

## Developing Reliability and Validation of Midwives' Skills regarding Basic Newborn Resuscitation Questionnaire (MSNRQ)

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### Abstract

#### Background

Effective basic newborn resuscitation is an important strategy to reduce the incidence of birth asphyxia and associated newborn morbidity and mortality. There is presently no valid and reliable tool to evaluate clinical midwives confidence to apply required skills of basic newborn resuscitation. This study was undertaken to develop and psychometrically test an instrument to measure basic newborn resuscitation skills among clinical midwives.

#### Materials and Methods

The multi-dimensional nature of the tool was confirmed, with four core factors being identified. A total of 118 midwives who attended the birth and performed basic newborn resuscitation were observed by a trained researcher to fill the required performed skills. The skills ranged from not performed to appropriately performed and met standard sequence.

#### Results

Content validity indices, CVI and CVR, for MSNRQ were 0.712 and 0.94, respectively. Reliability was confirmed in internal consistency ( $\alpha = 0.851$ ). Construct validity was confirmed using the generalized factor analysis.

#### Conclusion

The instrument was successfully tested and modified, and factorial validity was subsequently confirmed. There was strong evidence of internal consistency, reliability, content, and convergent validity of the basic newborn resuscitation skill instrument.

**Key Words:** Basic Newborn resuscitation, Midwives, Jordan, Psychotherapy.

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## 1- INTRODUCTION

Most babies start to breathe on their own, but globally, approximately 10 million newborn babies per annum are unable to do this (1), and approximately 3-6% need some assistance (2). Birth asphyxia is a leading factor of newborn mortality worldwide (3-7). The World Health Organization (WHO) estimated that 23% of all newborn deaths are due to asphyxia because of the failure to initiate and sustain breathing at birth, and 80% of birth asphyxia appears in developing countries (6). Effective basic newborn resuscitation is an important strategy to reduce the incidence of Birth Asphyxia (2, 8-11), and associated newborn morbidity and mortality (11, 12).

Basic newborn resuscitation is performed at birth to support newborns that require some assistance to achieve cardio-respiratory stability (8, 9). This includes tactile stimulation, airway support and positioning (2). Skilled health care providers can reduce complications of newborns at birth through early detection and management (12, 13). Importantly, outcomes for newborns can be markedly improved if health providers have appropriate newborn resuscitation skills (14). Thus, basic newborn resuscitation is an essential skill for those providing care during labour and birth (15). Worldwide, nearly 23% of neonatal deaths in the first week are due to birth asphyxia (4, 6, 16).

Normal births are usually attended by midwives in developed countries such as Australia. Thus, it is the midwives that often initiate basic newborn resuscitation for newborn babies when required. Inadequate newborn resuscitation training for midwives remains a contributory factor to neonatal death (16, 17). Also, some developing countries may not have policies requiring midwives to attend workshops on the latest newborn life support guidelines and techniques. Study findings highlighted several challenges

raised by midwives related to neonatal resuscitation training and competencies which are affected by organizational factors and teamwork (10, 11, 14, 18). Competence was hindered by lack of knowledge and skills in newborn resuscitation which was exacerbated by inadequate, ongoing Continuing Professional Education training. Similar issues have been raised, and findings showed that inadequate knowledge, skills, and preparation to perform basic newborn resuscitation were the main causes of adverse neonatal outcomes in most developing countries (10,11,14,18). Collecting information about midwives' skills in performing basic newborn resuscitation in delivery rooms lends itself to a quantitative approach (17). Evaluating the skills of midwives during newborn resuscitation in delivery rooms is a unique problem for the Jordanian health system. We aimed to identify a tool that was capable of measuring the different skills of midwives in performing basic newborn resuscitation.

## 2- MATERIALS AND METHODS

### 2-1. Method

A mixed method exploratory sequential design was used to address the study aim of the development of an instrument to assess skills of basic newborn resuscitation which should be conducted during the first 60 seconds after birth. Based on DeVellis framework (2016) for scale development and testing, the Midwives' Skills regarding Basic Newborn Resuscitation Questionnaire (MSNRQ) was developed via a 4-stage process to design, test and refine the instrument: (1) initial content development, (2) content analysis by expert reviewers, (3) pilot testing, and (4) psychometric evaluation. This process, which followed recommended scale development procedures (8), is described below. In the first stage, the questionnaire

has been adapted from the literature to better capture the concept of interest (assess required skills which are performed during basic newborn resuscitation). Several heart association organisations guidelines were reviewed and were followed to develop multi items scale. Then initial scales with 20 items were derived to assess performed skills (2, 19-21). As part of content validity testing, items were accepted, modified or deleted by the level of agreement between the reviewers, and appropriate changes were made by the suggestions of the experts. After that, 20 items were revised and 6 items were deleted.

