BMJ Open

Effectiveness of a short-structured training programme on knowledge of healthcare providers and programme managers involved in maternal and child health programmes in Odisha, India: a quality improvement study

Vikas Bhatia,[1,2] Arvind Kumar Singh ,[1] Prajna Paramita Giri,[1] Durgesh Prasad Sahoo[1,3]

To cite: Bhatia V, Singh AK, Giri PP, *et al*. Effectiveness of a short-structured training programme on knowledge of healthcare providers and programme managers involved in maternal and child health programmes in Odisha, India: a quality improvement study. *BMJ Open* 2021;**11**:e040841. doi:10.1136/bmjopen-2020-040841

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online. (http://dx.doi.org/10.1136/bmjopen-2020-040841).

VB and AKS are joint first authors.

Received 23 May 2020
Accepted 07 August 2021

For numbered affiliations see end of article.

Correspondence to
Dr Arvind Kumar Singh; arvind28aug@gmail.com

ABSTRACT

Objective To evaluate the effectiveness of training programme on knowledge related to new interventions proposed under India Newborn Action Plan (INAP) and Integrated Action Plan against Pneumonia and Diarrhoea (IAPPD).

Design Quality improvement study with pre-evaluation and post evaluation.

Setting The study was conducted in 17 districts of Odisha, India.

Participants and interventions The participants were healthcare providers and programme managers involved in maternal and child health programmes. Intervention was a short-structured (8 hours) training delivered to 127 batches with expected participation of 30 trainees in each batch. Training was divided into four modules covering new interventions related to INAP and IAPPD like causes of neonatal death, kangaroo mother care (KMC), feeding of low birthweight (LBW) infants, use of injection gentamicin, identification of possible serious bacterial infection (PSBI), identification and management of pneumonia and diarrhoea and key interventions for maternal health. Various modalities of teaching-learning method were used.

Outcome measures Pretraining and post-training knowledge assessment was done with a pretested tool consisting of 15 items. Each item carried equal weightage in calculation of knowledge score thus maximum possible knowledge score was 15. Feedback assessment was also done after the training.

Results The mean (SD) knowledge score significantly improved to 10.24 (2.24) after training as compared with 4.73 (1.94) before training, p<0.001 (n=982). There was significant improvement in knowledge for majority of the components namely causes of neonatal death (61.9% vs 28.1%), KMC (68.0% vs 54.6%), feeding of LBW infants (77.7% vs 6.9%), use of injection gentamicin (69.7% vs 11.2%), identification of PSBI (69.5% vs 59.5%). The improvement in knowledge score was more when healthcare providers and programme managers had provided a favourable response on feedback.

Conclusion Systematic pretest and post-test assessment coupled with feedback assessment can ensure the effectiveness of training programmes offered in programmatic settings.

Strengths and limitations of this study

- This study is derived from a large-scale multi-stakeholder training programme conducted in 17 districts of Odisha.
- The study demonstrates the role of structured training prior to a new programme implementation.
- It also highlights the role of feedback assessment in evaluation of training programme.
- Feedback was assessed immediately post-training and thus effect of training may be an overestimation.
- We did not assess the long-term impact of training programme on service delivery.

INTRODUCTION

India has made considerable progress in reducing child and maternal mortality over the last 15 years. The infant mortality rate decreased from 40 per 1000 live births to 32 per 1000 live births from year 2013 to year 2018.[1 2] The maternal mortality rate decreased from 130 per 100 000 live births during years 2014–2016 to 113 per 100 000 live births during years 2016–2018.[1 2] However, the pace of this reduction was not sufficient to achieve the Millennium Development Goals.[3 4]

In 2014, the Government of India adopted two global policies related to neonatal and child health: the Every Newborn Action Plan and the Global Integrated Action Plan against Pneumonia and Diarrhoea.[5 6] India adapted these two plans in the form of the India Newborn Action Plan (INAP) and the

Integrated Action Plan against Pneumonia and Diarrhoea (IAPPD).[6 7] INAP aims to achieve single-digit neonatal mortality rate and stillbirth rate using a continuum of care approach that starts from the preconception period. IAPPD aims to target two major infectious causes of death in children—pneumonia and diarrhoea—using a more comprehensive approach of prevention, protection and treatment. The neonatal period contributes to nearly two-thirds of infant deaths, whereas infections are responsible for approximately 50% of postneonatal infant mortality.[8] Thus, the implementation of INAP and IAPPD carries a huge potential to reduce child mortality. The successful implementation of INAP, IAPPD and the new maternal health (MH) guidelines (as part of INAP) will only be possible after capacity building of all stakeholders as well as sustaining continuous monitoring and supervision for the implementation of these initiatives.[6 7 9–14]

