

COMBATING POSTPARTUM HEMORRHAGE IN INDIA: MOVING FORWARD

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INTRODUCTION

The World Health Organization (WHO) estimates that, of the 529 000 maternal deaths occurring every year, 136 000 or 25.7% take place in India, where two-thirds of maternal deaths occur after delivery, postpartum hemorrhage being the most commonly reported complication and the leading cause of death (29.6%)¹. The unacceptably high maternal death ratio (540/100 000 live births)¹ in India during the last few decades remains a major challenge for health systems.

According to the same WHO estimates, for every maternal death about 20 women suffer from harm to general and reproductive health. In India, around 70% of the population lives in villages. Out of an estimated 25 million deliveries each year, 18 million take place in peripheral areas where maternal and perinatal services are either poor or non-existent. India's stated goal is to reduce maternal mortality (MMR) from 437 deaths per 100 000 live births that was recorded in 1991 to 109 by 2015. The MMR for 1998 is 407. Along with this improvement, the proportion of births attended by skilled health personnel has increased from 25.5% in 1992–1993 to 39.8% in 2002–2003, thereby reducing the chances of occurrence of maternal deaths¹.

The efforts to improve maternal health and reduce maternal mortality have been continuous in India since 1960 under the public health program of Primary Health Care – specifically under the Maternal and Child Health (MCH) program. In various policy documents, the government of India has listed the reduction of maternal mortality as one of its key objectives. Unfortunately, progress has been less than hoped for several reasons.

One of the critical bottlenecks for providing more high-quality emergency obstetric care (EOC) was a serious shortage of specialist staff such as obstetricians and anesthesiologists at various levels in rural areas. This deficiency was accentuated by the limited capacity for transfusion outside of the more sophisticated urban areas.

The present strategies to prevent maternal mortality in India focus on building a better and more fully functioning primary health-care system, from first referral level facilities to the community level. It is unfortunate that emergency obstetric care is not yet available for all patients in labor and this should be the main focus of the government as well as the medical profession.

Effective interventions for reducing the incidence of postpartum hemorrhage

Although training programs for traditional birth attendants (TBAs) are designed to improve the routine care for mothers and newborns at delivery, these interventions have proved ineffective in reducing maternal deaths^{2–5}. Neither trained TBAs nor any other category of minimally trained community health worker can prevent the vast majority of obstetric complications from occurring. Once a complication occurs, there is almost nothing TBAs, by themselves, can do to reduce the chance of morbidity or death that can ensue.

As women at high risk for postpartum hemorrhage account for only a small percentage of all maternal deaths, the vast majority of deaths occur in women with no known risk factors. Stated another way, risk screening programs

have had little impact on overall maternal mortality levels⁶⁻⁹.

Recognizing these flaws in the early recommendations of the Safe Motherhood Initiative, the present-day clear international consensus is that scarce resources should not be spent in trying to predict which women will have life-threatening complications (Safe Motherhood Initiative). Rather, maternal mortality reduction programs should be based on the principle that every pregnant woman is at risk for life-threatening complications. In order to reduce the maternal mortality ratio dramatically, all women must have access to high-quality care at delivery. That care has three key elements:

- (1) A skilled attendant at delivery;
- (2) Access to emergency obstetric care (EOC);
- (3) A functional referral system.

SKILLED ATTENDANTS AT DELIVERY

Evidence concerning the effect of skilled attendants at delivery is somewhat confused by different definitions and by variations across countries. The training of midwives and the regulations governing the procedures they are permitted to perform vary considerably. In 2004, WHO, the International Confederation of Midwives, and the International Federation of Gynecology and Obstetrics issued a joint statement with a revised definition of skilled attendant: 'A skilled attendant is an accredited health professional – such as a midwife, doctor or nurse – who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postpartum period, and in the identification, management and referral of complications in women and newborns.'

Wide variation exists in the extent to which skilled attendants are supported and supervised in the broader health system. This is also true for the number of deliveries that skilled attendants perform annually. In a country such as Malaysia, which dramatically lowered its maternal mortality in the 1960s and 1970s, midwives became the backbone of the program, each delivering 100–200 babies per year¹⁰. However, in many other countries, birth attendants

deliver far fewer babies. This affects their competence, because specific skills, such as manual removal of the placenta, require regular practice in order to be maintained. In Indonesia, for example, where tens of thousands of community midwives have been trained and deployed to villages around the country, each typically delivers fewer than 36 babies a year. Assessments within 3 years of placement found that confidence and competency-based skills were exceedingly low, with only 6% scoring above 70, the minimum level considered necessary for competence¹¹.

