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Therapists' consensus on an infant massage programme for high-risk infants from resource constrained contexts: a delphi study

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ABSTRACT

Background: *There are various infant massage programmes designed for infants born without complications, but there are limited options available for caregivers with high-risk infants from a resource-constrained context.*

Aim: *This study aimed to develop a caregiver-initiated infant massage programme specific for high-risk infants in a resource-constrained context to facilitate the bonding and attachment process between this dyad.*

Method: *A three-round Delphi study was conducted with purposively selected physiotherapists and occupational therapists with experience in the field of high-risk babies in a resource-constrained context. The design of the round one survey was informed by the available literature, and the subsequent two rounds of surveys were designed based on the prior rounds. Iteration of results was provided prior to the subsequent rounds.*

Results: *Attrition between rounds occurred from an initial 14 participants in round one to 8 participants in round three. Consensus on 19 massage strokes were achieved in addition to considerations for implementation of the programme with this population.*

Conclusion: *The implication of attrition requires further study. Notwithstanding this, an infant massage programme for high-risk infants was developed with the inclusion of considerations for this dyad's social and medical context.*

Key words: Infant massage, Infant massage programme, High-risk infants, Delphi technique, Bonding

INTRODUCTION

The birth of a high-risk infant is frequently the result of birth trauma[1]. It may result from a variety of factors such as delay in seeking medical attention during labour, non-initiation of antenatal care, late admission in pregnancy, as well as facility and management factors including inappropriate response to ruptured membranes, inadequate facilities and lack of transport and ventilator and resuscitation equipment[2]. These infants then subsequently spend a significant amount of time in hospital[3].

High-risk infants often do not respond appropriately to caregiver's cues which may lead to the primary caregiver feeling out of touch with their infant as well as in the infant feeling overwhelmed[4]. The future anticipated special needs that the infant may require, as well as the possibility of losing the medically fragile infant, results in negative emotions in the caregiver[3]. In addition to the underlying causes of the infant being born high-risk, there are also a variety of cultural and environmental factors which inhibit this bonding process such as the death of the infant's parent/s and resource-constrained living conditions[5,6]. Alongside these social factors is that breastfeeding, which is a source of bonding between the dyad[7], is often a challenge with infants who are born high risk. This is due to several risk factors such as the medical condition of the infant, the length of hospitalisation, the distance of the infant from the maternal residence and the type of delivery[8]. These medical and social factors impact on the bonding and attachment process between the dyad. Positive maternal or caregiver touch is essential as this contributes to the infant's feeling of safety, as well as its cognitive and social development[9,10].

The purpose of this study was to establish consensus on infant massage strokes deemed appropriate for high-risk infants, that can be included in a programme initiated by primary caregivers in their context, towards the aim of bonding and attachment in the mother-infant dyad.

LITERATURE REVIEW

A "high-risk infant" is an infant who requires a greater degree of monitoring and care compared to a healthy infant who was born full term[11]. The St Apollinaris high-risk baby policy has been included as a reference of high-risk infants[12]. This policy was developed due to rural district therapists experiencing limitations in their rehabilitation care owing to a lack of resources and policies[13], and so the rehabilitation team at this facility designed a guideline for the management of these clients. Early intervention rehabilitation teams are generally inclusive of occupational therapists (OT), physiotherapists (PT), speech therapists (SLT) and audiologists (Au), with OT and PT focusing on sensory-motor development, SLT concentrating on feeding and early communication and Au focusing on hearing in this context according to the focus of their undergraduate training. High-risk infants present as having one or more of the following[9,10]; born with a low birth weight (i.e. <1800g), preterm birth (i.e. <37 weeks), neonatal encephalopathy resulting in low APGAR scores of 7/10, infants requiring mechanical ventilation for more than 24 hours, infants presenting with seizures post-delivery,

infants presenting with infections (e.g. meningitis, syphilis, CMV, toxoplasmosis, herpes simplex), infants presenting with major morbidities (i.e. chronic lung disease, intraventricular haemorrhage, peri-ventricular leucomalacia) hyperbilirubinemia where the infant requires a blood transfusion, major malformations and abnormal neurological examination at discharge, cardiopulmonary distress, drug withdrawal syndrome requiring monitoring, suspected or proven neonatal sepsis and metabolic abnormalities ie. anaemia, hypoglycemia, hypocalcemia.

In their first year, many infants who are born prematurely or with a low birth weight present with more significant deficits in mental function as well as in neuromusculoskeletal and movement-related dysfunctions compared to children born at an average birth-weight or full term[14]. Approximately 50-70% of children born prematurely present with dysfunctions such as cognitive deficits, learning disabilities, attention problems, behavioral problems, and neuropsychological deficits when they reach school age[15]. These high-risk infants have a lower threshold for sensory input than other infants and in turn experience difficulty with tolerating physical handling and interaction[16]. The infant who has been in the neonatal unit has also been separated from her/his mother and so may have increased levels of dysregulation due to the clinical environment, the loss of opportunity to co-regulate in close physical contact with his/her mother and the limited experience of regular positive touch and nurturing physical contact and care, which will require extra sensitive handling and if this infant has a special need then this will need to be coupled with emotional support[17].

