Occupational therapy in neonatal services and early intervention

Practice guideline supplement

Evidence tables

Second edition

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Children, young people & families

This supplement provides details of the evidence used to formulate the recommendations in the guideline *Occupational therapy in neonatal services and early intervention* (RCOT 2022). Each piece of evidence is summarised in a table, including methodological details, study findings, and limitations. A full reference for each follows the tables. More information on the criteria and methodology of the grading of the evidence can be found in the full practice guideline, Table 10.4.

The full practice guideline is available on the Royal College of Occupational Therapists' website: https://www.rcot.co.uk/practice-resources/rcot-practice-guidelines

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Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Afand et al (2017).	Quasi-experimental clinical trial. Aim: to evaluate the effect of infant massage on anxiety in mothers of preterm infants discharged from the neonatal intensive care unit. Recruitment: mothers whose preterm infants were admitted to NICU in Akbar Abadi teaching centre, Tehran. Inclusion: primiparous subjects with age of 18–40 years, having no mental illness, with preterm delivery at the gestational age of 32–37 weeks; infants were hospitalised for at least 2 days, and having no anomaly. 70 mothers. Iran.	• The State-Trait Anxiety Inventory scale (Spielberger) was completed for mothers in both groups in the morning of the day before discharge. • Experimental group received 8 minutes of massage including 2 standard similar parts (each 4 minutes). • Massage was repeated in 2 parts on the day of discharge, and then state anxiety was re-measured using Spielberger's scale for all mothers. • Control group received no intervention.	• Maternal anxiety levels post-intervention.	• There was a significant difference in the overall mean score of maternal state anxiety between the 2 groups ($p<0.002$), although not in the severity of maternal state anxiety. • In both groups, the mean score of maternal state anxiety was significantly decreased on the day of discharge ($p<0.001$).	Grade C – Low. Downgraded due to: • Low level of evidence as it was a quasi-experimental study. • Researchers and participants were not blinded so significant bias potential. • Confident interval of 80% not 95% or higher. Comments: • Study was completed in Iran so difficult to know all the cultural differences between neonatal care in UK and Iran. • While positive the intervention may reduce maternal anxiety, it's not clear if intervention would have the same effect in the UK.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Allinson et al (2017).	Observational study. Aim: to compare the physiological stress of infants born <30 weeks' gestational age undergoing clustered nursing care versus standardised neurobehavioural assessments to understand if assessments cause additional stress. Recruitment: via tertiary neonatal intensive care unit as part of a larger study, between January 2011 and December 2013. Exclusion: congenital abnormalities known to affect neurobehaviour, medical instability or parents who did not speak English. 34 infants. Australia.	• The General Movements Assessment (GM), the Premie-Neuro Assessment (PN) and the Hammersmith Neonatal Neurological Examination (HNNE) were administered weekly from birth till 32 weeks' gestational age. • Assessments conducted when clustered nursing cares ongoing. • Clustered nursing cares defined as task or procedure necessary for the ongoing care of the infant, performed by either nursing staff, parent or combination. • Assessments and cares were video recorded.	• Heart rate (HR) as beats per minute. • Oxygen saturation at 5-second intervals. • Nasal continuous positive airway pressure (nCPAP) was also recorded, in case it was a confounding factor.	• 143 infants were recruited, resulting in 398 eligible videos. • 34 eligible videos from 34 infants were randomly selected. • 38% were on nCPAP during assessments/care. • Neurobehavioural assessments had lower mean HR compared with cares (95% CI -6.5 to -5.3 beats per minute, p<0.001), even after adjusting for nCPAP and protocol order. • Oxygen saturation was 2.4% higher after adjusting for nCPAP and protocol order (95% CI 2.1 to 2.9, p<0.001). • Heart rate was higher during assessments that included handling (mean difference 5.0 bpm, 95% CI 4.3 to 5.7, p<0.001) and stayed the same when adjusted for nCPAP. • Oxygen saturation was marginally higher during assessment that included handling (mean difference 0.4%, 95% CI 0.0% to 0.8%; p=0.046).	Grade D – Very low Comments: • Limitations include not specifying clustered cares being utilised, unable to determine if second person was available to support care, clustered cares should be avoided, being unable to randomise the order of neurobehavioural assessments and care due to clinical needs taking precedence. • Authors report perinatal characteristics of the cohort were average, and therefore findings should be generalisable. • Physiological stability seemed to be better maintained during assessments than care.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Als et al (2003).	Randomised controlled trial. Aim: to assess neurodevelopmental, medical and parenting effects of individualised developmental care. Inclusion: singleton, <29 weeks' gestational age, <1250g birthweight, mechanical ventilation starting within the first 3 hours after birth and lasting longer than 24 hours in the first 48 hours; alive at 48 hours; at least 1 family member with some English. Exclusion: chromosomal or other major genetic anomalies and congenital infections. 92 infants. First site: 19 control, 18 treatment. Second site: 20 control, 16 treatment. Third site: 8 control, 11 treatment. United States of America.	Control group: standard NICU care. Experimental group: Neonatal Individualised Developmental Care provided by 2 trained health professionals. Provision of NIDCAP (structured individualised environments) with weekly neurobehavioural observations through hospital stay, followed by weekly neurobehavioural reports, which described the infant's behavioural functioning and suggested ways to promote the infant's stability and competence. An infant's behaviours were recorded every 2 minutes for approximately 1 hour during a medical, nursing or parent caregiving activity.	At 2 weeks EDC (expected date of confinement): • Medical: days of endotracheal respiratory support, oxygen therapy, parenteral feeding, simultaneous parenteral and enteral feeding; average daily weight gain; weight, height and head circumference; severity of bronchopulmonary dysplasia and intraventricular haemorrhage; incidence of necrotising enterocolitis; severity of retinopathy of prematurity; discharge age; length of NICU stay; hospital charges. • Developmental: Assessment of Preterm Infants' Behaviour (APIB). • Parent functioning: Parenting Stress Index and Mother's View of the Child (MVC). • 3 NICU environment parameters and 11 caregiving parameters were measured every 6 months for randomly selected infants.	• Medical: experimental group had significantly better results in feeding outcomes; hospital stay/charges; necrotising enterocolitis; and better growth (weight, weight gain, height, and head circumference). • Neurobehavioural (APIB): experimental group achieved significantly different results, including better modulated in terms of autonomic and motor system regulation, better self-regulation, and required less facilitation. • Parent functioning: experimental group mothers perceived their children as better regulated and more gratifying; their own parental competence as greater and other life situations as less stressful (all significant).	Grade A – High. Comments: • No intention to treat analysis. • Brief information on statistical analysis and measures that could inform about precision and treatment effect. • Large number of outcome variables considered makes findings difficult to summarise with any impact. • Site differences affected results as opposed to using a single-centre study.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Asadollahi et al (2016).	Randomised controlled trial. Aim: to compare the effects of field massage and gentle human touch (GHT) on the urine cortisol levels as an indicator of stress in preterm infants. Recruitment: informed consent gained from parents of preterm infants admitted to NICU and then randomly allocated into 3 groups. Inclusion: passing 7 to 10 days from birth, no artificial ventilation, no medical order for intravenous or intramuscular injections, no congenital anomalies, mother willing to cooperate in study, no feeding of infant half an hour before massage. Exclusion: infants discharged from hospital within sixth day of study, critically ill and received severe invasive procedures within 5 days of intervention, non-consent. 84 premature infants. Iran.	• Infants randomly assigned into 3 groups. • First group touched by their mothers 3 times a day (15 mins) for 5 days by GHT technique. • Second group received 15 minutes Field massage with sunflower oil 3 times a day by mothers, for 5 days. • Group 3 received routine care.	• Urine samples collected on first and sixth days after intervention from all infants and analysed for cortisol levels.	• Despite reduced cortisol levels from first to sixth days in Field massage group, there was no statistically significant difference ($p>0.05$). • Percent of changes and ANOVA tests showed no significant difference between Field massage and control group ($p=0.026$).	Grade B – Moderate. Downgraded due to: • Too many variables considered in study, e.g. other medical procedures that the infant may have experienced. • Groups may have had large differences within them regarding different medical status and interventions required that would affect level of cortisol. Comments: • Intervention made clear, but not stated any other interventions taking place or whether mothers still encouraged to touch their babies. • Unsure how much parents knew about intervention before randomisation. • Encourages parental touch.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Askary Kachoosangy et al (2020).	