

Practice patterns of physiotherapists in neonatal intensive care units: A national survey

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Abstract

Objective: To determine practice pattern of physiotherapists in the neonatal intensive care units (ICUs) in India with regards to cardiopulmonary and neuromuscular physiotherapy. **Materials and Methods:** A cross-sectional survey was conducted across India, in which 285 questionnaires were sent via e-mail to physiotherapists working in neonatal intensive care units. **Results:** A total of 139 completed questionnaires were returned with a response rate of 48.7%, with a majority of responses from Karnataka, Maharashtra and Gujarat. More than 90% of physiotherapists performed chest physiotherapy in neonatal ICUs. Chest physiotherapy assessment predominantly focused on vital parameter assessment (86%) and in treatment predominantly focused on percussion (74.1%), vibration (75.5%), chest manipulation (73.3%), postural drainage (67.6%) and suction (65.4%). In neuromuscular physiotherapy more than 60% of physiotherapists used positioning, and parent education, whereas more than 45% focused on passive range of motion exercise and therapeutic handling. **Conclusion:** The practice pattern of physiotherapists for neonates in neonatal intensive care units involves both chest physiotherapy as well neuromuscular physiotherapy. Chest physiotherapy assessment focused mainly on vital parameter assessment (heart rate, respiratory rate and partial pressure of oxygen saturation SpO₂). Treatment focused on airway clearance techniques including percussion, vibration, postural drainage and airway suction. In neuromuscular physiotherapy most physiotherapists focused on parent education and passive range of motion exercise, therapeutic handling, as well as positioning.

Keywords: Chest physiotherapy, early intervention, neonatal intensive care unit, neuromuscular physiotherapy, survey

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Introduction

A Neonatal Intensive Care Unit (NICU) is a specially equipped nursery where critically ill and unstable infants receive diagnostic, therapeutic and life support care for a wide range of illnesses and conditions.^[1] A NICU is for those infants who are preterm, have low birth weight, or perinatal problems, or congenital abnormalities, respiratory disorders, neuromuscular disorders and for those who have undergone thoraco-abdominal surgery.^[2-4]

Physiotherapy is a part of the services delivered by the interdisciplinary team in the NICU.^[5] Chest physiotherapy commonly includes techniques like percussion, vibration, positioning for postural drainage and airway suctioning.^[6] It may be useful for the maintenance of a clear airway, as also to re-expand collapsed segments of the lungs, maintain adequate levels of oxygenation, facilitate early weaning, and reduce the probabilities of re-intubation.^[3,6,7]

For neuromuscular dysfunction, common therapeutic strategies for neuromuscular physiotherapy include positioning, skin to skin holding (kangaroo care), therapeutic handling, orofacial stimulation, taping, range of motion exercise, soft tissue mobilization (surgical scar release), hydrotherapy and parent education (feeding, dressing, positioning of infants for sleep, interaction/

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play).^[8-11] These developmental strategies are beneficial for the promotion of posture and movement appropriate to gestational age and medical stability, to modulate sensory stimulation in the infant’s NICU environment, to promote behavioral organization and physiological stability, to foster infant-parent attachment, and to provide direct intervention for neonatal feeding dysfunction and oral motor deficits.^[9,10,12]

Previous studies carried out in ICUs did not explore the practice pattern of physiotherapists in neonatal ICUs.^[13-17] A study done in India to identify the role of the physiotherapists in ICUs demonstrated that physiotherapists were involved in chest physiotherapy and mobilization, but the role of the physiotherapist specific to a NICU was not clear.^[16] There is a scarcity of literature regarding physiotherapy practice patterns in NICUs in India. Therefore, there was a need to identify the current practice patterns of physiotherapists in NICUs. The aim of the study is to determine the practice patterns of physiotherapists in NICUs in India with regard to cardiopulmonary and neuromuscular physiotherapy.

Material and Methods

Content validation

A total of 10 physiotherapists working in NICUs, experts in the field of neonatal physiotherapy were given the “Practice patterns of physiotherapists in neonatal intensive care units” questionnaire for content validation and accordingly the final questionnaire was prepared [Appendix 1].

