Neonatal Skill Labs– Enhancing Resident's Neonatal Resuscitation Competency by Simulation Based Training

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ABSTRACT

Introduction: Every pediatric resident encounters unanticipated high risk deliveries where the neonate requires extensive resuscitative measures and for which most have had no formal training. Neonatal skill labs provide the needed platform to train residents using simulation. Study objectives were to know if neonatal skill labs improve resident's knowledge and skills by simulation based training

Material and methods: An Interventional study was conducted on eight pediatric residents. Training in knowledge and in skills for performing neonatal resuscitation using an integrated skill station was done.

Results: Statistically significant pre to post gains for questionnaire assessment were observed for lessons one to four and six of the Neonatal Resuscitation Program ($p<0.05$). The pre post gain in skill score on 21 checkpoints of the integrated skill station was also significant ($p< 0.05$). The gain in confidence was significant being $p<0.05$ ($p=0.002$). Mean scores for both test case scenarios for training evaluation showed that most residents performed above average in both cases indicating their ability to correctly apply learnt skills.

Conclusion: Neonatal skill labs provide the residents confidence in a protected environment for practicing clinical skills prior to their real life application.

Keywords: Neonatal Resuscitation, Skill Labs

INTRODUCTION

The Neonatal Resuscitation Program based on the Neonatal Education Program (NEP) developed by Dr. Ron Bloom and Cathy has gained worldwide recognition in providing structured algorithms and guidelines for instructors and providers of neonatal life support.[1] The implementation of this program using skill labs to train new neonatal resuscitation providers allows development of skills using simulation. It allows room for mistakes and a chance to correct and learn from them in a controlled environment under the supervision and without compromising the patient's safety.

Skill labs refer to equipped practice rooms used as training facilities to offer medical students a safe environment to practice clinical skills before their real-life application.[2] These labs thus bridge the gap between the classroom and the clinical setting, decreasing the student's anxiety while performing procedures on actual patients.

Such a system is required as approximately 10% of newborns require some assistance to begin breathing at birth and less than 1% require extensive resuscitation measures.[3] The integration of these labs with the neonatal resuscitation training provides readiness for neonatal resuscitation by putting in place a system to assemble the appropriate personnel based on perinatal risk, ensuring immediate access to supplies and equipment, and standardization of behavioral skills that help ensure effective teamwork and communication. Birth asphyxia contributes to about 23% of neonatal deaths. In India, there are one million neonatal deaths every year and with the impact of birth asphyxia on childhood mortality being substantial it is the need of the hour to undertake measures to improve the practices involved in neonatal resuscitation.[4]

Our study thus aimed to find if the use of the skill lab model is better for imparting this crucial life-saving skill.

MATERIAL AND METHODS

This interventional study approved by the institutional ethics committee was conducted in January 2019 in the Department of Pediatrics at Rohilkhand Medical College and Hospital Bareilly. The study duration was two weeks and all the first and second year junior residents in the Department of Pediatrics were included in the study.

The aim of the study was to know if neonatal skill labs lead to an improvement in the resident's knowledge, skills and self-confidence in performing basic neonatal resuscitation post training. The materials used were: i) A pre- and post-training questionnaire for knowledge assessment and the questions were taken from review lessons 1-4 and lesson 6 mentioned in the Textbook on Neonatal Resuscitation 7th Edition[5], ii) An Integrated Skill station designed for skill assessment pre and post training and iii) A five point Likert's scale for confidence gain assessment.

To undertake this study, a skill lab was set near the neonatal intensive care unit (NICU).Each resident undergoing the 2 weeks training had to undertake a test on their prior knowledge on Neonatal resuscitation followed by a week long didactic lectures on lessons one to four and lesson

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six of the Textbook on Neonatal Resuscitation. Following this the residents underwent a pre assessment of their known skills in performing neonatal resuscitation on an integrated skill station based on the pattern suggested in the Neonatal Resuscitation Program Instructor's manual. The skill assessment was followed by another class by the faculty trainers (two Assistant Professors in the Department of Pediatrics) on the correct method for performing the above mentioned skills. They also helped the resident by encouraging correct practices and suggesting improvements in the deficient skills. Closure was achieved by post skill training assessment on the same stations and testing the acquired skills on two case scenarios to further test their ability to consolidate their training and apply it in different conditions. A Likert's scale assessment of confidence gained by the residents in knowledge and skill acquired by them post completion of neonatal skill labs was finally done.