Randomised controlled trial. Aim: to determine the effect of the Creating Opportunities for Parent Empowerment (COPE) program on the perceived maternal parenting self-efficacy of premature parents. Recruitment: neonates admitted to NICUs of 2 hospitals. Inclusion: birthweight between 1000 and 2500g; gestational age under 37 weeks; 5-minute Apgar score of 7 and more; no major abnormalities on brain ultrasound (grade III or IV intraventricular haemorrhage (IVH); absence of congenital anomalies or neuromuscular disorders; hospitalisation in NICU for at least 7 to 30 days. Exclusion: incurable disease, neonatal death during study, no parental consent. 45 preterm neonates: treatment (n=15), supervision (n=15), control group (n=15). Iran.	• Block design, double-blinded trial. • 4-phase educational-behavioural intervention to treatment and supervision group.	• Primary outcome was parental self-efficacy, assessed by the Perceived Maternal Parenting Self-Efficacy inventory. • All measurements performed pre- and post-completion with the valid equipment and by blind assessors.	• COPE mothers reported significantly stronger beliefs regarding their parental role and had more confidence in their ability in caring of neonates compared with control mothers ($p<0.001$).	Grade B – Moderate. Downgraded due to: • Small sample size. Comments: • Supports the role of occupational therapy in providing support and education to ensure parents able to participate. • Emphasises need to consider learning opportunities and delivering parent training packages in hospitals and after discharge. • Results relatable to guideline population.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Aydon et al (2018).	Qualitative – interviews. Aim: to explore the experiences of the NICU through to discharge of parents whose infants were born at 28–32 weeks' gestation age. Recruitment: via neonatal nurses not involved in the care of the infant at 1 hospital. Inclusion: infant born at 28–32 weeks' gestation age. Exclusion: infants born with anomalies or not expected to survive, parents who did not speak English or who were potentially difficult to follow up due to involvement with child and family protection services. 20 sets of parents. Mean maternal age = 29. Mean paternal age = 32. Australia.	• Interviews conducted when infants were 4–6 weeks' old (face-to-face) and roughly 4 weeks post-discharge (online or by telephone). • Interviews conducted with each parent individually by a nurse who did not care for the infant.	• None.	• 25 parents participated in the post-discharge interviews. • Parents were reassured by the professionalism and knowledge of staff, and while the NICU technology could be overwhelming, it was also reassuring. • Parents had mixed feelings about information they received while their infant was in hospital, with some feeling that they had enough, others not enough and still others too much, and information given could be inconsistent. • Post-discharge, many parents were pleased with the information they received prior to taking their infant home. • Many felt the discharge process itself was rushed and stressful. • Parents expressed mixed feelings about having their infants at home, with some anxious about the lack of support and others happy with the autonomy. • Parents felt a checklist showing what their infants had to achieve before discharge would have been helpful. • Parents preferred continuity of care and a confidential way to share feedback on staff or their experience.	Grade B – Moderate. Comments: • Limitations include recruiting from 1 hospital in Australia, no same-sex or single parents participated, and while the researchers did not care for the infants of the families involved, they were still working in the NICU being discussed, which may have affected parents' responses.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Axelin et al (2006)	Randomised crossover trial. Aim: to examine the effectiveness of a method called 'facilitated tucking by parents' (a parent holds the infant in a flexed position) in pain management during endotracheal/pharyngeal suctioning of preterm infants and the parents' perceptions of the method. Inclusion: <37 completed weeks of gestational age at birth, no major congenital anomalies, a need for regular endotracheal/pharyngeal suctioning and no analgesics for 4 hours before the procedure. 20 infants with 1 of their parents (60% mothers). Finland.	• In the 'facilitated tucking by parents', the parent had been taught the procedure in advance. • Facilitated tucking by parents was used during the whole endotracheal suctioning and after that until the infant had calmed down. • In control care, the nurse was allowed to talk to and pat the infant.	• Neonatal Infant Pain Scale (NIPS) score. • Heart rate and oxygen saturation. • Parents completed a questionnaire about their perception of the procedure.	• Facilitated tucking alleviates behavioural pain of preterm infants (NIPS scale) during endotracheal/ pharyngeal suctioning. • This innovation is a feasible, non-pharmacological pain management method which can be utilised during small, painful procedures in preterm infants to avoid adverse effects caused by pharmacological agents. • 95% of parents (19/20) preferred participation in their own infant's pain management during the pharyngeal/endotracheal suctioning compared with passive observation.	Grade A – High. Comments: • The authors suggest lack of long-term effect, which was not measured. • Not possible to blind assessors who recorded pain. Not clear if 1 of the assessors was the lead researcher and if this could have introduced bias. • Parents passively watching the procedure were more stressed – what could have been their thoughts if they had been free to choose to watch or leave?

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Bäcke et al (2020).	Qualitative content analysis of interviews. Aim: to explore parents' experience of closeness and involvement in their infants' care while in the NICU with their newborn undergoing Therapeutic Hypothermia (TH). Recruitment: convenience sampling of Swedish-speaking parents from different birth hospitals over 4 year-period (2013–2016). Parents of 11 surviving infants (8 mothers, 3 fathers). Sweden.	• Therapeutic Hypothermia.	• Parents' experience of infants' care in NICU, undergoing TH.	• All the parents shared the trauma of being both physically and psychologically separated from their infant. • All described a need for information and emotional support, and reported that the NICU staff had influenced the extent to which they as parents had been able to actively participate in the care. • Parents described the wish to be closer to their infant and be more actively involved in their infant's care.	Grade C – Low. Comments: • Sample consisted of parents of infants who were cared for at a single high-tech NICU in Sweden, therefore results can only be considered relevant for similar settings. • Though the interviews were rich in information, the time span of 3–5 years may be seen as too long to clearly remember all details – so time could have been a limitation as well as strength. • Data clearly presented in categories and sub-categories.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Baniasadi and Hosseini (2019).	Quasi-experimental study. Aim: to understand the behavioural response of preterm infants who received massage. Recruitment: via 1 hospital's NICU. Inclusion: birth at 28–34 weeks' gestational age, no congenital anomalies, not having undergone surgery, Apgar score >6 at 5 minutes, and lack of medical condition contraindicating the use of massage. 45 infants. Iran.	• Received massage for 3 × 5-minute periods a day for 5 days using Field massage technique, generally 1 hour after the afternoon feed. • Massage was started the day after enteral feeding began. • Massage was postponed by 1 hour if nursing care meant touching the infant. • Massage was stopped if the infant showed decreased heart rate or oxygen saturation levels, and delivered again when the infant was stable.	• Behavioural state was measured by scales developed by Scafidi et al, which included sleep state, awake state, and fidgeting/crying. • Motor activities were coded as single limb, multiple limb, gross body movements, startles and head turns. • Behavioural distress included mouthing/yawning movements, facial grimaces and clenched fists. • A research assistant recorded 15-second observations over a 10-minute period before and after massage. • Scores were calculated by summing the percentage of time the infant spent in each category or state.	• Massage had a significant effect on sleep state (p=0.003), awake state (p=0.04), fidgeting/crying (p=0.03) and motor activities (p=0.001). There was a greater mean of sleep, less awake state, less fidgeting/crying and fewer motor activities. • No difference found in behaviour distress.	Grade C – Low. Downgraded due to: • Being quasi-experimental, assessors were not blinded to the intervention and significant bias could have been introduced when assessing outcomes. Comments: • A health professional or researcher giving the massage may take away from the role of the parent.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Bartlett (2003).	Cohort study. Aim: to use the Alberta Infant Motor Scale (AIMS) to measure and describe the patterns of motor development in 8-month-old preterm infants. Recruitment: Parents scheduled for follow-up clinic between July 2000 and May 2001 for 8-month visit asked to participate. Inclusion: birthweight <1500g, presence of a complicated neonatal course with clinical findings placing them at high risk for developmental sequelae. Exclusion: infants with known chromosomal or musculo-skeletal malformations or anomalies. 48 parents/60 infants. Average infant age 8.08 months. Male:female ratio = 7:8. Canada.	Describing patterns of motor development.	AIMS carried out by physiotherapists. Neurological examinations carried out by physicians to categorise infants as neurologically normal, suspect or abnormal.	AIMS can be used to confirm neurologically abnormal population are 'not normal' but should not be used to monitor future motor development. It can be used as a discriminative tool for children considered neurologically normal (to confirm normality) or children suspected not to be within normal range of neurodevelopment (to confirm difference from the norm but not to definitively identify them as abnormal) – can be used as a monitoring tool for suspect infants. Supports repeated assessments due to variable development trajectory. It identifies delays in antigravity postural control in prone and standing.	