Multimodal Training Tool for Premature Care

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Abstract

Background The largest proportion (amongst total newborns requiring inpatient care) is constituted by healthcare needs of small and sick neonates. This has to be delivered by a team of skilled and competent healthcare professionals. Very few comprehensive packages exist for management of premature and sick newborns. WHO-CC, AIIMS with the help of nearly thirty-five leaders in neonatology and nursing champions caring for preterm infants developed a multimodal educational package with philosophy of “Do No Harm”

Methods The creation of the educational package included formative research for assessing health facility readiness, defining content deliverables and their layout. The modules thus developed were then field tested and validated. Each of the ten modules was then organized as pre-defined learning objectives, deliverables including text, videos, webinars, posters and job aids. The entire content is available as self-directed web based E-learning platform (www.pretermcare-eliminatingrop.com) designed to make users aware of the best care practices for preterm infants.

Results The inputs from the field testing workshop on content, interaction and teaching learning methodology were incorporated in the educational package. The participants felt that the content was explicit and clearly defined and the workshop facilitated free interaction. The online platform has 2500 registered participants registered till date. Nearly 80% of the participants felt that quality of information presented, organization of content and the degree to which the examples related to real scenarios was excellent to exceptional.

Discussion The learners are actively involved in the learning process and teachers are actually facilitators rather than ‘fact generators.’ The package focuses on the transformative learning strategies and the impact is likely to be revolutionary once it is taken to scale. In addition, the online web based learning platform along with its multimedia contents can be easily used for distance learning following which the participant can come for skill learning.

Background

Globally, 30 million newborn infants require some level of inpatient care each year. Of this, the largest proportion is constituted by healthcare needs of small and sick neonates which has to be delivered by a team of skilled and competent healthcare professionals. One in three of these small and sick neonates require *intensive inpatient care*, which can be provided only in a district or tertiary-level facility [1]. This care must be available 24 hours a day, 7 days a week. In addition, of the annual load of 1.7 million neonatal deaths; nearly half lives (~ 747,400 lives per year) can be saved by scaling-up a comprehensive set of facility-based interventions providing specific interventions for small and sick neonates [2, 3].

However, these proven interventions are not widely used in many LMICs and the main reasons there off include lack of resources and limited capacity (knowledge and skills) of health care workers. [4, 5]. While functional health systems are important to an extent, strategies aimed at improving the uptake of

evidence-based practices by improving the workforce's capacity to deliver them in a competent manner are essential. Various strategies to improve the quality of care include checklists [6–8], optimizing processes by testing iterative changes [9–12] and finally immersing participants in 'real-world' context training (simulation). Thus, investing in the front-line health care workers education and skill building is a crucial step to build confidence when they look after these preterm infants.

India has the single largest share (nearly 30%) of neonatal deaths in the world [13] and two-thirds of these deaths can be averted if evidence-based interventions are effectively implemented [13]. Facility-based care of newborns has a significant potential for improving the survival of newborns and neonatal mortality can be reduced by 23–50% in different settings if it is implemented effectively [14]. India has set up Special Care Newborn Units (SCNUs) to provide quality level II newborn-care services in several district hospitals with increasing institutional births. Currently there are more than 700 SNCUs, many of them in medical colleges. With this mushrooming of SNCUs, front-line health care professionals need to be updated via continuing education and skill competency based learning in small groups for best practices. Skills learning must be embedded with quality improvement training (SQIT) for professionals to give maximum dividends for improving performance [15] and the need of comprehensive preterm package that focuses on effective, timely and safe inpatient newborn care using the guiding principle of “Do No Harm” is exigent.

Globally, very few comprehensive packages exist for management of premature and sick newborns incorporating strategies aimed at improving the uptake of evidence based practices like thermal management, safe oxygen use, human milk feeding, infection prevention, and the prevention and screening of retinopathy of prematurity etc. The Perinatal Continuing Education Program (PCEP) from AAP is a comprehensive, self-paced education program in four volumes which includes step-by-step skill instruction, and practice-focused exercises on maternal and fetal issues but is not widely available [16] WHO gives evidence based recommendations for interventions during pregnancy, labour and during the newborn period that are aimed at improving outcomes for preterm infants and there are operative guidelines for facility based newborn care, but focus of both these guidelines is didactic learning and no separate skill training or assessment is included as a part of the package [17, 18].

