Community Based Prospective Study of Miscarriages in Context of Biomass Fuel Use by Tribal Women of Rural Remote Region

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ABSTRACT

OBJECTIVE

Community based prospective study was carried out to know about the occurrence of miscarriages in context of Biomass fuel use by rural tribal, pregnant women.

DESIGN

Cross-sectional analysis.

SETTING

Villages and Dr. Sushila Nayar Hospital, Utavali, Melghat, Amravati Maharashtra.

POPULATION

Study in 100 villages, all pregnancies included.

METHODS

After approval of the institute's ethics committee, study was conducted in 100 villages. After base information, villages were divided into 50 study, 50 controls, subdivided into 40 study villages with advocacy for protection from ill effects of Biomass fuel, 40 non-advocacy controls and 10 study villages where in addition to advocacy Chimneys were fixed on roofs of huts with no windows, for exit of smoke and 10 controls where neither advocacy was done nor Chimneys were fixed.

MAIN OUTCOME MEASURES

Change in occurrence of miscarriage with Biomass fuel use.

RESULTS

In 50 study villages, of 1005 pregnancies, 2.8% reported miscarriages and in 50 controls, of 1097 pregnancies 3.1% had miscarriage. Of 2700 pregnancies in 40 Advocacy study villages 6.6%, of 40 controls of 2700 pregnancies, 10.5% had miscarriages. In 10 villages with Advocacy as well as Chimneys, of 700 pregnancies, 2.4% had miscarriages in 10 controls, of 700 pregnancies 5.6% ended in miscarriages. In first year it could have been underreporting.

CONCLUSION

In rural tribal women miscarriages were not more than globally known, but Biomass fuel did affect occurrence of miscarriages.

INTRODUCTION

Miscarriage, defined as the loss of a pregnancy before viability, occurring in more than 10% of women affecting woman's overall health, is one of the most prevalent negative reproductive outcomes around the world.[1] Knowing occurrence, causes and prevention of recurrence are great persisting challenges. The miscarriage has been reported to be the most common severe adverse pregnancy outcome and stressful too. Exposure to air pollutants including Biomass fuel smoke may be responsible for higher risk of miscarriage.[2] Grippo[3] reported that evidence showed adverse effects of air pollutants on pregnancy. However it has been reported that there is scarce community based information about its burden, especially in rural women from low-income countries.[4]

OBJECTIVE

Community based prospective study was carried out to know about miscarriages in context of Biomass fuel used by rural, tribal women who had extreme poverty.

MATERIAL AND METHODS

After approval of the institute's ethics committee, the present prospective study was conducted over almost two and half years in 100 villages of Dharni Block of Melghat in Amravati District of Maharashtra Province of India where mother and child services were initiated after having created a health facility in one of the villages. Villages were visited 5 days a week and information was collected prospectively after taking consent with data entry on weekly basis. Pretested tool was used for collecting information and responses were recorded on the tool by the research assistants. Nobody was given tool to fill. In the first year the base information was collected in 100 villages and villages were divided randomly in 50 study and 50 controls and subdivided into 40 study villages where advocacy for protection from ill effects of Biomass fuel was done and 40 control villages in which no advocacy was done. In 10 study villages in addition to advocacy, Chimneys were also fixed on roofs of huts without windows for exit of smoke of Biomass fuel and in 10 control villages, neither Advocacy was done nor Chimneys were fixed.

RESULTS

Base information in study and control villages was comparable. Total 1005 pregnancies were reported in 50 study villages, and of them 28 (2.8%) reported miscarriages, 22 (78.6%) first trimester and 6 (21.4%) second trimester. And 1097 pregnancies were reported in 50 control villages, 34 (3.1%) reported miscarriages, 25 (73.5%) in first trimester and 9 (26.5%) second trimester. Of 1005 pregnant women in study villages, 341 (33.9%) were of 15-19yrs, 11 (3.2%) reported miscarriages, 9 (81.8%) first trimester and 2 (18.2%) second trimester and of 1097 pregnant women in control villages, 337 (30.7%) were of 15-19yrs, 13 (3.9%) of them had miscarriages, 10 (76.9%) first trimester and 3 (23.1%) second trimester. In study villages, 399 (39.7%) women were illiterate, 15 (3.8%) of them had miscarriages, 11 (73.3%) in first trimester and 4 (26.7%) second trimester. In control villages, 431 (39.3%) women were illiterate, 17 (3.9%) had miscarriages, 13 (76.5%) in first trimester and 4 (23.5%) second trimester. Overall 128 (12.7%) women were high school educated in study villages and 3 (2.3%) of them had miscarriages, 2 (66.7%) in first trimester and one (33.3%) second trimester. And 154 (14.0%) women were high school educated in control villages, 4 (2.6%) of them had miscarriages, 3 (75.0%) first trimester and one (25.0%) second trimester. Overall 589 (58.6%) women were housewives in study villages and 23 (3.9%) had miscarriages, 18 (78.3%) in first trimester and 5 (21.7%) second trimester. Of the 629 (57.3%) housewives in control villages, 25 (4.0%) had miscarriages, 20 (80.0%) in first trimester and 5 (20.0%) second trimester. Of 342 (34.0%) unskilled workers (Labourer) in study villages, 5 (1.5%) had miscarriages, 4 (80.0%) in first trimester and one (20.0%) second trimester. Of 364 (33.2%) unskilled workers (Labourer) in control villages, 7 (1.9%) had miscarriages, 4 (57.1%) first trimester and 3 (42.9%) second trimester. Amongst economically lower and lower middle class, of 901 (89.6%) women of 1005 in study villages, 27 (2.9%) had miscarriages, 21 (77.8%) in first trimester and 6 (22.2%) second trimester and in control villages of 971 (88.5% of 1097) women of lower and lower middle than, 31 (2.8%) had miscarriages, 23 (74.2%) in first trimester and 8 (25.8%) second trimester. Of 449 (44.7%) primigravida in study villages, 14 (3.1%) had miscarriages, 11 (78.6%) in first trimester and 3 (21.4%) in second trimester. In control

villages, of 497 (45.3%) primigravida, 16 (3.2%) had miscarriages, 10 (62.5%) in first trimester and 6 (37.5%) second trimester. In study villages of 556 (55.3%) women with more than two births, 14 (2.5%) had miscarriages, 11 (78.6%) in first trimester and 3 (21.4%) in second trimester and in controls of 600 (54.7%) women with more than two births, 18 (3.0%) had miscarriages, 15 (83.3%) in first trimester and 3 (16.7%) in second trimester [Table I].