The policy for maternal and newborn survival clearly envisages health system strengthening, training and capacity building for health workers and improving the accessibility and affordability of routine services, both at the facility and community levels, for mothers and newborns during times of both health and sickness.[15] However, it has been documented that a deficiency in both knowledge and skills remains an important barrier in the delivery of maternal and child health programmes.[16–18]

Didactic training programmes can significantly improve knowledge and thus the overall quality of care. Health workers undergo numerous routine and long trainings, but these trainings are normally not evaluated to assess their effectiveness in knowledge enhancement. Thus, we planned the evaluation of this short-structured training programme as part of a routine programme to demonstrate whether such programmes can be useful in bridging the knowledge gap, thus resulting in the overall promotion of maternal and child health.

This training was conducted for healthcare providers and programme managers working at facilities that carry out deliveries (ie, delivery points) in 17 districts in Odisha prior to the programme implementation of INAP and IAPPD in collaboration with the Government of Odisha and UNICEF. We performed this study with an objective of assessing the effectiveness of the structured training programme on the knowledge of different stakeholders regarding new interventions proposed in INAP and IAPPD.

MATERIAL AND METHODS

Study setting

We conducted this quality improvement study with a pre-evaluation and postevaluation in 17 out of 30 districts of Odisha from January to November 2017. Other agencies executed the training programme in the other 13 districts. Since there was a difference in the training plan and content, we did not include data from the other 13 districts in the present study. The state of Odisha is in the eastern part of India. Neonatal and child mortality in Odisha is higher than the national average. The districts that were included in the present study are shown in figure 1. These districts came from three zones, namely the Central (Mayurbhanj), Northern (Keonjhar, Angul, Bolangir, Sonepur, Bargarh, Sambalpur, Jharsuguda, Sundergarh, Deogarh) and Southern (Kandhamal, Gajapati, Rayagada, Koraput, Kalahandi, Nuapada, Boudh) zones, and comprised nearly 50% of the state's population.

Figure 1 Map of Odisha showing 17 districts where project was implemented.

Study participants

The study participants were healthcare providers and programme managers from District Programme Management Unit, that is, district programme managers and block programme managers; integrated child development services functionaries; subdivisional medical officers; the block medical officer in-charge; the child development project officer; medical officers (MOs), pharmacists; staff nurses; auxiliary nurse midwives (ANMs) and lady health visitors (LHVs) working at delivery points.

These healthcare providers and programme managers were either involved in the programme implementation or service delivery of maternal and child health programmes at various levels of the healthcare system in the district. Since this was part of the routine programme implementation activity and all healthcare providers and programme managers were expected to attend the training programme, as mandated by the state government (the employer of the trainees), no exclusion criteria were adopted for the study. We did not calculate the sample size for this study, as all healthcare providers and programme managers from 17 districts were expected to attend the training programme.

Training programme

Before implementing the training programme, a 1-day pre-implementation sensitisation and training programme (training of trainers) of 8 hours duration was conducted to train the master trainers. Master trainers

were either from academic institutions or were employed within the health system at the state level. All master trainers had experience working in maternal and child health programmes for at least 10 years and were extensively involved in different training programmes related to maternal and child health at the state level, thus they had the competency and experience to train district-level service providers. After this training, the training sessions for healthcare providers and programme managers (ie, the study participants) was conducted at the district level.

Training plan

The training session plan is provided as online supplemental file 1. The training programme was divided into four technical parts. The introduction session dealt with the current scenario of neonatal, infant and maternal mortality and a situational analysis of maternal and child health in Odisha. The second session covered training related to INAP and different components of INAP, with an emphasis on newer interventions, that is, vitamin K prophylaxis at birth, kangaroo mother care (KMC) and feeding of low birthweight (LBW) infants, injection gentamicin by ANMs, the use of antenatal corticosteroids for preterm labour, and the active management of the third stage of labour. The third session focused on different components of IAPPD. The fourth session comprised different components of new MH guidelines, that is, calcium supplementation during pregnancy and lactation, deworming in pregnancy, screening for hypothyroidism, screening for syphilis, the management of gestational diabetes mellitus, and the prevention and treatment of malaria during pregnancy.

