Turun yliopisto
University of Turku

BREASTFEEDING PRETERM INFANT FROM THE DELIVERY WARD VIA NICU TO HOME

Hannakaisa Niela-Vilén

TURUN YLIOPISTON JULKAISUJA – ANNALES UNIVERSITATIS TURKUENSIS
Sarja - ser. D osa - tom. 1223 | Medica - Odontologica | Turku 2016

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The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

ISBN 978-951-29-6423-9 (PRINT)
ISBN 978-951-29-6424-6 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
Painosalama Oy - Turku, Finland 2016

To my dear children, Siiri-Maria and Sisu,
and to the mothers participating in this study

Hannakaisa Niela-Vilén

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University of Turku, Faculty of Medicine, Department of Nursing Science, Finland

ABSTRACT

The aim of this study was to examine how to support breastfeeding of preterm infants immediately after birth in the delivery ward, during their hospital stay in a neonatal intensive care unit (NICU), and at home after hospital discharge. Specifically, the role of early physical contact, maternal breastfeeding attitude, and an internet-based peer support group were investigated. The delivery ward practices concerning the implementation of early physical contact between a mother and her infant admitted to a NICU were examined by a structured survey in two hospitals. An Internet-based, breastfeeding peer-support intervention for the mothers of preterm infants was developed and tested in a randomized controlled design with one year follow-up. The main outcomes were the duration of exclusive and overall breastfeeding, expressing milk, and maternal attitude. In addition, the perceptions of mothers of preterm infants were investigated by analyzing the peer-support group discussions with a qualitative approach.

The implementation of early physical contact was different between the two hospitals studied and was based more on hospital routines than the physiological condition of the infant. Preterm infants, who were born before a gestational age (GA) of 32 weeks, were hardly ever allowed to have early contact with their mothers. Both, a higher GA and early physical contact predicted earlier initiation and increased frequency of breastfeeding in the NICU. A maternal breastfeeding-favorable attitude predicted increased frequency of breastfeeding in the NICU and also a longer duration of overall breastfeeding. The actual duration of breastfeeding was, however, shorter than the mothers intended in advance.

The internet-based, peer-support intervention had no effect on the duration of breastfeeding, expressing milk, or maternal attitude. The participating mothers enjoyed the possibility of sharing their experiences of preterm infants with other mothers in similar situations. Some of the mothers also experienced being given useful advice for breastfeeding. Based on the mothers' discussions, a process of breastfeeding preterm infants was created. This included some paradoxical elements in the NICU where, for example, breast milk was emphasized over breastfeeding and support in the hospital varied. Hospital discharge was a critical point, when the mothers faced breastfeeding in reality. Over time, the mothers assimilated their breastfeeding experience into part of being a mother.

The care practices related to early physical contact in delivery wards need to be re-evaluated to allow more infants to have a moment with the mother. Maternal attitude could be screened prenatally and attitude-focused interventions developed. Breastfeeding support in the NICU should be standardized. Internet-based breastfeeding peer-support intervention was feasible but additional research is needed.

Keywords: breastfeeding, preterm infant, NICU, early physical contact, attitude, peer support

Hannakaisa Niela-Vilén

KESKOSVAUVA RINNALLA SYNNYTYSOSASTOLLA, VASTASYNTYNEIDEN TEHO-OSASTOLLA JA KOTONA

Turun yliopisto, lääketieteellinen tiedekunta, Hoitotieteen laitos, Suomi

TIIVISTELMÄ

Tutkimuksen tarkoituksena oli tarkastella keskosvauvojen imetystä ja sen tukemista synnytysosastolla, vastasyntyneiden teho-osastolla ja kotiutumisen jälkeen. Erityisesti kiinnostuksen kohteena olivat synnytysosastolla tapahtuvan varhaisen ensikontaktin, äidin imetysasenteen sekä internet-perustaisen vertaistuen merkitys keskosvauvan imetykselle. Synnytysosaston hoitokäytäntöjä varhaisen ensikontaktin toteuttamisessa äidin ja tehohoitoa tarvitsevan vastasyntyneen välillä kartoitettiin strukturoidulla kyselytutkimuksella, joka toteutettiin kahdessa sairaalassa. Lisäksi tutkimuksessa kehitettiin internet-perustainen imetyksen vertaistuki-interventio, jota testattiin satunnaistetussa koeasetelmassa. Interventiotutkimukseen osallistuvia keskosvauvojen äitejä seurattiin vuoden ajan. Tulosmuuttujat olivat täysimetyksen ja kokonaisimetyksen kesto, maidon lypsämisen kesto sekä äidin imetysasenne. Lisäksi äitien näkemyksiä keskosvauvan imetyksestä tarkasteltiin vertaistukiryhmään osallistuneiden äitien keskusteluja analysoimalla.

Ensikontaktin toteutuminen vaihteli sairaaloiden välillä ja perustui enemmän sairaalan rutiineihin kuin vauvan fysiologiseen vointiin. Ennen 32 täyttä raskausviikkoa syntyneet keskosvauvat eivät juuri koskaan päässeet synnytyssalissa ensikontaktiin äidin kanssa. Sekä pidempi raskauden kesto että varhaisen ensikontaktin toteutuminen kuitenkin ennustivat aikaisempaa imetyksen aloittamista sekä useampia imetyskertoja vastasyntyneiden teho-osastolla. Äidin imetysmyönteinen asenne ennusti sekä useampia imetyksiä sairaalassa sekä pidempää kokonaisimetyksen kestoa. Imetyksen toteutunut kesto oli kuitenkin lyhyempi kuin äidit olivat etukäteen suunnitelleet.

Internet-perustainen vertaistuki-interventio ei vaikuttanut imetyksen tai lypsämisen kestoon tai äitien imetysasenteeseen. Interventioon osallistuneet äidit kuitenkin pitivät mahdollisuudesta jakaa kokemuksia keskosvauvan imetyksestä ja hoitamisesta toisten samassa tilanteessa olevien äitien kanssa. Jotkut äidit kokivat myös saaneensa hyödyllisiä neuvoja imetyksen suhteen. Vertaistuki-interventioon osallistuneiden äitien keskustelujen analyysissa muodostettiin keskosvauvan imetyksen prosessi äidin näkökulmasta. Prosessi sisälsi paradoksaalisia elementtejä sairaalassa, esimerkiksi rintamaitoa arvostettiin enemmän kuin imetystä ja sairaalassa tarjottu imetystuki oli vaihtelevaa. Kotiutuminen oli merkittävä ajankohta imetyksen kannalta, kun äidit kohtasivat imetyksen todellisuuden. Ajan myötä äitien yksilöllinen imetyskokemus sulautui osaksi heidän äitiyttään.

Hoitokäytännöt synnytysosastolla tapahtuvasta ensikontaktista tulisi arvioida uudelleen, jotta useampi keskosvauva voisi saada hetken äidin sylissä ennen teho-osastolle siirtoa. Äitien imetysasenne voitaisiin mitata ennen synnytystä ja tarvittaessa kehittää asennetta muokkaavia interventioita. Imetysohjaus vastasyntyneiden teho-osastoilla tulisi standardoida. Internet-perustainen imetyksen vertaistuki-interventio osoittautui käyttökelpoiseksi, mutta lisätutkimus aiheesta on tarpeen.

Avainsanat: imetys, keskosvauva, vastasyntyneiden teho-osasto, ensikontakti, asenne, vertaistuki

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ABBREVIATIONS

BFHI	Baby Friendly Hospital Initiative
BKAC	Breastfeeding Knowledge, Attitude and Confidence scale
BMI	body mass index
BPD	bronchopulmonary dysplasia
BSES-SF	Breastfeeding Self-Efficacy Scale, Short Form
CFIR	Consolidated Framework for Implementation Research
CPAP	continuous positive airway pressure
GA	gestational age
IBFAT	Infant Breastfeeding Assessment Tool
IFQ	Infant Feeding Questionnaire
IIFAS	Iowa Infant Feeding Attitude Scale
IQ	intelligence quotient
KC	kangaroo care
MER	milk ejection reflex
NEC	necrotizing enterocolitis
NICU	neonatal intensive care unit
PCA	postconceptional age
PIBBS	Preterm Infant Breastfeeding Behavior Scale
PIFS	Preterm Infant Feeding Survey
PMA	postmenstrual age
PNA	postnatal age
POFRAS	Preterm Oral Feeding Readiness Assessment Scale
RCT	randomized controlled trial
SSC	skin-to-skin contact
SSRI	selective serotonin reuptake inhibitor
VLBW	very low birth weight
WHO	World Health Organization

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on following publications which are referred to in the text by their Roman numerals I–V:

I Niela-Vilén H, Axelin A, Salanterä S, Lehtonen L, Tammela O, Salmelin R & Latva R. 2013. Early physical contact between a mother and her NICU-infant in two university hospitals in Finland. Midwifery 29(12), 1321–1330.

II Niela-Vilén H, Axelin A, Salanterä S & Melender H-L. 2014. Internet-based peer support for parents: a systematic integrative review. International Journal of Nursing Studies 51(11), 1524–1537.

III Niela-Vilén H, Melender H-L, Axelin A, Löyttyniemi E & Salanterä S. 2016. Predictors of breastfeeding initiation and frequency of preterm infants in the NICU. Journal of Obstetric, Gynecologic, and Neonatal Nursing, doi:10.1016/j.jogn.2016.01.006, *in press.*

IV Niela-Vilén H, Axelin A, Melender H-L & Salanterä S. 2015. Aiming to be a breastfeeding mother in a neonatal intensive care unit and at home: a thematic analysis of peer-support group discussion in social media. Maternal & Child Nutrition 11(4), 712–726.

V Niela-Vilén H, Axelin A, Melender H-L, Löyttyniemi E & Salanterä S. 2016. Breastfeeding preterm infants – a randomized controlled trial of the efficacy of an internet-based peer-support group. *Submitted.*

1. INTRODUCTION

Breastfeeding is a topic which raises multiple and strong feelings; I have noticed that almost every person, both women and men, has an individual opinion on this topic. When I was working as a young midwife in the delivery ward, breastfeeding was not the first priority in my job – unfortunately, it was not even in the top ten. During my first pregnancy it became personally important to me. The low rates of breastfeeding in Finland and also globally inspired me to start thinking about what is the real reason why so many mothers do not breastfeed. In consequence, I became interested in attitudes, other mothers' advice, and the supportive atmosphere of society as a whole. By becoming involved in an interesting research project, my master's thesis focused on preterm infants' breastfeeding. Although it may seem like a cliché, this first step did lead to others, and this thesis is the current answer to how it is possible to support the process of breastfeeding preterm infant from the delivery ward via the neonatal intensive care unit (NICU) to home.

The World Health Organization (WHO) states in its Global strategy on infant and young child feeding: 'Breastfeeding is an unequalled way of providing ideal food for the healthy growth and development of infants' (WHO 2003, paragraph 10). Globally, less than 40% of all infants (WHO 2014b) are breastfed exclusively for six months, which is the official recommendation for exclusive breastfeeding followed by partial breastfeeding until two years of age or older (WHO 2003). Global infant mortality and morbidity would decrease if all infants were breastfed according to these recommendations (WHO 2014b). By implication, healthcare costs would be saved (Bartick & Reinhold 2010). In Finland, almost all mothers initiate breastfeeding, but the rates decrease rapidly after hospital discharge. After two months, 39% of infants are exclusively breastfed and only about one or two percent of Finnish mother-infant pairs reach the six months' goal. One third (33%) of infants are breastfed at the age of one year. (Uusitalo et al. 2012.)

Breastfeeding rates are even lower among preterm infants all over the world (e.g. Uusitalo et al. 2012, Donath & Amir 2008). Infants born before the full 37 gestational weeks are considered preterm. For example, less than 30% of Finnish preterm infants are exclusively breastfed at the age of two months and only about 15% are breastfed until the age of one year (Uusitalo et al. 2012). Preterm infants would especially benefit from breastfeeding even more than full-term infants; strong evidence shows that feeding preterm infant with a mother's own milk is associated with better health and development compared with formula-feeding (e.g. Ahrabi & Schanler 2013). Breastfeeding is also beneficial for mothers by lowering the risk of breast cancer, ovarian cancer, hypertension, cardio-vascular diseases and diabetes type II. In addition,

breastfeeding is economic and ecologic. (Chowdhury et al. 2015, Breastfeeding Promotion in Finland 2009.) However, breastfeeding preterm infants is challenging because of their immaturity. In order to initiate breastfeeding, respiratory and cardiovascular stability of an infant are needed. In addition, the infant needs to be able to coordinate suckling, swallowing and breathing. These skills develop by maturation, but also by practice, thus a specific gestational age at birth or postmenstrual age is not required. (Jones 2012, Nyqvist 2008, Nyqvist et al. 1999.)

Initiating and continuing breastfeeding is a complex process influenced by many factors related to both preterm infants and their mothers, but also influenced by clinical care practices (Maastrup et al. 2014a). More research on how to support breastfeeding preterm infants is needed as regards the whole process, starting from the delivery wards. Not much attention has been paid to the care practices, which are routinely performed with preterm infants in the delivery wards. Although the infants are not immediately able to suckle at the breast, we need to examine how to provide the best possible support for it to actualize in an NICU.

Furthermore, breastfeeding is much more than feeding a baby; it is strongly related to being a mother. In preterm infants especially, breastfeeding strengthens the mother-infant attachment (Callen & Pinelli 2005). Due to the various benefits to both mothers and infants, mothers of preterm infants deserve competent support and counseling regarding breastfeeding. High-quality support starting in the delivery ward and continuing in the NICU would provide the best possible foundation for successful breastfeeding at home. We need more concrete measures and interventions on these issues to be implemented by midwives and nurses. This thesis is intended as a response to this need.

2. REVIEW OF THE LITERATURE

The aim of this literature review is to gain an understanding of breastfeeding preterm infants, its unique challenges, and the current support which begins in the delivery ward and continues in the NICU and at home after hospital discharge. In addition, breastfeeding attitude and breastfeeding peer support were reviewed by also taking into consideration full-term infants. A systematic exploration of the literature was conducted in September 2015 in three databases Cinahl, PubMed, and in Cochrane reviews. Specified separate searches were made for preterm infants' breastfeeding, breastfeeding attitude, and breastfeeding peer support (Table 1.). In addition, articles were found by a manual search e.g. based on reference lists. Some reports and publications of the WHO, the Finnish National Institute for Health and Welfare, and the Official statistics of Finland were used to complete the review of the literature.

Table 1. Literature search conducted.

Keywords used (different combinations were used based on individual strategies of databases)	**PubMed** Titles/ Abstracts/ Accepted	**Cinahl** Titles/ Abstracts/ Accepted	**Cochrane reviews** Titles/ Abstracts/ Accepted	**Dupli-cates**	**Total number of included papers**
"Premature Birth" [Mesh] OR "Infant, Premature" [Mesh] OR "Infant, Very Low Birth Weight"[Mesh] OR preterm[ti] OR premature[ti] OR "low birth weight"[ti] AND "Breast Feeding"[Mesh] OR breastfeeding[ti]	534/235/101	267/115/73	29/11/7	42	139
"Breast Feeding"[Mesh] OR breastfeeding[ti] OR infant-feeding[ti] AND attitude[ti] OR MH "Attitude to Breast Feeding"	48/26/14	245/23/11	1/0/0	2	23
"Breast Feeding"[Mesh] OR breastfeeding[ti] AND "Peer Group"[Mesh] OR peer group*[ti] OR peer counsel*[ti] OR peer support[ti])	86/64/37	42/19/14	5/2/2	6	47
Limits: Abstracts, publication date 2005–2015, English					

2.1 Preterm infants and the special terms used for breastfeeding

Infants born before the full 37 gestational weeks are considered preterm. About 57 800 infants are born in Finland per year and 5.9% of these are born prematurely (Perinatal statistics: Parturients, deliveries, and newborns 2014). Consequently, breastfeeding of preterm infants resonates with over 3400 families in Finland every year. Globally, the rate of preterm births varies from 5% to 18%, and approximately 15 million infants are born preterm every year (WHO 2014a). Preterm infants all over the world are breastfed less than full-term infants; the initiation is less frequent and the duration of breastfeeding is shorter (McDonald et al. 2013, Uusitalo et al. 2012, Donath & Amir 2008, Flacking et al. 2007b, Åkerström et al. 2007).

2.1.1 Preterm infant's capacity and readiness to breastfeed

Successful oral feeding is dependent on the coordination of suckling, swallowing and breathing, which are often missing in infants born prematurely. These capacities seem to develop with maturation, but there is great variation in accomplishing these skills as regards the postmenstrual age (PMA). (Jones 2012.) Oral feeding is an important goal for a preterm infant to accomplish before hospital discharge. It has been suggested that oral feedings including breastfeeding could be initiated at 32–34 weeks of PMA (Briere et al. 2014b, Maggio et al. 2012), but there is evidence that breastfeeding competence is not related to a fixed age (Maastrup et al. 2014a).

Extremely preterm infants have to reach to the feeding milestones – the first enteral, full enteral, and the first and full oral feedings – gradually. Infants born before the full 32 weeks of GA and infants with some medical complications, for example bronchopulmonary dysplasia (BPD) or necrotizing enterocolits (NEC), have delayed attainment of the milestones (Park et al. 2015, Maastrup et al. 2014a, Hwang et al. 2013). The infants fed with breast milk achieve the feeding milestones earlier than formula-fed infants. (Park et al. 2015). In a Swedish study, breastfeeding was initiated at a PMA of 29 weeks, and exclusive breastfeeding was accomplished between 32 and 38 weeks (Nyqvist 2008). Oral feeding advancement protocols, for example non-nutritive suckling, might promote reaching the ability for oral feeding (Kish 2014), and improve the breastfeeding rates at hospital discharge (Bache et al. 2014). Non-nutritive sucking of pacifier has been shown to promote at least bottle feeding performance (Pinelli & Symington 2010). These results suggest that besides maturation, concrete practice might also have a role in learning to breastfeed.

Based on the Cochrane review conducted in 2012, there was no evidence of instruments to assess feeding readiness in the preterm infant population (Crowe et al. 2012). Nevertheless, after the review, some instruments have been developed. One instrument, developed in a study by Neiva et al. (2014), is capable of identifying infants with

adequate suckling and swallowing abilities, however, the corrected GA was the strongest factor predicting the success of oral feeding. The Preterm Oral Feeding Readiness Assessment Scale (POFRAS) was developed specifically to assess preterm infants' readiness for breastfeeding. The POFRAS consists of different factors assessing maturity, oral-motor skills, and oral-motor, neural and suckling development. The instrument seems to be valid for clinical use. (Fujinaga et al. 2013.)

All the oral feeding procedures should be introduced individually, and not based on a certain GA at birth or PMA (Briere et al. 2014b, Nyqvist et al. 2013, Jones 2012). The key messages provided in the review by Briere and colleagues (2014b) were that breastfeeding should be initiated early and prior to bottle feeding. Both NICU staff and families should be taught to assess the feeding readiness of the preterm infant in order to successfully implement cue-based feeding, which focuses on the individual infant's cues instead of measuring the volume or length of feeding. (Briere et al. 2014b.) In contrast to common belief, breastfeeding itself does not burden a preterm infant more than bottle feeding. Breastfed preterm infants have had improved physiological responses, such as higher oxygen saturation, higher body temperature, less desaturation events, and lower energy expenditure compared to bottle-fed infants (Maggio et al. 2012, Berger et al. 2009).

