

## A Review on Interventions to Improve the Maternal Care during Pregnancy and Childbirth in Rural India

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### Abstract

*Most of the maternal deaths occur in developing countries and India contributes to one-fifth of this maternal mortality. Many of these deaths are preventable through effective interventions. The present study aims to address the gap in the effect of improved quality of care in pregnancy and childbirth through a review of existing literature. Its focus on displaying the evidence of interventions on care during pregnancy and childbirth in rural India and to compile the existing evidence of the effectiveness of these interventions which may be helpful for policy making. The search strategy was to identify relevant articles in the database like MEDLINE, PubMed, Poptine, and Cochrane. A total of 264 abstracts from 2005 to 2018 were identified from the database search. After reviewing the abstracts against inclusion and quality assessment, 16 articles were found suitable for review. The review shows that community-level interventions focusing on women, frontline health workers and family members through knowledge enhancement, use of mobile technology and upgrading health facilities resulted in improvement in the utilization of maternal practices. This review found evidence that community health workers were effective in delivering health promotion or education or preventive intervention for maternal services in rural India.*

Keywords: Maternal care, pregnancy, childbirth, interventions, India.

### I. Introduction

India contributes to around one-fifth (19%) of the total global maternal mortality (WHO, 2015). There are huge inter-state and intrastate disparities in Maternal Mortality Ratio (MMR) which is an important matter to be addressed. According to the recent Sample Registration System-Maternal Mortality Ratio 2018, the risk of maternal death is one in approximately 2200 live births in Kerala as compared to one in 425 live births in Assam (Registrar General of India, 2018). Many of these deaths are preventable through the effective delivery of interventions. However, without assuring quality, an intervention might have less impact than a less effective one for which quality is maintained (Campbell & Graham, 2006).

There are a number of studies which focus on various intervention to improve the quality of care in different service deliveries during pregnancy and childbirth (Althabe et al., 2008; Raven et al., 2011). Quality of care throughout pregnancy in the form of essential antenatal, post-natal and delivery care is found to be positively associated with pregnancy and childbirth outcomes (Baral & Vashisth, 2014; Paudel et al., 2013; Simkhada et al., 2008). Other studies have found that maternal, new-born and child care interventions with quality improvements reduce maternal and child deaths (Haws et al., 2007; Nyamtema et al., 2011). In India, there is a sharp increase in institutional delivery from 39 per cent in 2005-06 to 79 per cent in 2015-16 with the wide coverage through government

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programmes and conditional cash transfer schemes (International Institute for Population Sciences, 2017a). However, maternal deaths have not gone down on parallel which suggests gaps in providing quality of services to the women. One study in Central Indian state of Madhya Pradesh suggests the critical need to improve the training quality of skilled birth attendants (Bali & Reddy, 2018). The study suggests that skilled birth attendants have 75.4 percentage of correct knowledge of procedure related to delivery care.

A study conducted in Bangladesh found that introduction of WHO Safe Childbirth Checklist (SCC) led to significant improvements in safe childbirth practices. It was found around 70 per cent improvement in safe child practices compared with the baseline (from 11 to 19 out of 27 practices) during the follow-up period of 12 months. This study also found a substantial increase in communication between nurse-midwives and mothers (counselling) in complications management which includes rational use of medicines. A multivariable model found that the necessary childbirth practice was 1.71 times better in follow-up in comparison with the baseline (Nababan et al., 2017). Several schemes (like introduction of JSY, JSSY, ASHA, etc.) were implemented in rural India to improve the MCH services and outcomes. However, the quality and effectiveness of the schemes need to be documented. The aim of the present review is (a) to show the evidence of interventions in the field of quality of care in pregnancy and childbirth in rural India, and (b) to present the effectiveness of such interventions to improve quality of care in rural India.

## II. Methods and materials

### *Search strategy*

The search strategy was similar to that of a systematic review and it was developed to identify relevant articles in the database like MEDLINE, PubMed Central, Popline, Cochrane and cross reference. In addition, we also searched in google and google scholar search engine for relevant papers. Manual exploration was also done from approachable libraries for the pertinent studies not available online.

