Original Research Article

A systems approach to Training for increasing preparedness for pregnancy associated infectious morbidity of mother and new-born in a Tribal District of Central Province of India

Abstract:

Background: Despite significant reduction in neonatal and maternal mortality in the last two decades, a pressing strategy is needed to meaningfully reduce preventable maternal and neonatal deaths which is crucial for achieving the Sustainable Development Goals.

Aim of the study: A project was therefore undertaken to design a need based comprehensive training beyond the limits of individual disease specific guideline for Health Care Workers in a tribal district of central India and measure its impact on awareness.

Material and Method A systems approach by 5 step ADDIE Model was followed to develop a training program which could address critical constituents of knowledge, skills and affective domain felt necessary for prevention and treatment of sepsis in Pregnant women and Neonates. The difference in Knowledge Scores between the pre-exposure and post-exposure responses was quantified to reflect effectiveness of the learning modules in increasing knowledge. For Program Evaluation a structured feedback was obtained regaining the participant's perception of the effective of the program and also suggestions for improvement.

Results: There were sixty-nine participants who took part in 5 different session with an average of fourteen participants per session. There was of significant difference between pre-test and post test scores among all types of the participants. The Mean Pre-test Score was found to be 9.468 +/- 2.865 while the Mean Post Test Score was found to be 14.340+/- 2.1394 with statistically significant difference ($t=-10.961$, $df=46$, $p<0.001$) indicating that the imparted education had significant effect on the knowledge of the participants. The participants had a highly positive

review of the session, with most participants giving a rating of more than 4 out of 5 on the Likert scale for all of the questions of the feedback

Conclusion: The systems-based approach highlights a framework for cross-sector collaboration with a community partnership, the skeleton of which can be adapted for various other training programs in healthcare.

Keywords : Neonatal, maternal mortality, pregnancy

Introduction

Of the preventable causes, peri-partum infection still contributes to about one-tenth of the global burden of maternal deaths and around 1 million neonatal deaths annually (1,2) There has been a paradigm shift in the spectrum of the infectious diseases which affect the mothers and their neonates over last few decades (3). This is attributable to several modifying factors like sterilization and disinfection practices, antibiotic use, resurgence of old and new infections due to drug resistance strains and pandemics (4-7). Despite significant reduction in neonatal and maternal mortality in the last two decades, a pressing strategy is needed to meaningfully reduce preventable maternal and neonatal deaths which is crucial for achieving the Sustainable Development Goals 3.1 and 3.2.(8) Increase in risk of infections is lent not only by the conditions during labour and childbirth (e.g. prolonged rupture of membranes, multiple vaginal examinations, manual removal of the placenta, and caesarean section) but also by several pre-existing genital infections in women, STIs, and recto-vaginal colonization with GBS(9-11). Growing evidence suggests a strong link between the above and increased risk of preterm labour and birth, premature rupture of membranes, postpartum endometritis, neonatal sepsis and other neonatal complications associated with prematurity (12-15).

Existing guidelines on safe birthing practices, sepsis prevention, rational use of antibiotics, syndrome management of STIs, GBS screening and its role in neonatal morbidity, etc. serve well to address a complex problem, but mostly focus on a specific component at a time and deliver guidance in a fragmented manner. The complex web of interacting forces within the existing system geared towards a common goal of reducing infections needs to be outlined. Health care workers preparedness is perceived as most important defence against prevention of sepsis in mother and new-born but often lacking the most (16). A structured sepsis awareness program

based on the training needs identified by the health care professions can thus improve the maternal and neonatal outcome significantly. (17, 18)

The work was carried out at a tribal district of Central Province of India which has a projected present population of 1.7 million population out of which 43 % of citizens are tribal(19). The maternal health and neonatal health parameters are way below the national average due to vast and inaccessible expanse of terrain (20). The Maternal and Neonatal health care facilities are principally provided by government run health infrastructure with the District Hospital as the apex referral centre for more peripheral Community Health Centres and Primary Health Centres which are mostly working to their full capacities due to scarcity of manpower and resources(20). A project was therefore undertaken to design a need based comprehensive training beyond the limits of individual disease specific guideline for Health Care Workers in a tribal district of central India and measure its impact.