Apart from clinical aspects, each session also covered managerial aspects and the role of different healthcare providers and programme managers in supportive supervision, supply chain management (drugs and equipment), reporting and review of programme.

We used different teaching-learning methods, such as power point presentations, group work and discussions, case-based learning, and demonstrations. We adapted the existing resource material developed by the child health division and MH division, Ministry of Health and Family Welfare, Government of India. Operational guidelines for INAP, IAPPD and the new MH guidelines were used as reference materials.[6 7 9–14]

Study investigators supervised a sample (nearly 10%) training conducted by different master trainers. The study investigators supervised the training through direct observation and did not use a supervision checklist. They discussed the training content, involvement in teaching-learning and facilitation by local teams with trainers. Minor modifications were made to the training content and delivery based on the feedback.

Assessment of training

Pretest and post-test evaluations were performed to assess knowledge of healthcare providers and programme managers using a pretested structured questionnaire consisting of 15 items, with 3 items related to MH and the rest related to child health (online supplemental file 2). The study investigators framed the questions and finalised them after seeking comments from trainers and healthcare providers and programme managers trained in the first three training sessions (data from these sessions are not included in the analysis). Difficulty level of questions, content clarity and the expected time required for the set of questions was deliberated and modified, if required. Using the expert-consensus method, we ensured that questions were coherent with the learning objectives of the training and covered in the training module. Each healthcare provider and programme manager were provided 30 min to complete the pretest before the start of training and post-test at the end of the training. An additional 15 min was provided to elicit feedback at the end of the training. The feedback was assessed using a structured format focusing on training methodology, training duration, complementary learning methods and the delivery of the training (online supplemental file 3). We did not record any personal identifiers to minimise the effect of observer bias in the response. However, we provided each healthcare provider and programme manager with a unique code that was the same for both the pretest and post-test.

Statistical analysis

The data were entered in Microsoft Excel 2013 (Microsoft Corporation, 2013) and analysed using IBM SPSS Statistics for Windows, V.20 (IBM Corp). The normality of data was assessed using skewness and kurtosis; normality plots; and statistical tests for normality, such as the Shapiro-Wilk and Kolmogorov-Smirnov tests. Descriptive data are presented as the mean (SD) or percentages. The comparison of overall pretest and post-test score was analysed using paired t-test. Difference in the mean score was compared across categories of age, gender and designation. The comparison of the difference in the mean between the pretest and post-test score between the two categories was analysed using unpaired test and between more than two categories was analysed using the analysis of variance. The pretest and post-test score for an individual item was assessed using McNemar's test. Association of mean difference in pretest and post-test score with type of feedback was seen using analysis of covariance after adjusting for age, gender and designation. A p value less than 0.05 was considered to be statistically significant.

Patient and Public Involvement

No patient was involved.

RESULTS

A total of 3467 healthcare providers and programme managers were trained as part of this training in 17 districts. Information related to the evaluation of the training was available for 982 healthcare providers and programme managers. Out of 982, 276 (28.1%) were

Table 1 Difference in overall knowledge score (before and after training) and stratified by age, gender, designation

Variable		Number	Pretest knowledge score Mean (SD)	Post-test knowledge score Mean (SD)	Difference between pretest and post-test knowledge score Mean (SD)	P value*
Overall		982	4.73 (1.94)	10.24 (2.24)	5.51 (3.00)	<0.001
Age	<30 years	327	4.99 (2.01)	9.67 (2.43)	4.68 (3.21)	0.048
	30–50 years	601	4.66 (1.87)	10.49 (2.11)	5.83 (2.88)	
	>50 years	54	4.07 (1.99)	10.96 (1.76)	6.89 (2.51)	
Gender	Male	293	4.78 (1.98)	10.16 (2.11)	5.39 (2.97)	0.823
	Female	689	4.72 (1.91)	10.27 (2.29)	5.56 (3.07)	
Designation	Medical officers	276	4.87 (2.01)	10.18 (2.17)	5.31 (3.02)	0.416
	ANM/LHV	90	4.82 (2.08)	10.63 (2.35)	5.81 (3.85)	
	Staff nurse	360	4.56 (1.92)	10.32 (2.26)	5.77 (2.92)	
	Male health workers	250	4.79 (1.80)	10.05 (2.22)	5.26 (3.05)	
	Others	6	5.67 (1.63)	10.00 (3.34)	4.33 (4.32)	

*P value for overall is for difference between pretest and post-test knowledge score. P value for age, gender and designation is for difference between the categories.
ANM, auxiliary nurse midwife; LHV, lady health visitor.

