

Training of health workers for Maternal Death Surveillance and Response program in India: knowledge assessment and analytical evaluation

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ARTICLE INFO

Article type:
Original article

Article History:
Received: 07-Feb-2019
Accepted: 08-Sep-2019

Key words:
Maternal mortality
Surveillance
Training evaluation

ABSTRACT

Background & aim: Most maternal mortalities are preventable; however, there are significant regional and global disparities in this regard. Maternal Death Surveillance and Response (MDSR) launched in India is a continuous cycle of identification, notification, and review of maternal mortalities to improve the quality of care and prevent future deaths. The Ministry of Health and Family Welfare in India conducted five national capacity-building workshops for MDSR during October 2017 and February 2018 with the objective of training medical doctors as future trainers and developing competency-based skills for each component of the program.

Methods: A training evaluation study was carried out on 144 workshop participants. Workshop outcomes in terms of trainees' knowledge were assessed using a 20-item pre-post questionnaire and skill evaluations through group work. The data were analyzed using SPSS software (version 25). The difference in proportions was ascertained using the Chi-square test.

Results: The mean score of the participants (n=144) increased from 13.2±2.3 in the pretest to 17±1.9 in the posttest (maximum score: 20). Themes generated during community and facility review sessions indicated the need for the capacity building of peripheral health facilities, sensitization for mandatory birth preparedness, complication readiness of all pregnant mothers by the frontline health workers, and regional-level MDSR training of all stakeholders involved in maternal mortality reporting.

Conclusion: Training sessions were effective in the skill development of the participants in understanding the structure and function of the MDSR program.

► Please cite this paper as:

Garg S, Basu S, Baswal D, Mariam W, Rustagi R. Training of health workers for Maternal Death Surveillance and Response program in India: knowledge assessment and analytical evaluation. Journal of Midwifery and Reproductive Health. 2020; 8(1): 2041-2049. DOI: 10.22038/jmrh.2019.38320.1427

Introduction

The death of a woman during pregnancy, childbirth or puerperium is termed maternal mortality and considered a key indicator of socioeconomic development, gender equality, and healthcare system functionality of a nation [1]. Over 303,000 maternal mortalities occur each year more than 99% of which happen in low and middle-income countries [2]. Most maternal mortalities are preventable and related to gender

disparity, lack of access to quality antenatal services, and failure to provide skilled obstetric care during delivery. The denial of safe motherhood represents a grave moral failing on the part of all those responsible for maternal wellbeing, including family, community, and health systems.

The global pace in the reduction of maternal mortality burden has been slow that is evident

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from the failure to meet the Millennium Development Goals in terms of decreasing maternal mortality burden by three quarters during 1990 and 2015 [3]. There is an enormous global and regional disparity in maternal health status in the contemporary world. Developed countries, such as the UK, Germany, and Australia, have single-digit maternal mortality ratio (MMR); however, countries in Sub-Saharan Africa registered an average MMR of 546 in 2015. The MMR of India has declined from 167 (2011-2013) to 130 (2014-2016) with significantly higher gains in the southern Indian states [4].

The gains in maternal health reflect an enhancement in the delivery of quality antenatal care services, especially in the government sector, improved birth preparedness by frontline health workers (FHWs), promotion of institutional delivery, and augmentation of maternal and child health referral facilities, including basic and emergency obstetric care or specialist comprehensive emergency obstetric care.

India has also launched several national programmatic initiatives for the promotion of safe motherhood that focus upon the increase of antenatal coverage and content without any expenses, development of institutional delivery,

and enhancement of hospital care quality during parturition and early postpartum period [5]. India is striving towards further accelerated lowering MMR to meet the Sustainable Development Goals interim target of 100 by 2020 and less than 70 maternal mortalities per 1,00,000 live births by 2030 [6].

The reduction of maternal mortality in developing countries requires ascertaining the social, economic, cultural, and medical causes of every maternal death, as well as initiating time-bound actions for their prevention. However, in the absence of an effective and continuous maternal death surveillance system, over half of all maternal mortalities remain unrecorded. Consequently, there was a failure to undertake quality Maternal Death Review (MDR), especially at primary and secondary healthcare levels and the inability to generate evidence for initiating corrective actions [7].

Maternal Death Surveillance and Response (MDSR) system is a continuous cycle of identification, notification, and review of maternal mortalities followed by learning-based actions to improve the quality of care and prevent avoidable deaths (Figure 1).