2.1.2 Benefits of breastfeeding and breast milk for a preterm infant

Breastfeeding and breast milk provides the correct nutrition to a preterm infant. The composition of breast milk varies with the stage of lactation (Menon & Williams 2013) and with the length of gestation; preterm breast milk contains higher levels of protein, sodium, chloride, calcium, zinc, copper, and folate than full-term breast milk hence providing the appropriate nutrition for a preterm infant. However, exclusive feeding with unfortified human milk has been associated with poor rates of growth and some nutritional deficits, thus individually planned, adequate nutritional supplements are needed when feeding preterm infants. (Tudehope 2013, Underwood 2013, Edmond & Bahl 2006.)

In addition to optimal nutrition, breastfeeding provides immunological, gastrointestinal, and developmental benefits to a preterm infant (Edmond & Bahl 2006, Callen & Pinelli 2005, Rodriguez et al. 2005). Exclusive human milk feeding prevents nosocomial infections (Rodriguez et al. 2005), necrotizing enterocolitis (NEC) (Herrman & Carrol 2014, Cristofalo et al. 2013, Corpeleijn et al. 2012), late onset sepsis, urinary tract infection (Ahrabi & Schanler 2013), and diarrhea (Tudehope 2013). Interestingly, breastfeeding protected preterm girls more than boys when determining severe acute lung disease (Klein et al. 2008). Gut maturation is delayed in formula-fed preterm infants compared with breastfed infants (Reisinger et al. 2014). Cow milk protein products seem

to increase mortality and morbidity in extremely preterm infants compared with an exclusive human milk diet (Abrams et al. 2014). These health outcomes also mean significant cost savings for the health care system. Each infection causes increased costs and may lengthen the hospital stay, causing more costs. (Rodiguez et al. 2005.) In addition, the cost of donor human milk is much higher than that of the mother's own milk. In a US study, most mothers of very preterm infants were not able to produce all the milk required and donor human milk was also needed. The costs were even greater if the infant had to exclusively receive donor milk. (Carroll & Herrmann 2013.) In addition, pasteurized donor milk does not provide the same nutrient as the mother's own milk (Underwood 2013).

Furthermore, feeding preterm infants with breast milk may lower the risk of metabolic syndrome in adult life (Ikeda et al. 2014). Other long-term benefits are, for example, better brain development and less frequent respiratory infections (Ahrabi & Schanler 2013). Prolonged breastfeeding has shown a positive association with cognitive development scores, especially in preterm infants (Quigley et al. 2012, Rodriguez et al. 2005), but there are also some controversial results concerning human milk having a positive effect on intelligence quotient (IQ) (Tudehope 2013). However, although formula-feeding may enhance the growth of a preterm infant the neurodevelopment is similar or even better in infants fed on breast milk (Roze et al. 2012). Based on a study by Korchazkina et al. (2006), both breast milk and formula milk have similar and sufficient antioxidant properties. In addition, breastfeeding may alleviate procedural pain in preterm infants, but additional research is needed (Prakeshkumar et al. 2012).

The psychological benefits of breastfeeding should not be underestimated either; direct breastfeeding and providing the mother's own breast milk to a vulnerable and sick preterm infant may make an important tangible contribution. Providing breast milk may symbolize a deeper contact with the infant and may be one of the few activities under the mother's direction while the infant is in the NICU (Swanson et al. 2012, Callen & Pinelli 2005) Breastfeeding is associated with greater mother-infant attachment, which is sometimes threatened because of the separation of the mother and her preterm infant. In addition, maternal empowerment and self-confidence are increased in breastfeeding mothers. (Callen & Pinelli 2005.) Furthermore, breastfeeding may have positive association with mother-infant interaction (Ravn et al. 2012), which may be especially important for infants born preterm.

The use of human milk for preterm infants should be promoted because according to current science, it has strong benefits and causes no harm (Kotey & Spatz 2013). However, Tudehope (2013) presents human milk as a possible source of the transmission of several bacteria, viruses, and possibly parasites. Pasteurization is the way to prevent harmful micro-organisms, but it also denatures some beneficial bioactive factors.

Alcohol, nicotine, and medication used by the mother can be transmitted in breast milk, but the benefits of breast milk are still considered more advantageous in most cases. (Menon & Williams 2013.)

2.2 Breastfeeding support for preterm infants in the delivery ward

Only a few studies have examined early breastfeeding support and practically none has considered delivery room practices concerning preterm infants' breastfeeding. However, mothers at risk for delayed onset of lactation (lactogenesis II) and a shorter duration of breastfeeding should be identified as early as possible. Preterm birth itself is one important risk factor for delayed onset of lactation. Other factors are high BMI of the mother, diabetes, pregnancy-induced hypertension, prolonged bed rest, cesarean birth, intrapartum complications, and some medications, e.g. magnesium sulfate. (Omarsdottir et al. 2015, Meier et al. 2013c, Mulready-Ward & Sackoff 2013.) Exposure to a maternal antenatal steroid may also delay lactogenesis II (Hallowell & Spatz 2012, Henderson et al. 2008). The risk factors mentioned are not noticed in delivery hospitals as often as they should (Meier et al. 2013c). In delivery wards, it should be noted that mothers of preterm infants are more likely to have complications in birth, such as cesarean delivery or receiving medications that may interfere with milk expression (Flaherman & Lee 2013).

In addition, mothers with lower socioeconomic status or a lower level of education, mothers who are not married, who smoke, or are very young, could benefit from targeted support because they will be more likely to stop breastfeeding soon after discharge or have a short duration of breastfeeding (Omarsdottir et al. 2015, Briere et al. 2014a, Demirci et al. 2013, Mulready-Ward & Sackoff 2013, Pineda 2011b, Zachariassen et al. 2010). Furthermore, an association between depression and breastfeeding has been found; mothers with more depressive symptoms were less likely to breastfeed (Northrup et al. 2013), and selective serotonin reuptake inhibitors (SSRI) may delay the onset of lactogenesis II (Meier et al. 2013c). More targeted interventions for these risk groups are needed (Northrup et al. 2013).

Correspondingly, there are some characteristics of infants that should be taken into account in early breastfeeding support. Preterm infants with a lower GA at birth, small birth weight or BPD, and infants from a multiple pregnancy are breastfed much less than older, heavier, healthier and singleton preterm infants (Bonet et al. 2011, Zachariassen et al. 2010, Lee & Gould 2009). In contrast, a Swedish population-based cohort study found no association between the degree of prematurity, birth weight or neonatal disorders and breastfeeding; in this study it was the families' low socioeconomic status that was associated with earlier weaning. (Flacking et al. 2007c.) However, the differing national contexts concerning breastfeeding may have a role in these conflicting results.

The feeding decisions for preterm infants made by mothers are mainly infant-focused such as breast milk is healthy, nutritious and protects the baby from becoming sick (Dowling et al. 2009b). Mothers have reported feelings such as sorrow, guilt, disappointment, and frustration because they were not able to breastfeed their preterm infants immediately after delivery (Davim et al. 2010). Prenatal counseling for breastfeeding might be a good strategy to support 'high-risk' mothers for example in cases of imminent preterm birth. If the preterm birth occurs unexpectedly, early postnatal counseling and encouragement are essential (Briere et al. 2014a). Providing a phone number to call in case of breastfeeding problems and not allowing donations of gift bags including formula preparations have increased the duration of breastfeeding (Mulready-Ward & Sackoff 2013).

There is some preliminary evidence about the association of very early initiation of milk expression with milk volume. Mothers are encouraged to initiate expressing milk while they are still in delivery room. Mothers of preterm infants, who initiated milk expression during the first hour after birth, had significantly higher milk volume one and three weeks after the delivery. In addition, lactogenesis stage II was demonstrated earlier in the mothers initiating early expression. (Parker et al. 2012.)

2.3 Initiating breastfeeding in the neonatal intensive care unit

2.3.1 The importance of environment

Both the physical and abstract environment and the atmosphere in the NICU are essential in breastfeeding initiation. The space and place constructions in the NICU can either make the mother feel like an unimportant visitor, or the 'owner' of the baby. When the NICU is constructed so that the mother feels that she is important as a mother and as a person, it also promotes breastfeeding. (Flacking & Dykes 2013.) Mothers want privacy when expressing milk, thus some mothers might feel most comfortable pumping at home. Single-family rooms in the NICU provide more privacy and closeness with the preterm infant. Mothers would like to be with their infants also during the night. (Dowling et al. 2012, Hammarlund et al. 2012.)

Inconsistent information regarding the importance of human milk and counseling as regards pumping is a major barrier for the initiation and maintenance of breast milk supply (Meier et al. 2013b). The Ten Steps to Successful Breastfeeding have also been shown to be relevant also for mothers of very preterm infants, but some modifications are needed (Nyqvist & Kylberg 2008). It is, however, paradoxical, that breastfeeding is not adequately supported in the NICUs, although it has been proven to be beneficial for the infant and the mother (Davanzo et al. 2012). The NICUs in Italy, for example, have had different care practices and levels of breastfeeding support and a wide variability in

breastfeeding rates was seen (Davanzo et al. 2009). Based on a Danish study, not all NICUs support breastfeeding optimally. The most common strategy was giving the mothers a possibility to room-in with their preterm infants before the infants' discharge. Most of the units have restricted the use of bottles. Other common strategies were unlimited visiting of parents and skin-to-skin practices. (Maastrup et al. 2012.)

A high-level of breastfeeding support in hospital increases breastfeeding rates in spite of the gestational age of infants (Goyal et al. 2014). By changing hospital care practices to be more family-centered and by supporting parental involvement it is possible to improve breastfeeding outcomes, for example, to decrease the GA at the beginning of breastfeeding (Raiskila et al. 2014). Communication between professionals and between parents and professionals are key elements in the promotion of breast milk feeding in the NICU (Lee et al. 2013). NICUs often have quite strict hourly-based feeding regimens, which, in a study by McInnes et al. (2010), were followed more or less accurately. Inconsistencies existed between the staff even within the same unit. Sometimes the one daily oral feeding was saved until the parents were present, but some staff members suggested that parents should not be involved in the first feeds because of their lack of experience. (McInnes et al. 2010.)

2.3.2 Establishing and maintaining milk supply by expressing milk

The first step toward breastfeeding is expressing milk in the mothers of preterm infants. Milk production begins during the first half of pregnancy (approximately at week 16, lactogenesis I), thus all mothers' breasts are prepared for lactation in spite of the degree of prematurity. However, stimulation of breasts after the delivery is needed to establish milk supply. To ensure successful milk supply, mothers of preterm infants need to pump milk at least 8–10 times per day, and also during the night. The volume of milk increases gradually over several days - up to two weeks. (Meier et al. 2013c, Spatz 2006.) Milk production may, however, increase at least 8 weeks postpartum and be different between the breasts (Hill et al. 2007b). Usually, by two weeks after birth it is possible to express 750–800 ml of breast milk each day (Hurst 2007). In a study by Bishara and colleagues (2009), the median total milk volume measured during days 21–30 postpartum in the mothers of very preterm infants (< 28 weeks) was 545 mL per day ranging from 224 mL to 1817 mL (Bishara et al. 2009).

By combining hand techniques with breast pumps it is possible to increase the total volume of milk. (Morton et al. 2009.) However, the most suitable method for milk expression depends on the individual mother (Becker et al. 2015). Early initiation of milk expression, initiated before 12 hours postpartum, is an important factor to promote and increase the duration of breastfeeding (Maastrup et al 2014b). Most mothers of even very low birth weight infants (< 1500 g) are able to provide their own milk to their infants

within the first days after birth. Based on a systematic review aiming to find strategies for improving the milk volume in mothers of VLBW infants it was found that, early initiation, increased frequency of expressing milk, and kangaroo care may positively impact milk volume (Parker et al. 2013a). Early milk output and early frequency of breast pumping during the first week after delivery predicted greater milk output at six weeks postpartum (Hill et al. 2005). Given specific guidance, milk production can be maintained until discharge and beyond if needed. Successful expressing in the NICU has been associated with later successful breastfeeding. (Husebye et al. 2014.)

Several barriers for successful initiation and maintenance of expressing milk have been identified. Mothers of preterm infants often feel anxious and stressed, which can disturb milk production (Lee et al. 2009, Sisk et al. 2006, Callen et al. 2005). Mother-infant separation and lack of privacy in the hospital environment may cause difficulties for expressing milk. (Alves et al. 2013, Sisk et al. 2010.) A mechanical pump is not an infant, thus an efficient, comfortable pump is important. However, no pump can completely imitate an infant's suckling. Some mothers may express the first small drops of colostrum by hand more successfully. (Hurst 2007.) Maintaining milk supply with pumping takes time, thus it is a huge responsibility and may feel exhausting (Lee et al. 2009). Difficulties with pumping and worries of inadequate milk supply have shown to be barriers to continuing (Alves et al. 2013). In contrast, some support for milk expression has been found, such as especially supportive people in the mothers' social networks, and a positive attitude toward pumping. In addition, the anticipation of direct breastfeeding motivated mothers to continue milk expression. (Sisk et al. 2010.) The infant's growth and the sense of normality have facilitated the milk supply (Alves et al. 2013). Nursing staff support for pump-dependent mothers is essential. Mothers need to be encouraged to have close physical contact with their infants to enhance hormonal response promoting lactation. (Hurst 2007.)

The psychological aspect has a great role in milk expression. Mothers may have faith in their milk as a 'healing' thing. Giving their own milk to the preterm infant feels to be the most important thing they can do for their small infants. This faith in their milk might be an important motivator to continue expressing milk. (Rossman et al. 2013.) Even mothers who had not planned to breastfeed, have wanted to express milk to compensate for a preterm birth (Lee et al. 2009). Sometimes professionals avoid counseling with mothers who are not interested in breastfeeding, but the breastfeeding counseling provided has not seemed to increase maternal anxiety even in mothers who were planning to formula-feed their preterm infants (Sisk et al. 2006). Providing breast milk has been experienced to be a positive thing and supportive of the sense of mothering (Bernaix et al. 2006). Some mothers find milk pumping as a comfortable and relaxing moment, whereas other mothers think it feels painful and stressful. Sometimes, a mother may experience milk pumping as paradoxical; it appears to be both a link and a wedge

between the mother and the infant. Some mothers dislike pumping, but they want to provide their own milk, thus they continue expressing milk. The staff in the NICU should be aware of this dualistic nature of thinking and support these pump-dependent mothers individually. (Hurst et al. 2013, Rossman et al. 2013.)

Research on fathers related to expressing milk is scarce. The fathers' role as supporters of expressing milk for their preterm infants comprises participation in the pumping process by e.g. assembling, cleaning, or transporting the pump or reminding the mother of the pumping time. In addition, fathers can take responsibility for daily domestic issues such as cleaning and cooking, and fathers can provide moral support by encouraging mothers. (Smith et al. 2006.)

If the mother is not able to express significant volumes of milk, she may experience feelings of embarrassment and maternal concern and a low milk supply can become a self-fulfilling prophecy (Flaherman & Lee 2013, Lee et al. 2009, Bernaix et al.2006). Milk supply concerns are often dealt with by using formula milk, which leads to decreased pumping (or breastfeeding), which may lead to a truly insufficient milk supply (Flaherman & Lee 2013, Lee et al. 2009). Sometimes long-term milk expression leads to objectification of breast milk, which may have a negative impact on the mother's breastfeeding experience (Sweet 2006). A support intervention for breast milk expression for the mothers of preterm infants has been developed and preliminary results showed that the intervention was acceptable and feasible. The intervention entailed two-hour education session and telephone follow-up and helpline. (Héon et al. 2014.) Breast milk expression during and after kangaroo care may produce a greater milk volume than that expressed sitting besides the incubator (Acuña-Muga et al. 2014). Parents need knowledge and especially mothers need continuous support for their motivation to maintain milk supply during the infant's hospital stay (Alves et al. 2013).

2.3.3 Transfer to direct breastfeeding

Transfer from tube feeding to breastfeeding is one of the challenges during the NICU stay. Skills and knowledge are needed from nursing staff members. Nurses are in a key position to promote the transfer because they have the most interaction with the infants and the parents. Nurses and parents can together assess the infant's stability and the cues given by the infant. (Jones 2012.) However, generally the decision to initiate oral feeding is made by the staff (McInnes et al. 2010). Breastfeeding is a central part of a demanding process of becoming a mother; especially for the mothers of preterm infants. Breastfeeding may be experienced as reciprocal or non-reciprocal or somewhere in-between. The feelings and emotions of the mother are important to consider in discussions between health care professionals and mothers. (Flacking et al. 2007.)

The transition from tube feeding to breastfeeding can be supported with test weighing and estimated breastfeeding. Test weighing is an accurate and easily used method for measuring the amount of milk ingested (Meier et al. 2013b, Funquist et al. 2010). The latter, estimated breastfeeding, has been stated to be a feasible method and less stressful for the mothers than test weighing. However, estimated breastfeeding has been found to decrease the rates of exclusive breastfeeding. (Ericson & Flacking 2013.) A cue-based pathway relying on the behavioral readiness signs of an infant (PMA ≥ 32) in order to initiate oral feedings, has resulted in earlier achievement of full oral feeding in preterm infants (Kirk et al. 2007). Pumping just before the breastfeeding session may stimulate the maternal milk ejection reflex (MER) released by oxytocin, and the preterm infant will get the milk more easily directly at the breast (Hurst 2005). Notably, if supplementary feeds given exceed the volume which preterm infants would have received directly at the breast, it may have negative impact on breastfeeding. This is because the infant is not as hungry as often as he/she should be to keep up the mother's milk production. (Mattsson et al. 2015.)

Other methods and interventions for transition, such as the semi-demand method, breast milk odor stimulation, and cup feeding, have also been developed and tested. The semi-demand method means using infant behavioral and cardiorespiratory signs to regulate at-breast feeding sessions. It has significantly shortened the transition time from tube feeding to breastfeeding in infants with BPD. (McCain et al. 2012.) The tube fed preterm infants, who were stimulated by the odor of breast milk during feedings, transitioned earlier to breastfeeding than the control infants (Yildiz et al. 2011). Related to this, exposure to the odor of mother's milk before breastfeeding session has also had a positive effect on suckling and the ingestion of milk (Raimbault et al. 2007). Cup feeding is one method for supporting the transition period, but the evidence for the benefits of cup feeding is weak (Collins et al. 2008) and no benefits for maintaining breastfeeding after hospital discharge was found (Flint et al. 2007). However, Mizuno and Kani (2005) stated that sipping/lapping is as safe a method as bottle feeding with regard to the infant's physiological parameters.

The time at the breast should not be restricted, and preterm infants should be allowed plenty of time to suckle and rest (Nyqvist 2005). Infant Breastfeeding Assessment Tool (IBFAT) has been developed to assess breastfeeding behaviors in full-term infants by their mothers. The IBFAT was tested in very low birth weight infants and their mothers. The scores correlated with milk intake, but did not identify the sessions with adequate or inadequate milk intake. (Furman & Minich 2006.) In Finland, the Preterm Infant Breastfeeding Behavior Scale (PIBBS) developed in Sweden by Nyqvist et al. (1996) is recommended as suitable instrument to assess breastfeeding behavior (Ikonen et al. 2015). This instrument is developed for observing actual breastfeeding situation (Nyqvist et al. 1999).

