

## RESEARCH ARTICLE

# Trends in Maternal Mortality in Medical College Jabalpur, India in the last 15 Years

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## ABSTRACT

**Aim:** The aim of our article was to study the causes of maternal deaths in our institution from the year 2001 to 2015 and to see whether there has been any decline in the preventable causes of death and if our results are comparable with the statistics of the state.

**Materials and methods:** The data pertaining to maternal mortality from 2001 to 2016 were entered in Excel sheets, and data analysis was done in Excel software. The impact of government schemes on mortality and antenatal care was evaluated and the problems at the tertiary care center were analyzed.

**Results:** Eclampsia and anemia, which are largely preventable causes of death, were and still continue to be the leading causes of mortality in our institution which is the tertiary referral center for a large tribal belt. Though data differ, the maternal mortality in our institution rose at the time of implementation of government schemes to fall to previous levels by 2015.

**Conclusion:** There has been a definite reduction in the maternal mortality of the state. In spite of various government schemes for promoting hospital deliveries and registering antenatal patients for care, the preventable causes of death still appear to be leading in maternal mortality. Our antenatal care needs further improvement and so does our tertiary level care.

**Clinical significance:** Government schemes have helped in getting critical referrals to tertiary care centers. Further reduction in mortality can be achieved only if our antenatal care and tertiary care can be improved.

**Keywords:** Anemia, Eclampsia, Hemorrhage, Maternal mortality, Preeclampsia, Sepsis.

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## INTRODUCTION

Maternal mortality is an important indicator of the economic and social well-being of a nation. The death of a young mother is a loss to the family and has long-term repercussions in the development of her children. Maternal mortality ratio is defined as the number of maternal deaths per 100,000 live births, whereas maternal mortality rate (MMR) is defined as the number of maternal deaths per thousand women in the reproductive age group. A maternal death is the death of a woman during pregnancy or within 42 days of termination of pregnancy irrespective of its site by causes directly related to or aggravated by pregnancy but not by accidental or incidental causes.

India along with Nigeria contributes to one third of the global maternal mortality and along with nine other countries accounts for 60% of the maternal mortality of the world.<sup>1</sup> It has an MMR of 174 deaths per 100,000 live births, which has fallen from 204 per 100,000 live births in 1990<sup>2</sup> but still is very high in comparison to developed countries. Madhya Pradesh (MP) is one of the backward states of India which occupies the fourth place in the states with the highest maternal mortality of 201/100,000.<sup>3</sup> Medical College Jabalpur is a tertiary referral center for a large number of districts including a large tribal belt in the vicinity of Jabalpur.

The aim of this study was to analyze the trends in maternal mortality over the last 15 years in Medical College Jabalpur with a study of the leading causes of death over these years and to analyze whether government initiatives have had an impact in reducing the preventable causes of maternal deaths.

## MATERIALS AND METHODS

The data pertaining to maternal mortality from 2001 to 2016 were entered in Excel sheets, and data analysis was done in Excel software. The impact of government schemes on mortality and antenatal care was evaluated and the problems at the tertiary care center were analyzed. Comparison with the statistics of Kerala was done, which is the state having the lowest mortality in the country. The permission of the ethical committee had been obtained before conducting the study.

