

# Development of an Evidence-Based Guideline for Preterm Infant Massage by Parents

## Abstract

Despite the increase in the survival rate of preterm and low birth weight (LBW) infants through the provision of high-technology neonatal care, the potential mortality and morbidity faced by these infants remain a concern. The morbidity and mortality rates of infants are inversely proportional to their birth weight and gestational age. Therefore, promoting infant weight gain reduces preterm infant morbidity. Clinical trials have suggested that infant massage provided by parents or therapists can promote weight gain, increase vagal activity and gastric motility in preterm LBW infants. No adverse reaction of infant massage is reported. As such, the application of an evidence-based guideline to clinical practice can help healthcare professionals provide high-quality care to preterm infants and thus produce better health outcomes. This paper presents the development of an evidence-based guideline for preterm infant massage. The challenges involved in implementing this evidence-based guideline are identified, and strategies for tackling these challenges are discussed. This guideline provides a model of care in the neonatal clinical setting.

**Keywords:** Gastric Motility; Infant Massage; Preterm Infant; Weight Gain; Vagal Activity

## Review Article

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## Introduction

Approximately 20.6 million preterm infants with LBW (less than 2,500 g) are born every year worldwide [1]. Preterm infant birth accounted for 7.6% of the total number of births in Hong Kong in 2004 [2]. The survival rate of preterm infants with LBW has been increasing since the 1980s because of the advancement in high-technology neonatal care [3]. Studies have reported that preterm infants are at high risk of suffering from various kinds of developmental impairment [3,4]. Among these impairments, gastrointestinal dysmotility, a condition that commonly affects preterm infants, is particularly significant [5]. Underdeveloped gastrointestinal function and immature peristaltic activity result in poor weight gain and prolonged parenteral nutrition requirement [5]. Literature has suggested that infant massage can promote weight gain, increase gastric motility and vagal activity in preterm infants [6]. Vagal activity refers to the activity of the vagus nerve. Increases in vagal activity and gastric motility are significantly related to weight gain as observed in infants who receive infant massages [6]. According to Field et al., [7] increased vagal activity may promote growth and development in infants. Vagal stimulation in preterm infants through a moderate-pressure massage may enhance gastric motility and increase the release of food absorption hormones, which contribute to weight gain. In addition, infant massage performed by parents is safe and feasible; it is also reported to provide parents an increased level of satisfaction [8]. However, clinical protocols on infant massage in Neonatal Intensive Care Units (NICUs) are limited.

This paper presents the development of an evidence-based guideline for infant massage by parents. The aim of the guideline is to enhance gastric motility and weight gain among preterm

infants and improve parental satisfaction in the NICU setting. The proposed guideline includes a wide range of safety, health, and satisfaction measures in the NICU setting. First, the paper provides an overview of the incidence of preterm birth and affirms the health needs of infants. Second, the health benefits of developing an evidence-based guideline are identified. Third, the challenges involved in implementing this evidence-based protocol in clinical settings are presented, and recommendations for overcoming these challenges are presented.

## Review of Relevant Evidence on Clinical Protocols on Infant Massage

To obtain evidence, a systematic search for relevant studies was performed on the following databases: Ovid MEDLINE, CINAHL, Proquest, Scencedirect, Cochrane Library, and PubMed. The search used a combination of keywords related to preterm infant (preterm infant, low birth weight), intervention (infant massage, massage), and outcome measures (weight gain, vagal activity, gastric motility). The studies identified for inclusion were narrowed down to full text articles written in English. Studies that compared the effectiveness of different massage oils were excluded; this was because massage oil brought out concerns, such as allergic reactions and a change of triglyceride and fatty acid profile [9,10]. A total of 12 articles were selected by two independent reviewers (Figure 1) [3,6,8,11-19]. The Jadad scale [20] was utilized to assess the quality of the randomized controlled trial (RCT) studies in this paper. The total score of the instrument is 5. A higher score indicates less bias. A score equal to or less than 2 indicates low quality, whereas a score equal to or higher than 3 indicates high quality. All RCTs selected in this study scored 3 or above on the Jadad scale (Table 1).