Primary caregivers are also faced with various extraneous factors such as a shortage of financial resources, limited transport and under-resourced hospitals[18]. These social risk factors affect the infants' cognitive and behavioural development[19] and also make it difficult for the sustainability of therapy programmes and medical intervention[13]. Unfortunately, these caregivers are further faced with long queues at hospitals, inefficient administration procedures where patients have to wait lengthy periods for their files and have a perception of disrespectful and "uncaring" attitudes from the staff at these hospitals[18]. Clients often have to be put on long waiting lists for therapy appointments and have poor access to equipment and assistive devices due to a lack of district funding[18].

These social factors (alongside the medical concerns of the infant, difficulty with breastfeeding and the emotional experience of the primary caregiver) hinder the bonding and attachment process. Infant massage therapy, in conjunction with other early intervention programmes, provides the supportive environment needed for attachment and bonding and appropriate stimulation for the infant and is used to optimise the infant's sensory experience which, in turn, improves development and functional outcomes[20]. The initial primary goal of intervention with preterm infants (after ensuring survival) is to prevent further exposure to dangerous environmental stimulation[21]. Additional goals of the intervention are to encourage and create a supportive environment which provides appropriate stimulation for the infant and which mirrors that provided in utero[22]. Other goals include providing support and strategies to the families of the infant so that they can become competent and confident in optimising their child's development and to empower them to be an active participant in their child's recovery programme[23]. It is therefore crucial that to increase caregiver competence and sustainability of the programme that they are taught the stimulation techniques to use with their children[23].

Bonding and attachment are essential developmental and neurobehavioural processes occurring between the mother and infant, starting in pregnancy and increasing in intensity of action in the early weeks of life. The infant develops security by having its psychological needs met through nurturing touch and proximity to the primary caregiver[24,25,26].

Infant massage consists of gentle, slow stroking of each part of the body through tactile stimulation by human hands[27]. This nurturing touch is beneficial in that it contributes to the infant's optimal development both psychologically and physically through stimulation, relaxation, relief and interaction[28] through enhancing the parent-child relationship and strengthening the emotional attachment[29]. Further benefits include improvements in social interaction, emotional functioning and soothing temperaments and sleep organisation in full-term infants[30].

A further benefit in the attachment process is that infant massage creates a purposeful and satisfying interaction between the dyad through a constructive and positive activity[31]. This dedicated infant massage time is also a protected time between the mother and the infant[31] which is relaxing for both amongst the many other demands which she is required to do during the infant's waking times such as nappy changing, bottle or breastfeeding, trying to decipher the different cries, alongside a lack of sleep as well as recovering from the physical birthing process if she is the mother[28]. Participation in infant massage has been shown to decrease depression, anxiety and stress experience in mothers, and improve their perceptions of self-efficiency in caregiving[29,30,32,33].

Early identification and intervention is recommended for all infants and toddlers who are presenting with difficulties as there is much evidence that this intervention has a positive effect on the development of the child throughout her/his life[34]. This is evident in neuroplasticity where young animals' and humans' exposure to sensory information and experiences from their environment results in growth and development as a result of specialisation and maturation of the nervous system[34].

METHODOLOGY

Study design: A three-round Delphi technique (Figure 1 p74) was used in this study with the aim of programme development[35,36] which was based on the available time and funding as well as the consideration of participation fatigue[37,38]. The strength in this method lies in the stability of the group consensus rather than on individuals' opinions[39]. Participants were required to respond on a survey comprising Likert scales[40] via a group facilitation process[38] to provide a holistic overview[41].

The study included the following phases:

- **Literature review (Phase 1):** The initial phase of the study focused on a comprehensive literature review on the high-risk infant, the contextual considerations for this dyad from the resource-constrained context as well as on infant massage to form a basis upon which the initial online survey could be created[38].
- **Delphi Process Round One:** Item Generation (Phase 2): Purposive sampling was used for this Delphi study[42] where specific participants were considered expert based on specific selection criteria[35,43]. Following the recruitment of the sample, the initial survey was uploaded online onto www.surveymonkey.com. The format and content of this initial survey were based upon the first authors' experience, her training as an Infant Massage Instructor through the International Association of Infant Massage (IAIM), and a comprehensive literature review[38,44]. Items for inclusion were based on consideration of the infant massage strokes as taught by the IAIM and the potential effect on the central nervous system and arousal levels of the high risk baby[16,34]. The fast paced,