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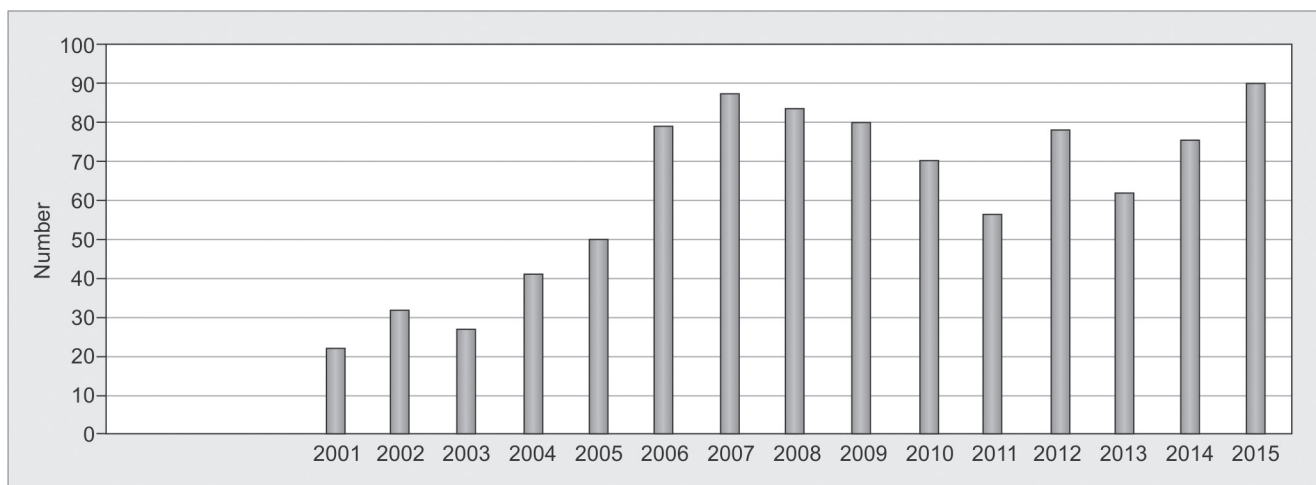
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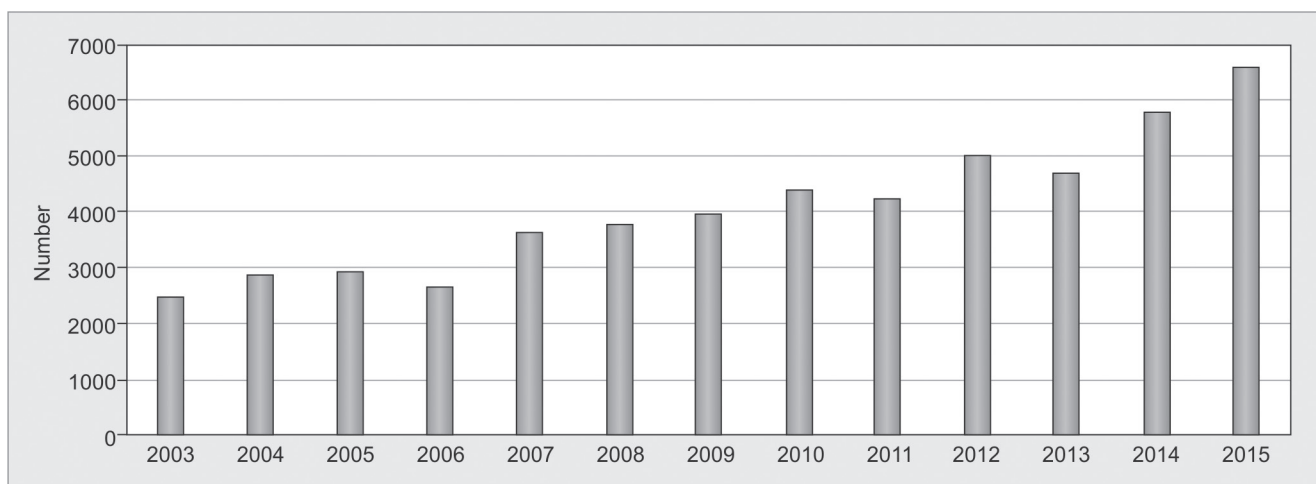
## RESULTS AND DISCUSSION

The number of deliveries and also the number of deaths have increased drastically in our institution. As against 2,000 deliveries and 22 deaths in the year 2001, there were 6,600 deliveries and 90 deaths in the year 2015 (Graph 1). This is largely due to government schemes, such as Janani Suraksha Yojana (JSY)<sup>3</sup> promoting institutional deliveries. At present, the state has 79% hospital deliveries. The number of deliveries in our institution has also risen significantly over the years, from about 2,000 in 2001 to more than 6,600 in 2015 (Graph 2). In an analysis of statistics from our intensive care unit (ICU) from January 1, 2015, to December 31, 2015, we found that hypertension in pregnancy, namely eclampsia and severe preeclampsia, is still the leading cause of death in our institution and is followed by severe anemia (Graph 3). The third place is occupied by obstetric hemorrhage and sepsis with equal number of deaths (Graph 3). This is followed by hepatitis and obstructed labor. Other medical disorders complicating pregnancy, such as viral fevers and malaria, also contribute to maternal mortality.