After having base information, Advocacy about protection from ill effects of Biomass fuel was done in 40 study villages. No Advocacy was done in 40 controls. Of the total 2700 pregnancies reported in 40 study villages, 179 (6.6%) had miscarriages, 133 (74.3%) in first trimester and 46 (25.7%) second trimester and of 2700 pregnancies reported in 40 control villages, 283 (10.5%) ended in miscarriages, statistically significant difference between study and control villages (P value <0.011), 225 (79.5%) in first trimester and 58 (20.5%) second trimester. Of 2700 women of study villages, 914 (33.9%) were of 15-19yrs and 89 (9.7%) of them had miscarriages, 70 (78.7%) in first trimester and 19 (21.3%) second trimester. And of 2700 pregnancies of 40 control villages, 832 (30.8%) women were of 15-19yrs and 127 (15.3%) had miscarriages, 105 (82.7%) in first trimester and 22 (17.3%) second trimester. Of 116 (4.3%) women of 30-34yrs in study villages, 3 (4.3%) had first trimester miscarriages and in controls, of 131 (4.9%) women of 30-34yrs and 16 (12.2%) had miscarriages, statistically insignificant difference between study and control villages (P value >0.3029), 15 (93.7%) in first trimester and one (6.2%) second trimester. Of 897 (33.2%) illiterate women in study villages, 85 (9.5%) reported miscarriages, 62 (72.9%) in first trimester and 23 (27.1%) second trimester and in controls, of 1013 (37.5%) illiterate women, 133 (13.1%) had miscarriages, statistically insignificant difference between study and control villages (P value >0.3165), 107 (80.5%) first trimester and 26 (19.5%) second trimester. Of 377 (14.0%) high school educated women in study villages, 16 (4.2%) had miscarriages, 13 (81.3%) in first trimester and 3 (18.7%) second trimester. Total 328 (12.1%) women were high school educated in control villages, 27 (8.2%) had miscarriages, statistically insignificant difference between study and control villages (P value >0.3109), 23 (85.2) in first trimester and 4 (14.8%) second trimester. Of 1164 (43.1%) housewives in study villages,

83 (7.1%) had miscarriages, 62 (74.7%) in first trimester and 21 (25.3%) second trimester. Of 1234 (45.7%) housewives in control villages, 128 (10.4%) had miscarriages, 100 (78.1%) in first trimester and 28 (21.9%) second trimester. Of 932 (34.5%) unskilled workers (Labourer) in study villages, 57 (6.1%) had miscarriages, 39 (68.4%) in first trimester and 18 (31.6%) second trimester and 951 (35.2%) in control villages, 87 (9.1%) had miscarriages, statistically significant difference between study and control villages (P value <0.0119), 65 (74.7%) first trimester and 22 (25.3%) second trimester. Amongst economically lower and lower middle class 2019 women (74.7% of 2700) in study villages, 148 (7.3%) had miscarriages, 108 (72.9%) in first trimester and 40 (27.1%) second trimester and in control villages, 237 (11.1%) had miscarriages. statistically significant difference between study and control villages (P value >0.0373), 189 (79.8%) in first trimester and 48 (20.2%) second trimester. Of 1098 (40.7%) primigravida in study villages, 84 (7.7%) had miscarriages, 63 (75.0%) in first trimester and 21 (25.0%) second trimester and in control villages of 981 (36.3%) primigravida, 137 (14.0%) had miscarriages, 109 (79.6%) in first trimester and 28 (20.4%) second trimester. And of 1602 (59.3%) women with 2 and more births in study villages, 95 (5.9%) had miscarriages, 70 (73.7%) in first trimester and 25 (26.3%) second trimester and of 1719 (63.7%) women with 2 and more births in control villages, 146 (8.5%) had miscarriages, statistically insignificant difference between study and control villages (P value >0.1799), 116 (79.5%) in first trimester and 30 (20.5%) in second trimester [Table II].

Further analysis was also done to look at the difference between users and non-users of Biomass fuel in study villages. In 40 study villages, 2135 (79.1%) of 2700 women used Biomass fuel, 565 (20.9%) did not use, so comparison was difficult but attempts were made. Amongst 2135 Biomass fuel users, of 724 (33.9%) women of 15-19yrs, 75 (10.4%) had miscarriages, 59 (78.7%) in first trimester and 16 (21.3%) second trimester and amongst 565 who did not use Biomass fuel, of 190 (33.6%) women of 15-19yrs, 14 (7.4%) had miscarriages, 11 (78.6%) in first trimester and 3 (21.4%) second trimester. Of 854 (40.0%) illiterate women who used Biomass fuel, 74 (8.7%) had miscarriages, 55 (74.3%) in first trimester and 19 (25.7%) second trimester. And amongst 43 (7.6%) illiterate women who did not use Biomass fuel, 11