The questionnaire consisted of two sections with a total of 29 questions. These covered two primary roles of physiotherapy in a neonatal ICU: Chest and neuromuscular physiotherapy. Chest physiotherapy mainly focused on assessment and treatment whereas neuromuscular physiotherapy primarily focused on treatment. Answers had to fall into the grades: “Always,” “Frequently,” “Sometimes,” “Rarely” or “Never.”

Written approval was obtained from the Institutional Ethics Committee. A cross-sectional survey was conducted across India, in which 285 questionnaires were emailed to physiotherapists working in NICUs. List of hospitals was obtained from the NABH [National Accreditation Board of Hospital and Healthcare Providers] and MCI [Medical Council of India] websites.

Data analysis

Responses were numerically coded to allow for descriptive summaries and frequency analyses of the

data. Data were analyzed via SPSS Version 17 (SPSS Inc, Chicago, Illinois, USA). Frequency variables regarding chest and neuromuscular physiotherapy were merged in order to create three responses; “always or frequently,” “sometimes” and “rarely or never.”

Results

Response

A total of 285 questionnaires were e-mailed to physiotherapists across India, with a total of 139 completed questionnaires returned. This made for a response rate of 48.7%. The responses were received from 12 states including Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. The majority of responders were from Karnataka ($n = 40$ [28.7%]), Maharashtra ($n = 32$ [23.0%]) and Gujarat ($n = 28$ [20.1%]) [Figure 1].

Chest physiotherapy assessment in neonatal intensive care unit

The frequency with which different chest physiotherapy assessment measures were used in the Neonatal ICU is given in Table 1 and Figure 2. A total of 94.9% responders performed chest physiotherapy in NICUs; of these more than 30% of the responders marked “always or frequently” for chest physiotherapy assessment. This included pre-treatment vital parameter assessment (heart

Table 1: Chest physiotherapy assessment in a neonatal intensive care unit

Assessment	Always or frequently <i>n</i> (%)	Sometimes <i>n</i> (%)	Rarely or never <i>n</i> (%)
Pre-treatment parameter assessment	120 (86.3)	11 (7.9)	8 (5.7)
Ventilator parameter setting	9 (6.4)	36 (25.9)	94 (67.6)
Suction during extubation	16 (11.5)	48 (36.5)	75 (53.9)
Post-treatment parameter assessment	120 (86.3)	11 (7.9)	8 (5.76)
Opinion for weaning	9 (6.4)	45 (32.3)	85 (61.1)
Decision-making in extubation	10 (7.1)	39 (28.0)	90 (64.7)

n: Number; %: Percentage

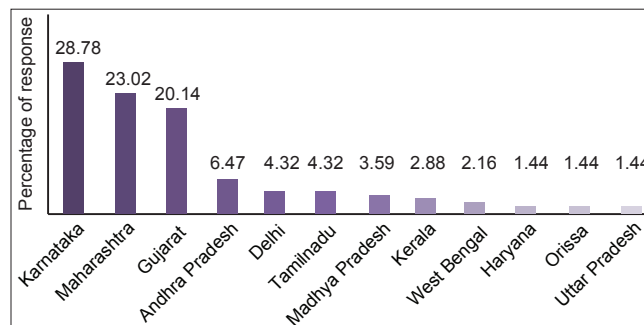


Figure 1: Response rate from different states of India (n= 139)

rate, respiratory rate, and SpO₂) [*n* = 120 (86.3%)], ventilator parameter setting [*n* = 9 (6.4%)], post-treatment vital parameter assessment (heart rate, respiratory rate, and SpO₂) [*n* = 120 (86.3%)], suction during extubation [*n* = 16 (11.5%)], opinion for weaning [*n* = 9 (6.4%)], and decision-making in extubation [*n* = 10 (7.1%)].