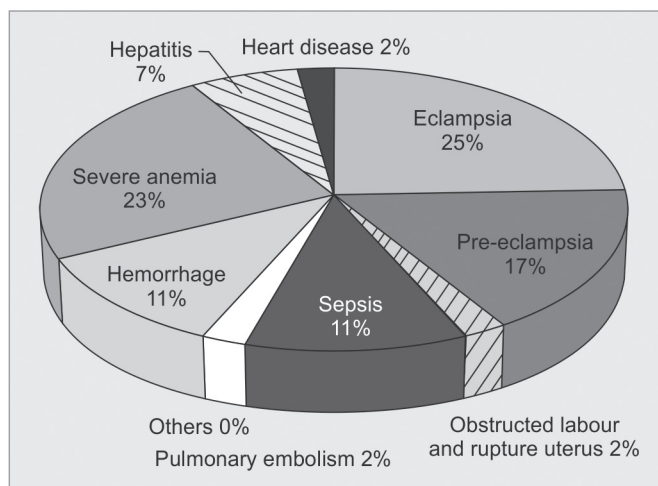
It was observed in our tables that the number of deaths as well as the number of deliveries rose in our institution from 2001 to 2015. These statistics were divided into three groups, namely, from 2001 to 2005, which was before the implementation of JSY; from 2006 to 2010, the period just after implementation of JSY; and 2011 to 2015, 5 years after the implementation of JSY. Janani Suraksha Yojana was implemented on April 12, 2005. We can see that there is a rise in the number of institutional deliveries along with a rise in the number of deaths, which is significantly high in this period. On comparing the number of deaths in the period from 2006 to 2010 with those from 2001 to 2005 we see that the number of deaths in the group from 2006 to 2010 is significantly higher in proportion to the number of deliveries (Table 1), odds ratio (OR) = 1.64 (1.37–1.96),  $\chi^2 = 28.98$ ; degrees of freedom (DF) = 1; p-value < 0.00000007 (highly significant). On comparing 2006 to 2010 with the data from 2011 to 2015, we see a significant drop in the number of deaths from 2011 to 2015 (Table 1); OR = 0.64 (0.55–0.73),  $\chi^2 = 38.98$ ; DF = 1; p-value = 0.000000 (highly significant). On comparing



Graph 1: Number of maternal deaths per year from 2001 to 2015



Graph 2: The trend in total number of deliveries per year from 2003 to 2015



**Graph 3:** Percentage-wise distribution of the causes of maternal death in 2015

the number of deaths from 2001 to 2005 with those from 2011 to 2015, no statistically significant difference was found, though the total number of deaths appeared to be high (Table 1); OR = 1.04 (0.87–1.25)  $\chi^2 = 0.17$ ; DF = 1; p-value = 0.68 (not significant).

These findings can be interpreted to mean that the number of deaths in the institution rose significantly with the implementation of JSY due to which the deaths that remained largely unreported due to home delivery and deaths at home started coming to the tertiary center. Due to the large number of morbid referrals, we see a higher number of deaths in this period. When the deaths

**Table 1:** Statistical comparison of deaths out of total deliveries in three groups of 5 year each

Years	Total number of deliveries		No. of maternal deaths	
	No.	%	No.	%
2001 to 2005	13,000	41.40	172	30.12
2006 to 2010	18,400	58.60	399	69.88
Total	31,400	100.00	571	100.00

OR = 1.64 (1.37–1.96);  $\chi^2 = 28.98$ ; DF = 1; p < 0.0000007

Year	Total number of deliveries		No. of maternal deaths	
	No.	%	No.	%
2006 to 2010	18,400	41.16	399	52.36
2011 to 2015	26,300	58.84	363	47.64
Total	44,700	100.00	762	100.00

OR = 0.64 (0.55–0.73);  $\chi^2 = 38.98$ ; DF = 1; p = 0.000000

Year	Total number of deliveries		No. of maternal deaths	
	No.	%	No.	%
2001 to 2005	13,000	33.08	172	32.15
2011 to 2015	26,300	66.92	363	67.85
Total	39,300	100.00	535	100.00

OR = 1.04 (0.87–1.25);  $\chi^2 = 0.17$ ; DF = 1; p = 0.68

from 2011 to 2015 are compared with those from 2006 to 2010 we see that the number of deaths has reduced significantly. This is due to more timely referrals, increasing number of hospital deliveries, and improved facilities at the tertiary center. On comparing the deaths in the period before JSY with the data from 2011 to 2015, there was no statistically significant difference as the number of referrals and hospital deliveries both has largely increased, but the tertiary center is better equipped to deal with the referrals. This can be extrapolated to depict that the number of deaths in the coming years will fall to significantly lower levels as compared with those from 2001 to 2005 as the overall health scenario improves in the state.