Grade C – Low. Comments: • Questionable reliability and accuracy of physicians' classification of infants – don't know what assessments were used. • Only a small number of neurologically abnormal children assessed (n=5). • This study looks at development at one point in time; researchers suggest surveillance of development over time. • The sample is not representative as it is limited to the high-risk follow-up cohort of 1 hospital.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Benzies et al (2013).	Systematic review. Aim: to review early interventions to identify key parent outcomes, estimate the intervention effects on parent outcomes, categorise the key intervention components associated with maternal outcomes and child outcomes, and apply the results to clinical practice and future research. Inclusion: children born >37 weeks' gestational age; RCT; primary RCT of a preventative intervention started before the child was age 3 years (corrected age); intervention involved mother and/or father; intervention included at least 1 session in the community; published in English. Exclusion: review articles, focused on a subset of preterm infants such as those already diagnosed with a developmental problem, or targeted nursing staff. 18 studies: sample sizes varied from 23 to 985. Countries: Australia, England, Germany, Italy, Netherlands, Norway, Japan, United States of America.	• Interventions supported parents to improve the quality of the infant's environment, which should improve developmental outcomes for preterm infants. • Most delivered an intervention with a curriculum or activities defined in a user's manual. • Some aspect of parenting education was integral to all interventions. The parenting education component was further divided into: (a) Information only (generic or individualised to the family, and may include discussion of information). (b) Guided observation of the infant. (c) Active involvement of parent in learning about their infant and guided reflection or self-evaluation.	• 11 of the 18 included studies reported maternal outcomes of stress, anxiety, depressive symptoms, self-efficacy and sensitivity/responsiveness in interactions with the infant – these were the studies included in the synthesis of parent outcomes. • Stress (7 studies). • Anxiety (4 studies). • Depressive symptoms (4 studies). • Self-efficacy (2 studies). • Maternal sensitivity/ responsiveness (6 studies).	• Positive and clinically meaningful effects were seen for anxiety ($p=0.01$), depressive symptoms ($p<0.0001$) and self-efficacy ($p=0.04$). • Interventions that included psychosocial support resulted in better outcomes for mothers. • 4 interventions had positive effects on maternal anxiety with improved child outcomes. • 3 interventions, 2 with a parent support component, had positive effects on maternal depressive symptoms. • Only 2 studies measured self-efficacy and both found positive effect (though studies had limitations). • Stress was the most commonly measured construct of all maternal psychosocial outcomes. However, the meta-analysis suggests that the interventions reviewed have little effect ($p=0.69$) on stress overall.	Grade A – High. Comments: • Inclusion of published English language only. • Lack of socio-demographically homogeneous samples may have influenced the ability to demonstrate effects of the interventions. • 1 study had challenges recruiting sufficient sample and was underpowered. • The measures used in the studies included in the meta-analyses varied and the results may reflect differences in the construct being measured. • It was not possible to consider the effects of dose, location of the intervention or study quality when conducting the meta-analyses. • Significant heterogeneity among the studies in the synthesis.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Bigsby et al (2011).	Case control study. Aim: to compare quality of movement of infants with prenatal cocaine exposure (PCE) at 4 months and 4 months' corrected age, and that of unexposed infants, using the Posture and Fine Motor Assessment of Infants. Inclusion: mothers >18 years. Exposed group: infants whose mothers used cocaine/opiates during pregnancy, based on self-reporting or finding of cocaine/opiate metabolites in meconium. Comparison group: infants without exposure. 903 participants. Groups matched on age, race and gender. United States of America.	Comparing quality of movement.	• Posture and Fine Motor Assessment of Infants (PFAMI-I). • The infant's medical and maternal characteristics.	• Infants prenatally exposed to cocaine had significantly lower posture scores than infants in the unexposed group (p=0.04). • There was no main effect of cocaine exposure on fine motor scores. • There were independent effects of gestational age at birth on both posture and fine motor scores at 4 months' corrected age. • PFMAI–I revealed a main effect of prenatal cocaine exposure on postural performance and differences in posture and fine motor development among infants born at or before 33 weeks' gestation, even after correcting for prematurity.	Grade B – Moderate. Upgraded due to: • Very robust observational study, with large sample and comprehensive management of all confounding variables, resulting in reliability of study findings to inform practice. Comments: • Characteristics of the sample may limit its generalisability to the UK population. • A potential confounder is the reliability of 'self-report' for drug-abusing mothers. • Likelihood that drug-abusing mothers may engage in other activities that could also affect childhood outcomes.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Bloch-Salisbury et al (2014).	Prospective cohort study. Aim: to detect any beneficial effect of SSC on the infant's cardiorespiratory stability. Inclusion (parents): no smoking, illicit drug and alcohol use throughout pregnancy and gave informed consent. Exclusion (infants): gestation age >35 weeks, congenital malformation, chromosomal disorders, congenital or perinatal infection of the CNS, intraventricular haemorrhage >grade 11 and HIE. 1 additional subject who developed NEC was excluded. 11 infants. 9 mothers and 1 father. Male:female infant ratio = 5:6. United States of America.	Incubator control period (CTL) and SSC periods carried out, with CTL period preceding the SSC condition. After equipment set-up, infants were fed and then there was an inter-feed interval. SSC for as long as the caregiver could manage in a semi-reclined position. CTL and SSC periods were matched for time from feed and duration.	• Interbreath interval (IBI) variance. • Heart rate and heart rate variance. • Apnea incidence. • Skin temperature and skin temperature variance.	Total time caregivers held their infant skin-to-skin ranged between approximately 30 and 160 minutes. There was a trend for less infant movement during SSC than for CTL (p=0.09). During SSC, increased infant IBI variance was associated with increased caregiver heart rate variance (rho 0.764, p=0.006). During SSC infant apnea incidence was also directly related to caregiver heart rate variance (rho 0.677, p=0.022), whereas during CTL infant apnea incidence was not related to caregiver heart rate (p=0.221) nor to its own heart rate variance (p=0.231). Results indicate that during SSC the cardiorespiratory stability of the premature infant was associated with that of their caregiver.	Grade C – Low. Comments: • Small sample size. • Possible bias of staff or caregivers. • Contamination of exposure – interventions, hiccups, technical problems and length of time of SSC. • 9 mothers and 1 father carried out SSC and this is not considered as a variable in results. • Statistical findings are limited in terms of significance. • Perturbations of the caregiver's heartbeat is not well defined and varies, so unable to determine at what point infant respiration became stable/unstable in response to caregiver's heartbeat.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Blomqvist et al (2013).	Descriptive, explorative study – part of a longitudinal study. Aim: to understand factors influencing the time and extent of kangaroo care (KC), who provides it, when and for how much time. Recruitment from October 2008 to September 2010 via 2 NICUs. Inclusion: infants cared for in the NICU from birth to discharge, singleton with no life-threatening illnesses, not yet 3 days old, parents speak Swedish. 104 infants. Sweden.	Kangaroo care with both mothers and fathers.	• Who provided KC. • When initiated. • Factors influencing time of initiation. • Extent to which practised during the infant's hospital stay. • Factors influencing the extent of KC.	Early initiation of SSC has a positive impact on the time parents care for their infants with SSC during a hospital stay.	Grade C – Low. Comments: • Parents participated in SSC to the extent they wanted to, so not able to generalise. • RCT considered unethical in this context.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Boo and Jamli (2007).	Randomised controlled trial. Aim: to compare the weight gain, head growth and breastfeeding rates in VLBW infants with or without exposure to short duration of skin-to-skin care (SSC) while in an NICU. Inclusion: VLBW (<1501g) infants who were in stable condition, nursed in a closed incubator, requiring only nasal continuous positive airway pressure, on inhaled oxygen of FiO2 ≤ 0.3 or a flow rate of <0.2 L/min via nasal prongs, able to tolerate enteral feeds of at least 50% of the required fluid volume, and at least 1 parent willing to participate in SSC should they be randomised to do so. Exclusion: lethal or major malformations, severe perinatal asphyxia with evidence of HIE, transfer to another hospital, abandoned by parents or parental refusal to participate. 126 infants. 64 SSC. 62 controls. Malaysia.	• SSC group parents were trained by a researcher in how to provide SSC. • Parents wore clothing with front-buttons to allow easy exposure. Mothers removed their bras. • During an SSC session, a parent sat in a standard type of sofa next to their infant's incubator/ cot. • They were taught how to hold their infant prone on their naked chest, in a semi-upright position and between their breasts. The infant wore only a nappy and a bonnet, covered by a clean thermal blanket. • If an infant showed signs of searching for feeds during an SSC session, its mother was encouraged to offer her breast. • Parents were encouraged to perform SSC for at least 1 hour daily.	