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Infant Sleep Location and Breastfeeding Initiation on the First Postnatal Night



Bergman, T 1999 "Closeness and Warmth" ICDC/IBFAN Penang

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Submitted for the degree of Master of Science

University of Durham

Department of Anthropology

2005

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29 NOV 2006

Abstract

Hospitals making a commitment to the UNICEF Baby Friendly Initiative adopt a number of practices to help increase breastfeeding initiation rates. Allowing mothers and their infant's uninterrupted skin to skin contact for at least the first 30 minutes following delivery (Righard 1990) and keeping mothers and babies close are two of the practices that have been shown to encourage breastfeeding initiation (McKenna & Bernshaw 1995). Bedding-in is an obvious extension to skin-to-skin contact and a way of ensuring that mothers and their infants stay close.

This randomised control trial investigates the effects of bedding-in compared to rooming-in on breastfeeding initiation, mother-infant contact and midwifery assistance required on the first post-natal night. In addition, a relatively new infant sleep condition (clip on crib) was assessed to determine whether infants and their mothers allocated to this condition behaved more like the bedding-in group or the rooming-in group in relation to breastfeeding initiation. Mothers were recruited via breast-feeding workshops held within the Royal Victoria Infirmary (RVI) when they were approximately 37 weeks gestation. Following vaginal delivery (without the use of intramuscular opiate analgesics) the behaviours and interaction of the mothers and their babies were recorded on the post-natal ward of the RVI using infra-red video equipment. Tapes were coded using the Noldus Observer 5.0 software according to an established taxonomy used in previous studies by the Parent-Infant Sleep Lab team. Data was analysed via Intention to Treat (ITT) and Treatment Received (TR) analysis using Kruskal-Wallis and Mann-Whitney U tests.

Results highlight the importance of prolonged close contact between mother and infant on breastfeeding initiation. Many mothers who were randomly allocated to rooming-in instinctively brought their infants into bed and mothers and infants who spent their first postnatal night in close contact initiated breastfeeding more successfully than those further apart. No significant difference was found in the amount of midwifery assistance with breastfeeding mothers requested or received between the three groups

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Declaration

Preliminary breastfeeding analyses in this thesis have been presented at the Measuring behaviour 2005 conference (Wageningen, Netherlands 30 Aug – 2nd September 2005) and an abstract published in the conference proceedings under the title ‘Bedding-in and Rooming-in on the Post-natal Ward: Breastfeeding Initiation’ and authorship E. Heslop, S.J. Leech and H.L. Ball.

All analyses and primary responsibility for writing of the publication were undertaken by Emma Heslop. Dr Helen Ball provided the video tapes and other demographic data for analysis. Helen Ball and Steve Leech helped with preparation and revision of the manuscript.

Statement of copyright

The copyright of this thesis rests with the author. No quotation from it should be published without her prior written consent and information from it should be acknowledged.

Acknowledgements

Helen Ball and the staff participating in the RVI Bedding-in study provided the video tapes and other data for analysis in this study. I wish to thank Helen for her invaluable help, support and friendship during every stage of this study (night and day), all of the mothers who took part in the research for allowing me to share one of the most special and precious times in their lives with them, the staff from the Royal Victoria Infirmary Post-natal wards for their interest and cooperation, the Infant Child Research Network and the Medical Anthropology in the North East research groups (both of Durham University) for the opportunities they provided me by funding two research trips- one to a 3 day breastfeeding workshop in Derby (2003) and one to the Measuring behaviour conference in the Netherlands (2005), my friend and colleague Steve and finally my husband Darren and my parents Sheila and Kenneth who supported me throughout my work on this thesis and gave me the inspiration and belief to see it through.

Funding for the RVI Bedding-in study (of which this study comprises a part) was provided by Babes-in-Arms. This work was presented in earlier stages to the Medical Anthropology North East Research Group (2005) and at the Durham University Post-graduate conference (September 2003) and I am grateful for the valuable feedback that was offered at these venues.

Background

In considering breastfeeding and sleeping from an evolutionary perspective we can say that infants have evolved to breastfeed and to be kept in close contact with their mothers both during the day and night for at least the first year of life (McKenna 1990a). This has been the case for 4.5 million years of human evolution and it is only within the last 150 years (Hardyment 1983) that we in the West have tried to alter this practice with the introduction of solitary sleeping in infancy and the mass production of formula milk in 1867 only added support to this practice. Through research some evolutionary anthropologists are trying to redress the balance and promote breastfeeding and bed-sharing both in the hospital and home environment. To not breastfeed is detrimental to mothers, infants and society as a whole and the numerous health problems associated with lack of breastfeeding have been well documented. Due to this the UK Government have set NHS Trusts a target of increasing breastfeeding initiation rates by 2% per year for the next 3 years (BFI UNICEF website).

One of the major initiatives to help promote breastfeeding is the United Nations International Children's Fund (UNICEF) Baby Friendly Initiative (BFI). Many hospitals are making a commitment to 'Baby Friendly' practices to encourage the early initiation and continued promotion of breastfeeding and most are developing policies on mother-infant bed-sharing on the post-natal ward (Ward-Platt & Ball 2002). To become 'Baby-Friendly' accredited hospitals are required to implement UNICEF's 10-steps to successful breastfeeding which state that mothers should be allowed uninterrupted skin-to-skin contact for at least half an hour following delivery, midwifery staff should encourage breastfeeding within the first hour, and advise mothers to keep their baby close to them at all times (UNICEF 2000). Mother-infant bed-sharing on the post-natal ward is encouraged, as a way of facilitating the establishment of both breastfeeding (Widstrom 1990) and bonding (De Chateau 1977), while helping mothers gain more post-partum rest (as they can comfort, feed,

and care for their babies in bed) (Ashmore 1997). In one British hospital introduction of a bedding-in policy resulted in a halving of the rate of supplementation with artificial formula (Ashmore 1997). Hospital bedding-in policies, therefore, provide a framework of guidelines via which mothers (who do not exhibit certain contraindications) can be allowed and even encouraged, to keep their baby in bed with them constantly while on the post-natal ward (Ashmore 1997).

Project aims

This research aims to investigate whether or not sleeping arrangement on the first postnatal night affects breastfeeding initiation.

Objectives

To observe, document and quantify the nature and extent of mother and infant night-time feeding interactions on the first night of life on the postnatal ward in three randomly allocated sleeping conditions specifically to assess whether sleeping condition affects breastfeeding initiation

Funding and Ethics

The data for this MSc was collected in conjunction with data for the University of Durham Parent-Infant Sleep Lab between April 2003 and December 2004. The Mother-Newborn Sleep Study, conducted by the University of Durham Sleep Lab Team, was funded by Babes-in-Arms. The study took place at the Royal Victoria Infirmary (RVI) in Newcastle, where collaborators included Dr Martin Ward-Platt (Senior Consultant Paediatrician). A pilot study was carried out in the summer of 2001 on the postnatal ward of the RVI and ethics approval for this study was granted by Northumberland and Tyne and Wear (Newcastle and North Tyneside) Local Research Ethics Committee in September 2002.

Literature Review

Anthropological perspective

It is useful to identify an evolutionary anthropological perspective when considering what normal infant feeding and sleeping patterns are. To date four evolutionary strategies have been recorded for mammalian care-giving and they are cache, nest, follow and carry (Bergman 2000). Humans have been classified as a carrying rather than a caching species (Lozoff 1979) as infants of caching species are often left in the nest for prolonged periods of time whilst the parents go and search for food. The composition of milk in these species is high in protein and fat allowing the mother to be away from their infant for prolonged periods of time with the nest and littermates providing warmth (Hinde 1984; Lozoff and Brittenham 1979) for instance, newborn rabbits only suckle once per day. Infants of carrying species on the other hand are adapted to accompanying the mother and require frequent feeding. Human breast milk is low in fat and protein and is easily digested, requiring infants to suckle frequently in order to satisfy their nutritional requirements (Trevathan 1993). Hinde (1984) suggests that the poor early thermoregulatory ability of the human infant and the presence of the primitive startle and grasp reflexes also support the argument that they were born prepared to be carried. Human infants are classified as secondarily altricial (Martin 1992) as their brains are only 25% developed at birth (McKenna 1990a). They are not truly altricial as although they are relatively helpless for the first year of life (an altricial trait), the human gestation period is relatively long and the infant quite large (relative to maternal body size) at birth, at which stage their eyes and ears are open. In all of these ways humans fit the precocial rather than the altricial pattern. With the conflict between encephalisation (brain growth) and bipedalism (walking upright, reducing the size of the pelvis) human infants were forced to be born neurologically immature (Trevathan 1993) making them unique among primates (with 12 months external gestation as their brain continues to grow) (Martin 1992) and requiring them to be in constant contact with their mother for food, warmth and protection (Lozoff & Brittenham 1977). Therefore it could be argued that infants are

designed to be in an environment in which they are in close contact with a caregiver throughout the day and night and that mother-infant contact co-evolved over millions of years of primate evolution (McKenna 1990a).

Human's closest living relatives are non-human primates and humans are distinct among the simian primate groups as they are the only group in which infants are expected to sleep independently (Anderson, 1984; Konner, 1981; Lozoff and Brittenham 1979) and are not exclusively breastfed. Therefore, the idea of humans placing infants on a separate surface let alone a separate room to sleep in addition to not breastfeeding is bizarre in evolutionary terms.

The kind of social environment in which humans evolved best fits the contemporary model found in modern day hunter-gatherers. In these societies infants are in constant contact with their mother or other adult caregivers throughout the day and night. This allows them constant access to resources (food, warmth, comfort and sensory stimulation) (Lancaster and Lancaster 1982), re-enforces the mother-infant bond (Bowlby 1953, 1969) and helps protect the infant from predation (Konner 1981).

However, this is not a behaviour exhibited exclusively by hunter-gatherer people, cross-culturally mother-infant co-sleeping (sleeping within sensory exchange of one another) is the norm. This was illustrated in 1971 when Barry and Paxson completed a comprehensive study into infant sleep location using data from the Human Relations Area Files and found that in 96/169 societies infants slept in the same room as their parents and in 73/96 actually in the same bed. Similarly in 1964 Whiting found that in 76% of societies studied the mother and the infant slept together (Whiting 1964). This important evolutionary and cross-cultural perspective has been highlighted in the work of McKenna (1990a, 1990b) who suggests that it is only very recently (in evolutionary terms) that we have started to sleep our infants in isolation. He suggests that co-sleeping (in the form of bed-sharing) may help confer some kind of protection against SIDS (McKenna and Mosko 1990). This proposal is supported by the research conducted in non-industrialised societies (Japan, Philippines, Bangladesh) where co-sleeping and breastfeeding are the norm as it reveals that SIDS rates are low compared to the high rates recorded in the West (Lee 1992; Singh et al 1992; Gantley & Davies 1993; Caudill & Plath 1966; Guthrie & Jacobs 1966). However, it has been suggested that this has more to do with the difference in actual sleeping environment

(use of duvets, pillows and soft mattresses) and social behaviours (smoking / alcohol levels) than the fact that Western cultures do not exclusively bed-share (a particular kind of co-sleeping in which the mother and her infant share the same sleep surface) and breastfeed. In Hong Kong infants were observed to bed-share on a firm surface (futon) (Nelson et al 1996) and a New Zealand study found that Pacific Island babies sleep on top of the bed covers rather than under them (Mitchell et al 1994) both of which are safer bed-sharing environment than those practiced in Western industrialised cultures (Drago and Dannenberg 1999; Drago 2000; Byard, Beal et al 1994, Nakamura, Wind et al 1999)

Until recently in the UK it was common practice for infants to bed-share and breast feed. The first records of habitual society-wide solitary sleeping of infants are in Western Europe 150- 170 years ago and by the 1850's the improvement in patented baby formulas was felt to be so great that manuals began to recommend them (Hardyment 1983). Both these practices arose following the Industrial Revolution, which occurred between 1750 and 1830. The Industrial Revolution transformed Great Britain from a largely rural population into a town-centred society engaging in factory manufacture, which was in part fuelled by the economic necessity of many women to find waged work outside the home. The need for women to work and the lack of wet nurses available at this time were two of the factors which encouraged the production of formula milk making it easier for mothers to be more independent and leave their infant to go out to work.

The first records of infants sleeping on a separate surface to their mother comes from the middle ages (9th century) when the church advised that infants sleep alone in their cradle until they were three years old due to fears of suffocation and overlaying (McLaughlin 1988). In the 17th century although infants were removed from the adult bed, their cradle still remained in the adults room (Sparkes 1980) and the whole family often slept in the same room (Illick 1988). However, during the 17th century when the affluent (with large houses and internal heating) became concerned with privacy they began the trend of placing their infants in their own room to sleep (Anders 1994). Hardyment (1983) states that, society wide, sleep was not considered a moral issue before the 19th century however, after 1840 the mood was changing and some child care experts started to encourage mothers to sleep their infants in a

separate room to help with the smooth running of the house (Barwell 1840 in Hardyment 1983). In 1812 Syer expressed concerns re co-sleeping and supported infants sleeping alone. This advice continued into western 20th century as professionals advised parents to sleep infants alone (Spock 1968).

In the 20th century fear of suffocation was still a primary reason given for sleeping infants alone although other reasons given include making infants more 'independent' and not 'spoiling' them and allowing parents some time alone to continue sexual relations (Goodrich 1968; Spock 1968; Nathan 1908). One of the primary goals of many new parents in the UK today is to get their infant to 'sleep through the night' as soon as possible. Paediatric textbooks suggest that infants should be 'sleeping through' by 3 months (12mn-5am) and this is referred to as the 'gold standard' (Moore & Ucko 1957). However these text books rely on data from the 1950's - 1960's when bottle feeding was the predominant mode of infant feeding, therefore these standards are based on the sleep patterns of a formula fed infants, which have been shown to be different from the sleep patterns of breast-fed infants (Horne, Parslow, et al. 2004). Infant sleep patterns have evolved over millions of years and it is unrealistic to think that we can alter them within the space of a couple of hundred years, to better suit the needs of parents. By training / forcing infants to sleep through the night and sleep in isolation we are stretching their adaptive capabilities which may have serious consequences in relation to Sudden Infant Death Syndrome (SIDS) (Call in McKenna 1990c). All this evidence suggests that modern western sleep expectations may be less than optimally adaptive (Anders 1994) and that co-sleeping is how a mother and her infant have evolved to sleep (to help promote safe sleep and breastfeeding).

Breastfeeding

The World Health Organisation (WHO) recommends exclusive breastfeeding for the first 6 months of life, due to the numerous health benefits, (WHO, 2001). However, breastfeeding rates in the UK are among the lowest in Europe (less than 50% at 6 weeks) and the North East specifically are among the lowest in the UK (Hamlyn et al 2002). Foster et al (1997), reports that 68% mothers in England and Wales initiate breastfeeding, but only 65% continue for 6 weeks or longer, and only 32% breastfeed

for 6 months. Hamlyn et al (2002) reveal that the prevalence of any breastfeeding in the UK as a whole at birth is 69% (up 3% from 1995). At 1 week 55% are still breastfeeding, by 4 months this has dropped to 28% and by 6 months 21% of mothers are continuing to give their infant breast milk.

A number of demographic factors are known to influence whether or not a mother is likely to initiate breastfeeding. Mothers in manual social class groups are less likely to breastfeed than those in non-manual groups (63% as opposed to 83% at birth). Mothers who remained in full-time education until they were 18 are more than 3 times as likely to breastfeed their infants to 4 and 6 months of age than mothers who left school aged 16 or under and more than 75% of mothers over the age of 30 breastfeed their babies compared with less than 50% of mothers under the age of 20. Also, depending upon where they live in the UK, some mothers are more likely to initiate breastfeeding than others, with 81% of mothers in the south east of England initiating breastfeeding they are more likely to breastfeed than mothers elsewhere in the UK. The lowest average rates are found in Northern Ireland, where just 54% of babies are breastfed at birth, and the North of England where only 61% are breastfed at birth (Hamlyn et al 2002).

Over the last decade (20th Century) breastfeeding rates have fluctuated (AAP 1982) with breastfeeding being at its lowest in the 1970's when only 1 in 4 mothers opted to breastfeed, by the 1980's up to 60% of mothers were initiating breastfeeding. However, before alternatives were introduced everyone accepted breastfeeding as standard practice and it is argued that we need to re-create this social support and public acceptance of breastfeeding in order to further increase the number of mothers who breastfeed (AAP 1982 p658)

The UK government has set NHS Trusts the goal of a increasing the breastfeeding rate by 2% per year for 3 years (2002 -2005)(UNICEF BFI 2004), thereby reducing the number of infants who are formula fed. The government aim to increase breastfeeding rates as formula feeding has been shown to be detrimental to infant and maternal health as well as to society as a whole. The most important health benefit of breast milk to the infant is that it is specifically designed to meet all the nutritional needs of an infant unlike formula milk which is not easily digested and therefore is

not efficiently used by the infant (Hernell et al in Freir 1980). Formula does not contain any of the antibodies that breast milk does therefore it is unable to enhance the infant's immune system helping protect against certain infection (Filteau 1994) including gastrointestinal, respiratory and ear infections (Howie 1990). Formula milk increases the incidence of juvenile onset diabetes (Park 1992) and otitis media (Duncan 1993). It also increases the severity of certain allergic conditions including eczema, psoriasis and asthma (Matthew 1977) as well as increasing the likelihood of infants becoming intolerant to cows milk (Cunningham 1991) and unlike breast milk it does not help with the development of the brain, central nervous system and sight (Lucas 1992 and Crawford 1993). Breastfeeding also has benefits for the infant later in life, therefore infants who are formula fed are at increased risk of suffering from many diseases such as Necrotizing Enterocolitis (NEC / bowel disease), heart disease and celiac disease and infants fed formula often become overweight due to overfeeding (Lucas, Lockton et al 1992). Formula fed infants do not develop as well mentally as breastfed infants and therefore score lower on intelligence tests (Rogan et al 1993). Furthermore formula milk possibly increases the incidence of some childhood cancers (Lymphoma and Hodgkin's disease) (Shu 1995) BFI) and it has also been suggested that formula fed infants are at an increased risk of SIDS (Mitchell & Scragg 1993, Bernshaw 1991). The action of breastfeeding helps with the correct development and formation of the jaw (Williamson 1994) which may affect clarity of speech (Broad 1972) Breastfeeding also increases protection against dental caries, and possibly causes less malocclusion (Labbock1987).

Lack of breastfeeding can also have significant health consequences for the mother, as mothers who do not breastfeed are at an increased risk of suffering from some forms of ovarian cancer (Rosenblatt 1993) as well as pre-menopausal breast cancer (Newcomb 1994) and endometrial cancer. Not breastfeeding is related to a higher incidence of osteoporosis (hip fractures) (Cummings 1993) and mothers who do not breastfeed do not gain the contraceptive protection inherent in breastfeeding, therefore the benefits of the reduced number of periods over a reproductive lifetime is lost (Lewis 1991). Additionally, lack of early breastfeeding prolongs post-natal bleeding (Gross 1991) and mothers who breastfeed lose weight and regain their figures quicker than mothers who do not breastfeed (Dugdale1989). Breastfeeding is also convenient especially for night feeds, travelling and storage as no preparation is required, mothers

who breastfeed save money as breast milk is free and no equipment is necessary and infants who are fed breast milk have less smelly nappies. If more mothers breastfed society could also benefit as the many health benefits would reduced illness as a whole, which costs society and the National Health Service, there would also be less waste from packaging of products associated with formula feeding.

Breastfeeding has physiological benefits to both the mother and the baby which are inherent in the close contact necessary for breastfeeding. Breastfeeding allows mothers and infants to bond (Klaus & Kennel 1976) which helps mothers learn how to react to their infant's subtle cues quicker (Barr 1988) and respond to them more affectionately (Feldman & Eidelman 2002). This in turn means that infants who are breastfed cry less (Christensson 1995, Barr 1988) and may develop faster if they stay in close contact with their mother following delivery (UNICEF BFI 2003). Breastfeeding has also been shown to calm a fractious baby thereby decreasing its stress and acting as pain relief or an analgesic (Gray, Watt et al 2000). It also helps mother build confidence and self esteem and promotes better sleep patterns as prolactin (released during breastfeeding) has a relaxing or calming effect (UNICEF BFI 2003).

Bed-sharing

In order to promote successful breastfeeding infants should feed on demand which requires feeding frequently during the night as babies who sleep with their mother feed more frequently than formula fed infants (thus stimulating her milk supply), and are more likely to breastfeed for longer than those babies who breastfeed without bed-sharing (Ball 2000). Research has shown that new mothers commonly adopt bed-sharing as a coping strategy for night-time care-giving in the first few months of their infant's life (Ball, Hooker et al 2000; Blair and Ball, 2004; Ball, Hooker et al 1999) and that during the 1980's and 1990's with the increased popularity of breastfeeding bed-sharing re-emerged as a regular child care practice (Nelson, Taylor et al 2001). In a study conducted in the North East of England (Ball, Hooker et al 1999) it was reported that 55% of infants bed-shared at least occasionally during 1st or 3rd month and that 70% of infants bed-shared at least occasionally during 1st 3 months of life. In

the UK as a whole, conservative estimates indicate that some form of parent-infant bed-sharing is practiced by around 50% of families with young babies, bed-sharing is most prevalent with neonates, and declines as infant age increases and a greater proportion of breastfed babies bed-share than formula-fed babies (73% vs. 38%) (Blair & Ball 2004).

Bed-sharing is also commonly practiced in other Western societies, for example within US communities it has been reported to occur routinely in 35% of white and 70% of black families (Lozoff, Wolf et al 1984). Willinger et al (2003) data from the US showed that from 1993-2000 bed-sharing (all night) increased from 6% to 13% and that 45% of infants bed-shared at least occasionally. A recent US study by McCoy et al (2004) also acknowledged that in their study population bed-sharing was 'not a rare practice' (p145) and was strongly associated with breastfeeding, especially at 1 month when twice as many breast-feeders bed-shared compared to non-breast-feeders. However, the authors note one of the limitations of the study as being the under representation of bed-sharing in their study population. Parents were asked where infants had slept for most of the night therefore the infants who only slept in the bed for a few hours will not have been recorded.