In addition to being properly trained for conducting routine deliveries, a second and more promising way in which skilled attendants can reduce the incidence of postpartum hemorrhage is by actively managing the third stage of labor in every delivery¹² (see Chapters 11 and 13). However, the same techniques of active management that can prevent some postpartum hemorrhages can also cause serious damage if performed incorrectly. This is not just a theoretical risk. Incorrect use of oxytocic drugs, for example, can cause the uterus to rupture, which, in the absence of surgical intervention, can lead to death.

The EOC Project in India

A project is being established to develop the capacity of general practitioners and non-specialist medical officers to provide high-quality EOC services in rural areas where skilled obstetricians are not available to prevent maternal mortality and morbidity¹³.

The Federation of Obstetrics and Gynecological Societies of India (FOGSI) has established five EOC training centers in rural India that will improve the provision of EOC services by medical officers, with the ultimate goal of reducing maternal mortality and morbidity. The project has been funded by the MacArthur Foundation, Baltimore, USA and the AMDD (Averting Maternal deaths and Disability), Columbia University, New York. JHPIEGO (an international health organization affiliated with Johns Hopkins University) assists FOGSI in its endeavor to assess and strengthen selected EOC training sites, train selected trainers and strengthen FOGSI's capacity in the area of

monitoring and evaluation. During Phase 2, FOGSI and JHPIEGO will also work together to orient key stakeholders to the value of these innovations in EOC training and service delivery for feedback in order to gain consensus among stakeholders for scale-up of the approaches and technical interventions.

FOGSI members who have a keen interest in training doctors and midwives for rural areas will run these training centers. Each center will have a coordinator and three to four faculty members. These are all staff of medical colleges or well-known consultants. The District Training Centers will have one obstetrician functioning as the District Trainer.

Design and methods policy

Training centers will be set up in medical colleges where there are dedicated doctors interested in rural women's health. All master trainers will be trained in EOC at the nodal center by doctors trained by JHPIEGO. Four master trainers at medical colleges and four at district level hospitals will provide the training in a uniform manner. Each training center will offer two types of courses: a short course of 3 weeks for upgrading the skills of doctors already working in rural or under-served areas but not possessing sufficient knowledge of EOC, and a long course of 16 weeks to provide comprehensive skills including training in performing a Cesarean section. This latter course will be composed of 6 weeks of training in medical college by four master trainers and 10 weeks of practical training in a district-level hospital. Courses will be competency-based and finalized in consultation with the Department of Health and Family Welfare. These courses will be open to any doctor working in rural and under-served areas, from the government, NGO or private sectors.

The roles of FOGSI/ICOG will be, first, to coordinate with medical colleges and government hospitals to make arrangement for training, and, second, to regularly monitor the master trainers, the training program and the quality of training centers and to formalize the end assessment and certification. At the end of each course, follow-up and support activities will ensure that the trainees start to offer EOC services after going back to their

work places. A Certificate will be issued at the end. Advocacy with the government and NGO heads is being negotiated to ensure that the trainee's facility is functional and to establish one training center in each state of India.

Expected outcomes

Five tertiary training centers and 20 district centers are well equipped to start the EOC Training Certification Course. Three tertiary centers and eight district centers have already started training, whilst two tertiary centers and 12 district centers will start functioning by the end of October 2006. A total of 162 doctors will be trained during the pilot project of 2 years for three centers established by FOGSI, MacArthur and JHPIEGO. FOGSI plans to develop, in a phased manner, one center per state in the future. It is expected that this pilot effort will be replicated by the government. The policy advocacy efforts will help in this direction to convince government and other stakeholders to support and develop the program so as to provide 24-h EOC services in rural areas.