This resulted in a 13-item instrument that intended to represent four domains of required skills by midwives while performing basic newborn resuscitation: (Domain 1) "Thorough drying, providing warmth and additional stimulation to initiate spontaneous breathing" (5 items); (Domain 2) "Second stage of being critical or life threatening if spontaneous breathing is not initiated" (4 items); and (Domain 3) "Rescue of breathing (Respiratory stability or distress" (2 items), and (Domain 4) "Circulatory system effectiveness" (2 items). Respondents rated their performed skills from 'not performed' to 'appropriately performed and met standard sequence' using a 4-point Likert scale. In addition, the section includes questions about the demographic background of the participants (age, education, and years of experience). It is important to mention that the performed resuscitation was evaluated for each midwife while performing basic newborn resuscitation for normal full-term neonates born by normal vaginal birth.

Four expert neonatologists with > 7 years of experience participated in content validation. The majority of the experts (83%) had obtained the American Board of Neonatal Advance Resuscitation Specialty Certification, and completed the basic life support neonatal training. Experts were

provided information regarding the purpose of the questionnaire and score sheet to ensure a standardized review. They scored the question construction, interpretability, and relevance, and provided feedback on its comprehensiveness. The questionnaire was revised, and 1 item was eliminated, 10 were modified, and 3 were added. To estimate content validity, the tool was presented to an expert panel of clinicians (n=12) (two obstetricians, ten midwife leaders) working in the field of newborn resuscitation. Each reviewer received detailed instructions that included a description of the purpose of the instrument and directions for assessing what items they are supposed to address. Feedback of the pilot study showed that the tool was easy to use, clear to read, and required 5-10 minutes (on average) to complete.

## **2-2. Participants**

Midwives who had a minimum of one year's experience and who either held a bachelor's degree in which a four-year bachelor of midwifery program was completed at a university or a diploma degree, and who agreed to participate in the study were approached. To recruit the study sample, the delivery room in two governmental hospitals in the northeast of Jordan were visited every day except holidays. All available midwives during selected day/shift were observed (convenience sample). A sample of 118 midwives who had a minimum of one year's experience, and holding either a bachelor (4 years), or diploma degree (2 years) was recruited. For each midwife, data were collected on a single occasion while performing basic newborn resuscitation for normal full-term neonates born by the vaginal route. Accordingly, each midwife was observed once while performing basic newborn resuscitation practice. Given that 118 participants were recruited, a ratio of 8.5:1 provided and it

is satisfactory in most cases for ordinary factor analysis. Participants were approached by the researcher's assistants in their local hospital. Participants were informed about the aim of the study and gave their permission to take part before filling the checklist. The tools were anonymous to help the midwives feel free to perform their usual care while being observed. The scale was filled by participants. Completion of the scale took approximately 5 to 10 minutes. Two clinical instructors helped to re-evaluate the filled questionnaire by each participant and to ensure that all items were checked.

### **2-3. Statistical analysis**

Before an exploratory factor analysis the suitability of data for such a factor analysis was assessed by the Kaiser-Meyer-Olkin (KMO) sample adequacy (3), and Bartlett's test of sphericity with  $p < 0.000$  (4). To examine the factorial structure of the scales, an exploratory factor analysis using principal factors extraction was undertaken, and the Varimax rotation method was used to obtain clear factorial structures (5). Factor loading of 0 was deemed as acceptable with a sample size of 118. Only factors with values above one were considered as relevant.

The reliability and subscales of the total scale and subscales was evaluated using the following criteria: (1) Cronbach's alpha coefficient (SSPS version 22.0, SPSS Inc.). A value higher than 0.70 is standard for defining acceptable reliability of the scale (2), corrected item-total correlation to evaluate the homogeneity of the scale, and (3) alpha estimate when an item was dropped. Poorly functioning items were defined as: (a) items that when deleted, increased the estimated alpha coefficient by more than 0.10, or (b) items that had a corrected item-total correlation less than 0.30 (2).

## **3- RESULTS**

### **3-1. Description of the sample**

The majority of midwives had higher diploma degree ( $n=96$ , 81.4%), and the remainder had a bachelor's degree ( $n=22$ , 18.6%). Seventy-five (63.6%) of the participants were employed at one of the hospitals, and 43 (36.4%) were employed at the other. Moreover, their mean years of experience was 8.66 (standard deviation [SD] = 6.27), and ranged from one year to 23 years of experience.