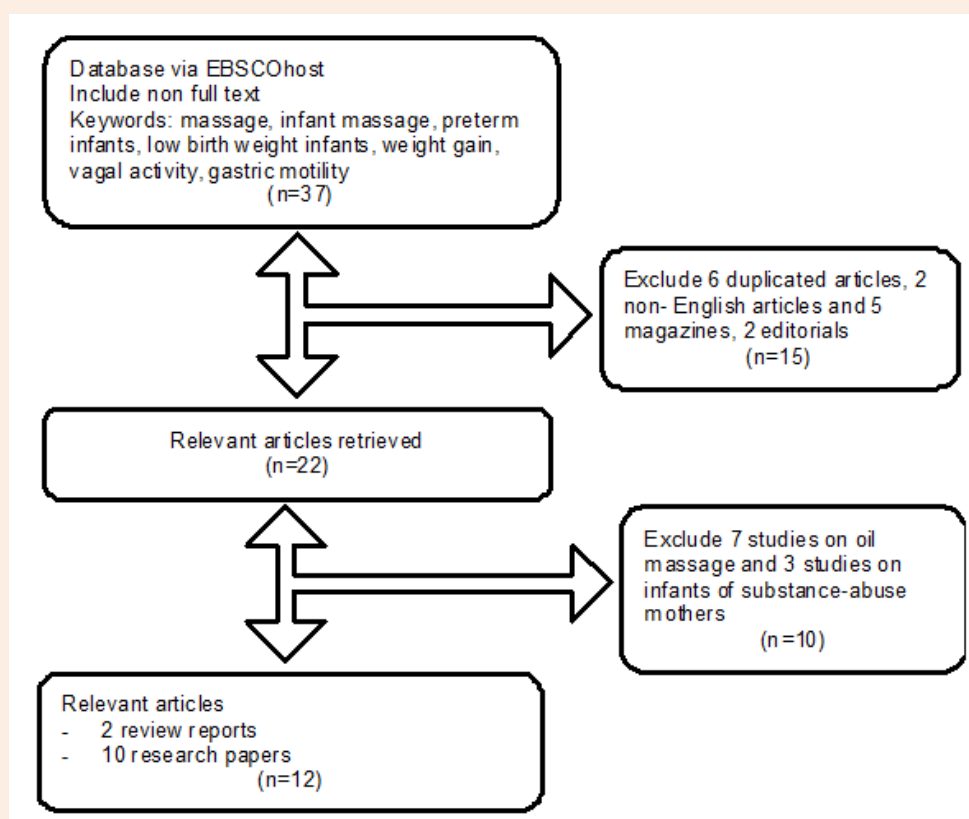


Figure 1: Literature search process.

### Massage Methods and Delivery Modes

Massage therapy in 10 out of the 12 articles consists of a 15 min massage session, which includes tactile stimulation with moderate pressure on the limbs and trunk and kinesthetic stimulation on the four limbs [3,6,11-15,17-19]. The other two massage methods are a 20 min touch procedure adopted by Livingston et al. [8] and acupressure and meridian massage adopted by Chen et al. [16].

Previous studies indicate that infant massage can be administered to preterm infants by qualified professionals, parents, and qualified traditional Chinese medicine (TCM) practitioners (i.e., acupressure and meridian massage). All trials wherein the massage was provided by qualified therapists showed a positive result; that is, the massage group gained more weight than the control and/or sham group [3,6,11-14].