2.3.4 Factors associated with breastfeeding in the NICU

Several studies have examined factors associated with breastfeeding or tested interventions for increasing breastfeeding rates in the NICU. Strategies need to be adapted into different settings: a successful strategy in one unit does not always fit into another (Nyqvist 2005). Comprehensive, hospital-wide systems to support and promote breastfeeding are demanding and long-term projects (Spatz 2005). In addition, race and ethnicity seem to have an association with the likelihood of breastfeeding which is a global challenge in multicultural countries (Lee et al. 2011). The presence of a human milk bank in the hospital has seemed to increase breastfeeding rates (Arslanoglu et al. 2013), at least opening a milk bank in a neonatal unit decreased the use of formula during the first month of the infants lives (Torres et al. 2010). Admitting mothers to the NICU together with the infant and minimizing the use of a pacifier were associated with earlier establishment of exclusive breastfeeding (Maastrup et al. 2014a). The use of test-weighing seemed also to increase the rates of exclusive breastfeeding. In general, the use of nipple shields should be avoided because it was associated with a shorter duration of breastfeeding (Maastrup et al. 2014b). Another study, however, recommends the use of nipple shields to facilitate milk transfer until the infants achieve term and are gaining weight (Meier et al. 2013b). Direct breastfeeding before or without bottle feeding is preferred to promote breastfeeding at discharge (Pineda 2011a); bottle feeding should be restricted until breastfeeding is well established (Nyqvist et al. 2013). With regard to late preterm (34–36 weeks of GA) infants, direct breastfeeding should be the first oral feeding offered (Briere et al. 2015a).

Kangaroo care (KC) is strongly recommended in both high-tech and low-income settings and parents should be encouraged to provide KC as much as possible, ideally starting from birth (Nyqvist et al. 2013). The amount of KC in the NICU is positively associated with the duration of breastfeeding in both very preterm and late preterm infants (Briere et al. 2014a, Nyqvist et al. 2013, Flacking et al. 2011, Ahmed & Sands 2010, Hake-Brooks & Anderson 2008, McInnes & Chambers 2008) and does not increase morbidity compared to a conventional care (Conde-Agudelo & Díaz-Rossello 2014, Ghavane et al. 2012, Edmond & Bahl 2006).

Increased parental involvement and the possibility to reside together with the infant increases the duration of breastfeeding compared with traditional care (Wataker et al. 2012). Interventions in designated NICUs according to the Baby Friendly Hospital Initiative (BFHI) have significantly increased breastfeeding rates (Parker et al. 2013b, Dall'Oglio et al. 2007), and the frequency of mother's milk use at discharge has found to be high in a Baby Friendly hospital (do Nascimento & Issler 2005). The Spatz Ten Steps for Promoting and Protecting Breastfeeding for Vulnerable Infants, implemented

during a 3-year period in the level III NICUs in the US, improved breast milk feeding rates at discharge. In addition, parent satisfaction with nurses' breastfeeding support increased. (Fugate et al. 2015.) Interventions educating mothers of NICU-infants have increased the knowledge about breastfeeding, the use of human milk and the breastfeeding rate at discharge (Ahmed 2008, Montgomery et al. 2008). Multidisciplinary intervention including education for nurses and neonatologists and extra counseling and support for the mothers of preterm infants has increased breastfeeding at hospital discharge (Gianni et al. 2014). Mothers singing to their preterm infant did not have any effect on feeding (Blumenfeld & Eisenfeld 2006), although previously reported singing and music has had positive effects, for example on the infant's weight gain (Standley 2002).

Insufficient milk supply has been identified as an important risk factor for early weaning (Hill et al. 2007a). However, there are some medications which could increase milk volume. Of these medications, a double-blinded RCT study examining the use of oxytocin nasal spray (Fewtrell et al. 2006) and the use of metoclopramide (Hansen et al. 2005), found no differences in total breast milk volume or the duration of breastfeeding between the study groups. Prophylactic use of these medications cannot be recommended because of limited evidence (Donovan & Buchanan 2012).

If the preterm infant has specific feeding difficulties such as fatigue or feeding-induced apnoea, it might delay the discharge. Parents may feel frustrated and the focus turns to the infant's weight gain instead of the parent-infant relationship. (Swift & Scholten 2010.) An extended length of stay in the NICU has been stated to be the most important risk factor for early weaning (Maia et al. 2011, Kirchner et al. 2009). Initiating breastfeeding for a preterm infant may be a long and demanding process, in which patience and hard work from the mother are needed. Sometimes breastfeeding of a preterm infant may become a duty instead of being a satisfying experience (Flacking et al. 2007). The best support for breastfeeding is to provide a favorable environment that enhances the mother's self-confidence (Flacking et al. 2006). According to Dennis (2003b), the level of breastfeeding self-efficacy predicts the breastfeeding success as regards choosing to breastfeed and how much effort the mother will invest. The role of the father in the decision-making about the feeding method seems to be important. The fathers, participating in an interview study, did not have any awareness of the possible negative influence of bottle feeding on breastfeeding. Fathers should also have more education about milk expression and breastfeeding. (Sweet & Darbyshire 2009.) Sometimes the parental expectations of natural breastfeeding are not quite realistic and health care professionals need to be sensitive when discussing preterm infant's feeding (Sweet 2008).

2.4 Continuing breastfeeding at home after hospital discharge

Hospital discharge may cause great excitement and even anxiety for the family of a prematurely born infant. A feeding plan is an essential part of the discharge planning of preterm infants. Careful preparation and planning of each relevant aspect for discharge is an important part of a high-quality care process. (Barkemeyer 2015.) After discharge, the support provided by health care professionals is essential and invaluable (Ahmed 2010). After discharge, preterm infants have more eating problems than full-term infants, such as vomiting or long durations of mealtimes. Solid foods are also introduced earlier than recommended. (Ross & Browne 2013.)

In Europe, breastfeeding rates concerning preterm infants at discharge vary from 19% to 70% (Bonet et al. 2011). In Nordic countries the rates are higher, for example, in Sweden 74% of preterm infants are exclusively and 93% at least partially breastfed at discharge (Flacking et al. 2003). The corresponding rates in Denmark are 68% and 85%, respectively (Maastrup et al. 2014a). Direct comparisons with Finnish statistics are not possible because of different measurement points. At two months of age, 26% of preterm infants are exclusively and 66% at least partially breastfed (Uusitalo et al. 2012), thus the rates in Finland are lower than in other Nordic countries, but higher than the average rates in Europe (Breastfeeding promotion in Finland 2009).

At discharge, mothers of very low birth weight (VLBW) infants have reported low milk volume, the mother being emotionally compromised and the infant being physically compromised are the main barriers to breastfeeding. Later at home, mothers continued to have the perception of the infant being physically compromised, which easily led to complementary feeding of expressed breast milk or formula by bottle or problems with the breastfeeding technique, which again led to complementary feeding. With complementary feeding mothers lost their production of oxytocin and prolactin because of the missing stimulation of their breasts, and experienced a further decrease in milk volume. (Callen et al. 2005.) The other main reasons for ceasing milk expression have been mother's returning to work and an inability to pump as often as needed (Sisk et al. 2006).

Mothers of preterm infants exclusively breastfeeding during the first week after discharge have seemed to have a longer duration of breastfeeding (Briere et al. 2014a). A study conducted in Italian NICUs, showed that breastfeeding of preterm infants is very limited at discharge. Breastfeeding rates varied between different hospitals included in the study. (Davanzo et al. 2012.) Early discharge with continuous lactation support promoted breastfeeding among healthy preterm infants (Ahmed & Sands 2010). Preterm infants discharged with tube feeding and home support by a nurse have been breastfed longer than the infants in the control group (Meerlo-Habing et al. 2009). Test weighing

might facilitate breastfeeding at home, if the families use accurate scales (Meier et al. 2013b, Meier et al. 2013c). Additional postnatal support has seemed to be one of the most advantageous interventions to improve breastfeeding outcomes (McInnes & Chambers 2008). A study investigating the effectiveness of proactive telephone support for the mothers of preterm infants is ongoing in Sweden. The mothers in the experimental group are phoned daily for two weeks after hospital discharge. The cost-effectiveness will also be assessed. (Ericson et al. 2013.)

2.5 Breastfeeding attitude

Attitude is 'the way a person views something or tends to behave towards it, often in an evaluative way' (MOT Collins English Dictionary 2009). Attitude has a cognitive, affective, and behavioral component. It might be difficult to directly measure an attitude, but by measuring the different components it is possible. (Altmann 2008.) Breastfeeding-related attitudes have been studied mostly in mothers of full-term infants or during pregnancy. Breastfeeding attitude has seemed to predict the duration of breastfeeding better than the sociodemographic factors (Martin-Anderson 2013). Attitude has been measured with different questions developed for each study in many different countries. However, the Iowa Infant Feeding Attitude Scale (IIFAS) has been used quite widely. It was developed in the US in 1999 (de la Mora et al. 1999), and has since been translated and validated in many countries, and also in Europe and Asia.

Breastfeeding attitude has been found to be a direct predictor of breastfeeding intention in primiparas in a qualitative study in which a theory of planned breastfeeding behavior model was created (Moore & Coty 2006). The mothers who breastfed for six months or longer, had a more positive attitude toward breastfeeding in a Korean study. Higher breastfeeding knowledge was associated with a more positive attitude. (Kang et al. 2015.) In a study comparing Indian women from two generations, pregnant women, and their mothers or mother-in-laws, indicated no significant differences between awareness or attitudes regarding breastfeeding. The level of awareness was good, but the attitude to implementing their knowledge in practice was missing. For example, almost all of the mothers knew that breast milk is the best food for a baby, but only less than 75% were ready to breastfeed immediately after birth. (Pandey et al. 2015.) About a half of Nigerian mothers had a positive attitude toward breastfeeding (Mbada et al. 2013). In Jordanian mothers, the attitude was quite positive and the mothers strongly believed that breastfeeding is easier and less expensive than formula feeding (Khassawneh et al. 2006).

In a comparison between final year student midwives, peer supporters, and breastfeeding women attending community breastfeeding support centers in the UK,

the peer supporters had the highest attitude score measured with the Infant Feeding Questionnaire (IFQ). High scores were attributed to the effective training of the peer supporters. (Darwent & Kempenaar 2014.) An instrument measuring breastfeeding knowledge, attitude, and confidence (BKAC) has been developed in Finland for developing individual breastfeeding counseling. Positive attitude was associated with more breastfeeding knowledge. (Laanterä et al. 2012, Laanterä et al. 2010.) Breastfeeding attitude has also been investigated with an interview approach among Vietnamese mothers. Although the general impression the mothers gave was positive and breastfeeding was considered beneficial to an infant, none of the interviewed (n = 23) mothers exclusively breastfed. (Lundberg & Ngoc Thu 2012.) Attitudinal factors, such as embarrassment of public breastfeeding or inconvenience of being tied down to the infant, have shown to be important barriers for breastfeeding (McCann et al. 2007).

Studies using IIFAS comprise the majority of research concerning breastfeeding attitudes. However, the IIFAS scores have been categorized differently between the studies, and grouping has not been done in most of the studies. Dungy et al. (2008) labeled the groups and suggest that an attitude score between 70 and 85 refers to 'positive to breastfeeding', 49–69 'neutral', and 17–48 'positive to formula feeding', i.e. 'negative to breastfeeding'. Breastfeeding attitude screened by the IIFAS prenatally or in a birth hospital, has been the strongest predictor of breastfeeding in an urban, low-income population in the US, Italy, Scotland, and in a convenience sample of Taiwanese mothers (Srinivas et al. 2014, Bertino et al. 2012, Ho & McGrath 2011, Dungy et al. 2008). In Canadian, the IIFAS demonstrated a good internal consistency for expectant mothers in the third trimester (Cronbach's alpha > 0.80) and predicted breastfeeding intentions (Twells et al. 2014). Correspondingly, in a US study, positive attitude during pregnancy was associated with intended breastfeeding (Persad & Mensinger 2008). The IIFAS has been translated in Arabic and validated for Lebanese women; Cronbach's alpha being 0.64 (Charafeddine et al. 2015). The Japanese version of IIFAS, used in the third trimester of pregnancy, was associated with higher exclusive breastfeeding rate at four weeks after birth. The Japanese version included 16 items; one item was removed after analysis (Cronbach's alpha 0.66) (Nanishi & Jimba 2014.) The three Chinese versions also predicted the duration of breastfeeding and showed good internal consistency (alphas 0.62–0.74) (Chen et al. 2013, Dai et al. 2013, Ho & McGrath 2012). Attitude score measured by the IIFAS was not associated with breastfeeding initiation or duration in Latino mothers in San Francisco (Holbrook et al. 2013). The IIFAS has been used in one study in Finland, in which positive attitude predicted the likelihood of exclusive breastfeeding (Hannula et al. 2014).

In a recently published study, the IIFAS was psychometrically tested in a multiethnic population during pregnancy in Singapore. Based on the analysis, two original

statements were removed due to low factor loadings and communalities. The psychometrically sound IIFAS consisted of 15 statements divided into three factors ('favorable to breastfeeding', 'favorable to formula' and 'convenience'). It is noteworthy, that the testing study had a convenience sample and it did not prove the predictive validity of the new version. (Lau et al. 2015.)

Only a few studies were found that measured attitude or rather a plan to breastfeed or the breastfeeding goals of mothers of preterm infants. A plan to breastfeed seems to be the strongest predictor of breastfeeding or expressing milk in VLBW infants (Sisk et al. 2009, Sisk et al. 2006). Setting a breastfeeding goal for oneself seemed to increase the likelihood of direct breastfeeding at discharge (Briere et al. 2015b). Intended length of lactation less than 34 weeks was associated with increased risk of using formula (Hill et al. 2007a). The Preterm Infant Feeding Survey (PIFS) was developed to examine attitudes concerning feeding decisions of mothers of preterm infants. It has been evaluated to be a valid and reliable tool to examine factors contributing to feeding decisions. (Dowling et al. 2009a.)

2.6 Breastfeeding peer support

Peer support can be defined as the assistance and encouragement provided from an individual to an individual who is considered equal. Peer support includes informational, appraisal and emotional support in various combinations. (Dennis 2003a.) Breastfeeding peer support has been the subject of a considerable number of studies, but there are clearly less studies concerning breastfeeding peer support in the mothers of preterm infants; the latter studies are described at the end of this chapter.

Breastfeeding peer support may also build social capital by bonding, bridging, and linking breastfeeding mothers with the peer-supporters (Thomson et al. 2015), and it can be implemented with reasonable costs (Chola et al. 2011). Peer counselors in general have seemed to be effective in improving the rates of breastfeeding initiation, duration, and exclusivity by providing reliable and individually appropriate information, as well as taking into consideration the cultural aspects of breastfeeding (Chapman et al. 2010, Rossman 2007). Peer supporters and health care professionals may both benefit from each other; first by enhanced social support and also by the easing of work-loads (Curtis et al. 2007).

Despite the support provided by a professional or peer, breastfeeding mothers want an authentic presence with someone they can take time to have a relationship with, and also who will have a facilitative approach with realistic information and encouragement. In contrast, mothers often criticize conflicting or standard information given by a reductionist approach or one that is undermining, increases pressures, or has an

insensitive touch. (Schmied et al. 2011.) Mothers appreciate flexible plans and support, feedback, and reassurance. Breastfeeding peer support can be considered as providing hope to the mothers. (Thomson et al. 2012.) Individual peer support is valued and positively received among the mothers (Nankunda et al. 2010). Emotional support from peer supporters is important especially when the environment is not supportive of breastfeeding (Meier et al. 2007).

It is suggested that peer support increases the duration of exclusive breastfeeding, especially in low or middle income populations (Jolly et al. 2012b, Sudfeld et al. 2012, Dyson et al. 2007, Meier et al. 2007). Different ethnic groups have responded differently to peer-support intervention in the US (Anderson et al. 2007). Targeting the peer-support programs to younger mothers and mothers without previous breastfeeding experience has been suggested (Bolton et al. 2009). Peer support has been conducted by face-to-face visits or by telephone, mostly in birth hospital or at home after hospital discharge, but sometimes also in antenatal contexts. Meetings with peer counselors have especially increased breastfeeding in first time mothers (Campbell et al. 2014, Cameron et al. 2010) and exclusive breastfeeding in both primi- and multiparas (Tylleskär et al. 2011, Anderson et al. 2005, Leite et al. 2005), but there are also some conflicting results that show no effect (Jolly et al. 2012a, Muirhead et al. 2006). Some effects of the diminishing of prelacteal feeding and the initiation of breastfeeding was shown after peer-support intervention in Africa; however, the differences in habits related to birth and breastfeeding were notable (Engebretsen et al. 2014). In-person contacts were evaluated as essential components of a breastfeeding peer-support intervention (Rozga et al. 2015). Mothers seem to have preferred peer-support groups over one-to-one support because of the social community (Hoddinott et al. 2006a). However, both have shown to be effective and increased breastfeeding at least in areas with below-average breastfeeding rates (Hoddinott et al. 2006b). One study focused on fathers was found; breastfeeding peer support provided for fathers did not improve the breastfeeding outcomes of their wives (Lovera et al. 2010).

Telephone peer support can be effective for certain health-related issues including breastfeeding (Dale et al. 2008). Peer support conducted by telephone or face-to-face has increased breastfeeding rates, supported women with low self-efficacy (Srinivas et al. 2014), and promoted the confidence to breastfeed (Ingram 2013). Completely telephone-based peer support seems to increase any type of breastfeeding (Reeder et al. 2014) and the exclusive breastfeeding duration in adolescent mothers (Meglio et al. 2010). However, telephone peer support did not show any effect on breastfeeding in an intervention study implemented in Hong Kong (Wong et al. 2007). A randomized controlled trial of telephone peer support initiated in the early postnatal period is ongoing in Australia (Forster et al. 2014). One study examining internet-based breastfeeding peer support was found: it aimed to analyze the discussions about breastfeeding in an online

community. The discussions mainly provided emotional support, and the topics were mainly general parenting issues including some breastfeeding discussion. (Cowie et al. 2011.)

Antenatal peer support might have an effect on breastfeeding if the intervention is targeted to a group of women who are planning to breastfeed (Ingram et al. 2010), but universal antenatal peer support showed no effect (Ingram et al. 2010, MacArthur et al. 2009). An antenatal peer-led breastfeeding class was found to be as effective as a nurse-led class with regard to breastfeeding outcomes. However, the classes were not equivalent: for example, mothers in the peer-led group were older and had a higher education. (Rempel & Moore 2012.) It is suggested that pregnant women attending peer-support groups during pregnancy are more likely to intend to breastfeed compared with mothers who do not join the groups (Mickens et al. 2009). Only one peer-support session (Ochola et al. 2013) or low-intensity support (Jolly et al. 2012b) seem to have been ineffective in increasing breastfeeding rates. Furthermore, the timing of peer visits needs to be determined in future studies to achieve the best possible effect (Sudfeld et al 2012). In a systematic review by Kaunonen et al. (2012) continuous peer support combined with professional support was evaluated as the most efficient.

Peer counseling has proved to be an effective intervention to promote breastfeeding outcomes in the mothers of preterm infants. Mothers who were randomized into a group meeting weekly with a peer counselor for six weeks had greater odds of providing breast milk at 12 weeks postpartum. (Ahmed & Sands 2010, Merewood et al. 2006). Mothers of low birth weight infants have benefitted from peer counseling, and the rates of exclusive breastfeeding have significantly improved (Agrasada et al. 2005). Based on a study by Oza-Frank et al. (2014), there should be both professional lactation consultants and peer supporters in the NICU to achieve an increase in breastfeeding rates.

