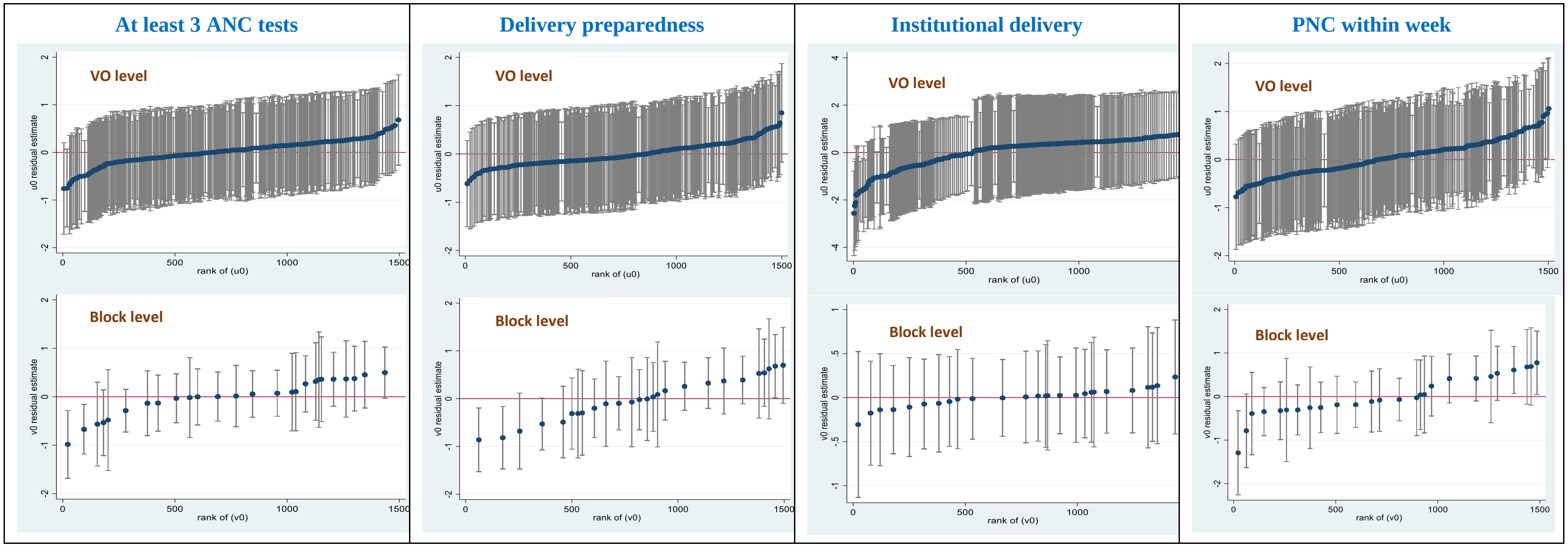


Table 4. Multilevel random intercept logit model for maternal health care practices for women from SHG households, UPCMP 2017