Other studies which suggest that bed-sharing facilitates breastfeeding include McKenna et al (1997), Pollard et al (1999) and Clements et al (1997). Clements et al conducted a population-based study of 700 infants in the Southeast of England and found that bed-sharing was associated with a longer duration of breastfeeding and that infants who were exclusively breastfeeding at discharge from the hospital were more likely to bed share (McCoy 2004 p145).

Lozoff (1983) uses examples from traditional societies to argue that it is the extended contact between the mother and her infant (within first few days / weeks) after birth which impacts on breastfeeding success and not the initial contact of the baby being placed skin to skin within the first hours or so after birth as in many traditional societies (94% of the cases) infants were bathed before being given to their mothers. 'However, virtually all of the traditional societies encouraged extended contact' (p597) and mothers rested with their infants, this has been described as the equivalent to 'rooming-in'. Lozoff argues that if the few hours after birth, described as the

'sensitive period', were so important for bonding and breastfeeding initiation then it is unlikely that so few cultures would engage in such contact. On the other hand extended contact is almost universal in all human populations suggesting that it is this which has most impact on breastfeeding initiation.

Close contact (skin-to-skin / kangaroo care)

A vast amount of research has been conducted on the effects of skin-to-skin contact and kangaroo care (placing a naked baby prone onto the mothers bare chest) in the immediate postnatal-period and in the subsequent days following delivery. In the sensitive period (initial period following delivery) babies can see, hear and respond, they experience a state of quiet alert, for up to 45 minutes after birth, giving the mother and infant an opportunity to explore and get to know one another. It also provides the ideal time to initiate breastfeeding. The affect of the sensitive period on maternal and infant behaviour was explored by Klaus and Kennel (1976), De Chateau (1976, 1977) and Christenson (1992, 1995).

A series of experiments by Klaus (1972) Kennell (1974) and Ringler (1975) on early and delayed contact identified that there is an early sensitive period for maternal attachment however they were unable to determine the timing of the sensitive period as women involved in the study experienced extra contact during the hospital stay as well as early contact soon after birth. Hales (1977) investigated early versus delayed contact and was able to conclude that the maternal sensitive period may be within the first 12 hours after birth. In one Swedish study Carlsson (1978) looked at early contact (within 1hour of delivery) and his results supported the conclusion that even brief initial mother-infant separation impacts on the 'affective components of mother-infant interaction' (Lozoff 1977) and indicates that the first hour after birth is especially important. Two other Swedish study by De Chateau (1976 and 1977) compared mothers who received early contact (15-20 min) with mothers who received routine care and followed them up at 3 months. They found that at 36 hours extra contact mothers were holding and cradling their infants more as well as holding them closer to their bodies (1976). At 3 months extra contact mothers kissed and looked at their infants more and extra contact infants smiled and laughed more and cried less. De Chateau concluded that as little as 15-20 min of extra contact following delivery

may be enough to affect later maternal and infant behaviours which result in more responsiveness and positive interactions and that being able to physically hold the baby was a crucial component in the early contact group (1977). O'Connor (1977) conducted research on rooming-in following delivery and he compared mothers who received standard hospital practice, contact every 4 hours with their infants for feeding, to mothers who roomed-in during the day (receiving an additional 8 hours of contact). His research indicates that extra contact may improve both subsequent mothering and child health by reducing the number of parenting disturbances / disorders requiring hospitalisation in low-income primiparous mothers at 12 to 21 month follow up. The above studies suggested that the timing and amount of contact between a mother and her infant may have profound affects on both maternal and child health as well as the relationship they form. Therefore, this research instigated the current practices seen in hospitals today including rooming-in on the post-natal wards and skin-to-skin contact following delivery.

In 1978 Dr Edgar Rey in Bogota, Columbia was the first to suggest Kangaroo care as a way of alleviating overcrowding and saving scarce resources in hospitals caring for low birth weight babies (Tessier 1998). Since then skin-to-skin contact / kangaroo care has been shown to have many benefits to both the mother and the infant. The major benefits of close contact (skin to skin and kangaroo care) on the hospital ward are related to breastfeeding as it has been shown to a) facilitate the establishment of breastfeeding by encouraging frequent suckling (Widstrom 1990) b) encourage spontaneous breastfeeding (Gomez-Papi et al 1998) c) reduce the incidence of supplementing with formula feeds (Ashmore 1997) d) increase breastfeeding rates at 1 and 3 months (Anderson 2003) e) promote continued breastfeeding (De Chateau 1977; Anderson 2003) f) increase maternal oxytocin levels suggesting that uterine contraction may be enhanced and milk ejection improved (Matthiesen and Uvnas-Moberg 2001; Nissen et al 1995) g) increase rate of maternal milk production (Insel 1997) resulting in mothers producing larger volumes of breast milk and lactating for longer periods than mothers who do not have skin to skin (Whitelaw 1998).

In addition to being beneficial for breastfeeding, close contact (skin to skin / kangaroo care) is beneficial in other respects as research on pre-term infants shows that close contact; a) encourages infants to sleep for longer, experience less agitation, apnea, and

bradycardia and exhibit more stable oxygen saturations (Messmer et al 1997) b) stabilises physiological respiratory patterns and oxygen saturation (Feldman & Weller 2002; Tessier 1998) c) improves infant state organisation (Feldman 2002) d) promotes thermo regulation (body temp) by facilitating heat exchange (Feldman 2002) e) increases rate of infant weight gain (Feldman 2002) f) affects infants cognitive skills (through rhythmic stimulation or sensory enrichment) to increase infant attention, alertness and exploratory skills leading to better infant mental and motor skills (Feldman 2002 p23) g) shortens hospital stay (Feldman 2002) h) helps infants recover rapidly from birth-related fatigue (Ludington-Hoe et al 1999).

Unfortunately it is unclear how far these findings can be extrapolated to term infants. However studies on full-term infants reveal that close contact soothes and calms infants promoting sleep, as skin to skin is analgesic for newborns, (Gray, Watt et al. 2000) it also helps to conserve energy and increases metabolic adaptation, increasing the well-being of the newborn infant (Christensson, Siles et al 1992). Studies into rooming-in found that full-term infants separated from their mothers (in a hospital nursery) slept considerably less than infants who slept by their mothers' bedsides (Keefe 1988) and that newborns sleeping in the same room as their mother spent less time crying than those who slept in separate rooms in the nursery (Keefe 1987).

In addition to being beneficial for infants, close contact has significant benefits for mothers too. Studies have shown that; mothers separated from their infants in hospital at night do not sleep any better than mothers who sleep with them by their bedside (room-in) (Keefe 1987; Waldenstrom 1991) and that bed-sharing assists in post-partum rest for mothers and cuts down on the sleep disruption caused by night-time breastfeeding, therefore promoting sleep (Ball, Hooker et al. 1999; McKenna and Bernshaw 1995; McKenna, Mosko et al. 1997; Ball 2000; Ashmore 1997). Furthermore, the close contact inherent in bed-sharing has joint benefits for mother and infant in that it; facilitates bonding (De Chateau 1977), enhances parent-child relationships (Tessier 1998) as well as improves communication and attachment between mother and infant (Feldman 2002; Tessier 1998). Skin to skin contact is beneficial for mothers as it is associated with lower maternal anxiety and more efficient participation of mothers in caring for their newborn infants (Vial-Courmont 2000). It also empowers mother's feelings making her more responsible, confident

and perceptive in the care of her infant as well as being more responsive to her infant's cues (Tessier 1998) and promotes a good early relationship between mothers and infants (Anderson 2003).

A review of the above literature illustrates the benefits of prolonged intimate interaction (skin-to-skin contact, kangaroo care) between mother and infant during the initial sensitive period. In many respects mother-infant bedding-in could be considered as an extension of this prolonged contact for the duration of the hospital stay.

Bed-sharing studies / results

Over the last 15-20 years there has been increased interest in the pros and cons of bed-sharing and so far research has been conducted in either the home (Durham UK and Otago NZ) or in a sleep lab environment situated within a hospital (California US, Bristol UK), or within a University (Durham UK) on babies aged 3 months or more (McKenna 1990; McKenna and Mosko 1993; Young 1999; Hooker 2001; Ball 2002).

Attention was drawn to the issue of bed-sharing by James McKenna in 1986 when he investigated sleep patterns of mothers and infants sleeping in close proximity. Results of this study found that bed-sharing mothers spent the majority of their sleep time in light non-REM sleep and experienced more fragmented sleep than solitary sleeping females. Bed-sharing infants spent less time in deep sleep and aroused more frequently than solitary sleeping infant and spent twice as long in REM sleep than their mother. Bed-sharing mothers and their infants also showed a significant overlap of sleep-wake stages and arousal patterns. McKenna's (1990) findings show that bed-sharing provides a sensory rich microenvironment for infants to sleep in and it has been suggested that this environment may help protect infant from dying from SIDS as they arouse more frequently which may prevent breathing control errors which may occur in prolonged 'adult like' sleep bouts. Further research by McKenna and Mosko (1993) also revealed that whilst breastfeeding mother-infant pairs bed-shared they slept in close proximity, with a high degree of mutual orientation and arousal overlap, infants breastfed more frequently and cried less often and infants were observed to

sleep in the safer supine position illustrating that bed-sharing is associated with safer, longer and more restful maternal and infant sleep (Mosko, Richard et al. 1997), and with successful breastfeeding (McKenna, Mosko et al. 1997)

In 1999 Young carried out similar research in the UK, however this time mother-infant pairs were observed sleeping in a double bed, and only infants were monitored. Young's Bristol hospital Sleep Lab studies reinforced the findings of McKenna and Mosko with regards to close proximity, mutual orientation, supine infant sleeping position, sleep state concordance and breastfeeding frequency (Young 1999).

Researchers from the University of Durham were the first to observe parents and infants co-sleeping in the home environment. No physiological monitors were used enabling them to capture 'normal' night-time behaviour. The result of this study showed that mother-infant bed-sharing behaviour was not affected by the presence of the father in the bed. It also provided background data on normal night-time behaviour (Ball 2000, Hooker 2001). Ball subsequently examined the behavioural and physiological correlates of by-the-bed and in-the-bed sleeping arrangements for breastfed infants in a sleep lab environment. The results of the research revealed the effect of bed-sharing on mothers and their infants as they were observed to a) exhibit a high degree of mutual orientation consistent with previous findings of bed-sharing video observations by McKenna, Mosko, Richard et al (1996), Young (1999) and Hooker (2001) b) experience significantly fewer intervals of awake time on the bed-sharing night than the cot night c) spend 100% of the bed-sharing night in close proximity, never being more than the infants arm length away d) display a high degree of mutual arousals. Other findings from this study revealed that a) regularly bed-sharing infants spend 98% of the bed night facing the mothers and mothers spend 75% of the night facing their infant b) on cot nights mothers predominantly (58%) slept facing their infant but the infant did not spend the majority of the time facing its mother (32%) c) regularly bed-sharing breastfed infants predominantly slept laterally facing the mother's breasts, only sleeping supine for 30% of the night (which may have implications for SIDS) d) on average infants core temperature was 0.2°C higher on bed night compared to cot night- explained by co-sleeping infants spending more time in the lighter stages of sleep (REM). The research concluded that for normal healthy infants bed-sharing was not associated with any increased risk from SIDS as

infants were observed to be able to alert parents to potential risk factors and that bed-sharing should be in a breastfeeding infant's best interests (Ball 2002)

Bed-sharing on the postnatal ward

A substantial amount of research has been conducted in the sleep lab and home environments on infants aged between 2 and 6 months however, there is currently no published research on the effects of bed-sharing on mothers and infants in the immediate postnatal period, either in the hospital or the home environment (Ward-Platt & Ball 2002) so little advice is available to mothers who express an interest in bedding-in (bed-sharing on the post-natal ward) with their infants. Therefore, given the current interest in, and concerns about, bedding-in, it is particularly timely that interest has now been focused towards bedding-in on the post-natal ward.

Hospitals making a commitment to 'Baby Friendly' practices are developing policies on mother-infant bed-sharing on the post-natal ward (Ward-Platt & Ball 2002) and UNICEF developed a sample bed-sharing policy to ensure that bed-sharing is practiced safely. To become 'Baby-Friendly' accredited hospitals are required to actively promote breastfeeding by implementing UNICEF's 10-steps to successful breastfeeding which state that among other things mothers should be allowed uninterrupted skin-to-skin contact for at least half an hour following delivery, midwifery staff should encourage breastfeeding within the first hour, and advise mothers to keep their baby close to them at all times (UNICEF 2000).

Hospital routines / practices

Hospital practices associated with postnatal care on the delivery suite and post-natal ward which affect breastfeeding initiation success include, most importantly, mother and infant separation after birth (Elander and Lindberg 1984) as the physiological interactions of the mother and her infant are dependent on their close proximity (Auerbach 2000). The mother responds to her infant (as the infant stirs the mother's body 'let's down' the milk supply in preparation for feeding, resulting in leaking of the breasts) and the infant responds to his mother (the smell of the milk encourages the infant to root) (Porter 1992). Medication given to mothers during labour for pain

relief can affect breastfeeding initiation as it makes infants drowsy which can reduce their ability to feed effectively (Crowell 1994) specifically pethidine given to mothers during labour has been shown to have a negative effect on breastfeeding initiation in the neonate (Nissen et al 1997). It can also be concluded that generally the earlier a mother-to-be receives medication the greater the chance her contractions will slow down, stop or cease to be effective (Thorpe 1996) increasing the risk of having to perform a caesarean section (Lieberman 1996). Infants who are delivered with help from vigorous suctioning, especially if they experience trauma, have been shown to be less inclined to suckle and feed (Widstrom 1987). Forcing the baby onto the breast may result in breast refusal, as the baby starts to associate the breast with a bad experience (Widstrom 1993) and ineffective position may also result in breastfeeding difficulties (Escott 1989). Therefore midwifery help with initiation of breastfeeding in the hospital is essential (Ferriset al, 1987; Foster et al., 1995; Riva, 1999; Sheehan et al., 2001). If pacifiers are introduced too early it can result in inappropriate feeding behaviour (Righard 1998) and promote nipple confusion. The timing after delivery of the first feed has been shown to be important for breastfeeding success (Salariya et al., 1978; Wright and Walker, 1983; Ferris et al, 1987) and as delayed feeding can be caused by certain hospital practices / schedules (i.e. examination of the baby, cleaning and weighing) these practices need to be minimised and hospitals should evaluate the ways in which they can support mothers and infants to initiate breastfeeding (Ashmore 1997).

Summary

The literature shows that breastfeeding is beneficial to mothers and infants and also suggests that bed-sharing can help facilitate the initiation of breastfeeding (Widstrom 1990). However, no current data is available (during the initial post-partum period) to confirm or refute this therefore, results from this study will further enhance this body of literature. The absence of any literature on bed-sharing in the initial post-partum period (1st night after birth) has led me to conduct this MSc thesis into the relationship between bed-sharing and breastfeeding initiation on the first night following delivery.

Research Questions

Null hypothesis

Sleep condition will have no affect on mother or infant night-time feeding behaviour on the first night of life.

The following abbreviations were used in this study to distinguish between the three sleeping conditions;

- Bed was used to indicate that the infant is sleeping in the bedding-in condition with its mother and that a cot side has been attached to the side of the mother's standard hospital bed on which the infant is sleeping.
- Crib was also used to indicate that the infant is bedding-in with its mother, although it is sleeping in a clip on crib which has been attached to the side of the mother's bed to form a separate but continuous sleep surface.
- Cot was used to indicate that the infant is sleeping in the same room as its mother (rooming-in) but that it is sleeping in a separate standalone cot on a different sleep surface to its mother.

Predictions were based on a *priori* knowledge gained from previous research findings investigating night-time mother-infant behaviour as discussed in the literature review. A number of key texts by Dr HL Ball, Prof J McKenna and Dr J Young are cited below;

Dr H L Ball

Ball, H. L. (2002). Risks to infants of sharing the parental bed: a physiological and behavioural study. Durham, University of Durham,

Ball, H. L. (2003). "Breastfeeding, bedsharing and infant sleep." *Birth* vol. 30(no. 3): 181-188(8).

Prof J McKenna

McKenna, J. (1997). "Bedsharing Promotes Breast Feeding." Pediatrics, **100**: 214-219

McKenna, J. (2002). Breastfeeding and Bedsharing: still useful (and important) after all these years. Mothering: Special Issue. **1**: 28-37.

Dr J Young

Young, J. (1999). Night-time behaviour and interactions between mothers and their infants of low risk for SIDS: A longitudinal study of room sharing and bed sharing. Institute of Infant and Child Health. Bristol, University of Bristol.

Young, J., P.J. Fleming, P. Blair & K. Pollard (2001). Night-time infant care practices: A longitudinal study of the importance of close contact between mothers and their babies. Deutscher Still-und Laktationskongress, Leipziger Universitätsverlag, Germany.

Predictions;

a) Close Contact

Infants placed in closer proximity to mother will spend a greater percentage of the night in

- i) close contact
- ii) any contact

over the whole observational period than infants sleeping further away.

Infants sleeping in closer proximity to mother will spend a greater percentage of the night in

- i) close contact
- ii) any contact

when mothers and infants appear asleep than infants sleeping further away.

Infants in closer proximity to their mother will spend a less of the night beyond their mothers touch;

- i) over the whole observation period.
- ii) when mother and infant appear asleep.

than infants sleeping further away.

b) Breastfeeding Initiation

Infants who are kept in close contact to their mother will attempt to breastfeed more frequently during the whole observation.

Mothers who have their infants sleeping closer to them will attempt to feed their infant more frequently than mothers who have their infant sleeping further away.

Mothers and Infants sleeping in closer proximity to one another will show;

- i) greater feeding effort
- ii) greater total duration of successful breastfeeding
- iii) greater total duration of attempting to breastfeed
- iv) greater total duration of breastfeeding lying down

than dyads sleeping further apart.

Mother –infant dyads assigned to the crib will behave more like the bed dyads than the cot dyads in relation to breastfeeding behaviour.

c) Midwifery Assistance

Mothers who have their infants sleeping closer to them will;

- i) request more assistance from midwives in relation to feeding.
- ii) receive a greater total duration of assistance with feeding

than mothers who have their infants sleeping further away.

Staff will visit mothers who have their infants sleeping closer to them more frequently than mothers who have their infants sleeping further away.

There will be no significant difference in the total duration of assistance (unrelated to feeding) received from midwives.

Overview of the study

This study is part of the RVI Bedding-in study conducted by the University of Durham Parent-Infant Sleep Lab team, which recruited expectant mothers from the Royal Victoria Infirmary (Newcastle-Upon-Tyne) approximately 3 weeks before the birth of their infant to study mother-infant night-time behavioural interactions on the postnatal ward during their infants first 2 nights of life. This study specifically concentrates on feeding behaviour during the first post-natal night. Ethics approval for the RVI Bedding-in study was granted by Northumberland and Tyne and Wear (Newcastle and North Tyneside) Local Research Ethics Committee in September 2002. All mothers who attended the breastfeeding workshops at the RVI from October 2002 to March 2005 were approached. Mothers who were non-smokers, planned to have a normal delivery and intended to breastfeed were eligible. A pilot study was carried out in the summer of 2001 and the research was funded by Babes-in-Arms.

Research Design

Process of recruitment

The RVI Bedding-in study volunteers were recruited from a convenience sample of expectant mothers who attended the bi-weekly breastfeeding workshops at the RVI from which 30 of the enrolled mothers were selected for inclusion in this study.

At the breastfeeding workshop a short presentation was given on the RVI Bedding-in study. Mothers-to-be were provided with an information sheet (Appendix 2) and invited to take part in the research. They were given the opportunity to ask questions before volunteering for the study. A small number of volunteers were also recruited via posters on the postnatal wards.

Mothers who expressed an antenatal interest in participating in the research were required to complete a study enrolment form (recording demographic information) (Appendix 3) and the first section of a 3 part consent form (Appendix 1). The information obtained was used to confirm the mother's ante-natal eligibility for inclusion in the study. The consent form gave the mother's consent for the research team to enrol her in the study, view her medical notes and approach her after delivery.

Eligible volunteers were randomly allocated to one of the three sleeping conditions via sequential sealed envelopes (bedding-in with a cot side (bed), bedding-in with a clip-on-crib (crib) or rooming-in with a standalone cot (cot)) and provided with a study label to be placed onto their hand held maternity records. An identical label was sent to maternity record at the RVI, which alerted midwives on the postnatal ward to the fact that the mother was a study participant and that they were required to telephone a specially designated 24 hour voicemail number to inform researchers that the mother had delivered. Volunteers continued to be recruited until the target for the RVI Bedding-in study had been obtained.

Randomisation

A randomised control trial method was chosen for this study rather than an unstructured observational design as the important differences the research team anticipated seeing between the three groups were less likely to arise through confounding and the statistically significant differences, which could be calculated between the groups, would carry more validity than purely observational differences.

Sample size

The RVI Bedding-in study was a 3-armed randomised control trial with 20 participants required for each of the arms (bed - bedding-in with a cot side, crib-bedding-in with a clip on crib and cot- rooming-in with a standalone cot) who were videoed on both of the 1st two postnatal nights. For the purpose of this thesis, which addresses a more limited range of questions, data from the 1st postnatal night for 10 dyads from each of the three groups was coded and analysed.

Selection / Inclusion criteria

Inclusion criteria for participation shown in Table 1 were checked verbally with mothers and midwives, and by checking and recording information from medical records (Appendix 4) prior to filming.

Table 1: Inclusion Criteria

Ante-natal Inclusion Criteria	Post-natal Inclusion Criteria	Infant Inclusion Criteria
<ul style="list-style-type: none">▪ Non-smokers;▪ Intention to breastfeed	<ul style="list-style-type: none">▪ No opiate analgesics either IV (intra-venously) or IM (intra-muscularly) during labour;▪ Vaginal delivery.	<ul style="list-style-type: none">▪ Good health (i.e. cared for on the general post-natal ward);▪ Born vaginally;▪ Greater than 37 weeks gestation;▪ Appropriate weight for gestational age (greater than 2500g);▪ Apgar score ≥ 8 at 5 min;▪ No medical problems.