(25.6%) had miscarriages, statistically insignificant difference between Biomass fuel users and non-users (P value >0.1165), 7 (63.6%) in first trimester and 4 (36.4%) second trimester. Of 209 (9.8%) high school educated women who used Biomass fuel, 15 (7.2%) had miscarriages, 12 (80.0%) in first trimester and 3 (20.0%) second trimester and of 168 (29.7%) high school educated women who did not use Biomass fuel, one (0.6%) had first trimester miscarriage, statistically insignificant difference between Biomass fuel user and non-users (P value 0.1471). Overall of 1027 (48.1%) housewives who used Biomass fuel, 69 (6.7%) had miscarriages, 52 (75.4%) in first trimester and 17 (24.6%) second trimester and of 137 (24.2%) housewives who did not use Biomass fuel, 14 (10.2%) had miscarriages, 10 (71.4%) in first trimester and 4 (28.6%) second trimester. Of 795 (37.2%) unskilled workers (Labourer) who used Biomass fuel, 48 (6.7%) had miscarriages, 35 (72.9%) in first trimester and 13 (27.1%) second trimester and 137 (24.2%) unskilled workers (Labourer) who did not use Biomass fuel, 9 (6.6%) had miscarriages, 4 (44.4%) in first trimester and 5 (55.6%) second trimester and amongst economically lower and lower middle class, 1811 (84.8%) of 2135 women who used Biomass fuel, 125 (6.9%) had miscarriages, 93 (74.4%) in first trimester and 32 (25.6%) second trimester and of 565 non-users of Biomass fuel, 208 (36.8%) economically lower and lower middle class women, 23 (11.1%) had miscarriages, statistically insignificant difference between Biomass fuel user and non-users (P value 0.1903), 15 (65.2%) first trimester and 8 (34.8%) in second trimester. Of 842 (39.4%) primigravida who used Biomass fuel, 67 (8.0%) had miscarriages, 49 (73.1%) in first trimester and 18 (26.9%) second trimester and of 256 (45.3%) primigravida who did not use Biomass fuel, 17 (6.6%) had miscarriages, statistically significant difference between Biomass fuel users and non-users (P value 0.0022), 14 (82.4%) in first trimester and 3 (17.6%) second trimester. Of 1293 (60.6%) women with 2 and more births who used Biomass fuel, 85 (6.6%) had miscarriages, 66 (77.6%) in first trimester and 19 (22.4%) second trimester. Of 309 (54.7%) women with 2 and more births, not using Biomass fuel, 10 (3.2%) had miscarriages, statistically significant difference between Biomass fuel users and non-users (P value <0.0001), 4 (40.0%) in first trimester and 6 (60.0%) in second trimester [Table III].

In 10 of 50 study villages Chimneys were also installed for exit of smoke in addition to advocacy and the information was collected. Post-Chimney fixation 700 pregnancies were reported in 10 study villages. Of them 17 (2.4%) had miscarriages, 11 (64.7%) in first trimester and 6 (35.3%) second trimester, Of 700 pregnant women in 10 control villages, 39 (5.6%) had miscarriages, statistically significant difference between study and control villages (P value <0.0126), 25 (64.1%) first trimester and 14 (35.9%) second trimester miscarriages. Of 700 pregnant women in 10 study villages, 287 (41.0%) were of 15-19yrs, 6 (2.1%) had miscarriages, 2 (33.3%) in first trimester and 4 (66.7%) second trimester miscarriages. And of 700 pregnant women of 10 control villages, of 267 (38.1%) women of 15-19yrs, 16 (6.0%) had miscarriages, statistically insignificant difference between study and control villages (P value >0.2556), 9 (56.3%) first trimester and 7 (43.8%) second trimester. Overall 233 (33.3%) of 700 women were illiterate in study villages, 8 (3.4%) had miscarriages, 5 (62.5%) in first trimester and 3 (37.5%) second trimester. And in control villages, of 274 (39.1%) illiterate women, 16 (5.8%) had miscarriages, statistically insignificant difference between study and control villages (P value >0.4158), 10 (62.5%) in first trimester and 6 (37.5%) second trimester. Overall 54 (7.7%) women were high school educated in study villages, one (1.9%) had first trimester miscarriage. Of 51 (7.3%) high school educated women of control villages, 3 (5.9%) had first trimester miscarriages, statistically insignificant difference between study and control villages (P value >0.4612). Of 263 (37.6%) housewives in study villages, 11 (4.2%) had miscarriages, 6 (54.5%) first trimester and 5 (45.5%) in second trimester and 317 (45.3%) housewives in controls, 19 (6.0%) had miscarriages, 10 (52.6%) first trimester and 9 (47.4%) second trimester. Of 247 (35.3%) unskilled workers (Labourer) in study villages, 4 (1.6%) had miscarriages, 3 (75.0%) first trimester and one (25.0%) second trimester and of 217 (31.0%) labourer amongst controls, 11 (5.1%) had miscarriages, 8 (72.7%) in first trimester and 3 (27.3%) second trimester. Amongst economically lower and lower middle class, 530 (75.7% of 700) pregnant women of study villages, 15 (2.8%) had miscarriages, 9 (60.0%) in first trimester and 6 (40.0%) second trimester and in controls of 522 (74.6%) women, 30 (5.7%) had miscarriages, 18 (60.0%) in first trimester and 12 (40.0%) second trimester. Of

239 (34.1%) primigravida in study villages, 11 (4.6%) had miscarriage, 6 (54.5%) in first trimester and 5 (45.5%) second trimester and in controls, of 224 (32.0%) primigravida, 19 (8.5%) had miscarriages, 11 (57.9%) in first trimester and 8 (42.1%) in second trimester. Of 461 (65.9%) women with 2 and more births in study villages, 6 (1.3%) had miscarriages, 5 (83.3%) first trimester and one (16.7%) second trimester. In controls of 476 (68.0%) women with 2 and more births, 20 (4.2%) had miscarriages, statistically insignificant difference between study and control villages (P value <0.0596), 14 (70.0%) first trimester and 6 (30.0%) second trimester [Table IV].