With the pressing need, World Health Organization Collaborating Centre (WHO-CC) for Training and Research in Newborn Care, All India Institute of Medical Sciences (AIIMS), New Delhi along with Post Graduate Institute of Medical Education Research, Chandigarh and Government Medical College and Hospital, Chandigarh with the help of nearly thirty-five leaders in neonatology and nursing champions caring for preterm infants developed multimodal educational package with funding support from Queen Elizabeth Diamond Jubilee Trust (QEDJT) and administrative support through Public Health Foundation of India (PHFI).

Methods

This package uses latest pedagogy of blended learning and has ten modules. The learning module uses participatory learning methodology and involves self-reading, poster demonstration, role play, videos and webinars followed by knowledge self-evaluation by multiple choice questions (MCQs). The skills are evaluated by objective structured clinical examination (OSCE). Competency-based learning is administered in small groups using low cost innovative models (simulation methodology) for building team approach, improving communication and performance and thus enhancing psychomotor skills.

The creation of the educational package included formative research for assessing health facility readiness, defining content deliverables and their layout. The modules thus developed were then field tested and validated. Each module (of a total of ten modules) was then organized as pre-defined learning objectives, deliverables including text, videos, webinars, posters and job aids. A separate facilitator guide for the modules was also simultaneously developed which in addition elaborated on the teaching methodology.

The overall model of the workshop was based on “train-the-trainer” to build the capacity of peer education trainers to deliver the same learning to their peer group once they return to the parent unit. The specific objectives included enabling participants to understand the basic concepts through participatory teaching learning methodology and clarify basic concepts in each specific module through group discussions and learn through skills- and simulation based education. The study was approved by the institute ethics committee.

Creation of content (figure 1)

Formative research (Fig. 1a)

Formative research was undertaken to assess readiness of health facilities (special newborn care units) for implementation of quality improvement program. Evaluation was done to note the strengths and weaknesses in healthcare processes in these facilities. Health system readiness was assessed in terms of facility infrastructure and healthcare practices. Knowledge, attitudes, practices and skills of healthcare providers, state-level child health coordinators, health administrators and parents of preterm neonates were assessed in five major domains i.e. good control of oxygen therapy, improving nutritional status, exposure to blood products, less systemic infections and good developmental support. These domains were chosen so because these are the basic pillars for optimum quality of care of preterm infants. Study tools included focus-group discussions, in-depth interviews, multiple-choice questions, objective structured clinical examinations and direct observation of care. The results of this research have been detailed elsewhere (under publication).

Deliverables and layout of content

The participants expressed specific needs for their training material. This included requirement of easily downloadable small videos which could run on their personal smart-phones. They also expressed desire for concise reading material and summarization of the content as key messages at the end of videos and webinars.

Content outline workshop (Fig. 1a)

Having identified the need, and the deliverables, the next step was to identify the content outline and learning objectives. The content developers' team included thirty-five doctors and nursing professionals who had been actively involved in training and facilitating the functional newborn care units for more than 10 years. A total of 10 groups with each group (three to four members) assigned a specific module topic were formed (panel 1).

All team members participated in a '*sticky note exercise*' in which each member was given four to five sticky notes and was expected to put up at-least one learning objective in a module and its possible deliverables, based on domains identified in formative research. The basic idea of using this exercise was two-fold; first, penning down one's thoughts separately and later sharing the ideas in the group thus increasing ownership. Second, getting them to move around and share their group sticky notes displayed on the boards with other groups thus enhancing engagement and interaction within groups. This interaction helped the members identify challenges faced by front line workers thus identifying misconceptions and improving understanding.