• The body temperature (measured via an abdominal skin probe), heart rate and oxygen saturation of each infant were monitored continuously during these sessions using a cardiorespiratory and pulse oximetry monitor. • Infants were weighed naked using a digital weighing scale each morning before their first feed. • Their head circumferences were measured each week using standard disposable paper tapes. • Breastfeeding.	Infants in the SSC group had better mean weekly increase in head circumference ($p<0.0001$) and higher breastfeeding rate at discharge ($p=0.04$).	Grade A – High. Comments: • Time of onset of SSC intervention and acceptability among parents in the study groups need to be considered when generalising the outcomes to the UK. • Lack of allocation concealment, unblinded intervention, failure to obtain consent from the control group and imbalances at recruitment. • At time of enrolment, overlooked mothers' education levels, infants' receipt of expressed breast milk and post-menstrual age of infants.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Bröring et al (2017).	Systematic review. Aim: to integrate the available evidence on sensory modulation problems in preterm infants <37 weeks' gestational age (GA) and their association with neurocognitive and behavioural problems. Inclusion: empirical studies that report n preterm children born <37 weeks' gestation; assess the construct of sensory processing (disorder in terms of sensory modulation); use a measurement (test, questionnaire, rating scale) to evaluate sensory processing; evaluate a diagnosis of sensory processing disorder; published in an English-language peer-reviewed journal. 18 studies.	• None.	• Assessment of sensory modulation problems including sensory profile, the sensory rating scale and test of sensory functions in infants.	• Evidence in support of sensory modulation problems reported in 14 preterm studies and 2 population-based studies reported significant associations between GA and sensory modulation problems. • Other 2 studies did not find evidence for association. • Risk factors include: GA, birthweight, white and grey matter abnormalities, length of NICU stay and patent ductus arteriosus.	Grade A – High. Limitations include: • Some evidence of bias (e.g. selection) in included papers and limited quality of some of the included studies.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Brown and Pridham (2007).	Longitudinal cohort study. Aim: to explore the contribution of the adaptiveness of early maternal feeding behaviour to the adaptiveness of later infant feeding behaviour, accounting for maternal depressive symptoms and neonatal health. Inclusion: infants were ≥35 weeks' gestation, appropriate weight for gestational age, no major congenital malformations, and no known drug exposure; mothers were ≥17 years and could speak and read English. Both breast- and bottle-feeding mothers were included. Exclusion: infants with an intraventricular bleed of greater than grade II. 37 preterm infants and their mothers. Study ran from time of transfer of infant feeding behaviour responsibility through 4 months post-term. United States of America.	Maternal and infant feeding behaviours.	• The adaptiveness of maternal and infant feeding behaviours (Parent–Child Early Relational Assessment). • Maternal depressive symptoms (CES-D Scale). • Initial assessment at SCN and 4-month follow up at participant's home.	• The study gives support to the idea that early maternal behaviours are related to later infant behaviours. • The study demonstrated that the quality of maternal feeding behaviour as early as prehospital discharge was related to the quality of infant feeding behaviour at 4 months. • Early patterns of mother – infant interaction may be particularly critical, either for the patterns of infant behaviour that are engendered or for the pattern of maternal behaviour that establishes the pattern of infant behaviour or both.	Grade C – Low. Comments: • Small sample size and large degree of homogeneity in sample will have impact on transferability of results. • Infant status measure may not have been sensitive enough. • Use of another instrument besides the PCERA to describe the adaptiveness of infant behaviour would strengthen the study of the relationship of the mother's behaviour with the infant's. • Longer-term follow up would likely strengthen results. • Lack of discussion re potential researcher's bias or confounding factors.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Carbasse et al (2013)	Prospective observational cohort study. Aim: to assess the safety and effectiveness of skin-to-skin care (SSC) with vulnerable very preterm infants (VPIs) in the NICU and the impact of respiratory support and infant birthweight. Convenience sample recruited over 6 months from 1 Level III NICU. Inclusion: born <33 weeks' gestational age and sufficiently clinically stable: fraction of inspired oxygen (FiO_2) <50%, set ventilator respiratory rate <50/min, no major respiratory event requiring medical interventions in prior 12 hours, and if mother accepted initiating SSC and nursing team available to perform and monitor. Exclusion: severe respiratory distress (FiO_2 >50%) or persistent pulmonary hypertension, IVH (≥grade 3), or severe sepsis. 96 infants. Male:female ratio = 11:8. France.	• Observational recording of the first or the first 2 episodes of SSC in all VPIs admitted to the NICU. • VPIs were diapered and held in the prone kangaroo position during SSC. If they had an umbilical catheter in place, they were often placed on their side. • They mostly wore a head cap and were covered by blankets. • Transfer from incubator to the mother was mainly performed with the assistance of 2 nurses using the sitting transfer method. However, some mother–infant dyads performed a standing transfer.	• Physiological parameters – including heart rate, RR, oxygen saturations (SaO_2), axillary temperature, and transcutaneous partial pressure of carbon dioxide ($TcPCO_2$). • Adverse events, e.g. bradycardias and desaturations, were systematically recorded by the nurse caring for the infants. Parameters measured and reported by the nurse caring for the infants at 5 minutes ahead of SSC initiation corresponding to baseline; 5 minutes after initiation; +30 to 60 minutes after initiation; 5 minutes prior to termination; and 5 minutes after the infant reinstallation in the incubator.	• During SSC, there were significant increases in oxygen saturation ($p<0.001$) with decreases in oxygen requirement ($p=0.043$). • Apneas/bradycardias requiring minor intervention occurred in 19 (13%) SSCs, without need for SSC termination. These variations were similar for intubated newborns (18%) as compared with newborns on nasal continuous positive airway pressure (52%) or breathing room air (30%). • Ventilated infants exhibited a significant increase in transcutaneous partial pressure of carbon dioxide ($p=0.01$), although remaining in a clinically acceptable range, and a greater decrease in oxygen requirements during SSC ($p<0.001$) than non-ventilated infants. • Skin-to-skin contact in the NICU seems safe and effective even in ventilated VPIs.	Grade C – Low. Comments: • Potential for selection bias inherent to all observational studies; however, the study population was precisely detailed to allow comparison and to help better define safe criteria for SSC in vulnerable infants. • Possible impact of reporting accuracy on physiological parameters. • The behavioural effect of SSC should also be taken into account in this population. • Potential effects of personal feelings of nurses/parents about SSC.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Cardin (2020).	Qualitative. Aim: to explore concepts of occupational and co-occupational performance in the NICU and provide rich descriptions of parent and infant occupations in this setting. Recruitment: convenience sampling at Level 3 NICU via fliers in NICU entryways. Inclusion: parents (aged 18–40 years) of hospitalised infants admitted to NICU at time of study. 14 parents . Mean age = 29.7 years. Range = 19–37 years. United States of America.	Conversational, semi-structured interview of activity-focused questions, (e.g. 'What activities do you value doing/doing with your child in the NICU?') and supplemented by prompts such as 'Can you explain that further?'	• Parent and infant occupations comparison with organisational matrix.	• 5 themes of occupational engagement emerged: 1) perceiving 'they' versus 'I'; 2) maintaining proximity; 3) expressing emotions, values and beliefs; 4) addressing health issues; 5) analysing.	Grade C – Low. Comments: • Provides additional information on how different opportunities for parenting occupations can be affected by presentation. • Parents signed consent form and were not paid for participation, but no acknowledgement of any ethical approval for study. • Semi-structured interview that used some questions to structure may have been somewhat leading, biasing results.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Caretto et al (2000).	Qualitative. Aim: to understand current trends in parent education on infant feeding in the NICU and the role of occupational therapists in educating parents. Inclusion: the hospital where they were employed had an NICU and the director of neonatology was listed in United States Neonatologists: Directory 1996. 100 neonatologists responded – a 53% response rate (190 questionnaires mailed out). Completed by 38 nurses, 37 occupational therapists, 13 physicians, 5 physical therapists, 4 speech and language pathologists, and 1 nutritionist. United States of America.	Parent and infant feeding trends.	Questionnaire had closed and open-ended questions on: • General information about parent education: teaching methods, programme, information packages, extent of parent participation in care. • The role of occupational therapy in providing parent education in infant care and feeding. • NICU discharge information related to parent education. • Demographic information about hospital.	