In 10 Study villages 517 (73.8% of 700) women were Biomass fuel users and only 183 (26.2%) did not use Biomass fuel, making comparison difficult. Amongst 189 (36.6%) women of 15-19yrs, out of 517 Biomass fuel users, 6 (3.2%) had miscarriages, 4 (66.7%) first trimester and 2 (33.3%) second trimester and of 98 (53.6%) women of 15-19yrs who did not use Biomass fuel, 2 (2.0%) had first trimester miscarriages with no second trimester miscarriages, statistically insignificant difference between Biomass fuel users and non-users (P value >0.1264). Of 181 (35.0%) illiterate women who used Biomass fuel, 6 (3.3%) had miscarriages, 3 (50%) in first trimester and 3 (50%) second trimester. Of 52 (28.4%) Biomass fuel non-user illiterate women, 2 (2.9%) had first trimester miscarriages with no second trimester miscarriages. Of 236 (45.6%) Biomass fuel user housewives, 9 (3.8%) had miscarriages, 5 (55.6%) first trimester and 4 (44.4%) second trimester. And of 27 (14.8%) housewives who did not use Biomass fuel, 2 (7.4%) had first trimester miscarriages and no second trimester miscarriages. Overall of 210 (40.6%) unskilled workers (Labourer) who used Biomass fuel, 4 (1.9%) had miscarriages, 2 (50.0%) in first trimester and 2 (50.0%) second trimester and 37 (20.2%) unskilled workers (Labourer) who did not use Biomass fuel, there were no miscarriages. And amongst economically lower and lower middle class, 440 (85.1%) women of 517 who used Biomass fuel, 13 (2.9%) had miscarriages, 7 (53.8%) in first trimester and 6 (47.2%) second trimester and in non-users of Biomass fuel. Of 90 (49.2%) economically lower and lower middle class 183 women, 2 (2.2%) had first trimester miscarriages and no second trimester miscarriages. Overall of 166 (32.1%) primigravida who used Biomass fuel, 9 (5.4%) had miscarriages, 5

(55.6%) in first trimester and 4 (44.4%) in second trimester. And of 73 (39.9%) non-user primigravida, 2 (2.7%) had first trimester miscarriages with no second trimester miscarriage, statistically significant difference between Biomass fuel users and non-users (P value <0.0487) [Table V].

DISCUSSION

Garber-Epstein reported that the experience of miscarriage was grounded in the meaning of being a woman, as the loss of the pregnancy undermined the woman's basic belief in her fertility and as a result threatened meaning and role as a woman.[5] Miscarriage which continues to be common globally is a real tragedy for women. In many cases cause of miscarriage is also not obvious. Merklinger[6] reported that air pollution could influence a woman's reproductive health, specifically menstrual cycle characteristics, oocyte quality with risk of miscarriage. Luteal phase shortening, a possible manifestation of luteal phase deficiency, can result from fossil fuel combustion. This suggested that air pollution may contribute to fertility problems including miscarriage. The effects of environmental pollution on miscarriage were still unclear.[7] In the present study of 6800 pregnancies, 580 (8.5%) had miscarriage, not higher than globally known, overall 441 (76.1%) miscarriages were in first trimester and 139 (23.9%) in second trimester, usual ratio of abortions. However in study villages overall of 2652 Biomass fuel users, 167 (6.3%) had miscarriages, 124 (74.2%) in first trimester and 43 (25.8%) second trimester. Of 748 non-users of Biomass fuel, 29 (3.9%) had miscarriage with 20 (68.9%) first trimester and 9 (31.1%) second trimester miscarriages, significant difference between overall miscarriage with more second trimester miscarriage. Most of the studies conducted among populations with low/moderate exposures of smoke have provided little evidence of association with miscarriage.[8] Women with agricultural and related work had a significantly higher prevalence of miscarriage. Interventions could be targeted more on women with low SES to increase health benefits as well as economic gains for health programs in such communities.[9] Monthly miscarriages positively correlated with PM10 and ozone levels but not with NO_2 levels. Higher values of PM10 and miscarriage were evident in cities compared with those without pollutant industries, with number of miscarriages two fold higher in the former group. Miscarriage occurrence was affected

by PM10, particularly if industrial areas present and Ozone concentrations, also at levels below the legal limits. There is limited community-based information about early indicators related to miscarriage.[7] There is hardly any research about Biomass fuel use and miscarriages. In the present study base information was comparable, in 50 study villages, 2.8% women had miscarriage, 78.6% in first trimester and 21.4% second trimester and in 50 control villages 3.1% women had miscarriage, of 73.5% in first trimester and 26.5% second trimester. After having baseline information, advocacy about protection from ill effects of Biomass fuel use was done in 40 study villages and no advocacy in 40 control villages. In 40 study villages 6.6% women had miscarriage, 74.3% in first trimester and 25.7% second trimester and in 40 control villages, 10.5% women had miscarriages, significantly more in control villages, 79.5% in first trimester and 20.5% second trimester. In 10 study villages Chimneys were also installed in addition to Advocacy and the information was collected. Overall 2.4% women had miscarriage in study villages, 64.7% in first trimester and 35.3% second trimester and 10 control villages, 5.6% women had miscarriages, significant difference between study and control villages, of 64.1% first trimester and 35.9% second trimester miscarriages. In the first year the numbers seem small. It could be underreporting as the research assistants were strangers to women. As they settled, understanding was developed. In the present study 70.5% women were anaemic which seems to add to the problem. Maternal hepcidin is regulated by signals related to the progression of pregnancy and that pregnancy loss is associated with profound changes in maternal iron metabolism. These observations highlighted the existence of fetoplacental signals that modulated maternal iron homeostasis and high miscarriages among rural woman. This also might have contributed in rural tribal women.[10] There are few studies about the association between breathing polluted air and adverse pregnancy outcomes. Study indicated a significant association between each 10-unit increase in SO2 and spontaneous miscarriage in lag 0 and 9 days. Chong et al[1] also opined that pregnant women should avoid polluted air. Desai[11] did a study to know the impact of miscarriage under reporting on pregnancy data and related research. Fewer than half of miscarriages that in the five calendar years preceding respondents' interviews were reported in the National Survey of Family Growth (NSFG). Efforts to improve

miscarriage reporting are needed to strengthen the quality of pregnancy data to support maternal, child, and reproductive health research.