Chest physiotherapy treatment in neonatal intensive care unit

The frequency with which chest physiotherapy treatment was used in the NICUs is given in Table 2 and Figure 3. More than 50% of physiotherapists marked “always or frequently” for chest physiotherapy treatment. These included percussion [*n* = 103 (74.1%)], vibration [*n* = 105 (75.5%)], chest manipulation (percussion + vibration) [*n* = 102 (73.3%)], postural drainage [*n* = 94 (67.6%)], head down position during the use of mechanical ventilator [*n* = 50 (35.9%)], only suctioning [*n* = 82 (58.%)], chest manipulation followed

Table 2: Chest physiotherapy treatment in a neonatal intensive care unit

Treatment	Always or frequently <i>n</i> (%)	Sometimes <i>n</i> (%)	Rarely or never <i>n</i> (%)
Percussion	103 (74.1)	28 (20.1)	8 (5.7)
Vibration	105 (75.5)	25 (17.9)	9 (6.4)
Percussion+vibration	102 (73.3)	28 (20.1)	9 (6.4)
Postural drainage	94 (67.6)	33 (23.7)	12 (8.6)
Head down postural drainage in ventilated neonates	50 (35.9)	69 (49.6)	20 (14.3)
Suction	82 (58.9)	41 (29.5)	16 (11.5)
Chest manipulation+suction	91 (65.4)	35 (26.1)	13 (9.3)
Pre-treatment nebulization	48 (34.5)	78 (56.1)	13 (9.3)
AMBU	64 (46.0)	57 (41.0)	18 (12.9)
Salineduring suction as lavage	32 (23.0)	90 (64.7)	17 (12.2)
Mucolytic agent	12 (8.6)	102 (73.3)	25 (17.9)
Post-treatment nebulization	22 (15.8)	98 (70.5)	19 (13.6)
Prone in ventilated neonates	31 (22.3)	49 (35.2)	59 (42.4)

AMBU: Artificial manual breathing unit; N: Number; %: Percentage

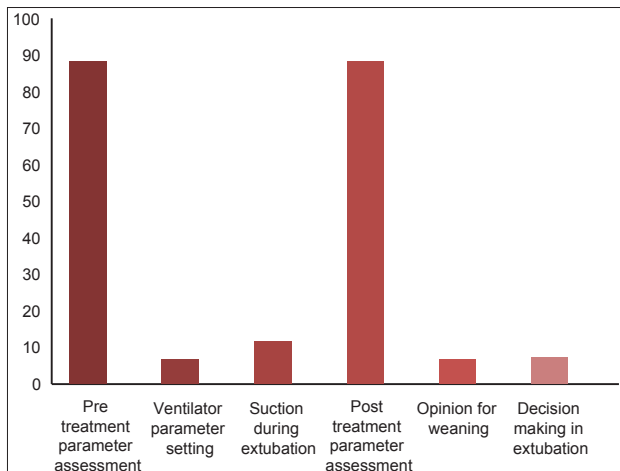


Figure 2: Chest physiotherapy assessment in a neonatal intensive care unit

by suctioning [*n* = 91 (65.4%)], prone positioning in ventilated neonates [*n* = 31 (22.3%)], pre-treatment nebulization [*n* = 48 (34.5%)], artificial manual breathing unit (AMBU) [*n* = 64 (46.0%)], saline [*n* = 32 (23.0%)], post-treatment nebulization [*n* = 22 (15.8%)], and use of mucolytic agent [*n* = 12 (8.6%)].

