Journal of Pediatric and Womens Healthcare

The Effectiveness of Simulation based Training for Life Saving Skills to Improve Knowledge, Skills and Attitude of Nurses on Caring Mothers and Newborn: Quasi Experimental Study

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Abstract

Background: Although babies and mothers are dying from obstetric emergency, simulation based training reduces the incidence. Health care simulations are interventions that have been used worldwide to reduce adverse outcomes in critical patient care settings. Simulation on Helping Babies Breathe and Helping Mothers Survive-Bleeding are interventions used to teach birth attendants lifesaving skills in order to reduce complications and deaths of babies and mothers at birth. However, these interventions have been under-utilized due to shortage of well-trained staff and shortage of equipment in resource –limited area, which includes Tanzania. Therefore, we need to find the effective simulation based training to nurses in the health center in order to reduce maternal and neonatal complications as well as deaths.

The aims of this study are to evaluate the effectiveness of simulation based training for emergency life saving skills for nurses on the basic obstetric emergency care.

Methods: A quasi experimental design with control. The intervention group will be nurses working in maternal and neonatal units who will receive the simulation based training while the control group will include nurses working in maternal and neonatal units who will not receive the intervention. In evaluation of post intervention health centers will be matched with control by their MMR. The intervention group will be assessed before and after intervention while controls will be assessed six months post-training for the purpose of comparison with intervention group. The primary outcome is the difference between groups in change of knowledge, skills and attitude of nurses.

Keywords: Effectiveness; Simulation; Pre-training; Post-training; Obstetric emergency

Abbreviations

MMR: Maternal Mortality Rate; NMR: Neonatal Mortality Rate; BEmCO: Basic Emergency Obstetric Care; CEmCO: Comprehensive Emergency Obstetric Care; MoHSW: Ministry of Health and Social Welfare; WHO: World Health Organization; TDHS: Tanzania Demographic and Health Survey; RCH: Reproductive and Child Health; TNMC: Tanzania Nurses and Midwife Council; SDG: Sustainable Development Goal; MDG: Mellennium Development Goals; AMSTL: Active Management of Third Stage of Labor; UNICEF: United Nations Children Fund; PPH: Postpartum Hemorrhage; SELSS: Simulation based Training for Emergency Life Saving Skills; LSS: Life Saving Skills; NLN: National League of Nurses; NESF: Nursing Education Simulation Framework; GDA: Global Development Alliance; OSCE: Objective Structure Clinical examination; RMO: Reginal Medical Officers

Background

Over the last 25 years from 1990 to the end of 2015, it is estimated that maternal and neonatal mortality has been decreased by 44% and 47% respectively [1,2]. However this indicating slow reduction rate [3].

The main causes of maternal deaths include hemorrhage, hypertensive disorders, infections, prolonged labor and unsafe abortion [4]. Hemorrhage and hypertension are the top leading causes of maternal death in South Asia and Sub Saharani Africa. These deaths can be indicators of the

health care provided during antenatal, intrapartum and postpartum periods**.** While three quarters of the neonatal deaths are caused by birth asphyxia (31%), preterm complications (25%) and sepsis (20%) [5]. However, about 80% of neonatal death is contributed by low birth weight associated by prematurity [5]. Many of these deaths may be preventable if the settings have skilled attendants, emergency obstetric drugs, medical supplies needed for EmCO and referral abilities [6].

Strategies done to reduce maternal and Neonatal mortality in Tanzania

The Government of Tanzania had committed to reduce the number of maternal and newborn deaths through a number of strategies which include: expanded program of immunization (EPI) in 1975, Safe motherhood initiatives 1989 [7]. National Reproductive and child health (RCHS) 1994, Integrated Management of Childhood Illness (ICM)**.**

Currently, the Tanzanian government has initiated key interventions aimed at reducing maternal and neonatal mortality. The government's initiatives aim to increase the number of deliveries attended by skilled health personnel, increase the number of health facilities providing neonatal, child, and maternal health services and expand Emergency Obstetric Care (EmOC) coverage including availability and provision of BEmOC in all health care levels (especial dispensaries and health centers). The package of BEmOC for mothers with complications involves parenteral antibiotics for infections, uterotonic drugs (parenteral oxytocics) for hemorrhage prevention, parenteral anticonvulsants for preeclampsia and eclampsia (i.e. magnesium sulfate), manual removal of placenta and retained products after miscarriage, abortion and after assisted vaginal delivery, as well as performing basic neonatal resuscitation using bag and mask [8-10]. However, the quality of BEmCO depends on the ability to make quick and correct decisions, as well as early referral and transport [11].