CONCLUSION

The present study was aimed to explore the association between use of Biomass fuel and miscarriage in rural tribal pregnant women who lived in extreme poverty. It was found that there was sure association, especially with Anaemia, Low Birth Weight and Small for gestational age. Although the effects of miscarriage differ between women, it can have major physical and psychological effects. Providing effective personalised care is important. Reliable information on the effectiveness of interventions used is therefore essential.

KEYWORDS

Miscarriages, Tribal Rural Women, Biomass fuel use.

AUTHOR CONTRIBUTION

Frist author Dr. S. Chhabra conceived the idea, planned, executed, did analysis and wrote article, the Co-author Mr. V. Rathod collected information and helped in analysis and in writing the article.

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ETHICAL STATEMENT

Study was conducted after taking approval of institutional ethics committee dated 7th Feb 2018.

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TABLE-I MISCARRIAGES IN 50 STUDY AND 50 CONTROL VILLAGES

VARIABLES	PREG-NANT IN STUDY 50	%	TOTAL MISCAR RIAGES	%	FIRST TRIME-STER		SECOND TRIME-STER		PREG-NANT IN CON-TROLS 50	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER	
					No.	%	No.	%					No.	%	No.	%
AGE																
15 to 19	341	33.9	11	3.2	9	81.8	2	18.2	337	30.7	13	3.9	10	76.9	3	23.1
20 to 24	412	41.0	15	3.6	12	80.0	3	20.0	471	42.9	17	3.6	12	70.6	5	29.4
25 to 29	203	20.2	2	1.0	1	50.0	1	50.0	224	20.4	3	1.3	2	66.7	1	33.3
30 to 34	36	3.6	0	0.0	0	0.0	0	0.0	49	4.5	1	2.0	1	0.0	0	0.0
35 to 39	13	1.3	0	0.0	0	0.0	0	0.0	16	1.5	0	0.0	0	0.0	0	0.0
TOTAL	1005	100.0	28	2.8	22	78.6	6	21.4	1097	100.0	34	3.1	25	73.5	9	26.5
EDUCATION																
ILLITERATE	399	39.7	15	3.8	11	73.3	4	26.7	431	39.3	17	3.9	13	76.5	4	23.5
PRIMARY	261	26.0	6	2.3	6	100.0	0	0.0	277	25.3	8	2.9	6	75.0	2	25.0
MIDDLE	197	19.6	4	2.0	3	75.0	1	25.0	213	19.4	5	2.3	3	60.0	2	40.0
HIGH	128	12.7	3	2.3	2	66.7	1	33.3	154	14.0	4	2.6	3	75.0	1	25.0
GRADUCATE	13	1.3	0	0.0	0	0.0	0	0.0	13	1.2	0	0.0	0	0.0	0	0.0
POST GRADUCATE	7	0.7	0	0.0	0	0.0	0	0.0	9	0.8	0	0.0	0	0.0	0	0.0
TOTAL	1005	100.0	28	2.8	22	78.6	6	21.4	1097	100.0	34	3.1	25	73.5	9	26.5
OCCUPATION																
HOUSEWIFE	589	58.6	23	3.9	18	78.3	5	21.7	629	57.3	25	4.0	20	80.0	5	20.0
UNSKILLED	342	34.0	5	1.5	4	80.0	1	20.0	364	33.2	7	1.9	4	57.1	3	42.9
SEMI-SKILLED	52	5.2	0	0.0	0	0.0	0	0.0	69	6.3	2	2.9	1	0.0	1	0.0
SKILLED	19	1.9	0	0.0	0	0.0	0	0.0	27	2.5	0	0.0	0	0.0	0	0.0
BUSINESS	3	0.3	0	0.0	0	0.0	0	0.0	8	0.7	0	0.0	0	0.0	0	0.0
TOTAL	1005	100.0	28	2.8	22	78.6	6	21.4	1097	100.0	34	3.1	25	73.5	9	26.5
ECONOMIC STATUS																
UPPER	3	0.3	0	0.0	0	0.0	0	0.0	7	0.6	0	0.0	0	0.0	0	0.0
UPPER MIDDLE	7	0.7	0	0.0	0	0.0	0	0.0	11	1.0	0	0.0	0	0.0	0	0.0
UPPER LOWER	94	9.4	1	1.1	1	100.0	0	0.0	108	9.8	3	2.8	2	66.7	1	33.3
LOWER MIDDLE	143	14.2	7	4.9	6	85.7	1	14.3	173	15.8	9	5.2	7	77.8	2	22.2
LOWER	758	75.4	20	2.6	15	75.0	5	25.0	798	72.7	22	2.8	16	72.7	6	27.3
TOTAL	1005	100.0	28	2.8	22	78.6	6	21.4	1097	100.0	34	3.1	25	73.5	9	26.5
PARITY																
P1	449	44.7	14	3.1	11	78.6	3	21.4	497	45.3	16	3.2	10	62.5	6	37.5
P2	392	39.0	12	3.1	10	83.3	2	16.7	420	38.3	16	3.8	13	81.3	3	18.8
P3	103	10.2	2	1.9	1	50.0	1	50.0	124	11.3	2	1.6	2	100.0	0	0.0
P4	37	3.7	0	0.0	0	0.0	0	0.0	37	3.4	0	0.0	0	0.0	0	0.0
P5 ABOVE	24	2.4	0	0.0	0	0.0	0	0.0	19	1.7	0	0.0	0	0.0	0	0.0
TOTAL	1005	100.0	28	2.8	22	78.6	6	21.4	1097	100.0	34	3.4	25	73.5	9	26.5