### *Inclusion criteria*

Those articles which fulfilled the following PIOS criteria were included in the current study: *Population*: The study which had an intervention focused on pregnant women. *Intervention*: The interventions were on antenatal care, delivery care and postnatal care. *Outcomes*: The measured outcomes included variations in knowledge, attitudes and practices during pregnancy, delivery and postnatal care. *Study design*: Only those studies using experimental, quasi-experimental, pre-post and controlled comparison designs were considered for the review.

### *Key words*

Key words like ‘acceptability’, ‘access to health care’ ‘antenatal care’ ‘ANMs’, ‘awareness program’, ‘ASHAs’, ‘anaemia during pregnancy’, ‘behavioural intervention’, ‘birth outcomes’, ‘childbirth’, ‘community workers’, ‘conditional cash transfer’, ‘community mobilisation’, ‘delivery kit’, ‘evidence based delivery care’, ‘gestational diabetes’, ‘health education’, ‘health program’, ‘high risk women’, ‘hypertension’, ‘IFA consumption’, ‘implementation research’, ‘India’ ‘institutional deliveries’, ‘intervention’, ‘integration’, ‘incentive’, ‘intrapartum’, ‘maternal care’, ‘maternal health’, ‘maternal mortality’, ‘maternal survival’, ‘mHealth’, ‘mobile clinic’, mobile phone, ‘preeclampsia’, ‘pregnant women’, ‘perinatal care’, ‘PHC’, ‘preterm birth’, ‘Janani Suraksha Yojana-JSY’, ‘Janani Shishu-Suraksha Karyakram-JSSK’, ‘quality of care’, ‘rural’, ‘safe delivery’, ‘sub-centre’, ‘TT injection’, ‘uptake’ and ‘rural India’ are used in combination to search the eligible articles.

*Data collection process*

A total of 264 abstracts from 2008 to 2018 were identified from the database search and cross references. After reviewing the abstracts against inclusion and exclusion criteria, 40 articles were found suitable. A majority of the studies were excluded because the study design was cross-sectional. Full texts of 40 articles were assessed again for inclusion and exclusion criteria and 24 articles were excluded for a variety of reasons like cross sectional study design, some of them were RCT protocol and clearly not mentioned whether the study was conducted in rural areas or results were not given for rural areas. Therefore, a total of 16 studies were included for the review (Figure 1). Data was extracted systematically using pre-formulated tool consisting of study design, setting, target population, components of intervention, control/comparison and key findings/outcomes. Data was then synthesised by combining studies with similarities in outcomes/key findings. Quantitative synthesis or meta-analysis was not carried out as the population, methodology, interventions and outcome of the studies were heterogeneous in nature.

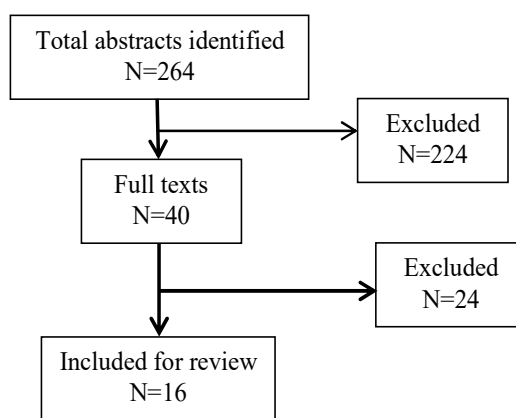


Figure 1: Flow diagram of systematic search results for the review

*Study characteristics*

*Geographical Setting:* The studies included in the current review were conducted in Haryana, Maharashtra, Karnataka, Rajasthan, Telangana and Uttar Pradesh.

*Study design:* Out of 16 studies included, six were Randomized Control Trials, four were pre-post studies, five were quasi-experimental study and one cohort study.

*Year of publication:* Articles published between 2008 and 2018 were considered.

*Narrative synthesis:* The incorporated studies were, therefore, categorised and described as reported in results section.