Three of the selected studies were conducted to examine the feasibility of parents performing the massage on their preterm infants [8,15,19]. The preterm infants were medically stable and had a minimal gestational age of 32 weeks, weight greater than 1,000 g, and intact skin. The results revealed that the infants massaged by parents gained more weight than those in the control group. Ferber et al. [15] conducted an RCT where parents were

trained by massage therapists; their performance and compliance with the massage protocol were monitored by massage therapists to ensure a uniform administration of intervention. The control group showed a significantly smaller weight gain (20.5 g/day) than the massage group managed by health professionals (28.3 g/day) and the massage group managed by mothers (26.3 g/day). No significant difference in weight gain was observed between the latter two groups. Livingston et al. [8] reported that implementing a massage program performed by parents in acute NICU is feasible for medically fragile infants. Furthermore, all parents in the massage group reported a high level of satisfaction during the 7-day massage period.

Acupressure and meridian massage are commonly employed by TCM practitioners to maintain good health. A RCT conducted in Taiwan reported a significant weight gain of 39 g/day in the infant massage group in the second week of intervention but not in the first week. The control group exhibited a weight gain of 31 g/day [16]. Thus, a longer massage period results in a more significant weight gain. Nevertheless, concerns regarding the cost effectiveness and feasibility of application were raised because acupressure and meridian massage need to be administered by qualified TCM practitioners.

**Table 1:** Selected studies on infant massage.

Selected Study	Study design / *Jadad score <sup>20</sup>	Study Population	Intervention	Frequency	Duration	Major Findings in Massage Group
Chen et al. (2008)	RCT / 4	Preterm and low birth weight infant (N=40)	Acupressure/meridian moderate pressure massage	15 min. per session, 3 times a day.	14 days	<ul style="list-style-type: none"> <li>• No weight gain over the 1st week, but higher weight gain in 2nd week of study</li> </ul>
Diego et al. (2005)	RCT / 5	Medically stable preterm neonates (N=48)	Moderate pressure massage therapy programme	15min session, 3 times a day.	5 days	<ul style="list-style-type: none"> <li>• Increased weight gain</li> <li>• Increased Vagal activity</li> </ul>
Diego et al., (2007)	RCT / 4	Medically stable preterm neonates (N=80)	Moderate pressure massage therapy	15min session, 3 times a day.	5 days	<ul style="list-style-type: none"> <li>• Increased weight gain</li> <li>• Increased Vagal activity</li> </ul>
Ferber et al. (2002)	RCT / 3	Healthy preterm infants (N=51)	Massage therapy programme	15-min session, 3 times a day	10 days	<ul style="list-style-type: none"> <li>• More Weight gain</li> <li>• No difference in calorie intake</li> </ul>
Field et al. (2006)	RCT / 3	Medically stable preterm infants (N=68)	Moderate pressure massage therapy programme	15-min session 3 times a day	5 days	<ul style="list-style-type: none"> <li>• More weight gain</li> <li>• Less stressed, more relaxed behaviour and higher vagal tone</li> </ul>
Field et al. (2008)	RCT / 4	Preterm infants in nursery (N=45)	Massage therapy programme	15-min session, 3 times a day	5 days	<ul style="list-style-type: none"> <li>• Vagal activity increased significantly</li> <li>• Greater increase in weight gain/insulin/IGF-1</li> </ul>
Ho et al. (2010)	RCT Pilot / 4	Very low-birth weight preterm infants (<34 weeks and <1500g) (N=24)	Moderate pressure massage programme	15 min. session, once a day, 5 days per week	4 weeks	<ul style="list-style-type: none"> <li>• No significant difference in weight gain (small sample size)</li> <li>• Earlier hospital discharge</li> </ul>
Livingston et al. (2007)	RCT / 4	NICU infants with complex medical condition (N=12)	Massage programme	20 min session once per day	7 days	<ul style="list-style-type: none"> <li>• All vital signs are within the safety limits during massage therapy</li> <li>• Caregivers reported high level of satisfaction</li> <li>• No significant difference in head circumference and length of stay</li> <li>• Nurses reported moderate to high level of satisfaction towards the massage programme</li> </ul>
Massaro et al. (2009)	RCT / 4	Healthy preterm infants (N=60)	Massage with kinaesthetic stimulation	15min session, 2 times a day		<ul style="list-style-type: none"> <li>• Higher weight gain No significant difference in head circumference and length of stay</li> </ul>
Mathai et al. (2001)	Controlled trial without randomization	Well preterm infants with birth weights 1000-2000g (N=48)	Massage programme	15-min massage session, 3 times a day	From day 3 to term corrected age	<ul style="list-style-type: none"> <li>• More Weight gain</li> <li>• No significant growth in Body length &amp; Head circumference</li> <li>• Improved Neuro- Behavioral Assessment Scale</li> </ul>