TABLE-II MISCARRIAGES IN 40 STUDY ADVOCACY AND 40 CONTROL NON-ADVOCACY VILLAGES

VARIABLES	PREG-NANT WOMEN IN STUDY 40	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER		PREG-NANT IN CON-TROLS 40	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER	
					No.	%	No.	%					No.	%	No.	%
AGE																
15 to 19	914	33.9	89	9.7	70	78.7	19	21.3	832	30.8	127	15.3	105	82.7	22	17.3
20 to 24	1002	37.1	64	6.4	40	62.5	24	37.5	1022	37.9	81	7.9	48	59.3	33	40.7
25 to 29	591	21.9	23	3.9	20	87.0	3	13.0	621	23.0	56	9.0	54	96.4	2	3.6
30 to 34	116	4.3	3	2.6	3	100.0	0	0.0	131	4.9	16	12.2	15	93.8	1	6.3
35 to 39	77	2.9	0	0.0	0	0.0	0	0.0	94	3.5	3	3.2	3	0.0	0	0.0
TOTAL	2700	100.0	179	6.6	133	74.3	46	25.7	2700	100.0	283	10.5	225	79.5	58	20.5
EDUCATION																
ILLITERATE	897	33.2	85	9.5	62	72.9	23	27.1	1013	37.5	133	13.1	107	80.5	26	19.5
PRIMARY	668	24.7	49	7.3	37	75.5	12	24.5	691	25.6	66	9.6	52	78.8	14	21.2
MIDDLE	477	17.7	24	5.0	17	70.8	7	29.2	467	17.3	38	8.1	27	71.1	11	28.9
HIGH	377	14.0	16	4.2	13	81.3	3	18.8	328	12.1	27	8.2	23	85.2	4	14.8
GRADUCATE	168	6.2	2	1.2	1	50.0	1	50.0	114	4.2	12	10.5	10	83.3	2	16.7
POST GRADUCATE	113	4.2	3	2.7	3	100.0	0	0.0	87	3.2	7	8.0	6	85.7	1	14.3
TOTAL	2700	100.0	179	6.6	133	74.3	46	25.7	2700	100.0	283	10.5	225	79.5	58	20.5
OCCUPATION																
HOUSEWIFE	1164	43.1	83	7.1	62	74.7	21	25.3	1234	45.7	128	10.4	100	78.1	28	21.9
UNSKILLED	932	34.5	57	6.1	39	68.4	18	31.6	951	35.2	87	9.1	65	74.7	22	25.3
SEMI-SKILLED	382	14.1	31	8.1	25	80.6	6	19.4	327	12.1	53	16.2	46	86.8	7	13.2
SKILLED	144	5.3	6	4.2	5	83.3	1	16.7	121	4.5	11	9.1	10	90.9	1	9.1
BUSINESS	78	2.9	2	2.6	2	0.0	0	0.0	67	2.5	4	6.0	4	0.0	0	0.0
TOTAL	2700	100.0	179	6.6	133	74.3	46	25.7	2700	100.0	283	10.5	225	79.5	58	20.5
ECONOMIC STATUS																
UPPER	57	2.1	3	5.3	3	100.0	0	0.0	41	1.5	5	12.2	4	80.0	1	20.0
UPPER MIDDLE	227	8.4	9	4.0	8	88.9	1	11.1	187	6.9	13	7.0	10	76.9	3	23.1
UPPER LOWER	397	14.7	19	4.8	14	73.7	5	26.3	324	12.0	28	8.6	22	78.6	6	21.4
LOWER MIDDLE	884	32.7	56	6.3	37	66.1	19	33.9	924	34.2	93	10.1	72	77.4	21	22.6
LOWER	1135	42.0	92	8.1	71	77.2	21	22.8	1224	45.3	144	11.8	117	81.3	27	18.8
TOTAL	2700	100.0	179	6.6	133	74.3	46	25.7	2700	100.0	283	10.5	225	79.5	58	20.5
PARITY																
P1	1098	40.7	84	7.7	63	75.0	21	25.0	981	36.3	137	14.0	109	79.6	28	20.4
P2	876	32.4	76	8.7	54	71.1	22	28.9	958	35.5	122	12.7	97	79.5	25	20.5
P3	566	21.0	17	3.0	14	82.4	3	17.6	587	21.7	21	3.6	16	76.2	5	23.8
P4	109	4.0	2	1.8	2	0.0	0	0.0	118	4.4	3	2.5	3	0.0	0	0.0
P5 ABOVE	51	1.9	0	0.0	0	0.0	0	0.0	56	2.1	0	0.0	0	0.0	0	0.0
TOTAL	2700	100.0	179	6.6	133	74.3	46	25.7	2700	100.0	283	10.5	225	79.5	58	20.5