Equipment set up and overnight recording

Following confirmation of delivery, eligibility and consent research staff allocated the mother-infant pair a single room and assigned the correct equipment for their randomly allocated sleeping condition. Mothers assigned to either of the two bedding-in conditions were also provided with a standalone cot for transportation of their infant. A set of custom designed video equipment was erected at the foot of the mother's hospital bed. The Sony TRV18e camcorder was mounted on the top of a 7ft Manfrotto monopod which was attached to the bed frame using 2 Manfrotto super-clamps. The audio, visual and sound cable from the camcorder ran directly into an attaché case containing a long play 12-hour record capability VCR and a Time Code Generator allowing continuous overlaying of a time signal onto the video tape. The case was placed at the bottom of the mother's bed and pushed half way under so as to

be as unobtrusive as possible. The equipment was powered by a transformer mounted in the case and required only a single power lead.

Research staff demonstrated how to use the equipment and instructed the mother to start recording once she was ready to settle down for the night. A LCD screen was used for positioning of the camera, for remote adjustment of the focus and to allow the mother to see what was being recorded. Due to the zero-lux camera the video recordings were made in complete darkness. The mother was told that she may stop the recording at anytime by use of the remote control and that if left running the tape would stop itself after 8 hours worth of recording.

The RVI Bedding-in study required that mothers stay for the 1st two postnatal nights, although they were free to leave, the majority went home on the third morning once the research team had taken the equipment down, conduct a short interview regarding their post-natal experiences and gained the mothers signed consent for them to take the tape away to be included in the study.

Information collected from the mother's medical records, initial interview on the night of delivery and the interview after the second night of filming were recorded onto a sheet and entered into an excel database for analysis. On completion of the video recording mothers received a gift voucher and a tape of clips. After discharge, as part of the RVI Bedding-in study, all participants were followed up via telephone interviews at 2, 4, 8 and 16 weeks to gather data on feeding and sleeping practices.

The tapes were coded by research staff and analysed using ethological techniques in order to be consistent with other studies of bed-sharing behaviour and to objectively quantify breastfeeding behaviour.

Behavioural Research

Ethological approach

An ethological approach to studying behaviour was utilised in this research. The advantages and limitations of using the ethological approach to study human

behaviour have been well reviewed (e.g. Huntingford 1984, Martin and Bateson 2002). Advantages included that the ethological approach forces the observer to become familiar with their subjects which encourages a greater degree of objectivity, allowing behavioural features to be identified which may have otherwise be missed. The ethological approach also requires information on how human behaviour is organised to be provided at a high level, this may provide new insights into the way human beings behave. Limitations include that the ethological method and concepts are time consuming both to learn and apply and that they can provide some but not all of the information necessary to describe and measure the complex human interactions observed (Huntingford 1984).

The behavioural taxonomy

The foundation of any ethological investigation is the ethogram or behavioural taxonomy. An ethogram can be described as a catalogue of descriptions of the discrete, species-typical behaviour patterns that form the basic behavioural repertoire of the species (Lehner, 1987 in Martin and Bateson 2002).

Categories within the ethogram should be clearly defined and developing a set of precise and unambiguous category of definitions can be a slow process. However, once definitions are sufficiently precise and detailed other observers will be able to observe and record the same things in the same way (Martin and Bateson 2002) providing unbiased recordings.

When hypothesis driven research is conducted it is not necessary to record a complete catalogue of all interactions, only those specifically relevant to the hypothesis being tested. Therefore it was possible for the purpose of this study to narrow the number of categories down to include only the behaviours of interest and an ethogram was developed using knowledge amassed from previous research experience (Ball , Young and McKenna) to include categories which focused on night-time behaviour and interactions between mothers and their infants (Appendix 5).

Recording data

Behavioural data can be recorded continuously or by time sampling. Continuous recording also known as all-occurrence sampling or complete record sampling (Slater 1978) was used in this study to produce an exact record of the behaviour, with the times at which each instance of behaviour pattern occurred (for events), or began and ended (for states) giving both frequencies and durations.

However, due to practicalities it is almost impossible for the researcher to record everything continually (time) and one consequence of continuous recording is that fewer categories can be recorded at any one time. Trying to record everything can mean that nothing is measured reliably. In this study this problem was overcome by the fact that the data was video recorded which meant that the behaviour (tape) could be analysed as many times as necessary and limited categories of data were coded.

Data collection equipment- recording medium.

Options available for recording the behaviour of mother-infant night-time behaviour included film or video recording, a verbal / written description, automatic recording devices, check sheets and computer event recorder. In this study video recording medium was used and the tapes were coded using a computer event recorder (Noldus Observer 5.0) which allowed a complementary set of notes to be recorded alongside the coding.

Video recording gave an exact visual record of the behaviours which were replayed for analysis. The video recordings were coded into quantitative measurements relating to specific behavioural categories using a computer event recorder. The major problem with video analysis was that it was very time consuming. Also, videotape recordings restrict the field of view and depth of focus, and this had the potential to cause key details to be lost i.e. when mother got out of bed and left the field of view it was sometimes impossible to tell what she was doing

The Noldus Observer 5.0 software (computer event recorder) enabled the observer to continuously record 8 hours of mother-infant behavioural observations as events or

states directly onto the computer via its keyboard. Each key denoted a particular behaviour which the programme recognised and recorded along with the time it was pressed (derived from an internal clock). As a further sophistication some keys to be used as 'modifier' keys to add another level of detail. This particular software package also comes with a sophisticated procedure for analysing and presenting the data and also has the ability to calculate reliability statistics

For the RVI bedding-in study a total of 11 behavioural classes were continuously coded over the 8 hour period with 8 modifier classes (sub categories). In this study 9 out of the possible 11 behavioural classes were analysed along with 6 of the possible 8 modifier classes which are detailed in the Taxonomy table (Appendix 5)

Using event recorders has several pros and cons The pros include that; durations can be recorded accurately; the observer can record more rapidly-occurring behaviours and use more categories; it cuts down on work of transcribing check lists; large quantities of data can be compactly stored. However, the cons include that; the sophistication of some packages may be unnecessary for some research; data can be lost from computers; they are not very adaptable; they can prevent the observer from actually 'looking' at the raw data before sending it away for complex analysis-creating a barrier between the observer and their data; the ease of data collection may be a curse as you may collect too much data (e.g. irrelevant data); some people may be unable / unwilling to become involved in computer programming (Martin & Bateson 2002)

Written descriptions of certain behaviours were also recorded by typing notes onto the computer whilst continuously coding the video. They were particularly useful for recording rare or complex behaviours.

Coding the data

Sampling methods

The behavioural sample method selected for this study was Focal pair sampling which can be defined as 'observing one dyad pair for a specified length of time and

recording all instances of their behaviour – usually for several different categories of behaviour’ (Martin and Bateson 2002). Here the behaviour of 30 mother and infant pairs were observed continuously for 8 hours on the first post-partum night. All movements and noises made by the mother or infant were recorded as well as mother-infant interactions.

Focal pair sampling is only suitable when it is possible to keep the subjects within view for the total length of the observation. This is the reason why focal sampling was ideally suited to this study. Studying mother-newborn night-time behaviour on the postnatal ward lends itself well to this sampling method as mothers and their infants spend the vast majority of the night in the same location (bed) and a great proportion of the night either asleep or feeding and comforting their infant which theoretically limits their movements to within view of the camera.

However, if the focal individual is obscured or goes out of sight recording must stop or be recorded as out of sight (time out) until it is visible again. Omitting time out may however bias the sample if subjects systematically tend to do certain things while out of sight for example feed, so overall time spent feeding would be disproportionately represented (Martin and Bateson 2002). This was not foreseen as a problem for this study but even so an out of sight and no data option was available to the observer for each behavioural category.

Focal pair sampling should be paired with another sampling method (Lehner 1996) therefore, Ad libitum sampling was used to complement the focal pair sampling in this study. It meant that no systematic constraints were placed on the observer who was free to note down whatever they considered important during observations. These notes were inserted into the behavioural record at relevant points in time.

Problems with this technique include that day-to-day activities are likely not to be recorded in favour of more conspicuous ‘interesting’ behaviour. However, *ad libitum* can be helpful during preliminary observations (to gain a feel for the subjects and what behaviours to observe) and to record rare and interesting events (Martin and Bateson 2002). In this study this technique was used to help ‘explain’ some of the

mother or infants behaviour or to draw attention to a particular event / sequence whilst coding.

Measures of behaviour

Of the four standard ways of measuring behaviour (latency, frequency, duration and intensity (Martin and Bateson 2002)) two were used here. Frequency is described as the number of occurrences of the behaviour pattern per unit of time as frequency is a measure of the rate of occurrences i.e once every 4 hours. Alternatively and more frequently, frequency can be used to refer to the total number of occurrences. However it is essential to record the length of the observation period so as not to be misleading and frequency of the total number of occurrences of any behaviour should be expressed as a rate of occurrences (number per unit time). Duration is described as the length of time for which a single occurrence of the behaviour pattern lasts (measured in minutes and seconds). Total duration can be used to refer to the total length of time for which all occurrences of a specific behaviour lasted, over the whole observation session. As with frequency the total length of the observation session must be recorded for the total duration of the behaviour to be of use e.g.40 minutes per 8 hours.

Both events and states, which lie at opposing ends of a behavioural gradient, were recorded for this study. Events are behaviour patterns of relatively short duration, which can be approximated to points in time for example a mother presenting her nipple to her infant. The *frequency* of occurrence of a behavioural event would be recorded. States on the other hand are behaviour patterns of relatively long duration, such as prolonged sleep states or body positions. States are recorded in *durations* for example the total time an infant spent asleep over an 8 hour recording would be a measure of the total duration of a state. The onset and termination of a behavioural state can be recorded as an event and this can be used to calculate the *frequency* of a states occurrence. (Martin and Bateson 2002, Altmann 1974)

Measuring bout length

Certain behaviours often occur in clusters often stopping and starting for a few minutes or seconds in succession- these can be referred to as *bouts* for example breast feeding bouts or crying bouts. If bouts are neatly clumped into discrete bouts then it is relatively easy to distinguish one bout from the next. However, if bouts are not discretely clumped then coding rules must be formulated. In this study feeding bouts were considered to be a single bout if infants were detached from the breast for no more than 5 minutes.

Analysing the results

Reliability and validity of measures

To determine consistency (reliability) within and between observers, within-observer reliability and between-observer reliability was measured.

Within-observer reliability was used to measure the extent to which a single observer obtained consistent results when coding the same behaviours on different tapes on different occasions. To do this the observer coded the same tape on two separate occasions one towards the beginning of the study and one towards the end (Martin and Bateson 2002). These two sets of information were then compared and a Kappa statistic of 0.92 was produced which was accepted as confirming the reliability of the data entry.

Between-observer reliability is used to measure the extent to which the two observers obtained similar results when coding the same behaviours on the same tape on the same occasion as it measures the agreement between different observers attempting to measure the same thing. To assess between-observer reliability, a sample of a video tape recording would be coded simultaneously by the two observers on a number of occasions throughout the study (Martin and Bateson 2002). However only one observer coded the tapes included in this thesis therefore there was no need to conduct between-observer reliability.

Analytical methods

Once behavioural data had been coded and tabulated the analyses were conducted following both 'intention-to-treat' and 'treatment received' principles. Intention-to-treat analysis (ITT) compares the study groups in terms of the treatment to which they were randomly allocated, irrespective of the treatment they actually received or other trial outcomes (Heritier 2003). Randomisation aims to ensure that the factors that may affect the outcome measures under investigation are evenly distributed among the groups. This therefore ensures that any differences observed in the outcomes between the groups are actually a result of the trial intervention rather than patient choice, for instance. Any other form of analysis may potentially introduce bias into the treatment comparisons. ITT generally gives a conservative estimate of the treatment effect compared to the effect that would be seen if there was full compliance.

However, in reality not all participants conform to or stay in their allocated condition and the requirements for an ideal ITT analysis include full compliance with randomised treatment. Results from a pilot study (conducted by the Parent-Infant Sleep Lab Team (2001-02) revealed that not all of the mothers participating in the trial would fully comply with their randomised condition. Although every effort was made to ensure that mothers stayed in their randomly allocated treatment group due to ethical implications no mother could be forced to adhere to their randomly allocated treatment group. Therefore the data was also analysed using Treatment-received (TR) analysis. This is an approach which 'analyses all participants according to the treatment they actually received, regardless of what treatment they were originally allocated' (Heritier 2003). Although this does seem logical it also means that the effect of randomisation is compromised as in effect some participants will just be doing what they would have done anyway without randomisation.

Statistical techniques

Although parametric statistics are usually the most powerful tests in relation to finding a real effect (i.e. to disprove the null hypothesis) non-parametric statistics were used to analyse the data collected, as for many of the distributed variables the standard deviation appears to be greater than the mean (due to the inclusion of zeros

in the results), implying that the data are too skewed to be treated by parametric statistical descriptions, or parametric tests. To describe the midpoint and variation medians and full ranges were used for figures. Median, full ranges and percentages were used in tables.

Medians were calculated using the number in the middle of a set of given numbers and full ranges recorded the minimum and the maximum result in each group.

For between group comparisons Kruskal-Wallis (one way analysis of variance) tests were used to see if there was any significant difference across the three independent groups (cot-crib-bed). Mann-Whitney U tests were used to test for significance between 2 independent groups (cot-crib, crib-bed, bed-cot) where continuous data were collected. This is one of the most powerful nonparametric tests, and it is an alternative to the parametric t test when the researcher wishes to avoid the t test's assumptions.

The analysis was conducted using a combination of Microsoft EXCEL, SPSS (Statistical Package for Social Sciences) and Noldus Observer 5.0 computer software packages. Significance was assigned when $p < 0.05$.

Summary

This study observed night-time feeding behaviours of 30 mothers-infant dyads for a period of 8 hours on their first post-natal night. Focal pair continuous sampling was chosen as the most appropriate sampling method as it provided data on both durations and frequencies of behaviours. Using the Noldus Observer software behaviours were recorded as events or states. Coded behavioural data were analysed using intention-to-treat analysis as it gave unbiased and consistent estimates of a treatment policy. As it was predicted that not all mothers would comply with the randomised condition data were also analysed using treatment-received analysis.

Results

In the 20 month recruitment period 144 mothers expressed a willingness to take part in the larger bedding-in study. Of these 60 mother-infant pairs were filmed and the data obtained on a sub-sample of 30 mother-infant pairs was selected for analysis in this thesis. Demographic breakdowns of the 30 families included in this thesis sub-sample are presented in Table 2. For comparative purposes data are also presented in Table 2 on the demographic characteristics of all breastfeeding mothers delivering at the RVI, and all mothers included in the 2000 UK Infant Feeding Survey*.

Demographic characteristics

Table 2: Comparison of thesis sample to breastfeeding mothers who delivered at the RVI and all mothers in England*

Variable	Thesis sample % (n=30)	All B-F Mothers at RVI % (n=2360)	All mothers in England *
Age of mother (median)	31.5 (21-39)	31.0	No data
Under 20	0 (0)	2.8 (67)	7
20-24	6.6 (2)	4.4 (339)	18
25-29	16.6 (5)	25.3 (596)	28
30-34	53.3 (16)	33.9 (800)	30
35+	23.3 (7)	23.6(558)	16
Age of father (median)	32.0 (25-48)	No data	No data
Marital Status			No data
Married	76.6 (23)	64.1 (1512)	
Living with partner	20 (6)	n/a	
With partner, living apart	3.3 (1)	n/a	
Single, no partner	0 (0)	26.7 (630)	
Not stated	0 (0)	9.2 (218)	
Mothers Education		No data	
16 or under	3.3 (1)		37
17-18	23.3 (7)		34
19 or over	73.3 (22)		28
Family Income		No data	No data
below £5,000	3.3 (1)		
up to £10,000	0 (0)		
up to £15,000	3.3 (1)		

up to £20,000	10 (3)		
up to £30,000	0 (0)		
above £30k	80 (24)		
unknown	3.3 (1)		
Mothers		No data	
Occupational Class			
Upper (1 & 2)1	50 (15)		6
Middle (3, 4 & 5)	36.6 (11)		43
Lower (6,7,8 & 9)	13.2 (4)		28
Unemployed / Student	0 (0)		24
Fathers		No data	
Occupational Class			
Upper (1 & 2)	46.6 (14)		32
Middle (3, 4 & 5)	33.2 (10)		35
Lower (6,7,8 & 9)	19.8 (6)		15
Unemployed / Student	0 (0)		19
Mothers Ethnicity			
White UK	93.3 (28)	69.19 (1633)	91
Non-White UK	6.6 (2)	17.54 (414)	6
Other	0 (0)	13.26 (313)	1
First baby	93.3 (28)	No data	47
Later baby	6.6 (2)		53
Median birth weight (g)	3368 (2620-	3415	
Less than 2500	4250)	4.1 (97)	6
2500-2999	0 (0)	16.2 (383)	17
3000-3499	20 (6)	35.8 (845)	34
3500+	46.6 (14)	43.9 (1035)	43
	33.3 (10)		
Median gestational age (days)	283 (259-298)	No data	No data
Length of labour (median)	09:35 (01:25- 34:15)	No data	No data
Length of time until mother held baby		No data	
Less than 1 hour	86.6 (26)		92
1 hour +	6.6 (2)		8
missing	6.6 (2)		0
Length of time until baby was first put to the breast		No data	
Immediately / few min	20 (6)		28
Within 1 hour	30 (9)		44
1 hour – 4 hours	33.3 (10)		14
4 hours – 12 hours	10 (3)		5
12 hours +	6.6 (2)		7

The demographic characteristics of the mothers who took part in this study have been compared to breastfeeding mothers (defined as any breastfeeding at discharge) who delivered their infants at the Royal Victoria Infirmary in 2004 (but did not take part in

the research) (Table 2). This comparison indicates that the sample of mothers who participated in this study appear to be representative of breastfeeding mothers who delivered at the RVI. Furthermore, mothers in the thesis sample were typical of breastfeeding mothers on the whole in the UK i.e. married, well educated, relatively affluent, 30+ year old home owners (as defined by the Infant Feeding Survey 2000) although no statistical tests could be performed to confirm these impressions.

Sample characteristics

It is important to ensure that there are no significant differences in the characteristics of mothers and infants allocated to the different randomised conditions, as these could confound the outcomes. Breakdowns of data on the participants by randomly allocated condition are shown in Table 3.

Table 3: Parental characteristics

	Whole Sample	Bed	Clip on Crib	Stand-alone Cot	Statistics *
Total number	30	10	10	10	
Age of mother (median)	31.5 (21-39)	31.5 (28-39)	31.5 (21-37)	31.5 (22-37)	KW = 4.57 p= 0.102
Age of father (median)	33.4 (25-48)	34.2 (28-43)	33.1 (26-39)	32.9 (25-48)	KW = 1.29 p= 0.522
Marital Status					
Married	76.6 (23)	7	9	7	
Living with partner	20 (6)	3	1	2	
With partner, living apart	3.3 (1)	0	0	1	
Single, no partner	0 (0)	0	0	0	
Mothers Education					
Up to age 16	3.3 (1)	0	1	0	
16-18	6.6 (2)	1	0	1	
Vocational training	6.6 (2)	0	2	0	
A levels	10 (3)	2	0	1	
University	46.6 (14)	4	5	5	
Post-graduate	26.6 (8)	3	2	3	
Family Income					
below £5,000	3.3 (1)	0	1	0	
up to £10,000	0 (0)	0	0	0	

up to £15,000	3.3 (1)	0	0	1	
up to £20,000	10 (3)	0	2	1	
up to £30,000	0 (0)	0	0	0	
above 30k	80 (24)	10	7	7	
unknown	3.3 (1)	0	0	1	
Mothers					
Occupational Class					
Upper (1 & 2)	15	4	4	7	
Middle (2, 3, & 4)	11	6	4	1	
Lower (5, 6, 7, 8 & 9)	4	0	2	2	
Unemployed / Student	0	0	0	0	
Fathers					
Occupational Class					
Upper (1 & 2)	14	6	4	4	
Middle (2, 3, & 4)	10	3	4	3	
Lower (5, 6, 7, 8 & 9)	6	1	2	3	
Unemployed / Student	0	0	0	0	
Mothers Ethnicity					
White UK	25	9	8	8	
Non-White UK	0	0	0	0	
White Other	3	0	1	2	
Non-White Other	2	1	1	0	
First-time mothers	28	10	9	9	
Second-time mothers	2	0	1	1	

*Kruskal-Wallis Tests (non-parametric) were conducted as a test of difference for continuous variables. Cell counts were too small to permit reliable calculation of chi square comparisons on categorical data.

These analyses demonstrate that from the start there were no statistically significant differences between the 3 treatment groups. However, the lack of significance does not indicate that all the groups can be regarded as the same, as the groups are too small for Chi square tests to be performed and the non-significant Kruskal-Wallis results may well be due to the small sample sizes.

Table 4: Infant characteristics

Characteristics	Whole Sample	Bed	Clip on Crib	Stand-alone Cot	Statistics *
Sex of baby					
Male	14	5	6	3	
Female	16	5	4	7	
Gestational age (days)					
median	283	285	281.5270	280	KW=2.58 p= 0.274
range	(259-298)	(259-298)	-289)	(263-291)	
Birth weight (g)					
median	3368	3345	3247.5	3377.5	KW=1.55 p=0.460
range	(2620-4250)	(2680-4040)	(2620-4250)	(3080-3650)	
Apgar score (mean)					
At 1 min	8 (6-9)	8 (6-9)	8 (8-9)	8 (7-9)	KW=0.38 p=0.825
At 5 min	9 (9-10)	9 (9-10)	9 (9)	9 (9)	KW=2.15 p=0.341
Age of baby at start of filming (hh:mm)	14:22 (03:35-23:20)	12:05 (03:35-23:20)	16:03 (07:18-23:00)	14:57 (06:43-22:52)	KW=3.86 p=0.145

Table 4 illustrates that all infants were full term (over 37 weeks gestation) and healthy (with an appropriate weight for gestational age and an Apgar score of 9 or over at 5 minutes after birth), and that there were no significant differences in infant characteristics across the three groups. All infants were under 24 hours old at the start of filming. Although the infants ranged from 03:35hrs to 23:20 hrs old at the time of filming the difference between the groups was not statistically significant.