Hypertensive disorders of pregnancy, namely eclampsia and severe preeclampsia, along with severe anemia were and still are the most important causes of maternal mortality in our institution. When the percentage of each cause of death among the total number of maternal deaths was computed for each year from 2001 to 2015, the trend hardly shows any remarkable change over the years (Graph 4). The largely preventable causes are still leading even today.

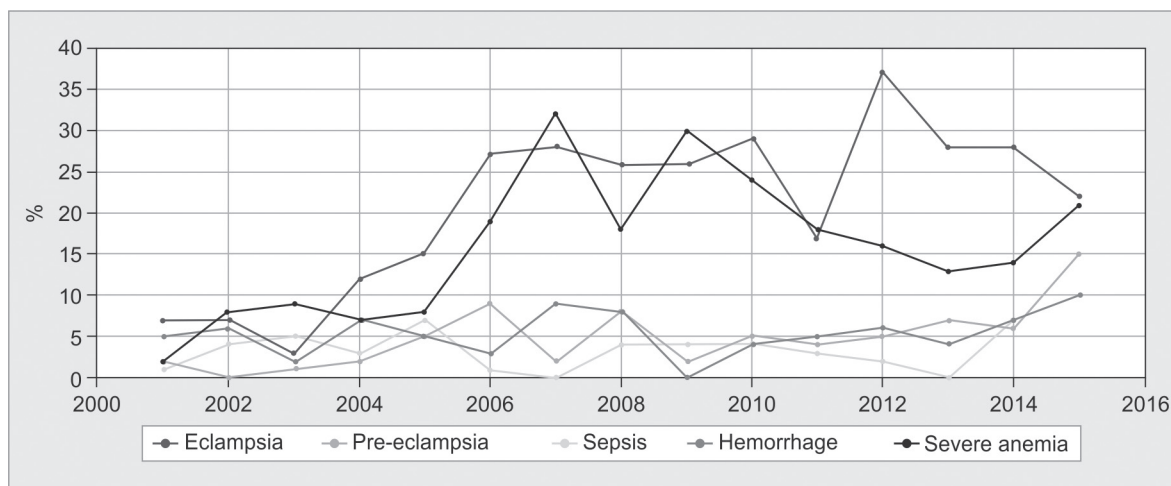
Our statistics for the year 2015 show a total number of 6,615 deliveries out of which there were 6,190 live births. The year had 226 admissions for eclampsia and 1,006 admissions for preeclampsia. There were 216 admissions for severe anemia and 63 admissions for a combination of severe anemia with preeclampsia. Our data show 9.7% mortality in eclampsia, 1.5% in preeclampsia, and 9.7% in cases of severe anemia.

The state of MP has an MMR of 221/100,000, and the statistics of the state quote hemorrhage to be the most important cause of death in the state.<sup>4</sup> The state of Kerala has the lowest MMR of 61/100,000 in the country,<sup>5</sup> with obstetric hemorrhage being the leading cause of death followed by hypertension.<sup>6</sup>

Though the government schemes have tremendously improved the number of institutional deliveries, with MP and Chhattisgarh having 79% institutional deliveries,<sup>7</sup> still our state is unable to achieve the millennium development goals<sup>8</sup> in the reduction of maternal mortality.

Logically, it would require three steps to reduce maternal mortality: (1) proper antenatal care, (2) facilities for timely referral services, and (3) facilities for expert critical care at the tertiary center.

The preventable causes of death like eclampsia and anemia are the major causes of death, pointing to the poor quality of antenatal care. The first factor leading to poor antenatal care is the patient factor. The low level of education and ignorance on the part of the patient and her family is an important factor in patients who do not receive proper antenatal care. There is a significant reduction in mortality at the level of secondary education and



**Graph 4:** Percentage-wise trend distribution of causes of maternal mortality from 2000 to 2016

above.<sup>9</sup> The autonomy of a woman is also reflected in her antenatal care. If a woman is working and earning, she would be expected to have greater autonomy in the household. Paradoxically it was noted in a survey that working women had less number of antenatal visits by health-care workers as compared with housewives.<sup>9</sup> It is likely that health visitors found it easier to visit housewives as compared with working women.