Materials and Method

A systems approach by 5 step **ADDIE Model (21-22)** was followed to develop a training program which could address critical constituents of knowledge, skills and affective domain felt necessary for prevention and treatment of sepsis in Pregnant women and Neonates without the burden of redundant information. During the **Analysis phase**, discussions with the stake holders like Funding agency, Government officials, Hospital administration and Subject Experts in the project team revealed the felt needs of the training. In the first meeting with the Trainees, brain storming closely expressed the expectations from the training with the larger goal of obstetrics and neonatal sepsis prevention in mind. In the **Design phase**, the core learning areas were identified and listed for the proposed training which are outlined in table 1.

In **Development Phase** teaching material was developed to address the different domains of learning contained in the core learning areas. Table 2. The Teaching learning methods included Interactive lectures on the cognitive and affective domain contents, hand outs including Do and don'ts, antibiotic prophylaxis and Treatment guidelines. A simulation based video was developed by the research team to demonstrate sample collection and transportation for group b streptococcus screening in target antenatal population. Hands on training to the participants was imparted on women attending antenatal clinics and Roshni Clinics (dedicated clinic's for women an initiative of government of Madhya Pradesh) The **Implementation Phase** began with

monthly visit of the Project team to the District hospital the apex referral centre and also to the peripheral community health centres. One to two hours session began by collecting baseline demographic and service related information from the participants. The pre-test score was provided to collect the baseline knowledge of the participants. The interactive session began by the principle of known to unknown encouraging maximum possible participation. After the lecture and video presentation hands on training of the doctor and nurses were carried out in the outpatient department of the Host Health facility on the specific day of Roshni Clinic. Counselling, informed consent, antennal group B streptococcus screening, sample collection, management of STI was demonstration supervised by the Research Team. The session was concluded by post-test scoring.

Statistical Analysis: Responses from the participants were scored and calculated using a model answer key. A score of 'one' or 'zero' was awarded for each correct or incorrect answer, respectively, and the sum total for each participant was expressed as the "Awareness Score" described on an ordinal scale as follows: Fair (8), Average (10) and Good (14). Maximum achievable score was 20. The difference in Knowledge Scores between the pre-exposure and post-exposure responses was quantified to reflect effectiveness of the learning modules in increasing knowledge. For **Program Evaluation** structured feedback was obtained regarding the participant's perception of the effective of the program and suggestions for improvement. The feedbacks were critically analysed and necessary changes were made in the study material and Knowledge scoring tool before the next session.

Descriptive statistics was used for qualitative data and paired t test was used to compare outcomes. Effect size was estimated to assess magnitude of effect on knowledge due to intervention (small, medium, or large).

Results

The In-service staff in maternity services includes Medical and Nursing officers of varying educational backgrounds and experience. They not only are involved in patient care but also share responsibilities of different proportions, depending on their posts, of managerial tasks including record keeping and implementation of government schemes in one of most

underdeveloped corners of the state. There were sixty-nine participants who took part in 5 different sessions with an average of fourteen participants per session. Sixty Four participants were nurses and 5 were doctors. Four sessions were held in the District hospital and one was held in Community Health Centre located in remote tehsil. Out of the 69 participants 59.42% (n=41) had more than twenty years of service, 31.88% (n=22) had 10-20 years of service and rest 8.6% had less than 10 years of experience.

There was of significant difference between pre-test and post test scores among all types of the participants. The **Mean Pre-test Score** was found to be 9.468 +/- 2.865 while the **Mean Post Test Score** was found to be 14.340+/- 2.1394 with statistically significant difference ($t=-10.961$, $df=46$, $p<0.001$) indicating that the imparted education had significant effect on the knowledge of the participants.

The participants had a highly positive review of the session, with most participants giving a rating of more than 4 out of 5 on the Likert scale for all of the questions of the feedback. The mean scores of the questions for the knowledge/awareness session depicted in table 3.

More than 90% of the participants reported that they are more aware of the standard guidelines for STI management now. About 86.4% of the participants had expectation of more such seminars that was delivered. More than four-fifth of the participants reported that the use of language was clear and about 89.4% of the people had their doubts cleared in the session. About 87.9% of the people understood the different types of discharges related to STIs. More than 90% of the people understood the data collection process, and the usage of antibiotics very well. About 91.9% of the participants felt that the information provided in the seminar was beneficial. About 87% of the participants reported that the training session met their expectation, and more than 98% of the participants were satisfied with the video demonstrations. Overall, it was found that most of the participants found the session informative, beneficial, and meeting their expectation.