Module development

Having finalized the outline and the nature of deliverables, the teams developed the content on the evidence based interventions based on existing WHO guidelines wherever available. The development of each module underwent four phases (Fig. 1b). In the first phase (content development phase), each team (three team members including a nursing officer) developed separate power-point presentation for webinars, scripts for videos and webinars, text material (for print and display) and formative assessment plan for the respective modules. In the second phase this content was reviewed by experts (with respect to relevance, evidence and deliverables). The third phase included face-to-face discussions on potential technical and editorial changes required (external review phase). This lasted for an average three days for each module and six such sessions were held over duration of one year. The team members developed webinars and videos with help of professionals and technical expertise team working simultaneously. The fourth phase included a repeat face to face review meeting of all teams and all reviewers wherein the reviewers gave inputs on the prepared modules and suggested modifications if any (April 2017). The modules thus developed as a part of the current preterm baby package have been listed in Panel 1.

Panel 1: Modules in the "preterm baby package"

1. Thermoregulation
2. Kangaroo mother care
3. Optimal oxygen administration
4. Less systemic infections
5. Optimal use of continuous positive airway pressure (CPAP),
6. Developmental supportive care and pain management
7. Good nutrition
8. Less use of blood products
9. Delivery room care and stabilization of a preterm infant
10. Follow up care pertaining to retinopathy of prematurity (ROP)

Field testing and validation

The reviewed materials were then field tested on 34 front line users (both doctors and nurses) in a two day face to face workshop where all the draft materials were shared (May 2017). The users were given specific user name and password a priori (two weeks before face to face meeting) to enable them to see videos, webinars and other course material online before coming for workshop. The users appreciated the content, its flow and its organization. The nursing officers expressed desire of conversion of content into local language. Their feedback on content and timeline was noted and incorporated.

Module structure and methodology of training

Each module was then organized into pre-defined learning objectives. The contents were serially numbered and included webinars, videos, script, key messages, posters and job aids. Each learning objective in module had a self-assessment through multiple choice questions. The modules delivered knowledge content and were followed by later development of skills. This enabled the reader to orient to the overall structure of the educational package before the skill sessions. All the modules are available at <https://www.newbornwhocc.org/Facility-Based-Care-of-Preterm-Infant.html>.

The printed version of the modules was packaged into two volumes with separate learner's and facilitator modules; the facilitator module listing learning methodology with key tips for facilitator in addition to the course content and the learner's module displaying content in a sequential manner.

Web based platform

The entire content was then converted into a self-directed web based E-learning platform (www.pretermcare-eliminatingrop.com) designed to make users aware of the best care practices for preterm infants. The user can start off with any module and do them in any sequence; however within a module each learning objective has to be completed in a systematic sequence. There is a timed self-assessment multiple choice questionnaire at the end of each objective in a module and the user can go to the next objective if a minimum pass score is obtained in the given objective. The user has three attempts to pass each objective in a module. The online platform has an inbuilt system for scoring this self-assessment, and automatically generating completion certificates and keeping central records for completion.

Certain issues had to be kept in mind while designing the platform, which would also be relevant while building similar medical e-learning platforms, especially when the main intended audience is Indian users. The design of the website is intended to be minimalistic and easily navigable, to make the process easier for users who do not have as much experience with technology. User data security is of the utmost importance, so usernames, passwords, emails etc. were, and should be, stored in a way that is secure against data theft. It was also ensured that users could not trick the assessment system. The website was optimized for use with a weak internet connection, and materials were made available for offline download, so that users without a constant internet connection would not face issues. An FAQ section was also included to acquaint new users with the interface. A big advantage of a web-based approach is that these changes can be implemented swiftly, in tune with the user's demands.

Workshop format

The skill learning and simulation components of the 'preterm baby package' are delivered in workshop format (by participatory learning methodology). The workshop mandates attendance as team of a doctor and a nursing officer. The learner (after completing the respective module online) comes for session on skill learning and simulation. The online link is shared with prospective participant at least two weeks before the training.

A typical three day workshop involves first day dedicated to quality improvement training using POCQI methodology (www.pocqi.org) wherein the participants learn the basic principles of quality improvement through group discussions and group exercises and formulate their own quality improvement projects followed by hands on training on the two specified modules over the next two days.