Upscaling the program

The advocacy efforts of FOGSI have resulted in a significant change in the priorities of the government of India for phase II of the Reproductive and Child Health Care program. Very recently, the Indian government committed itself to the EOC training project of FOGSI. According to the preliminary discussions with the government, FOGSI has been entrusted with the task of developing 20 tertiary training centers and 160 district training centers wherein 2000 medical officers will be trained for 16 weeks of comprehensive emergency obstetric care. These medical officers will provide a skilled high-quality comprehensive EOC through the network of first referral units and community health care centers at subdistrict and Taluka places (a Taluka is an administrative block consisting of 80–100 contiguous villages). The whole program has been planned within a time frame of 5 years. During the same time period, the government will upgrade these centers with the necessary infrastructure such as an operating theater, equipment, blood storage

facilities and persons trained in anesthesia. This conceptual change in providing EOC at under-served places will take EOC to the areas where it is most needed and will bring about a significant reduction in the maternal mortality ratio.

The AOFOG PPH initiative

The Asia Oceania Federation of Obstetrics and Gynaecology (AOFOG) has launched a program called the AOFOG PPH Initiative¹⁴. This program focuses on the active management of the third stage of labor in areas with skilled birth attendants and in areas where misoprostol is available but without skilled birth attendants. This effort is in support of the FIGO/ICM joint statement on the management of the third stage of labor to prevent postpartum hemorrhage. The focus is on training of trainers in the national societies of those countries whose maternal mortality ratio exceeds 100/100 000 live births.

Objectives

The objectives of the AOFOG PPH initiative are:

- (1) To disseminate a standard protocol for active management of the third stage of labor and to ensure uniform and safe institutional practice;
- (2) To train the service providers (doctors, midwives, nurses, family welfare visitors) in the institutes to perform active management of the third stage of labor for all women giving birth;
- (3) To inform the medical and nursing profession about the rational use of uterotonic drugs, such as oxytocin and ergometrine, and the role of misoprostol for preventing postpartum hemorrhage;
- (4) To discuss, demonstrate and to train the service providers regarding the evidence-based management for postpartum hemorrhage;
- (5) To develop an action plan to be implemented in respective institutes and to monitor the outcome.

It is expected that the participants of each individual institute will be able to state and demonstrate the standard protocol for active management of the third stage, will practice active management of the third stage and have an updated knowledge and skills for the management of postpartum hemorrhage.

ACCESS TO EMERGENCY OBSTETRIC CARE

Even under the very best of circumstances, with adequate nutrition, high socioeconomic status and good health care, approximately 15% of pregnant women experience potentially fatal complications. Fortunately, virtually all obstetric complications can be successfully treated if EOC is universally accessible and appropriately utilized. United Nations guidelines recommend a minimum of one comprehensive facility and four basic EOC facilities per 500 000 population. To reduce maternal mortality ratios by 75%, high-mortality countries must substantially improve access to emergency care.

Solution exchange for maternal and child health practitioners in India

India is a vast, powerful storehouse of knowledge. While 'expert' knowledge is well documented, valuable knowledge gained through practitioner experience is typically lost or ignored. Furthermore, practitioners cannot always access the knowledge they need, such as whether a particular idea was tried before or where to turn when facing a bottleneck. To harness this knowledge pool and help practitioners avoid reinventing the wheel, the United Nations offices in India created the *Solution Exchange* – a free, impartial space where professionals are welcome to share their knowledge and experience¹⁵. Members represent a wide range of perspectives from government, NGOs, donors, the private sector and academia. They are organized into Communities of Practice built around the framework of the Millennium Development Goals. Members interact on an ongoing basis, building familiarity and trust, gaining in knowledge that helps them contribute more effectively – individually and collectively – to development challenges.

Communities begin with the Solution Exchange's personalized 'Research Service'. Here individual members post questions on the Community's web-based platform about the development challenges they face; other members respond to these questions and the moderation team provides research into them. The tacit knowledge and expert knowledge are brought together in a summarized 'Consolidated Reply' which is circulated to the Community, normally within 10 working days.

The Maternal & Child Health (MCH) Community, facilitated by WHO, UNICEF and UNFPA country offices in India, focuses on implementation issues facing the attainment of the development goals and targets in the Tenth Five-Year Plan of India, the National Population Policy 2000, Rural Health Mission and Phase II of the Reproductive and Child Health Programme, which correspond most closely to the universally endorsed Millennium Development Goals and targets leading to reduction of maternal and child mortality.