Second comes the quality of the interventions received in antenatal visits or checkups. When a woman is visited at home by a health worker, the most likely intervention she gets is injection of tetanus toxoid. If a woman visits a primary health center, it is not necessary that she will always have a blood pressure (BP) checkup, urine test, and hemoglobin estimation, which ideally she is supposed to get.<sup>10</sup>

Very few pregnant women tend to have the four antenatal checkups in pregnancy as given in the Royal Children's Hospital guidelines.<sup>11</sup> Most patients do not go for an antenatal checkup in the first trimester.<sup>9,10,12,13</sup> In patients who do have three or four antenatal visits, the visits are many a time improperly spaced for an accurate assessment of any developing complication. In addition, in case of any intervention, such as admission or referral to a higher center advised to the patient, compliance may be low due to various social or economic factors.<sup>10</sup>

Provision of iron and folic acid tablets is the simplest possible intervention for the prevention of anemia as most cases of anemia are nutritional. Unfortunately, even on being provided with iron and folic acid tablets, many women may not take the 100 tablets they are supposed to take for varied reasons, such as nausea or dislike for the tablets.<sup>10</sup>

One of the initiatives of the government is the web-based mother and child tracking system started in 2009 in which name-based tracking of pregnant women and children has been initiated by Government of India as a

policy decision to track every pregnant woman, infant, and child up to 3 years, by name for provision of timely antenatal care, institutional delivery, and postnatal care along with immunization and other related service.<sup>10</sup> Under this system, every pregnant mother is given a unique identification number at her first antenatal visit. The purpose is to have a unique large database with which every mother and child can be tracked individually. It is the duty of health workers to track down a woman who fails to turn up at her scheduled next visit. However, this system may not work in all cases due to the large population and the migratory tendency of the target population. Auxiliary nurse midwives are given training in recording BP, doing hemoglobin estimation and urine examination. Still, the application of this training appears to be lacking at the grassroots level as the skills and dedication of these workers vary and may not be up to the mark in all. In spite of these drawbacks, this system has brought a large improvement in the reporting of maternal deaths in all states which were grossly underreported, especially in backward states like MP. In MP, total 3,754 deaths were reported by the government in 5 years, whereas according to Annual Health Survey 2010 to 2011 from the time period of July 2010 to March 2011, total 26,438 maternal deaths should have been reported.<sup>4</sup>

The quality of antenatal care as given by most tiers of the system may be inadequate, for various reasons.<sup>9</sup> Health workers either may fail to record BP or may be unable to record correctly. In most government facilities, such as district hospitals, the doctor-patient ratio is too skewed, with one or two medical officers looking after 100 to 150 outpatients per day, prohibiting the ideal amount of attention needed for individual cases. Many of the rural areas have quacks practicing as registered medical practitioners and the level of literacy is too low for patients to understand the difference. Medical officers too need to be trained in the prevention of preeclampsia and eclampsia

according to World Health Organization guidelines. The need to identify cases of preeclampsia and be able to refer them to higher centers for active management has to be emphasized to the health-care providers.

The second step would be timely referral to higher centers. This service has improved in many regards. There are good roads and free transport is available for pregnant women. Still, the decision to take a woman to a higher facility depends on the literacy and socioeconomic status of the family. Delay in taking a patient to a higher facility when she is not in labor occurs due to a number of reasons like no one at home to look after children, no one to accompany the patient, and unwillingness to lose wages at work in case of admission. Most Indian government facilities either are understaffed or even if they do have enough staff they are unwilling to take the complete responsibility of a patient's nursing care. Hence, a patient without attendant is unable to reach the higher centers.