### **3-2. Statistical Analysis**

Principal-component exploratory factor analysis (EFA) was used to determine the internal validity of the MSNRQ. The principal-component analysis determines the factors and adjusts the factor weights with Varimax rotation to determine the allocation of the individual items to any dimensions of the questionnaire. Acceptable factor loading was considered accepted for 0.4 or more. Following the EFA, Cronbach's alpha was used to test for internal consistency. Data were managed and analysed using SPSS software version 22.0.

### **3-3. Description of the Scale Prior Exploratory Factor Analysis**

The KMO test indicates sample adequacy with a value of 0.78. The Bartlett's test of the scale was significant ( $P=0.001$ ), which indicates the good strength of the relationship among variables and the appropriateness of conduction factor analysis on the items.

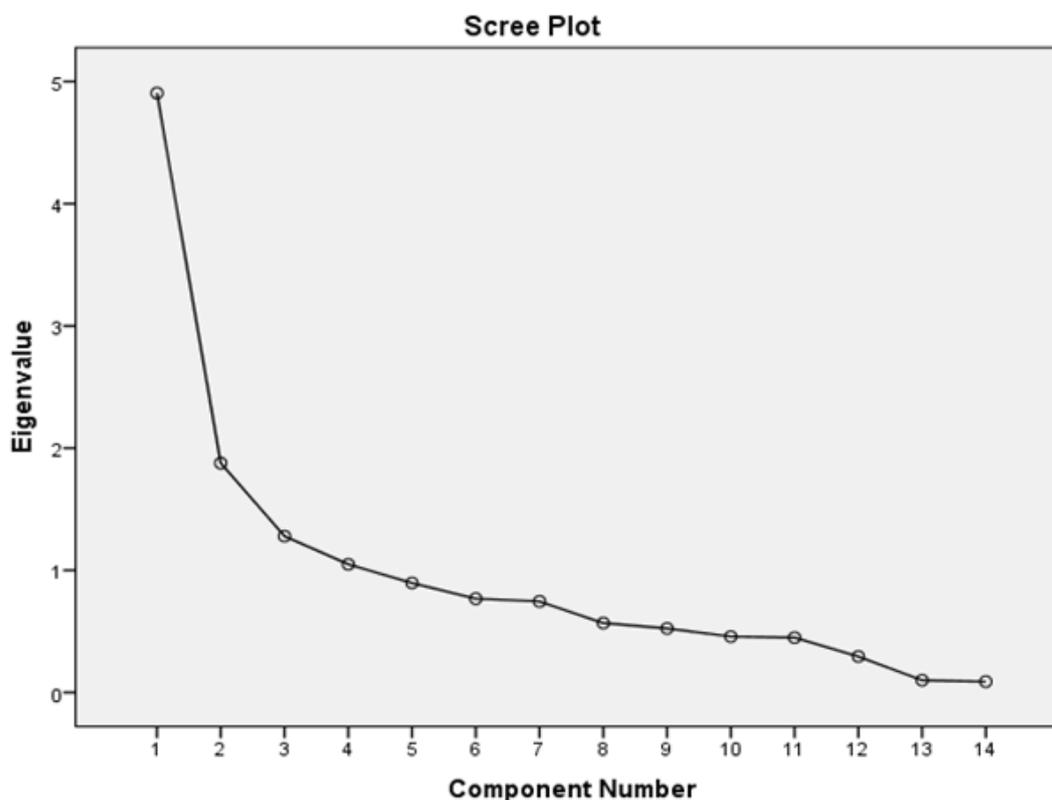
### **3-4. Exploratory Factor Analysis**

An EFA using principal components analysis was conducted to test for internal validity of the MSNRQ among midwives. The primary components analysis with the fourteen scale items yielded four eigen values and a scree plot (**Figure.1**) suggesting a four-factor solution accounted for a total of 65.1% of the total variance: 35.03% variation for the first factor,

13.40% for the second, 9.13% for the third, and 7.49 for the fourth factor. Upon forcing the four-factor solution to standardize the loadings, it was found that five items in the questionnaire loaded on factor 1, four items on factor 2, two items on factor 3, and two items on factor 4.

From the fourteen items, one item about 'reassessing newborn's skin colour was eliminated because it did not uniquely load on either of the factors. The results indicated that the scale is four-dimensional with five items loading on factor 1, thorough drying, providing warmth and additional stimulation to initiate

spontaneous breathing, four items on factor 2, second stage of being critical or threatening life if spontaneous breathing is not started, two items on factor 3, respiratory stability or distress, and two on factor 4, circulatory system effectiveness (heart is the key of observation) (**Table.1**). Scale reliability analysis was tested using Cronbach's alpha (**Table.2**). Overall, Cronbach's alpha coefficients ranged between 0.712 and 0.94, for the four questionnaire factors, and 0.851 for the total scale including the 13 items, respectively.