TABLE-III MISCARRIAGES IN 40 STUDY VILLAGES AMONGST USERS AND NON-USERS OF BIOMASS FUEL

VARIABLES	PREG-NANT IN USERS	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER		PREG-NANT IN NON-USERS	%	TOTAL MIS CAR RIA GES	%	FIRST TRIME-STER		SECOND TRIME-STER	
					No.	%	No.	%					No.	%	No.	%
AGE																
15 to 19	724	33.9	75	10.4	59	78.7	16	21.3	190	33.6	14	7.4	11	78.6	3	21.4
20 to 24	731	34.2	53	7.3	34	64.2	19	35.8	271	48.0	11	4.1	6	54.5	5	45.5
25 to 29	493	23.1	21	4.3	19	90.5	2	9.5	98	17.3	2	2.0	1	50.0	1	50.0
30 to 34	110	5.2	3	2.7	3	100.0	0	0.0	6	1.1	0	0.0	0	0.0	0	0.0
35 to 39	77	3.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	2135	100.0	152	7.1	115	75.7	37	24.3	565	100.0	27	4.8	18	66.7	9	33.3
EDUCATION																
ILLITERATE	854	40.0	74	8.7	55	74.3	19	25.7	43	7.6	11	25.6	7	63.6	4	36.4
PRIMARY	605	28.3	39	6.4	30	76.9	9	23.1	63	11.2	10	15.9	7	70.0	3	30.0
MIDDLE	361	16.9	19	5.3	14	73.7	5	26.3	116	20.5	5	4.3	3	60.0	2	40.0
HIGH	209	9.8	15	7.2	12	80.0	3	20.0	168	29.7	1	0.6	1	100.0	0	0.0
GRADUCATE	63	3.0	2	3.2	1	50.0	1	50.0	105	18.6	0	0.0	0	0.0	0	0.0
POST GRADUCATE	43	2.0	3	7.0	3	100.0	0	0.0	70	12.4	0	0.0	0	0.0	0	0.0
TOTAL	2135	100.0	152	7.1	115	75.7	37	24.3	565	100.0	27	4.8	18	66.7	9	33.3
OCCUPATION																
HOUSEWIFE	1027	48.1	69	6.7	52	75.4	17	24.6	137	24.2	14	10.2	10	71.4	4	28.6
UNSKILLED	795	37.2	48	6.0	35	72.9	13	27.1	137	24.2	9	6.6	4	44.4	5	55.6
SEMI-SKILLED	214	10.0	27	12.6	21	77.8	6	22.2	168	29.7	4	2.4	4	100.0	0	0.0
SKILLED	61	2.9	6	9.8	5	83.3	1	16.7	83	14.7	0	0.0	0	0.0	0	0.0
BUSINESS	38	1.8	2	5.3	2	100.0	0	0.0	40	7.1	0	0.0	0	0.0	0	0.0
TOTAL	2135	100.0	152	7.1	115	75.7	37	24.3	565	100.0	27	4.8	18	66.7	9	33.3
ECONOMIC STATUS																
UPPER	13	0.6	3	23.1	3	100.0	0	0.0	44	7.8	0	0.0	0	0.0	0	0.0
UPPER MIDDLE	67	3.1	9	13.4	8	88.9	1	11.1	160	28.3	0	0.0	0	0.0	0	0.0
UPPER LOWER	244	11.4	15	6.1	11	73.3	4	26.7	153	27.1	4	2.6	3	75.0	1	25.0
LOWER MIDDLE	769	36.0	48	6.2	34	70.8	14	29.2	115	20.4	8	7.0	3	37.5	5	62.5
LOWER	1042	48.8	77	7.4	59	76.6	18	23.4	93	16.5	15	16.1	12	80.0	3	20.0
TOTAL	2135	100.0	152	7.1	115	75.7	37	24.3	565	100.0	27	4.8	18	66.7	9	33.3
PARITY																
P1	842	39.4	67	8.0	49	73.1	18	26.9	256	45.3	17	6.6	14	82.4	3	17.6
P2	634	29.7	67	10.6	51	76.1	16	23.9	242	42.8	9	3.7	3	33.3	6	66.7
P3	502	23.5	16	3.2	13	81.3	3	18.8	64	11.3	1	1.6	1	100.0	0	0.0
P4	106	5.0	2	1.9	2	100.0	0	0.0	3	0.5	0	0.0	0	0.0	0	0.0
P5 ABOVE	51	2.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	2135	100.0	152	7.1	115	75.7	37	24.3	565	100.0	27	4.8	18	66.7	9	33.3

TABLE-IV MISCARRIAGES IN 10 STUDY ADVOCACY AND CHIMNEY AND 10 CONTROL NON-ADVOCACY AND NON- CHIMNEY VILLAGES

VARIABLES	PREG-NANT IN 10 STUDY	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER		PREG-NANT IN 10 CON-TROLS	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER	
					No.	%	No.	%					No.	%	No.	%
AGE																
15 to 19	287	41.0	6	2.1	2	33.3	4	66.7	267	38.1	16	6.0	9	56.3	7	43.8
20 to 24	265	37.9	8	3.0	6	75.0	2	25.0	257	36.7	14	5.4	9	64.3	5	35.7
25 to 29	91	13.0	3	3.3	3	100.0	0	0.0	103	14.7	6	5.8	4	66.7	2	33.3
30 to 34	36	5.1	0	0.0	0	0.0	0	0.0	49	7.0	3	6.1	3	0.0	0	0.0
35 to 39	21	3.0	0	0.0	0	0.0	0	0.0	24	3.4	0	0.0	0	0.0	0	0.0
TOTAL	700	100.0	17	2.4	11	64.7	6	35.3	700	100.0	39	5.6	25	64.1	14	35.9
EDUCATION																
ILLITERATE	233	33.3	8	3.4	5	62.5	3	37.5	274	39.1	16	5.8	10	62.5	6	37.5
PRIMARY	287	41.0	5	1.7	3	60.0	2	40.0	257	36.7	13	5.1	8	61.5	5	38.5
MIDDLE	85	12.1	3	3.5	2	66.7	1	33.3	87	12.4	6	6.9	3	50.0	3	50.0
HIGH	54	7.7	1	1.9	1	100.0	0	0.0	51	7.3	3	5.9	3	100.0	0	0.0
GRADUCATE	24	3.4	0	0.0	0	0.0	0	0.0	19	2.7	1	5.3	1	0.0	0	0.0
POST GRADUCATE	17	2.4	0	0.0	0	0.0	0	0.0	12	1.7	0	0.0	0	0.0	0	0.0
TOTAL	700	100.0	17	2.4	11	64.7	6	35.3	700	100.0	39	5.6	25	64.1	14	35.9
OCCUPATION																
HOUSEWIFE	263	37.6	11	4.2	6	54.5	5	45.5	317	45.3	19	6.0	10	52.6	9	47.4
UNSKILLED	247	35.3	4	1.6	3	75.0	1	25.0	217	31.0	11	5.1	8	72.7	3	27.3
SEMI-SKILLED	96	13.7	2	2.1	2	100.0	0	0.0	87	12.4	6	6.9	4	66.7	2	33.3
SKILLED	67	9.6	0	0.0	0	0.0	0	0.0	58	8.3	2	3.4	2	0.0	0	0.0
BUSINESS	27	3.9	0	0.0	0	0.0	0	0.0	21	3.0	1	4.8	1	0.0	0	0.0
TOTAL	700	100.0	17	2.4	11	64.7	6	35.3	700	100.0	39	5.6	25	64.1	14	35.9
ECONOMIC STATUS																
UPPER	17	2.4	0	0.0	0	0.0	0	0.0	12	1.7	0	0.0	0	0.0	0	0.0
UPPER MIDDLE	34	4.9	0	0.0	0	0.0	0	0.0	27	3.9	0	0.0	0	0.0	0	0.0
UPPER LOWER	119	17.0	2	1.7	2	100.0	0	0.0	139	19.9	9	6.5	7	77.8	2	22.2
LOWER MIDDLE	224	32.0	6	2.7	4	66.7	2	33.3	209	29.9	12	5.7	8	66.7	4	33.3
LOWER	306	43.7	9	2.9	5	55.6	4	44.4	313	44.7	18	5.8	10	55.6	8	44.4
TOTAL	700	100.0	17	2.4	11	64.7	6	35.3	700	100.0	39	5.6	25	64.1	14	35.9
PARITY																
P1	239	34.1	11	4.6	6	54.5	5	45.5	224	32.0	19	8.5	11	57.9	8	42.1
P2	263	37.6	5	1.9	4	80.0	1	20.0	241	34.4	14	5.8	10	71.4	4	28.6
P3	184	26.3	1	0.5	1	0.0	0	0.0	196	28.0	4	2.0	2	0.0	2	0.0
P4	14	2.0	0	0.0	0	0.0	0	0.0	28	4.0	2	7.1	2	0.0	0	0.0
P5 ABOVE	0	0.0	0	0.0	0	0.0	0	0.0	11	1.6	0	0.0	0	0.0	0	0.0
TOTAL	700	100.0	17	2.4	11	64.7	6	35.3	700	100.0	39	5.6	25	64.1	14	35.9