• All occupational therapist respondents reported that they provide parent education on positioning. • Most commonly reported types of teaching methods were demonstration (98%), discussion (97%), handouts (95%) and hands-on practice (95%). • Rooming-in was reported as a teaching method by 88%. Findings suggest that the occupational therapist's role may not be clearly understood by other NICU professionals.	Grade C – Low. Comments: • No pilot study conducted. • The directory from which the sample was secured may not have been a complete listing of NICUs. • Addressing the questionnaire to the director of neonatology was not a direct method of reaching occupational therapists in the NICU; questionnaires may not have been forwarded appropriately. • With a 47% non-response rate, bias may have been a factor in the study.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Chiarello et al (2006).	Observation. Aim: to compare motor behaviour, playfulness and parent–child interactions during mother–child and father–child play in children with motor delay. Recruitment via early intervention programmes and therapists in southern Pennsylvania and New Jersey. Inclusion: sufficient levels of motor delay as assessed using the gross motor (GM) and fine motor (FM) sections of the Peabody Developmental Motor Scales. 20 children with both mothers and fathers. Children ranged from 7 to 36 months. Mean age 17.7 months. Male:female ratio = 11:9. United States of America.	Parents were given standardised instructions directing them to play with their child. Separate video recordings of mother–infant play and father–infant play, with non-standardised set of toys and in environment chosen by family. 12-minute recordings/sessions, then parent completed Maternal Observation Interview, then 5-minute break, then 12-minute session with second parent.	• Children's playfulness (used Test of Playfulness). • Children's motor behaviours (used Peabody Developmental Motor Scales) – locomotion, movement transitions, reach, grasp/manipulation. • Positions for play – supine, prone, side-lying, sitting, quadruped, kneeling, standing. • Parent handling – holding, carrying the child, use of adaptive positioning equipment, manually positioning the child. • Parent interactive behaviours (used Maternal Observation Interview) – achievement orientation, affect/affirmation, defectiveness, responsiveness.	6/20 children performed differently between parents. 4 improved performance with mothers. 2 improved performance with fathers. Equal motor behaviours performance with both parents. Parents achieved similar levels of achievement orientation, affect/affirmation and directiveness, although mothers more responsive. No statistical difference in children's playfulness.	Grade C – Low. Comments: • Small sample size. • Results based on 1 short interaction with each parent separately, within recorded, structured session which may influence results. • Coders not blind to study purpose. • Convenience sample. • Description of motor behaviours during play was narrowed to occurrence, not quality. • Not able to determine whether the play behaviours studied occur naturally throughout the children's daily routine or how frequently parents interact with their children. • Did not look at how parents play with their child, how siblings influence play or how the environmental context in which the family lives may impact on interactions. • The parents may have had assumptions on the role of physiotherapists and thus played differently with their children.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Cho et al (2016).	Quasi-experimental design. Aim: to analyse the effects of kangaroo care (KC) on physiological measurements, maternal–infant attachment and maternal stress. Inclusion: preterm infants with corrected gestational ages ≥33 weeks who had completed ventilator care, without sepsis and congenital deformity. Exclusion: receiving respiration therapy with a ventilator and E-tube insertion; receiving medicines that could influence sleeping patterns; having a possible risk of infection and skin disease; and having a catheter inserted in the artery and veins or the umbilical cord. 40 infants. Mothers who refused SSC were allocated to the control group; characteristics similar to intervention group. South Korea.	• KC was conducted 3 times per week, with 30-minute duration, for a total of 10 times. • Mothers sterilised their chests, wore a sterile gown and sat in a chair designated for kangaroo care. • Room temperature was maintained at 24°C and noise was minimised. • The mother held her infant to her bare chest in a vertical position, holding the infant's bottom in one hand and letting the other hand touch the infant's head and back, the infant wearing only a nappy and hat. • The mother sat and leaned her infant forward by 60°. The infant's head was turned to one side to touch the ear to the mother's chest. The infant's mouth and nose were faced sideways to ensure open breathing.	• Physiological outcomes – body weight, heart and respiration rates, oxygen saturation and body temperature. • Maternal–Infant Attachment – a modified and corrected maternal–infant attachment measurement tool was used. • Maternal Stress – maternal stress level related to stress factors in the NICU was measured by using a modified version of the Parental Stress Scale.	After kangaroo care, the respiration rate significantly differed between the 2 groups. Physiological functions: • After controlling for body weight, heart rate and respiration rate, respiration rate after kangaroo care significantly differed between the groups (p=0.020), with the RR being more stable in the SSC group. Maternal–infant attachment: • Significantly changed at post-test; experimental group had higher maternal–infant attachment scores than the control group at post-test (p=0.001). Maternal stress: • Differed significantly (p=0.001), with kangaroo care being effective in reducing maternal stress.	Grade B – Moderate. Downgraded due to: • The lack of randomisation when allocating the control and experimental groups. Comments: • This study was conducted with a small sample size of mothers and preterm infants at a single hospital. • Study insufficiently powered. • The natural maturity of preterm infants was not considered. • The researchers couldn't control extraneous variables such as feeding state, IV administration.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Chrupcala et al (2015).	Service evaluation. Aim: to increase the number of neonates who were fed according to cues prior to discharge and potentially decrease length of stay (LOS). Inclusion: surgical and non-surgical neonates of all gestational ages. Exclusion: neonates younger than 32 weeks' gestation, who required intubation, continuous positive airway pressure (CPAP), high-flow nasal cannula (HFNC) or did not have suck or gag reflexes were excluded as potential candidates for infant-driven feeding. 20 infants at baseline, and 150 infants at post-implementation. Large variation in infant presentation, with a variety of medical and surgical diagnoses. United States of America.	Quality improvement approach to increase uptake of practice change. Baseline data collection, designation of Infant-Driven Feeding (IDF) Champions, creation of a multidisciplinary team, creation of electronic health record documentation, initial staff education, monthly team meetings, re-education throughout the duration of the project, and patient–family education.	• Date of birth, date of admission, date of discharge, gestational age, primary diagnosis, date of the first oral feeding, corrected age at time of the first oral feeding, the feeding cues demonstrated and the total length of stay. • The data collected from 20 neonates at baseline served as a comparison when determining the effectiveness of IDF. • Post-implementation data collected over a 10-month period. • The data collection period was divided into 5-month increments to measure the improvement seen in the unit as the practice of IDF became a more integrated part of routine nursing practice.	The baseline data revealed that the mean total LOS for these patients was 43 days with a median LOS of 26.5 days (range, 10–115 days); compared with post-implementation data, the mean total LOS for these patients was 36.4 days with a median LOS of 23.5 days. This finding suggests a decrease in total LOS by 6.63 days. Infants who were able to be fed according to cues achieved full oral feedings faster and were discharged from the hospital sooner.	Grade D – Very low. Downgraded due to: • No objective statistical analysis. • Uneven baseline data group and post-implementation group (20:150). • Specific setting in USA may not be generalisable to UK and wider population. • No male:female ratio identified. • No blinding, so significant potential bias. Comments: • Baseline and post-implementation sample sizes not of equal size – but both comprised a diverse and medically complex patient population not previously studied with regard to the implementation of infant-driven feeding practices.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Cong et al (2012).	Randomised controlled trial. Aim: to compare longer kangaroo care (KC) and shorter KC before and throughout heel stick with incubator care (IC). Recruitment via Level III NICU. Inclusion: infants: 28–32 weeks' gestational age and >14 days old when recruited; in an incubator; NPO or on bolus feeds; mothers: >18 years old and English speaking. Exclusion: known congenital anomalies; severe PVL/IVH who had undergone surgery; receiving sedation, vasopressors or analgesics; mothers used drugs during pregnancy, signs of tissue breakdown or inflammation/ necrosis of either heel. 26 infant–mother dyads. United States of America.	• KC of 15-minute and 30-minute intervals, and standard IC. • 24–72-hour washout period heel stick blood draws that were clinically warranted and ordered by healthcare providers were used as the painful procedures. • KC: the infant was transferred by the researcher from the incubator onto their mother's chest, in a prone and an upright position at an incline of 30 to 40 degrees, and then covered across the back with a blanket and with the mother's cover gown. KC intervention began at baseline (30 minutes before the heel stick) and continued throughout heel warm, heel stick and blood collection, and recovery phases.	