	Model-1: At least 3 ANC tests			Model-2: Delivery preparedness			Model-3: Institutional delivery			Model-4: PNC within 7 days		
	Naive model	Full model		Naive model	Full model		Naive model	Full model		Naive model	Full model	
	OR (95% CI)	OR (95% CI)	p-value	OR (95% CI)	OR (95% CI)	p-value	OR (95% CI)	OR (95% CI)	p-value	OR (95% CI)	OR (95% CI)	p-value
Women/SHG characteristics:												
Age of the women												
Below 24 years (Ref.)												
25-49 years		1.04 (0.75-1.38)	0.428		1.47 (1.04-2.01)	0.011		1.16 (0.68-1.90)	0.339		1.22 (0.93-1.60)	0.083
Woman's education												
No formal schooling (Ref.)												
Up to 7 years		1.55 (1.04-2.23)	0.015		1.05 (0.64-1.62)	0.454		1.85 (1.06-3.13)	0.017		1.02 (0.68-1.45)	0.476
8 to 11 years		2.01 (1.35-2.85)	0.000		1.55 (0.97-2.37)	0.032		3.36 (1.78-5.95)	0.000		1.08 (0.73-1.51)	0.361
12 or more years		2.39 (1.53-3.58)	0.000		1.68 (1.00-2.64)	0.024		4.12 (2.01-7.92)	0.000		1.75 (1.15-2.48)	0.005
FLW contacts during pregnancy												
None/<3 contacts (Ref.)												
3-6 contacts		2.06 (1.30-3.20)	0.001		1.62 (0.88-2.84)	0.067		1.38 (0.66-2.57)	0.225		-	
7 or more contacts		3.06 (1.92-4.72)	0.000		1.65 (0.92-2.76)	0.051		2.02 (0.94-3.80)	0.036		1.93 (1.43-2.58)	0.000
Health issues were discussed in SHG meetings												
No (Ref.)												
Yes		1.28 (0.92-1.80)	0.083		1.69 (1.13-2.51)	0.004		1.10 (0.62-1.78)	0.400		1.40 (0.99-1.91)	0.027
Daira Mapping done by SHG												
No (Ref.)												
Yes		1.02 (0.72-1.41)	0.501		1.08 (0.72-1.54)	0.374		0.72 (0.40-1.19)	0.095		1.13 (0.80-1.55)	0.248
SHG distributed congratulation letter/health leaflets												
No (Ref.)												
Yes		0.94 (0.26-2.43)	0.363		2.40 (0.46-7.92)	0.209		0.63 (0.08-2.58)	0.154		1.74 (0.51-4.44)	0.237
SHG received supportive supervision from ISC/MS												
No (Ref.)												
Yes		1.21 (0.84-1.66)	0.160		1.13 (0.77-1.60)	0.287		1.61 (0.89-2.78)	0.059		0.99 (0.72-1.33)	0.435
Home visits done by SHG members												
No (Ref.)												
Yes		1.19 (0.34-3.05)	0.491		1.08 (0.20-3.30)	0.404		3.19 (0.38-12.34)	0.178		0.72 (0.21-1.82)	0.190
Received advices on **delivery care*** by SHG members/VO/SS/MS												
No (Ref.)												
Yes		1.69 (1.15-2.43)	0.004		2.97 (2.11-4.13)	0.000		2.12 (1.10-3.88)	0.011		1.54 (0.99-2.28)	0.028
Accompanied by SHG members during ANC visits												
No (Ref.)												
Yes		1.76 (1.27-2.36)	0.000		1.29 (0.94-1.72)	0.060		1.10 (0.66-1.71)	0.402		1.04 (0.79-1.34)	0.415

Village Organization characteristics:												
VO shared list of facilities for delivery to SHG												
No (Ref.)												
Yes		1.38 (0.93-1.93)	0.057		0.86 (0.56-1.30)	0.211		2.23 (1.04-4.29)	0.019		1.00 (0.67-1.42)	0.454
ISC or Swasthya Sakhi attended the VO meeting in last 3 months												
No (Ref.)												
Yes		1.25 (0.83-1.83)	0.156		0.73 (0.43-1.10)	0.077		1.00 (0.48-1.77)	0.454		1.36 (0.90-1.97)	0.078
VO collective action												
Low (0-4) (Ref.)												
High (5-9)		0.89 (0.61-1.27)	0.235		1.00 (0.64-1.49)	0.474		1.78 (0.86-3.44)	0.076		1.16 (0.79-1.61)	0.237
VO Linkages with Health services												
Low (0-2) (Ref.)												
High (3-4)		1.37 (0.87-2.08)	0.094		1.19 (0.71-1.83)	0.279		1.54 (0.65-3.20)	0.196		1.38 (0.87-2.09)	0.089
Village development score												
Low (0-2) (Ref.)												
High (3-5)		1.25 (0.85-1.80)	0.147		1.30 (0.81-1.97)	0.162		0.85 (0.37-1.51)	0.288		0.88 (0.58-1.27)	0.225
Block characteristics:												
Proportion of SC population at block												
Less than 25 percent (Ref.)												
25 percent or more		0.92 (0.57-1.42)	0.321		0.89 (0.40-1.72)	0.295		0.65 (0.34-1.15)	0.065		0.76 (0.31-1.29)	0.147
Population covered by SHGs at block												
Less than 30 percent (Ref.)												
30 percent or more		1.49 (0.79-2.76)	0.120		0.85 (0.34-1.95)	0.256		1.69 (0.78-3.27)	0.109		1.45 (0.64-2.92)	0.212
Duration of SHG formation in the block												
Less than 10 years (Ref.)												
10 years or more		0.81 (0.38-1.39)	0.197		1.76 (0.71-3.56)	0.126		0.75 (0.32-1.41)	0.174		0.91 (0.39-1.69)	0.342
Constant	2.72 (2.06-3.53)	0.42 (0.15-1.00)	0.024	0.26 (0.19-0.35)	0.12 (0.03-0.26)	0.000	13.59 (9.44-20.26)	3.03 (0.75-8.42)	0.082	0.51 (0.37-0.7)	0.31 (0.11-0.91)	0.022
Model Fit Statistics												
Bayesian DIC	1743.2	1689.2		1504.1	1464.8		941.2	906.1		1888.4	1858.2	
Variance (Block)	0.290 (0.079-0.725)	0.166 (0.005-0.508)		0.375 (0.125-0.837)	0.458 (0.135-1.079)		0.105 (0.002-0.583)	0.0436 (0.001-0.266)		0.412 (0.130-0.954)	0.348 (0.061-0.981)	
Variance (VO)	0.309 (0.108-0.593)	0.318 (0.055-0.691)		0.334 (0.055-0.648)	0.460 (0.146-0.909)		1.375 (0.723-2.375)	1.598 (0.689 - 2.862)		0.449 (0.209-0.767)	0.386 (0.053-0.780)	
ICC (Block)	**0.0744**	**0.0439**		**0.0937**	**0.1088**		**0.0220**	**0.0088**		**0.0991**	**0.0863**	
ICC (VO)	**0.0794**	**0.0842**		**0.0834**	**0.1092**		**0.2881**	**0.3238**		**0.1080**	**0.0958**	
N	1505	1505		1505	1505		1505	1505		1505	1505	