Table 5: Labour information

Characteristic	Whole sample	Bed	Clip on Crib	Stand-alone Cot	Statistics
Labour					
Spontaneous	27	9	10	8	
Induced	3	1	0	2	
Total duration of labour (hh:mm)	09:35 (01:25-34:15)	11:30 (04:11-34:15)	05:30 (01:25-10:15)	09:00 (03:52-18:48)	KW=1.3 p=0.523

Epidural					
Yes	13	8	0	5	
No	17	2	10	5	
Complications during delivery					
None recorded	17	2	8	7	
Foetal distress	3	2	0	1	
Delay in 2 nd stage	6	3	1	2	
Maternal blood loss	1	1	0	0	
Cord around infant neck	1	1	0	0	
Over distended bladder	1	0	1	0	

The majority of infants in each condition were born spontaneously (see Table 5). No statistically significant differences were observed in total duration of labour between the three groups. A preponderance of epidural anaesthesia was observed amongst the women allocated to the bedding-in condition which may in part explain the greater median labour duration in this group. Five of the mothers allocated to the standalone cot condition received an epidural. Subsequently, 3 out of 5 of these mothers left their infant in the standalone cot for the majority of the night and did not switch conditions. The reason for this may have been due to the fact that medication given to mothers during labour for pain relief makes infants drowsy and reduces their ability to feed effectively (Crowell 1994) therefore these infants would have slept more and fed less during the first postnatal night.

The majority of mothers did not have any complications during delivery (17/30) with 80% of the clip on crib mothers and 70% of the standalone cot mothers not having any complications. However, 80% of the bedding-in mothers did experience complications during delivery which included delay in second stage (30%) and foetal distress (20%) and 75% of these mothers had received an epidural. Of the 13 mothers who had received an epidural 8 of them went on to have complications during labour, indicating a positive correlation between receiving an epidural and experiencing complications. This indicative result adds weight to the argument that drugs during labour impede delivery progress (Thorpe 1996) and increase the chances of complications during delivery (Lieberman 1996). Of the mothers who had complications 6/8 had been allocated to the bed and 2 had been allocated to the standalone cot condition.

Table 6: Postnatal Information

F= Anova: Single Factor p= significance value	Whole sample	Bed	Clip on Crib	Stand-alone Cot	Statistics
Timing of skin to skin contact after birth (min) Missing data No contact	0 (0-240) 6 1	0 (0-240) 1 0	0 (0-180) 2 0	0 (0-30) 3 1	KW= 1.11 p=0.574
Place of skin to skin contact Delivery Room Recovery Room Postnatal Ward No contact	25 (1 pool) 1 3 1	9 0 1 0	8 (1 pool) 0 2 0	8 1 0 1	
Duration of skin to skin contact (min) Missing data No contact	25 (0-180) 4 1	15 (5-60) 1 0	60 (10-90) 3 0	30 (0-180) 0 1	KW= 1.06 p=0.589
Timing of initial breastfeed after birth (min)	67.5 (1-2040)	82.5 (30-2040)	45 (5-360)	60 (1-720)	KW= 1.96 p=0.375
Place of initial breastfeed Delivery Room Recovery Room Postnatal Ward	16 (1 pool) 5 9 (1 x 2 nd)	5 3 2 (1 x 2 nd)	6 (1 pool) 0 4	5 2 3	
Duration of initial breastfeed (min) No data	20 (2-90) 2	25 (5-45) 0	10 (3-90) 0	25 (2-45) 2	KW= 0.66 p=0.718

No significant difference was found between the timing of skin to skin contact in the 3 groups. The majority of the infants (25/30) were placed in skin to skin contact in the delivery room – 90% of bedding-in and 80% of clip on crib and standalone cot infants. All except one infant, who was assigned to the standalone cot condition, received skin to skin contact during the first 24 hours.

Duration of skin to skin contact, as reported by the mother, ranged from no contact to 2 hours, and no statistically significant differences were observed across the 3 conditions. Likewise for the timing of the initial feed.

There was no statistical difference between the timing of initial breastfeed in the three groups but there was much variation as some infants fed within 1 min (cot) after birth whereas another took 34 hours (bed).

Just over half of the infants in the sample (16/30) breastfed for the first time in the delivery room (50% of the bed and cot and 60% of the crib infants). The remaining infants either fed in the recovery room or on the postnatal ward. There was no statistical difference in the duration of the initial breastfeed within the 3 groups with both the bed and cot groups feeding for a median duration of 25 minutes and the crib group feeding for a median of 10 minutes. However, the variation between individual infants ranged from 2-90 minutes.

Video data

As detailed in the previous chapter (methods) video data were analysed using both Intention to Treat (ITT) and Treatment Received (TR) analysis. Data from both analyses are presented in Tables 7 and 9 as well as Figures 1- 18.

Table 7: Analysis performed

Analysis	Bed	Clip on Crib	Standalone Cot
Intention to Treat (ITT)	10 (33%)	10 (33%)	10 (33%)
Treatment Received (TR)	20 (67%)	4 (13%)	6 (20%)
Total Number who changed condition	1	6	5

A breakdown of how the sample changed with the percentage of mothers who moved their infants from their allocated sleep condition for the majority of the observation can be found in Table 8.

Table 8: Change of condition

	Total Number (out of 30)	Percentage of whole sample	Percentage of Condition (out of 10)
Bed - Standalone Cot	1	3	10
Standalone Cot - Bed	5	17	50*
Clip on Crib - Bed	6	20	60
Clip on Crib – Standalone Cot	0	0	0
Did not change	18	60	-

Note: there was no option available for mothers to change condition from bed or standalone to clip on crib as the clip on crib was not available / provided unless they had been assigned to that condition.

Table 8 shows that 60% of the infants allocated to the crib and 50% of the infants allocated to the cot were moved into the bed for the majority of the observation. Only 10% of the infants allocated to the bed were moved out of the bed and into a standalone cot.

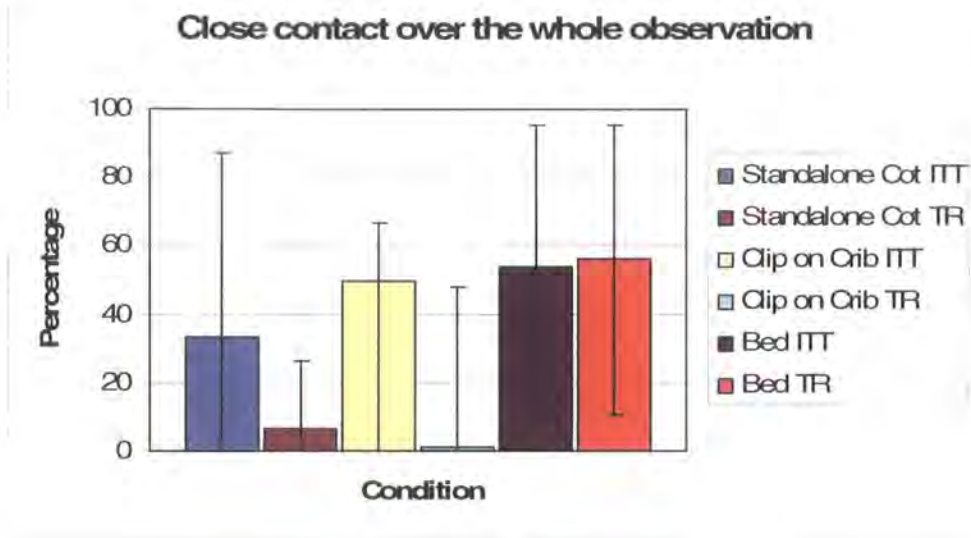
Results from the video tape data analysis of contact, feeding and assistance are presented in tables 8 and 9 and figures 1-18.

Contact

It was predicted that ‘Infants placed in closer proximity to their mother will spend a greater percentage of the night in close contact- (skin to skin and non-skin to skin) with their mothers over the whole observation period than infants sleeping further away’. The outcome measures selected for analysis and used to address the

predictions include data on the percentage of the night an infant spent in close contact with its mother over the whole observation and results are presented in figure 1.

Figure 1:



The percentage of close contact over the whole observation using ITT analysis ranged from 34% (for babies allocated to the cot group) to 54% (for babies allocated to the bed group) (figure 1). No significant differences were found over the three groups (Kruskal-Wallis) or in pairwise comparisons (Mann-Whitney U). However when data were analysed by TR the range was from 1% for babies in the crib to 56% for babies in the bed and the difference between the three groups was highly significant ($p=0.001$, Kruskal-Wallis). Furthermore, when Mann-Whitney U Tests (1 tailed) were performed a significant difference was revealed between the bed and crib group ($p=0.003$), and between the cot and bed group ($p=0.000$).

In Figure 1 the range bars demonstrate that there is much variation in the contact received by babies in each of the 3 groups, and that there is much overlap between groups, however the expected difference between close contact for those babies who slept in the bed (TR) and those in the cot and the crib (TR) is clearly apparent.

It was predicted that 'Infants placed in closer proximity to their mother will spend a greater percentage of the night in any contact- (including partial) with their mothers over the whole observation period than infants sleeping further away. Data on

percentage duration of any contact was collected to address this prediction and results are presented in figure 2.

Figure 2:

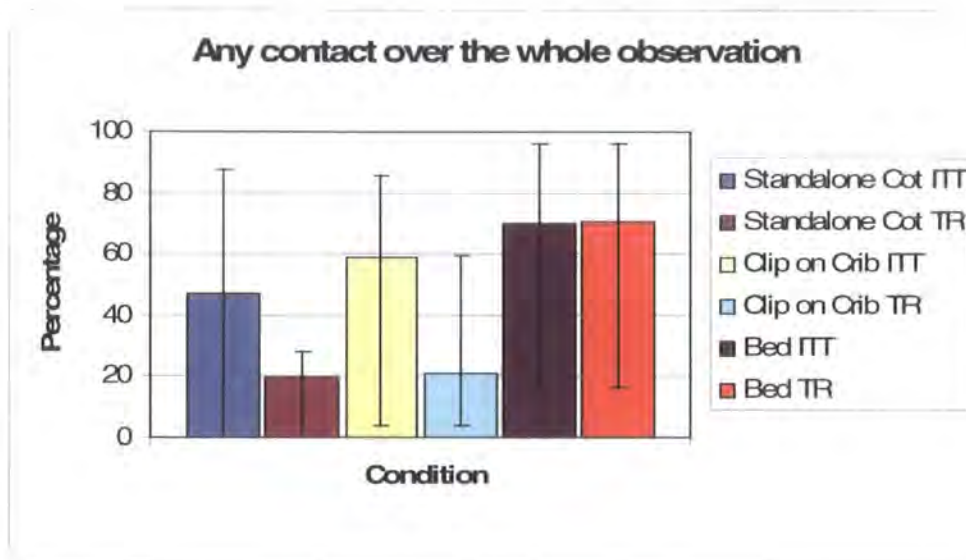


Figure 2 illustrates that the duration of any contact (including partial contact) received by infants over the whole observation is not significantly different between the three groups when analysed using ITT analysis (ranged from 47-69%) but is highly significant when analysed via TR analysis ($p=0.0001$ Kruskal-Wallis) as any contact ranged from 19% (for infants in the cot) to 70% (for infants in the bed).

A significant difference was also recorded when Mann-Whitney U Tests were performed using the TR analysis as crib and bed groups were found to be significantly different ($p=0.007$) as were the bed and cot groups ($p=0.000$). The range bars demonstrate that there is much variation in the duration of any contact received by babies in each of the 3 groups, and that there is much overlap between the groups. The expected difference between any contact for those babies who slept in the bed (TR) and those in the cot and the crib (TR) can be seen in figure 2 as the infants who slept in the bed received more than three times as much contact than the infants in the crib or cot condition. All babies in the bed and crib groups received some contact during the whole observation, but not all babies in the cot group did (ITT and TR).

It was predicted that ‘Infants placed in closer proximity to their mother will spend less observed time beyond their mothers touch over the whole observation period than

infants sleeping further away. The percentage of the observation that infants spent beyond their mothers touch (defined by arm's reach) was recorded and results are shown in figure 3.

Figure 3:

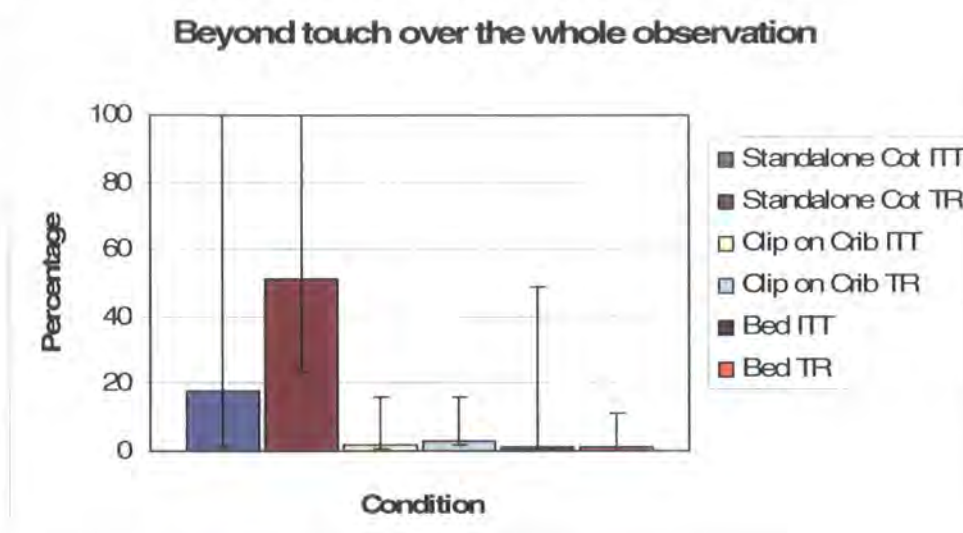


Figure 3 demonstrates that when results were analysed using Kruskal-Wallis, over the whole observational period, a statistically significant difference was found between the three groups when analysed via both ITT ($p=0.032$) and TR analysis ($p=0.000$). Mann-Whitney U (1 tailed) revealed a significant difference between the cot and crib condition when analysed using both ITT ($p=0.032$) and TR ($p=0.000$) analysis. A significant difference was also found between the cot and bed groups when analysed using ITT ($p=0.000$) and TR analysis ($p=0.029$). There is no overlap between the cot range bar for the TR condition with either of the bed or crib conditions indicating that as expected cot infants did spend the greatest duration of the observational period beyond touch (between 20% and 100% of the night).

Figure 1 supports the prediction 'infants who sleep in closer proximity to their mother will spend a greater percentage of the night in close contact (skin to skin and non-skin to skin) with their mothers, over the whole observation period, than infants sleeping further away'. In addition Figures 2 and 3 illustrate that infants who are placed in closer proximity to their mothers spend a great duration of the whole observation in any contact (including partial contact) and less time beyond mothers touch than infants who are placed further away.

Following on from recording the percentage of the whole observation that infants spent in close contact, any contact and beyond touch with their mother, the percentage contact time while both mother and infant were asleep was recorded. It was predicted that ‘Infants sleeping in closer proximity to their mother will spend a greater percentage of the time in close contact- (skin to skin and non-skin to skin) with their mothers when mother and infant appear asleep than infants sleeping further away’. Data on the percentage of the night an infant spent in close contact with their mother while they appeared asleep was collected to address this prediction and results are presented in figure 4.

Figure 4:

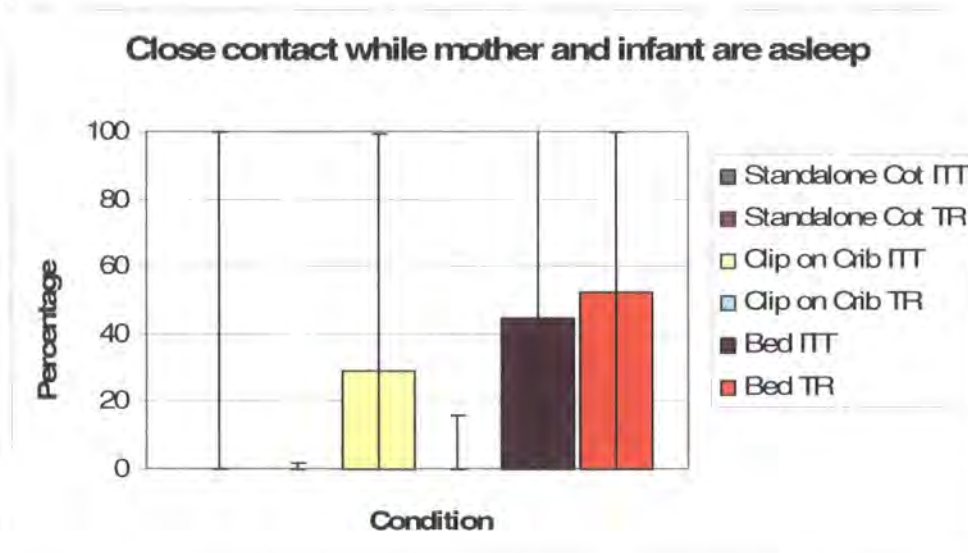


Figure 4 shows the variation in close contact between the groups while both mother and infant were asleep. Median percentage durations for close contact ranges from 0-44% when analysed using ITT analysis and from 0% - 53% when analysed using TR analysis. There was no statistically significant difference between the three groups when analysed using ITT analysis but there was when using TR analysis ($p=0.006$ Kruskal-Wallis). The same was true when Mann-Whitney U Tests were performed, infants in the crib spent a significantly shorter percentage of the night in close contact with their mother while they were asleep than infants in the bed ($p=0.037$). An even greater significant difference was found between the standalone and bed infants with bed infants spending a significantly greater time in close contact whilst asleep ($p=0.007$).

The range bars show that there is significant overlap between the ITT groups. The TR bars however show that the expected direction of duration of close contact received is as expected with bed infants receiving the longest durations of close contact (0-100%), cot infants receiving minimal amounts of close contact (0-2%) and crib infants being somewhere in the middle (0-16%) but more like the cot group than the bed group.

It was predicted that Infants sleeping in closer proximity to their mother will spend a greater percentage of the night in any contact- (including partial) with their mothers when mother and infant appear asleep than infants sleeping further away. Data on the percentage of the night mothers and infants were in any contact whilst asleep was collected and is presented in figure 5.

Figure 5:

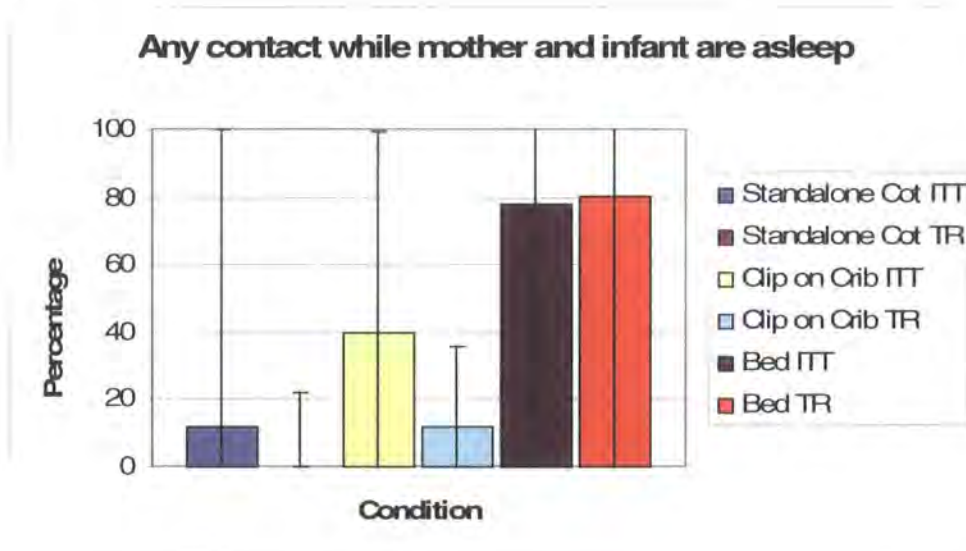


Figure 5 shows that there is no statistical difference between the percentage of the night infants spent in close contact (including partial) with their mother when they were both asleep (range 12%-78%) when analysed using ITT analysis. However, the difference between the three groups (which ranged from 0% to 81%) was found to be highly significant ($p=0.001$ Kruskal-Wallis) when analysed using TR analysis.

A significant difference was also recorded when Mann-Whitney U Tests were performed using the TR analysis as crib and bed groups were found to be significantly different ($p=0.023$) as were the bed and cot groups ($p=0.000$). The TR range bars

demonstrate that, as expected, infants who slept closer to their mothers were in contact for the longest durations whilst they were asleep, although there is overlap between the three groups bed infants by far (more than 4x as much) received the most contact with some being in contact for 100% of the time they were asleep.

It was predicted that 'Infants sleeping in closer proximity to their mother will spend less observed time beyond their mothers touch when mother and infant appear asleep than infants sleeping further away'. Percentage of the night infants spent beyond touch when both mother and infant appear asleep was recorded and results are presented in figure 6.