The health facilities should be equipped with trained health staff to manage obstetric complications as well as the newborn complications. The government has committed to train in-service and pre-service on management of obstetric emergencies. However the Tanzanian training curriculum is based on didactic classroom based teaching methods rather than the simulation method (focused on skills and performance). Furthermore, the simulation is the key method of training in knowledge and skills deficit [12]. It is well established that knowing a concept does not universally apply to implementing an action or plan [13].

Simulation in clinical outcome improvement

Health care simulations are interventions that have been used worldwide to reduce adverse outcomes in critical patient care settings [14]. Helping Babies Breathe is evidence-based curriculum used in neonates care and resuscitation, utilizing simulation based curriculum training [15]. It was developed by American Academy of Pediatrics designed to train birth attendants in low resource countries on the important skills of newborn resuscitation [16].

Helping Babies Breathe is initiated soon after delivery, all newborns are evaluated for crying, if the baby is crying well will need monitoring with its mother, if the baby doesn't cry will need basic resuscitation [17]. The intervention includes thoroughly drying the baby and stimulating the baby to breath, cleaning the airway starting from the mouth then to the nose to avoid aspiration, followed by bag and mask ventilation. However, few babies approximately

one percentage will need advanced resuscitation including specific medications and cardiac resuscitation [18]. However, this intervention has been under-utilized due to shortage of well-trained staff and shortage of equipments in resource –limited area, which includes Tanzania.

First formative evaluation of this course has been conducted in Pakistan and Kenya, and it has shown high satisfaction and self efficacy rating among the participants [15]. In 2009, a simulation program of helping babies breathe was implemented to eight hospitals in Tanzania: including three major referral hospitals (Muhimbili National Hospital, Bugando Medical Center and Kilimanjaro Christian Medical Center), four regional hospitals (Amani, Burunguni, Sekotoure and Mawenzi), and one district hospital (Haydom Lutheran Hospital). These hospitals were successful in reducing newborn deaths within 24 hours as well reducing stillbirth [19].

In 2010, the Helping Babies Breathe training conducted as evaluation after training, in Haydom Lutheran Hospital Northern Tanzania, emphasizing on basic steps; drying, stimulating, suction, warming, and initiating face and mask ventilation within the Golden Minute after birth. Report showed significance improvement recall in simulation of neonatal care and resuscitation training from 41 to 74% [15].

Simulation on Helping Mothers Survive – Bleeding after birth is evidence-based training program designed to teach birth attendants lifesaving skills on how to prevent, detect, manage and control postpartum hemorrhage, this program developed by Jhiego and Laerdal Global Health. The first pilot study conducted in a rural referral hospital in Northern of Tanzania in March 2012. However, the study showed increased in knowledge, skills, and confidence of participants soon after simulation on active management of postpartum hemorrhage (AMSTL) in the study health facilities [20].

Using simulation based training to health care workers in the poor resource countries including Tanzania is an appropriate intervention for improving knowledge and skills on maternal and neonatal emergency management, since this intervention has been done and shown improvement in obstetric emergency management of health care workers.

Simulation based training has been reported as a good method of teaching clinical research nurses in Cambridge. In the evaluation session about 90-100% of nurses reported the simulation training met their expectations and they have gained from the training [21].

This study aims to evaluate the effectiveness of simulation based training for emergency life saving skills for nurses on the basic obstetric emergency care (BEmOC) that is supposed to be conducted at the health center before the women or babies are referred to the hospital.