**Table 1:** Selected studies on infant massage(Cont.)

Field et al. (2010)	A review report	NICU preterm infants	Moderate pressure massage	10-15 min session, 2-3 times a day	5-10 days	<ul style="list-style-type: none"> <li>• Increased weight gain</li> <li>• Reduced hospitalization</li> <li>• Increases gastric motility and vagal activity</li> </ul>
Vickers et al. (2009) (A review)	A review report	Preterm infants (<37 weeks or <2500g at birth)	Systematic tactile stimulation by human hands	15 min, 3-4 times a day.	5-10 days Except one study with 30 days following discharge	<ul style="list-style-type: none"> <li>• Gained more weight</li> <li>• Reduced length of hospital stay</li> <li>• Low risk of adverse effect</li> </ul>

\*The Jadad scale is used for rating the quality of the randomized controlled trial study. A score  $\leq 2$  indicates low quality; a score  $\geq 3$  indicates high quality. The articles received a score of 1 for each of the following criteria:

1. The study was described as randomized.
2. Method to generate sequence of randomization was described
3. The study was double blinding.
4. Method of double blinding was described and it was appropriate
5. There was a description of withdrawal and dropouts

## Risk of Bias in Studies

### Selection bias and performance bias

Considering that gestational age and birth weight significantly influence the intervention result, only two studies [3,14] employed stratified randomization to ensure group similarity and avoid the selection bias. In the other studies, details of randomization were not clearly stated.

For a fair comparison, it is important to ensure that every infant was under comparable conditions, such as receiving the same daily routine nursing care. In the study conducted by Diego et al., [11] parents and clinical staff were blind to the study to reduce performance bias. In the study of Ho et al., [3] parents and nursing staff were reminded not to perform extra massage or exercise on the infants during the study period.

Applying a consistent massage technique is also essential in obtaining a credible research result. In the research of Massaro et al., [14] massages were performed by nurses who were trained by the same licensed massage therapist. The massage therapist continued to supervise the massage technique of nurses to ensure intervention consistency. In the study of Diego et al., [11] infant massage was performed by different therapists. In several other studies, [6,13] the methods adopted to control other independent variables or covariance were not mentioned. This lacking detail may encumber the degree of credibility of the study findings.

### Sampling characteristics

All selected studies declared that no significant between-group difference in sample characteristics was observed. Sample size calculation was deemed important in determining the statistical

power of the study findings, yet the sample size was relatively small in this area of interest. This condition might be due to the fact that subject recruitment was challenging. Livingston et al. [8] planned to recruit 52 infants each for the massage and control groups. However, only 12 infants were successfully recruited. The authors explained that this recruitment failure was due to the acute and unstable condition of the target population. In a pilot study conducted by Ho et al., [3] only 24 subjects were recruited in the 10-month research period. In addition, dropouts and withdrawals significantly influence the research result. In the study by Ferber et al., [15] the attrition rate was 7%, and the refusal rate was 14%. The reasons for attrition and withdrawal were related to parents' personal factors or changes in the participants' medical condition.

### Effects of intervention

The selected studies reported a larger weight gain in the massage group than in the control and sham groups [3,6,11-15]. In a review report provided by Field et al., [18] massaged preterm infants showed 28% to 47% more weight gain than the infants in the control group who only received routine care. Massage therapy can increase vagal activity and gastric motility, which have a positive effect on weight gain [6,11]. Although a review conducted by Vickers et al. [17] doubted the credibility of previous studies because of suspected selective reporting of the study outcomes, the authors agreed that massage has a low risk of adverse effects on preterm infants.