• Heart rate variability (HRV) – HRV indices were measured using ANX3.0, a portable, non-invasive, real-time HRV monitor that assesses autonomic nervous responses. • Infant behavioural state was measured using the Anderson Behavioural State Scoring System (ABSS) – 12 categories from deep sleep to hard crying. • Infant's severity of illness measured by the Score for Neonatal Acute Physiology Version II (SNAP-II), a simplified neonatal illness severity score that measures 6 physiological variables during the first 12 hours of life.	Heart rate variability: • HR decrease during heel stick phase occurred in a few infants in all conditions, but more decreases happened in IC than KC30 and KC15 at 60 seconds of heel stick ($p<0.05$). • HR changes were significantly different among 3 conditions during heel stick at 30 seconds ($p<0.05$) and at 120 seconds ($p<0.05$). • Pairwise comparisons showed that infants' HR changes were more in IC condition than in both KC30 and KC15 at 30 seconds ($p<0.05$) and at 120 seconds ($p<0.05$). Infant behavioural state: • During the last 5 minutes of baseline, infants had different quiet sleep time in KC30 (86%), KC15 (76%) and IC (52%) ($p<0.05$). • In both KC30 and KC15 conditions infants spent more time in quiet sleep than in IC ($p<0.05$). During the first 3 minutes of heel stick, the differences in crying were not significant.	Grade B – Moderate. Downgraded due to: • Generalisation of findings is limited by the small sample size and insufficient power. • Extrinsic factors such as variation in stimulus intensity, infant behavioural states and positioning were not considered, and present potential confounders. • KC presented another confounder in that it affected the heel stick length (it was approximately 30 to 60 seconds longer in the incubators). • Data collection and infant behavioural state coding procedure could not be completely blind to KC conditions. Comments: • Intragroup variability was high.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Cong et al (2009).	Prospective randomised crossover trial. Aim: to assess whether kangaroo care (KC) assisted in mediating responses to heel stick procedures. Recruitment via Level II NICU. Inclusion: 30–32 weeks' gestation age, 2–9 postnatal days old, cared for in an incubator and English-speaking mothers. Exclusion: known congenital anomalies, periventricular/ intraventricular haemorrhage (≥ to Grade III), history of surgery, having received sedation, vasopressor or analgesic, exposure to drug abuse during pregnancy, multiples at birth, and showing signs of severe tissue breakdown of either heel as measured by the Neonatal Skin Condition Score. 14 infants. Control group = 7. Treatment group = 7. Male:female ratio = 4:3. United States of America.	• KC for 60 minutes before heel stick procedure. • Group A – received routine incubator care (IC) on the first day of the study and KC on the second day. • Group B – received KC on the first day of the study and routine IC on the second day. • A 24-hour washout period was incorporated into the design for both groups. • Only heel sticks that were clinically warranted and ordered by physicians or neonatal nurse practitioners were used as the painful procedure in the study.	Infant behavioural state, heart rate, heart rate variability (HRV) indices including low-frequency (LF) and high-frequency (HF) power and the LF/HF ratio measured over baseline, heel warming, heel stick and recovery periods in KC and IC conditions.	Infants experienced better balance in response in KC than IC condition as shown by more autonomic stability during heel stick. Overall, HRV differences between KC and IC were that LF was higher in KC at baseline ($p<0.01$) and at heel stick ($p<0.001$), and HF was higher in KC at baseline than in the IC condition ($p<0.05$). The LF/HF ratio had less fluctuation across the periods in KC than in IC condition and was significantly lower during recovery in KC than in IC ($p<0.001$).	Grade A – High. Comments: • Small sample size. • Researchers were not blinded, with the possibility of bias. • The results of this study were not similar to previous studies and the differences could not be explained. • Some babies included had only 1 heel stick procedure. • Results are medium-effect size.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Coughlin et al (2010).	Cohort study. Aim: to develop an infant position assessment tool to standardise best practices in neonatal positioning and evaluate its effectiveness in teaching consistent positioning practice. Recruitment across 6 NICUs. Inclusion: participating in training about developmentally supportive interventions. 6 NICUs. United States of America.	Infant Positioning Assessment Tool (IPAT) used in conjunction with a system-wide education programme on developmentally supportive interventions (including positioning).	IPAT as pre-post measure. Neonatal staff blinded to when the follow-up assessments were being conducted.	• Pre-education assessment: IPAT used on 55 infants. • Post-education assessment: IPAT used on 50 infants. • Significantly higher IPAT scores at post-test within each NICU ($p<0.0001$). • All infants assessed on IPAT at post-test were optimally positioned (IPAT score=12).	Grade D – Very low. Downgraded due to: • Simple, small-scale study – only measuring gross differences in service provision following an education intervention. Comments: • Impact on infant outcomes of positioning practices not discussed. • Lack of detail on methods, participants and outcomes.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Craciunoiu and Holsti (2017).	Systematic review. Aim: to systematically review the validity of neurobehavioural assessments administered to premature infants before term-equivalent age to predict long-term neurodevelopmental outcome. Inclusion: initial testing done prior to term-equivalent age. Exclusion: non-peer-reviewed articles or articles not published in English. 5 assessments and 11 studies.	• Studies investigated the Neonatal Behavioural Assessment Scale (NBAS), Test of Infant Motor Performance (TIMP), General Movements (GMs), Neurobehavioural Assessment of the Preterm Infant (NAPI) and the Neonatal Oral Motor Assessment Scale (NOMAS).	• Methodological quality of studies was assessed using the Consensus-based Standards for Selection of Measurement Instruments checklist.	• 7 studies were rated good, 3 fair and 1 excellent. • Evidence suggests the GMs and TIMP may have predictability, with high to moderate specificity. • The NBAS, NAPI and NOMAS had low to moderate specificity.	Grade A – High. Comments: • Limitations include only 1 small study assessing NOMAS and large age ranges of assessed infants, and possibility of selection bias due to only 1 person selecting, extracting and analysing the data and only English-language studies being included. • Common issues with the quality of the studies included lack of reliability testing, blinding of assessors, and narrowly defined gestational age blocks. • Authors state it is important to consider that some assessments required infant handling during assessment, and how that may affect the infant.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Crowle et al (2015).	Prospective cohort study. Aim: to see if the General Movements (GM) assessment could identify common risk profiles in the writhing age for infants who have had major surgery. Recruitment via a tertiary surgical unit, 2012–2014. Inclusion: surgery within first 30 days of life, eligible for follow up in specific clinic. Exclusion: known chromosomal abnormality or childhood neurological disorder with a known course of lifelong disability, e.g. spina bifida, or would receive follow up at another hospital. 170 infants. Male:female ratio = 3:2. Born at mean age 38 weeks' gestational age. 49% had major cardiac and 51% had non-cardiac surgery within the first 90 days of life. Australia.	A General Movements (GM) assessment was conducted at term following major surgery, completed by 3 assessors trained and certified by GM Trust. Assessors were blinded to type of surgery, although there would have been visual clues such as presence of stoma bags or surgical scars that may have reduced the effectiveness of blinding. Infants were dressed in minimal clothing, and intravenous lines were adjusted to allow free movement of the limbs. Infants were assessed only when they were considered to be stable and not on respiratory support or sedatives.	The writhing movements for all 170 infants and the amount of abnormal movement seen in this population using a GM assessment.	The most common profile was poor repertoire (47%). 38 per cent had normal writhing movements and 8% had cramped synchronised movements, which is the highest category for cerebral palsy. No significant difference between cardiac and non-cardiac surgical groups or in gestational ages or birthweights. Not statistically significant but the odds of having an abnormal GM result increased by 3% every day after surgery. The authors attributed this to the length of time needed before the infant was stable and well enough for GM assessment.	Grade D – Very low. Downgraded due to: • Used the writhing movements which are a poor predictor and did not do serial assessments. • Although a proportion showed abnormal writhing movements, the results cannot be used to predict later function and many may improve with time. Comments: • Used single centre as a convenience sample. • Excluded infants born before 29 weeks' GA. • Incomplete blinding due to presence of stomas, scars etc. • Only 1 GM assessment per infant; recommendation is that 2 are taken.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Crozier et al (2016).	Cohort study. Aim: to examine the prevalence and type of sensory processing differences in children born preterm and to understand the risk factors for atypical sensory processing difficulties. Inclusion: gestational age <25 weeks and birthweight <800g, Grade 4 IVH, PVL, severe retinopathy, home O_2 or children participating in funded research studies, and parent could complete questionnaire. 160 children assessed at a follow-up clinic at 4.5 years of age. Male:female ratio = 51:49. Canada.	Examining sensory processing differences and difficulties.	Short Sensory Profile – 38-item validated caregiver-completed questionnaire. Designed to measure sensory processing difficulties.	