**Maternal Death Surveillance and Response (MDSR) system:
a continuous-action cycle at community, facility/hospital, regional &
national levels**

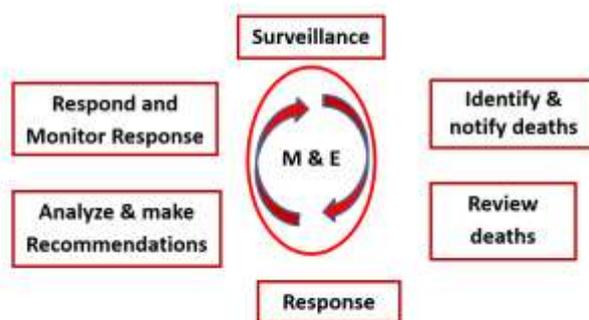


Figure 1. Maternal Death Surveillance and Response: A continuous-action cycle

The MDSR was developed as a sequel to the preexisting MDR program that incorporated

countrywide learnings (Figure 2).



Figure 2. Transition from Maternal Death Review to Maternal Death Surveillance and Response

The limitations of pre-MDSR strategies were (i) irregular underreporting of maternal mortalities due to the suboptimal quality of reports (e.g., discrepancies, blank columns, and deletion of columns), (ii) lack of focus on nonmedical causes with rarely reported systemic gaps, and lack of focus on translating review findings into coordinated measures for the prevention of maternal mortalities.

The MDSR targets prompt identification and timely report of maternal mortalities both at the community and facility levels, strengthening the linkage of health information systems and quality

improvement processes at all levels of healthcare [7]. Features of the revised MDSR strategy include the sensitization of medical personnel, incentives for FHWs, verbal autopsy of maternal mortalities at the community, and confidential death review at the facility level. Furthermore, the cause of every maternal death is determined by the application of the classical three-delay model in which the first delay occurs due to delay in decision-making toward seeking care, second delay due to delay in reaching care or health facility, and third one reflecting delay in receiving care at the health facility (Table 1) [8].

Table 1. Classical three-delay model and application in Maternal Death Surveillance and Response

First delay	Second delay	Third delay
Delay in deciding to seek care (lack of birth preparedness)	Delay in reaching health facility (lack of complication readiness)	Delay in receiving care (lack of facility readiness)
<ul style="list-style-type: none"> • Failure to recognize danger signs • Reluctance of mother or family to seek care due to cultural constraints • Lack of empowerment • Lack of encouragement from relatives and community to seek care • No one to take care of children and home • No one to accompany to hospital • Lack of awareness about 	<ul style="list-style-type: none"> • Long distance to hospitals • Difficult terrains/roads • Unavailable or expensive transportation • Lack of knowledge about appropriate health facilities • Costs related to the accompanying person 	<ul style="list-style-type: none"> • Comprehensive emergency obstetric care • Competency of healthcare providers • Availability of skilled human resources, particularly specialists • Supplies (e.g., medicines, equipment, blood, and investigation) • Availability of beds (i.e., booked/unbooked cases) • Quality of care • Availability and adherence

First delay	Second delay	Third delay
entitlement		to standard operating procedures (e.g., triaging, assessment, partograph)
<ul style="list-style-type: none"> Financial constraints 		

The process of identifying maternal mortalities and initiating timely and appropriate responses through public health system requires a complete stakeholder understanding of their assigned roles and responsibilities for the error-free operation of the surveillance data flow process. With this background in mind, the Ministry of Health and Family Welfare (MoHFW) in the Government of India planned five national capacity-building workshops for the skill development of national-level trainers on MDSR programs.

The above-mentioned workshops were conducted at Sevagram (Gujarat state), Chennai (Tamil Nadu state), Lucknow (Uttar Pradesh state), Chandigarh (Punjab and Haryana state), and Guwahati (Assam state), India, during October-February in 2018. The goal of these workshops was to deliver a practical introduction of MDSR that supports the establishment of a functional, effective, and action-oriented MDSR across India.

This training evaluation study was conducted to determine if the Indian maternal death surveillance and training workshops were effective in improving the knowledge of the Indian MDSR program functionality. Moreover, this study was performed to assess the readiness of workshop trainees for MDSR program implementation within the Indian public health system.