**III. Results***Enhancing antenatal care and institutional deliveries*

Eight studies focused on increasing antenatal care (ANC) and institutional deliveries by creating awareness (Alehagen et al., 2012; Kumar et al., 2012; Sharma et al., 2018), upgrading health facility (Amudhan et al., 2013), mobile technology (Menaka et al., 2017) and integrating with other programmes (Bindoria et al., 2014; Kojima et al., 2017; Madhivanan et al., 2013). Auxiliary nurses, medical officers and field workers were trained to motivate women for first ANC check-up within 16 weeks of gestation, at least three ANC visits and a postnatal visit, identifying the high risk pregnancy (Alehagen et al., 2012). As a result, the first ANC before 16 weeks increased from 38 per

cent to 63 per cent and the referred cases increased from 25 per cent to 52 per cent. The percentage of institutional deliveries improved from 40 per cent to 74 per cent. The number of maternal deaths decreased from 32 to 8. Another quasi-experimental study was conducted in Uttar Pradesh and Rajasthan among pregnant women aged 15-25 years (Sharma et al., 2018) in two primary health centres (PHCs). The intervention included sensitizing family, community and capacity building of frontline health workers through individual or group counselling and advocacy meeting with community members yielded in significant increase in more than three ANC visits and institutional deliveries.

A cluster RCT was conducted in Shivgarh, Uttar Pradesh (Kumar et al., 2012). The interventions comprised of birth preparedness, emergency preparedness and hygiene delivery were provided by community health workers (CHWs) during two prenatal (60 and 30 days before EDD) home visit, community meetings and folk meetings. Significant improvement in knowledge of danger signs was observed in intervention area than control. In another study in PHC, Telangana pregnant women were registered through mobile application and high risk pregnancies were screened through an automated algorithm (Menaka et al., 2017). This resulted in one third of high-risk pregnant women and were referred to higher centres. The PHC, Ballabgarh was upgraded to provide 24/7 intrapartum care services free of cost with additional ANM trained in conducting deliveries with referral support (Amudhan et al., 2013) as a result the institutional deliveries were increased by 14 points from 45 per cent to 59 per cent.

#### *Integrating with HIV facilitates*

A quasi-experimental study was conducted in 40 villages of Mysore district, Karnataka to emphasize the importance of ANC and HIV testing through community education and meetings by women's self-help groups (Madhivanan et al., 2013). It was reported that the percentage of ANC was higher in intervention area (72.5%) than control area (43.3%). In another study by Bindoria et al (2014) on functional facility-based integrated counselling and testing centres (FICTCs) round-the-clock at PHCs in Satara district, Maharashtra resulted in detection of 27 per cent of HIV-infected pregnant women during antenatal care (Bindoria et al., 2014).

#### *Influence of Janani Shishu Suraksha Karyakarm (JSSK)*

Retrospective study of 32 months was extracted from PHC, Chhainsa, Ballabgarh, Haryana (Salve et al., 2017). The data were compared to pre- (August 2010 to November 2011) and post-implementation (Dec 2011 to November 2013) of JSSK scheme. Approx. 2.7 times increase in institutional deliveries were observed during pre- JSSK (26.8%) and post- JSSK (73.2%) in spite of no significant development either in human resources or in infrastructure up-gradation at the study facility.

#### *Enhancing IFA consumption during pregnancy*

Three studies (Ahamed et al., 2018; Shivalli et al., 2015; Srivastava et al., 2015) focused on increasing demand and consumption of IFA during pregnancy. Significant reduction in prevalence of anaemia (from 72.6% to 50.7%) was observed among currently pregnancy women in the three poor performing blocks of Varanasi district, Uttar Pradesh by social mobilization for IFA consumption through print media, social media and interpersonal communication (Srivastava et al., 2015). An open label RCT was conducted among 400 pregnant women (12-16 weeks of gestation) at 17 villages in Haryana (Ahamed et al., 2018) in which the first dose of IFA was supervised by ASHA every week. There was 6 per cent reduction in the prevalence of anaemia in the intervention group as compared with the control group was observed. In another quasi-experimental study conducted in one block of Uttar Pradesh shows that involving family members and putting reminder materials at home as Trial of Improved Practices (TIPs) strategy increased consumption of IFA among pregnant women. Thereby, the prevalence of anaemia went down by half as the compliance of IFA consumption was higher (85%) (Shivalli et al., 2015).