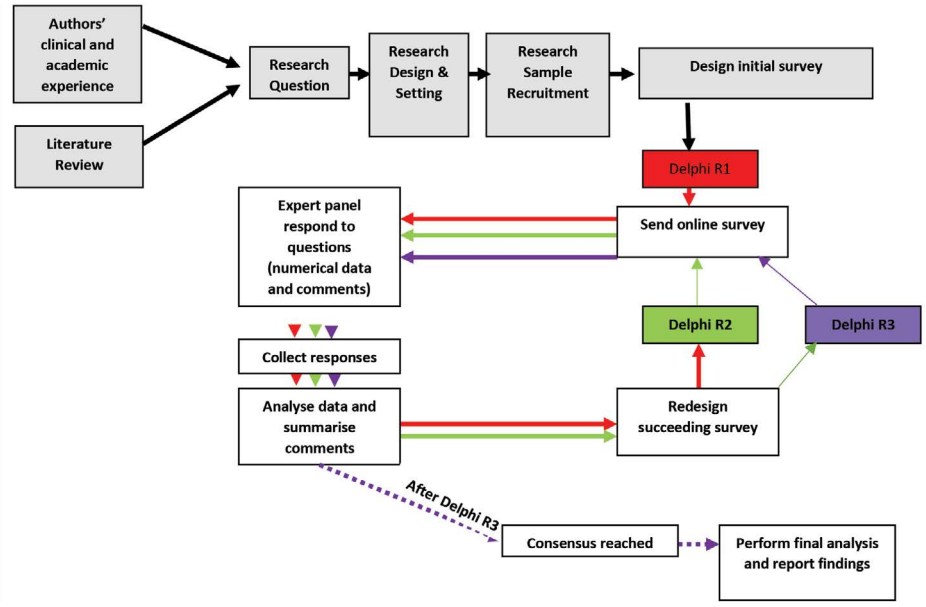

Figure 1: The methodological process based on du Plessis & Human[36] & Skulmoski, Hartman, & Krahn[40]

Table I: Demographics of survey participants in survey one (n=29)

GENDER		AGE				
Male	Female	20-25	26-30	31-35	36-40	40+
0%	100%	17.24%	41.38%	13.79%	3.45%	24.13%
LEVEL OF EDUCATION			PROFESSION			
Bachelor Degree	**Masters Degree**	**Post doctoral Degree**	**Occupational Therapy**		**Physiotherapy**	
72.41%	24.14%	3.44%	82.76%		17.24%	
EXPERIENCE (in years) WORKING WITH HIGH-RISK INFANTS						
<1	1-5	6-10	11-15	16-20	21+	
3.45%	48.28%	17.24%	13.79%	6.90%	6.90%	
LOCATION						
KZN	**GAUTENG**	**WESTERN CAPE**	**FREE STATE**		**MPUMALANGA**	
58.62%	13.79%	13.79%	10.34%		3.45%	

tickly and alerting massage strokes could be disorganising to the arousal levels of the high-risk infant, and as such were excluded. The slower, deeper-pressured, calming and organizing strokes were favoured for inclusion[16,34,45].

- **Delphi Process Round 2:** Consensus on item generation (Phase 3): The list of infant massage techniques formulated from the initial survey and from the additions from the expert participants in round one was pared down in the round two survey[46]. The three-point Likert scales from survey one were collapsed into a two-point scale where "Important" and "Nice to have" were reduced to "Important"; and "Not important" remained as is. Items which were infrequently rated by participants in round one were still included in this survey to gain clarity[37]. Iteration was not provided at this stage as round one and round two aimed to establish consensus on similar items.
- **Delphi Process Round 3:** Consensus (Phase 4): The third round included iteration, where an organised summary of the previous round one and round two results was distributed to the participants so that they were aware of the range of opinions and positioning of the programme based on these opinions[35]. Following this feedback, the participants were provided with the round three survey based on the findings of round two[36]. The two-point Likert scale from round two was maintained with a change in terminology from "Important" to "Agree" and "Not important" to "Disagree". The list of items in survey three was reduced by including only those items that achieved a *priori* consensus threshold of ≥70%[47]. This threshold is concurrent with previous studies which was noted as an acceptable threshold[48,49].
- Development of the Programme (Phase 5): This phase comprised the final collation and development of the infant massage programme and was based on the consensus obtained in Round Three.

Sampling and sampling techniques: Purposive sampling was employed in the selection of experts for this study based on specific selection criteria[36,43]. This approach was used to ensure that a homogenous sample was maintained for this study which would yield satisfactory results even though the sample size is smaller[40]. The following selection criteria were used in this sampling approach which was based on the qualities of the expert panel rather than on the sample size[37]. The selection criteria based on Akins and colleagues[42] and Bruce and colleagues[43] included, (i) having a bachelor degree in occupational therapy or physiotherapy, (ii) knowledge and practical engagement in intervention with high-risk infants for a minimum of one year, (iii) knowledge of and practical engagement in community-based clinics or rural district hospitals for a minimum of one year, (iv) capacity and willingness to participate in and contribute to the development of an infant massage programme for high-risk infants from resource-constrained contexts, (v) good written communication skills in English and (vi) adequate computer literacy and computer skills[38]. Participants who did not meet the selection criteria were excluded from the study. To maintain the rigour of the results from the Delphi technique, this study aimed for a response rate of 70% throughout the study[38]. Therefore, for this study to obtain, what was considered to be a small sample size of n=15 respondents, the study should have begun with n=23 participants[43]. This selection of a homogenous small sample size was based on the theory that there are marginal benefits of a larger sample size above a certain threshold as a large sample size may increase the reduction in group error, but the management of the data analysis and Delphi technique may become cumbersome[40].