Mothers of preterm infants valued and respected the support and knowledge received from breastfeeding peer supporters who were mothers of former NICU infants. The mothers gained informational and emotional support from the peer supporters and also hope in their situations. They enjoyed sharing their experiences with somebody who had had the same experience and knew how difficult milk expression and breastfeeding in the NICU can be. (Rossman et al. 2011.) Kristoff et al. (2014) reported on a peer-support group established in a neonatal unit by two NICU nurses interested in breastfeeding support. The face-to-face meetings held once a month were highly valued by the participating mothers. The challenges of maintaining the group were related to time and cost. (Kristoff et al. 2014.) In the US, positive experiences have been accomplished by training former NICU parents to be peer supporters working together with NICU nurses (Meier et al. 2013a, Rossman et al. 2012).

2.7 Starting point for this study

Despite the large volume of breastfeeding research, there are still some gaps that need to be filled. The whole path of preterm infant from the delivery room to the NICU and finally to home should be examined. Most of the previous studies have followed breastfeeding until the infant's discharge or few weeks after that. Studies with a longer follow-up are needed to understand the whole process of preterm infants' breastfeeding. In addition, the focus should be placed on issues which can be influenced by midwifery or nursing practices.

First, research concerning delivery ward practices in preterm infants' breastfeeding is lacking. It has been known for a long time that early skin-to-skin contact between a mother and her healthy full-term infant promotes breastfeeding (Moore et al. 2012), but in preterm infants the association has not been studied. Second, no previous research on maternal breastfeeding attitude or self-efficacy in the mothers of preterm infants, or the possible association between attitude and breastfeeding exists. Third, peer support is a quite efficient method to improve breastfeeding rates and it is valued by the mothers, but internet-based breastfeeding peer support has not previously been studied. The availability of the Internet is, however, increasing all the time for the global population. In Finland, practically all fertile-aged women use the Internet and a majority also use social media (Official Statistics of Finland 2014).

From a scientific perspective, breastfeeding is a multidimensional phenomenon, and it has to be approached with different methods to capture the different aspects. Both quantitative and qualitative approaches, complementing each other, are needed. Breastfeeding can be measured objectively, but it means more than just feeding the infant and measuring the duration of breastfeeding. Breastfeeding has a strong psychological aspect and it induces feelings; especially preterm infants' breastfeeding can be very emotional, thus also subjective and holistic methods are needed. Furthermore, intervention studies in breastfeeding promotion are required to tailor the support to different settings and populations (Renfrew et al. 2012).

3. AIMS OF THE STUDY

The overall aim of this study was to examine how to support breastfeeding of preterm infants immediately after birth in the delivery ward, during their hospital stay in a neonatal intensive care unit, and at home after hospital discharge. The aim was to specifically describe and determine the role of early physical contact between a mother and her preterm or sick infant, maternal breastfeeding attitude, and breastfeeding self-efficacy related to the initiation and duration of breastfeeding. A further aim was to develop and test by experimental design an internet-based peer-support intervention created to support breastfeeding in the mothers of preterm infants. The perspective of the mothers of preterm infants was examined by a qualitative approach.

The detailed research questions of the studies were:

1) How is the initiation of breastfeeding of preterm and sick infants supported in the delivery ward?

   a) How is early physical contact between a mother and her preterm or sick infant implemented in the delivery ward? (Study 1)

   b) Is there an association between early physical contact and the initiation of breastfeeding? (Studies 1 and 3)

2) How is breastfeeding supported during the preterm infant's hospital stay?

   a) Which factors predict the initiation and frequency of breastfeeding preterm infants in the NICU? (Study 3)

   b) What are the mothers' perceptions on breastfeeding their preterm infants in the hospital? (Study 4)

3) How can breastfeeding of preterm infants be supported via the Internet after hospital discharge?

   a) What outcomes does internet-based peer support produce for parents (Study 2)?

   b) How feasible is an internet-based breastfeeding peer-support intervention? (Study 3)

   c) Does the internet-based breastfeeding peer-support intervention have an effect on the duration of breastfeeding, breastfeeding attitude, or self-efficacy in the mothers of preterm infants compared with routine care? (Study 3)

   d) What are the mothers' perceptions of breastfeeding their preterm infants at home? (Study 4)

4. MATERIAL AND METHODS

4.1 Study designs

Different study designs were used throughout the study to obtain answers to the research questions (Table 2.)

Table 2. Research questions, designs and samples.

Research question	Design	Sample
1) How is the initiation of breastfeeding of preterm and sick infants supported in the delivery ward?	Study 1 (Paper I): Descriptive design, prospective structured survey (2008–2009)	Preterm or sick full-term infants admitted in the NICU immediately after the birth in two hospitals, n = 178 + 203; the mothers of those infants, n = 69 + 85
	Study 3 (Paper III): Randomized controlled trial and follow-up (2011–2015) -> baseline data	Mothers of preterm (GA < 35) infants, n = 124 (experimental group, n = 60, control group, n = 64)
2) How is breastfeeding supported during the preterm infant's hospital stay?	Study 3 (Paper III): Randomized controlled trial and follow-up (2011–2015) -> baseline data	Mothers of preterm (GA < 35) infants, n = 124 (experimental group, n = 60, control group, n = 64)
	Study 4 (Paper IV): Descriptive, qualitative design, analysis of social media postings (2011–2013)	Postings (n = 305) written in the internet-based peer-support group in social media by the mothers of preterm infants (n = 22), the peer-supporters (n = 3) and the midwife
3) How can breastfeeding of preterm infants be supported via the Internet after hospital discharge?	Study 2 (Paper II): Systematic integrative review (2013–2014)	Literature review: Cochrane, PubMed, Cinahl, PsycInfo (search until March/2014)
	Study 3 (Paper V): Randomized controlled trial and follow-up (2011–2015)	Mothers of preterm (GA < 35) infants, n = 124 (experimental group, n = 60, control group, n = 64)
	Study 4 (Paper IV): Descriptive, qualitative design, analysis of social media postings (2011–2013)	Postings (n = 305) written in the internet-based peer-support group in social media by the mothers of preterm infants (n = 22), the peer-supporters (n = 3) and the midwife

4.2 Internet-based peer-support intervention and routine care

The experimental intervention (Studies 3 and 4) was a closed breastfeeding peer-support group called 'Keskosvauva rinnalla' ('Preemie at the breast') in social media (Facebook) (Figure 1.). The group was established and maintained for this study. No individuals were accepted in the group other than the mothers participating in the experimental group. The mothers were invited to participate in the group based on their individual needs without any obligations. The frequency of use of the group was not followed apart from by questionnaires filled in by the mothers. However, the number of actual participants and the postings written by them were followed. Mothers randomized in experimental group received information and advice about how to join in the group at the same time as the first questionnaires. Mothers had no organized internet access in the hospital.

Mothers outside the study group and with previous experience of breastfeeding preterm infant were asked to provide peer support. The three voluntary mothers were recruited from a local Finnish association for families with preterm infants. The peer supporters had individual experiences of breastfeeding their own preterm infants, but they were not expected to have been 'successful' or have any certain duration of breastfeeding. No special training was organized for the peer supporters, but they were advised to be encouraging, supportive, and breastfeeding-favorable. The participating mothers were also peer supporters to each other. In addition, a midwife (researcher) was available to answer potential questions on breastfeeding. The participating mothers had access to the group for at least a year after their infant was born.

Figure 1. The cover picture of the breastfeeding peer-support group in social media (Original drawing: Sanna Laaksonen).

All of the mothers were provided with routine counseling and support for breastfeeding. All pregnant women in Finland are expected to have breastfeeding counseling during pregnancy in the maternity clinics. This support continues in birth

hospitals, where midwives in the delivery and postpartum ward and nurses in the NICU provide breastfeeding and breast pumping counseling to mothers. (Klemetti & Hakulinen-Viitanen 2013.) Routine counseling for the mothers of preterm infants in hospital includes advice on initiating milk expression by hand during the first six hours postpartum, and to continue by expressing with a manual or electric breast pump at least eight times per day. Mothers are encouraged to bring even the smallest amounts of milk to their preterm infants from the first day. The NICU has free visiting hours for parents but provides very limited possibilities to stay overnight because they have only one room suitable for that. After hospital discharge, the health and welfare of all the infants in Finland are followed in child health clinics. Public health nurses in child health clinics also provide breastfeeding counseling and support (Rova & Koskinen 2015). All the mothers participating in this study were provided routine breastfeeding support in the hospital, and in the maternity and child health clinics.

4.3 Settings, designs and subjects

Study 1 (Paper I)
The prospective structured survey was conducted in two Finnish university hospitals ('A' and 'B') starting from November 2008 and continuing until March 2009. All preterm or sick full-term infants in these hospitals needing NICU care directly from the delivery ward were eligible for the study. The number of eligible infants in hospital A was 185 and in hospital B 235. A questionnaire concerning the implementation of early contact between a mother and her infant was expected to be completed by the staff members participating in the infant's care. Altogether 178 infants in hospital A and 203 infants in hospital B with at least one questionnaire completed by a midwife or auxiliary nurse were included in the study.

In the latter part of Study 1, a subsample of these infants and their mothers mentioned above participated in the study. The final sample size was 69 mothers with 76 infants in hospital A and 85 mothers with 94 infants in hospital B. Over half of the mothers were primiparas, 55% in hospital A and 63% in hospital B. (Table 3.)

Study 2 (Paper II)
A systematic integrative review of the internet-based peer-support for parents was conducted in 2014. The review included 38 studies focusing on what kind of internet-based peer-support groups or interventions had been provided for parents and what the main outcomes for the parents had been.

Table 3. Characteristics of the study infants and their mothers in Study 1.

Infant characteristic	**Hospital A n = 178**	**Hospital B n = 203**	**P-value**
Birth weight, g Median (range)	3210 (400–6040)	2950 (500–5035)	0.081
Gestational age, weeks Median (range)	38.0 (23.3–42.3)	37.9 (25.0–42.4)	0.081
Apgar 1 minute Median (range)	8 (0–10)	8 (1–9)	0.437
Proportion of sick full-term infants,n (%)	110 (62%)	114 (56%)	
Proportion of late preterm (32–36.9) infants, n (%)	57 (32%)	61 (30%)	0.050
Proportion of very preterm (< 32) infants, n (%)	11 (6%)	28 (14%)	
Maternal characteristic	**Hospital A n = 69**	**Hospital B n = 85**	**P-value**
Age, years Median (range)	31 (17–43)	31 (19–45)	0.558
Number of previous children, Median (range)	0 (0–3)	0 (0–6)	0.325

Study 3 (Papers III and V)

A randomized controlled study with a follow-up was conducted in 2011–2015. During an almost a three-year period from June 2011 to March 2014 all mothers who gave birth in Turku University Hospital, Finland, before the full 35 gestational weeks were eligible for the study. Although the established limit for a preterm birth is 37 weeks, infants considered as 'late preterm' (35.0–36.9) were excluded because these infants do not always need intensive care, and specifically only infants who were transferred to the NICU were examined.

Based on the power calculation, 128 mothers in total (n = 64 mothers per group) were needed to detect the difference in the change of attitudes and the change of the breastfeeding rate between the groups. The assumed difference in the attitude scale (IIFAS, Iowa Infant Feeding Attitude Scale, de la Mora et al. 1999) between the experimental and control groups was 5 points (two sample t-test, two-sided, SD 10). The attitude-score in the IIFAS can range from 17 to 85 points. Correspondingly, the assumed difference in the breastfeeding rate is 20 percentage units (Pearson Chi-square test, one-sided). Both analyses were done with a power level of 0.80 and a significance

level of 0.05. The estimated sample size was not quite reached because of the difficulties in recruiting mothers, and some organizational changes in the study hospital.

When the recruitment ceased, the sample consisted of 124 mothers of preterm infants, in which 60 were randomized into an experimental group and 64 into a control group. (Table 4.) The participating mothers were considered as a one group when analyzing the baseline data, because no differences between the groups existed at the baseline. The intervention effect on breastfeeding was not was expected during the infant's hospital stay because of 1) the mothers' limited possibilities to access the group in the hospital, and 2) the short exposure of the intervention. Forty-four of the 60 mothers actually registered in the internet-based peer-support group. However, the intent-to-treat principle was followed in the statistical analyses and all 60 mothers were included in the intervention group. The follow-up of participating mothers continued until April 2015. A different number of mothers completed the questionnaires during the follow-up. At the last measurement point 40 mothers in the experimental group and 50 mothers in the control group were able to be contacted. The flow of participants throughout the study is described in Paper V, Figure 1.

Study 4 (Paper IV)

A descriptive, qualitative design was used when analyzing the preterm infants' breastfeeding from the perspective of the mother, based on the postings written in the internet-based breastfeeding peer-support group. The experimental group of mothers who participated in the internet-based peer-support group between June 2011 and February 2013 participated in this sub-study. During this period, there were altogether 30 mothers and three peer supporters in the group. Eight mothers were considered as passive observers, because they did not write any questions or comments, thus there was a total of 305 postings written by 22 mothers; the postings of three peer supporters and the midwife were also analysed. Most postings (n = 221) were written by the mothers participating in the group and the rest of the postings (n = 36 and 48) were written by the peer supporters and the midwife, respectively. The median age of the participating mothers was 29 years, ranging from 20 to 46 years. The majority (n = 21) of the mothers were primiparae.

Table 4. Characteristics of participating mothers and their infants in experimental and control groups in Study 3.

Maternal characteristic	Experimental group n = 60	Control group n = 64	P-value
Age, years Median (range)	29 (19–46)	31 (20–46)	0.20
Primiparas n (%)	41 (68%)	45 (70%)	0.69
Married/Cohabiting n (%)	57 (97%)	61 (95%)	0.99
Vaginal delivery n (%)	29 (48%)	27 (42%)	0.53
Infant characteristic	**Experimental group infants n = 70** (10 pairs of twins)	**Control group infants n = 72** (8 pairs of twins)	**P-value**
Birth weight, g Mean (SD)	1688 (605)	1765 (629)	0.46
Gestational age, weeks Median (range)	32.0 (25.0–34.9)	32.9 (26.0–34.9)	0.80
Apgar 1 minute Median (range)	8 (1–10)	8 (1–10)	0.96
Length of hospital stay, days Median (range)	26 (7–200)	24 (7–112)	0.56

4.4 Data collection and the instruments used

Study 1 (Paper I)

Whenever a preterm or sick full-term infant needing intensive care was born, the midwife and auxiliary nurse who were responsible for the delivery and the infant, respectively, were asked to complete a questionnaire about the early physical contact between the mother and her infant. However, auxiliary nurses were present only in hospital A. In addition, the paediatrician who cared for the infant, were asked to fill in a questionnaire. It was possible to have three completed questionnaires per each infant. However, one completed questionnaire by a nurse (midwife or auxiliary nurse) was enough for inclusion in the study.

In the latter part of the study, the mothers of NICU infants were approached by the researcher no earlier than four days after the delivery. At least one completed questionnaire about the early physical contact was a primary inclusion criterion. The exclusion criteria for the mothers were 1) the infant was discharged from the NICU before day 4, 2) the mother had not seen her baby until day 7, 3) the mother did not speak Finnish, or 4) the infant's condition was life-threatening or he/she died. Altogether, 90 mothers in hospital A and 91 mothers in hospital B were excluded. After giving a written informed consent to participate, the mothers were asked to fill in the questionnaires about their background variables and early physical contact. Mothers of 30 infants (A, n = 12, B, n = 18) declined to participate or never returned the questionnaires.

Three different structured and short questionnaires, developed for the study, were used: one for midwives and auxiliary nurses, one for pediatricians, and one for mothers. The questionnaires for the midwives and auxiliary nurses included nine questions and the pediatricians' six questions related to the implementation of early physical contact. There were five structured options in the question about the early physical contact between a mother and her NICU infant: 1) skin-to-skin contact, 2) holding, 3) touching, 4) seeing the infant and 5) no contact in the delivery room. If the infant was allowed to have physical contact with the mother (skin-to-skin or holding), the staff members evaluated which factors facilitated the contact. Respectively, if physical contact was not implemented (touching, seeing, or no contact), the impeding factors were evaluated. Both questions had structured options.

The questionnaire designed for the mothers included nine questions and it contained the question of early physical contact, and also a question about the initiation of breastfeeding. The options were exclusive, partial, or occasional breastfeeding, or no breastfeeding. In addition, age and parity were requested from the mothers as background variables. Neonatal data describing the infants' physiological condition were collected from patient records. (Figure 2.)

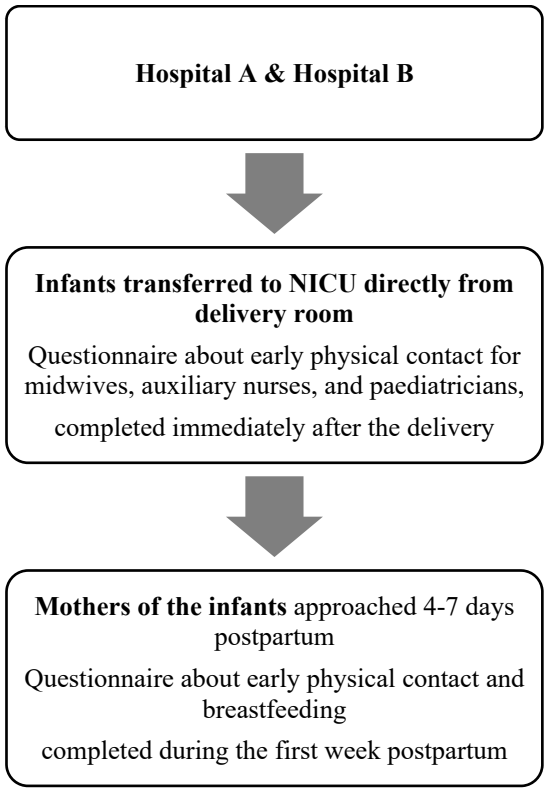

Figure 2. Measurement protocol in Study 1.

Study 2 (Paper II)

A systematic literature search was carried out in four databases: Cochrane, PubMed, Cinahl and PsycInfo. The search was conducted in November 2012 and updated in March 2014. The search terms used are presented in Paper II in Table 1. The publication years were not limited because it was expected that research on internet-based peer-support had only started in the late 20th century. The search was carried out by the primary investigator (HN-V) and the titles, and then the abstracts, were screened independently by two reviewers (HN-V & AA). After the selection process, 38 publications met the inclusion criteria. These publications were exposed to quality evaluation according to criteria by Gifford et al. (2007). The quality evaluation was conducted independently by two researchers (HN-V & H-LM).

Study 3 (Papers III and V)

Mothers of preterm infants (GA < 35 weeks) were approached one to seven days after the delivery by the researcher (HN-V) or one of the midwives trained by the researcher. A mother was excluded if 1) she could not speak Finnish, 2) her infant's condition was critical or he/she died, or 3) the mother had a syndrome or illness preventing breastfeeding. After signing the informed written consent, the mothers were given a

sealed envelope including information on their randomized group: letter ‘A’ referred to the experimental and ‘B’ referred to the control group. The study was not blinded after the randomization.