Another problem with the referral system is the step-wise referral from the referral units. Many patients who are in need of tertiary level care as emergency admissions are referred from the basic levels to the district hospital in Jabalpur and then after some duration of stay they are referred to Medical College Jabalpur, resulting in the loss of lot of precious time, which is important for the survival of the patient. Nursing staff and medical officers at the primary level need to be trained in recognizing a patient in need of tertiary level care so that the patient may get quick assistance by direct referral to the tertiary facility.<sup>14</sup>

The last level is the problems at our tertiary center. National Health Mission has funded the construction of new obstetric ICU in medical colleges for obstetric critical care. The ICU in our setup started functioning on August 15, 2014. The ICU still has a high mortality rate of 90 deaths in 2015. As the unit is new, it still does not have all necessary infrastructural facilities (Table 2). The unit still suffers from power failures and failures of central oxygen supply. All necessary investigations for critical care are either not available at all or not available outside routine working hours and on holidays and Sundays. In a situation where liver function tests are available only in routine working hours on working days and important

**Table 2:** Infrastructural deficiencies in the ICU

Investigation	Requirement	Availability	Deficiency
Arterial blood gas analyzer	1	Nil	1
Portable ultrasound	1	Nil	1
Portable X-ray machine	1	Nil	1
Dialysis unit	1	Nil	1
Autoanalyzers for blood biochemistry	1	Nil	1
Generator	1	Nil	1
Staff requirements			
Dialysis technician	1	Nil	1
Intensivists	3	Nil	3
ICU technicians	3	Nil	3

investigations, such as arterial blood gases and parameters of coagulation are not available at all, one needs assistance from private laboratories during emergency hours and holidays. Clearly, this puts a financial burden on the patients and many are unwilling to bear these expenses. In the end, this results in empirical management which does not give the optimum outcome. Lack of good quality ventilators resulted in high mortality though good quality ventilators are available since March 2016. Lack of nursing staff with training in critical care and absence of technicians to handle the equipment is also an issue. Round the clock services of trained intensivists are a must for good results in an ICU, and this is still not available in the unit.

In addition, renal failure is an important complication and cause of death in our ICU. Hemodialysis is required for at least three or four patients per month. The nephrology unit of our medical college has four dialysis units but due to lack of technicians, dialysis is not done in emergency hours and holidays.

*Comparison with Kerala:* A state with high literacy and the lowest mortality. The state of Kerala has a high literacy rate of 94% with male literacy being 96% and female literacy of 92%. In comparison, MP has a total literacy rate of 70.6% with male literacy of 80.5% and female literacy of 60%. The maternal mortality of MP in 2011 to 2012 was 230 as compared with 66 in Kerala, showing significantly high mortality in MP. On comparing the health infrastructures of the two states, a high shortfall of health centers is seen in MP (Table 3).<sup>15,16</sup> In

**Table 3:** Comparative health infrastructure in Madhya Pradesh and Kerala

Particular	Madhya Pradesh			Kerala		
	Required	In position	Shortfall	Required	In position	Shortfall
Subcenters	12,134	8,869	3,445	3,525	4,575	–
PHCs	1,977	1,156	821	586	809	–
CHCs	494	333	161	146	217	–
Medical officers at PHCs	1,156	814	342	809	1,152	–
OBG doctors at CHC	333	73	260	217	Data NA	Data NA
Nursing staff at PHCs and CHCs	3,487	2,491	996	2,328	2,014	314

PHC: Primary health center; CHC: Community health center; OBG: Obstetrics and gynecology; NA: Not applicable

comparison, Kerala has more than the required number of health centers. Madhya Pradesh also has a shortage of doctors, obstetricians, and nurses, while Kerala either has no such shortage or very less shortfall in comparison to MP (Table 3).<sup>15,16</sup>

## CONCLUSION

The statistics of our institution show a rising trend in the number of deliveries as well as deaths per year over the last 16 years. Eclampsia, preeclampsia, and anemia are still the leading causes of death though they are largely preventable causes. Though the government emphasis on promoting institutional deliveries has definitely reduced the maternal mortality of the state, greater emphasis needs to be given on improving the quality of antenatal care, which is the area which still seems to be deficient in the state. Provision of the best possible facilities for obstetric critical care at the tertiary level centers is a must as the number of hospital deliveries has increased and the critical patients have to be salvaged. To achieve results like Kerala, MP needs to work on its total literacy as well as female literacy, which is very high in Kerala. Apart from this, adequate health infrastructure needs to be provided for optimum results, which can be seen in Kerala as a model state.

There is a very high incidence of preeclampsia and eclampsia in our region, and the authors recommend that research on the genetic and nutritional profile of our region is warranted to seek the cause.

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