Demographic Profile of Participants

A total of 29 participants began the survey and completed the demographic section (Table I p74). Of these 14 participants com-

Table II Infant massage strokes included in the consensus programme

SURVEY ONE		SURVEY TWO		SURVEY THREE		THERAPIST'S INSTRUCTIONS FOR STROKES
Agreed %	Disagreed%	Agreed %	Disagreed %	Agreed %	Disagreed %	
LOWER LIMBS						
*	75.00	25.00	100.00	0		Complete all strokes on one limb before progressing to the next limb
*	75.00	25.00	100.00	0		Apply deep pressure around the infant's ankle by circulating the ankle with your thumb
100.00	0	100.00	0	100.00	0	Cup the infant's leg in your hand for 5 seconds and tell the infant to relax, use resting hands and additional deep pressure
94.12	5.88	91.67	8.33	100.00	0	Cup the infant's foot in your hand for 5 seconds and tell the infant to relax, using deep pressure and avoiding light touch
94.12	5.88	100.00	0	100.00	0	Using adapted Indian milking, place one of your hands on the infant's hip joint. Using your other hand cup the leg and using pressure move your hand from the hip to the knee and then the knee to the ankle
*	66.67	33.33	44.44	55.56		Using hug and glide, start at the upper thigh with your hand turning opposite to each other whilst grasping the thigh. Twist each hand as you move from the thigh to the ankle whilst applying deep pressure.
*	66.67	33.33	62.50	37.50		Using adapted Swedish milking, place one of your hands on the baby's ankle joint. Using your other hand cup the leg and using pressure move your hand from the ankle to the knee and then the knee to the hip
*	83.33	16.67	100.00	0		Touch each toe separately using deep pressure
STOMACH						
93.33	6.67	72.73	27.27	100.00	0	Use one of your hands and apply deep pressure on the stomach
*						
	90.91	9.09	100.00	0		Place your right hand below the infant's naval. Use a sweeping motion with deep pressure in a clockwise direction below this position.
86.67	13.33	72.73	27.27	100.00	0	Use a circular sweeping motion of one hand to sweep from the left hip to the right hip below the infant's naval
*	81.82	18.18	100.00	0		Using deep pressure move up from the right hip, across from right to left and then down
CHEST						
86.67	13.33	72.73	27.27	88.89	11.11	Using both of your hands, do resting hands on the infant's chest
93.33	6.67	81.82	18.18	88.89	11.11	Using both hands, draw the shape of a book on the infant's chest. This will involve both hands going up the sternum, outwards to the left/right, down the lateral aspect of the chest and then back to the medial position.
*	63.64	36.36	55.56	44.44		Using butterfly, place both hands at the side of the infant's ribs, slide your hand diagonally across the infant's chest to the opposite shoulder and then back to the starting position. Repeat with the other hand.
UPPER LIMBS						
*	72.73	27.27	100.00	0		Complete all strokes on one limb before progressing to the next limb
100.00	0	100.00	0	100.00	0	Cup the infant's arm in your hand for 5 seconds and tell the infant to relax, using resting hands
93.33	6.67	100.00	0	100.00	0	Using adapted Indian milking, place one of your hands on the infant's shoulder joint. Using your other hand cup the arm and using pressure move your hand from your shoulder to the wrist. Avoid pulling the arm.
*	63.64	36.36	66.67	33.33		Using hug and glide, start at the shoulder with your hands turning opposite to each other whilst grasping the arm. Twist each hand as you move from the shoulder to the wrist whilst applying deep pressure.
86.66	13.33	90.91	9.09	100.00	0	Try and open the infant's hand gently with your thumb and press your thumb into the palm.
*	90.91	9.09	100.00	0		Using your fingers roll each of the infant's fingers separately
FACE						
71.43	28.57	72.73	27.27	87.50	12.50	Apply deep pressure around the perimeter of the infant's face following the facial contours using your thumbs, your left thumb on the left side while your right thumb concurrently moves on the right side
*	81.82	18.18	87.50	12.50		Using your fingertip, apply small circles around the infant's jaw
BACK						
100.00	0	100.00	0	100.00	0	Using one hand, apply resting hands on the infant's back for 5 seconds
100.00	0	100.00	0	100.00	0	Using both of your hands apply deep pressure as your comb down the lateral sides of the spine, from the top to the bottom of the spine, the left hand on the left side and the right hand on the right side

*** Asterisk marked strokes were not questioned in survey one**

Table III Considerations for implementation of the infant massage programme with high risk infants from resource constrained contexts