Evaluation of Training

Kirkpatrick's four levels of training effectiveness provided a model for program evaluation:

Level 1 Evaluation – *Reaction:* This was assessed using a pre and post simulation 5 point Likert's scale: 1 - not confident at all, 2 – slightly confident, 3-somewhat confident , 2 – fairly confident and 5 -completely confident.

Level 2 Evaluation – *Learning:* Assessment in knowledge and skills among residents by analysis of their pre and post simulation questionnaire scores and observer based skill assessment on the integrated skill station.

Knowledge assessment :Pre and Post training Questionnaire assessment (Max score :59) and the lessons tested were: Lesson 1- Foundations of Neonatal Resuscitation (max score:6) , lesson 2-Preparing for resuscitation(max score-6), Lesson 3-initial steps of Newborn care (max score:11) , lesson 4-Positive pressure ventilation (max score:25) and lesson 6:Chest compressions (max score:11)

Skill assessment: This was done using an Integrated skill station with Manikin with 21 assessment check points

Level 3 Evaluation – *Transfer:* The application of skill and knowledge was further tested on two simulated case scenarios replicating real life cases. The skills could not be tested on real life scenarios due to logistic reasons.

The two mock case scenarios used were:

Mock Case 1: Gestation Age: Term/Post Term, Estimated Weight: >3.5 Kg, Mode of Delivery: Vaginal Delivery, Risk Factor: Shoulder Dystocia, Condition at Birth: Apneic and Heart Rate: 40 beats/minute; Lessons Evaluated: 1-4 and 6(if baby deteriorates) ,Skill evaluation done on Manikin.

Mock Case 2: Gestation Age: Term/Post Term, Estimated Weight: >3 Kg, Mode of Delivery: Vaginal/Cesarean Delivery, Risk Factor: Meconium Stained fluid, Condition at birth: Irregular breathing and Heart Rate: 80 beats/min; Lessons Evaluated: 1-4 and 6(if baby deteriorates), Skill evaluation on Manikin.

Level 4 Evaluation – *Results*

STATISTICAL ANALYSIS

Data compilation and initial screening was done and descriptive statistics were calculated. Data for the pre- and post-self-confidence questionnaire responses were compared using the responses on a 5 point Likert's scale. The Paired t test was used to analyze the pre and post knowledge based questionnaire scores and Wilkcoxon Signed Rank test was used to analyze the pre and post simulation skill assessment on an integrated skill station comprising of 21 check points. The scores for two mock case scenarios were examined to see how many students passed in each.

RESULTS

Knowledge assessment: There was a significant average difference between Pre and Post simulation test scores [t=11.041,p=.000 (<0.05)].On average, post test scores were 21.38 points higher than pre test scores (95% CI [25.9527, 16.7973])(Figure 1).

Skill Assessment: The Wilcoxon Signed Rank Test indicated the Post simulation skill assessment (mean rank=4.50) was more favorable to Pre skill assessment (mean rank=.00) and that simulation elicited a significant change in skill performance scores (Z= -2.533, p=.011[<0.05])(Figure 2).

Performance on Mock Case Scenarios

Mock case 1: 25% students scored 80-90% marks, 25% students scored 70-80% marks , 25% students scored 50-60% marks,13% students scored 90-100% marks and 12% students scored 60-70% marks.

Mock case 2: 50% students scored 90%-100% marks,25% students scored 80-90% marks , 13% students scored 70-80% marks and 12% students scored 60-70% marks.

Change in residents' self-confidence: Pre training >60% residents were not confident at all in performing Neonatal resuscitation but Post training 50% were fairly and completely confident in the same.