Neuromuscular physiotherapy treatment in neonatal intensive care unit

The frequency with which neuromuscular physiotherapy was used in the NICUs is given in Table 3 and Figure 4. A total of 80.5% physiotherapists performed neuromuscular physiotherapy in the NICU. Among them, 30% of physiotherapists marked “always or frequently”. These methods included passive range of motion [*n* = 69 (49.6%)], therapeutic handling [*n* = 68 (48.9%)], multimodal sensory stimulation [*n* = 43 (30.9%)], orofacial stimulation [*n* = 47 (33.8%)], kangaroo care [*n* = 43 (30.9%)], neonatal massage [*n* = 20 (14.3%)], taping [*n* = 11 (7.9%)], scar tissue mobilization [*n* = 10 (7.1%)], positioning [*n* = 101 (72.6%)], and parent education [*n* = 84 (60.4%)]. Hydrotherapy

Table 3: Neuromuscular physiotherapy treatment in a neonatal intensive care unit

Neuromuscular physiotherapy	Always or frequently <i>n</i> (%)	Sometimes <i>n</i> (%)	Rarely or never <i>n</i> (%)
Passive range of motion exercise	69 (49.6)	33 (23.7)	37 (26.6)
Therapeutic handling	68 (48.9)	29 (20.8)	42 (30.2)
Multimodal sensory stimulation	43 (30.9)	55 (39.5)	41 (29.5)
Oro-facial stimulation	47 (33.8)	51 (36.7)	41 (29.5)
Kangaroo care	43 (30.9)	44 (31.6)	52 (37.4)
Neonatal massage	20 (14.3)	42 (30.2)	77 (55.4)
Taping	11 (7.9)	37 (26.6)	91 (65.4)
Hydrotherapy	0 (0)	5 (3.6)	134 (96.4)
Scar tissue mobilization	10 (7.1)	49 (35.2)	80 (57.5)
Positioning	101 (72.6)	10 (7.1)	28 (20.1)
Parent education	84 (60.4)	17 (12.2)	38 (27.3)

AMBU: Artificial manual breathing unit; N: Number; %: Percentage

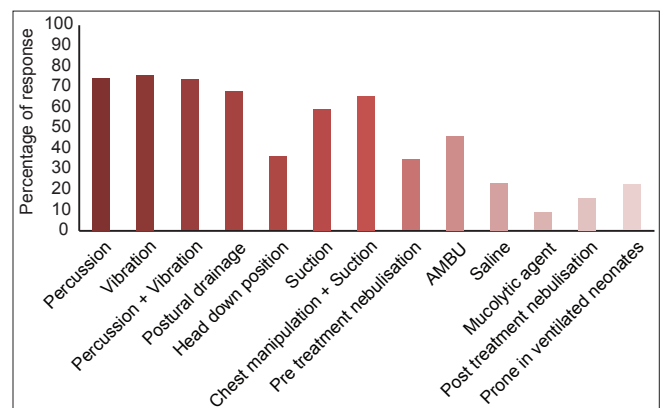


Figure 3: Chest physiotherapy treatment in a neonatal intensive care unit. AMBU-Artificial manual breathing unit

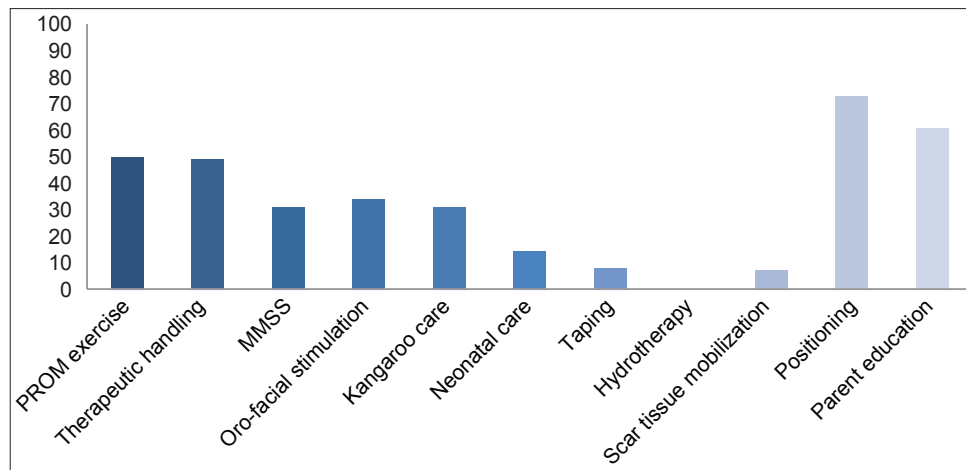


Figure 4: Neuromuscular physiotherapy treatment in a neonatal intensive care unit. PROM-Passive range of motion, MMSS-Multi modal sensory stimulation

was not frequently performed by the physiotherapists in India [$n = 0$].