SURVEY ONE		SURVEY TWO		SURVEY THREE		THERAPIST'S INSTRUCTIONS FOR STROKES
Agreed %	Disagreed%	Agreed %	Disagreed %	Agreed %	Disagreed %	
DURATION						
Average calculated 10 minutes		92.31	7.69	Consensus reached		Duration of massage routine: average of 10 minutes
*				87.50	12.50	Ability of this massage programme to be completed in the limit of 10 minutes
CONCLUSION CONSIDERATIONS						
100	0	81.82	18.18	100.00	0	Integration: use resting hands on each part of the body that has been massaged and name the areas for the infant.
100	0	81.82	18.18	100.00	0	Say thank you to the infant for accepting the massage
92.85	7.14	90.91	9.09	100.00	0	Dressing the infant
*	90.91	9.09	100.00	0		Sharing a cuddle with the infant
STROKE REPETITION						
Average calculated: 3		90.91	9.09	100.00	0	Include one repetition of each stroke. However, after one week of massage this can be increased to two repetitions with a subsequent increase to three repetitions in the following week.
RECOMMENDED OILS/CREAMS						
28.57	71.43	Excluded				Cold pressed sunflower oil
21.43	78.57	Excluded				Sunflower oil
28.57	71.43	Excluded				Olive oil
78.57	21.43	81.81	18.18	87.50	12.50	Non-perfumed baby cream
*	54.55	45.45	50.00	50.00	Coconut oil	
*	27.27	72.73	Excluded	Vaseline		
*	*	87.50	12.50	Aqueous cream		
SENSORY INPUT						
85.72	14.29	90.91	9.09	100.00	0	Primary caregiver singing softly and quietly
100	0	100.00	0	100.00	0	Primary caregiver talking to the infant
50	50	18.18	81.82	Excluded		Music in the background
100	0	81.82	18.18	100.00	0	Eye contact
*		100.00	0	100.00	0	Skin to skin contact
*		81.82	18.18	100.00	0	Facial expressions
TRAINING OF THE PROGRAMME						
71.43	28.58	72.73	27.27	Consensus reached		Ability of the massage programme, alongside a handout, to be trained to a primary caregiver from this context in one 30 minute session by an Occupational Therapist or Physiotherapist
POSITIONING OF THE PRIMARY CAREGIVER						
78.57	21.43	90.91	9.09	100.00	0	Caregiver seated on the floor on a blanket in long sitting with infant positioned with it's head by the caregivers knees and legs up against the caregivers stomach
71.43	28.58	81.82	18.18	100.00	0	Caregiver seated on a bed in long sitting with infant positioned with it's head by the caregiver's knees and legs up against the caregiver's stomach
85.71	14.29	72.73	27.27	100.00	0	Towel/blanket rolled around perimeter of infant for cradling support
92.85	7.14	100.00	0	100.00	0	Lower limbs of primary caregiver supporting edge of infant for cradling support
78.57	21.43	63.64	36.36	62.50	37.50	Caregiver seated on the floor in long sitting with infant lying on caregiver's legs in supine
ADVANTAGEOUS TIME OF DAY FOR IMPLEMENTATION OF THIS MASSAGE PROGRAMME AT HOME BY THE PRIMARY CAREGIVER						
64.29	35.71	27.27	72.73	Excluded		Following the first nappy change in the morning
92.86	7.14	72.73	27.27	100.00	0	Before the infant's bed time

57.14	42.86	36.36	63.64	62.50	37.50	Three times a day if possible	
*	81.82	18.18	100.00	0		After bath time	
*	100.00	0	100.00	0		When the baby is in a quiet alert state	
MEDICAL CONSIDERATIONS							
*		100.00	0	100	0	Deemed medically stable as determined by the medical team	
*		15.38	84.62	100	0	Full term gestational age	
*		90.00	10.00			The infant's vital signs (blood pressure, pulse, temperature, respiration) must be stable, as deemed by the medical doctor	
*		61.54	38.46	Explained under "medically stable and vital signs"		Is on ventilator support	
*		46.15	53.85	Explained under "medically stable and vital signs"		Is not requiring oxygen	

*** Asterisk marked strokes were not questioned in this relevant survey**

pleted the round one survey, 13 completed round two, and 8 participants completed round three.

Validity and Reliability: The authors were aware of the concepts of validity and reliability during the data collection and data analysis processes. Validity was maintained through the appraisal and piloting of the online surveys prior to implementation of the surveys by two expert professionals who were not participants in the study[37, 38] as well as the inclusion of selection criteria which meant the participants were representative of the field of expertise[50] and their consensus contributed towards inter-rater reliability. Concurrent validity was increased through the inclusion of three successive rounds[31]. Reliability was maintained as the data from the comments in each survey guided the subsequent surveys, and so the tool was based on the responses of the participants and not on that of the authors.