Each learner gets the learner's module printed version on second day and completes the modules in the respective workbook while being facilitated simultaneously by table facilitators in group work. The idea is for them to open up and share each other's experiences and practices in the respective units during group work, and highlight key messages from the learning objectives. The facilitator uses the same interaction as a learning opportunity to emphasize key points.

Though the expected time may vary depending on the number of modules entailed to be discussed in each workshop, a typical three day workshop would cover two modules in addition to quality improvement followed by an entire day dedicated to skill learning and simulation followed by assessment of skills of each individual participant on the same day.

Dissemination workshops (December 2017, December 2018, January 2019, May 2019, September 2019, December 2019)

AIIMS WHO-CC organized six dissemination workshops at New Delhi where in participants from medical colleges and adjoining special newborn care units, nursing faculty and in-house nurses from the same units were empowered with these tools and their local problems were addressed through a quality improvement approach.

Online survey for feedback of the web -platform

An online feedback was taken from users through a Google form with links sent to their mails on their overall satisfaction with the course, their perceived proficiency, quality and pace of training materials, their readability and time dedicated to the assessment methodology. In addition, the design and ease of navigation of the platform was also noted, and users were asked to compare their experience with the platform to a traditional paper-based approach. Open feedback was also noted.

Results

Field testing workshop (May 2017)

The field testing workshop included 34 participants (20 doctors and 14 nurses) and feedback was collected on content, interaction and teaching learning methodology. The feedback on the educational package is summarized in Table 1. The participants felt that the content was explicit and clearly defined and the workshop methodology facilitated free interaction of participants and facilitators.

Table 1
Field testing feedback on educational package (n = 34)

Content is explicit and clearly defined	5 (4–5)
There was free student to facilitator interaction	5 (4–5)
The teaching methodology is interactive	4 (4–5)
All your doubts in a particular session were cleared	4 (4–5)
Training is useful for your professional activities	5 (4–5)
You shall be able to implement the knowledge learnt in your clinical domain	5 (4–5)
You shall be able to implement the skill/s learnt in your clinical domain	5 (4–5)
You achieved overall satisfaction fro the course modules	4 (4–5)
Do you feel that the material is time consuming and exhaustive?	1 (1–2)
After undergoing the which module/s do you feel confident to manage a baby with the respective clinical condition	28 (82.3%)
1. Thermoregulation	
2. Optimal oxygen administration	24 (70.5%)
3. Kangaroo mother care	29 (85.2%)
4. Feeding of the low birth weight infant	29 (85.2%)
Likert Scale where 1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: Agree, 5: strongly agree.	

Dissemination workshops

The participating medical colleges in the six dissemination workshops done by coordinating center are depicted in Fig. 2. The faculties trained in the workshops organized similar workshops in their respective states. The entire package is envisioned to be administered by state medical colleges to the SNCUs under their supervision via 'hub and spoke' model.

Online platform (www.pretermcare-eliminatingrop.com)

The platform has nearly 2500 participants registered till date. The feedback is outlined in Table 2. A total of 188 participants responded. Of these, 136 (72.3%) participants completed one module in 60 minutes (Fig. 3). When asked to rate their proficiency in the content area after attempting the course, 172 (95.6%) participants expressed as being proficient or expert (Fig. 4). Nearly 80% of the participants felt that quality of information presented, organization of content and the degree to which the examples related to real

scenarios was excellent to exceptional. The participants were comfortable with platform navigation both through the content and through the assessment questions. They felt that their learning experience improved to a significant extent and that they shall be able to implement the knowledge gained and skills learnt in their private practice (Fig. 5–7).