All participating mothers filled in the first structured questionnaires in the hospital during the first week postpartum. The mothers in the experimental group received instructions on how to join in the peer-support group in social media. The second questionnaires were given to mothers at their infants’ discharge and the mothers returned the completed questionnaires by mail. The third and fourth questionnaires were sent by mail at three and six months of the infant’s corrected age, respectively. The fifth and last measurement point was at twelve months of the infant’s corrected age, when the researcher phoned the mothers. If the mother could not be contacted by phone, a short questionnaire was sent to her by mail. Despite a mother not returning the previous follow-up questionnaires (at three and six months), she was phoned at the last measurement point. (Figure 3.)

Structured questionnaires were developed for this study, and validated instruments (1–2) were used. In the first questionnaire, mothers were asked about their background variables such as age, education, parity, and smoking habits. They also reported whether their pregnancy was intended, their happiness during the pregnancy, the mode of delivery, their birth experience, their breastfeeding intentions, and the importance of breastfeeding. The same question about early physical contact in the delivery room as in Study 1 was included in the questionnaire of this study. Questionnaires three and four contained questions about the current status of breastfeeding and expressing milk and the reasons for breastfeeding cessation if relevant.

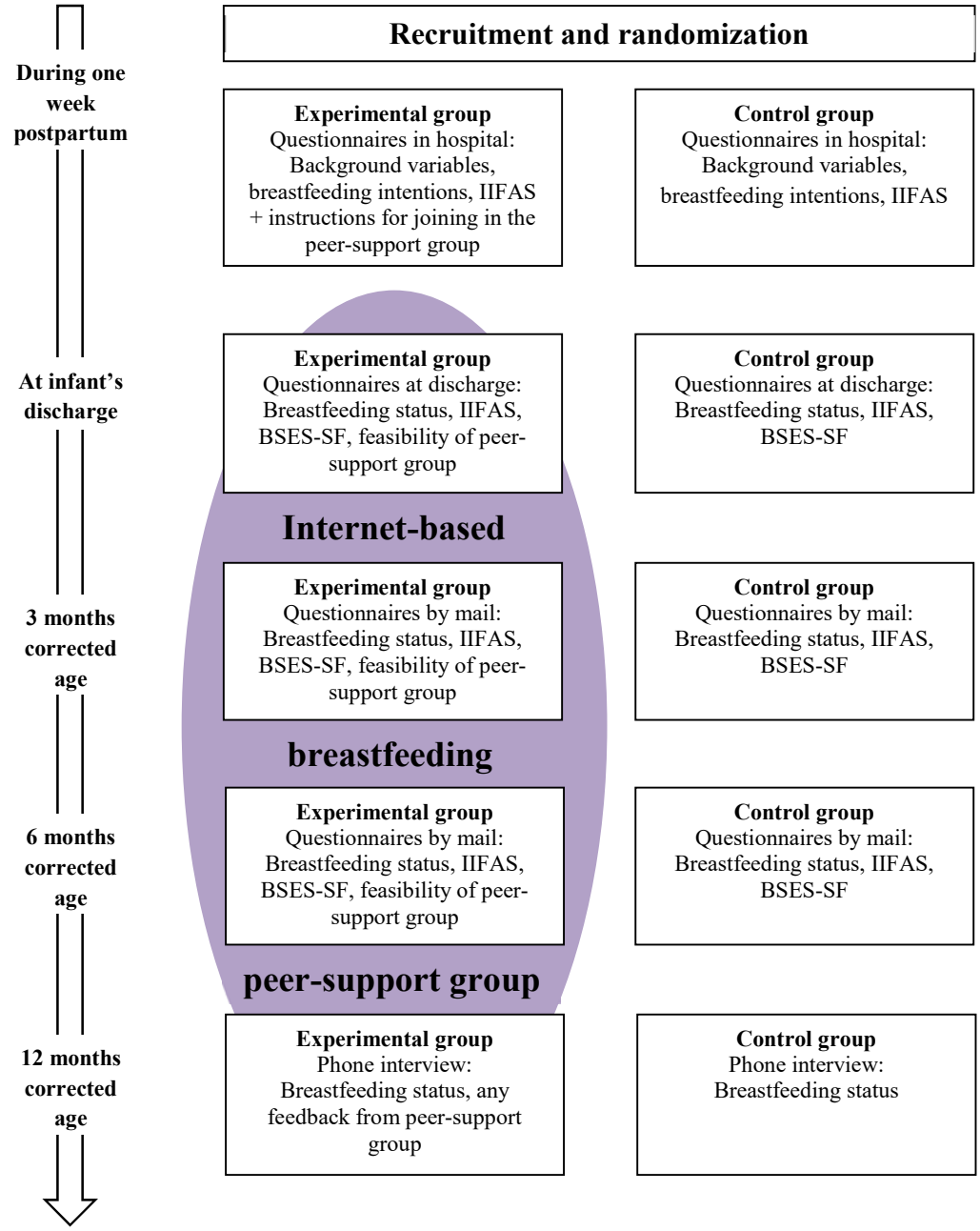

Figure 3. Measurement protocol and the instruments used in Study 3.

Validated instruments used:

1) An instrument measuring breastfeeding attitudes was completed at all measurement points except the last one. The Iowa Infant Feeding Attitude Scale

(IIFAS, de la Mora et al. 1999) is a valid and reliable instrument including 17 statements with a Likert scale measuring breastfeeding attitude. The score can range from 17 to 85; a higher score indicating a more positive attitude. The original version had good internal consistency (Cronbach's alpha 0.86) (de la Mora et al., 1999). The Finnish version has been used in one study previously with Cronbach's alpha 0.73 (Hannula et al. 2014). The IIFAS score during early pregnancy has found to predict breastfeeding at discharge (e.g. Sittlington et al. 2007).

2) Breastfeeding self-efficacy was measured with a Breastfeeding Self-Efficacy Scale, Short form (BSES-SF, Dennis 2003b) at the infant's discharge, at three and six months of the infant's corrected age. This instrument can be used to identify breastfeeding mothers at risk of early cessation of breastfeeding, or to evaluate the effectiveness of an intervention. BSES-SF includes 14 Likert-scale statements and the totaled scores range from 14 to 70, the higher score indicates a higher level of breastfeeding self-efficacy (Dennis 2003b). The BSES-SF has shown good internal consistency both in the original (Cronbach's alpha 0.94) and Finnish (Cronbach's alpha 0.93) versions (Dennis 2003a, Hannula et al., 2014).

The data concerning the initiation and frequency of breastfeeding, bottle feeding, kangaroo care, and the length of hospital stay were collected from the infants' patient records. In addition, neonatal data including gender, single, or multiple birth, GA, birth weight, Apgar scores, and ventilator treatment were collected.

The data collection had to be terminated at the end of March 2014, because the NICU in Turku University Hospital was moved into another location inside the hospital, and the care model was changed from an open bay unit to a family-room model. The change in circumstances concerning breastfeeding was significant and could have been considered as a new intervention.

Study 4 (Paper IV)

The discussions in the internet-based breastfeeding peer-support group were copied and pasted into a Word-file. The names of the participating mothers and peer-supporters were replaced by codes. All discussions from the beginning of the group (June 2011) to the data collection point (February 2013) were included. The participating mothers were separately asked for permission to analyze their discussions.

4.5 Data analysis

Statistical analysis (Studies 1 and 3 / Papers I, III and V)
In both studies, median, range, and quartiles were used to describe the data because of non-normal distributions. Mean and standard deviation (SD) were also used if possible. P-values (two-tailed) less than 0.05 were considered statistically significant. Both SPSS 15.0/19.0 and SAS software (version 9.3 for Windows) were used in performing statistical analyses.

In Study 1, the implementation of early physical contact was described with frequencies. The questionnaire filled in by a midwife was used as a primary data source when evaluating the type of early physical contact. In some analyses, early contact was divided in two different categories, e.g. 'skin-to-skin' and 'holding' were considered as 'realized early contact', and the other options (touching, seeing, no contact) were considered as 'no contact'. To test the statistical significance of the differences between hospitals, a Mann-Whitney U-test (continuous variables) and a Chi-Square test (categorized variables) were used. Goodman and Kruskal's Gamma (Goodman & Kruskal 1954) was used to examine the association between early physical contact and the initiation of breastfeeding.

In Study 3, baseline characteristics were compared between study groups with a Chi-Square test or Fisher's exact test, or two-sample t-test, or a Mann-Whitney U-test depending on the distribution of the data. A Pearson correlation was calculated between the continuous variables (GA, BSES-SF and the duration of breastfeeding). Additional descriptive statistics concerning attitude were calculated for mothers who completed all the questionnaires and those who had missing data during the study.

Cox's proportional hazard model was used in examining the first initiation of breastfeeding in the NICU, the duration of exclusive/overall breastfeeding, and the duration of expressing milk. The frequency of breastfeeding was analysed by multi-way analysis of variance. In the models for breastfeeding initiation and frequency, the infant who initiated breastfeeding later was chosen to examine the situation when the mother of twins was breastfeeding both of her infants. In the initial models the following factors were included: GA, maternal education level, mode of delivery, ventilator treatment, multiple birth, early physical contact, the age of mother, IIFAS score, happiness during pregnancy, birth experience, planned duration of breastfeeding and kangaroo care (only in the frequency analysis). Correspondingly, at the starting point of the models concerning the duration of breastfeeding and expressing milk, the study group, education, early contact, previous children (as categorical factors), the mother's age, the IIFAS score at the first measurement point, the frequency of kangaroo care (adjusted with the length of hospital stay), and GA were included.

Breastfeeding attitude was analyzed by a hierarchical mixed linear model, because the IIFAS score was measured repeatedly (baseline, at discharge, at three and six months). The IIFAS score followed a normal distribution, which was checked visually and using a Shapiro-Wilk test. The initial model of factors associated with attitude at baseline included the planned duration of breastfeeding, the study group, happiness during pregnancy, whether the pregnancy was planned, the birth experience, the importance of breastfeeding, resources for breastfeeding, and the time between measurement points. Whether the study group, happiness during pregnancy, or birth experience had an effect on mean change over the time of the infants' hospital stay, was also examined. An unstructured covariance structure was used in the model.

Factors included in the model examining the change of attitude during the follow-up (baseline, 3, 6 months) were: the study group, education, early contact, the mother's age, previous children, time, GA, the frequency of breastfeeding and kangaroo care in the hospital (adjusted with the length of hospital stay). A compound symmetry covariance structure was used. In all hierarchical mixed linear models, a Kenward-Roger correction for degrees of freedom was performed.

In all the statistical models conducted, non-significant factors were gradually omitted (backward selection); a p-value of less than 0.10 was used in the model selection procedures.

Qualitative data analysis (Studies 2 and 4 / Papers II and IV)

In the systematic integrative review, a content analysis method according to Hsieh and Shannon (2005) was used. The data were divided into sub-groups based on the research questions. The contents relevant to the research questions were written into a matrix and then coded and categorized. The analysis was performed by the researcher (HN-V) in collaboration with the research group.

Thematic analysis (Braun & Clarke 2006) was used when analyzing the data from the discussions of the peer-support group (Study 4). Thematic analysis is a flexible method without strict theoretical commitments. It was a suitable method because the main interest was in the content of the discussions. The data consisted of 305 postings (approximately 38 pages of text in Word-file). The data were coded inductively by the researcher, and the initial themes were identified. The major themes were produced in close collaboration with the other researcher (AA), who was familiar with the data as well. During the analysis process, the coding phase was returned continuously, and the relationship between the themes and the raw data was respected. Sub-themes were formed based on denser coding, and sub-themes were collated as coherent patterns under the major themes. All the major and sub-themes were precisely defined. In addition to the two researchers, the other members of the research group (H-LM & SS) provided constructive criticism and feedback in every phase of the analysis.

4.6 Research ethics

The study protocol of Study 1 received a favorable statement from the Ethics Committee of Pirkanmaa Hospital District, and it was accepted in both of the study hospitals. The other empirical studies (Studies 3 and 4) received a favorable statement from the Ethics Committee of Hospital District of Southwest Finland and were approved by Turku University Hospital. Throughout all the studies, responsible conduct in the research has been maintained (Finnish Advisory Board on Research Integrity 2012). Permissions to use the validated questionnaires (IIFAS, BSES-SF) were requested and received from the original developers of the instruments by email.

The staff members (Study 1) were not asked for a separate written informed consent, instead the completed questionnaire concerning the implementation of early contact was considered to be the consent. The staff had received basic verbal and written information on the study beforehand by the researcher. No information about the staff members was collected, the questionnaire was entirely about the early contact between the mother and her infant.

Breastfeeding mothers are allowed to be research subjects only if the research cannot be performed with other subjects, or if the results are likely to be beneficial for other breastfeeding women (Medical Research Act 488/1999). In studies concerning breastfeeding, the best option is to recruit breastfeeding mothers, who are able to provide profound data on the topic. Written informed consent was obtained from all the mothers of preterm infants participating in each study. A separate consent for the analysis of the postings in the internet-based peer-support group was obtained; i.e. a mother could participate in the randomized controlled trial, but prohibit the analysis of the postings she might write.

Mothers were approached no earlier than four days postpartum (Study 1) or one day postpartum (Studies 3 and 4) to give them at least some time to adapt to the preterm birth. Preterm birth may be a chaotic experience and mothers are often anxious and worried about their infants' condition and health (Aagaard & Hall 2008). The consent in studies 3 and 4 was requested earlier in order to obtain the baseline data on breastfeeding attitude as early as possible. However, only mothers of physiologically stable infants were asked and the recruitment of mothers with unstable infants was delayed until the end of the first week postpartum. Mothers were provided with both verbal and written information and they had the possibility to ask questions or to contact the researcher whenever needed. Privacy was ensured by a sensitive approach by the researcher and collecting the data with questionnaires. The mothers returned the completed questionnaires in sealed envelopes. Data from questionnaires were saved with ID numbers without any personal details of the mothers to ensure confidentiality. The peer-

support intervention was provided only for the mothers in the experimental group. However, all mothers were provided with the routine breastfeeding counseling, which is the current and normal care practice in Turku University Hospital.

The studies did not contain any invasive methods, but breastfeeding is a very emotional issue and may be strongly related to motherhood and being 'a good mother' (Marshall et al. 2007). With preterm infants especially, breast milk and breastfeeding may have a very strong significance for the mother. Breastfeeding or expressing breast milk may symbolize a deeper contact with the infant; and it is often classified as 'successful' or 'unsuccessful' (Swanson et al. 2012, Flacking et al. 2006). Unsuccessful breastfeeding may cause feelings of guilt (Flacking et al. 2006). Participating in this study may have caused some emotional burden, for example, if the realization of breastfeeding did not meet the mother's expectations. The mothers had an opportunity to write freely about their current thoughts and feelings as regards breastfeeding in every questionnaire. It also seemed to be an easy way to relieve negative feelings. In the phone interviews, the researcher asked about breastfeeding in as neutral a way as possible, and in the discussion the mothers were again encouraged to talk about their feelings and thoughts.

5. RESULTS

5.1 Early physical contact in the delivery ward can predict more successful breastfeeding (Studies 1, 3 / Papers I and III)

Only some of the NICU-admitted sick full-term and preterm infants were allowed to have early physical contact with their mothers in the delivery ward. In addition, there were differences in the implementation of early physical contact between the two study hospitals. Infants in hospital A, had early physical contact with their mothers more often than infants in hospital B (67% vs. 43%, $p < 0.001$). The difference in care practices concerning late preterm (GA 32.0–36.9) infants was indicative; in hospital A 49% and in hospital B 34% of late preterm infants were allowed to have early physical contact with their mothers ($p = 0.051$). None of the very preterm (GA < 32.0) had even short-term contact with the mother in the delivery room before NICU-admission in either hospital. In the latter data from hospital A (Study 3), i.e. the data collection initiated two years later, which included only preterm infants born before 35 gestational weeks, 26% of infants had early physical contact with their mothers; one of them being born before the gestational age of 32 weeks.

Both midwives and pediatricians evaluated that nursing staff practice was the most common facilitating factor in the implementation of early physical contact. The most common impeding factors were the unstable condition of the infant and cesarean section. The infants' physiological condition did not explain physical contact in every case. There were no differences in umbilical pH measurements in the delivery ward between the infants having early contact or not ($p = 0.148$). In late preterm infants, there were no differences either in the one minute Apgar scores ($p = 0.187$).

In Study 1, the mothers of the NICU-infants reported their breastfeeding status on average six days after the birth. The association between early physical contact and the initiation of breastfeeding was moderate and there were no significant differences between the study hospitals. It seemed that those late preterm infants, who had had early physical contact, were breastfed more than the infants without the early contact. In hospital A, 47% of the late preterm infants who had had early physical contact were exclusively or partially breastfed, whereas only 34% of the late preterm infants without early physical contact were exclusively or partially breastfed (gamma 0.21). In hospital B, the respective percentages were 82% and 36%, and there was also the strongest association between early physical contact and breastfeeding (gamma 0.60). Only one very preterm infant of the whole data set was reported as being breastfed during the first week postpartum.

With the longer follow-up in Study 3, early physical contact in the delivery room was a strong predictor of both the first initiation and the frequency of breastfeeding in the NICU. It must be noted, however, that early physical contact and gestational age correlated positively, e.g. the higher the GA, the more probable the implementation of early contact. Despite the correlation, early physical contact had independent and significant power in the complex process of preterm infants' breastfeeding. Preterm infants, who had even a short-term skin-to-skin contact in the delivery room, initiated breastfeeding at the median postnatal age of two days, whereas infants who had no early contact, initiated breastfeeding at the median postnatal age of twenty days ($p = 0.0075$). Correspondingly, breastfeeding during the infant's hospital stay was more frequent if the mother had had early physical contact with her preterm infant in the delivery room than without the contact (11 sessions/week vs. 2 sessions/week, $p = 0.013$).

5.2 Varying breastfeeding during the NICU stay (Studies 3, 4 / Papers III and IV)

5.2.1 Initiation of breastfeeding in the NICU

The first initiation of breastfeeding was at the infants' median postnatal age of four days ranging from 0 to 70 days. The median PMA was 34.1 weeks (range 30.1–36.3, quartiles 32.9 and 34.9) at the first breastfeeding session. Significant factors associated with earlier initiation were a higher GA ($p < 0.0001$), no ventilator treatment ($p = 0.0025$), early physical contact ($p = 0.0075$), and a higher maternal education level ($p = 0.013$).The median frequency of breastfeeding in the NICU was 4.0 times per week, in a range from 0 to 47. The significant factors in the model that predicted increased breastfeeding in the NICU were a higher GA ($p < 0.0001$), early physical contact in the delivery room ($p = 0.013$), and maternal breastfeeding attitude ($p = 0.024$). (Table 5.)

Table 5. The significant factors predicting the first initiation and the frequency of breastfeeding in the NICU. The median postnatal ages (PNA) of preterm infants and the median number of weekly breastfeeding sessions are reported.