Data analysis: Descriptive statistics assisted in determining the level of consensus by a summary of the data via central tendencies and standard deviations[38]. The mean assisted in establishing the group opinion and the standard deviation assisted in assessing the level of disagreement on each item[51]. The qualitative responses in the open-ended 'comments' section were analysed using content analysis by grouping similar items together which had several different terms but which appeared to be the same issue to provide one universal description[38]. The content analysis and the statistical summaries formed the quantitative basis for developing the online survey for subsequent rounds[52].

Ethical considerations: Ethical clearance was obtained from the Humanities and Social Sciences Research Ethics Committee at the University of KwaZulu-Natal (ethical clearance number HSS/0533/017M). Participants volunteered participation via an informed consent document and were free to withdraw without prejudice. Confidentiality was ensured by the participants being given an option to include their email address for further correspondence if they chose to. Responses without this contact information were included and remained anonymous.

RESULTS

Delphi Round One Survey (n=14): Consensus was obtained on all massage strokes, which were included in the initial survey and obtained from the literature review conducted by the authors in phase one of the study[38]. Participants who commented noted that specific strokes should be included in the programme. One participant indicated the following when commenting on the lower limbs "*hug and glide provides much more proprioceptive input*" and which was confirmed by another participant who also noted "*hug and glide (squeeze and twist)*". This observation was also noted by a third participant who recommended the inclusion of "*deep compression along long bones - from hip to knee and knee to heel. Calming, well tolerated in supine and good prep for therapeutic activities*" which has similar characteristics to the hug and glide massage stroke. Another participant suggested the inclusion of "*swedish milking*". A further recommendation was "*touching each toe separately*". When commenting on the stomach, participants recommended "*circular sweeping motion across the stomach in a clocking motion to mimic bowel movements*" and "*clockwise circular sweep*" as well as "*along large colon- up from right hip, across from right to left and then down to aid digestion and soothe cramps*".

It was recommended by one participant that "*butterfly*" be included as a massage stroke for the chest which is a technique which stimulates and deepens breathing in the infant[28]. For the upper limbs, two participants indicated that "*hug and glide*" should be included, one participant recommended the inclusion of "*swedish milking*" and two participants recommended "*finger rolling*" or "*rolling each finger separately*". One participant suggested "*small circles around the jaw with fingertips*" as well as a further "*maybe 'relax the jaw' or jaw clenching*".

It was noted in this survey that the average recommended duration for an infant massage routine is 10 minutes as well as the repetition of each stroke three times. There was consensus obtained on excluding certain oils/creams as recommendations for this population and these included "*cold pressed sunflower oil*", "*sunflower oil*" and "*olive oil*".

Delphi Round Two Survey (n=13): All strokes which had obtained consensus in round one were confirmed with a subsequent consensus in round two. There was also a further consensus on six additional strokes added in round two which were based on the comments gathered in round one. However, there was a non-consensus noted for the added sub-items "*hug and glide*" and "*swedish milking*" for the lower limbs as well as "*butterfly*" for the chest and "*hug and glide*" for the upper limbs.

One of the participants recommended "*a cuddle*" as a conclusion consideration in survey

one and this was confirmed in survey two by obtaining consensus. Participants noted in survey one that further beneficial sensory input could include "*encourage skin to skin*". The recommendation was also to include "*facial expressions*" which were confirmed with a result of consensus in survey two. Further additions included that participants recommended the inclusion of "*vaseline*" and "*coconut oil*" for use during the massage routine. The use of "*coconut oil*" did not obtain consensus and "*vaseline*" achieved consensus of not being important.

It was also recommended by participants in survey one that this routine be implemented "*after bath time when cream should be applied*" and "*I would suggest after bath time*", "*when baby is happy and calm*" and "*so long as baby is calm-alert state*" as well as "*when the baby is in the quiet alert state*". These were confirmed by consensus in survey two.

Delphi Round Three Survey (n=8): This survey confirmed the consensus strokes from the round one and round two surveys. However, there was a further non-consensus on the four sub-items discussed above in round two on "*hug and glide*" and "*swedish milking*" for the lower limbs as well as "*butterfly*" for the chest and "*hug and glide*" for the upper limbs. It was confirmed in this survey that this programme would be able to be completed in the recommended limit of 10 minutes. Participants suggested that should the primary caregiver be unable to complete the massage routines on the whole body in 10 minutes then they should, "*complete one area, and end in the above-mentioned routine (conclusion considerations). The next session start at a missed area or only do resting hands on a previously completed area*", "*can complete routine later*", "*at the next massage, the caregiver could start where they left off*" and confirmed with "*start the next time with the body parts she did not do*".

The recommendation of completing the routine three times a day if possible did not obtain a final consensus in survey three with participants stating; "*build-up to 3x per day*" and "*this will give mothers a number to aim for, which may get in the way, rather than promoting bonding in this dyad where separation post-birth has been necessary due to medical reasons*". A further non-consensus on the recommendation of the use of "*coconut oil*" was noted in survey three, as in survey two. This is confirmed with comments from the participants of "*new research showing coconut oil is not as good as previously thought*", "*I don't think this is easily accessible in this context*", "*may not be easily accessible*" and "*may be costly for population group*". "*Vaseline*", a commercially produced mineral oil, was excluded in survey three based on its consensus of not being relevant in survey two. However, one participant did note in survey two that "*although Vaseline may not be the best choice- it is most commonly used by caregivers in resource constrained settings*". The inclusion of "*aqueous cream*" as a recommendation obtained consensus. Non-consensus was also noted in the final positioning sub-item.