Figure 6:

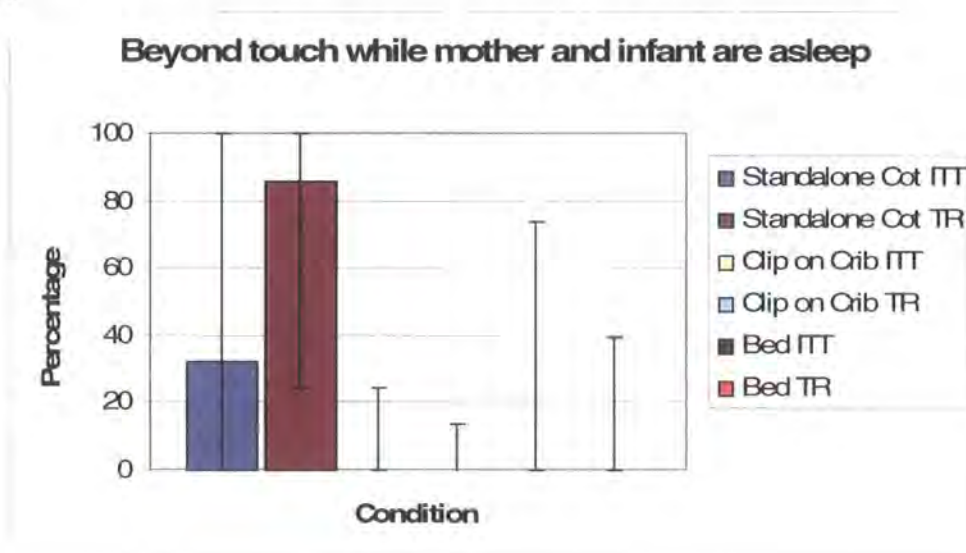


Figure 6 demonstrates that infants who are placed to sleep further away from their mother (cot) spend a significantly greater percentage of the time beyond touch than infants sleeping in close proximity to their mother (bed) when analysed using both ITT ($p=0.016$ Kruskal-Wallis) and TR ($p=0.000$ Kruskal-Wallis) analysis.

When Mann-Whitney U Tests were performed no significant differences were found between the crib and bed condition. However differences were recorded between the cot and crib conditions using both ITT ($p=0.029$) and TR ($p=0.010$) analysis as well as between the cot and bed conditions again using ITT ($p=0.035$) and TR ($p=0.000$) analysis. The graph shows that infants who were in the bed and the infants in the crib while they slept (TR) both spent a median of 0% of the night beyond mothers touch. However range bars reveal that infants in the crib group (TR) spent the least time

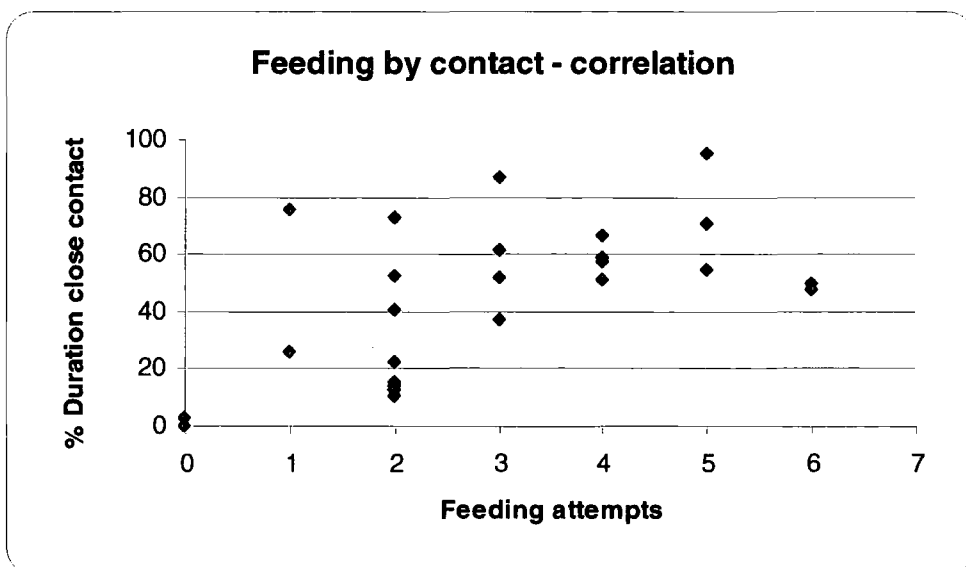
beyond mothers touch and, as expected, infants who were in a cot while they slept (TR) spent the greatest percentage of the night (86%) beyond mothers touch.

Figure 4 supports the prediction 'infants who sleep in closer proximity to their mother will spend a greater percentage of the night in close contact (skin to skin and non-skin to skin) with their mothers, when mother and infant appear asleep, than infants sleeping further away'. In addition Figures 5 and 6 illustrate that infants sleeping in closer proximity (bed) to their mothers spend a greater duration of the time when both mother and infant appear asleep in any contact (including partial contact) and less time beyond mothers touch (arm's reach) than infants sleeping further away (cot).

Breastfeeding

It was predicted that 'Infants who are kept in close contact to their mother will attempt to breastfeed more frequently during the whole observation'. Data on duration of close contact and number of attempts at breastfeeding over the whole observational period were collected and a graph was produced (figure 7) to show the correlation between the two.

Figure 7:

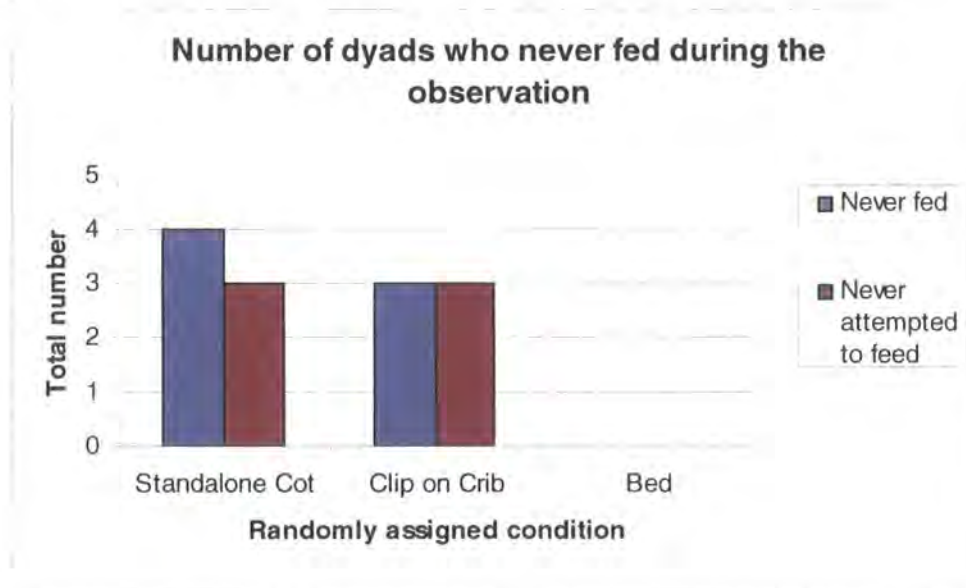


A positive correlation (correlation coefficient =0.704135) can be seen in figure 7 between number of feeding attempts and percentage of the night infant spent in close contact (irrespective of their allocated sleep condition). Therefore this supports the

prediction that infants who are kept in close contact with their mother will show more attempts at breastfeeding on the first postnatal night.

Indeed Figure 8 reveals that all of the infants who were randomly allocated to the bed (ITT) fed successfully at least once during the observational period. However three mothers allocated to each of the standalone cot and clip-on-crib conditions never attempted to feed their infant and an additional infant allocated to the cot never fed successfully on their first postnatal night. All infants allocated to the bed condition successfully managed to feed.

Figure 8:



It was predicted that 'Mothers who have their infants sleeping closer to them will attempt to feed their infant more frequently than mothers who have their infant sleeping further away'. Data on the number of attempts mothers made at breastfeeding by presenting their nipple over the whole observation was recorded per allocated sleep condition (ITT) as well as by actual condition (TR) and data is presented in figure 9.

Figure 9:

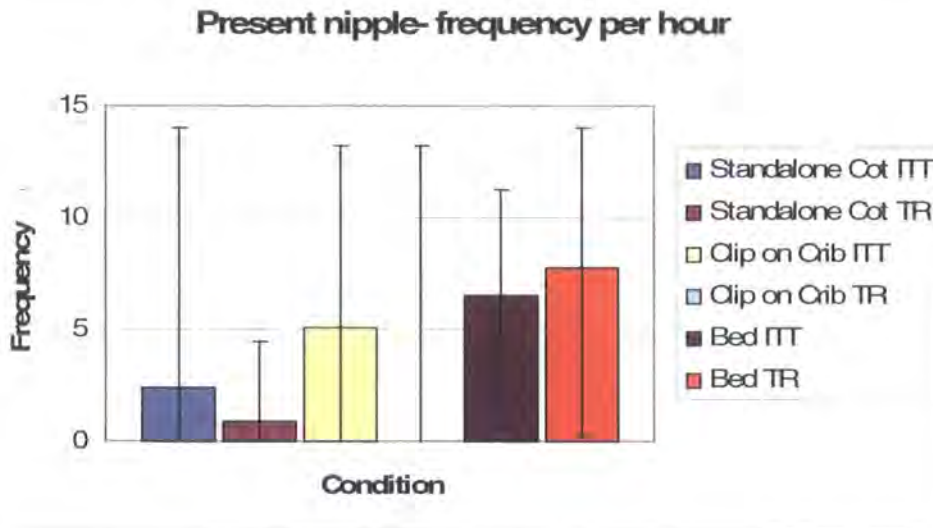


Figure 9 shows that on average mothers who had their infants closer to them attempted to feed them more frequently (as defined by frequency of presenting her nipple). The number of times a mother presented her nipple ranged from 2.4 – 6.5 times per hour for the ITT analysis and 0 – 7.7 times for the TR analysis. When analysed using Kruskal-Wallis test no significant difference was found between the three groups analysed via ITT but a significant difference was revealed between the three groups analysed via TR analysis ($p=0.018$). Furthermore a significant difference was found between the cot and the bed (TR) ($p=0.007$) when analysed using Mann-Whitney U. Range bars show that there is much variation and overlap between the three groups but that mothers who had their infant in the bed presented their nipple approximately 6 times per hour. It also shows that some of the cot and crib mothers never attempted to feed their infant at all as they never presented their nipple. The clip on crib median result can be explained by the low number of mothers in this group (4) as of these only $\frac{1}{4}$ attempted to feed their infant therefore only $\frac{1}{4}$ were successful and the median result therefore equalled 0.

It was predicted that ‘Mothers and Infants sleeping in closer proximity to one another will show greater feeding effort than dyads sleeping further apart’ Feeding effort data was recorded in two ways firstly by frequency of feeding per hour (figure 10) and secondly as percentage duration of feeding over the whole observation (figure 11). Total numbers of successful and unsuccessful feeding bouts and total durations of feeding were recorded

Figure 10:

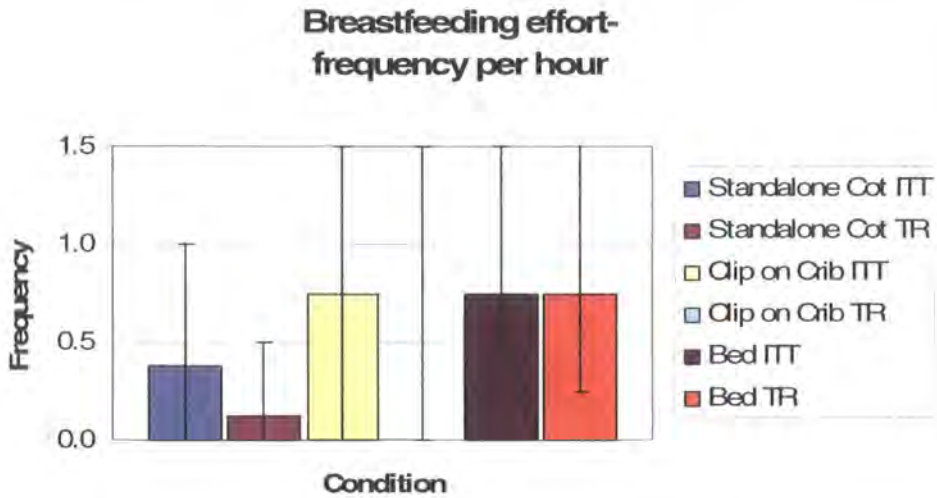


Figure 10 represents the breastfeeding effort expended by mothers on the first postnatal night (as defined by calculating the number of times a mother attempted to and or successfully breastfed their infant per hour) and it shows that mothers who had their infants in the bed exerted more breastfeeding effort when analysed using both ITT (0.75) and TR (0.75) analysis compared to infants in the standalone cot (ITT= 0.38, TR= 0.13) and crib (ITT= 0.75, TR=0.00) conditions. This difference was not significant over the three groups when analysed using Kruskal-Wallis via ITT but it was when analysed via TR ($p=0.005$). When analysed using Mann-Whitney U a significant difference was found between the infants in the standalone cot and the bed using TR ($p=0.001$) analysis. Range bars show that although there is some overlap between the three groups as expected infants who were in the bed (ITT and TR) fed more frequently than infants in the cot or crib. It also shows that all bed mothers (ITT and TR) attempted to feed their infant but that some cot and crib mothers never did.

Figure 11:

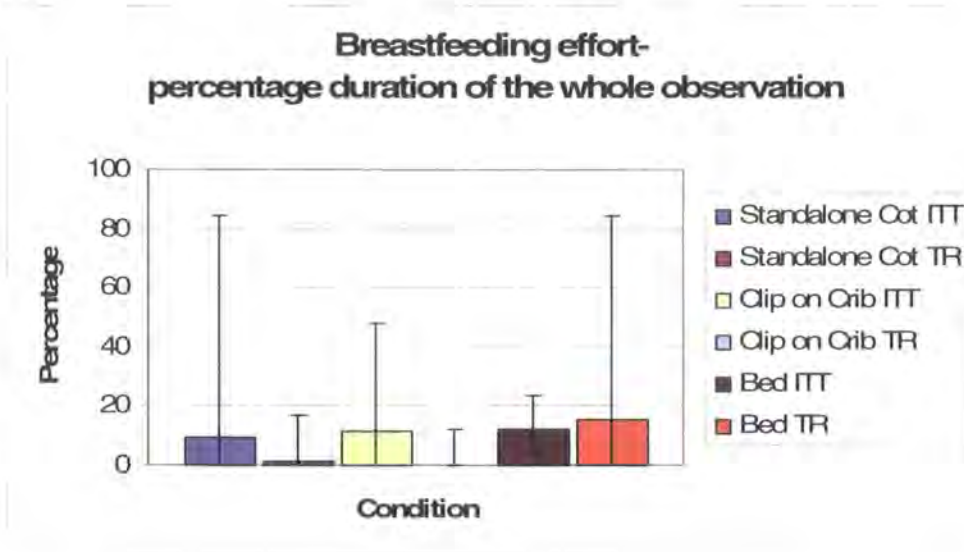


Figure 11 shows the percentage of the whole observation that mothers spent attempting to and or successfully feeding their infant and that the percentage ranged from 1% - 16% when analysed using TR and 9% - 12% when analysed using ITT. As expected TR analysis revealed that infants in the bed were breastfeeding for longer durations than infants in the crib or cot and this difference was significant ($p=0.021$ Kruskal-Wallis). Furthermore when analysed using Mann-Whitney U a significant difference was found, for TR groups, between the crib and the bed ($p=0.007$) as well as the cot and the bed ($p=0.002$). There was no significant difference between the cot and the crib indicating that mothers who placed their infants to sleep in the crib behave more like mothers who place their infants in a cot rather than the bed when it comes to breastfeeding effort. Range bars show that there is a lot of variation between the groups in percentage duration of breastfeeding effort but it also shows that as expected all of the mothers who had their infants in the bed (ITT and TR) attempted to feed their infant and when analysed using TR it was the bed mothers who were shown to be exerting the greatest percentage of breastfeeding effort.

It was predicted that 'Mothers and Infants sleeping in closer proximity to one another will show greater total duration of successful breastfeeding than dyads sleeping further apart'. Data on total durations of successful breastfeeding (infant latched on to mother's breast) were collected and results are presented in figure 12. This data was also used to address the prediction that 'Mother -infant dyads assigned to the crib will

behave more like the bed dyads than the cot dyads in relation to breastfeeding behaviour.

Figure 12:

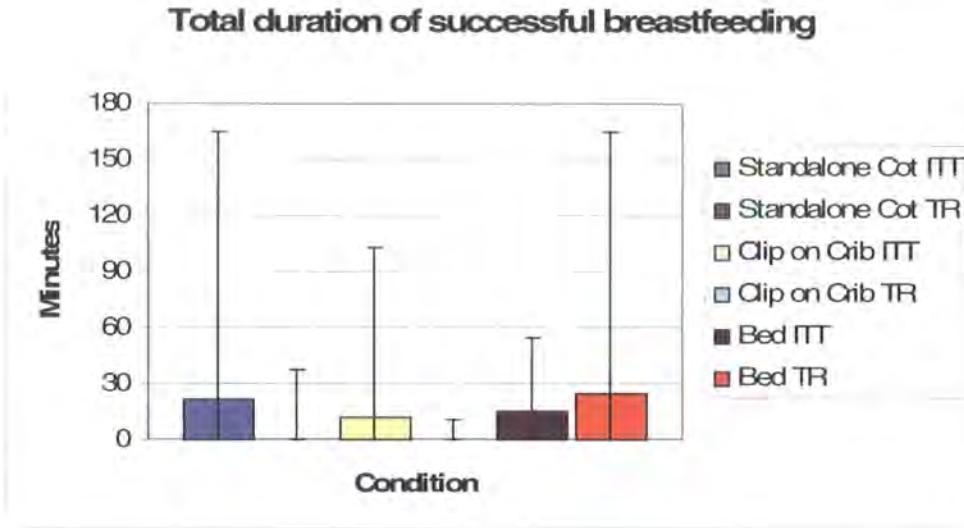


Figure 12 shows that the total duration of successful breastfeeding over the whole observational period ranged from 11-21 minutes for the ITT analysis and 0-25 minutes for the TR analysis. A significant difference was found between the three groups when analysed using Kruskal-Wallis for both ITT ($p=0.015$) and TR ($p=0.003$). Additionally when analysed using Mann-Whitney U a significant difference was found between the ITT cot and crib groups ($p=0.023$), the ITT crib and bed groups ($p=0.009$), the TR crib and bed groups ($p=0.0012$) as well as the TR cot and bed groups ($p=0.01064$) confirming that infants who spend the majority of the night in close contact with their mother (bed TR group) breastfeed for longer total durations on the first postnatal night. It would also appear that infants in the crib behaved more like the infants in the cot than the infants in the bed when it came to duration of successful breastfeeding. Figure 12 shows that not all of the mothers who had their infant in the bed successfully breastfed and that as expected in the TR groups the infants in the bed fed for the longest durations (25 minutes) as the median duration of successful breastfeeding for both the cot (0.5 minutes) and the crib (0.1 minutes) groups are so low. The range bars show that there is a lot of variation between the groups and within the groups for successful breastfeeding.

It was predicted that 'Mothers and Infants sleeping in closer proximity to one another will show greater total duration of attempting to breastfeed than dyads sleeping further apart. Data on total durations of attempting to breastfeed (infant not latched on) were recorded and data is presented in figure 13.

Figure 13:

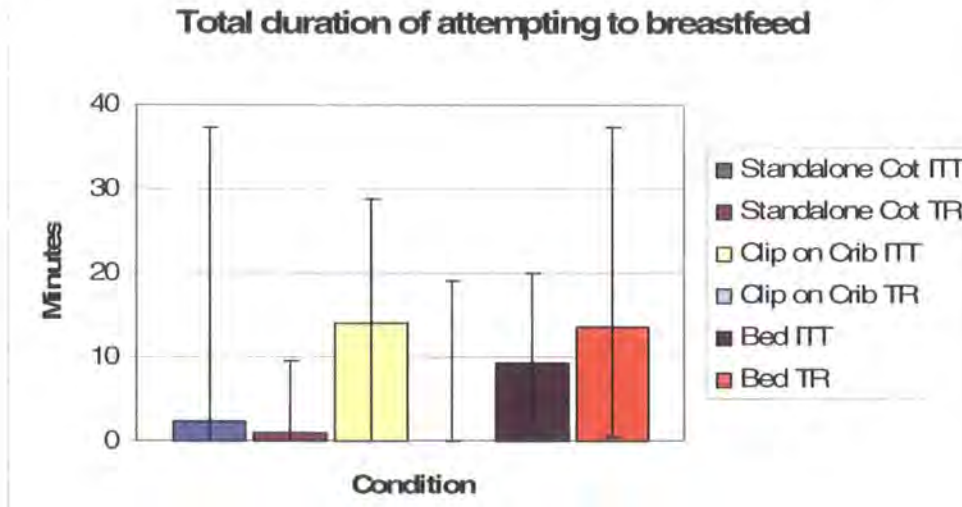


Figure 13 shows that mothers who had their infants closer spend a greater total duration attempting to breastfeed and when analysed using Kruskal-Wallis a significant difference was found between the three TR groups ($p=0.010$) but not the ITT groups. Furthermore a highly significant difference was found between the cot and the bed TR groups ($p=0.007$) and the crib and the bed group ($p=0.045$) when analysed using Mann-Whitney U. No significant difference was found between the cot and the crib group suggesting that mothers in the crib group behaved more like the mothers in the standalone cot group than the mothers in the bed group when analysed using TR (i.e. less feeding attempts). Range bars show that there was a lot of variation in the time spent attempting to breastfeed but also that in the TR analysis groups the expected direction of breastfeeding duration can be clearly seen.

It was predicted that 'Mothers and Infants sleeping in closer proximity to one another will show greater total duration of breastfeeding lying down than dyads sleeping further apart'. Therefore total durations of breastfeeding lying down were recorded and data is presented in figure 14. In addition it was predicted that 'Mother – Infant dyads assigned to the crib will behave more like the bed dyads than the cot dyads in

relation to breastfeeding behaviour. This data is also presented in figure 14.