	The first initiation of breastfeeding			**The frequency of breastfeeding in the NICU**		
	Infants' PNA, days			**Breastfeeding sessions/week**		
	Median	Q_1, Q_3*	p-value	Median	Q_1, Q_3*	p-value
Gestational age (GA)						
< 28 weeks	44	29, 49		0.3	0, 2	
28–31.0 weeks	9	7, 16	< 0.0001	1	0, 13	< 0.0001
32–34.9 weeks	3	2, 5		7	4, 13	
Early physical contact						
No contact	20	6, 46		2	0, 4	
Seeing	8	5, 18		1	0, 5	
Touching	6	4, 8	0.0075	5	3, 7	0.013
Holding	3	2, 6		12	1, 13	
Skin-to-skin	2	1, 3		11	6, 18	
Ventilator care						
Yes	13	6, 39	0.0025	NS**		
No	4	2, 7				
Maternal educational level						
Elementary school	8	2, 16				
Secondary	8	3, 13	0.013	NS**		
University/polytechnic	5	3, 15				
Maternal breastfeeding attitude						
IIFAS score < 62.5*	NS**			2	0, 7	0.024
IIFAS score ≥ 62.5*				7	3, 11	

Q_1, Q_3 = Lower and upper quartile
***NS = Non-significant factor*

5.2.2 Mothers' experiences of the information and counseling they received

At the infants' discharge, 77 mothers evaluated the breastfeeding information and counseling received during their infants' hospital stay. The majority of mothers (n = 57, 74%) were satisfied and 29% were extremely satisfied with the information provided. Similarly, the majority of mothers (n = 54, 71%) were satisfied and 43% was extremely satisfied with the counseling received. Almost all the respondents had expressed milk according to the hospital guidelines; 94% of the mothers reported expressing milk several times per day and also during the nighttime. The rest of the mothers reported expressing only during the daytime.

5.2.3 Mothers' views and perceptions of breastfeeding their preterm infants in the NICU

A description of a process of breastfeeding a preterm infant was created based on the qualitative data from the peer-support group. The process of breastfeeding a preterm infant began in hospital, immediately after the infant was born. The first main theme describing the initiation of the process was named 'breastfeeding paradox in hospital'.

The mothers described breastfeeding in the hospital as paradoxical, because the mothers felt, for example, that the NICU-nurses provided conflicting advice and counseling. In addition, mothers felt they had so many other issues in relation to their infant's care that they did not have enough energy to focus on breastfeeding without consistent support. This main theme included five aspects: 1) early discharge at the expense of breastfeeding, 2) risks to the infant's health, 3) varying nurse support, 4) breast milk before breastfeeding, and 5) kangaroo care being under-utilized for breastfeeding support.

According to the mothers, the main aim of the care in the NICU was to be discharged as early as possible. Oral feeding and sufficient weight gain were the main criteria for discharge. The mothers were clearly advised that feeding the infant by bottle would ensure a faster discharge than breastfeeding, because it was easier to attain optimal growth by bottle-feeding. Breastfeeding was also seen as a risk to the infant's health. Sometimes the duration of breastfeeding session was limited or breastfeeding was allowed only once per day. These limitations were justified with the preterm infants' limited physical resources, compromised breathing, and optimal weight gain.

Based on the mothers' discussions, the quality of breastfeeding support was dependent on the individual nurse. Some of the nurses, according to mothers this was only a minority, were always encouraging and supportive in breastfeeding sessions. Some mothers gained the impression that some of the nurses was not motivated enough to support breastfeeding. Primarily, the mothers desired individual and equal counseling and support from all the nurses. The counseling given in the NICU was a determining factor for the mothers to be able to manage breastfeeding at home. The fourth dimension was 'breast milk before breastfeeding', which meant that breast milk was valued more than breastfeeding. According to the mothers, the importance of breast milk and pumping milk was constantly emphasized by the nurses. The amount of breast milk and the frequency of pumping was requested on a daily basis. Breast milk itself was strongly related to the NICU and direct breastfeeding to home, and they seemed to be two unconnected issues.

Kangaroo care (KC) was practiced a lot, especially with very preterm infants who had a long-term hospitalization. KC was, however, under-utilized for breastfeeding support.

The staff in the NICU was very positive about KC, but from the mothers point of view the staff did not use KC to support breastfeeding. Based on the mothers' discussions they had not been encouraged to let the infant practice suckling at the breast during KC.

5.3 Supporting breastfeeding of preterm infants at home (Studies 2, 3, 4 / Papers II, V, III, IV)

5.3.1 Previous findings on outcomes of internet-based peer-support groups for parents

Based on the systematic, integrative review that was conducted, up-to-date informational support was the most important element parents appreciated in the internet-based peer support. Mothers were more active participants than fathers and groups for 'fathers only' were a minority. In mothers, emotional support was emphasized and mothers also enjoyed being a member in a virtual community. Only two studies examining breastfeeding-focused groups were found describing the main uses of a breastfeeding discussion board (Cowie et al. 2011), or how internet groups provide breastfeeding support (Gribble 2001); but neither of them tested the effectiveness of the peer support. In general, internet-based peer support seemed to have some positive effects on parenting skills and parents' mental well-being, but the evidence was limited because of the very few experimental studies.

5.3.2 Feasibility of the breastfeeding peer-support intervention

At three months from term (the third measurement point in Study 3), most mothers in the experimental group (n = 28, 74% of the respondents) reported that they visited the peer-support group at least twice a month. The median duration for a visit was five minutes. The visits were most frequent after the infant's discharge and during the first months after the birth; the frequency had already decreased at the infants' corrected age of six months. At that point, 50% of respondents reported that they visited the group at least two times per month. Sixteen mothers (n = 16) never joined the group; the reasons for not visiting the group at all were that it was not considered necessary, or a lack of time, or only a minor interest in social media.

About half (50%–58%) of the respondents at all three measurement points (at discharge, three and six months) assessed that they were mostly passive observers and wrote no comments or questions in the group. In the feedback section, the most common suggestion for improving the group was, however, more active discussions. The responsibility for activating discussions was given to the moderator of the group.

The majority (75%–95%) evaluated visiting the peer-support group as effortless and pleasant during the whole follow-up. About half of the mothers (50%–59%) evaluated

that visiting the group was useful, however, only a few mothers (n = 8; 26 % of respondents at three months' measurement point) reported the visits as having any impact on breastfeeding. Although over half of the mothers (52%, 53%, 73%) considered the support provided by the midwife as useful, peer support was evaluated more often as useful (62%, 72%, 86%) at all three measurement points.

More than any effect on breastfeeding, the group provided other benefits, such as peer support for mothers of preterm infants and the awareness that other mothers have similar problems. For example, 55% (n = 16) of the mothers reported as having benefited from the peer support provided at the three months measurement point. A very few mothers also reported that the group increased their feelings of guilt for not being able to breastfeed.

5.3.3 Duration of breastfeeding and the effect of the peer-support group

The intended duration of breastfeeding measured at baseline was 6 months in both groups, but in reality these intentions were not reached. The median duration of exclusive breastfeeding was 0 months in both study groups ranging from 0 to 5.0 months and from 0 to 6.0 months in the experimental and control groups, respectively. The median duration of overall breastfeeding was 3.0 months (range 0–14.0 months) in the experimental group and 4.3 months (range 0–13.0 months) in the control group. The duration of expressing milk was 4.0 months ranging from 1.5 months to 11.0 months in the experimental group, and the respective numbers in the mothers of the control group were 3.8 months (0.5–9.0 months). The internet-based peer-support intervention had no effect on the duration of exclusive breastfeeding ($p = 0.82$) or any breastfeeding ($p = 0.52$), or expressing milk ($p = 0.44$).

Breastfeeding attitude measured by the IIFAS and the number of previous children were the only factors, which were statistically significantly associated with the duration of breastfeeding. The duration of breastfeeding was longer in mothers with a higher attitude score compared with the mothers with lower scores ($r = 0.32$, $p = 0.013$). The mothers with two or more previous children breastfed longer compared with the mothers with one or no previous children (6.0 months vs. 4.0 months, $p = 0.09$). The infant GA at birth was positively correlated with the duration of exclusive breastfeeding GA ($r = 0.27$, $p = 0.0074$), but not with the overall duration of breastfeeding.

5.3.4 Reasons for breastfeeding cessation

The most common reason for breastfeeding cessation throughout the study was definitely an insufficient milk supply. At the three months' measurement point 40 (32%) of all participating mothers reported their reasons for breastfeeding cessation. An insufficient milk supply was the primary reason in 27 cases. At the last measurement point, 17 (49 %) of the experimental group and 18 (41%) of the control group mothers reported this as the primary reason for cessation. Another common reason was that the

infant did not learn to suckle at the breast. Sometimes the reason for cessation was that breastfeeding was arduous. Some of mothers who breastfed for a longer period (over six months), mentioned that they ceased breastfeeding because the infant was big enough to eat something else. (Table 6.)

Table 6. The primary reasons for breastfeeding cessation in both groups during the follow-up reported by the mothers.

	At three months N = 40		**At six months N = 44**		**At twelve months N = 79**	
	Experi-mental n = 24	Control n = 16	Experi-mental n = 19	Control n = 25	Experi-mental n = 35	Control n = 44
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Insufficient milk supply	20 (83%)	7 (43%)	15 (79%)	13 (52%)	17 (49%)	18 (41%)
Infant did not learn to suckle	3 (13%)	6 (38%)	0	8 (32%)	6 (17%)	7 (16%)
Breastfeeding was arduous	0	0	0	3 (12%)	3 (9%)	6 (14%)
Baby big enough to eat something else	0	0	0	0	7 (20%)	4 (9%)
Other reason	1 (4%)	3 (19%)	4 (21%)	1 (4%)	2 (5%)	9 (20%)

5.3.5 Maternal breastfeeding attitude

At the baseline, the mean score of the IIFAS for all participants was 64.5 (SD 7.1) indicating quite positive breastfeeding attitudes. During the follow-up, the attitude score moderately decreased. The mean score of the IIFAS was 63.5 (SD 7.7) at the six months' measurement point ($p = 0.001$). No intervention effect on the attitude score existed.

The mothers, who did not consider breastfeeding important, had a lower attitude score than the mothers who considered breastfeeding very important (54.0 v. 65.8, $p < 0.0001$). The birth experience was significantly associated with breastfeeding attitude. If the mother had a mostly negative birth experience, her attitude score was significantly lower than mothers with a mostly positive birth experience (55.5 vs. 62.7, $p = 0.015$). In addition, the mean change in attitude during the infant's hospital stay differed depending on the birth experience. The mean attitude score decreased from 64.5 to 46.4 between the two measurement points for mothers who had rated their birth experience as negative. In contrast, the mean attitude score increased from 61.9 to 63.6 for mothers with a very positive birth experience ($p = 0.0006$).

Additional descriptive analysis of the data showed that those mothers (n = 56) who had completed both follow-up questionnaires (at three and six months), had higher IIFAS scores than the mothers (n = 68, drop-out group) who had completed only one of those questionnaires or neither of them. The mean attitude score changed differently between these groups: there was a strong decrease from 63.5 to 56.9 in the 'drop-out group' and only a slight decrease in the 'all-questionnaires-completed group'. (Figure 4.) The mothers who had completed all the questionnaires, breastfed and expressed milk longer; their infants were born at a higher GA and early physical contact in the delivery room was implemented more often compared with the mothers of the 'drop-out group'.

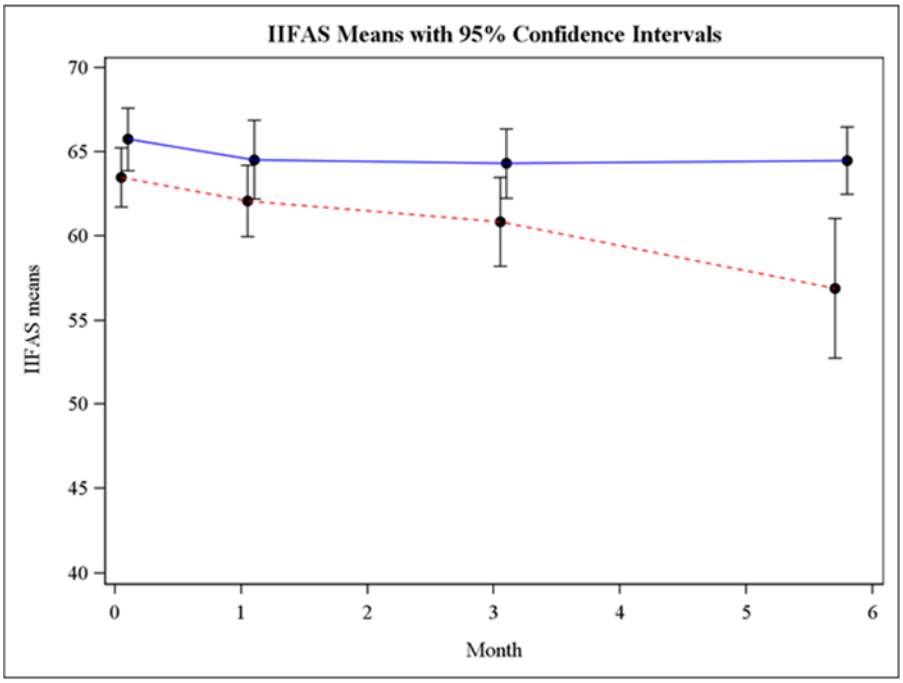

Figure 4. The change of breastfeeding attitude score measured by the IIFAS during the follow-up in the 'all-questionnaires-completed group' (blue) and in the 'drop-out group' (red).

5.3.6 Maternal breastfeeding self-efficacy

The mothers (n = 65) who had completed the BSES-SF scale at their infants' discharge, had a mean total score of 50.8 (SD 10.1). The self-efficacy score was not included in the models constructed, and the possible change of BSES-SF during the follow-up was not analyzed, due to missing data. There was a positive correlation between breastfeeding self-efficacy and exclusive ($r = 0.28$, $p = 0.032$) and overall breastfeeding ($r = 0.35$, $p = 0.0048$).

5.3.7 The mothers' views and perceptions of breastfeeding their preterm infants at home

After the paradoxical breastfeeding experiences in the NICU, the experience of the mothers after discharge could be described as the 'reality check' of breastfeeding at home, and the breastfeeding experience as part of being a mother (Study 4).

The preterm infant's discharge from hospital was a blessed event. At home, it was also the time to start breastfeeding, but it proved to be more demanding than the mothers had anticipated in advance. The reality check of breastfeeding at home included three aspects. First, the mothers had information needs that had not been met and a lack of skills. At home, they noticed that the breastfeeding counseling they had received in the hospital was insufficient, or in some cases a barrier to successful breastfeeding. Some of the mothers were advised, for example, not to breastfeed until the small infant reached a certain weight limit, or that the daily number of breastfeeding sessions should be restricted. The mothers did not have enough knowledge or skills to solve their breastfeeding problems. For example, the mothers were insecure about when it would be the right time to change from bottle-feeding to direct breastfeeding and how to do it. A very common concern was whether the infant was getting enough milk from the breast.

Second, breastfeeding continued to be a risk for the infant's health. The mothers did not want to risk their preterm infants' welfare and they wanted to prioritize the infant's weight gain over their desire to breastfeed. Bottle-feeding was considered a safer method than breastfeeding, because by using a bottle it was easier to ensure that the infant was getting enough milk. Third, for some mothers the infant's discharge represented new opportunities at home. Mothers who were highly breastfeeding-motivated consciously strove towards successful breastfeeding. They tried to find solutions to their problems one by one. Every step towards progress affirmed their self-confidence concerning breastfeeding.

Over time, the mothers absorbed their breastfeeding experiences into their own motherhood. Breastfeeding was experienced as successful or unsuccessful. Based on the discussions of the mothers, successful breastfeeding referred to breastfeeding according to the general recommendations. Shorter or no breastfeeding was usually described as 'unsuccessful' breastfeeding. The third theme in the process of breastfeeding had two subthemes. 'Being proud of successful breastfeeding' meant that those mothers who breastfed successfully, were really proud at having achieved it. The mothers felt that it was something to be attributed to their own credit. Successful breastfeeding enabled mothers to feel satisfied with their own motherhood.

The other subtheme was called ‘Disappointment in unsuccessful breastfeeding’. This meant feelings of disappointment, failure, or even shame; the mothers felt themselves to be ‘a bad mother’ or ‘unwomanly’. Breastfeeding was seen as a chance to compensate for an ‘unsuccessful’ pregnancy, and not reaching this was sometimes hard to process. Sooner or later, they accepted this disappointment as part of their motherhood experience. Many of these mothers were dreaming of successful breastfeeding with a future-baby. (Figure 5.)

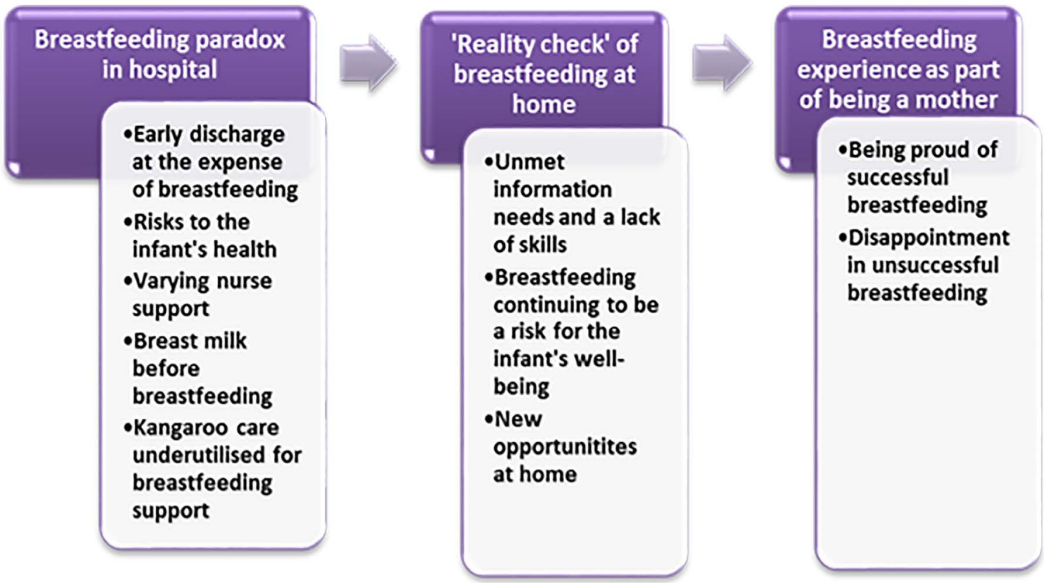

Figure 5. The process of breastfeeding preterm infant from the perspective of the mother. (Modified from IV, Niela-Vilén et al. 2015.)

5.4 Summary of the main results

The main findings of this study are summarized in Table 7.

Table 7. Summarized results for each research question.

Research question	Results
1) How is the initiation of breastfeeding of preterm and sick infants supported in the delivery ward?	Early physical contact between a mother and her preterm infant predicted earlier initiation and increased frequency of breastfeeding during the infant's hospital stay. However, only a small part of preterm infants were allowed to have even a brief contact with their mothers before admission to the NICU. Infant's physiological well-being did not explain the early physical contact in every case.
2) How is breastfeeding supported during the preterm infant's hospital stay?	Gestational age and early physical contact predicted both earlier initiation and increased frequency of breastfeeding during preterm infants' NICU stay. Maternal breastfeeding-favorable attitude was associated with increased frequency of breastfeeding. From the perspective of the mothers breastfeeding support and counseling received from the hospital was conflicting.
3) How can breastfeeding of preterm infants be supported via the Internet after hospital discharge?	The internet-based breastfeeding peer-support intervention developed for this study did not have an effect on the duration of breastfeeding, expressing milk, or breastfeeding attitudes. Mothers enjoyed the experience of sharing their problems with their peers. A breastfeeding-favorable attitude was the strongest predictor of the longer duration of breastfeeding. Infant's hospital discharge was a very significant moment for breastfeeding and the mothers were not prepared to solve breastfeeding problems at home. Generally parents, especially mothers, are active users of internet-based peer support.