In summary, various clinical trials have shown that infant massage is positively related to weight gain in preterm infants. The potential mechanism may have been initiated by the increased vagal activity and gastric motility caused by the massage. Ferber et al. [15] indicated that massage provided by

qualified professionals and trained parents produce a similar effect of weight gain among preterm infants. Thus, encouraging parents to massage their preterm infants is practical and effective. Prolonged acupressure and meridian massage result in more weight gain. However, these interventions need to be administered by qualified TCM practitioners. Concerns about cost effectiveness and the difficulty of training healthcare professionals and parents to apply acupressure and meridian massage have impeded the replication of such a study.

Lastly, educating parents to massage their preterm infants with LBW may improve the physical well-being of the infants and increase parental satisfaction. As such, an evidence-based care guideline for preterm infant massage by parents was developed in the present study based on the aforementioned related studies.

### Evidence-Based Care Guideline For Preterm Infant Massage By Parents

The evidence-based care guideline was developed on the basis of published reports and literature. The guideline is to be implemented in the NICU setting. The guideline includes the objectives and procedures of infant massage as well as recommendations for the assessment methods. The rationales of the recommended evidence-based practice are also provided in the guideline.

#### Objectives

The objectives are to enhance gastric motility and weight gain among preterm infants and increase parental satisfaction in the NICU setting.

#### Recommendation 1: assessment and planning

Comprehensive assessment should be conducted to evaluate the current health condition of preterm infants. The assessment defines the suitability of giving a massage to preterm infants. The inclusion criteria for preterm infants are as follows:

- (i) an infant's gestational age must be equal to or greater than the corrected age of 32 weeks, and
  - (ii) its weight must be greater or equal to 1,000 g.
- An infant should be excluded if it
- (i) has a limb fracture or shoulder dystocia,
  - (ii) is on inotrope support,
  - (iii) requires intubation or is on nasal continuous positive airway pressure (CPAP), and
  - (iv) it has or is suspected to have necrotizing enterocolitis.

**Rationale:** Infants who are too immature or who display symptoms of medical instability or unsuitability for a massage should be excluded [8]. Massage delivery is also contraindicated for infants with fractured bones. Moreover, sick preterm infants may show over-reactive responses and poor tolerance to external stimulation and thus require minimal handling care [21]. These

infants must be excluded to avoid fluctuations in blood pressure induced by handling and unsynchronized breathing with a ventilator caused by infant struggling. Infants suffering from necrotizing enterocolitis will have abdominal distension and will require gastrointestinal resting for 7 to 14 days [22].

#### Recommendation 2: staff training

A briefing about the objectives and detailed arrangement of infant massage should be included in the guideline and provided to the nursing staff. All nursing staff involved should be equipped with the necessary knowledge and skills on infant massage. They must be taught massage skills by a qualified infant massage instructor with the same set of teaching materials and by a return-demonstration to ensure consistency in application. In addition, a "massage competency checklist" regarding the preparation and procedures of infant massage should be used to assess staff competency during the return-demonstration. The training course should be accredited by the hospital.

**Rationale:** A qualified infant massage therapist and an accredited training course are essential for the quality assurance of staff training.

#### Infant massage protocol

Infant massage should be performed between two feeds. Avoid performing massage on infants who are too full or hungry. During and after a massage session, closely observe the conditions of the infants, which include infant heart rate, oxygen saturation, respiration rate, skin temperature, and skin color. Infant massage should be a 15 min session divided into three 5 min phases. This massage protocol is adopted from Scafidi et al. [23].

##### Phase I: Tactile stimulation (5 min)

Perform strokes. Each stroke should be performed with moderate pressure, such that a slight skin indentation or color change is observable. The infant must be in a prone position. Stroking should be in the following sequence, with 1 min allotted for each part:

- (i) from head to face,
- (ii) from neck to shoulders,
- (iii) from upper back to waist,
- (iv) from thighs to feet, and
- (v) from shoulders to hands.