Discussion

To the best of our knowledge, this is the first study reporting practice patterns of Indian physiotherapists working in NICUs. According to the results of our survey, both chest and neuromuscular physiotherapy were used by physiotherapists in the treatment of neonates. The novel findings of our study are as follows:

- Chest physiotherapy assessment predominantly focused on vital parameters which includes heart rate, respiratory rate, and SpO₂
- The most common technique used in chest physiotherapy treatment was chest manipulation which involves percussion, vibration, postural drainage and suction
- For neuromuscular physiotherapy, positioning, parent education, passive range of motion exercise, and therapeutic handling were predominantly used by physiotherapists.

In our survey 86% of physiotherapists noted their patients’ vital parameters pre- and post treatment, in order to determine the patient’s physiological status. An Indian study on physiotherapy practice patterns in adult ICUs showed that the response rate for vital parameter assessment was 98%.^[18] This suggests that regular vital parameter monitoring is a standard practice pattern among physiotherapists working in neonatal and adult ICUs in India.

According to our survey, 11.5% of physiotherapists were involved in suction during extubation. Our survey showed that 6% of physiotherapists were involved in

ventilator parameter setting, as against 10% in adult ICUs in India and 12% in Europe.^[13,16] Our survey showed that 7% physiotherapists were involved in decision-making during extubation compared to 25% in European ICUs.^[13] The current study showed that 6% physiotherapists were involved in weaning patients off the ventilator, compared to 18% for adult ICU patients in India and 22% in Europe.^[13,16]

Our survey indicated that treatment included chest manipulation, postural drainage, and suction. Percussion is used to augment mobilization of secretions by mechanically dislodging viscous or adherent mucus from the airway.^[19] It was shown that 74% of respondents used percussion as a chest physiotherapy treatment of choice in neonates. A similar study on adult ICUs in India showed that the response rate for percussion was 93.6% whereas it was 98% in Europe and 79% in Australia.^[13,15,18] Vibration is used in conjunction with percussion to help move secretions to the larger airway.^[19] According to our survey, 75% of respondents used vibration for neonates. For adult ICU patients it was 96.2%, 98% in Europe, and 87% in Australia.^[13,15,19]

Postural drainage is an intervention for airway clearance by mobilizing secretions in one or more lung segments to the central airways by placing the patient in various positions so that gravity assists in the drainage process.^[19] As per our survey 67.3% of physiotherapists working with neonates in an ICU used postural drainage. For physiotherapists working with adult ICU patients, the response rate was 95% in India, and 98% in Europe.^[13,16]

According to our survey 58.9% of the physiotherapists used airway suction for neonates. For adult ICU patients the response rate for airway suction was 94.2% in India, 70% in Europe and 82% in Australia.^[13,15,18]

Evidence showed that prone position is used to facilitate extremity flexion toward the midline, limit uncontrolled flailing extremity movement, and encourage more stable vital signs.^[11] According to our survey, 22.3% of respondents used the prone position in ventilated neonates. As per our survey the manual resuscitator was made use of by 46% physiotherapists for both mobilizing secretion and hyperinflation of lungs during treatment.^[16] The importance of nebulization lies in the humidification of inspired gas, the delivery of a medication like bronchodilator or in aiding bronchial hygiene.^[20] Our survey showed that 35% of respondents used pre-treatment nebulization and 16% used post-treatment nebulization. In adult ICUs it was 59.3%.^[18] Normal saline (0.9% NaCl) was used for lavage during suction by 23.0% physiotherapists whereas a mucolytic agent was used by 8.6% to reduce the thickness or viscosity of bronchial secretion.