DISCUSSION

This study attempts to establish the role of skill labs in

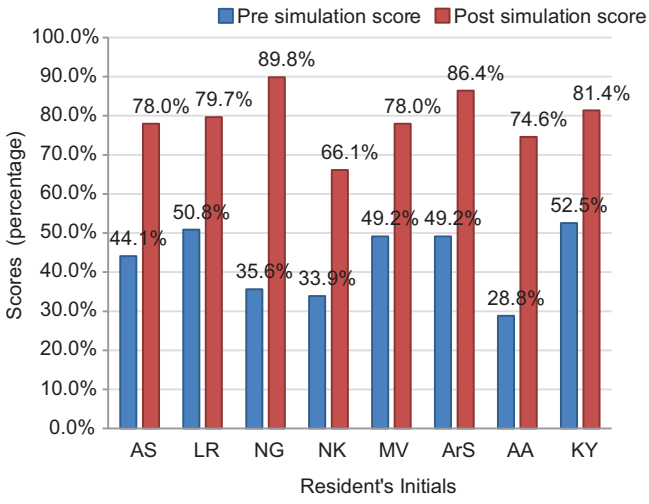

Figure-1: Knowledge Assessment

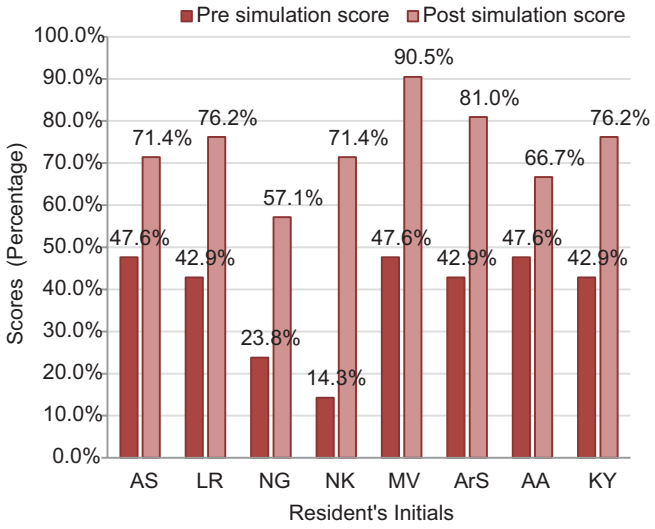

Figure-2: Skill assessment

being an efficient tool for imparting simulation based training to postgraduates in the correct practices of Neonatal Resuscitation to improve their efficiency and confidence to undertake such practices in real life scenarios. The positive gains in knowledge and skills amongst the pediatric residents at Rohilkhand Medical College as evident from this study highlights the importance of skill labs in providing simulation based training in neonatal resuscitation . These results were similar to a study conducted by Han T et al on 11 pediatric residents posted in neonatal ward in Third Hospital of Peking University in which similar to our study the gain in scores post-training versus pre-training was significant($P<0.01$).[6] Another study by Lee MO et al in Rhode Island Hospital on 27 emergency medicine residents found that simulation-based educational intervention significantly improved emergency medicine residents' knowledge and performance of the critical initial steps in resuscitation.[7] Other notable studies with similar observations include those by Halamek L. et al in which they found superiority of simulation-based training program (NeoSim) in neonatal resuscitation.[8] and by Sophie Rubio-Gurung et al who concluded that high-fidelity simulation improved technical skills and teamwork in neonatal resuscitation.[9]

The Neonatal Resuscitation programme is a worldwide accepted set of standardized steps required to be undertaken for the management and resuscitation of a newborn baby. Every hospital or health care facility with a delivery room also requires neonatal resuscitation providers for proper management of the newborn.In India where there is high incidence of perinatal asphyxia (23%)[10], there is an urgent need to educate the people engaged in neonatal care to be trained in correct practices of neonatal resuscitation .Thakre R. in an article on neonatal resuscitation in India mentioned that the neonatal life support practices are far from implementation in majority of the delivery rooms in India due to lack of technology, lack of resources, and absence of skills.[11] The most renowned training institutes that cater to postgraduate courses in India still continue to follow didactic lectures for imparting resuscitation training while continuing with the traditional old practices in the same, leading to production of untrained neonatal resuscitation providers. This problem of large number of established untrained neonatal life support providers was highlighted in a study conducted on Pediatricians in Gujarat by Bansal S. et al in which they found that most pediatricians lacked contemporary knowledge of Neonatal Resuscitation.[12]

The lack of proper training also causes lack of confidence especially amongst residents made responsible for providing life support to newborns, a common practice in most Indian Medical Institutions making them prone to mistakes, indecisions and sedate response to situations that demand prompt and competent measures.

The limitations of our study were a small sample size. The study occurred in one setting at one institution with pediatric residents, and did not include a control group. The residents served as their own control group. Measurement of actual practice outcomes in the real-life setting was not tested because of obvious constraints. The extent to which the results will generalize to other pediatric residency programs will depend on the similarity of contexts and residents' prior experiences in neonatal resuscitation as also replication of the curriculum and training with an intervention and control group and the inclusion of Level 4 outcomes measurements.

CONCLUSION

In conclusion**,** our study brings out the effectiveness of skill labs and simulation based training in imparting knowledge and skills in neonatal resuscitation to the trainee resident. These labs also provide a platform for imparting and ensuring standardized practices in neonatal resuscitation and the opportunity to make mistakes and correct them in a simulated environment. However we believe that its effectiveness can only truly be documented if the training is retained and executed perfectly in real life scenarios.

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