*Randomized clinical trial to show drug efficacy*

Geller et al (2008) carried out RCT in four PHCs of Belgaum, Karnataka to see the efficacy of misoprostol on reduction of post-partum haemorrhage (PPH) (Geller et al., 2008) which was administered by ANMs. Another cluster randomised non-inferiority community trial was conducted where a total of 58 ANMs were randomized either to provide primary prevention (n=38) or secondary prevention (N=20) (Raghavan et al., 2016) to women with low risk pregnancies willing for delivery with an ANM at home or sub-centre. Secondary prevention of PPH was found to be non-inferior to universal prophylaxis based on the postpartum haemoglobin ( $\leq 7.8\text{g/dl}$ ). Athawale et al. (2013) conducted RCT among singleton pregnancy women in Wardha in which one tablet Mifepristone 200mg per oral stat was given to women and placebo to women in control. The percentage of vaginal delivery was significantly higher in intervention (76%) group as compared with control (36%) group. Subhedar et al. (2013) conducted among diagnosed pregnancy induced hypertension (PIH) rural women in Wardha to see the effect of Labetalol against Methyldopa. It was found that Labetalol is helpful in better and quicker control of blood pressure and the chances of spontaneous onset of labour were greater in the same group than the methyldopa group.

**IV. Discussion**

This paper synthesised evidence relating to interventions that improved quality of care during pregnancy and childbirth practices in rural India. Studies were conducted in Haryana, Maharashtra, Karnataka, Rajasthan, Telangana and Uttar Pradesh. The review showed that community level interventions focusing on women, frontline health workers and family members through knowledge enhancement about quality of maternal and child health services and use of technology or a combination of interventions conducted in rural India result in improvement of the quality of care during maternal and childbirth practices. A number of interventions had been carried out to increase the antenatal care and institutional deliveries. The interventions such as creating awareness and capacity building of frontline health workers (Alehagen et al., 2012; Kumar et al., 2012; Sharma et al., 2018), community mobilization (Sharma et al., 2018), birth preparedness and hygiene delivery (Kumar et al., 2012) upgrading health facility (Amudhan et al., 2013), using mobile technology (Menaka et al., 2017), integrating with other programmes (Bindoria et al., 2014; Kojima et al., 2017; Madhivanan et al., 2013) and implementing JSSK (Salve et al., 2017) significantly increased the ANC visits and institutional deliveries.

Prevalence of anaemia among pregnant women is a public health problem. IFA consumption (100+ tablets) during pregnancy was found to be only 23 per cent among pregnant women in India in 2014-15 (International Institute for Population Sciences, 2017b). Among the reasons for poor compliance of IFA consumption was poor awareness and forgetfulness (24-26). Hence, multifaceted approach was taken to create demand and compliance of IFA during pregnancy (Shivalli et al., 2015 and Srivastava et al., 2015). The consumption of first dose of IFA per week was supervised by ASHA (Ahamed et al., 2018) or involving family members (Shivalli et al., 2015) showed a significant improvement in compliance of IFA consumption during pregnancy. The finding indicates that involving ASHA or family members may increase the IFA consumption during pregnancy and improve the birth outcomes.

There is extensive evidence that community health workers have potential to improve quality of care and providing MCH services. They may identify high risk pregnancy (Alehagen et al., 2012; Menaka et al., 2017 Patel et al., 2017), conduct deliveries (Amudhan et al., 2013), supervise IFA consumptions (25), provide nutrition counselling (Nair et al., 2017) and create awareness (Alehagen et al., 2012; Kumar et al., 2012; Sharma et al., 2018). Evidence on use of mobile technology in creating awareness and reminder for services of maternal and child health care enhanced the knowledge and services utilization (Datta et al., 2014; Menaka et al., 2017). Not only creating awareness and trained manpower increased the MCH services but also upgraded PHCs to provide 24x7 intrapartum care with additional trained ANMs, and provide HIV tests and HIV counselling (Bindoria et al., 2014).

The studies found that capacity building of community health workers not only improved antenatal care services (Alehagen et al., 2012; Bindoria et al., 2014), but also created awareness of maternal health. This indicates that enhancing the capacity of CHWs in various aspects of MCH programmes may improve the quality of care during pregnancy and childbirths.

### Conclusion

This review found evidence that community health workers were effective in delivering health promotion or education or preventive intervention for maternal and child health in rural India. It also suggests that upgrading the health facility or integrating the intervention with ongoing programmes made an impact on MCH outcomes.

### Limitations

We allowed for a wide range of study design in order to get a comprehensive picture. Limitations of the review include methodological problems like inadequate information about implementation, who imparted the intervention, frequency of intervention delivery, sample selection, randomization and method to control confounding and/or contamination, duration of follow-up and loss to follow-up. Variations in interventions, training and outcomes make it difficult to compare or quantify the effectiveness. Our attempt to categorize the studies in a meaningful way based on interventions or outcomes was challenging due to the heterogeneous nature of intervention and its results.