6. DISCUSSION

6.1 Discussion of the results

6.1.1 Delivery room practices supporting breastfeeding

In the hospitals studied, supporting breastfeeding when a preterm infant is born was not the first priority of the staff of the delivery ward. The implementation of early physical contact between a mother and her preterm infant in the delivery room was not a common practice, instead the separation of a mother and her infant was the routine (Baylis et al. 2014). Less than half of preterm infants born at 32–37 weeks GA, and only one of the very preterm infants (< 32 weeks) (Studies 1 and 3), were allowed early physical contact with the mother. Early physical contact in the delivery room along with GA at birth were the strongest predictors of both breastfeeding initiation and frequency during the hospital stay of preterm infants. Interestingly, early physical contact was not effective when tested alone, but when tested in the model together with many other factors, it showed significant power. In addition, a negative birth experience was associated with a negative breastfeeding attitude, which was associated with less breastfeeding. Attitude-related factors are discussed in more detail in a later chapter. Based on this study, the delivery room practices are significant in supporting preterm infants' breastfeeding although they have not been the focus of research previously.

In healthy full-term infants, early physical contact, better known as skin-to-skin contact (SSC), is strongly recommended because of the multiple benefits for both mother and infant, including breastfeeding promotion (Moore et al. 2012). Early SSC is a normal care practice in birth hospitals in Finland, but only with healthy full-term infants. When a preterm infant is born, the primary task is to secure infant's health by supporting respiration. The medical procedures are usually performed in another location, inhibiting the physical contact between the mother and infant. However, The Ten Steps to Successful Breastfeeding by the WHO, expanded to neonatal intensive care, recommends continuous skin-to-skin contact immediately after birth (Nyqvist et al. 2013). Skin-to-skin contact with a parent might be the optimal environment to stabilize the infant's condition immediately after birth and even transport her/him to the NICU.

Based on midwives' and auxiliary nurses' perception, the infant's unstable condition, and cesarean sections seemed to pose the most significant obstacles to the implementation of early contact. The unstable condition, however, was based on midwives subjective evaluation and not always supported by infant's physiological parameters, such as umbilical pH. In addition, the operating theater poses an obstacle for early contact without question. It is justified to argue that care practices and ward routines were the determining factors guiding the first moments of the infants and their

mothers. This result was consistent with earlier data (Baylis et al. 2014, Latva et al. 2008). It might be possible to arrange for a preterm infant to have a short physical contact in the operating theater, because it is no longer impossible for full-term infants (Frederick et al. 2015). Although it is notable in this study that the operating theater routinely impeded the contact between a mother and her infant, but it might enable the father to be the primary contact.

Even a brief physical contact might be meaningful for the mother. It prevents the feeling that the baby does not belong to the mother (Latva et al. 2008), reduces stress (Franck et al. 2004), and strengthens bonding between a mother and her preterm infant (Flacking et al. 2006). For the preterm infant, the early physical contact prior to admission to the NICU has been associated with less emotional and behavioral problems at five to six years of age (Latva et al. 2008). Furthermore, based on this study, early physical contact increases the likelihood of early initiation of breastfeeding, which has been previously shown only in full-term infants (Moore et al. 2012). Parent-infant closeness and breastfeeding are important aspects of family-centered care implemented in many NICUs (Gooding et al. 2011). Family-centered care, which is also one of the guiding principles of the Baby Friendly Hospital Initiative (BFHI) adapted to NICUs (Nyqvist et al. 2013), would also be applicable more generally to delivery wards, where it might provide new insights to implement closeness and see the continuum of closeness and breastfeeding also in preterm infants.

The findings of this study strongly suggest implementing early contact between a mother and her preterm infant whenever it is possible. The purpose is not by any means to risk the infant's health, but by careful evaluation it might be possible to allow more preterm infants to have early physical contact with their mothers. Criteria should be developed together with the delivery ward and NICU staff on how to assess the clinical status of an infant at risk. Childbearing families giving birth to a preterm infant need also to be informed about the delivery ward practices. It is noteworthy in this study that a higher GA increased the probability of early physical contact, and the variables correlated. Early physical contact, however, was a statistically significant factor in the models despite the correlation and it had significant power together with the GA in the very complex process of breastfeeding initiation in preterm infants.

The mother's birth experience was associated with breastfeeding success via breastfeeding attitude. Negative birth experience, negative breastfeeding attitude and a shorter duration of breastfeeding seemed to be related. The first moment with the infant has been shown to be an important element of the birth experience at least in primiparous women (Guittier et al. 2014). In addition, the infant's transfer to a neonatal unit has been associated with a negative birth experience (Waldenström et al. 2004). Midwives need to especially invest in individual support of mothers giving birth to a preterm baby, and

provide information, emotional support, and encouragement - and be calm and confident. In addition, the involvement of the father is recommended. (Sawyer et al. 2013.) All women should also be provided with the possibility to talk about the birth experience during the postpartum period (Guittier et al. 2014, Klemetti & Raussi-Lehto 2014). Working through the experience of preterm birth is essential to have mutual mother-infant interaction (Keren et al. 2003).

6.1.2 Breastfeeding in the NICU

In addition to early physical contact in the delivery room, discussed in the previous chapter, higher GA at birth was the other strong factor predicting earlier initiation and increased frequency of breastfeeding. Furthermore, a lack of ventilator treatment and higher maternal education level were significant predictors for the first breastfeeding, whereas a maternal breastfeeding-favorable attitude predicted increased frequency of breastfeeding.

Previously, Briere et al. (2015b) presented the fact that about half of the preterm infants in their study (n = 88) were breastfed at least once per day. Having the first oral feeding at the breast increased the likelihood of at least one direct breastfeeding daily. In addition, increased frequency of breastfeeding was explained by a shorter length of stay in the NICU, which was chosen over the GA to describe the condition of the infants (Briere et al. 2015b). A low GA is a simple explanation for delayed initiation of breastfeeding, but it reveals that the care practices are not evidence-based. Quite strong evidence shows that breastfeeding initiation is not tied to a fixed GA or PNA (e.g. Maastrup et al. 2014a). In this study, breastfeeding was initiated at a median PMA of 34 weeks, which is quite late. The decision to initiate breastfeeding should be assessed individually and must not be made based only on the infant's GA at birth or PMA, because even very preterm infants may have the capacity to breastfeed (Maastrup et al. 2014a, Jones 2012, Nyqvist 2008). Feeding readiness can be assessed by observing infant's rooting behavior, e.g. mouth opening, tongue extension and head turning. If the infant is provided with the possibility to suckle at the breast, areolar grasp, latching on, suckling behavior, and swallowing need to be observed to assess the readiness for nutritional breastfeeding. (Nyqvist 2008.) Ventilator treatment is a barrier to breastfeeding, but respiratory support with CPAP enables suckling at the breast (Maastrup et al. 2014a), and nonnutritive suckling at the breast is possible after extubation (Spatz 2004). Suckling on the breast after expression of breast milk may result in better breastfeeding outcomes (Edmund & Bahl 2006). It is important that the staff does not present any unnecessary limitations to mothers when they initiate breastfeeding (Nyqvist 2008), thus continuous education of the staff, or any other suitable strategy, needs to be developed to promote knowledge transmission of the latest evidence-based care (Wallin 2009). A lack of sustained collaboration between staff

members and between staff and parents may be a barrier to successful support of breastfeeding (Lee et al. 2013).

Maternal sociodemographic factors have been in a determining role when predicting breastfeeding success (e.g. Briere et al. 2014a, Zachariassen et al. 2010). A higher maternal educational level has also previously been associated with more breastfeeding, and this was also found in this study. Other sociodemographic factors were not investigated in this study due to the small amount of data. Nevertheless, it is important to recognize these factors, and the risk factors for lactation difficulties e.g. intrapartum complications or antenatal steroids (Meier et al. 2013c, Hallowell & Spatz 2012, Henderson et al. 2008). However, most of these are quite difficult or even impossible to change, thus other factors, such as care practices, which are possible to change should be the focus of breastfeeding studies in the future.

In this study, KC was initiated quite early, and it was practiced a great deal, especially in the care of very preterm infants, but it was neither a significant predictor of the frequency of breastfeeding in the NICU nor the duration of breastfeeding. Previous studies have shown quite strongly a positive association between KC and the duration of breastfeeding (Briere et al. 2014a, Flacking et al. 2011, Ahmed & Sands 2010, Hake-Brooks & Anderson 2008, McInnes & Chambers 2008). KC promotes milk secretion naturally because of the oxytocin released by skin-to-skin contact, however, active nursing practices are needed when using it for breastfeeding promotion. None of the mothers participating in the peer-support group discussions in this study, reported having been encouraged to breastfeed while ‘kangarooing’. Nurses and midwives need to be aware of this unique breastfeeding opportunity and be active in supporting and guiding the mothers. A mother needs to learn to hold the infant close to her body and help the infant to have the nipple inside their mouth to trigger the suckling reflex (Nyqvist 2008).

Despite the family-centered approach of the NICU, breastfeeding was not always prioritized very highly. Instead, breast milk was highly valued and the mothers were strongly encouraged and they felt sometimes even pressured to express milk. If the emotional aspects of breastfeeding and providing breast milk are diminished, breastfeeding becomes a duty and something which must be performed to be a good mother (Swanson et al. 2012, Flacking et al. 2006). In addition, long-term breast milk expression may result in breast milk objectification and a negative breastfeeding experience (Sweet 2006). The significance of breastfeeding to a mother is much more than just feeding the infant; at its best it is active interaction with the infant and an interdependent relationship enhancing bonding (Flacking et al. 2007, Flacking et al. 2006). The value of direct breastfeeding needs to be elevated at least at the same level as breast milk. Expressing milk is also quite arduous compared to direct breastfeeding (Buckley & Charles 2006).

At the infant's discharge from hospital, mothers evaluated being very satisfied with the breastfeeding counseling and support during the hospital stay. However, the support for breastfeeding in the NICU was not optimal based on the other findings of this study, for example, the quite late initiation and the low frequency of breastfeeding in the NICU (e.g. Nyqvist 2008), and breastfeeding being considered a threat to an early discharge in some cases. The discharge is such a long awaited occurrence that the mothers are grateful for all the support and guidance received, and rely on nurses' expertise about all aspects concerning their infants (Swanson et al. 2012, Flacking et al. 2006). In addition, based on the mothers' discussions in the peer-support group, the mothers were not expecting any problems concerning breastfeeding, but only anxious to get home and start breastfeeding properly. Later at home, after facing unexpected problems, the mothers understood that there were some inconsistencies in the breastfeeding counseling and support they had received in the hospital. A feeding plan supporting breastfeeding also at home, however, should always be part of the discharge plan of a preterm infant (Barkemeyer 2015).

6.1.3 Breastfeeding attitude

This was the first study, to our knowledge, to show the significance of maternal breastfeeding attitude in breastfeeding preterm infants. A breastfeeding-favorable attitude predicted increased frequency of breastfeeding during the preterm infant's hospital stay and a longer duration of breastfeeding.

The mother's attitude did not predict the first breastfeeding occasion, but it did predict the frequency of breastfeeding during the preterm infant's hospital stay. As reported in a previous study (McInnes et al. 2010), the staff in this study also seemed to make the decision about the readiness of initiating breastfeeding, and the mother had no power to influence that. Ideally, nurses and parents could together assess the cues given by the infant to initiate breastfeeding (Jones 2012). However, the mother's positive attitude increased breastfeeding after the first initiation; the mothers might feel that they have had 'permission' to feed their infant as they want. In future, the level of breastfeeding knowledge of mothers needs to be strengthened; if the mothers were more aware of breastfeeding-related issues, they could also demand high-quality counseling from the hospital staff. The responsibility for successful breastfeeding cannot be placed on the health care professionals only, as the mothers have to be active and willing to breastfeed. Increasing mothers' knowledge about breastfeeding beginning from early pregnancy is a central goal in the action program for breastfeeding promotion in Finland by the National Institute for Health and Welfare (Breastfeeding Promotion in Finland 2009).

The maternal breastfeeding attitude after the preterm birth was positive, but it decreased during the follow-up. The decline during the hospital stay was even greater if the mother

had had a negative birth experience. During the whole follow-up, the mothers who completed all the questionnaires and had a longer duration of breast feeding, had only a minor decrease in attitude scores. Instead, the 'drop-outs' had a shorter duration of breastfeeding, and quite a sharp decrease in attitude scores.

As the birth experience was significantly associated with breastfeeding attitude, it is important for midwives to be aware of this in order to individually and sensitively support those mothers who give birth prematurely. A preterm birth itself is sometimes a chaotic experience causing stress to the mother (Aagaard & Hall 2008). It is possible that mothers, who have had physical contact with their preterm infants, remember their whole birth more positively than mothers who have not even seen their infants; this sometimes being the case in emergency caesarean sections or if the infant needs immediate resuscitation. The birth experience, early physical contact, and breastfeeding attitude might be in a complex relationship with each other.

Considering the significance of maternal attitude in the process of breastfeeding preterm infants, it could be reasonable to screen breastfeeding attitude prenatally in mothers with an imminent preterm birth, so that their breastfeeding support could be tailored more individually in the future.

6.1.4 Breastfeeding support via internet-based intervention

The internet-based peer-support intervention showed no effect on breastfeeding, expressing breast milk, or breastfeeding attitude, but it seemed to have some other beneficial properties, such as peer support for mothers of preterm infants. This was the first study on the effectiveness of internet-based breastfeeding peer support. Previously conducted peer-support interventions in the NICU and after discharge with face-to-face or telephone support have shown encouraging results and the breastfeeding rates have increased (Oza-Frank et al. 2014, Merewood et al. 2006). The effectiveness of previous internet-based peer-support interventions for parents has not been given much attention in studies, and no interventions targeted only for breastfeeding support have been studied before.

In this study, some weaknesses in the design might have had an influence on the possible intervention effect. The effect was diminished because of a large proportion of the mothers did not join the peer-support group, and because of the high drop-out rate during the follow-up. The use of social media has changed quite rapidly during the data collection period 2011–2015, and it could be speculated that mothers today would join the social media –based peer-support group more readily with their mobile devices while they were still in the hospital. During the data collection, the use of tablet computers and smart phones has risen quite dramatically. For example, 3% of the age group of 25–34 years used tablets in 2011, whereas the respective proportion was 37% in 2014.

Furthermore, the use of smart phones has increased by about ten percentage points per year. (Official Statistics of Finland 2014 & 2011). During this study process, it has become clear that research processes progress rather slowly and have problems keeping pace with the developing technology. Due to the small number of preterm infants born in one hospital in Finland, the baseline data collection, for example, took almost three years.

The second issue possibly diminishing the intervention effect might be that this first time tested peer-support intervention might have not been strong enough to supplement the gap caused by the varying and inconsistent breastfeeding support in the hospital. Inadequate and suboptimal support has also been stated in many previous studies (Hallowell et al. 2014, Meier et al. 2013b, Maastrup et al. 2012), and this was an essential part of the phenomenon of paradoxical breastfeeding in the hospital according to the mothers participating in the peer-support group in this study.

The primary aim in the future should be standardizing the breastfeeding counseling and support in Finnish birth hospitals (Klemetti & Raussi-Lehto 2014). Implementing evidence-based knowledge into practice is a demanding process including many different aspects. The Consolidated Framework for Implementation Research (CFIR) might provide a useful structure for this process. First of all, the intervention or new practice needs to be adapted to the particular organization, because without adaptation, the results may be poor. The organizational factors are also essential, for example, economic or cultural contexts provide the outer setting for the implementation. (Damschroder et al. 2009.) Cost-effectiveness of breastfeeding would be one efficient way to prove the benefits of breastfeeding to the management level. In the US, for example, the burden of suboptimal breastfeeding has been calculated in dollars. Based on the cost-effectiveness studies conducted, with more optimal breastfeeding the American society would save billions of dollars yearly by decreased morbidity rates for infants and mothers, and they would have fewer cases, perhaps in the thousands, of, for example, breast cancer and hypertension (Bartick et al. 2013, Bartick & Reinhold 2010).

In addition, the implementation process includes the inner setting in the organization comprising of structural and cultural aspects (Damschroder et al. 2009). Will and passion are needed to make the change in care practices. Courses for acquiring knowledge and skills are available (e.g. WHO & UNICEF 2009), but the challenge is to motivate all staff members to participate. Individuals have different feelings about new things and practices; they do not passively accept all the changes, but modify or re-design them or sometimes just complain. Moreover, the implementation process itself is a major factor in the successful implementation. (Damschroder et al. 2009.)

The primary idea of the peer-support intervention was that the activity of the participating mothers was the major component of the intervention, but it could be seen as a threat to the fidelity and effectiveness (Medical Research Council 2006). Furthermore, the fidelity should have been confirmed more rigorously, for example, by controlling the use of the peer-support group more accurately. It would have been beneficial for example to visit the group for the first time together with the participating mother and the researcher while the mother was still in hospital.

The breastfeeding internet-based peer-support group in this study was feasible and easy to access, and generally, parents have been pleased with the internet-based peer support based on the integrative review conducted in this study. Mothers, who joined the breastfeeding peer-support group, mostly enjoyed the experience and some of them felt they received support with their breastfeeding. In addition, and more importantly, they reported peer support from other mothers as being helpful, commenting that it was a relief to be aware that others have similar problems. In a study of Rossman et al. (2015), mothers evaluated peer support as the most facilitative aspect of developing a maternal identity in an NICU. Peer support is considered an essential component of family-centered care (Hall et al. 2015). For some mothers in this study, the peer-support group might have decreased the feelings of guilt of unsuccessful breastfeeding, but for some mothers, the group increased the feelings of guilt. Breastfeeding is a sensitive issue and the mothers of preterm infants are often stressed by their infant's health problems (Aagaard & Hall 2008). In the future, alongside developing this peer-support intervention in social media, some other prenatal interventions could be developed. Mothers, who are hospitalized because of imminent preterm birth, could benefit from an intervention that would increase their knowledge and skills of breastfeeding.

6.1.5 Duration and cessation of breastfeeding

In this study, the duration of breastfeeding was quite short, and shorter than the mothers intended in advance. In addition, the duration was very short compared to the recommendations of the World Health Organization (WHO 2003). Exclusive breastfeeding proved to be very demanding to achieve due to the dietary supplements prescribed for preterm infants and routine bottle feeding. Based on some previous studies, exclusive breastfeeding is possible to establish in the majority of preterm infants (Maastrup et al. 2014a), even from a postmenstrual age of 32 weeks (Nyqvist 2008), however, the GA did not predict the duration of breastfeeding in this study.

The results of this study are in concordance with previous Finnish breastfeeding rates: only one or two percent of all mothers exclusively breastfeed for six months and about one third continue to breastfeeding until the baby is 12 months (Uusitalo et al. 2012).