##### Phase II: Kinesthetic stimulation (5 min)

The infant must be in a supine position. Perform kinesthetic stimulation to the four limbs separately as follows:

- (i) abduction and adduction for upper limbs and flexion and extension on the shoulder and elbow (1 min for each limb),
- (ii) flexion and extension on the hip and ankle (1 min for each limb), and
- (iii) cycling motion to both legs (1 min).

**Phase III:** Repeat the tactile stimulation (5 min)

**Recommendation 3: continuous infant assessment performed by a nurse**

The body weight, calorie intake, and output volume of the infants should be assessed daily. For tube-fed infants, the residual gastric content before each feed must be measured. These assessments are to be performed by a nurse and should be continued until the infants are discharged from the NICU.

Infant vital signs, including heart rate, oxygen saturation, respiration rate, skin temperature, and skin color, should be recorded prior to the start of the massage, every 5 min during the massage session, and then every 15 min for an hour after the massage. These vital signs should be documented. Infant massage should be stopped if abnormal vital signs or visible signs of distress occur. Signs of distress include significant color change, more than 30 s of crying, or hyperextension of extremities [8].

**Rationale:** Continuous assessment allows for a comparison between massage and non-massage infants. Regular assessment performed by a nurse may improve the confidence of parents and encourage them to continue performing infant massage even after discharge.

**Recommendation 4: parent preparation and training**

**Parent preparation:** Before parent training, a massage briefing session should be provided for each pair of parents. An information booklet should also be provided to assist learning. The definition of infant massage, the objectives and benefits of infant massage, the preparations before performing infant massage and the details of the three massage phases are to be included in the information booklet along with photos to help explain the content and procedure. A nurse must formally document that a booklet has been given to the parents and ensure that they understand the information.

**Rationale:** Nurses can facilitate parental education and perform a demonstration effectively by using a colorful information booklet [24]. Parents can refer to the booklet at any time when in doubt.

**Training of parents**

Preterm infants have weak immunity. Thus, parents should be reminded to wash their hands in accordance with the standard hand-washing protocol suggested by the Centre of Health Protection [25]. They must also wear masks and gowns before entering the cubicles. Before opening the incubator portholes, parents should be required to use an alcohol-based hand-rub solution for their hands and wrists for at least 20 s until their hands are dry [25].

For the parent training, a nurse first teaches the procedures of infant massage on a mannequin step by step based on the prepared information booklet. Second, the nurse demonstrates the full execution of infant massage on an infant, with particular emphasis on the special points to which parents should pay attention. Third, the parents return-demonstrate the infant massage on a mannequin. Fourth, the nurse assesses the infant massage skills of the parents against a "Parents' skill competency

checklist." If the parents fail in any items in the checklist, they are required to practice and perform infant massage on a mannequin until they pass all the competency items.

**Rationale:** Demonstration and return-demonstration are performed to ensure the competency of parents as well as the safety, uniformity, and standardization of the intervention [26]. Banford et al. [27] stated that demonstration and return-demonstration are the most effective mechanisms of delivery in health education. Parents can learn each step, the sequence of infant massage, and any special points that they must pay attention to during the demonstration; this is because the condition of each infant is different. Parents can ask questions directly, and nurses can guide and enhance the interaction. Nurses can assess the understanding, technique, and competency of parents during the return-demonstration to ensure that the infants will receive a safe and standardized intervention.

**Recommendation 5: infant massage by parents**

Whether parents pass all the items in the infant massage competency checklist should be confirmed. Parents can then proceed to perform infant massage on their infants for 15 min daily. A nurse must be in attendance while a parent is providing the massage. The vital signs and responses of infants should be closely monitored to help observe the parents' massage technique and any change in the infant's condition.

**Rationale:** This guideline was designed in accordance with the ward situation to promote safety and feasibility in providing infant massage to preterm infants in NICU, where the nurse-to-patient ratio is 1:1 or 1:2 at most. Therefore, maintaining continuous close observation during the infant massage period is feasible. Moreover, the uniform performance of parents and the early detection of changes in the condition of infants can be ascertained.