The main focuses of the MCH Community are to improve maternal health and reduce maternal mortality, and to improve child health and reduce infant and child mortality. The MCH Community has now been in action for almost a year, with membership growing from 130 to 725 during this time, representing 28 states and union territories of India and a few members from outside India as well. Discussions have ranged from skilled attendance at birth, setting up a telemedicine center, exclusive breast-feeding and complementary feeding, operationalizing urban Integrated Child Development Services, medical termination of pregnancies, etc.

Safe motherhood initiative from FOGSI

'Optimizing Labor workshops' were held in 66 societies across the country, and four Workshops on postpartum hemorrhage were sponsored by AOFOG. The Federation was able to involve doctors from the government service and nurses practicing in rural areas in the workshops along with its members. Workshops were held in the Societies that cater to large rural populations such as Kalyani in Bengal, Gawhati in Assam, Rajmundhry and Vijaywada in

Andhra Pradesh, Chidambaram in Tamil Nadu, Loni, Solapur and Amravathi in Maharashtra, Bijapur and Shimoga in Karnataka, Kota and Ajmer in Rajasthan, Jabalpur and Sagar in Madhya Pradesh, to name just a few¹⁶.

The take-home messages from these workshops were, first, that actively managed and supervised labor has a better outcome with a decreased incidence of operative deliveries, and, second, that an actively managed third stage decreases the blood loss and incidence of postpartum hemorrhage.

REFERRAL SYSTEMS

Widely available, good-quality EOC is necessary but not sufficient by itself to reduce the incidence of postpartum hemorrhage. Appropriate utilization is also necessary. A helpful way to analyze the barriers to utilization is through the '*three delays model*'¹⁷. Once a complication occurs, the key to saving a woman's life is to provide her adequate care in time. The delays leading to death can be divided into three categories:

- (1) Delay in deciding to seek care;
- (2) Delay in reaching care;
- (3) Delay in getting treatment at the facility.

One important element of strategies to reduce delays is the strengthening of the referral system. Widespread 'failures' in referral systems are often present, particularly for the poor and marginalized. The recent review by Murray and Pearson¹⁸ found significant gaps in understanding how referral systems are currently functioning in addition to highlighting a fundamental problem in the literature, that is, that many studies rely on a conceptualization of an ideal referral system that has a dangerously tenuous relationship to realities on the ground.

Maternity referral systems were first conceived at a time when risk screening was thought to be an appropriate maternal mortality reduction strategy, even for high-mortality countries. This conception assumed a stepwise hierarchy of increasingly sophisticated facilities, and it assumed that high-risk women would be referred up the ladder as their pregnancy

progressed. Today, however, maternal mortality strategies concentrate on emergencies, because it is acknowledged that time is critical. An elegant model of referral from facility to facility could be worse than inefficient, it could be deadly!

Although organized ambulance services appear to be part of the referral system in every country that has achieved major maternal mortality reductions, access to transport is only one part of a far more complex problem. Maternal mortality strategies that address the 'second delay' simply by funding and organizing transport fail to grapple with perhaps even more critical systemic issues.

First and foremost is the need for referral facilities that provide 24-h 7-day-a-week care within a reasonable distance of where people live. Murray and Pearson conclude that 'Extensive pyramidal structures of referral systems with multiple tiers of facilities would seem to offer little benefit in the majority of cases for maternity care and simply delay treatment'¹⁸. In most countries, attention should be concentrated on referral within the district-level system. From the perspective of a district health system as a whole, it is the strength of the referral facilities and associated supervision and referral systems that should determine the level of skill that birth attendants must have in order to avert maternal deaths, not vice versa. Murray and Pearson provide the example of Yunnan, China, where accessible referral facilities, a well-functioning referral system, and a strong and very active supervision system meant that semi-skilled village doctors could successfully conduct normal births, recognize problems, stabilize patients, and refer them onward for more complex treatment of emergencies. With this system, Yunnan reduced its maternal mortality ratio from 149 to 101 in the 1990s¹¹.

Unfortunately, however, such results have not been documented for TBAs. A stated goal of many training programs for TBAs is to improve their referral of women experiencing obstetric emergencies to facilities that can manage them. A recent meta-analysis of studies evaluating training programs designed to improve referral practices of TBAs found little effect¹⁹. Other recent studies explore why TBAs often fail to refer even patients with obvious

complications. They find that fear of losing prestige and future business often gets in the way.