Methods/Design

Design

This is a quantitative approach using quasi experimental design with control. The intervention group will be nurses working in maternal and neonatal units who will receive the intervention (simulation based training) who will be selected purposively while the control group will include nurses working in maternal and neonatal units who will not receive the intervention. In evaluation of post intervention health centers will be matched with control by
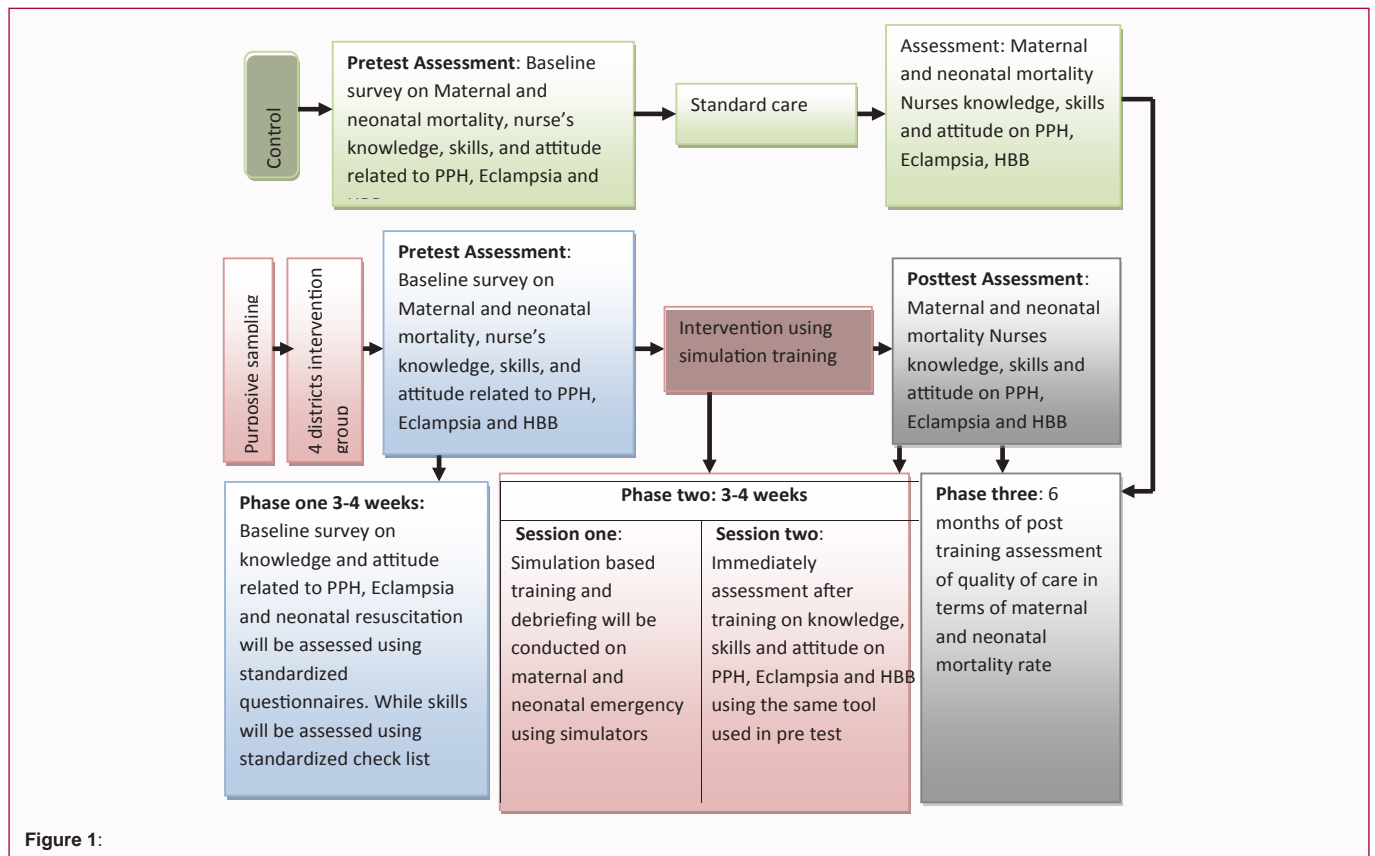
Figure 1:

their MMR. The intervention group will be assessed before and after intervention while controls will be assessed four months post-training for the purpose of comparison with intervention group.

Setting and recruitment

The study site will be selected purposively by their MMR, and all participants will be selected conveniently at the health centers.

Inclusion criteria:

• Nurses working in maternal and newborn units (antenatal, postal natal and labour ward) because these are the units where you can find maternal and neonatal emergency happen.

• Nurses with working experience of one year and above.

Exclusion criteria:

• Prior training in maternal and neonatal resuscitation course post graduation.

Comparator group

In the compactor group participants will not receive simulation training, they will be assessed their knowledge, skills and attitude on caring maternal and neonatal asphyxia and maternal and neonatal deaths.