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Table 1: Data synthesis of included studies in systematic review

Author	Study Area	Study design	Control	Intervention	Provided by	Participants	Outcomes
Ahamed et al., 2018	17 villages under PHC, Ballabgarh, Haryana	Open label RCT N=400	Yes	The first dose of IFA every week was supervised by ASHA	ASHA	Pregnant women	Compliance of IFA consumption in the control group was 60.4% whereas it was 69.1 in the intervention group. There was 6% reduction in the prevalence of anaemia in the intervention group as compared to control group.
Alehagen et al., 2012	Ahmednagar district, Maharashtra	Pre- & post-study design	NA	First ANC check- up within 16 weeks of gestation, at least 3 ANC visits, and a postnatal visit, identifying the high-risk pregnancy) and supervision of growth, malnourishment and development, providing food, vitamin and immunization	ANM	Pregnant women	The first ANC before 16 weeks increased from 38% to 63% and referred cases increased from 25% to 52%. The percentage of institutional deliveries increased from 40% to 74%. The number of maternal deaths decreased from 32 to 8.
Amudhan et al., 2013	One PHC in Ballabgarh, Haryana	Pre- & post-quasi-experimental design	NA	To provide 24/7 Intrapartum care services free of cost with additional ANM trained in conducting deliveries with referral support	ANM	Pregnant women	The institutional deliveries were increased by 14.2% from 45.1% to 59.3%.
Athawale et al., 2013	Rural Hospital, Sawangi (Meghe), Wardha	RCT	Placebo n=50	One tablet mifepristone 200 mg per oral stat.	Hospital/Doctors	Singleton pregnancy gestation age 37 completed weeks	Vaginal delivery intervention 76% as compared to 36% in control. Augmentation required in 26% of women in study group as compared to 80% in control group.

Author	Study Area	Study design	Control	Intervention	Provided by	Participants	Outcomes
Bindoria, et al., 2014	Clinic patients (PHCs/SCs), Satara Dist, Maharashtra	Pre- & post-	NA	Integrating the PPTCT program, NACO (NACP) with the MCH component of the NRHM by offering HIV screening and counselling at PHC/SC 24x7 ICTCs, IEC, training, pre-post counselling and mobile Van	ASHAs for mobilizing and nurses for screening HIV	Pregnant women	Annual HIV screening of ANC attendees increased from 55% pre-intervention to 79% post-intervention ( $p < 0.001$ ). Percentage of functional PHCs with NRHM and supported ICTC facilities increased from 47.2% to 97.2%.
Geller et al., 2008	4 PHC area of Belgaum District, Karnataka 43 villages	RCT N=1620	Placebo	Misoprostol	ANM	Pregnant women	The rate of PPH among women receiving misoprostol was 6.4% compared with a placebo rate of 12.0%.
Kojima et al., 2017	Rural Mysore, Karnataka	Quasi-experimental design	Not Available	A mobile clinic system was set up to educate rural communities about maternal child health, train community health workers in common safe birthing procedures and providing comprehensive antenatal care, prevention of mother-to-child transmission of HIV and testing for specific infections	Community workers and health care providers	Men and women	Approximately 49.5% cases of moderate to severe anaemia and 4.3% cases of hypertension were identified and treated among the pregnant women.
Kumar et al., 2012	Faridabad, Haryana	RCT	Yes	ENC comprised birth preparedness, including preparation of the delivery room, prior identification of birth attendant and emergency preparedness such as financial savings; hygienic delivery and immediate newborn care; clean umbilical cord and skin care; thermal care including skin-to-skin care; immediate	CHWs	Pregnant women	Knowledge of danger signs during pregnancy and labour was significantly higher, and significantly lower proportions of women reported problems in pregnancy and labour in the intervention arm than in the control arm. The proportions of women who self-recognized problems ( $P=0.0004$ ) and who discussed problems with family members or neighbours ( $P=0.0004$ ) during