MOs, 360 (36.7%) were nurses, 90 (9.2%) were ANM and LHV, 250 (25.5%) were male health workers and 6 were other staff. The mean (SD) age of trainees was 33.9 (8.1) years and 689 (70.2%) were females.

Change in pretraining and post-training knowledge

The mean (SD) knowledge score significantly improved to 10.24 (2.24) after the training compared with 4.73 (1.94) before the training (p value <0.001). Improvement in knowledge score was significantly higher in >50 years age group (increase in mean score=6.89) than in <30 years age group (increase in mean score=4.68), p=0.048. However, there was no significant difference in pretraining and post-training test scores across gender and designation (table 1). The proportion of healthcare providers and programme managers giving correct response during post-test evaluation improved significantly as compared with pretest evaluation for most of the components namely feeding of LBW babies (77.7% vs 6.9%, p value <0.001), use of gentamicin by ANM for management of sepsis (69.7% vs 11.2%, p value <0.001), managing severe dehydration (77.7% vs 13.9%, p value <0.001), zinc dosage (68.2% vs 16.2%, p value <0.001), calcium supplementation (76.1 vs 22.8%, p value <0.001) and deworming during pregnancy (78.5% vs 22.0%, p value <0.001). However, no considerable change was seen in post-test results for vitamin K prophylaxis (36.3% vs 34.3%, p value =0.418) (table 2).

Assessment of feedback

Out of 982 healthcare providers and programme managers who participated in the study, information related to feedback was available for 973. Thus, we analysed the improvement of knowledge score by type of feedback for only 973 healthcare providers and programme managers. The change in mean (SD) knowledge score was highest for healthcare providers and programme managers who had given positive feedback regarding the training, that is, 'training length was just correct' (7.08 (3.23), p value <0.001), the teaching method was highly appropriate (6.71 (3.10), p value <0.001), the complementary learning methods were most relevant (7.43 (2.36), p value <0.001) and the training met their expectations to the fullest (6.53 (3.00), p value <0.001) (table 3). Districts with better feedback, such as Sambalpur, Keonjhar, Bolangir and Angul showed better test score differences than Mayurbhanj and Deogarh, which gave poor feedback (figure 2).

DISCUSSION

We imparted the INAP and IAPPD training to 3467 healthcare providers and programme managers in 127 batches and evaluated the effectiveness of the training on the knowledge of 982 healthcare providers and programme managers in 17 districts of Odisha. We found that the overall knowledge score as well as knowledge for majority of individual components improved significantly after the training. Knowledge score improvement was more for healthcare providers and programme managers who had given the feedback of the 'training length was just correct', found complementary learning methods to be most relevant, and said that their training expectations were fully met. Similarly, districts that showed better improvement in the knowledge score provided better feedback.

Table 2 Difference in knowledge before and after training for each component regarding maternal and child health

Training component	Pretest correct response N (%)	Post-test correct response N (%)	McNemar's test statistic	P value
Child health				
Causes of neonatal death	276 (28.1)	608 (61.9)	191.54	<0.001
Vitamin K prophylaxis	337 (34.3)	356 (36.3)	0.65	0.418
Kangaroo mother care	536 (54.6)	668 (68.0)	32.62	<0.001
Feeding in low birth weight	68 (6.9)	763 (77.7)	666.16	<0.001
Use of injection gentamicin by ANM for management of sepsis	110 (11.2)	684 (69.7)	517.86	<0.001
Identification of signs of possible serious bacterial infection	584 (59.5)	682 (69.5)	21.00	<0.001
Identification of signs of severe dehydration	137 (13.9)	763 (77.7)	552.14	<0.001
Use of zinc in diarrhoea	159 (16.2)	670 (68.2)	407.04	<0.001
Diarrhoea management using ORS	393 (40.0)	771 (78.5)	284.25	<0.001
Identification of fast breathing	290 (29.5)	613 (62.4)	197.49	<0.001
Treatment of severe pneumonia	406 (41.3)	704 (71.7)	170.28	<0.001
Antenatal corticosteroids in preterm labour	528 (53.8)	655 (66.7)	34.29	<0.001
Maternal health				
Calcium supplementation in pregnancy	224 (22.8)	747 (76.1)	451.88	<0.001
Deworming during pregnancy	216 (22.0)	771 (78.5)	491.06	<0.001
Active management of third stage of labour	387 (39.4)	600 (61.1)	86.93	<0.001

ANM, auxiliary nurse midwife; ORS, Oral Rehydration Solution.