Half of the children presented with atypical sensory processing patterns (46%). Apgar scores (p=0.03) and days spent in the NICU (p=0.02) were independently associated with atypical sensory processing. More than 40% displayed greater under-responsiveness or sensory seeking (high threshold). One-third displayed visual/auditory, taste/smell, movement and tactile sensitivity (low threshold).	Grade C – Low. Comments: • Did not account for all confounding factors, e.g. procedural pain. • Did not account for any therapy interventions received during time span before assessment. • Did not complete separate analysis for children who scored in probable versus definite ranges. • Data did not account for readmissions. • Measure was limited to parent report. • Prenatal and socioeconomic risk factors were not collected.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Cunningham et al (2018).	Systematic review. Aim: to understand if kangaroo care affects the weight of preterm or low birthweight infants in a neonatal unit. Inclusion: studies published in English, quantitative methodology, measured kangaroo care's effect on weight. 17 studies. 10 RCTs. 7 quantitative methodology. Studies took place in India (4), Kenya (1), Australia (1), USA (1), Malaysia (1), Ethiopia, Indonesia and Mexico (1), Iran (2), Zimbabwe (1), Egypt (2), Korea (2), Brazil (1).	• All studies included low birthweight infants who may or may not been born preterm. • 15 studies stipulated infants needed to be medically stable. • Total sample size was 2,487. Largest sample size was 985 and smallest was 20. • All had an experimental group and a control group. The experimental group received kangaroo care while the control group received conventional mother care or traditional holding care.	• Primary outcome was weight of infant. • Secondary outcome was breastfeeding.	• 6 RCTs and 4 quantitative studies reported significant weight gain among the intervention group. • 3 RCTs and 2 quantitative studies reported weight gain among the intervention group but this was not significant. • 1 RCT reported no difference between groups. • 1 quantitative study reported significant weight gain in the control group. • Meta-analysis of these RCTs shows a statistical significance between the intervention and control groups ($p<0.00001$), indicating that kangaroo care promoted weight gain. • Breastfeeding outcomes among RCTs: 5 showed increased breastfeeding; 1 showed the intervention group began breastfeeding earlier; others did not report differences of statistical significance. • 1 quantitative study reported a significantly higher rate of breastfeeding among the intervention group.	Grade A – Very high. Comments: • Limitations include differing inclusion and exclusion criteria among studies, which may have influenced results. • Authors suggest more research is needed into the number of hours per day of kangaroo care necessary to be effective.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ding et al (2019).	Systematic review. Aim: to systematically review English and Chinese randomised controlled trials (RCTs) related to the effects of family-centred care interventions on preterm infants' and parental outcomes in NICUs and conduct meta-analysis of the identified RCTs. Inclusion: only randomised controlled trials, preterm infants ≤37 weeks' gestational age and parents. Australia.	19 studies (10 from English and 9 from Chinese databases) were included; meta-analysis included 15 studies (7 English and 8 Chinese RCTs).	• Infant and parent clinical outcomes. • Included studies were assessed for risk of bias using Cochrane Manual 5.1.0. • Meta-analyses used mean differences (MDs), standardised mean differences (SMDs) or odds ratio (OR), followed by 95% confidence interval (CI). • Heterogeneity was tested with Cochran's Q chi-squared test, tau-squared test and inconsistency index.	• Meta-analysis showed significant improvements in weight gain (7 studies: MD 4.57; 95% CI 0.1–0.52; p<0.001; I^2=94%). • Readmission (3 studies: OR 0.23; 95% CI 0.10–0.52; p<0.001; I^2=0%). • Parent satisfaction (5 studies: OR 11.20; 95% CI 4.76–26.34; p<0.001; I^2=0%). • Skills of parents (4 studies: SMD 2.57; 95% CI 2.19–2.96; p<0.001; I^2=53%). • Knowledge of parents (4 studies: SMD 2.74; 95% CI 2.47–3.00; p<0.001; I^2=0%). • Parental anxiety at follow up (3 studies: SMD −0.19; 95% CI −0.28 to −0.09; p<0.001; I^2=0%). • Parent depression at follow up (2 studies: SMD 0.37; 95% CI −0.63 to −0.12; p=0.004; I^2=44%).	Grade A – High. Comments: • The findings suggest that parenting interventions implemented by healthcare professionals have positive effects on motor skills.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Dol et al (2017).	Systematic review. Aim: to examine the effect of ehealth interventions used in neonatal intensive care units (NICUs) on parent-related and infant outcomes. Inclusion: studies that included parents or primary caregivers of infants requiring care in NICU; evaluated any ehealth interventions including communication (web-based platforms, mobile apps, video conferencing, web cameras, push technology, SMS, text messaging); or combination of both education/ communication; experimental and epidemiological study designs, randomised controlled trials, non-randomised controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case-control studies, and analytical cross sectional studies. 8 studies included in review. Canada.	• Considered studies that evaluated any ehealth interventions in neonatal intensive care units, including education (e.g. web-based platforms, mobile applications); communication (e.g. videos, SMS or text messaging) or a combination of both. Comparators included no ehealth interventions and/or standard care.	• This review considered studies that included parent-related outcomes (use and acceptance, stress/anxiety, confidence, financial impact, satisfaction and technical issues) and neonatal outcomes (length of stay, postmenstrual age at discharge, parental presence and visits).	• Majority of studies were low to very low quality. • Study design and type of ehealth technology examined varied greatly. • Primary findings suggest parent acceptance and use of ehealth interventions, but unclear impact on neonatal outcomes, particularly on length of stay. • Due to variation in interventions, meta-analysis not possible, so not able to determine statistical differences across outcomes.	Grade A – High. Comments: • Heterogeneity across studies precluded meta-analysis, but consistent trends across all studies examining parental acceptance of ehealth interventions suggest that parents are willing to accept interventions as part of their NICU care, so strong justification for further study. • Results cannot be applied to local population. • Several studies had small sample sizes, which limited generalisability and sufficient power to draw conclusions.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Dudek-Shriber (2004).	Cohort study. Aim: to determine the occurrence, level and frequency of stress experienced by parents, parent/ infant characteristics that result in different stress scores, and the influence of infant and parent characteristics predicting stress. Recruitment via single NICU in an urban area. Inclusion: NICU stay >7 days. 181 parents. Most parents white and married. United States of America.	Parental stress.	Parent stress measured on 4 subscales of Parental Stressor Scale (PSS):NICU: • The sights and sounds of the unit. • The appearance and behaviours of the infant. • The impact on the parents' role and their relationship with their babies. • The parents' relationship and communication with the staff.	Results from 162 parents. Gestational age was significant in relation to the stress occurrence score on the Baby Looks and Behaves subscale (p=0.002). Parents of infants less than 28 weeks' gestational age obtained significantly higher stress occurrence scores than parents whose infants were in the 28–36-week range. Parents of infants less than 28 weeks' gestation also experienced a significantly higher overall stress score on this subscale. Scores measuring a feeling of general stress were highest on the PSS:NICU, suggesting that the stress experienced by parents may often be diffuse, especially for parents of a premature baby with a respiratory disorder and longer length of stay. The most stressful aspect is an altered parent role and relationship with their baby. This alteration is particularly stressful for mothers, younger parents, and parents of infants with a cardiovascular diagnosis.	Grade C – Low. Comments: • Non-random convenience sample from 1 hospital and geographic location. • Parents assured of complete confidentiality, but it may have been difficult for them to accurately rate their stress because their infant was receiving care in the NICU (risk of censure). • Author reports that careful interpretation of the results is required, because each NICU environment has its own unique set of circumstances that can potentially contribute to the parental stress.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Duncan et al (2020).	Prospective multi-centre cohort study. Aim: to determine associations between hand function at age 18–22 months and scores on the Movement Assessment Battery for Children (MABC) at 6–7 years of age in extremely preterm children. Recruitment: via 15 Neonatal Research Network centres between May 2005 and February 2009. Inclusion: enrolment in the support Neuroimaging and Neurodevelopment Outcomes (NEURO) study, had complete hand function assessments at the 18–22 month neuromotor examination, and completed the Manual Dexterity Subtest of the MABC at the 6–7-year visit. 313 children. United States of America.	• None.	• Pincer and grasp capacity, exaggerated hand preference and ability to perform bimanual functions were assessed using subsections of the standardised Neonatal Research Network (NRN) neuromotor examination at 18–22 months' corrected age. • MABC used to characterise motor and coordination impairments at age 6–7.	• Children with early hand function deficits were more likely to have definite deficits at age 6–7 in MABC subtests and had lower mean scores in Manual Dexterity (p=0.006), Balance (p=0.035) and Total Test (p=0.039). • After controlling for confounding variables, children with early hand function deficits were nearly 3 times more likely to have lower MABC subtest scores at 6–7 years (2.78, 1.36–5.68 at 95% confidence interval, p=0.005).	