Intervention group

The intervention group will receive simulation based training after baseline assessment on maternal, neonatal deaths, knowledge, skills and attitude, the simulation training will include management of severe pre eclampsia, eclampsia and hemorrhage using Mama Natelia manique, and it will also include basic neonatal resuscitation using Neonatalia maniques. The simulation will take 45 minute and

debriefing will be for 15 minutes. There will be immediate assessment after simulation based training and another assessment will be done after six months to check retention of knowledge and skills.

Intervention components

Every health center, the baseline data (pre training) and intervention (simulation training) will take one day; another one day is for post training assessment. The goal of the intervention will be to assess the effectiveness of the simulation based training on management of maternal and neonatal emergency (PPH, Eclampsia and Birth asphyxia) using maniques and flip chart (Mama Natalia and Neonatalia), drugs used to control hemorrhage, uterotonics drugs (administration of oxytocin 10IUIM, Misoprostol 600µg orally), controlled cord traction while applying counter traction on uterus, uterine massage after delivery of placenta, maintain communication with the woman throughout the process [22,23].

The contents for PPH management will include identification of cause of bleeding, inset large bore cannula (14G,16G,or 18G), set infusion fluid isotonic crystolloids best is normal saline if not available ringers lactate, blood sample for grouping and cross match containers, indwelling catheter, for uterine atone oxytocine 10IU IM then 20IU IV, 40IU in normal saline or ringers lactate, or misoprostol rectal 1000µg or both, Bimanual uterine compression and external aortic compression are recommended as temporary measures until substantive care is available or refer the women while continue with bimanual uterine or external aortic compression [22,24]. Simulation based training on how to manage PPH, critical thinking and decision making according to condition in order to provide quality care and gain competence.

Package for hypertension (pre eclamsia/ eclampsia) management

will includes definition of pre eclampsia and eclampsia, signs of pre eclamsia and eclampsia, management of pre eclampsia including how to give anticonvulsant (magnesium sulphate including loading and maintenance dose and route), antihypertensive (Hydralizen dose and route, Nifedipine dose and route, aldoment), and referral patens [16,24]. Also it will include monitoring for side effect of magnesium sulphate (urine output, respiration and patellar reflex), catheterization, monitoring of maternal and fetal condition.

Neonatal resuscitation (Helping Babies Breathe) training package will includes the causes of neonatal death, procedure of resuscitating a newborn soon after been delivered, the nurse/midwives should drying, simulating the newborn, management of the newborn when doesn't cry soon after delivery, penguin suction, bagging and ventilation. The main element to achieve this goal is by using simulation training.

The intervention group will be assessed before and after intervention while controls will be assessed four months post-training for the purpose of comparison with intervention group, shown in Figure 1 below.

Primary outcome: The difference between the groups in maternal and neonatal deaths, nurse's knowledge, skills and attitude on caring PPH, Eclampsia and Helping Babies Breathe from baseline to post intervention assessment.

Secondary outcome:

1. The difference between the groups in maternal deaths change from baseline to six months post training.

2. The difference between the groups in neonatal deaths from baseline to six months post training.

3. The differences within the group in maternal complications (PPH and Eclampsia) from baseline to six months post training.

4. The differences within the group in neonatal complications (birth asphyxia) from baseline to six months post training.

5. The difference between the groups in maternal and neonatal complications from baseline to six months post training.

Assessment

Baseline: This study will have three phases; the first phase will be pre-training assessment for baseline survey on maternal and neonatal mortality, knowledge, skills and attitude of nurses on caring maternal (PPH, Severe pre eclampsia and Eclampsia) and neonatal (birth asphysia) emergency in both intervention and control group. Participants will complete questionnaires after being selected to either control or intervention group. Control and intervention group will be given the same questionnaires and check list under the same condition in their own environment, However, every H/C will be treated as one group, in order to allow the researcher to be able to test for any variation among nurses within the H/C, between the H/C, within the district and among the districts within the Region. This will take 3-4 weeks before intervention [25]. The assessment will be conducted by researcher and assistant using self administered questionnaires and checklist. The researcher will give simulation scenarios on lifesaving skills on maternal PPH, eclampsia and neonatal resuscitation as well as observing and recording the nurses when conducting hand-on skills using check list, while assistant will be doing video recording and all participants will be consented.

The second session, One day after baseline, another group of

two experts who will be blinded of the trained and not trained group in order to prevent halo effect (Rosenzweig, 2014) will collect data immediately after training on nurse's knowledge, skills and attitude on management of PPH, eclmapsia and neonatal basic resuscitation to the participants using the same questionnaires and scenarios used during pre training with the aim of checking understanding and skills gained immediately after training (post test).