DISCUSSION AND IMPLICATIONS

Massage strokes for high-risk infants

High-risk infants have a lower threshold for sensory input. They may experience difficulty tolerating tactile input from handling and interaction[16] which is an imbalance between discriminative interpretation and the need for a defense response[53]. The use of deep touch pressure and the resultant activation of the dorsal column medial lemniscal system (DCML) blocks the protective response to touch and so, in turn, results in decreased levels of distractibility[53] and pain relief[54]. Therefore, the massage stroke must have pressure to be able to gain these benefits of DCML activation as light touch, activation of the anterolateral system, can be aversive for the infant and result in protective responses and strong emotional reactions[53].

Resting hands is a simple holding technique which activates the DCML system and is especially beneficial with a medically fragile, premature or colicky baby[4]. This is done by warming of the hands, placing them on the infant and then letting the hands go heavy and warm[4]. Due to the nature of this technique, it helps the dyad to become more conscious of the experience of touch[4] and improve the infant's body awareness of these areas through the activation of the DCML system[53]. This technique will be implemented in a massage stroke with the lower limbs, upper limbs, chest and the back. Deep pressure will further be added to the ankles by circulating the ankle with the caregiver's thumb as this will further stimulate growth and development and joint flexibility[28]. This deep pressure will also be added to the infant's toes by touching each toe separately. However, caution must be given when massaging the feet as commented by a participant that "*These babies often have quite tender feet from all the prodding and poking in NICU*". The infant's fingers may also not have been mobilised very much in the unit and so the individual will be required to try and open the infant's hand gently with their thumb and press into the palm as well as roll each of the fingers. These strokes are beneficial as they are "*very useful to prevent contractures and increase input into palm*".

These high risk infants who have been in the neonatal unit or in kangaroo mother care have also not been mobilised very often or picked up unless it was medically necessary. Indian milking of the upper and lower limbs is included in the programme as it relaxes the limb and encourages blood flow to the infant's feet or hands[28] and so encourages normal movement patterns.

The high-risk infant may also have experienced gastro-intestinal concerns due to the nature of their medical condition and so may be presenting with constipation. Through massage of the abdomen area of the infant, the gas and intestinal matter is moved toward the bowel as these strokes assist in mimicking the movement of the bowel and this will assist with alleviating gas and discomfort[4]. Three strokes will be done on the stomach area which include a sweeping motion with deep pressure in a clockwise direction, circular sweeping motion from hip to hip and deep pressure movement across the bowels.

High-risk infants may have been overstimulated on their face during their stay in the unit in the anterolateral system, as commented; "*babies who have had NGTs hate their faces being touched or heads held firmly - beware of fear response*" and "*babies in the NICU faces are usually overstimulated due to be oscillated, ventilated, tube feeding through the nose. Also the regular suction and wiping of the face*". This may also be as a result of the high receptor density on the face which is very sensitive to touch and so can result in overstimulation[54]. However, it is still recommended that these two strokes are conducted on the face where deep pressure is applied around the perimeter of the infant's face as well as applying small circles around the infant's jaw. These strokes are beneficial in that they alleviate tension in the jaw, support chewing and speech[28].

Touch of the infant's back activates a larger receptor field where the receptor density is low and so is less sensitive to touch[54] and thus has a calming effect for the infant. The massage stroke to be done on the back will require deep pressure combing down the lateral sides of the spine from superior to posterior. The added benefit of this stroke is that it will also stimulate body awareness in the infants as their backs are not an area that is frequently touched during their daily routine[28].

The study highlighted a non-consensus on the inclusion of "*hug and glide*" for the upper and lower limbs where the stroke involves. This massage stroke motion involves a twisting motion of the limb which would activate the anterolateral system and so result in the dysregulating effects of activating this system with this sensitive infant[54]. Therefore, these strokes will be excluded from the programme to avoid this aversive response.

"*Swedish milking*" of the lower limbs was also a stroke that did not obtain consensus in this study. The purpose of this stroke is to aid circulation from the feet and back towards the heart[4] and it is for this purpose that it will be included in the programme.

The final non-consensus was regarding the "butterfly" technique on the chest. This technique is beneficial for the infant in that it stimulates and deepens breathing[28] which is beneficial for this high-risk infant who often has a history of breathing difficulties due to preterm birth or low birth weight and so it will be included in the programme.