Most common neuromuscular physiotherapy techniques used by Indian physiotherapists for neonates are positioning, therapeutic handling, passive range of motion exercise, and parent education. Evidence suggests that infants born preterm have immature musculoskeletal systems that are influenced by positioning. Exposure to prolonged atypical positioning in the NICU has been associated with torticollis, positional plagiocephaly, reduced movement quality, and lower extremity malalignment.^[21] Supportive positioning may enhance the development of normal skeletal alignment and provide opportunities for normal movement patterns,^[11,21] like to promote more optimal cranial molding and prevent plagiocephaly and torticollis.^[9,11] In our survey 72.6% respondents used positioning in the NICU as part of neuromuscular physiotherapy.

Parent and caregiver teaching is a primary role of therapists in the NICU. Research on educating parents to interpret the meaning of their infant's behavioral cues and developmental status has been shown to reduce parental stress and improve parental mental health, as well parent-infant bonding.^[9,10,21] In our survey 60.4% respondents were involved with parent education.

A passive range of motion is mainly given to the infant who has congenital restriction of joint mobility, and evidence also suggests that passive range of motion in the extremities has been advocated as an intervention to increase bone mineral density.^[11,21] As per our survey 49.6% respondents used passive range of motion as a treatment technique.

Therapeutic handling improves motor development of infants; 48.9% of physiotherapists used therapeutic handling for neonates. Feeding is a functional activity of the highest priority for infants and caregivers and as such is an integral part of neonatal physiotherapy practice. Evidence suggests that orofacial stimulation hastens feeding progression in neonates and decreases the transition time of oral feeding.^[9,21] Our survey showed that 33.8% of respondents used orofacial stimulation.

Evidence for multimodal sensory stimulation suggests that sensory stimuli may enhance state regulation, speed transition to full nipple feedings, mitigate stressful environmental stimuli and shorten length of hospital stay, whereas tactile stimulation alone may improve short-term growth and reduce length of stay.^[9,21] According to our survey 30.9% of respondents used multimodal sensory stimulation for neonates.

Adjunct interventions like kangaroo care or skin to skin holding showed improvement in physiological stability, fostered infant-parent attachment, and promoted soft flexion of the infant's arms, legs, trunk, and neck. The immediate benefits for self-regulation may include temperature regulation, improved oxygen saturation, and decreased respiratory rate.^[11,22] Kangaroo care was encouraged by 30.9% of physiotherapists, as showed by our survey. Neonatal massage was shown to produce favorable effects to reduce stress levels and improve infant-parent attachment in neonatal ICU environment.^[21] There was a 14.3% response rate for using neonatal massage in our survey.

Taping is mainly used to stabilize the joints or to prevent abnormal movements. We found that a very small percentage of physiotherapists (7.9%) used taping in India. Scar tissue mobilization is employed to relieve surgical scars.^[8] We found that 7.1% physiotherapists provide scar tissue mobilization to relieve surgical scars. Hydrotherapy with a swaddled infant may be a useful adjunct intervention for facilitating self-regulation.^[11] Our survey showed that hydrotherapy is rarely used by Indian physiotherapists in the NICU ($n = 5$).

The limitations of this study include the possibility that participants responded to the survey questionnaire with perceived ideal answers, thereby giving what they considered to be the best or more appropriate answer to each question. This may not reflect the actual practice patterns of physiotherapists. Future research can be focused on more specific assessment and treatment measures used by physiotherapists in the NICUs and to

identify factors such as inter-professional needs and type of specialized care that may influence practice patterns.

Conclusions

Practice patterns of physiotherapists working in NICUs involve both chest physiotherapy as well neuromuscular physiotherapy. Chest physiotherapy assessment has been found to focus mainly on vital parameters which involves an assessment of heart rate, respiratory rate and SpO₂. Treatment is found to predominantly focus on airway clearance techniques like percussion, vibration, postural drainage and airway suction. For neuromuscular physiotherapy strategies preferred by most physiotherapists were parent education, passive range of motion exercise, therapeutic handling and positioning.