Third phase, this will be post training assessment of maternal and neonatal mortality, knowledge, skills and attitude of nurses on caring maternal and neonatal emergency after six months of training. The aim is to compare outcome with the baseline information and assess retention of knowledge and skills. Research assistants will be trained in data collection during pre training and post-training to maintain consistency of information [26-28].

Sampling Technique and Sample Size

Sampling technique: Four districts in the region will be selected purposively using the criteria of high MMR. After selecting the four districts which are intervention group all health centres in the districts will be involved in the study. Based on statistics at the health centres all nurses in the selected health centres will be included until we reach a sample size of 343. The assessment will be done for two shift (morning and afternoon shift) in order to include all nurses in the health centre; it is expected to have no changes of nurses in health centres. Later on after intervention the other three districts will be assessed post test for comparison purpose.

Sample size: The sample size for nurses will be calculated using the below formula (West & Briggs, 2015).

$$n = \frac{\left\{ Z\alpha \sqrt{\left[\pi o (1-\pi o) \right]} + 2\beta \sqrt{\left[\pi 1 (1-\pi 1) \right]} \right\}^2}{(\pi 1 - \pi o)^2}$$

where n = maximum sample size.

Zα = Standard normal deviation (1.96) at 95% confidence level for this study.

2β = standard normal deviate (0.8) with a power of demonstrating a statistically significant difference before and after the intervention between the two groups at 80%.

πo = Proportion at pre- intervention (baseline knowledge of LSS 23% (Makene et al., 2014).

π1 = proportion after intervention (proportion with adequate knowledge after intervention 41%) (Makene et al., 2014).

$$n = \frac{\left\{ 1.96 \sqrt{\left[0.23 (1-0.23) \right]} + 0.8 \sqrt{\left[0.41 (1-0.41) \right]} \right\}^2}{(0.41 - 0.23)^2}$$

$$n = \frac{4.71496}{0.0324}$$

n= 146 with adjustment for 10% attrition, the calculated sample size is 161.

Independent variable is simulation based training (intervention). The variable will be categorized as pre-trained and post-trained group. For analysis purpose pre-trained group will be coded 1 and post- trained group will be coded 0.

Dependant variables: Intermediate dependant variables - Knowledge, skills and attitude of nurses on handling eclampsia,

hemorrhage and neonatal resuscitation.

Long term dependant variables – maternal and neonatal mortality

Covariates are social demographic characteristic: Age will be measured in years (continues variable), sex will be measured into male and female (categorical variable), experience in working with maternal and neonatal unit will be measured in years (continues), in service training will be measured as trained and not trained (categorical), availability of supplies (drugs, equipments,) will be measured as available and not available (categorical), guidelines will be measure available and not available (categorical).

Analysis plan

Data collected will be entered into computer, cleaned then analyzed using SPSS software program. Effect of training to knowledge and skills will be analyzed through comparing the mean score of the trained group and the group not trained. Their t-test value and respective p values will be used to determine the significance of their mean score. Kruskal-Wallis H test will be used to test nonparametric, that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable, this will be used to test nurses knowledge among the districts and among H/Cs. Mann-Whitney U test will be used to compare difference within groups. Difference in Differences will be analyzed to compares the changes in outcome over time between treatment and comparison groups to estimate impact. Responses for attitude will be dichotomized into positive attitude and negative attitude, effect of training to attitude will be analysed through Binary logistic regression analysis where the crude odds ratio and adjusted odds rations with their 95% confidence intervals will be reported. All results will assume a two tailed distribution with an alpha of 5%.

Discussion

Many nurses would benefit from this training although intensive intervention cannot be conducted due to the high cost of this intervention. This study will provide stake holders (ministry of health, colleges and Universities) with simulation training using simple low cost maniques to teach nurses and nurse students to gain knowledge, skills and change of attitude on caring women with PPH, Severe pre eclampsia and eclampsia and how to resuscitating babies who failure to cry and breathe soon after being delivered. Also the stake holders will be advanced to include simulation training in the nurse's curriculum.

Consideration for Future Research

We advice other researcher do conduct this type of research in more than one region so that the findings could be much generalized.

Declarations

Ethical approval

Ethical approval was reviewed and obtained from the research and publication committee of the Dodoma University. The committee reviewed and approve the research design and all other materials on the November 2016 and will approve all study protocol amendment.

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