Materials and Methods

The curriculum of the training sessions was entirely based on the guidelines for the MDSR

program issued by the Government of India in 2017 [7]. The PowerPoint presentations for the training workshops were developed at the Department of Community Medicine of a premier medical college in Delhi in consultation with representatives from the National Health Mission, MoHFW, Government of India, and National Health Systems Resource Centre (NHSRC). The residents and the faculty applied an exhaustive literature search on collecting relevant data from countries, especially the Southeast Asian region. The presentation modules were as follows:

1) Introduction and context setting: This module informed the participants of the burden of maternal mortality in India in comparison with global indicators, regional disparity, interstate variation, and targets to be achieved. The MDSR objectives were explored in depth, and various challenges in the prevention of maternal mortalities were summarized utilizing the classical three-delay model.

2) Community-based MDSR: Personal, family or community level factors aggravating the risk of maternal mortality were explored in this module.

3) Facility-based MDSR: It was conducted to ascertain the gaps in the quality of services provided in healthcare facilities and identify any gaps, which could contribute to maternal mortalities. Hospitals from the subdistrict level to teaching hospitals should conduct facility-based MDSR under the guidance of a facility nodal officer (Figure 3).

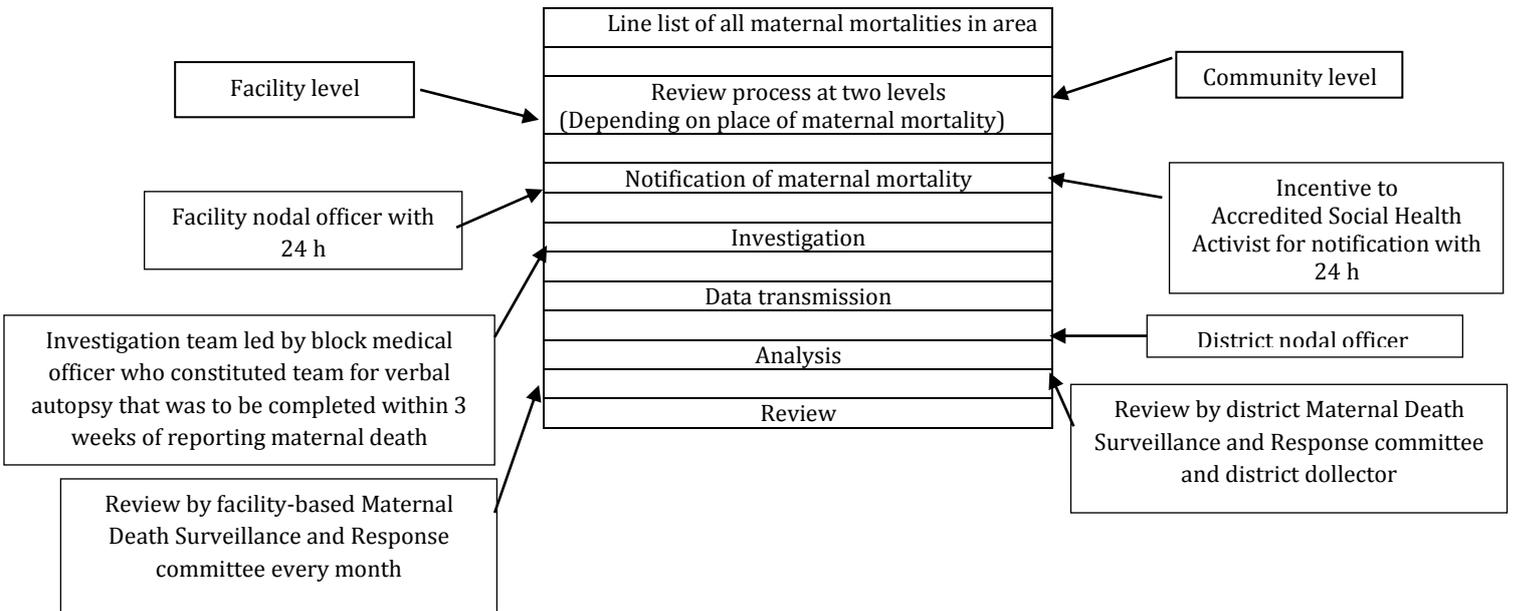


Figure 3. Data flow in Maternal Death Surveillance and Response process

4) Analysis of maternal mortalities: The analysis of MDSR data, both qualitative and quantitative, is essential for ascertaining the causes of maternal mortality and the possible actions at various levels of healthcare that could have prevented them. The models of analysis include pathway analysis and maternal near miss (MNM).

5) Confidential review: It is the multidisciplinary anonymous investigation of all or a sample of maternal mortalities occurring in health facilities, critical observation of the line of management adopted in these instances at the health facility, and identification of possible avoidable or remediable factors.