Since the 1970s though, when the majority of Finnish babies were fed with formula milk, the breastfeeding rates have increased, although not enough. Almost all mothers today initiate breastfeeding, but over 70% of infants are already given additional milk in the birth hospital and after one month less than half of infants are exclusively breastfed (Uusitalo et al. 2012, Breastfeeding promotion in Finland 2009). Cultural aspects related to breastfeeding have been studied very little, but it is possible to speculate that breastfeeding is experienced as quite burdensome, especially at the beginning, and the confidence in the good quality of formula milk is high. The early initiation of additional milk and possible breastfeeding problems after discharge result in using formula milk and finally ceasing breastfeeding. The problems might be emphasized in preterm infants because of their immaturity and the emphasis on weight gain. The attitude and atmosphere of the whole of society needs to be developed to be more breastfeeding-favorable beginning; this needs to be done from primary schools (Breastfeeding promotion in Finland 2009).

Globally, the duration of preterm infants' breastfeeding seems to have a wide variation from 36 days (Killersreiter et al. 2001), to 3.2 months (Vassilaki et al. 2014), however, the study populations are not fully comparable because of different GAs and the categorization of birth weight. In Nordic countries, the breastfeeding rates have traditionally been higher, for example in Sweden, the exclusive breastfeeding rate of preterm infants at discharge was 74% and the overall rate 93% (Flacking et al. 2003) and in Denmark the corresponding rates were 68% and 85% (Maastrup et al. 2014a). It is not possible to make direct comparisons with this data, but this study confirms that preterm infants are breastfed less in Finland compared to other Nordic countries (Breastfeeding Promotion in Finland 2009).

The main reason for the cessation of breastfeeding was an insufficient milk supply, which is consistent with earlier data on mothers of preterm infants (Hill et al. 2007a) and also with Finnish mothers of full-term infants (Uusitalo et al. 2012). Mothers of preterm infants may feel that their infants are physically compromised and not able to breastfeed efficiently, and that complementary feeding would be an easy solution (Callen et al. 2005). Complementary feeding by formula milk decreases the stimulation of breasts, which creates a negative feedback loop, and the mother easily may come to a conclusion that her milk supply is insufficient. Based on this study, the mothers of preterm infants may think that by breastfeeding they can compensate for an 'unsuccessful' pregnancy and be verifiable good mothers. By implication, if the breastfeeding was also 'unsuccessful', it is an enormous additional disappointment to a mother. Breastfeeding is very sensitive area of motherhood (Marshall et al. 2007), and especially something that needs to be understood as an essential part of being a mother of a preterm infant.

6.2 Validity and reliability of the studies

Validity and reliability concerning the whole research process and particularly the sample, questionnaires, and instruments used in all the studies will be discussed in this section. Both the strengths and threats to the validity and/or reliability are discussed. In general, integrating different research approaches and methods provides stronger evidence and enhances the validity and reliability (Waltz et al. 2010).

The questionnaires used in the survey (Study 1) were developed for the study and used for the first time. A descriptive survey is a usable design to gain more information from a situation that occurs naturally (Burns & Grove 2009) and questionnaires are a convenient data collection method with a large sample (Waltz et al. 2010). The questionnaires were piloted by midwives (n = 10), paediatricians (n = 10) and mothers of NICU-infants (n = 5). Some changes improving the linguistic clarity of the questions were made based on the piloting. Answers to the study questions were obtained, but the questionnaires were too general in order to give detailed information on the differences in the care practices in the study hospitals. Answers to the research questions were, however, obtained with the developed questionnaires, which is the essential aspect of the validity (Waltz et al. 2010). This aspect of the study would have been strengthened by direct observations of the clinical environment and care practices in both the delivery ward and the NICU.

The sample size was estimated based on the NICU-statistics in both hospitals so as to provide a representative sample. The data were collected by the researcher in hospital A, and by trained nurses in hospital B. Only seven infants in hospital A and 32 infants in hospital B were excluded because of missing questionnaires in the first phase, thus the data described the care practices quite well. However, the data collection took a month longer in hospital B, which may have caused some differences in the characteristics of infants between the hospitals. The sample covered 30% and 20% of the NICU-infants in year 2008 in hospitals A and B, respectively. The results should not be generalized outside the study setting, however, the results provide new information and some insights into the possible variation of care practices concerning early physical contact in different hospitals.

Study 2 was a systematic integrative review, and the validity and reliability were evaluated based on criteria by Whittemore (2005). Studies with diverse methodologies were investigated and the appropriate review method was chosen at an early stage. The search was made in four databases: PubMed, Cinahl, PsycINFO and Cochrane. The number of search terms related to the Internet is high, which presented some challenges when managing the search. However, the search terms used were determined together with an information specialist. The accurate search terms are shown in the published

article (Paper II, Table 1). The study selection process was performed by two reviewers, which enhanced the validity. An additional manual search was done using the reference lists of the chosen articles and three more papers were included. Including only published studies written in English may also be seen as a limitation. Excluding, for example, non-published dissertations might have enhanced the quality of the data, but then again some relevant studies might have been missed. Data extraction and analysis was performed by one reviewer, but with close collaboration with the other members of the review team.

In Study 3, the strength was the randomized controlled design (Burns & Grove 2009), although controlling the confounding variables in the real life of the mothers and families is quite impossible. The study participants might, for example, search for breastfeeding knowledge from internet discussion boards or visit some mother-to-mother groups supporting breastfeeding. The confounding variables were possible, however, for all the participating mothers, regardless of the study group.

The long-follow up was also a strength, and this study provides unique data regarding Finnish mothers of preterm infants. The questionnaires were partly developed for the study, however, the same question about the implementation of early physical contact, as in Study 1, was used in Study 3. The questionnaires were piloted for clarity and intelligibility using three (n = 3) mothers of NICU-infants, and no changes were needed. Validated instruments were used for measuring breastfeeding attitude (IIFAS) and self-efficacy (BSES-SF). These instruments have been previously used in many countries and studies, and they proved also to have high internal consistency in this study (Table 8).

Table 8. The reliability of the instruments used in this study

Instrument	**Cronbach's alphas**			
	First measurement point	Second measurement point	Third measurement point	Fourth measurement point
IIFAS*	0.75	0.74	0.71	0.75
BSES-SF**	-	0.90	0.95	0.96

**Iowa Infant Feeding Attitude Scale (de la Mora et al. 1999)*
***Breastfeeding Self-Efficacy Scale – Short Form (Dennis 2003b)*

The sample size was determined by a power analysis, but was not totally achieved due to organizational changes in the study hospital. In hindsight, the power analysis was based on too optimistic numbers concerning the duration of breastfeeding. However, the expected change in attitude scale was more realistic, although not achieved. The sample as a whole covered a wide range of mothers and their preterm infants born at different GAs. All of the participants were, however, quite highly educated compared with the

Finnish population (Official Statistics of Finland 2014b). In addition, the proportion of single mothers and mothers who smoked during pregnancy was very low (Perinatal statistics: Parturients, deliveries and newborns 2014). The decision to collect the data at the last measurement point by phone instead of mailing the questionnaires increased the response rate. However, for participants, there is a difference when answering an anonymous questionnaire to answering directly to the researcher on the phone, and this may have affected the answers.

The number of mothers who refused to participate was quite high. The reasons for refusal were most often the stressing situation caused by preterm birth, or having little interest in social media. It can be speculated that the mothers who were not interested in breastfeeding, refused to participate. The data were collected from one hospital thus the results have to be generalized with caution; but the findings may provide new insights in hospitals with similar settings and population. The baseline data collection period was quite long, almost three years, which may have caused some changes in the care practices in the hospital. However, the characteristics of the mothers and infants did not differ between the experimental and the control group.

The internet-based peer-support intervention showed no effect, but the results of this study may guide the further development of the intervention used in this study, or the development of possible new interventions. The possible intervention effect was diminished because of the large proportion of mothers who did not join the peer-support group. Another problem was the high drop-out rate during the follow-up, which is a common disadvantage of using questionnaires (Waltz et al. 2010). The activity of the participating mothers in the peer-support group was the major component of the intervention, which could be seen as a threat to the fidelity. No special training was organized for the peer supporters, which can be considered a limitation. The peer supporters might have benefitted from special education to support the participating mothers more homogeneously (Meier et al. 2007). However, professionalizing peer supporters may lead to tension in relationships with health care professionals (Aiken & Thomson 2013).

The qualitative data in Study 4 were collected from the internet-based peer-support group and analyzed by thematic analysis (Braun & Clarke 2006), which was a suitable method because the interest was in the content of the discussions. The data were copied directly in its original form from the peer-support group to a Word-file. The validity and reliability of the study have been discussed in relation to credibility, dependability, and transferability (Graneheim & Lundman 2004). Regarding credibility, the researcher, who is also a midwife, operated as the breastfeeding counsellor in the peer-support group. This combination of different roles might have influenced the analysis. The

credibility concerning the analysis was enhanced by tight collaboration with the co-researchers who were also familiarized with the original data.

The dependability was threatened by a long data collection period. The first mothers in the peer-support group had different starting points compared with the last mothers in relation to previously existing discussions in the group. The researcher presented some questions in the group, which worked as stimulants for the discussion and were not aimed at manipulating the content. The presence of the researcher (midwife) might have inhibited some mothers in writing questions or comments or expressing their opinions or experiences. Transferability of the results may be limited because the sample comes from one area in Finland, and the hospital policies and the care culture concerning breastfeeding may differ in other areas, however, the data saturation was reached and realized through repetitive discussion of the topics.

7. IMPLICATIONS AND FUTURE RESEARCH

The following suggestions for practical implications are given based on this study:

1) Care practices in the delivery ward need to be modified to facilitate a brief early physical contact between mothers and their preterm or sick infants. The infants born by caesarean also need to be taken into consideration. Patient safety cannot be endangered, thus new care practices need to be developed in collaboration with delivery ward and NICU staff and the parents of these vulnerable infants. The concept of family-centered care could be adopted also in delivery wards to emphasize the importance of parent-infant closeness in preterm and sick infants.

2) The level of breastfeeding counseling needs to be raised and standardized in the birth hospitals by educating all staff members, and developing a protocol of how to support breastfeeding in the mothers of preterm infants. The WHO has developed and updated a 20-hour course for staff in maternity hospitals to support breastfeeding (WHO & UNICEF 2009). Moreover, specific education packages could be developed with the support of breastfeeding specialists. A breastfeeding counselling course could be required of all staff members who take care of pregnant women, women in labour, women postpartum, or newborn infants. Breastfeeding is an essential aspect of family-centered care, but its role needs to be emphasized over breast milk, because of both the nutritional and emotional advantages.

3) Breastfeeding attitude screening for mothers with an imminent preterm birth would be a quick and easy method of providing a starting point for individual breastfeeding support. The IIFAS is a valid and reliable scale, and a Finnish translation already exists.

4) Breastfeeding peer support could be recommended for all mothers of preterm infants as an additional source of support. The effectiveness of peer support concerning breastfeeding cannot be guaranteed, but both emotional and informational support for the mothers is provided. Internet-based peer-support groups provide a possibility to join in the group despite geographical distance or time. These groups could be maintained, for example, by midwives or nurses in hospitals or public health nurses in child health clinics.

Preterm infants' breastfeeding needs to be studied further in the future. Suggestions for future research are divided into similar areas as the implications for practice:

1) The differences in care practices concerning early physical contact in different hospitals need to be studied further. In addition, the safety issues of early physical

contact need more investigation. This study did not describe the mothers' perspective on early physical contact, not to mention the fathers and partners, who were omitted in this study.

2) Educational interventions have been studied a great deal and the main problem might not be in their effectiveness, but the lack of will to promote breastfeeding and implement the education from the management level. Future studies should be directed to investigate hospital policies related to breastfeeding. Cost analysis needs to be done to ensure that promoting breastfeeding is beneficial and cost-effective. In addition, research is needed on how these best practices can be successfully implemented in clinical practice.

3) The negative change of attitudes needs to be investigated in a larger population of mothers of preterm infants. This was the first study where the change of attitudes was shown and the reasons for the change need to be studied more carefully. Because it is possible to purposely change attitude, attitude-focused interventions would be interesting to develop and test. In addition, the breastfeeding attitudes of the staff in birth hospitals might have an effect on breastfeeding support, thus it also needs to be studied.

4) The breastfeeding peer-support intervention in social media deserves to be further developed and tested. Based on the feedback received from the mothers it is possible to improve the intervention. Breastfeeding specialists could be asked to participate in the development. The group moderator and the peer supporters might benefit from special training. The effectiveness of the intervention could be tested again with a larger sample with more rigorously controlled fidelity.

8. CONCLUSIONS

Care practices in the delivery room are already significant when supporting breastfeeding of preterm infants. The implementation of early physical contact between a mother and her NICU-infant in the delivery room is inconsistent and should be promoted. In addition to gestational age, early physical contact seems to be the most important factor when initiating the process of breastfeeding in the mothers of preterm infants. In the NICU, breastfeeding counseling should be standardized by educating the staff, because currently conflicting advice is provided to mothers. The value of breastfeeding needs to be recognized, not only breast milk.

Internet-based peer-support group demonstrated no effect on breastfeeding, expressing milk, or breastfeeding attitude, but the weaknesses in the study design may have diminished the effect, thus additional research is needed. Peer-support intervention in social media was considered pleasant and easy to access. Mothers felt relieved when other mothers had similar problems and concerns, and they could share their experience. This was the first study examining breastfeeding attitudes in the mothers of preterm infants. A maternal breastfeeding-favorable attitude predicted increased frequency of breastfeeding in the NICU and a longer duration of breastfeeding. Attitude seemed to be a stronger predictor of breastfeeding than sociodemographic factors. In the future, attitude-focused intervention studies are needed.

9. ACKNOWLEDGEMENTS

I want to express my sincerest gratitude to my excellent supervisors, Professor Sanna Salanterä and Principal Lecturer Hanna-Leena Melender. Without Sanna's scientific courage and enthusiasm, this study would not exist. I deeply appreciate her endless creativity, innovativeness and joy for life. Sanna has always been supportive and encouraged me to take responsibility and solve the problems myself. During the whole study, her methodological expertise has been extremely valuable. Although Hanna-Leena has been in Vaasa, she has been as close as the nearest internet connection. As we both have a background in midwifery, it has been easy and fun to collaborate – you can always count on a midwife. Hanna-Leena has always answered my sometimes desperate emails with compassion, professionality and practical advice. Together Sanna and Hanna-Leena supplement each other perfectly; the first taking care of the innovations and bigger picture and the latter concentrating on practical issues and details.

My warmest thanks go to Docent Anna Axelin, who I consider to be my third supervisor, mentor, and friend. This study might not be even have started without her, and during the process her support has been invaluable; there has been nothing I could not ask or discuss with Anna. I have learnt so much about methods, the practical details of conducting research, and scientific writing from her, to mention only a few issues. Her passion for science is something I continuously admire.

I sincerely wish to thank Docent Katja Joronen from the University of Tampere and Associate Professor Audrey Lyndon from the University of California, for officially reviewing this thesis. Their careful review helped me to correct all the inconsistencies and to improve the whole thesis.

This study was carried out at the Department of Nursing Science, University of Turku, and I warmly thank the Head of the Department, Professor Helena Leino-Kilpi for supporting me during these years. We share a mutual connection and respect because of the mysterious Laitila-spirit, which we both are privileged to have.

I want to thank Docent Samuli Rautava, MD, PhD, from Turku University Hospital, for his advice, positive attitude, and encouragement throughout the study. I warmly thank Professor Liisa Lehtonen, MD, PhD, from Turku University Hospital, and Reija Latva, MD, PhD, Docent Outi Tammela, MD, PhD, and Raili Salmelin, PhD, from Tampere University Hospital and University of Tampere, for their guidance during my very first steps as a researcher. Their firm experience in research and scientific writing added to Raili's expertise in statistics, supported me significantly to overcome the first scientific challenges. After the first steps, Biostatistician Eliisa Löyttyniemi, MSc, continued to guide me further in the world of statistics. She has patiently explained to me over and

over again, and drawn dozens of figures to illustrate the analyses performed. I could have not survived without her expertise. I also wish to express my gratitude to Elizabeth Nyman and Suzanne Collins for editing and improving my English.

My sincerest thanks go to Heidi Välimäki, RM, and Johanna Salopää, RM, for their assistance in coordinating the data collection with me. I also want to thank the whole magnificent staff of delivery ward (‘360’) and prenatal ward (‘312’) at Turku University Hospital for their support and willingness to participate and help in data collection. Especial thanks go to the retired Heads of both wards, Christel Lindqvist and Erja Rantanen for always trusting in me and being positive toward my studies. I thank the voluntary peer supporters Anne-Mari Söderdahl, Johanna Himanen and Sabina Sundqvist for their help in the peer-support group. My heartfelt thanks go to all the mothers of preterm or sick infants, who were willing to participate in this study regardless of their stressful life event. They made this study possible.

I am happy to have such a wonderful work mates in the Department of Nursing Science. I warmly thank my colleague and roommate Sanna Koskinen, for her friendship. We have shared the ups and downs of doctoral candidates supporting each other. Our daily lunch breaks and yearly conference trips have been full of laughter and joy. I want to especially thank the group of doctoral candidates called ‘Jälkiviisaat’, including Lotta Hamari, Sanna Koskinen, Anni Pakarinen, Heidi Parisod, Laura-Maria Peltonen and Eriikka Siirala. This group has been a source of real peer support. I thank my roommates Christina Athanasopoulou and Camilla Strandell-Laine and colleagues Tella Lantta and Kaisa Kauppi, for interesting discussions, support and being good company. In addition, I want to thank all the amazing people in the Department of Nursing Science. They have always been willing to help whenever needed. I have really enjoyed working together with them.

I thank my doctoral candidate colleagues in the Finnish Doctoral Education Network in Nursing Science for providing me with insights into other universities and sharing their thoughts in our more or less scientific discussions. I also thank all colleagues in the Doctoral Programme in Nursing Science in University of Turku. Our colourful discussions in seminars have given me many new ideas and strengthened my decisions concerning this thesis.

I am grateful to all my friends who have always ensured my sanity: Niina K, Laura J, Mari E, Sari V-I and Anne V, and all human and animal friends in Laitilan Hevosharrastekeskus. I thank Merja G for driving with me together between our homes and delivery ward in Turku University Hospital for many years. I am so happy that they all are in my life. I wish to send my loving thanks beyond the stars, for my dearest friend and my daughter’s godmother Elisa, who lost her fight with cancer last year.

My humble thanks go to my parents, Mirja and Jukka, who have supported and encouraged me in so many ways. They still are the best support for me and my family. I thank my brother Petri and his wife Katja, and their children Anni, Aada, and Otto, for providing totally non-scientific life in our summer cottage. I also thank my mother-in-law Mirjami and father-in-law Helge and my sister-in-law Kirsi and her spouse Jari for always supporting me. I want to express my hearty gratitude to my step children, Hannele and Aleksi, for letting me be part of their life, and their unconditional love for their younger siblings. I thank my dear children Siiri-Maria and Sisu, for being such fantastic kids. Because of them, I will never forget what is most important in life. I really owe a big thanks to my loving husband, Jari, who has patiently taken care of our daily life whenever I have been writing, teaching, or travelling – a sign of true love.

This study was financially supported by the Finnish Doctoral Programme in Nursing Science, which enabled me to work full-time researcher for four years. In addition, I want to acknowledge the Department of Nursing Science of University of Turku, Turku University Foundation and The Federation of Finnish Midwives for financially supporting my study.

Laitila, February 23rd, 2016

Hannakaisa

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