**Fig.1:** Scree Plot for the Exploratory Factor Analysis.

**Table-1:** Factor structure and loading for MSNRQ Items.

Items	Factors			
	1	2	3	4
8. If not breathing or crying (evidence of meconium), clearing airway of newborn (Intervention to maintain good respiratory efforts).	0.576			
2. Assessing colour of amniotic fluid.	0.636			
3. Drying the overall body of newborn (intervention to conserve heat).	0.732			
4. Providing warmth to the newborn through adequate rapping and turning on heater light on resuscitator (intervention to conserve heat).	0.794			
14. Give supplementary oxygen (100%) if the baby is cyanotic and breathing and with HR greater than 100 bpm.	0.609			
1. Assessing newborn's gestational age.		0.588		
5. Assessing newborn's skin colour.		0.623		
6. Assessing muscle tone of newborn.		0.701		
7. Assessing newborn's breathing pattern or crying.		0.774		
9. Reassessing newborn's respiration rate (RR).			0.944	
10. Give supplementary oxygen (100%) if HR > 100 (bpm) but still cyanotic.			0.948	
11. Reassessing newborn's heart rate (HR) if not crying/ breathing.				0.919
12. Give supplementary oxygen (100%) if the baby is breathing with HR greater than 100 bpm but is cyanotic.				0.927
13. Reassessing newborn's face and whole body skin colour.				

**Table-2:** Factors' Descriptive analysis of the scale and reliability analysis of each factor items.

Factor	Number of items	Scale mean $\pm$ SD	Scale Variance	Cronbach's alpha
1. Thorough drying, providing warmth and additional stimulation to initiate spontaneous breathing.	5	2.61 $\pm$ 0.46	35.03	0.795
2. Second stage of being critical or threatening life if spontaneous breathing not initiated.	4	2.58 $\pm$ 0.52	13.40	0.713
3. Rescue of breathing (Respiratory stability or distress).	2	2.61 $\pm$ 0.46	9.13	0.944
4. Circulatory system effectiveness.	2	2.61 $\pm$ 0.46	7.49	0.942
Total	13	2.63 $\pm$ 0.45	65.05	0.851

SD: Standard deviation.

As shown in **Table.2**, descriptive analysis of the scale factors showed that the scale mean score was 2.63 (SD=0.45) for the total scale, 2.61 (SD=0.46) for **factor 1**, 2.58 (SD=0.52) for **factor 2**, 2.61 (SD=0.46) for **factor 3**, 2.61 (SD=0.46) for **factor 4**.

#### 4- DISCUSSION

This paper addresses the design and validation of the development of

Midwives' Skills regarding Basic Newborn Resuscitation Questionnaire (MSNRQ). This tool has been developed and tested to evaluate midwives' basic neonatal resuscitation skills and practices in Jordan. Midwives who had a minimum of one year's experience, and holding either a bachelor (4 years) or diploma degree (2 years) at two hospitals in Jordan were observed. The tool was used to collect data for each midwife included in the study

while they were performing basic newborn resuscitation for normal full-term neonates born by the vaginal route. Resuscitation skills among midwives were evaluated using the developed tool to observe any specific deficiencies in midwives' resuscitation practice. Two midwifery clinical instructors were recruited from Jordan University of Science and Technology as resuscitation observers and who used the tool to evaluate each observed midwife practice. These observers received special resuscitation training on the use of the evaluation tool at our institution simulation laboratory. The WHO (6), British Resuscitation Council (19), and Australian and New Zealand (20) guidelines were reviewed to develop the instrument of data collection on midwives' skills in basic newborn resuscitation. The observed basic newborn resuscitation skills were defined as the initial steps of resuscitation initiated immediately after birth (during the first five minutes). The instrument consisted of a checklist of steps required for basic newborn resuscitation. It comprised fourteen items of basic skills for resuscitation that should be conducted by midwives.

## 5- CONCLUSION

In conclusion, testing of the scale provided evidence for their use as a valid and reliable tool for the evaluation of skills regarding Basic Newborn Resuscitation. The essential strengths of this scale were to provide more specific aspects of the assessment of specific and focused skills required to be conducted during the first 60 seconds after birth to save the life of a newborn and help them to breathe. The skills include all the necessary steps that should be done to help newborn accommodate to the new environment which is different from uterine environment. The skills are not only limited to helping the baby to breathe but also include basic skills required to initiate both respiratory and circulatory system

besides controlling all other body systems to manage overall baby condition. In the future, the scale may contribute to the assessment of the quality of care and service developments in Jordan. Moreover, use of the scale may be useful for other countries with similar practices and hospital conditions such as limited resource settings with a lack of adequate in-service training during birth.

**6- CONFLICT OF INTEREST:** None.

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