6) MDSR committees: The participants were instructed on the compositions, roles, and functionalities of various MDSR committees operational at different health-system levels.

The workshop trainers were predominantly the members from the Maternal Health Division of the MoHFW, NHRSC, as well as departments of gynecology/obstetrics and community medicine in various medical colleges across India. Each workshop included 30-35 participants held during a two-day period in which the subjects were provided with comprehensive training, hands-on learning, and competency-based skills for each component of the MDSR program. A practical demonstration of the functionality of MDSR was provided through field visits on the second day of the workshop.

The workshop training outcomes enabled the participants to:

- Understand how MDSR can reduce maternal mortality
- Know the structure of the MDSR system in India, including stakeholder roles and responsibilities
- Gain competence in using standardized tools for the assessment of MDSR
- Demonstrate the ability to recommend appropriate measures to maintain the integrity of MDSR, conduct monitoring and evaluation, and gain competence for the cascade training of FHWs and medical officers at peripheral health facilities for enabling their participation in the MDSR process

Workshop outcomes were assessed using the

Kirkpatrick evaluation criteria [9]. Learning and reaction evaluations were assessed in each of the individual participants, and skill evaluation was performed through group work.

A pre-post questionnaire method was used for the assessment of improvement in the MDSR program related to the knowledge of the participants. A questionnaire with 20 multiple-choice items with a single correct answer was used to evaluate the knowledge with 1 score awarded for correct and 0 for incorrect and unanswered items within an allocated time of 15 min. These questions assessed the participants' understanding of the concepts of maternal mortality, MNM, data flow in the MDSR process, role of stakeholders, and methods for the analysis of maternal mortalities while adhering to the MDSR guidelines.

The study participants were divided into four groups with the proportional distribution of faculty, medical officers, and nursing officers. A case study providing a real-life situation of maternal death was randomly assigned to each group. The groups had to discuss and arrive at reasons for maternal death within the framework of the three-delay model.

The participants had a field visit on the second day of the training where they were provided with hands-on skills in correctly filling up of the community and facility-based MDSR forms through real-world case studies.

The groups were allocated a household that had experienced a recent episode of maternal death. The team was accompanied by a local FHW. Verbal autopsy was conducted, and based on the results, a moderated group discussion among the participants was held exploring the threadbare various facets of the case. The facility mortality reviews were desktop exercises in which the cases of maternal mortalities and adherence to established protocols in the hospital setting were assessed.

The data were entered in Microsoft Excel (version 2013), cleaned, and analyzed using SPSS software (version 25). The results were expressed in frequency and proportions for categorical variables, as well as mean and standard deviation, for continuous variables. The difference in proportions was ascertained using the Chi-square test, and the difference

between mean scores was calculated by the paired t-test. P-value less than 0.05 was considered statistically significant.

Results

A universal sample of 144 workshop trainees filled up the pretest and posttest questionnaires during the five workshops. The mean score of the participants increased significantly from 13.2 ± 2.3 in the pretest to 17 ± 1.9 in the posttest (maximum score: 20) ($P < 0.01$; Cohen's d : 1.25). During the pretest, a high level of knowledge deficiency was observed regarding the Tenth Revision of the International Classification of

Diseases (ICD-10) in maternal mortalities, confidential review committee composition, and concept of obstetric transition. An increase in the knowledge level of the participants was noticed in almost all these domains after the training on the posttest.

The maximum range of improvement was indicated in knowledge regarding the obstetric causes of ICD-10. However, there was the least improvement regarding the identification of the person responsible for the verification of maternal mortalities in the community (Table 2).

Table 2. Change in Maternal Death Surveillance and Response knowledge of participants from pretest to posttest (n=144)

	Pretest		Posttest		P-value
	Correct responses (n)	(%)	Correct responses (n)	(%)	
Maternal mortality definition	140	97.2	141	97.9	0.7
Maternal mortality: Most common cause	134	93	142	98.6	0.01*
MDSR full form	133	92.3	143	99.3	0.003*
Maternal near miss definition	141	98	143	99.3	0.34
Maternal near miss to MDSR ratio	64	44.4	132	91.6	<0.001*
Tenth Revision of the International Classification of Diseases	30	20.8	120	83.3	<0.001*
Identification of CBMDSR	102	70.8	127	88.2	<0.001*
Notification of CBMDSR	131	91	142	98.6	0.003
Verification of CBMDSR	56	38.9	66	45.8	0.23
Notification of FBMDR	123	85.4	142	98.6	<0.001*
Line list of FBMDR	117	81.2	135	93.7	<0.001*
Migrant mortality decision to investigate	73	50.7	93	64.6	<0.001*
Transit mortality notification	73	50.7	115	79.9	<0.001*
Confidential review committee	23	16	106	73.6	<0.001*
FBMDSR committee composition	106	73.6	100	69.4	0.43
First delay	87	60.4	100	69.4	0.11
Second delay	120	83.3	141	97.9	<0.001*
Third delay	118	81.9	137	95.1	<0.001*
Obstetric transition	59	41	110	76.3	<0.001*
Pathway analysis	79	54.9	117	81.2	<0.001*