Maternal mortality strategies should focus on building a functioning primary health-care system, from first referral level facilities to the community level. Emergency obstetric care must be accessible for all women who experience complications in pregnancy and child birth. Skilled birth attendants, whether based in facilities or communities should be the backbone of the system. Skilled attendants for all deliveries must be integrated with a functioning district health system that supplies *and* supports them adequately.

Achievements of the health department

The government of the state of Tamil Nadu is committed to providing good-quality medical care to the people in the rural areas. To achieve this, 105 primary health centers have been upgraded to 30-bed hospitals²⁰. These hospitals have been equipped with X-ray machines, ECG, ultrasonography, operation theaters and laboratories. Another 180 primary health centers provide 24-h delivery care.

In addition, 62 Comprehensive Emergency Obstetric and Newborn Care (CEONC) centers have been established for providing 24-h maternal and child health-care services, including Cesarean sections. These centers have been so located as to be accessible within an hour's travel from anywhere in Tamil Nadu. In the second phase, more hospitals will be upgraded as CEONC centers so as to reduce the time to 30 min.

For the first time in India, a birth companion scheme has been introduced, permitting one female attendant to stay with the antenatal mother during labor in the labor room of all government health institutions to provide psychological support.

In this state, maternal deaths have been reduced by 25% during the last 4 years (2001–2004). An excellent network of blood banks and blood storage centers has been established in the government health institutions to ensure the supply of blood and its components (86 blood banks and 26 blood storage centers).

COMMENTS

In the safe motherhood community today, the question is often posed as whether to give highest priority to training a cadre of workers with midwifery skills who can attend every birth or to focus on strengthening emergency obstetric care services (including the human resources necessary to staff them) in order to treat the approximately 15% of pregnant women who experience complications. Under the strategy of emergency obstetric care first, therefore, emergency services need to be accessible to all (albeit not used by all). In theory, the two interventions – skilled attendants for all births and emergency obstetric care for complicated ones – do not contradict each other. But, as strategies in resource-constrained settings, they fit together less easily. Ultimately, both interventions appear to be necessary to reach very low maternal mortality levels: in every country with a maternal mortality ratio of less than 50 – or even less than 100 – a high proportion of births are attended by skilled health personnel and access to emergency obstetric care is widespread. Be that as it may, the reality in high-mortality countries today is that policymakers are indeed confronted with a choice between the two interventions, at least as a matter of emphasis or priority setting. Where should they put their scarce financial, human, and managerial resources? How should they sequence these interventions?

To look for an answer, we should look to contemporary cases of the few countries or sub-national units in which maternal mortality ratios of less than 100 have been achieved. In Malaysia and Sri Lanka, a step-by-step approach, starting with coverage of basic facilities that can deliver emergency obstetric care, followed by a focus on utilization and quality, went hand in hand with the professionalization of midwifery and a governmental commitment to ensuring universal access to health services, including access by the poor and people in rural areas¹⁰. Over the course of several decades, both countries reduced the incidence of postpartum hemorrhage and thus halved their maternal mortality ratios every 6–12 years, going from more than 500 in 1950 to less than 30 by the early 1990s.

In a country like India, the vast majority of births (often more than 80%) take place at

home, very often attended by family members or neighbors, TBAs or other kinds of minimally trained community health workers. The health system is so weak that there is no hope of providing emergency obstetric care or even a true skilled birth attendant in rural areas at any time in the foreseeable future: therefore the strategy should be to provide some additional training to community health workers or traditional birth attendants, making them, in effect, semi-skilled attendants.

The enormous pressure that concerned policy-makers feel to do something for the millions of women who give birth in these circumstances is recognized. It is also recognized that a semi-skilled worker may have the potential to save a substantial number of newborns who otherwise would die. But it must be clearly stated that a strategy of training tens of thousands of semi-skilled workers who will not be backed up by a supervision system, a supply system, or a referral system, is not a strategy that will significantly reduce maternal mortality. In fact, the proliferation of unsupported, unsupervised, semi-skilled workers ('certified' after short training courses to manage deliveries) who are deployed in the context of policies effectively that marketize and privatize health care has the potential to increase the dangers for pregnant and delivering women. In some cases where such a strategy is being considered, the explicit objective is to train such workers on the assumption that they will set up their own private practices²¹. Such private provision will be quite outside any government supervision, any effective regulatory system, or even any self-policing professional body.