With respect to overall feedback elements as well, the response was found to be highly positive, again with most participants giving a score of 4 or more for most questions (out of 5). The mean scores of overall feedback elements are depicted in table 4. About 95.7% of the participants gave positive feedback for content explanation, and about 84.8% of the participants gave a positive review of the presentation. About 78.3% of the participants gave positive feedback for its utility

to their present job profile. About 69.6% of the people felt that more training sessions like these are required in the future. About 87% of the people gave positive feedback that their knowledge was increased sufficiently after the session.

Discussion and conclusion

The pool of trainees in our study consisted of in-service medical officers and nursing personnel with a mixed experience background and a certain level of competency. Working in remote rural areas, the overtaxed staff wears multiple hats, working above and beyond their intended roles at times, to provide care within a resource constrained healthcare system (2).

It was important to capitalize on their prior experience and develop an instructional module taking into consideration the trainee experience, their expectations, perceived community needs, and the local logistic shortcomings. Adults learn best when the training involves moving beyond the one-dimensional concepts and theoretical instructions. The idea was to develop a comprehensive understanding of the dynamic and interconnected nature of the whole causal spectrum, and to incorporate a system of unified front within the existing healthcare channels against all ports of infections. Relevant critical gist was handpicked from within the existing guidelines (23-28). These, integrated together made better sense in delineating the continuum of care essential to prevent infections and their consequences in pregnant women and neonates

A significant jump in knowledge was evident using the hybrid module as the mean awareness scores increased from 9.468 +/- 2.865 to be 14.340+/- 2.1394 with statistically significant difference ($t=-10.961$, $df=46$, $p<0.001$). The framework for the module was developed utilising the ADDIE model which has proven useful for blended learning as a part of continuing education under the healthcare settings. Various web based and offline courses on Basic Life Support, management specialization in oncology, Tobacco counselling, neonatal cranial ultrasound training modules etc. have been developed and successfully tested using the ADDIE blueprint (28-31). The model allows to create an adaptable and goal-oriented design which can influence knowledge, skills, and attitudes in learners, and which can be easily incorporated within the existing curricula in medical education.

Like any other education modality, the development of the present training module and placing it convincingly within the existing healthcare channels needed a robust background of systematic

planning. The model was contained within the larger framework of a systems approach which at its core, has been described as an “enterprise aimed at seeing how things are connected to each other within some notion of a whole entity” (32). Systems thinking re-orients perspectives by broadening our understanding of the complex interactive components within a system conglomerate and identifying how this learning may be applied to develop potential solutions (33) The composite view for our study through the systems lens to reduce preventable maternal and neonatal infections can be described as follows:

- Identification of an intervention that can be adapted to fit into the existing health system: STI screening at least once per trimester and GBS Screening at 35-36 weeks.
- Training and skill development in experienced providers using a simplified hybrid module for a refresher course that serves to form intuitive links within the various existing guidelines and explained in the context of local needs and logistics: Identification and syndrome management of STIs in antenatal women, detection and prophylaxis against GBS, proper technique for sample collection and transportation, safe birthing practices, identification of the clinical spectrum of peripartum and neonatal sepsis, logistic troubleshooting, rational antibiotic use and antibiotic resistance, etc.
- Organization of a resource team consisting of a network coalition of ground level providers, local and central stakeholders and policy makers to identify gaps in care and to provide resource chain to address the same.
- Capacity building by coordinating financial and technical support for initial infrastructure and functional development with an ongoing focus on continued sustainability: Coordination of funding, and regular technical assistance from a team of Gynaecologist, Microbiologist and Community Medicine specialist for a period of initial eighteen months by organised visits to the Betul district hospital on the day of ROSHNI clinic (Wednesday) which provides dedicated healthcare service to women under the state health department.

The systems-based approach highlights a framework for cross-sector collaboration with a community partnership, the skeleton of which can be adapted for various other programs in healthcare. One impressive example of systems approach leading to significant reduction in maternal mortality in Zambia and Uganda was the SMGL initiative that utilized the systems

strengthening approach by strategic, multidimensional involvement of high-level political leadership, focused public attention, evidence-based interventions, a broad coalition of stakeholders etc. to develop a culture of zero tolerance for preventable maternal and new-born deaths at all strata of society (34). Another study utilised the systems thinking to capture the dynamics of neonatal mortality in Uganda, and identify it as the first step towards exploring the strategies and the priorities that should be addressed (35). Such holistic approaches that acknowledge the complexity and the multicomponent character of a problem are fundamental in changing the narrative around the maternal and neonatal healthcare especially in the developing world. The provider training serves as a starting point towards larger organizational changes. The present course proved effective measured from the standpoint of the first two levels of the Kirkpatrick's evaluation model (36). This was evident by an overall positive feedback on satisfaction with the intervention (Kirkpatrick level 1), and significant improvement of scores in pre and post training assessment (Kirkpatrick level 2). However, keeping up the momentum is vital for continued sustainability of the program. This can be achieved with a critical analysis of workplace observations and interval audits (Kirkpatrick level 3), and a district level monitoring of health indicators (Kirkpatrick level 4) which can be part of ongoing project funded by National Health Mission Government of Madhya Pradesh.