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				breastfeeding with no pre-lacteal feeding; and care seeking from trained providers.			pregnancy were 40% and 50% higher, respectively, in the intervention arm than in the control arm. No significant difference in Institutional delivery was observed between two arms. Breastfeeding within 1 hour was 5 times higher in study arm than control arm
Madhivana et al., 2013	40 villages Mysore District, Karnataka	Quasi-experimental design n=418	Yes. Intervention provided by research staff n=418	Community education meetings conducted one day prior to arrival of mobile clinic included key messages on birth preparedness, ANC, recognizing danger sign of during pregnancy, delivery care and HIV testing n=512	Women's self-help groups	Community	Percentage of ANC were higher in intervention area (72.5%) than control area (43.0%) Consented to HIV testing was universal in both the areas. Though HIV prevalence of 0.9% and 0.6% was detected in intervention and control area respectively.
Menaka et al., 2017	PHC, Ranga Reddy District, Telangana	Experimental study N=204 study group and control group each 102	Yes	Initially registered in the mobile application. The high-risk pregnancies were highlighted by an automated algorithm for which further management were carried out.	Community health workers	Antenatal women	The percentage of having more than 4 ANC visits was 75.4% and 62.7% in study and control group respectively. In the control group 16.7% women were referred to higher centres whereas, in the study group 33.3% women were referred.
Raghavan et al., 2016	Bijapur District, Karnataka	RCT	Yes, standard care	800 mcg sublingual misoprostol administered (secondary prevention)	ANM	Women with low risk pregnancies	Secondary prevention of PPH with misoprostol in non-inferior to universal prophylaxis based on the primary outcome of postpartum haemoglobin. Secondary prevention could be a good alternative to universal prophylaxis as it medicated fewer women and is an acceptable and feasible strategy at the community level.

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Salve et al., 2017	PHC, Chhainsa, Ballabgarh, Haryana	Pre- & post-JSSK	NA	Pre- (August 2010-November 2011) & Post- (Dec 2011-March 2013) Janani Shishu Suraksh Karyakram (JSSK)		Pregnant women	Approx. 2.7 times increased in Institutional deliveries were observed pre JSSK (26.8%) and Post JSSK (73.2%).
Sharma et al, 2018	Uttar Pradesh and Rajasthan	Quasi-experimental study design 2 PHC intervention one PHC control	Yes n=554	Sensitizing family members, community mobilization and capacity building of frontline health functionaries through individual or group counselling and advocacy meetings with community members (head of the village, local governance and religious group members n=1140 CHW accompanied ANC women.	Project staff	Pregnant and lactating women aged 15-25 years	Significant increase in more than 3 ANC visits (study area: from 63.3 to 75.6%; control: from 50.2 to 52.8%), institutional deliveries (study area: 73.3 to 87.8%; control area: 82.3 to 80.7%) and postnatal care (study area from 16.5 to 29.7%; control area 13.9 to 18%), immediate breastfeeding (study area: from 83.1 to 90.4%; control area:86 to 88.7%). The difference in difference analysis revealed a net improvement of 13% in the intervention area over the control area.
Shivalli et al., 2015	4 villages Chiraigaon Community Development Block (CBD), Varanasi	Quasi-experimental study N=197	Yes, n=2 villages	Det and IFA intake Trial of improved practices (TIPs) communication and counselling guide and home-based reminder materials with messages and pictures, interpersonal communication, active participation of family members.	Project staff	Pregnant women in 13 to 28 weeks of gestation	The prevalence of anemia reduced by half in TIPs group and increased by 2.4% in the control group. Compliance of IFA consumption was also higher in intervention group (85%) than control group (38%).
Srivastava et al., 2015	3 poor performing blocks of Varanasi District, Uttar Pradesh	Cohort	NA	Social mobilization activities like (print media, radio/TV talk, post card campaign, sensitization meeting with opinion leaders, chemists and druggists, medical representatives, school			Significant reduction in prevalence of anaemia (from 72.6% to 50.7%) was observed among currently pregnant women

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				programmes) for IFA consumption			
Subhedar et al., 2013	Rural population, Wardha, Maharashtra	RCT	n=50	90 were given Labetalol and 90 were given Methyldopa	Doctors	Diagnosed PIH women	Labetalol is more advantageous than methyldopa in terms of better and quicker control of blood pressure. The chances of spontaneous onset of labour were greater in the labetalol group than in the methyldopa group. Those patients on labetalol, who required induction of labour were noted to have a better Bishop score at the time of induction