It is not suggested that highly trained specialists are not necessary to reduce maternal mortality. Many categories of health personnel can be taught to provide various health services – as long as effective systems of support, supervision and supplies are established.

All the interventions necessary to save women's lives can be delivered in a district health system – at the primary care and first referral levels. This does not mean that women must give birth in facilities, nor does it mean that TBAs and other private providers have no place in a delivery system. The case studies of countries that have substantially reduced

maternal mortality demonstrate that success is possible with multiple combinations of home and institutional births, attended by different categories of health workers, as long as women have access to emergency obstetric care staffed by skilled health personnel¹¹.

References

- Lynn P, Freedman RJ, Waldman H de Pinho, Wirth ME. Who's got the power? Transforming health systems for women and children. UN Millenium Project Task Force on Child Health & Maternal Health, 2005:77-95
- Rosenfield A, Maine D. Maternal mortality – a neglected tragedy: where's the M in Mch? *Lancet* 1985;2:83-5
- Greenwood AM, Bradley AK, Byass P, et al. Evaluation of a primary care programme in the Gambia: the impact of traditional birth attendants on the outcome of pregnancy. *J Trop Med Hygiene* 1990;93:58-66
- Goodburn EA, Chowdhury M, Gazi R, et al. Training traditional birth attendants in clean delivery does not prevent postpartum infection. *Health Policy Planning* 2000;15:394-9
- Smith JB, Coleman NA, Fortney JA, et al. The impact of traditional birth attendant training on delivery complications in Ghana. *Health Policy Planning* 2000;15:326-31
- Danel I, Rivera A. Honduras, 1990-1997. In Koblinsky M, ed. *Reducing Maternal Mortality: Learning from Bolivia, China, Egypt, Honduras, Indonesia, Jamaica and Zimbabwe*. Washington, DC: World Bank, 2003
- McCaw-Binns A. Jamaica, 1991-1995. In Koblinsky M, ed. *Reducing Maternal Mortality: Learning from Bolivia, China, Egypt, Honduras, Indonesia, Jamaica and Zimbabwe*. Washington, DC: World Bank, 2003
- Maine D. *Safe Motherhood Programs: Options and Issues*. New York: Center for Population and Family Health, Columbia University, 1991
- Greenwood AM, Greenwood BM, Bradley AK, et al. A prospective study of the outcome of pregnancy in a rural area of the Gambia. *Bull WHO* 1987;65:635-43
- Pathmanathan I, Liljestrand J, Martins J, et al. *Investing in Maternal Health in Malaysia and Sri Lanka*. Washington, DC: World Bank, 2003
- Koblinsky M, Campbell O. Factors affecting the reduction of maternal mortality. In Koblinsky M, ed. *Reducing Maternal Mortality: Learning from Bolivia, China, Egypt, Honduras, Indonesia, Jamaica and Zimbabwe*. Washington, DC: World Bank, 2003
- McCormick M, Sanghvi H, Kinzie B, McIntosh N. Preventing postpartum hemorrhage in low-resource settings. *Int J Gynaecol Obstet* 2002;77:267-75
- Abstract of proceedings submitted by Dr Prakash Bhatt, Vice President FOGSI on personal communication
- AOFOG PPH Initiative, FOGSI memories 2005. Publication from Federation of Obstetric & Gynecological Societies of India
- Solution Exchange for Maternal & Child Health Practitioners in India. Personal communication by Dr. Meghendra Banerjee. mch@solutionexchange-un.net.in
- FOGSI memories 2005. Publication from *Federation of Obstetric & Gynecological Societies of India*
- Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Soc Sci Med* 1984;38:1091-110
- Murray SF, Pearson S. Maternity referral systems in developing countries: challenges and next steps. A scoping review of current knowledge. Background paper commissioned by the UN Millenium Project Task Force on Child Health and Maternal Health and the World Health Organization. New York, 2004
- Sibley L, Sipe TAT, Koblinsky M. Does traditional birth attendant training improve referral of women with obstetric complications: a review of the evidence. *Soc Sci Med* 2004;59:1757-68
- Tamil-Nadu Government Publication on World Health Day, 2006. *Times of India*, April 7th, 2005
- Mavalankar D. Auxiliary nurse midwives' (ANM) changing role in India: Policy issues for reproductive and child health. Ahmedabad: Indian Institute of Management, 1997