Ethics approval: The Project has been approved by Institution Human Ethics Committee with the registration number LOPEFO133 under the title "A pilot project on interventional capacity building of in-service staff (medical officers and Nursing staff and nursing college faculty) to bring down Group B Streptococci, reproductive tract infections associated adverse pregnancy outcomes in tribal district of Betul Madhya Pradesh".

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

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Tables: 1 List of Core Learning Areas

	Core Learning Areas
	1. Safe Birthing Practices 2. Obstetrics Sepsis Prevention and Management 3. Identification of Antenatal Group B Streptococcus colonisation and its significance 4. Significance of STI identification in women including Pregnancy 5. Syndromic Approach to Sexually Transmitted Infection Treatment 6. Rational Use of Antibiotics and Antimicrobial Resistance 7. Basics of Clinical Microbiology , Sample collection, Transportation and Culture 8. Signs and Symptoms of Early and Late Neonatal Sepsis.

Table 2. Teaching and Learning Methods for Core Areas.

Core Learning Area	Cognitive and Affective domain	Psychomotor Domain
1. Safe Birthing Practices (23)	1. Interactive lecture 2. Question and answer session with Feedback 3. Pre-test- post-test questionnaire	
2. Obstetrics Sepsis Prevention and Management(24)	1. Interactive lecture 2. Question and answer session with Feedback 3. Pre-test- post-test questionnaire	
3. Identification of Antenatal Group B Streptococcus colonization and its treatment.(25)	1. Interactive lecture with hand out (Treatment guidelines of GBS sepsis prevention(x)) 2. Question and answer session with Feedback 3. Pre-test- post-test questionnaire	Hands on training in Antenatal clinics and Roshni Clinics
4. Significance of STI identification in women including Pregnancy and Syndromic Approach to Treatment(26)	1. Interactive lecture with hand out (NACO STI treatment guideline.(z)) 2. Question and answer session with Feedback 3. Pre-test- post-test questionnaire	Hands on training on Antenatal clinics and Roshni Clinics
5. Rational Use of Antibiotics and Antimicrobial Resistance(27)	1. Interactive lecture 2. Question and answer session with Feedback 3. Pre-test- posttest questionnaire	

4. Basics of Clinical Microbiology , Sample collection, Transportation and Microbial Culture	1. Interactive lecture with hand Out (Dos and Don'ts) 2. Question and answer session with Feedback 3. Pre-test- post-test questionnaire	Simulation Video And Hands on training in Antenatal and Roshni Clinics
5. Signs and Symptoms of Early and Late Neonatal Sepsis.(28)	1. Interactive lecture 2. Question and answer session with Feedback 3. Pretest- posttest questionnaire	

Table 3. **Mean scores given by the participants in response to the feedback questions (N=66)**

	Mean	Std. Deviation
Awareness of new Medical guidelines for STI/GBS	4.379	.8904
More expectation related to seminar	4.455	.9476
Language used was cleared	4.273	.9852
Doubts cleared related to STI	4.455	.8626
Understanding of different types of discharges in STI	4.455	.8446
Data Collection form and consent letter form Understanding	4.606	.8749
Understanding of use of antibiotics in controlled manner According to Guidelines	4.636	.6711
Information Given in seminar was beneficial	4.576	.8424
Informational seminar/hands on training met your expectation	4.485	.8986
Video demonstrations cleared the method of sample collection	4.742	.6155

Table 4**: Mean scores of overall feedback elements (N=46)**

	Mean	Std. Deviation
Feedback of content explained on the scale of 1 to 5	4.587	.5803
Feedback of presentation on the scale of 1 to 5	4.326	.7319
Feedback utility of job profile on the scale of 1 to 5	4.065	.8794
Feedback of more training required on the scale of 1 to 5	3.870	.9800
Feedback of knowledge enhancement given on the scale of 1 to 5	4.326	.8180