TABLE-V MISCARRIAGES IN 10 STUDY VILLAGES AMONGST USERS AND NON-USERS OF BIOMASS FUEL

VARIABLES	PREG-NANT IN USERS	%	TOTAL MISCA RRIAG ES	%	FIRST TRIME-STER		SECOND TRIME-STER		PREG-NANT IN NON-USERS	%	TOTAL MISC ARRI AGES	%	FIRST TRIME-STER		SECOND TRIME-STER	
					No.	%	No.	%					No.	%	No.	%
AGE																
15 to 19	189	36.6	6	3.2	4	66.7	2	33.3	98	53.6	2	2.0	2	100.0	0	0.0
20 to 24	208	40.2	8	3.8	5	62.5	3	37.5	57	31.1	0	0.0	0	0.0	0	0.0
25 to 29	65	12.6	3	4.6	2	66.7	1	33.3	26	14.2	0	0.0	0	0.0	0	0.0
30 to 34	34	6.6	0	0.0	0	0.0	0	0.0	2	1.1	0	0.0	0	0.0	0	0.0
35 to 39	21	4.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	517	100.0	15	2.9	9	60.0	6	40.0	183	100.0	2	1.1	2	100.0	0	0.0
EDUCATION																
ILLITERATE	181	35.0	6	3.3	3	50.0	3	50.0	52	28.4	2	3.8	2	100.0	0	0.0
PRIMARY	248	48.0	5	2.0	3	60.0	2	40.0	39	21.3	0	0.0	0	0.0	0	0.0
MIDDLE	43	8.3	3	7.0	2	66.7	1	33.3	42	23.0	0	0.0	0	0.0	0	0.0
HIGH	26	5.0	1	3.8	1	100.0	0	0.0	28	15.3	0	0.0	0	0.0	0	0.0
GRADUCATE	11	2.1	0	0.0	0	0.0	0	0.0	13	7.1	0	0.0	0	0.0	0	0.0
POST GRADUCATE	8	1.5	0	0.0	0	0.0	0	0.0	9	4.9	0	0.0	0	0.0	0	0.0
TOTAL	517	100.0	15	2.9	9	60.0	6	40.0	183	100.0	2	1.1	2	100.0	0	0.0
OCCUPATION																
HOUSEWIFE	236	45.6	9	3.8	5	55.6	4	44.4	27	14.8	2	7.4	2	100.0	0	0.0
UNSKILLED	210	40.6	4	1.9	2	50.0	2	50.0	37	20.2	0	0.0	0	0.0	0	0.0
SEMI-SKILLED	42	8.1	2	4.8	2	100.0	0	0.0	54	29.5	0	0.0	0	0.0	0	0.0
SKILLED	19	3.7	0	0.0	0	0.0	0	0.0	48	26.2	0	0.0	0	0.0	0	0.0
BUSINESS	10	1.9	0	0.0	0	0.0	0	0.0	17	9.3	0	0.0	0	0.0	0	0.0
TOTAL	517	100.0	15	2.9	9	60.0	6	40.0	183	100.0	2	1.1	2	100.0	0	0.0
ECONOMIC STATUS																
UPPER	7	1.4	0	0.0	0	0.0	0	0.0	10	5.5	0	0.0	0	0.0	0	0.0
UPPER MIDDLE	12	2.3	0	0.0	0	0.0	0	0.0	22	12.0	0	0.0	0	0.0	0	0.0
UPPER LOWER	58	11.2	2	3.4	2	100.0	0	0.0	61	33.3	0	0.0	0	0.0	0	0.0
LOWER MIDDLE	156	30.2	5	3.2	3	60.0	2	40.0	68	37.2	1	1.5	1	100.0	0	0.0
LOWER	284	54.9	8	2.8	4	50.0	4	50.0	22	12.0	1	4.5	1	100.0	0	0.0
TOTAL	517	100.0	15	2.9	9	60.0	6	40.0	183	100.0	2	1.1	2	100.0	0	0.0
PARITY																
P1	166	32.1	9	5.4	5	55.6	4	44.4	73	39.9	2	2.7	2	100.0	0	0.0
P2	172	33.3	5	2.9	3	60.0	2	40.0	91	49.7	0	0.0	0	0.0	0	0.0
P3	165	31.9	1	0.6	1	100.0	0	0.0	19	10.4	0	0.0	0	0.0	0	0.0
P4	14	2.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
P5 ABOVE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	517	100.0	15	2.9	9	60.0	6	40.0	183	100.0	2	1.1	2	100.0	0	0.0