1.	Modules completed median (range)	4 (3-8)
2.	Average time spent on each module (up to 60 minutes)	136 (72.3%)
3.	Overall, how satisfied were you with this course? (1 – Very dissatisfied, 5 – Very satisfied)	5 (4-5)
4.	Please rate your proficiency in the content area before attempting the course	
	· 1 – Beginner (Novice)	14
	· 2- Advanced beginner	25
	· 3- Competent	85
	· 4- Proficient	41
	· 5 - Expert	23
5.	Please rate your proficiency in the content area after attempting the course. (Beginner to Expert: 1 to 5)	
	· 1 – Beginner (Novice)	2
	· 2- Advanced beginner	2
	· 3- Competent	12
	· 4- Proficient	96
	· 5 - Expert	76
6.	How would you rate the course on the following dimensions?*	
	(1- Very poor, 2- poor, 3 fair, 4 excellent, 5- exceptional)	147 (78.2%)
	· Quality of the information presented	
	· Organization of the modules and learning objectives	150 (79.8%)
	· Degree to which the examples provided reflected real-world scenarios	151 (80.3%)
7.	How would you rate the scripts and learning aids on the following dimensions?*	
	1. Range of information covered	132 (70.2%)
	2. Clarity of content	147 (78.2%)
	3. Presentation of content	150 (79.8%)
8.	How would you rate the videos and webinars on the following dimensions? *	

	· Overall quality	150 (79.8%)
	· Clarity of speaker	142 (75.5%)
	· Pace of videos (140)	140 (74.5%)
	· Readability of video content (150)	150 (79.8%)
9.	How would you rate the assessments on the following dimensions?*	
	· Clarity of questions	138 (73.4%)
	· Appropriate difficulty of questions	125 (66.4%)
	· Degree to which the assessments measured appropriate knowledge and skills	131 (69.6%)
	· Degree to which the assessments reinforced concepts covered in the course	136 (72.3%)
10.	How would you rate the online platform on the following dimensions?*	
	· Ease of navigation on the homepage and through the modules	142 (75.5%)
	· Ease of navigation through the content (scripts, webinars, videos, MCQs) within each learning objective	140 (74.4%)
	· Ease of navigation of the MCQ test grading system	139 (73.9%)
	· Auto-certificate generation system	147 (78%)
	· Availability of technical support	128 (68%)
	· Overall design and visual appeal	150 (79.7%)
11.	To what extent has the presentation of the content on an online, interactive learning platform changed your experience? (Worsened your learning experience (1) to improved your learning experience to a great extent) (5)	5 (4-5)
12.	To what extent has your confidence with the course material improved as a result of taking this course? (Not at all (1) to a great extent (5))	5 (4-5)
13.	How likely is it that you will be able to implement the knowledge that you learned? (extremely unlikely (1) to extremely likely (5))	5 (4-5)
14.	How likely is it that you will be able to implement the skills that you learned? (extremely unlikely (1) to extremely likely (5))	5 (4-5)

15.	Based on your experience, how likely are you to recommend the course to other people? (extremely unlikely (1) to extremely likely (5))	5 (4-5)
*N (%) rated as excellent or exceptional by participants		

Table 2

Feedback of the online platform (www.pretermcare-eliminatingrop)

Panel 2 A lists the excerpts from the developer (a Grade 11 student) of this online platform and also verbatim remarks from the faculty of two medical colleges (Panel 2B) who did the training workshops at their respective medical colleges.

Panel 2: Excerpts from the developer of platform and users of the educational package

<p>Panel 2 A</p> <p>Excerpt from the developer of the platform</p> <p>Developing this platform was a great learning experience and working at such a large scale really helped improve my skills as a programmer, and taught me how I could use computer science to make a tangible impact. I would love to continue work while in college, so please feel free to contact me about anything related to the site or other projects!</p>
<p>Panel 2 B:</p> <p>Medical college faculty “Nurses and residents are very aware that KMC is medication and treatment and not to be done just casually. Nurses maintain records of hours of skin-to-skin and feeding in each shift. The sister-in-charge of every shift begins the duty by asking how many hours of skin-to-skin and how much of mothers’ milk is provided.” Thank you team for envisioning the amalgamation of quality improvement and skill learning.</p>

Discussion

There is a worldwide call for investing in quality in-patient neonatal care and designating facilities for specialized and intensive newborn care. In addition, simultaneous investments are also required to ensure adequate and appropriate trained human resources, supplies, and data-systems for well-functioning neonatal care.

Truly saying, attainment of defined competencies and evaluation of health care professionals, and not time or academia should define education. In addition, health care needs teamwork, and this is no longer a desire but a necessity, the importance of which cannot be undermined due to transformation of health systems.