**Evaluation Plan**

After implementing the evidence-based guideline, it is important to monitor and evaluate any changes in outcomes so that positive effects can be supported and negative ones can be remedied [28]. Monitoring the effect of evidence-based practice change on health care quality and outcomes can help identify flaws in implementation and determine which patients are most likely to benefit. Therefore, an evaluation plan should be established to assess the feasibility of the implementation plan. An evaluation plan that includes the following components should be developed.

1. Inclusion and exclusion criteria and number of preterm infants to be involved
2. Outcome measures including gastric motility, infant body weight, and parental satisfaction
3. Analysis methods to compare the outcome variables within the group and between the infant massage group and the usual care control group
4. Determination of the effectiveness of the evidence-based guideline

## Barriers and Recommendations

### Risk of infection

Preterm infants have weak immunity. Thus, increased handling during infant massage may increase the chances of bringing in foreign germs into the incubator, which might lead to infection [29]. Hand washing and environmental hygiene should be promoted and emphasized to minimize the risk of infection related to increased infant handling [30]. All parents are to be given an information booklet introducing the steps to minimize the risk of carrying bacteria into the NICU. In addition, parents should be guided in adhering to the standard hand-washing protocol prior to infant massage to prevent bringing germs into the incubator. The daily cleaning of incubators, which is a part of the NICU routine to maintain good environmental hygiene, should be ensured.

### Attitude of healthcare professionals

Apparently, extra manpower and the reluctance of healthcare professionals toward the implementation of an infant massage program would be challenges. Healthcare professionals may be reluctant to change because of heavy workload and manpower shortages. They may also be reluctant to learn new knowledge and skills because of a sense of insecurity [31]. Therefore, objective evidence should be presented to healthcare professionals to facilitate a better understanding of the importance of infant massage in enhancing weight gain and gastric motility among preterm infants. Moreover, presenting evidence on improvement in patient outcomes can help healthcare professionals better understand the positive effects of practice change. Training sessions should be conducted prior to the implementation of the protocol to increase the confidence of healthcare professionals. In the NICU setting, the nurse-to-patient ratio is 1:1 or 1:2 at most. As such, it is feasible to maintain continuous close observation during infant massage and ascertain the uniform performance of parents and early detection of changes in the infants' condition. Moreover, developing a concise and user-friendly guideline would help healthcare professionals follow the recommendations easily and provide consistent care to their patients.

### Parents' willingness

Unlike term infants, preterm infants face different kinds of difficulties related to fetal growth. Preterm infants are extremely fragile that parents are afraid of touching them. Inviting parents to perform infant massage on their babies can teach parents a proper method to help their infants in a safe manner. An infant massage can improve parent-infant bonding as most parents are eager to have close contact with their babies [32]. In addition, given that parents are the ones who perform infant massage, it is more cost effective as extra manpower is not needed to implement the intervention. Parents can also continue to perform infant massage after their infants are discharged.

## Conclusion

The morbidity and mortality rates of infants are inversely proportional to their birth weight and gestational age. Poor weight gain and gastric motility are the common difficulties faced by preterm infants with LBW. The evidence-based literature review conducted in this article indicated that infant massage is positively related to weight gain among preterm infants because of the increased vagal activity and gastric motility. Preterm infants are fragile, and their parents are reluctant to touch them because parents are afraid that they might hurt them. Parents can be invited to perform infant massage and taught the proper and safe method to help their infants. This procedure improves parent-infant bonding and is cost effective because it directly addresses the need for extra manpower to implement the intervention. Moreover, parents can continue performing infant massage even after the infant is discharged. All these accurate and reliable pieces of evidence form the basis for the development of the proposed evidence-based guideline for infant massage. The guideline can bolster the confidence of both healthcare professionals and parents. Using this guideline to educate the parents of preterm infants will assist in making clinical practice more effective in improving patient outcomes, which, in turn, will raise the standard and quality of healthcare.

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