Significant improvement was observed in the knowledge for different components, namely, feeding of LBW babies, use of gentamicin, managing severe dehydration, zinc dosage, calcium supplementation and deworming during pregnancy. Studies in other countries have also reported similar findings. Nelson *et al* observed that knowledge scores of the frontline maternal, newborn and child health workers in South Sudan improved significantly after the training.[19] Khayati *et al* reported a significant improvement in knowledge regarding the management of children with cough and breathing difficulties among the community health workers trained in Indonesia.[20] Knowledge regarding KMC also improved significantly in our study. Batra observed similar findings, where in the post-test, the score improved to 100%.[21] In our study, knowledge related to vitamin K injection did not improve significantly. This is in dissonance with a previous study on vitamin K prophylaxis for newborns by Nahrel *et al* where a significant improvement in knowledge was seen after the training.[22] A couple of factors could have been affected the difference between the two studies. First, the study participants in their study were mostly nurses whose basic training course includes this topic, whereas our participants were a mixed group of healthcare providers and programme managers. The second reason could be the nature of training itself, whereas their training was specifically on skilled birth attendance, ours had a wider array of knowledge to be imparted. Logically, having multiple learning objectives will compromise with focused training. However, these do not fully explain this lack of improvement in knowledge related to vitamin K. This reveals a gap that needs to be considered in future training. The improvement in knowledges scores was also associated with older age but not with gender and designation. Age is expected to affect the scores because older individuals would have more experience and may be able to absorb the training content better. Lack of gender difference validates the enrolment and comparable performance of both genders as front-line healthcare providers and programme managers.

We analysed the improvement in the knowledge score with the feedback and found that a positive feedback was related to a higher increase in knowledge score. We could not find any study that evaluated a training programme based on the trainee's feedback. The relationship of good feedback with better knowledge score improvement could be due to varying levels of comprehension among the trainees. Healthcare providers and programme managers who could fully understand the content, found the training to be helpful and yielded better scores. This hints that the level of comprehension should be considered while clubbing different categories of workforce for the training.

This study was the first to evaluate a training programme provided to approximately 4000 healthcare providers and programme managers divided into 17 districts of Odisha.

Table 3 Difference in pretest and post-test score according to feedback received from participants

Characteristics	N (%)	Pretest knowledge score Mean (SD)	Post-test knowledge score Mean (SD)	Difference between pretest and post-test knowledge score * Mean (SD)	Adjusted mean difference†	P value
Training length sufficient to meet learning goals						
Just correct	470 (48.3)	4.03 (1.92)	11.12 (2.32)	7.08 (3.23)	7.06	<0.001
Too long	466 (47.9)	5.34 (1.69)	9.63 (1.67)	4.29 (1.79)	4.30	
Too short	37 (3.8)	5.81 (2.05)	7.57 (2.26)	1.76 (1.80)	1.85	
Teaching method						
Highly appropriate	500 (51.4)	4.20 (1.95)	10.91 (2.29)	6.71 (3.10)	6.70	<0.001
Majority of teaching methods were appropriate	438 (45.0)	5.26 (1.73)	9.69 (1.83)	4.43 (2.19)	4.44	
Teaching methods can be improved	35 (3.6)	5.57 (2.13)	8.34 (2.62)	2.77 (3.93)	2.81	
Complementary learning methods						
Most relevant	454 (46.7)	3.84 (1.49)	11.27 (1.97)	7.43 (2.36)	7.40	<0.001
Relevant	470 (48.3)	5.49 (1.95)	9.42 (2.03)	3.93 (2.46)	3.95	
Somewhat relevant	49 (5.0)	5.55 (1.97)	9.12 (2.34)	3.57 (3.28)	3.57	
How well the training meets your expectations						
Fully met my expectations	663 (68.1)	4.29 (1.88)	10.8 (2.19)	6.53 (3.00)	6.51	<0.001
Met some of my expectations	297 (30.5)	5.69 (1.71)	9.12 (1.80)	3.43 (1.75)	3.46	
Did not meet	13 (1.3)	4.85 (1.62)	8.46 (2.10)	3.62 (1.76)	3.74	
Overall	973 (100)	4.73 (1.94)	10.27 (2.22)	5.54 (3.03)		