The “preterm baby package” is a comprehensive educational package where learners are actively involved in the learning process and teachers are actually facilitators rather than ‘fact generators’. The facilitators connect to the learner’s experience base and the package is focused how the facilitators help them learn what is most useful from their aspect rather than simply trying to increase their knowledge base.

The package encompasses four broad spheres; first being knowledge domain which encompasses what is useful to the learner; second the teaching learning methodology in workshop which involves group discussions, webinar and video discussions, experience sharing and interaction (thus mobilizing all potential learning channels) rather than didactic teaching and imperative participation only as a team and not as an individual; third incorporation of QI learning on day 1 and helping teams prepare their context specific projects and fourth incorporation of skill and simulation learning as a part of the workshop training. Further, the feedback from the front line users (both in field testing and users of online platform) provides a broad framework to program managers and policymakers on the importance of incorporating quality improvement and immersion in skills and simulation environment for fruitful learning experience. Although the concept appears simplistic, this education methodology requires ongoing facilitator involvement.

The role of facilitator as a mentor and guide rather than a teacher is the key to delivery of the module. In addition, the facilitator's role is not a one-time interaction, it is indeed ongoing. This initiates with the workshop module delivery and goes on to skill learning and simulation and thereafter ongoing facilitation for the quality improvement project and establishing local leadership in a particular unit for ongoing skill and simulation case runs. The facilitator is able to create a team and disseminate package at the local health facility while simultaneously embracing quality improvement.

The package focuses on the transformative learning strategies and the impact is likely to be revolutionary once it is taken to scale. In addition, the online web based learning platform along with its multimedia contents can be easily used for distance learning following which the participant can come for skill learning.

The workshops achieved many successes. We trained nearly 200 learners, which translates into 100 teams from different SNCUs. The overall feedback on the workshop methodology has been promising and the participants felt empowered to utilize the knowledge and psychomotor skills for their own units.

The challenge now is twofold, first to ensure that quality improvement and learning material reach all health workers working in special newborn care units and second to update the content given the changes in ongoing evidence. Additionally, to achieve an impact at the population level, the package needs to be incorporated into comprehensive pre and in-service education, the linkage with quality improvement needs to be ongoing.

Conclusion

The current package focuses on the transformative learning strategies. The online web based learning platform along with its multimedia contents can be easily used for distance learning following which the participant can come for skill learning.

Abbreviations

WHO-CC: World Health Organization

AIIMS: All India Institute of Medical Sciences, New Delhi

PGIMER: Postgraduate institute of Medical Education and Research, Chandigarh

GMCH: Government Medical College and Hospital, Chandigarh

QEDJT: Queen Elizabeth Diamond Jubilee Trust

PHFI: Public Health Foundation of India

SNCU: Special newborn care unit

NHM, MP: National health mission, Madhya Pradesh

PCEP: Perinatal Continuing Education Program

MCQs: Multiple choice questions

OSCE: Observed Structured Clinical Examination

Declarations

Ethics approval and consent to participate

Informed written consent was taken from participants; Ethical approval by AIIMS Institute ethics Committee reference Number: IEC/NP-314/ 07.08.2015, RP-06/2015

Consent for publication

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this submitted article

Competing interests:

The authors declare that they have no competing interests

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Authors' contributions

- AT and DC had the primary responsibility for protocol development, and related data management and prepared the first draft of the manuscript and did data analysis
- AT, DC, PK, AKD helped in study implementation
- VG prepared the online platform for e-learning for the preterm package, prepared the online feedback proforma helped in its data analysis
- AKD and PK participated in development of the protocol, supervised implementation of the study and provided critical inputs in manuscript writing.
- AKD would act as guarantor of the study.

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Figures

1 (a)

1b

Figure 1

(a) Phase of formative research and outline and 1 (b) content development

Figure 2

Participating medical colleges and other institutions in the dissemination workshops

Figure 3

Time taken by participants to complete one module

Figure 4

Change in user experience due to presentation of content on an online platform

Figure 5

User's increase in confidence with course material after the course

Figure 6

User's ability to implement the knowledge learnt during the course

Figure 7

User's ability to implement the practical skills learnt during the course