Figure 14:

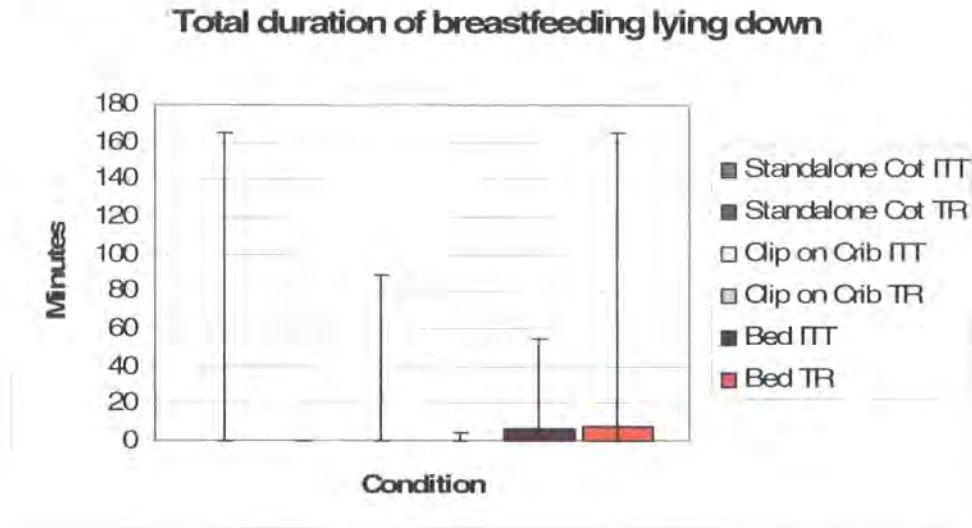


Figure 14 shows that mothers who had their infants sleeping closer, in the bed, breastfed their infants lying down for longer durations than mothers who had their infants in a crib or a cot. A significant difference was found between the ITT groups when analysed using Kruskal-Wallis ($p=0.048$) and a significant difference was also found between the ITT cot and crib ($p=0.009$) however no significant difference was found between any of the TR groups. This can be explained by the large number of ITT cot mothers who changed condition. No mothers in the cot TR group fed their infant lying down at all and TR crib mothers only fed for a very minimal time (0.9min) lying down indicating that if mothers had to sit up to lift the baby up then they were more likely to attempt to feed the infant sitting up than lying down. Therefore it can be said that mothers who had their infant in the crib behaved more like the cot group than the bed group. Range bars show that not all mothers who had their infants in the bed spent some time breastfeeding lying down and that the durations spent breastfeeding lying down are variable.

Comparison between breastfeeding initiation success in the 50% of mother-infant dyads who did not change their randomised condition from standalone to bed to the 50% of those who did can be seen in Table 9.

Table 9: Breastfeeding initiation success of mother-infant dyads that stayed vs. changed condition.

Indicators of breastfeeding initiation success	SA - SA Stayed	SA - BI Changed	T-test - stayed & changed condition
Feeding effort (S+U) freq per hr	0.15	0.7	0.017
Feeding effort % duration	3.79	32.9	0.107
Present nipple	1.25	6.35	0.097
Total duration of successful bf (min)	8.46	61.8	0.130
Total duration of attempting to bf (min)	0.99	17.04	0.099
Total duration of bf lying down (min)	12.6	44.4	0.382
Breastfeeding at 2 weeks %	40	80	n/a

A comparison of the two groups (mothers who left their infant in the standalone cot and mothers who moved their infant into the bed) shows that there is a statistically significant difference between the amount of feeding effort (attempting to and successfully breastfeeding) mothers exhibited on the first post-natal night. Results show that mothers who left their infant in the standalone cot tried to or successfully breastfeed 0.15 times per hour compared to 0.7 times per hour for the mothers who brought their infants into bed.

When mothers were interviewed after their second post-natal night the mothers who changed condition from cot to bed, on average, reported (on a scale of 1-5, with 1 being the most satisfied) that they were generally more satisfied (3) with breastfeeding initiation than the mothers who left their infants in the standalone cot (4.8). Mothers who brought their infants into bed also reported (on a scale of 1-5 with 5 being the hardest) that they found it slightly harder to initiate breastfeeding (2.8) than mothers who left their infants in the standalone cot (2.4), although this difference was not significant.

When mothers were interviewed via telephone at 2 weeks (as part of the RVI Bedding-in study), 80% (4) of the infants who were brought into the bed were exclusively breastfeeding compared to 40% (2) of the infants who were left in the standalone cot.

Midwifery assistance

It was predicted that 'Mothers who have their infants sleeping closer to them will request more assistance from midwives in relation to feeding than mothers who have their infants sleeping further away'. The total number of calls to midwife was recorded and call frequency per hour was calculated. Data is presented in figure 15.

Figure 15:

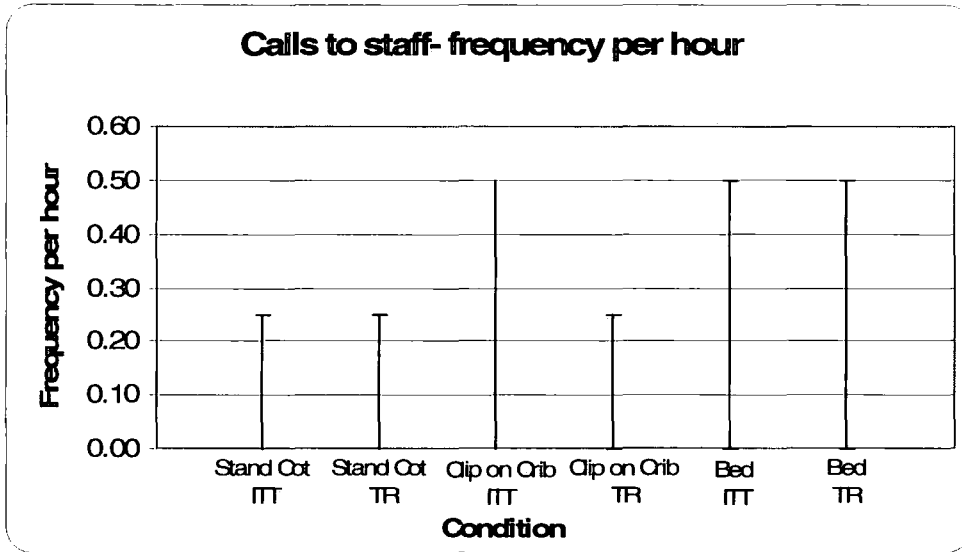


Figure 15 reveals that there was no significant difference under ITT or TR analysis across the three groups when analysed using Kruskal-Wallis and Mann-Whitney U Test, possibly due to the limited number of calls made to midwives throughout the observation, which is indicated by the median for each group being 0. Range bars show that the range of the number of calls to midwives was large for each group with a lot of overlap.

It was predicted that 'Staff will visit mothers who have their infants sleeping closer to them more frequently than mothers who have their infants sleeping further away'. Data on number of help bouts (freq per hr) was collected (figure 16) and number of times midwife offered help (without prior request from mother) was also calculated.

Figure 16:

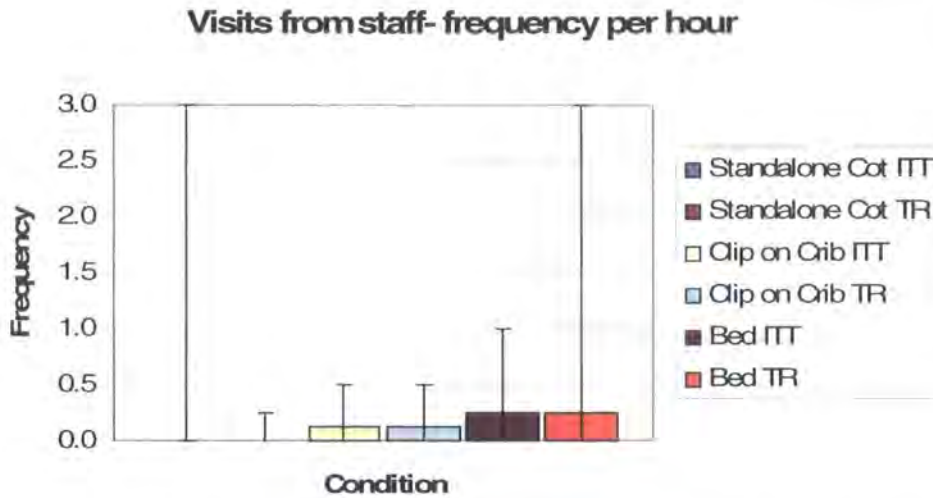


Figure 16 shows no statistical difference between the three groups when analysed using ITT and TR analysis. However as expected the TR data is indicative of a correlation between number of visits from staff and proximity of infant to mothers as staff visit mothers more frequently if they have their infants closer to them. The range bars show that there is some overlap between the three groups of number of visits and that in all groups some mothers were never visited by staff during the observation.

By comparing TR analysis in figures 15 and 16 we can see that the midwifery staff visited mothers (without mothers calling for them) more often if they had their infants closer to them.

It was predicted that 'There will be no significant difference in the total duration of assistance (unrelated to feeding) received from midwives'. Total duration of time midwife spent in the room was recorded and data is presented in figure 17.

Figure 17:

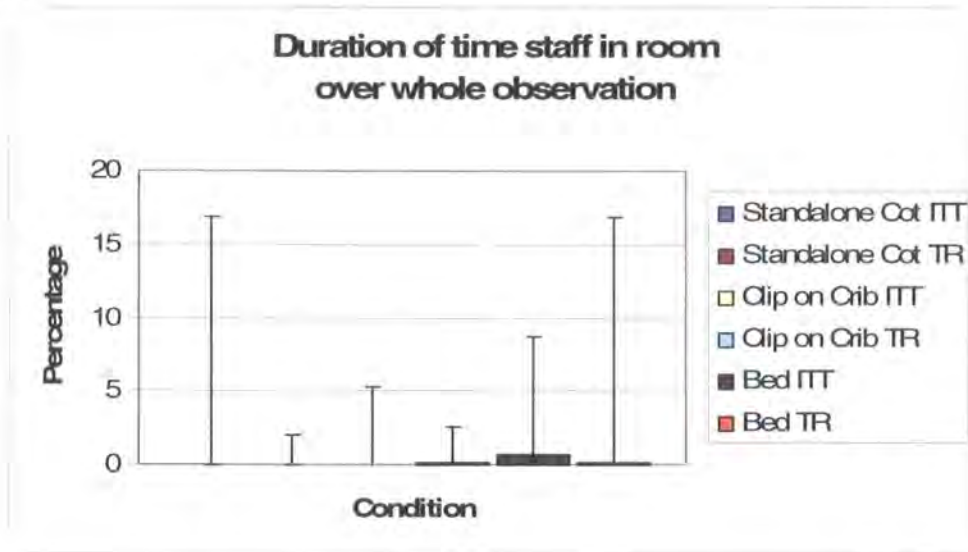


Figure 17 shows that the median percentage duration of time staff spent in the mothers room ranged from 0% to 0.6% for ITT analysis and from 0% to 0.2% for TR analysis. No significant difference was found when data were analysed using Kruskal-Wallis or Mann-Whitney U Test. The range bars indicate that no matter which condition mothers had their infants in (ITT and TR) in some cases staff never appeared in the mother's room during the course of the observation and that the number of visits were very variable.

It was predicted that 'Mothers who have their infants sleeping closer to them will receive a greater total duration of assistance with feeding than mothers who have their infants sleeping further away'. Total duration of midwifery assistance with feeding (i.e. verbal or physical help- feed) was recorded to address this prediction and the results are illustrated in figure 18.

Figure 18:

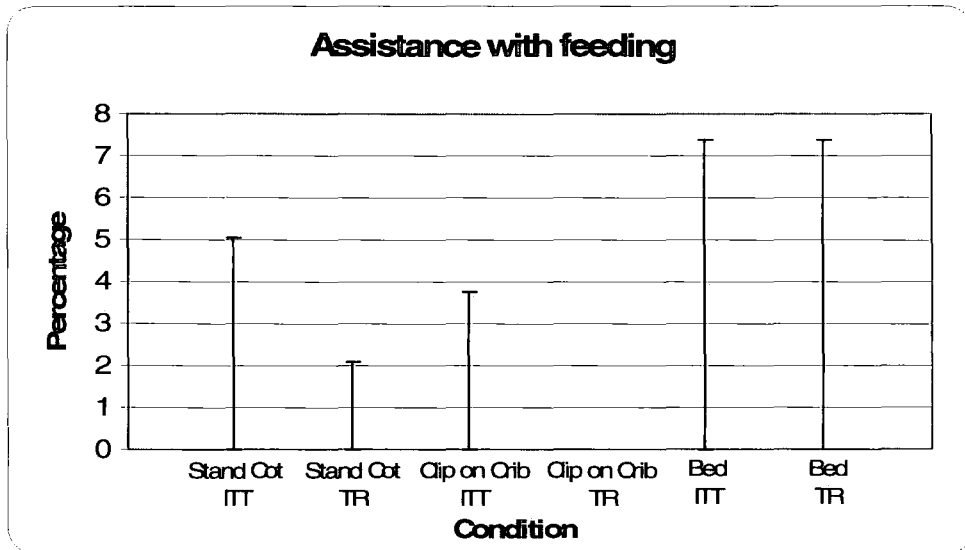


Figure 18 shows the percentage of the time, over the whole observation, that mothers received assistance with feeding. The median percentage for each group was 0% due to the small percentage of time that midwives spent assisting mothers with feeding. (To put this into perspective 1% = 2 min 24 sec) therefore no significant difference was found between the groups when analysed using Kruskal-Wallis or Mann-Whitney U.

Interview data

Data on breastfeeding initiation success was collected at two interview point. Information collected from the initial interviews (after second night of filming) included how mothers feel about breastfeeding on the morning after the first night (breastfeeding satisfaction) and initiation success, measured by whether infants received any formula and breastfeeding on discharge. Breastfeeding initiation success was also measured using information from the 2 week telephone interview (conducted as part of the RVI Bedding-in study) as mothers were questioned as to whether their infant was still receiving breast milk. Results are presented in Table 10.

Table 10: Breastfeeding initiation success

	Whole sample	Bed	Clip on Crib	Standalone Cot
Received Formula				
Yes	1	1	0	0
No	29	9	10	10
B-F on discharge				
Yes	28	8	10	10
No	1	1	0	0
Missing	1	1	0	0
B-F at 2 weeks				
Exclusive	23	7	10	6
Mixed	5	2	0	3
Formula	1	1	0	0
Missing	1	0	0	1
Maternal Satisfaction with B-F- Success	3.5 (1-5)	3.2 (1-5)	3.3 (1-5)	3.9 (2-5)
Maternal Satisfaction with B-F- Ease	2.8 (2-5)	2.8 (2-5)	2.9 (2-4)	2.6 (2-4)

Table 10 shows that only one infant received formula before they were discharged from hospital and they had been assigned to the bed condition and only 1 infant was not breastfeeding on discharge (this was not the same infant) although data for 1 infant is missing we can not say that in this sample formula use resulted in unsuccessful breastfeeding initiation. At 2 weeks 100% of the crib infants are exclusively breastfed as were 70% of the bed infants and 60% of the cot infants.

Table 11: Breastfeeding success

	Bed	Crib	Stand alone	Total	Statistics
Number of mothers who thought they had been more successful than the median success rating	5	5	4	14	ns
Number of mothers who thought they had been less successful than the median success rating	5	5	6	16	ns

Table 12: Breastfeeding ease

	Bed	Crib	Stand alone	Total	Statistics
Number of mothers who found breastfeeding easier than the median ease rating	5	2	5	12	ns
Number of mothers who found breastfeeding harder than the median ease rating	5	8	5	18	ns

When mothers were asked to rate their satisfaction with their breastfeeding experiences (table 11 and 12) on a scale of 1-5, with 1 indicating it had been the most successful and easiest, no statistical differences (calculated using Chi Square statistic and Extension of the median test) in the Likert scale scores were found between the three groups on how easy mothers found breastfeeding (Table 12) or how successful (Table 11) they thought breastfeeding had been during the first postnatal night. Although bed mothers thought breastfeeding had been the most successful and cot mothers found it the easiest (Table 10).

Discussion

This study contributes to the knowledge on the benefits of mother-infant contact and breastfeeding success. Numerous studies, discussed below, have been conducted on the effects of initial contact (in the first hour after birth), particularly on pre-term infants but to date no research has been conducted on the effects of extended contact during the first post-natal night on breastfeeding initiation success. The data collected in this study demonstrates that close mother-infant contact on the post-natal ward during the first night of life has a positive effect on breastfeeding initiation.

The most significant findings from this research are;

1. Although randomly allocated to 3 conditions, mothers who were separated from their infants were most likely to switch conditions and because each of the samples were small the switching was likely to have a large effect on the ITT analysis. Therefore, any effects observed in ITT were diluted by the mothers who didn't stay in their randomised condition.
2. Infants allocated to the bed condition received more feeding attempts than infants allocated to the cot condition.
3. Mothers and infants who shared a bed (allocated or choice) had greater feeding success than mothers and infants who were further apart.
4. Despite the fact that many mothers switched conditions there was a significant difference across the three groups in terms of the time infants spent beyond mothers' reach.
5. Staff spent very little time providing breastfeeding assistance at night to mothers in any of the groups and there was no significant difference in the frequency with which mothers and babies were checked by staff.

The nature of the data

In order to accurately capture information on breastfeeding frequency on the first postnatal night video recording is clearly more effective in obtaining objective data than reliance upon maternal recall. However video data collection does suffer from certain limitations. In this study limitations were apparent in the use of a fixed camera position and the time consuming nature of coding.

Filming from a fixed camera position was the biggest difficulty. On occasion an infant's face may appear to be obscured by blankets making determination of sleep state difficult. In these cases infant waking/sleeping state is determined using movement and audio cues. Similarly, infants may be recorded as feeding whilst the infant's face and/or mother's breast is obscured from view. In these circumstances feeding is recorded only if there is clear indication of feeding behaviour from audio cues; 'sucking' noises made by the infant or verbal references to the ongoing feeding practice made by the mother or midwife. This practice of inferring behaviour from cues other than direct visual classification has the potential to introduce some error into the data.

Because data coding was time consuming it was necessary to employ additional data coders. This introduces the potential for differences in coding between observers. Furthermore individual observers may drift over time in their coding accuracy; these issues were addressed by the application of a strict coding taxonomy and frequent reliability testing. Observer reliability was tested using Kappa and a Kappa statistic of 0.92 was produced which was accepted as confirming the reliability of the data entry.

Participant cross over

Intention to treat analysis compares the study groups in terms of the treatment to which they were randomly allocated. This has the advantage of giving an unbiased and consistent estimate of treatment effect and admits non-compliance and protocol deviations, thus reflecting a real clinical situation. There are however limitations in that the estimate of treatment effect is generally conservative because of dilution due

to non-compliance. In equivalence trials, this analysis will favour equality of treatments. Further, interpretation becomes difficult if a large proportion of participants cross over to opposite treatment arms.

In this study a large number of participants did cross over treatment groups (as discussed below) therefore during analysis participant movement from assigned condition was dealt with by applying a ‘treatment received’ analysis in addition to the ‘intention to treat analysis’.

Key findings

1. Switching conditions

Although randomly allocated to 3 conditions, mothers who were separated from their infants were most likely to switch conditions (50% of the mothers allocated to the cot and 60% of mothers allocated to the crib subsequently brought their infant in to bed for the majority of the night) and because each of the samples were small the switching was likely to have a large effect on the ITT analysis. Therefore, any effects observed in ITT were diluted by the mothers who didn’t stay in their randomised condition.

In order to address this issue in large randomised control trials per-protocol analysis can be used. Per-protocol analysis uses only those subjects who comply with their randomly assigned condition perfectly. However, there were too few mothers in this thesis study who fully complied with their random allocation to employ per-protocol analysis (although it was possible to carry out these analyses for the larger Bedding-in study). Therefore Treatment Received analysis was used for ‘all participants according to the treatment they actually received, regardless of what treatment they were originally allocated’ (Heritier 2003). The main drawback of this compromise was that the methodological benefits of randomisation were somewhat compromised as in effect, some participants were just doing what they would have done anyway without randomisation. Future studies would do well to account for the large deviation from assigned condition.

The reason why so many mothers changed their randomly allocated sleep condition from cot to bed may have an evolutionary explanation. Human infants have evolved to be kept in close contact with their mother for feeding, comfort and warmth as they are relatively helpless for the first year of life as their brains are only 25% developed at birth (McKenna 1990a). This is as a result of the evolutionary conflict which occurred between encephalisation (brain growth) and bipedalism (walking upright, reducing the size of the pelvis). This conflict forced infants to be born in a neurologically immature state (Trevathan 1993), making them unique among primates in requiring a 12 months external gestation as their brain continues to grow (Martin 1992). This requires them to be in constant contact with their mother for food, warmth and protection (Lozoff & Brittenham 1977). Therefore it could be argued that infants are designed to be in an environment in which they are in close contact with a caregiver throughout the day and night and that mother-infant contact co-evolved over millions of years of primate evolution (McKenna 1990a).

Additionally, humans have been classified as a carrying rather than a caching species (Lozoff 1979) and this is primarily due to the fact that human breast milk is low in fat and protein and is therefore easily digested, requiring infants to suckle frequently in order to satisfy their nutritional requirements (Trevathan 1993) to do this they need to be in close contact with their mother.

Indeed in many cultures (Barry and Paxson 1971), including hunter-gatherers, (Lancaster and Lancaster 1982) infants are kept in close contact with their mother during the day and night. Given the evolutionary advantages of close mother and infant contact it could be argued that there may be an instinct for close contact that may explain the large number of mothers who changed location. Indeed infants who were alert (born without any medication) also instinctively want to be close to their mother and if separated from their mother they will make efforts (if they are able) to maintain proximity (i.e. crying).

However, if mothers are changing infant sleep locations from cot to bed on the postnatal ward, without midwives knowledge we must remember that this may have implications for healthcare policy. If midwives are unaware that a mother has her infant in bed then she will not know to check whether any of the

contraindications to bed sharing exist (FSID / UNICEF leaflet) which may result in a new mother bedding-in in an unsafe manner.

2. Feeding attempts

A significant difference in feeding frequency (per hour) was found between infant randomised to the bed and infants randomised to the cot. Feeding frequently (rather than increased feeding durations) has been shown to provide best results for breastfeeding initiation success and UNICEF BFI recommend breastfeeding little and often in the first postnatal days to ensure successful breastfeeding initiation (UNICEF 2005). Therefore breastfeeding frequency can be used as a measure of breastfeeding initiation success.