Inclusion of other sensory stimulation during massage routine

Consensus from this study highlighted the inclusion of contingent tactile stimulation, which is massage conducted alone or in conjunction with visual and/or auditory stimulation[55]. The participants agreed on the inclusion of eye contact between the dyad, skin to skin contact, as well as the primary caregiver singing softly and quietly and talking to the infant whilst showing facial expressions[27]. The benefits of these are that they assist in increasing vocalisations, smiles, eye contact and approach behaviours in the infant who is possibly experiencing difficulty with responding appropriately to the mother due to the nature of her/his medical condition[56]. A further benefit is that by the primary caregiver responding to different facial expressions and vocalisations from the infant it will further assist the infant in becoming familiar with the caregiver's tone of voice, physical prompts, and cues, thus supporting bonding and integration of a variety of social-interactive experience[23]. The infant also uses the caregiver's emotional expressions to help make sense of their environment[23]. The inclusion of skin to skin contact is beneficial in helping the infant to remain calm and relaxed, which is in addition to the calming effect of the massage routine[47].

Duration of massage routine

A consensus was not obtained in this study about the recommendation of repeating the massage routine three times a day. However, with the support from Field's protocol[57] as well from a participant's comment of *build up to 3x per day* it is recommended that this routine be conducted up to three times a day if the dyads are comfortable with this. This study also obtained consensus on the inclusion of infant massage before the infant's bed time or after bath time as this will help with obtaining the benefits of massage on sleep[58].

However, whilst keeping these recommendations as a priority it is further considered that primary caregivers initiate that infant massage routine when both they and the infant are in a state which is accepting and ready for the process as it is remembered that this dyad is also faced with many other responsibilities and contextual factors in these early days.

The massage routine should be concluded by integrating the infant's body by using resting hands on each part of the body that has been massaged and naming the areas. This should be in addition to saying thank you to the infant for accepting the massage and dressing the infant. Finally, the dyad should share a cuddle as this is a technique which will also aid in the bonding and attachment process through nurturing touch[59] and is a means of expressing emotions without words[45].

Use of oils/creams

It is recommended that the massage routine is initiated with the use of oils/creams; such as non-perfumed baby cream or aqueous cream. However, it is essential to note that the substance used is non-occlusive and does not block the skin pores but allows the skin to breathe[60]. The substance should also be safe and suit the baby's delicate skin, and the ingredients of the formula should have been tested for their potential to cause contact sensitivity[61]. The use of coconut oil with this population did not obtain consensus on its inclusion or exclusion. However, research has shown the positive effects of preterm weight gain with the use of coconut oil over mineral oils[61] due to the transcutaneous absorption of the vegetable oil through the thinner and more vascular skin of the infant[62]. Although there are clear benefits of using this oil it "*may not be easily accessible*" and "*may be costly*" for this population in their resource-constrained context. It must also be noted that certain cosmetic products and baby creams such as Vaseline and Johnsons baby products are also sensitising agents as they contain formaldehyde and may contribute to allergic contact dermatitis (ACD) and so should be avoided when conducting infant massage[63].

LIMITATIONS

There was participant attrition between subsequent Delphi rounds in this study. The potential reasons for this attrition from the initial group of n=29 participants; could be attributed to, (i) therapists not presenting with an interest in this area of practice once they started the survey[36], (ii) having insufficient current knowledge of the topic[36], and (iii) insufficient time available to them to be part of the research process[36]. The decrease observed in the response rate over the three rounds may have been due to the participants being busy and experiencing difficulty to participate fully[40]. Previous studies have noted that as the number of rounds increase and the effort required by the participants, that a drop in the response rate is often observed[38,39,40,42,48,48-50]. There is limited evidence of reliability when using the Delphi technique[38] and the primary author was unable to test and retest the outcomes of the surveys with a different sample due to time constraints.

CONCLUSION

A three-round Delphi technique completed by physiotherapists and occupational therapists guided the development and consensus on an infant massage programme for high-risk infants from resource-constrained contexts. It is recommended that a user-friendly format is designed which can be provided to caregivers from therapists during their intervention session as a home programme. This programme and its relevant considerations are available and accessible for therapists to use to train these primary caregivers from this context, to implement these massage techniques with their high-risk infants.

A collaborative goal of the intervention of physiotherapists and occupational therapists working with high-risk infants is to encourage and create a supportive environment which provides appropriate stimulation for the infant and which mirrors that provided in utero[22]. As therapists, the focus needs to be on including strategies in the early intervention rehabilitation programme that optimises the infant's sensory experience and thus improve developmental and functional outcomes[20] but one that is still appropriate and accessible for this population. The aim of this research study was achieved in

providing an infant massage guideline that can be utilised and accessed in this setting to achieve that collaborative goal.

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AUTHOR CONTRIBUTIONS

Lauren Michelle Perks completed this study as part of the requirements towards a Masters degree and was responsible for the conceptualisation, data collection, analysis and drafting of the first version of the manuscript. Gina Rencken & Pragashnie Govender were supervisors of the study and assisted in conceptualisation of the study, guidance on the choice of methodology as well as for critical inputs throughout the drafting of the manuscript. GR & PG were responsible for the revisions through the review process.

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