*Difference of mean in three groups was calculated using analysis of variance test.
†Adjusted mean difference was calculated with difference in score as dependent variable and feedback as independent variable. Age, gender and designation were adjusted as covariates in analysis of covariance test.

Put together, the INAP and IAPPD programmes are intervention packages. A few of these interventions were either an introduction or were in the programme but without any national guidelines. We tried to cover clinical and managerial aspects of the programme in a short training programme, as some of the interventions were already part of programme delivery. The focus of training was primarily on improvement of knowledge. Effectiveness of a training programme can be judged in terms of knowledge enhancement (immediate and most proximal), skills improvement and improvement of health outcomes.

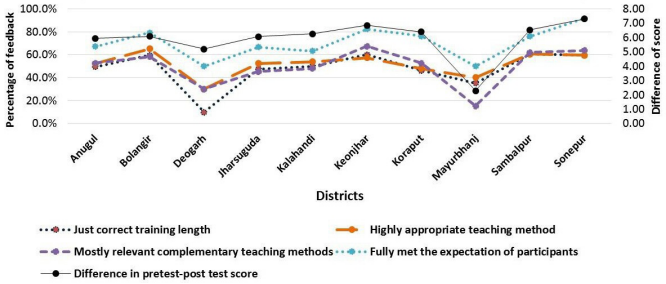

Figure 2 District wise observed difference in pretest and post-test score according to feedback received from participants.

An increase in knowledge is an essential component of quality improvement but is not sufficient. Previous studies related to maternal and child health in low and middle income countries suggest existence of deficiency in the knowledge among service providers and benefit of training/capacity building programmes in the overall quality improvement of programme implementation.[23–28] Since, a deficiency in knowledge and skills has also been documented as an important barrier in delivering quality maternal and child healthcare services, these kinds of trainings should be well planned and assessed.[22–24 29–31] It will be challenging to infer about the effectiveness of training programmes without assessment and obtaining data during the training for quality improvement.

Our study had some limitations. One of the limitations of the present study was that complete data were available for only 25% of healthcare providers and programme managers. Many of them came late for the session or left early and could not fill both the pretest and post-test questionnaires resulting in their exclusion from the analysis. However, we compared the nature of job, age and gender profile of healthcare providers and programme managers who had not returned the training evaluation and feedback assessment forms with those who had

returned the forms and found that both the groups had a similar profile. Another limitation was that we did not collect information on years of experience and details of the previous training, which could have provided more information on reasons for score differences and factors to be considered during such training. We also could not explore the role of customer satisfaction though self-audit (which in this case are caregivers of children and pregnant women) or any other measure in assessing the impact of our training. Beneficiaries or customers are the most important stakeholders for any quality improvement programme and play an important role in the success of any quality improvement programme.[29–31] Additionally, we could not measure the long-term impact of training programmes in service delivery. Our study is limited to the analysis of immediate post-training feedback and not long-term outcomes.

CONCLUSION AND RECOMMENDATIONS

This training programme conducted for 127 batches of 17 districts was highly effective in improving the knowledge of healthcare providers and programme managers. We also found that improvement in knowledge was associated with the positive feedback about the perceived quality of training. Short and structured training programmes are useful tools for improving knowledge among healthcare providers and bridge the knowledge gap. Systematic pretest and post-test assessment coupled with feedback can ensure the effectiveness of the training programme. Strategies should be adopted to systematically evaluate training programmes conducted in programmatic settings and districts should evaluate their routine training programmes in a scientific manner on a routine basis.