Specifically the literature has shown that; a) babies who fed early fed more frequently (De Carvalho, 1983); b) more frequent feeding increases prolactin supply (Noel 1974) and oxytocin improving milk ejection (Matthiesen and Uvnas-Moberg 2001; Nissen et al 1995); c) infants who suckled more encouraged their mothers milk to come in sooner (Yamauchi and Yamauchi 1990, Widstrom 1990); d) a better milk supply is maintained (Yamauchi and Yamauchi 1990); e) feeding little and often is better for preventing sore nipples (UNICEF 2005); f) more practice leads to better latching on success (UNICEF 2005).

In one study the effects of frequency and duration of breastfeeding on infants milk intake and weight gain was investigated. It revealed that infants who were encouraged to nurse more frequently (than 3-4 hourly) fed more frequently during the first 2 weeks and on day 15 took more milk and had gained more weight from birth than the control group (De Carvalho, 1983). Another study investigated the relationship between the frequency of breastfeeding, milk intake and weight loss. They found that mothers nursed their infant, on average, 4.3 +/- 2.5 (SD) times (range 0 to 11) during the first 24 hours after birth. The frequency of breastfeeding during the first 24 hours after birth correlated significantly with frequency of meconium passage, maximum weight loss, breast milk intake on day 3 and day 5 and less weight loss from birth to time of discharge (Yamauchi and Yamauchi 1990).

The rationale behind feeding frequency and increased breastfeeding success may be linked to the evolved positive feedback loop of how breastfeeding (prolactin and oxytocin) works. When the baby suckles at the breast sensory impulses pass from the nipple to the brain. In response the anterior part of the pituitary gland, at the base of the brain secretes a hormone called prolactin. Prolactin is transported in the blood to the breast where it directs the alveoli to produce milk. Prolactin levels in the blood remain high for up to 90 minutes after the feed (Noel 1974) and help the breast produce the milk for the next feed. Therefore if a baby suckles more frequently, the mother's breast will be stimulated to produce more milk. This is important when initiating breastfeeding as it is this stimulation which helps the mother's milk to 'come in' sooner (Yamauchi and Yamauchi 1990). Night feeds are especially important for milk supply as prolactin levels are higher at night therefore a breastfeed at night causes a greater prolactin surge than one given during the day (Howie 1985). In addition to milk production prolactin can help mothers feel relaxed and sleepy, so she will usually rest well after a night feed (Riordan et al 1993).

A second hormone called oxytocin also starts to secrete from the pituitary gland when an infant suckles at it mothers breast. Oxytocin is carried to the breast in the blood and makes the myo-epithelial cells around the alveoli contract which in turn makes the milk which has collected in the alveoli flow. Indeed sometimes the milk will spontaneously eject from the nipple and this is called the 'oxytocin reflex'. Oxytocin makes the milk stored in the mother's breast flow and this is an unconditioned response to suckling (Riordan et al 1993). Unconditioned responses illustrate that mothers as well as infants have been 'designed' to breastfeed.

The mother's oxytocin reflex can be stimulated by sensations such as touching, seeing and hearing her baby. Mothers who keep their infants close help their bodies prepare to breastfeed and help their milk flow. If a mother is separate from her infant between feeds her oxytocin reflex may not work so easily therefore we can say that mothers who have their infants close are more likely to breastfeed frequently as their oxytocin reflex will be stimulated more easily and effectively. (Matthiesen and Uvnas-Moberg 2001; Nissen et al 1995).

The fact that infants allocated to the bed were found to attempt to feed and successfully feed significantly more frequently than those allocated to the cot in spite of crossovers means the finding is particularly robust and can be generalised. In fact infants who were kept in closer contact to their mothers had more feeding attempts than infants who were further away as can be demonstrated by a correlation between percentages of time spent in close contact with frequency of breastfeeding across the whole sample of mothers. It is clear that babies who spent the most time in close contact breastfed the most frequently.

Additionally, this research revealed that all infants allocated to the bed fed successfully, at least once, on the first postnatal night. Results from sleep lab studies support this finding as they found that in older infants (3 months+) bed-sharing is associated with successful breastfeeding (McKenna, Mosko et al. 1997, Young 1999 and Ball 2002). However there is currently no published data on the effects of bed-sharing on mothers and infants in the immediate postnatal period, either in the hospital or the home environment (Ward-Platt & Ball 2002) so little advice is available to mothers who express an interest in bedding-in (bed-sharing on the post-natal ward) with their infants.

Feeding frequency and success was found to be greater in the bed group as mothers who had their infants in the bed (allocated or choice) attempted to feed their infants significantly more frequently and spent a greater length of time attempting to feed their infant than mothers who had their infants further away, therefore you would expect that they would have a greater success rate. This result may also be explained by the physiological interactions which occur between the mother and her infant when they are kept in close proximity (Auerbach 2000) and the nipple is frequently stimulated. The mother responds to her infant (the mother's body 'let's down' the milk supply in preparation for feeding, resulting in leaking of the breasts) and the infant responds to his mother (the smell of the milk encourages the infant to root) (Porter 1992).

In order to promote successful breastfeeding initiation infants should be encouraged to feed on demand which requires feeding frequently during the night. Indeed UNICEF BFI- Step 8 states that midwives should encourage breastfeeding on

demand. This recommendation comes from findings of research conducted into the benefits of rooming in and has resulted in many hospitals developing policies which state that an infant should be kept in close contact to their mother day and night so mothers can reach and care for their infant easily and then feed their infant on demand. It also means that the infant does not have to start crying before the mother respond as mothers learn how to respond to the signs that their infant gives. Bedding-in is has extra advantages for breastfeeding as it is easier for a mother to rest and breastfeed and the disturbance of breastfeeding at night can be ameliorated.

Research has shown that new mothers commonly adopt bed-sharing as a coping strategy for night-time care-giving in the first few months of their infant's life (Ball, Hooker et al 2000; Blair and Ball, 2004; Ball, Hooker et al 1999) and mothers who feed in bed often feed lying down. If mothers are shown how to breastfeed lying down they are able to breastfeed their infant at night without having to fully wake up which further helps ameliorate some of the work inherent in frequent breastfeeding. It was therefore predicted that mothers who had their infants in the bed would breastfeed lying down for longer duration than mothers who had their infants further away. Results from this research did not support the prediction as mothers who had their infants in the bed (allocated or choice) did not breastfeed lying down for greater total durations than mothers who had their infants in a cot or crib. The rationale behind this prediction was that midwives would encourage bedding-in mothers to breastfeed lying down as a way of ensuring that mothers received enough rest in spite of frequent breastfeeding attempts, but this did not seem to be the case, although this may have been due to the short duration of time midwives were observed to be in the room.

3. Feeding success

Infants who spent the majority of the night in the bed were breastfed for significantly longer durations than infants in the crib or cot. Furthermore a significant difference was found between the crib and the bed as well as the cot and the bed groups. This result was as expected as numerous studies have shown that there is a close relationship between breastfeeding and bed-sharing such that mothers who breastfeed are more likely to bed-share and mothers who bed-share are more likely to breastfeed. (Ball, Hooker et al (2000) ; Blair and Ball, (2004); Ball, Hooker et al (1999) Blair &

Ball (2004) McCoy et al (2004), McKenna et al (1997), Pollard et al (1999) and Clements et al (1997).

Additionally, a significant difference in feeding effort was found between the mothers who had their infants in the crib and the mothers who had their infant in the bed for the majority of the night (allocated or choice). A difference was also recorded between the mothers who had their infant in the cot and those who had their infant in the bed condition. However there was no significant difference between the cot and the crib conditions. Therefore we can conclude that in general mother-infant dyads in the crib condition behaved more like the dyads in the cot rather than the bed condition with respect to breastfeeding duration and effort. We expected that mothers who had their infants in the crib would behave more like the bed mothers than the crib mothers as the crib provided a continuous surface for the infant to lie on. However, these results suggest that it not enough to have the baby in the same room but that to increase breastfeeding initiation rates further mothers must have their infants in the same bed.

When mothers were interviewed and their satisfaction scores were analysed across the three groups no statistical differences in the Likert scale scores were found on how easy mothers found breastfeeding or how successful they thought breastfeeding had been during the first postnatal night. This lack of significance may be explained by the large number of mothers who changed conditions as mothers who switched conditions from bed to cot were found to have significantly greater durations of breastfeeding effort (attempting to and successfully breastfeeding) when compared to mothers who left their infants in the standalone cot. Additionally, when mothers were interviewed after their second post-natal night the mothers who changed condition from cot to bed, on average, reported that they were more satisfied with breastfeeding initiation than the mothers who left their infants in the standalone cot. Mothers who brought their infants into bed also reported that they found it harder to initiate breastfeeding than mothers who left their infants in the standalone cot. These results indicates that mothers who brought their infants into bed did so for breastfeeding and that those who did had more breastfeeding success but had to put more effort in to achieve it.

4. Beyond touch

Over the whole observational period, a statistical difference was found between the three groups when time spent beyond mothers touch was analysed using assigned condition and chosen condition. Additionally, infants who were sleeping further away from their sleeping mother spent a significantly greater percentage of the time beyond touch than infants sleeping in closer proximity to their mother when analysed using both ITT and TR analysis. This means that although mothers allocated to the cot spent a lot of time breastfeeding their infants in bed they complied with the conditions for sleep and this is likely to be the reason for the significant difference found under finding 2 (above) as mothers sleeping apart from their infants did not have the opportunity to “feed in their sleep”.

There is clear evidence that for a variety of reasons infants should not be separated from their mother (see below) but specifically breastfeeding initiation success may be affected. In addition to the hormonal effects explained previously Lozoff (1983) uses examples from traditional societies to argue that it is the extended contact between the mother and her infant (within first few days / weeks) after birth which impacts on breastfeeding success. This suggests that prolonged sleep contact is more important than the initial contact of the baby being placed skin to skin within the first hours or so after birth as in many traditional societies (94% of the cases) infants were bathed before being given to their mothers ‘However, virtually all of the traditional societies encouraged extended contact’ (p597). One implication of this study therefore is that encouraging mothers to keep their babies in close contact while they are awake may be insufficient for effective breastfeeding initiation.

Research into early versus delayed contact concluded that the maternal sensitive period may be within the first 12 hours after birth (Hales 1977). One Swedish study looked at early contact (within 1 hour of delivery) and concluded that even brief initial mother-infant separation impacts on the ‘affective components of mother-infant interaction’ (Carlsson 1978). Research on rooming-in following delivery indicated that extra contact may improve both subsequent mothering and child health by reducing the number of parenting disturbances / disorders requiring hospitalisation in low-income primiparous mothers at 12 to 21 month follow up (O’Connor 1977).

The above studies (Lozoff 1983, Hales 1977, Carlsson 1978, O'Connor 1977 and Yamauchi 1990) suggest that the timing and amount of contact between a mother and her infant may have profound effects on both maternal and child health as well as the relationship they form. Therefore, this research instigated the current practices seen in hospitals today of rooming-in on the post-natal wards and policies such as UNICEF BFI 10 steps to successful breastfeeding have been developed. Indeed Step 7 of 10 states 'Practice rooming in and allow mothers and infants to remain together 24 hours a day is based upon'.

Although the above research suggests the practice of rooming in is better than separation for breastfeeding success results from this research reveal that bedding-in is even better for breastfeeding initiation and this is supported by the vast amount of research which has been conducted on the effects of skin-to-skin contact and kangaroo care (placing a naked baby prone onto the mothers bare chest) in the immediate postnatal-period and in the subsequent days following delivery (sensitive period). The effect of the sensitive period on maternal and infant behaviour was explored by Klaus and Kennel (1976), De Chateau (1976, 1977) and Christenson (1992, 1995). A review of the literature illustrates the benefits of prolonged intimate interaction (skin-to-skin contact, kangaroo care) between mother and infant and the major benefits of close contact on the hospital ward have been shown to be related to breastfeeding as discussed in the literature review (Gomez-Papi et al 1998, Ashmore 1997, Anderson 2003, De Chateau 1977, Anderson 2003, Matthiesen and Uvnas-Moberg 2001, Nissen et al 1995, Insel 1997, Whitelaw 1998). In many respects mother-infant bedding-in could be considered as an extension of this prolonged contact for the duration of the hospital stay and a way of keeping mothers and infants close to help initiate breastfeeding success.

5. Staff assistance

Many hospitals are making a commitment to 'Baby Friendly' practices to encourage the early initiation and continued promotion of breastfeeding and most are developing policies on mother-infant bed-sharing on the post-natal ward (Ward-Platt & Ball 2002). To become 'Baby-Friendly' accredited hospitals are required to implement

UNICEF's 10-steps to successful breastfeeding. Step 5 of the 10 steps states that midwives should show mothers how to breastfeed, and how to maintain lactation even if they are separated from their infants (UNICEF 2000).

The mothers in this study were primarily first time mothers and therefore had no previous breastfeeding experience. Correct positioning of the baby at the breast is of paramount importance to the success of breastfeeding and the prevention of potential problems, both to the mother and her baby. Forcing the baby onto the breast may result in breast refusal, as the baby starts to associate the breast with a bad experience (Widstrom 1993) and ineffective position may also result in breastfeeding difficulties (Escott 1989). Therefore midwifery help with initiation of breastfeeding in the hospital is essential (Ferriset al, 1987; Foster et al., 1995; Riva, 1999; Sheehan et al., 2001).

New mothers may also require help to become familiar with the signs which show that her baby is ready to feed (i.e. feeding cues). Although keeping infants in close contact to mothers has been shown to empower mothers' feelings making her more responsible, confident and perceptive in the care of her infant as well as being more responsive to her infant's cues (Tessier 1998). As mothers who have their infants closer to them attempt to feed more frequently it might be expected that these mothers would require the most midwifery assistance with feeding. However, this was not the case as no significant differences in assistance with feeding were found across or between the groups in this study.

Having their infants close has also been shown to be beneficial for mothers as it is associated with lower maternal anxiety and more efficient participation of mothers in caring for their newborn infants (Vial-Courmont 2000). Therefore it could be argued that mothers who have their infants in the bed require less midwifery assistance with caring for their infant.

UNICEF advise midwives (although there is no written policy) to visually check mothers who are known to be bed-sharing on the postnatal ward every 15 minutes. Results from this research indicate that this practice was not performed on the postnatal ward for the time the mothers in the study were being filmed as mothers

who had been randomly allocated to the bed were checked on average 0.38 times per hour. Possible reasons for this may include that staff knew that if they went into the room their actions would be recorded and maybe because they were 'camera shy' or maybe because they thought we were observing 'them' they refrained from entering the room. Additionally some midwives and mothers switched the camera off while the midwife was in the room therefore this data was lost.

Although it was predicted that mothers who had their infants in the bed would call for assistance more frequently than mothers who had their infants further away no significant differences were found in the amount of help mothers requested or received in relation to feeding on the first postnatal night. This prediction was based on the knowledge that mothers who have their infants closer attempt to feed them more frequently (Widstrom 1990) and because the majority (93%) of the mothers were first time mothers it was anticipated that they would request assistance with feeding more frequently. However, mothers who had their infants in the bed (allocated or choice) did not call for midwives significantly more than mothers who had their infant in the cot. The reason why this result may not have been significant may have to do with the limited data available on the number of times mothers called midwives and if more data had been collected a significant result may have been found.

Furthermore it was predicted that midwives would offer more assistance to mothers who had their infants in the bed in relation to feeding but again no significant difference was found. It was thought that bed mothers would receive more assistance firstly because they would request it (which was not the case) and secondly because midwives would be checking on these mothers more frequently (for safety reasons).

UNICEF recognise how important it is to make sure that mothers receive enough help and support with breastfeeding (Step 5), especially in the first few days, as this is the time when most mother will give up. It has been reported that 32% of breastfeeding mothers experienced problems feeding their baby in hospital and that mothers who did not receive help for these problems were more likely to have given up breastfeeding within the first 2 weeks than those who received help (Hamlyn 2002).

Additional research has shown that the mother's experiences in hospital affect breastfeeding continuation. The Infants Feeding Survey reported that the steepest fall

in breastfeeding duration occurs in the first 2 weeks, and particularly in the first 2 days after birth. Approximately one fifth of mothers who started breastfeeding had stopped within 2 weeks and 16% had stopped within 1 week. Mothers of first babies who had initially tried to breastfeed were more likely to have given up breastfeeding by the time they left hospital (15%) than mothers of second or later babies (10%). Mothers who gave up in the first few days were more likely to say that they did not like breastfeeding. Insufficient milk (26%), painful breasts/ nipples (27%) and baby would not suck / rejected breast (35%) were the 3 main reasons mother's breastfed for less than 1 week. Reasons for giving up breastfeeding during the early weeks commonly included baby rejecting the breast and painful nipples (Hamlyn 2002). Effective help and support with breastfeeding from midwives, especially for mothers with no previous breastfeeding experience, in the early days may help reduce the number of mothers who give up breastfeeding before it has been established.

The nature of the sample

In any study it is important to recognise that the composition of the sample studied may affect the results obtained. In this section I discuss the characteristics of the women who participated and the factors relating to labour and delivery that may have affected the outcomes of this study.

Demographic information

The RVI Bedding-in study volunteers were recruited from a convenience sample of expectant mothers who attended the bi-weekly breastfeeding workshops at the RVI from which 30 of the enrolled mothers were selected for inclusion in this study. The advantage of this type of recruitment include that we were able to recruit mothers from an easily available, captive, eligible audience in a shorter period of time. However a possible disadvantage was that these mothers could all have similar demographic backgrounds as it could be argued that a certain 'type' of mother would attend breastfeeding workshops and volunteer for research. Therefore these mothers may not representative of the UK population as a whole but may be representative of the breastfeeding population in Newcastle-Upon-Tyne.

Basic demographic and socio-economic data were collected for all mothers who participated in the research and the results from the Infant Feeding Survey 2000 were used to determine whether the profile of the breastfeeding mothers in England as a whole differ in any way from the breastfeeding mothers who participated and were selected for inclusion in this sub-sample. The Infant Feeding Survey 2000 reported that the highest incidence of breastfeeding were found among 'mothers from higher occupations, with the highest educational levels, aged 30 or over, from ethnic minority backgrounds and are among mothers of first (as oppose to later) babies' (Hamlyn 2002). Therefore it can be said that Mothers in this sample were typical of breastfeeding mothers in the UK on the whole except for the under representation of women from ethnic minority background, although no statistical tests were performed to confirm this due to small sample sizes and lack of comparable data.

Labour information

A statistically significant difference ($p=0.016576$) in total duration of labour was found between the three groups. A preponderance of epidural anaesthesia was observed amongst the women allocated to the bedding-in condition which may in part explain the greater mean labour duration in this group as it has been concluded that if mothers receive medication during labour it increases the chance that their contractions will slow down, stop or cease to be effective (Thorpe 1996).

80% of the bedding-in mothers had complications during delivery including delay in second stage (30%) and foetal distress (20%). 75% of these mothers had received an epidural during labour. Therefore this result supports the argument that drugs during labour impede delivery progress (Thorpe 1996) and increase the chances of complications during delivery (Lieberman 1996).

Half of the mothers allocated to the standalone cot condition received an epidural and subsequently 60% of these mothers left their infant in the standalone cot for the majority of the night and did not switch conditions. The practices of giving a mother analgesics during labour have been shown to interfere with the success of breastfeeding initiation as these drugs can cross the placenta and make the baby unresponsive and unwilling to breastfeed (Righard 1992, Crowell 1994). The

medication would also make infants drowsy (Crowell 1994) and therefore these infants would have slept more and fed less during the first postnatal night so mothers would not feel the need to bring them into bed.

Postnatal information- skin to skin contact and initial breastfeed

The factors which are known to affect breastfeeding initiation success (timing and duration of skin to skin contact and initial breastfeed) are detailed in Table 6. It is important to establish that there are no significant differences across the groups so as to ensure that any differences found in breastfeeding initiation success were as a result of the randomly allocated sleep condition and not due to the practices experienced before filming. However, we must acknowledge that the non-significant Kruskal-Wallis results may be due to the small sample sizes and therefore do not confirm that the groups were the same before the intervention, only that they are not statistically different. In hindsight it may have been more appropriate to carry out the research on a larger sample population but the practical time constraints associated with conducting this research for a Master's degree did not make this possible.

UNICEF BFI, 10 steps to successful breastfeeding, Step 4 states that midwifery staff should 'Help mothers initiate breastfeeding within half an hour of birth' as length of time until mother held baby and length of time until baby was first put to the breast have both been found to affect breastfeeding initiation (De Chateau 1976, 1977 and Lozoff 1977). The Infant Feeding Survey 2000 found that those mothers who held their infant within the first hour of giving birth were more likely to initiate breastfeeding than those who did not hold their baby in the first hour. It also found that delays in feeding were associated with an increased likelihood of stopping breastfeeding in the first 2 weeks. In 2000, 16% of mothers who breastfed immediately had given up by the end of the second week compared with 26% of those, for one reason or another, had not put their baby to the breast for more than 1 hour after birth. (Hamlyn 2002)

UNICEF state that mothers should be able to hold their infant immediately after delivery as early contact makes it more likely that a mother will start to breastfeed and breastfeed for longer. Mother-Infant separation after birth should be avoided as this

leads to mothers being unable to respond to their infants feeding cues and makes it less likely that breastfeeding will be successful. Infants are usually alert and responsive in the first 1-2 hours after birth and should be ready to attach to the breast and feed.

If first contact is delayed for more than 1 hour breastfeeding is less likely to be successful (Righard 1992, Widstrom 1990, De Chateau 1997). No significant differences were found between timing and duration of skin to skin contact and initial breastfeed in the three groups in this study.