* Statistically significant

MDSR: Maternal Death Surveillance and Response

CBMDSR: Community-based Maternal Death Surveillance and Response

FBMDSR: Facility-based Maternal Death Surveillance and Response

The participant understanding of the three delays also improved after training. Complete knowledge of the three delays was present in 80 (55.5%) participants on the pretest and 95 (66%) subjects on the posttest.

In the course of facility review sessions, several themes emerged during group discussions between the trainers and participants. There was a felt need for capacity building, especially in the obstetrics and gynecology departments of government hospitals (e.g., instrument audits, 24-hour blood banks, installation, and enhancement of intensive care units), training of private practitioners regarding MDSR, and sensitization of doctors and paramedical staff to ensure respectful maternity care for the improvement of client participation in regular antenatal check-ups. Several participants felt that all doctors should be universally sensitized toward mandatory inquiry and investigation of amenorrhoea in all female patients of the reproductive age group.

During the community review sessions, including verbal autopsy, the quality of antenatal care received by deceased mothers was often perceived as compromised. Mothers' families were often socioeconomically disadvantaged, lacked birth preparedness and complication readiness suggestive of poor outreach by the FHWs indicating the need for heightened sensitization and rigorously training to achieve prompt alerting, reporting, and overall system responsiveness.

A large proportion of maternal mortalities in India occur due to the second and third delays signifying delays in transit to facility/tertiary centers and initiation of effective treatment. The stakeholders agreed on the need for strengthening the efficiency of referral mechanisms for complicated obstetric cases and upgrading health facilities in peripheral and remote areas for the reduction of the patient transit time.

Discussion

An integrated resource for the training of trainers in Indian MDSR program was developed and applied in five national-level workshops. There was a significant

improvement in the MDSR-related knowledge and skills of the participant trainees after a 2-day comprehensive training session. Based on the participant field investigations conducted during the workshops, consensus feedback emerged for the enhancement of data capture, data quality, and rectification of identified deficiencies in the health system for improving overall MDSR outcomes.

The workshops demonstrated that the training sessions were effective in skilling participants through the enhancement of their functionality knowledge and application of MDSR in their respective health settings. This national-level workshop laid the platform by forming a team of trainers for the cascade training of medical officers and FHWs through regional MDSR workshops, which were initiated.

Globally, MDSR training roll-outs have preceded an increase in maternal mortality reports in national databases and identification of the causal problems [10]. Similar findings and learnings have been reported from Ethiopia where an MDSR training program was cascaded downwards from the national level to health professionals at the regional, zonal, and district levels [11]. The World Health Organization report on the global implementation of MDSR has also identified the lack of training and adequacy of its funding as a major barrier in the successful application of MDSR in lower and middle-income countries [12].

Case studies from vulnerable countries, such as Tanzania, have recognized the MDSR training of both healthcare workers and health administrations for the dissemination of the program rules as a key opportunity in achieving optimal transition to the new system of surveillance [13-14]. In Bangladesh, cascade training involving health professionals, nurses, and family planning staff for scaling up MDSR has been instrumental in capacity building for the collection, management, and review of data required by the program [15].

In conclusion, the MDSR training resource package was effective in providing the Indian healthcare workers with a theoretical and practical ground for the implementation of the MDSR program in their respective health facilities. Monitoring and assessing the program findings would indicate to what extent the

training sensitized health workers and promoted their adherence to the program guidelines. Furthermore, the integration of these MDSR guidelines with the Indian undergraduate and postgraduate medical curriculum may also enable program sustainability.

Conclusion

Training sessions were effective in the skill development of the participants in understanding the structure and function of the MDSR program.

Acknowledgements

The authors thank Dr. Himanshu Bhushan, Advisor, National Health Systems Resource Centre (NHSRC) for his critical inputs during the workshop preparations.

Conflicts of interest

Authors declared no conflicts of interest.

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