Note: Naïve model includes no covariates at any level and presents cluster-level variance; Full model include women/SHG level variables, village/VO level variables and block level variables; DIC: The Bayesian Deviance Information Criterion (DIC) is an MCMC penalized goodness of fit measure. It is equivalent to the Akaike Information Criterion (AIC) used in maximum likelihood estimation.; CI refers 95% credible interval; ICC: Intra class correlation coefficient-the degree of homogeneity of the outcome within clusters. Models are adjusted for caste, wealth status, SHG strength, SHG membership for the women etc

Summary and Discussions

In view of hypothesized socio-ecological framework, the multilevel logistic regression models were used to assess the effect of various BCC activities conducted through SHGs and their federations on maternal health practices in rural Uttar Pradesh. Overall, we found that there were some levels of clustering in maternal health care practices at village and block level which we attempted to adjust while estimating the effect of various program activities as well as other contextual factors through multilevel models. Results reiterated the potential of SHGs in promoting correct health practices through BCC interventions. The SHGs and their federations can bridge the gap between community and public health system as women have reported of fair number of contacts with FLWs during their pregnancy and post-delivery. There was fair participation of SHG members in BCC activities like discussion of health issues in SHG meetings, home visits, daira mapping etc. to promote correct health practices. Findings also suggest SHGs federation's critical role in organizing program activities and supporting SHGs in carrying out integration of BCC interventions by making collective demands for certain services/entitlements from panchayat and health facilities. However, their participation in the program was not close to the expectations of the program. Less than one-fourth of VOs scored high in the index developed for measuring their involvement in the program.

As hypothesized in the ecological framework the context plays significant role in BCC approach. The context was quantified through many indicators such as village development index, SHG saturation and durations of presence of SHGs in the block, caste compositions, etc., and we found that more than three fourth of VOs were from the villages with higher village development score. This indicates availability of right kind of environment or context to support the demand generated through BCC activities. But we must be cautious in interpreting the index score in this way. Each village is unique and there is lot of heterogeneity in terms of caste composition and socio-economic culture.

Findings indicate that socio-demographic differential existed in terms of maternal health care practices. Women with no or less formal education, belonging to schedule caste or schedule tribes and from poor wealth status were in disadvantaged group which are common and usually supported by other studies also. However, evidence from other studies suggests that BCC interventions through SHGs helped in reducing the equity gap in accessing and utilization of health services (Hazra, et al., 2019; Mehta et al., 2020a). Practice of some of the correct RMNCH behaviors like ANC checkup, institutional delivery was high among SHG members which is also reported by other studies (Mehta et al., 2020b). However, findings indicate that the contact with FLWs increases the chances of practicing correct health behaviors. This suggest that there should be close coordination or partnership among SHGs, their federations and FLWs to accelerate the impact of BCC interventions. Similarly, findings also suggest positive impact on health behaviors of the women when SHGs had close network and coordination between SHGs with their federations (VOs) such participation in VHND or interaction with Village Health and Sanitation Committee, FLWS attended VO meetings etc. Some of the block level characteristics SHG saturation and duration of SHGs' presence in the blocks were found to be affecting positively the maternal health practices of the women from SHG households. Overall, SHGs and their federations can be useful platform for health behaviour change communication along with convergence with health system to improve maternal and child health in rural India.

However, there are several challenges as documented by previous studies (Aboud & Singla, 2012; Rahman, Leppard, Rashid, Jahan, & Nasreen, 2016) in implementing BCC interventions at scale being it is more focused on material rather that conduct, meaning a greater part of resources and time go into the generation of materials. Also, there could be disproportionate capabilities at local levels in terms of skills and abilities to develop and disseminate BCC messages considering contexts of the target population. Further, involving men in behaviour change intervention was found to be limited or negligible which could be a promising strategy of any BCC intervention for improving maternal and child health and nutrition otherwise (Tokhi et al., 2018).

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