Author affiliations
[1]Department of Community Medicine & Family Medicine, All India Institute of Medical Sciences Bhubaneswar, Bhubaneswar, Orissa, India
[2]All India Institute of Medical Sciences, Bibinagar, Hyderabad, Telangana, India
[3]Department of Community Medicine and Family Medicine, All India Institute of Medical Sciences, Bibinagar, Hyderabad, Telangana, India

Acknowledgements We acknowledge all the trainers and healthcare providers and programme managers involved in the study. We also acknowledge support of Department of Health and Family Welfare, Government of Odisha, Consultants and specialist of UNICEF field office, Odisha. District health officials of 17 districts where the training/programme was conducted. English editing of the manuscript was done by American Journal Experts (AJE).

Contributors VB, AKS and PPG conceived and designed the study. AKS, PPG and DPS acquired and analysed the data and prepared the initial manuscript. VB, AKS, PPG and DPS revised the draft critically. All authors have read and approved the final manuscript. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding This training was supported by UNICEF grant number BHU/901/003/006/2016/950 dated 27 October 2016.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval The Institutional Ethics Committee of All India Institute of Medical Sciences, Bhubaneswar (Reference number: T/EMF/CMFM/16/13) approved the study. We did not elicit written consent from healthcare providers and programme managers, as it was part of the training programme provided as part of routine health programme implementation. We had permission from the Government of Odisha to conduct the training programme. All trainees were employees of the Government of Odisha.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

ORCID iD
Arvind Kumar Singh http://orcid.org/0000-0001-7063-7435

REFERENCES

1 Office of the Registrar General and Census Commissioner of India Sample registration system. Statistical report, 2018. Available: https://censusindia.gov.in/Vital_Statistics/SRS_Report_2018/SRS_Statistical_Report_2018.pdf [Accessed 11 May 2021].
2 Office of Registrar General. *Special Bulletin on maternal mortality in India 2016-2018*. New Delhi, India: Office of Registrar General, 2020. https://censusindia.gov.in/vital_statistics/SRS_Bulletins/MMR%20Bulletin%202016-18.pdf
3 World Health Organization (WHO). Millennium Development Goals (MDG) 4: Reduce child mortality [Internet]. Who.int, 2015. Available: https://www.who.int/topics/millennium_development_goals/child_mortality/en/ [Accessed 11 May 2021].
4 World Health Organization (WHO). Millennium Development Goals (MDG) 5: Improve maternal health [Internet]. Who.int, 2015. Available: https://www.who.int/topics/millennium_development_goals/maternal_health/en/ [Accessed 11 May 2021].
5 World Health Organization (WHO). *Reaching the every newborn national 2020 milestones: country progress, plans and moving forward*. Geneva: WHO, 2017. https://apps.who.int/iris/bitstream/handle/10665/255719/9789241512619-eng.pdf
6 WHO/UNICEF. *Ending preventable child deaths from pneumonia and diarrhoea by 2025: the integrated global action plan for pneumonia and diarrhoea*. Geneva: WHO, 2013. https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf
7 Government of India. *India newborn action plan*. New Delhi: Ministry of Health and Family Welfare, 2014. http://www.newbornwhocc.org/INAP_Final.pdf
8 Sankar MJ, Neogi SB, Sharma J, *et al*. State of newborn health in India. *J Perinatol* 2016;36:S3–8.
9 Ministry of Health and Family Welfare. National guidelines for calcium supplementation during pregnancy and lactation. government of India, new Delhi, India, 2014. Available: http://nhsrcindia.org/sites/default/files/Guidelines for Calcium Supplementation during Pregnancy and Lactation.pdf [Accessed 11 May 2021].
10 Ministry of Health and Family Welfare. National guidelines for Deworming in pregnancy. government of India, new Delhi, India, 2014. Available: http://nhsrcindia.org/sites/default/files/Guidelines for Deworming in Pregnancy.pdf [Accessed 11 May 2021].