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Appendix 1

Practice pattern of physiotherapist in neonatal intensive care unit questionnaire

(This questionnaire is designed to provide information about current physiotherapy practice pattern in Neonatal Intensive Care Units in India.)

(Please answer all the sections and mark wherever appropriate)

Role of chest physiotherapy in Neonatal ICU

- Are you performing chest physiotherapy for neonates in neonatal ICU?
 Yes No

If yes, please answer the following questions.

Chest Physiotherapy Assessment in Neonatal ICU

- Do you assess vital parameters (Heart rate, Respiratory rate, SPO₂) pre and post treatment?

- Always Frequently Sometimes Seldom Never
- Are you involved in setting ventilator parameters?
 - Always Frequently Sometimes Seldom Never
 - Is physiotherapist's opinion taken before weaning a neonate from the mechanical ventilator?
 - Always Frequently Sometimes Seldom Never
 - Do you perform any of the following roles in extubation?
 - i. Suctioning during extubation
 - Always Frequently Sometimes Seldom Never
 - ii. Decision-making in extubation
 - Always Frequently Sometimes Seldom Never
- Chest Physiotherapy Treatment in Neonatal ICU
- How often do you use the following chest physiotherapy techniques?
 - i. Do you prefer percussion only?
 - Always Frequently Sometimes Seldom Never
 - ii. Do you prefer vibration only?
 - Always Frequently Sometimes Seldom Never
 - iii. Do you prefer to give percussion and vibration (chest manipulation) both together?
 - Always Frequently Sometimes Seldom Never
 - Do you perform postural drainage position?
 - Always Frequently Sometimes Seldom Never
 - Do you perform head down postural drainage position in ventilated neonates?
 - Always Frequently Sometimes Seldom Never
 - Do you perform suctioning?
 - Always Frequently Sometimes Seldom Never
 - Do you prefer chest manipulation and suctioning together?
 - Always Frequently Sometimes Seldom Never
 - Do you perform prone position in ventilated neonates?
 - Always Frequently Sometimes Seldom Never
 - Do you use AMBU while performing chest physiotherapy and/suctioning?
 - Always Frequently Sometimes Seldom Never
 - Is mucolytic agent used by you during treatment?
 - Always Frequently Sometimes Seldom Never
 - Is saline used by you during treatment?
 - Always Frequently Sometimes Seldom Never
 - Do you apply nebulizer before the treatment?
 - Always Frequently Sometimes Seldom Never
 - Do you apply nebulizer post treatment?
 - Always Frequently Sometimes Seldom Never
- Neuromuscular Physiotherapy Treatment in Neonatal Intensive Care Unit
- Do you perform neuromuscular physiotherapy techniques on neonates in the neonatal ICU, whenever it is required?
 - Yes No
 - If yes, please answer the following questions.
 - Do you apply/advise positioning for infant in neonatal intensive care unit?
 - Always Frequently Sometimes Seldom Never
 - Do you prefer therapeutic handling in neonatal ICU?
 - Always Frequently Sometimes Seldom Never
 - Is multimodal sensory stimulation used in your neonatal ICU setup?
 - Always Frequently Sometimes Seldom Never
 - Do you give orofacial stimulation in neonates?
 - Always Frequently Sometimes Seldom Never

- Do you perform joint mobilization (passive range of motion) exercises?
 Always Frequently Sometimes Seldom Never
- Do you advice skin to skin holding by parents (kangaroo mother care) for infant?
 Always Frequently Sometimes Seldom Never
- Are any of these adjunct interventions given by you if they are necessary?
 - i. Neonatal massage
 Always Frequently Sometimes Seldom Never
 - ii. Taping
 Always Frequently Sometimes Seldom Never
 - iii. Hydrotherapy
 Always Frequently Sometimes Seldom Never
 - iv. Scar tissue mobilization (surgical scar release)
 Always Frequently Sometimes Seldom Never
- How often do you give education to parents in neonatal intensive care unit?
 Always Frequently Sometimes Seldom Never

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