Breastfeeding initiation success

UNICEF BFI, 10 steps to successful breastfeeding, Step 6 states that Midwifery staff should 'Give newborn infants no food or drink other than breastmilk, unless medically indicated' furthermore Step 7 states 'Give no artificial teats or pacifiers to breastfeeding infants' as Blomquist (1994) found that supplementary feeding on maternity wards shortened the duration of breastfeeding and prelacteal feeds (artificial feed given before breastfeeding is established) replace colostrum as the baby's earliest feed and interfere with sucking (Righard 1992a)

The Infant Feeding Survey reported that the use of formula in hospital was a strong indicator of mother giving up breastfeeding after leaving hospital. Two fifths (40%) of breastfeeding mothers whose babies had been given a bottle while in hospital had stopped breastfeeding within 2 weeks, compared with one in eight breastfeeding mothers (13%) whose babies had not been given a bottle.

Therefore, factors which may result from poor breastfeeding initiation were monitored. The group which appeared to have the most difficulty with breastfeeding initiation as measured by formula use and breastfeeding on discharge was the bedding-in group, although no statistical tests were performed to confirm this due to the small cell counts. However we can see that the babies who did not establish breastfeeding were those who did not remain in the allocated bed condition. It is also possible that the lack of breastfeeding success for these infants is related to delivery complications that subsequently kept them out of the mother's bed.

Mother's satisfaction (measured by success and ease) with feeding was also recorded as it has been shown that hospital experiences affect duration of breastfeeding (Hamlyn 2002) although no statistically significant differences were found between the three groups.

Summary

This randomised control trial shows that evolutionary biological anthropology can go some way to providing explanations for breastfeeding related behaviours observed between mothers and infants on the first postnatal night and results can be used to help inform practice on the postnatal ward.

Infants are vulnerable for the first year of life as due to the evolutionary conflict between walking upright and brain growth they are born prematurely and require total caregiver dependency (McKenna 1990). An external gestation is required to complete brain growth and in order to do this an infant needs to be kept in close proximity to its mother and to feed frequently. Results from this research revealed that although randomly allocated to 3 conditions, mothers who were separated from their infants were most likely to switch conditions and bring their infants into bed. This suggests that mothers, as well as infants, instinctively know that to increase breastfeeding initiation success it is better to be in close contact.

Infants have been designed to be kept in close contact to their mothers and lactation has been designed to operate most effectively when the infant is close enough to feed frequently (Matthiesen and Uvnas-Moberg 2001; Nissen et al 1995). In this study infants allocated to the bed condition received more feeding attempts than infants allocated to the cot condition. Furthermore, mothers and infants who shared a bed (allocated or choice) had greater feeding success than mothers and infants who were further apart.

Research has shown that infants should not be separated from their mothers in the immediate postnatal period as it may have serious consequences for their health and wellbeing (Lozoff 1983, Hales 1977, Carlsson 1978, O'Connor 1977 and Yamauchi

1990) and even more importantly it may affect breastfeeding initiation success. In addition to the hormonal effects of keeping infants close (oxytocin reflex) examples from traditional societies can be used to argue that it is the extended contact between the mother and her infant within first few days and weeks after birth which impacts on breastfeeding success (Lozoff 1983). In this study despite the fact that many mothers switched conditions there was a significant difference across the three groups in terms of the time infants spent beyond mothers' reach revealing that infants in the cot were at a disadvantage to infants in the bed with regards to breastfeeding initiation.

Hospitals working towards becoming 'Baby Friendly' are developing policies on mother-infant bed-sharing on the post-natal ward (Ward-Platt & Ball 2002) and implementing UNICEF's 10-steps to successful breastfeeding. Step 5 of the 10 steps states that midwives should show mothers how to breastfeed, and how to maintain lactation even if they are separated from their infants (UNICEF 2000). However results from this research reveal that staff spent very little time providing breastfeeding assistance to mothers in any of the groups and there was no significant difference in the frequency with which mothers and babies were checked by staff. This may have consequences for breastfeeding initiation and continuation as mothers who do not use correct positioning and attachment of the baby at the breast may encounter problems (Widstrom 1993, Escott 1989). Therefore midwifery help with initiation of breastfeeding in the hospital is essential (Ferriset al, 1987; Foster et al., 1995; Riva, 1999; Sheehan et al., 2001).

Conclusions

This randomised control trial highlights the importance of prolonged close contact between mother and infant on breastfeeding initiation. Many mothers who were randomly allocated to have their infants in the standalone cot (rooming-in) instinctively brought their infants into bed (bedding-in) and mothers and infants who spent their first postnatal night in close contact initiated breastfeeding more successfully (frequency and duration) than mothers and infants who spent the majority of the night further apart. Additionally no significant difference was found in the amount of midwifery assistance mothers requested or received over the three groups.

Human mothers and infants have evolved to breastfeed and infants are designed to be kept in close contact with their mother for the first year of life (McKenna 1990a). In many cultures it is common practice for mothers to sleep with their infants (Whiting 1964, Barry and Paxson 1971) therefore when mothers and infants are kept in close contact for the majority of the night on the postnatal ward (bedding-in), even without much midwifery assistance, it is not surprising that mothers attempt to and successfully breastfeed their infant more than mothers and infants who are beyond touch (rooming-in). Indeed it would appear that mothers as well as infants instinctively know that increasing close contact may increase breastfeeding success.

Research on the practices of rooming-in (as opposed to separation) have revealed that rooming-in increases breastfeeding initiation success (Yamauchi & Yamauchi 1990) therefore it seems logical to conclude that bedding-in (in the mothers bed) is the next step towards further increasing the breastfeeding initiation success on the postnatal ward and hospital policies should be developed to ensure that mothers are encouraged to do this safely to help meet the UK government target of increasing breastfeeding rates by 2% per year.

Appendix

1

CONSENT FORM**MOTHER-NEWBORN SLEEP STUDY (BEDDING-IN)**

This is to confirm that I have read the information for parents about this study and I am willing to take part.

I have spoken to(one of the research team) who has fully explained the project to me and s/he has given me the opportunity to ask questions.

I understand that I may withdraw from the study at any time, without giving a reason.

INITIAL CONSENT

I give my initial consent to take part in this study and have filled out the study enrolment form. I understand that the research team will notify the hospital of my participation in the study, and hospital staff will alert the research team when I have delivered.

Mother's signature _____ Date _____

PLEASE SEND THIS FORM, WITH THE SIGNATURE FOR INITIAL CONSENT, TO THE RESEARCH TEAM IN THE ENVELOPE PROVIDED. WHEN YOU HAVE HAD YOUR BABY WE WILL BRING IT FOR YOU TO SIGN AGAIN BEFORE FILMING.

CONSENT FOR FILMING

My baby has now been born. I am still willing to participate in the study, and give my consent for filming, and for birth details to be obtained from my medical notes.

Mother's signature _____ Date _____

FINAL CONSENT

I have been given the opportunity to watch the video-tapes made by the research team, and give my consent for them to be used for this study.

Mother's signature _____ Date _____

Researcher's signature _____ Date _____

Baby's name _____ Baby's date of birth _____

Appendix

2

INFORMATION FOR VOLUNTEERS

MOTHER-NEWBORN SLEEP STUDY (BEDDING-IN / ROOMING-IN)

You are invited to take part in a study about how mothers and their infants sleep on the first two nights after birth. Please read this sheet carefully, and let us know if you have any questions, or need more information.

What is the study about? Years ago newborn babies were taken to the hospital nursery at night. Nowadays we know that it is important for newborn babies to be near their mothers (day and night) and hospitals now practice 'bedding-in' (baby by mother's bed-side). Many mothers like to sleep with their new baby, perhaps because it is convenient for breastfeeding, or because it helps them get to know their baby, or because -- after 9 months together-- they don't want to their baby to be on his/her own. Some hospitals are now encouraging 'bedding-in', but we need to know how to make sure babies are safe when they sleep in their mother's hospital bed. We need to make sure babies don't fall out of bed, and find out whether an unusually long and tiring labour, or certain painkillers during labour, might affect the mother's awareness of her baby during sleep. We need to compare mothers and babies who 'bed-in' with some who 'room-in'. This study will help us learn about what happens when mothers and newborns sleep in different ways, and help us understand how to make these first nights good ones.

Who do we need? We need to find mothers who intend to breastfeed their baby, and who would be willing for them and their baby to be videoed during the night on the first two nights after the baby is born. In order to take part mothers must be non-smokers, and mother and baby must both be healthy, and mother must not have received opiate analgesia in labour. If you think you would like to take part we will ask you to sign an initial consent form. This will give us permission to ask the hospital to let us know when your baby has been born. After the birth one of the research team will visit you in the hospital to see if you are still willing to be videoed.

What will it involve? Mothers and babies who take part in the study will be videotaped sleeping in hospital on the first two full nights after the baby has been born. You would be randomly allocated to one of 3 sleeping arrangements: baby in crib by mum's bed, baby in side-car crib attached to mum's bed, or baby in mum's bed with side-car attached. We begin filming when you settle down for the night, and stop filming in the morning. We will put up a small video camera at the end of your bed, and give you a remote control so that you can turn it on and off. The camera works with an infra-red light and can film in the dark, so you can choose whether or not to keep a light on in the room. Using the remote control you will be able to turn the camera off and on whenever you wish. After you have been videoed you will be able to watch your tapes, and if there are any bits you would like to erase you will be able to. When you are happy for us to take the tapes we will ask you to sign a final consent form that will give us permission to use them for the study. If, after filming, you decide you do not want us to use them, you can ask us to destroy them. Tapes will be kept securely for 6 years for analysis and follow-up, then destroyed.

What else do we need to know? We will need to find out some information about your labour and delivery that might affect your sleep or your baby's sleep on the night you are videoed. For instance, did you have a long and tiring labour, or were you given any pain relief that might have affected your sleep. We can collect this information from your medical records. Your signature on the consent form at the time of filming will give us permission to ask the hospital for the information that we need from your records. We will also ask your permission to phone you for a brief follow-up interview at 2, 4, 8 and 16 weeks to find out how your baby is getting on, and about the sleeping arrangements you use at home.

Confidentiality We will release no information about you or your baby that we collect for this study to anyone without your permission. Your names will not appear on the videotapes, which will be identified by codes, and the videos will be stored securely. Anonymous information only will be used for scientific reports. You are welcome to discuss this study with your doctor if you wish, and share this information sheet with him/her. We have obtained ethics approval from Newcastle and North Tyneside Health Authority to carry out this project. Insurance up to £2 million exists to cover injury or any other harm caused by taking part in this study.

Small thank you If you and your baby take part in this study you will receive a £10 gift voucher, you will be signed to a single ward, and (if you would like one) we will make you a tape of clips of your baby's first nights.

You change your mind You do not have to take part in this study if you do not want to, and even if you sign the initial consent form you can change your mind and withdraw at any time. You do not have to give us a reason, and your care will not be affected in any way. Just let one of the research staff know that you no longer wish to take part. Our phone numbers are below. If you have any questions about the study, or if there is anything that you need more information about, please contact us at the phone number or address below.

Project Directors: Dr Helen Ball (Parent-Infant Sleep Lab, Uni Durham) & Dr Martin Ward-Platt (Consultant Paediatrician, RVI).
Research Staff: Ms. Emma Kitching (Project Co-ordinator) & Mr Steve Leech (Research Associate). Telephone (0191) 3340260

Parent-Infant Sleep Lab, Elsworth Building, Queen's Campus, University of Durham, Thornaby, Stockton-on-Tees.

FREEPOST Address: Dr Helen Ball, University of Durham, FREEPOST NEA9209, Stockton on Tees, TS17 6BR

Appendix

3

MOTHER'S NAME _____

STUDY ID CODE RVI-02-_____

STUDY ENROLMENT FORM

MOTHER-NEWBORN SLEEP STUDY (BEDDING-IN)

Contact details

Address _____

Phone _____

Enrolment information

Expected date of delivery _____

Do you smoke? Yes No
Are you taking any medication that affects your sleep? Yes No
If 'yes', please give details _____

Are you enrolled in any other research studies? Yes No
If 'yes' please give details _____

Is this your first baby? Yes No
If 'no', how many babies have you given birth to? _____
Did you sleep with any of your previous babies in hospital? Yes No
If 'yes' please give details _____
Did you sleep with any of your previous babies at home Yes No
If yes, at what ages, and for how long? _____

Do you intend to breastfeed your baby? Yes No
Have you breastfed before? Yes No
If yes, please describe when, and how long for _____

Demographic information

When we write our report from this study we will need to describe the group of people who took part. This is why we need to collect the following statistical information. Please circle, or fill in, the appropriate answer.

Marital status: Married / Living with partner / With partner, living apart / Single, no partner.

Education: Up to age 16 / 16 - 18 / Vocational training / A levels / University / Post-graduate

Family Income: below £5,000 / up to £10,000 / up to £15,000 / up to £20,000 / up to £30,000 / above £30K

Mother's current occupation (or occupation before this pregnancy): _____

Occupation of baby's father: _____

Mother's Age: _____ Age of Baby's father: _____

Mother's Date of Birth: _____

Mother's Ethnicity (please describe): _____

Please complete and return this form, together with the consent form, in the envelope provided.

Appendix

4

RVI Bedding-in/Rooming in project
Medical information taken from patient white / yellow notes

Patient's name:		Study no: RVI/01/	
Admission date: Admission time:			
Delivery date: Time:		Name of baby:	
Date of videoing: Time:		Gender:	
How long between delivery and start of filming:		Gestational age:	

Description of Labour- Labour & Delivery Notes Summary Sheet 1 (White)						
Was labour spontaneous or induced?						
	1st stage Established Labour Onset		2nd stage Full Dilation of Cervix		3rd stage Delivery of Baby	
Start Time						
Duration						
Drugs given (how delivered)	Time	Drug (amount)	Time	Drug (amount)	Time	Drug (amount)

Medical procedures conducted with approx. timing	
Episiotomy/stitches	
Epidural	
Induction	
Forceps	
Ventouse	
Other	

Infant birth details- In Baby Notes by Pediatrician at 2 nd general examination		
Infant birth weight:		
Height (if available):		
Head circumference:		
Apgar score at delivery:	At 1min:	At 5 min:

Complications during delivery	
Mother	Infant

Mother's pre pregnancy details- On Admission Sheet / Antenatal Booking Sum.	
Height:	
Weight:	
Weight gain	
Medication taken by mother (unrelated to pregnancy and birth):	

Other person in attendance:
Timing & duration of skin to skin:
Any other comments:

Mother-Newborn Sleep Study RVI
Initial Interview (after 2nd night of filming)

Study code: RVI-02-_____

Date: _____

Info collected by: _____

Wives on duty night of filming	
After delivery	
When did baby start breastfeeding?	
How long after delivery did baby start breastfeeding?	
First night	
Did feeding go?	
Did you have any difficulties? Was it harder or easier than you anticipated?	
Did you receive enough help and advice for breastfeeding?	
How would you rate the help you received? Not enough, just right, too much	
How helpful did you find the advice you received on a scale of 1 (v bad) to 10 (v good)	
How successful did you feel initiation of breastfeeding was (compared to how you imagined it would be)?	
Did you & your baby sleep?	
How would you rate your quality of sleep on a scale of 1 (v bad) to 10 (v good)?	
How many hours do you think you got?	
How was your overall night-time experience? Terrible -> V. Bad -> Bad -> Fair -> Good -> V. Good -> Excellent	
Were you happy with where your baby slept last night?	
Did you have any problems with the condition?	
Did you move your baby between conditions? If yes, why did you change conditions? If anyone suggest to you changing where your baby slept, who.	
Second night	
Did feeding go?	
Did you have any difficulties? Was it harder or easier than you anticipated?	

<p>do you receive enough help and advice regarding feeding?</p>	
<p>How would you rate the help you received? Not enough, just right, too much</p>	
<p>How helpful did you find the advice you received on a scale of 1 (v bad) to 10 (v good)?</p>	
<p>How successful did you feel initiation of breastfeeding was (compared to how you imagined it would be)?</p>	
<p>Did you & your baby sleep?</p>	
<p>How would you rate your quality of sleep on a scale of 1 (v bad) to 10 (v good)?</p>	
<p>How many hours do you think you got?</p>	
<p>How was your overall night-time experience? Outstanding -> V. Bad -> Bad -> Fair -> Good -> V. Good -> Excellent</p>	
<p>Are you happy with where your baby slept last night?</p>	
<p>Do you have any problems with the situation?</p>	
<p>Do you move your baby between conditions? If yes, why did you change conditions? Has anyone suggest to you changing where your baby slept, who.</p>	

Third night – if applicable

<p>How did feeding go?</p>	
<p>Do you have any difficulties? Is it harder or easier than you anticipated?</p>	
<p>Do you receive enough help and advice regarding feeding?</p>	
<p>How would you rate the help you received? Not enough, just right, too much</p>	
<p>How helpful did you find the advice you received on a scale of 1 (v bad) to 10 (v good)?</p>	
<p>How successful did you feel initiation of breastfeeding was (compared to how you imagined it would be)?</p>	
<p>Did you & your baby sleep?</p>	
<p>How would you rate your quality of sleep on a scale of 1 (v bad) to 10 (v good)?</p>	
<p>How many hours do you think you got?</p>	
<p>How was your overall night-time experience? Outstanding -> V. Bad -> Bad -> Fair -> Good -> V. Good -> Excellent</p>	
<p>Are you happy with where your baby slept last night?</p>	

Did you have any problems with the condition?	
Did you move your baby between conditions? If yes, why did you change conditions? Did anyone suggest to you changing where your baby slept, who.	
Comparing the two nights	
How did feeding on the first night compare to feeding on the second night?	
How did you sleep on the first night compared to the second night?	
How did your baby sleep on the first night compared to the second night?	
Has your baby received anything other than breast milk since delivery? If yes, what?	
Have you been shown how to hand express milk?	
Have you been shown different positions for breastfeeding?	
Has positioning and attachment been discussed with you?	
Have you decided how long do you intend to breast feed for? If yes, how long	

Would you like a video of clips from your baby's first 2 nights? Yes [] No []

Thank-you, we will contact you again in 2 weeks time

Appendix

5

Subjects	Behavioural Classes	Modifier Classes	Behaviour Name	Description	Type	Analysis
Mother Infant	Sleep state		Active awake	The subject is clearly awake and physically active.	State	Duration
			Passive awake	The subject is clearly awake (eyes open) but relatively physically inactive.	State	Duration
			Appears asleep	The subject is physically inactive and appears to be asleep (eyes closed).	State	Duration
			Indertermin8	Although the subject is in sight it is not possible to determine their sleep state.	State	Duration
			Out of sight	The subject is out of sight.	State	Duration
			NO SLEEP DATA	No data is available about sleep state. Most frequently due to cessation of video recording.	State	Duration
Mother Infant	Proximity		Close contact skin to skin	Infant is naked or with little clothing and at least the torso of the infant is touching the bare flesh of the mother.	State	Duration
			Close contact non-skin/skin	At least the torso of the infant is against the mother's body but there is clothing or other material between them.	State	Duration
			Partial contact	A small part of the infant's body is in contact with the mother's body.	State	Duration
			Infants arm length (Non contact)	The infant is not in contact with the mother but is close enough to her that the infant may theoretically reach out and make contact	State	Duration
			Mothers arm length (Non contact)	The infant is not close enough to the mother to reach out and touch her, but they are close enough that the mother could reach out and touch the infant.	State	Duration

	Classes	Classes	Description	Type	Analysis	
			Beyond touch (Non contact)	Mother and infant are not close enough for either party to reach out and touch the other without moving positions.	State	Duration
			Inderterminate1	Although both mother and infant are visible it is not possible to determine their relative proximity.	State	Duration
			NO PROX DATA	No proximity data is available, frequently due to cessation of video recording.	State	Duration
Mother	Events		Present nipple	Mother present nipple to infant	Event	Frequency Latency
			Offer milk / colostrum	Subject presents milk / colostrums to infant	Event	Frequency Latency
			Mum calls nurse	Mother calls midwife via buzzer or verbal communication	Event	Frequency
			NO EVENT DATA	No event data is available. Frequently due to cessation of video recording.	State	Duration
Infant	Feeding		Feeding	Infant is ingesting nutritional substance	State Event	Duration Frequency Bout % of the night
			Not feeding	Infant is not ingesting nutritional substance	State	Duration
			Attempts to feed	Visual or audio cues strongly suggest that the infant is ingesting nutritional substance though actual ingestion cannot be confirmed	State	Duration
			Assumed feed OOS	There are strong behavioural indications that infant ingests nutritional substance around this time period, but this cannot be confirmed by visual/audio	Event	Frequency
			NO FEED DATA	No feed data is available frequently due to cessation of video recording	State	Duration
		Feeding Position	Knee/pillow prop	Mother is generally sitting using her knee or pillow to provide an elevated surface for the infant	State Event	Duration Frequency

	Classes	Classes		Description	Type	Analysis
			Rugby ball	Mother holds infant in an underarm position, securely held by forearm and elbow	State Event	Duration Frequency
			Cradle	Mother holds infant with their tummy to her tummy with one or both arms under the infant providing support	State Event	Duration Frequency
			Cross-cradle	Mother holds infant with arm opposite to the feeding breast and hand supporting head	State Event	Duration Frequency
			Lying down	Mother is on her back or side with infant on same or adjacent sleep surface	State Event	Duration Frequency
			Other	Any other feeding position	State Event	Duration Frequency
			Missing feeding position	Unable to ascertain feeding position.	State Event	Duration Frequency
Midwife	In room	Feeding	Physical help feeding	Nurse is physically assisting the infant's ingestion of nutritional substance	State Event	Duration Frequency
			Verbal help feeding	Nurse is providing help/information directly relating to infants ingestion of nutritional substance	State Event	Duration Frequency
			Not helping feed	Nurse is not assisting in any element of infant's ingestion of nutritional substance	State	Duration
			Missing nurse feeding	Unable to determine whether nurse is helping feed or not.	State	Duration
Infant	Location		Standalone cot	Clear plastic crib on wheeled stand	State	Duration
			Clip on crib	Clear plastic cot with 1 cut away side that attaches to the side of the mother's hospital bed	State	Duration
			Mother's bed	Standard hospital bed provided for the mother	State	Duration
			Other5	Any other location (please insert explanatory note)	State	Duration
			NO LOCATION DATA	No location data is available frequently due to cessation of video recording	State	Duration



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