11 Ministry of Health and Family Welfare. National Guidelines for Diagnosis & Management of Gestational Diabetes Mellitus, 2014. Available: http://nhsrcindia.org/sites/default/files/Guidelines for Diagnosis Management of Gestational Diabetes Mellitus.pdf [Accessed 11 May 2021].
12 Ministry of Health and Family Welfare,, Government of India. National guidelines for screening of hypothyroidism during pregnancy, 2014. Available: https://nhm.gov.in/images/pdf/programmes/maternal- health/guidelines/National_Guidelines_for_Screening_of_Hypothyroidism_during_Pregnancy.pdf [Accessed 11 May 2021].
13 Ministry of Health and Family Welfare,, Government of India. Screening for syphillis during pregnancy, 2014. Available: http://nhsrcindia.org/sites/default/files/Guidelines for Syphilis Screening during Pregnancy.pdf [Accessed 11 May 2021].
14 Ministry of Health and Family Welfare,, Government of India. Engaging general surgeons for performing caesarean sections and managing obstetric complications, 2014. Available: http://nhm.gov.in/images/pdf/programmes/maternal-health/guidelines/C-section_document_Low_Res_5th_Jan.pdf [Accessed 11 May 2021].
15 van den Broek NR, Graham WJ. Quality of care for maternal and newborn health: the neglected agenda. *BJOG* 2009;116 Suppl 1:18–21.
16 Malhotra S, Zodpey SP, Vidyasagaran AL, *et al*. Assessment of essential newborn care services in secondary-level facilities from two districts of India. *J Health Popul Nutr* 2014;32:130–41.
17 Ariff S, Soofi SB, Sadiq K, *et al*. Evaluation of health workforce competence in maternal and neonatal issues in public health sector of Pakistan: an assessment of their training needs. *BMC Health Serv Res* 2010;10:319.
18 Monebenimp F, Tenefopa M, Mve Koh V, *et al*. Competence of health care providers on care of newborns at birth in a level-1 health facility in Yaoundé, Cameroon. *Pan Afr Med J* 2012;11:45.
19 Nelson BD, Ahn R, Fehling M, *et al*. Evaluation of a novel training package among frontline maternal, newborn, and child health workers in South Sudan. *Int J Gynaecol Obstet* 2012;119:130–5.
20 Khayati FN, Haryanti F, Laksnawati IS. The impact of training on the management of children with cough of the health workers' knowledge, attitude and skills in the management of children with cough and breathing difficulties. *Int J Res Med Sci* 2015;3:47–52.
21 Batra K M. Effectiveness of structured teaching protocol on knowledge related to kangaroo mother care among staff nurses. *Nurs Midwifery Res J* 2014;10:100–5.
22 Nahrel R, Thakur H, Armo M. To assess the knowledge and skill, about antenatal and intrantal care among paramedical workers posted in health center of tribal area of Chhattisgarh. *Innov J Med Heal Sci* 2015;5:162–5.
23 Dillip A, Kimatta S, Embrey M, *et al*. Can formalizing links among community health workers, accredited drug dispensing outlet dispensers, and health facility staff increase their collaboration to improve prompt access to maternal and child care? A qualitative study in Tanzania. *BMC Health Serv Res* 2017;17:416.
24 Lawry L, Canteli C, Rabenzanahary T, *et al*. A mixed methods assessment of barriers to maternal, newborn and child health in gogrial West, South Sudan. *Reprod Health* 2017;14:12.
25 Ameh CA, Kerr R, Madaj B, *et al*. Knowledge and skills of healthcare providers in sub-Saharan Africa and Asia before and after competency-based training in emergency obstetric and early newborn care. *PLoS One* 2016;11:e0167270.
26 Thukral A, Lockyer J, Bucher SL, *et al*. Evaluation of an educational program for essential newborn care in resource-limited settings: essential care for every baby. *BMC Pediatr* 2015;15:71.
27 Okereke E, Tukur J, Aminu A, *et al*. An innovation for improving maternal, newborn and child health (MNCH) service delivery in Jigawa state, Northern Nigeria: a qualitative study of stakeholders' perceptions about clinical mentoring. *BMC Health Serv Res* 2015;15:64.
28 Willcox M, Harrison H, Asiedu A, *et al*. Incremental cost and cost-effectiveness of low-dose, high-frequency training in basic emergency obstetric and newborn care as compared to status quo: part of a cluster-randomized training intervention evaluation in Ghana. *Global Health* 2017;13:88.
29 Berwick DM, James B, Coye MJ. Connections between quality measurement and improvement. *Med Care* 2003;41:I–30.
30 Gholipour K, Tabrizi JS, Asghari Jafarabadi M, *et al*. Effects of customer self-audit on the quality of maternity care in Tabriz: a cluster-randomized controlled trial. *PLoS One* 2018;13:e0203255.
31 Gholipour K, Tabrizi JS, Asghari-Jafarabadi M, *et al*. Customer's self-audit to improve the technical quality of maternity care in Tabriz: a community trial. *East Mediterr Health J* 2016;22:309–17.