Grade B – Moderate. Upgraded due to: • Very thorough observational study using standardised assessments. Comments: • Limitations include the MABC manual dexterity test focusing on visuomotor coordination and not visual-spatial integration, the NRN neuromotor examination does not have published psychometric properties, and unknown bias from drop-out and exclusion of 7% of children whose impairment precluded conducting the MABC. • Highlights importance of assessing hand function at 18–22 months for predicting outcomes of school readiness.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Dür et al (2018).	Qualitative. Aim: to explore meaningful activities of parents of very low birthweight (VLBW) preterm infants. Recruitment: parents of VLBW preterm infants treated at Division of Neonatology, Paediatric Intensive Care and Neuropaediatrics of the Medical University of Vienna. Inclusion: being a parent of an infant born alive prior to complete 37 weeks of gestation and with VLBW (≤1.5g); without a history of psychiatric and/or neuromotor disease; with sufficient German reading/speaking skills; participate within 6 months after the discharge of their VLBW preterm infant(s). Exclusion: death of preterm infant; insufficient German reading/ speaking; proven psychiatric/ neuromotor disease. 36 parents. Austria.	• Focus group interviews led by a moderator experienced in focus group interviews. • 3–5 participants per focus group. • Participants asked to talk about their experiences related to their activities. They were encouraged to describe and discuss any experience and diverse opinions. • Followed an interview guide containing topics such as activities of daily living, meaning of activities before and after preterm birth and maintenance of meaningful activities.	• Phenomenological analysis exploring meaningful activities of parents of VLBW preterm infants.	• Parents reported that the meaning of certain activities changed due to preterm birth. • Meaningful activities, like bathing the baby and gardening, could foster a transition from a feeling of parental immaturity to a feeling of maturity, following healthcare instructions to possessing healthcare skills, and a functioning-only state to a balance of activities.	Grade B – Moderate. Upgraded due to: • Rigorous and thorough qualitative study with a potential large impact on OT input on a neonatal unit to add to the perspective of OT intervention for parents from a mental health perspective, support parent wellbeing, personal and co-occupations.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
El-Dib et al (2011).	Cohort study. Aim: to assess the infants at term-equivalent age using the NICU Network Neurobehavioral Scale (NNNS) and then again at 18 months' corrected age using the Bayley Scales of Infant Development (BSID-II) to see if there is any correlation of abnormal NNNS score at term with a low Mental Developmental Index (MDI) or Psychomotor Developmental Index at 18 months. Recruitment via an NICU from February 2006 to October 2008. Inclusion: ≤34 weeks' GA, <1500g at birth. Exclusion: major congenital abnormality. 67 infants, 41 examined at 18 months' corrected age. Male:female ratio = 3:2. Mean gestational age = 28.3 weeks. United States of America.	Correlation of assessment scales and development progress.	• Scores at term age on NNNS and scores at 18 months' corrected age on the BSID-II to test the predictive value of the NNNS for later neurodevelopmental outcome. • Infants were evaluated with NNNS at term-equivalent and 12 summary scores were assigned. • Infants who had 2 or more NNNS summary scores that were 2 standard deviations beyond the mean of the study group were categorised as having abnormal NNNS. • Mental Developmental Index (MDI) and Psychomotor Developmental Index (PDI) of BSID-II were determined at 18 months' corrected age.	More infants with abnormal NNNS had significant neurodevelopmental delay at 18 months' CA compared with those with NNNS within normal range, but this difference was not statistically different (50% vs 31%, p=0.38). Lower MDI was associated with poorer behavioural regulation and more non-optimal reflexes. For the PDI a significant model also emerged. Lower PDI was associated with poorer behavioural regulation, more non-optimal reflexes, increased hypertonicity and higher need for handling strategies to maintain alert state (p=0.002).	Grade C – Low. Comments: • Small study. • Used published norms rather than a cohort from within the same hospital setting. • Unable to start assessment in sleep for nearly 70% of the infants. • Variable initial state of examined infants (proper administration of the NNNS items is dependent on the presence of proper state). • A specific appointment may not match the feeding schedule of the infant, which affected results.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Elsagh et al (2019).	Randomised controlled trial. Aim: to determine the effects of neonatal massage with prone positioning in preterm infants on heart rate (HR) and oxygen saturation (SaO_2) status. Recruitment: hospitalised infants in neonatal intensive care units (NICU) across selected hospitals of Alborz University of Medical Sciences in Karaj, Iran. Inclusion: conscious infants, 34–37 weeks of gestational age, weight over 1500g, being breastfed, the need for at least 1 week hospitalisation, primary diagnosis of respiratory distress, being dependent to O_2 with Oxihood (after winning O_2, the SaO_2 drop under 85%), no involvement in congenital cardiac diseases and their respiratory complications, no active haemorrhage, least level of SaO_2 of 89%, no contraindications for touch, no dermal complications, no mother's addiction to cigarette and alcohol, no paralysis in the limbs, no congenital major abnormalities and asphyxia. Exclusion: infants' unstable body temperature, blood and blood products transfusion, an indication for reintubation, involving pneumothorax or chest tube, and mother's lack of cooperation or their exaggerated anxiety and infants' apnoea during procedure stopping intervention. 75 preterm infants (33–37 weeks). Iran.	• Infants were randomly assigned (via lotto card) to 1 of 3 groups: prone position, massage or a control group. • Infants in the prone position group were laid in this position for 1 hour. In the massage group, the infant was massaged for 10–15 minutes. • The intervention (prone position or massage) was administrated for 5 straight days. • All stages were recorded by a handy camera and then coded by someone blind to group assignment.	• The repeated measure analysis of variance (ANOVA) test was performed to evaluate and compare the effect of interventions. p value less than 0.05 was considered as statistical significance. • HR and O_2 Sa recordings.	• The Repeated Measure two-way Analysis of Variance (RMANOVA) result showed a significant difference in HR and SaO_2 in different time points among control, position and massage groups with RMANOVA ($F_{10,360}=10.376$, $p<0.001$). • HR values were reduced and SaO_2 values were increased in intervention groups with RMANOVA ($F_{5,360}=2.323$, $p<0.001$). • Results showed that massage and prone positions equally led to the reduction of HR and increase of SaO_2 compared to control group.	Grade D – Very low. Downgraded due to: • Study methodology could allow for bias. • Findings may not be applied in a UK setting and not in line with current safe sleep practices in the UK.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Evans et al (2014).	Systematic review. Aim: to systematically review the efficacy of parenting interventions in improving the quality of the relationships between mothers and preterm infants. Inclusion: <37 weeks' gestational age, RCTs or quasi-RCT, no congenital abnormalities, studies using parenting interventions or measuring mother/infant attachment/relationship, mother/infant relationship data, standardised mother/preterm outcome measures, in English. Exclusion: parenting interventions not measuring attachment, non-randomised studies, no control group, or without standard deviations. 14 RCTs included (countries not specified).	Parenting interventions focusing on improving the mother–infant relationship: Mother–Infant Transaction Program (MITP), State modulation, Nursing Systems Toward Effective Parenting-Preterm (NSTEP-P), Infant Behavioral Assessment Intervention Program (IBAIP), guided participation, kangaroo holding, traditional holding and individualised family-based intervention.	• Efficacy of parenting interventions in improving relationship outcomes. • To identify at the post-intervention assessment if delivery location/context and intensity/duration or delivery mode determined the effectiveness of the intervention.	The most effective interventions were very similar in intensity and duration of sessions: • Guided participation (7.5–10 hours over 8 weeks). • Kangaroo holding (4.5–9 hours from hospital stay to 3 months post-discharge). • Individualised family-based intervention (4.5 hours during the hospital stay). • State modulation (9 home visits till 5 months of age). Outcome heterogeneity did not allow the comparison of results of the interventions trialled.	Grade A – High. Comments: • Some small sample sizes. • Changes to intended delivery mode of intervention. • Uneven distribution of neurological impairment in control/intervention. • Randomisation bias. • Lack of comparison of outcome measures used in the selected RCTs.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ferber and Makhoul (2008).	Randomised controlled trial. Aim: to examine the effect of kangaroo care on preterm infants undergoing a painful procedure. Recruitment via 1 large medical centre. Inclusion: gestational age 28–34 weeks at birth, age 5–10 days at onset of study with a weight range of 1000–2000g at birth. Exclusion: fetal distress, birth via Caesarean section, foetuses with estimated weights <10th percentile for gestational age, congenital anomalies, neurological impairment, age <5 days, infant unstable or not weaned from ventilator and parental nutrition only. 30 infant–mother dyads. Israel.	• 4 conditions: blood test stick (BT) or without the blood test stick; (W) procedure, either during kangaroo care (K) or during standard within-crib care (C). • Each was observed in 4 separate sessions: baseline session – 10 minutes; intervention (BT or W) – 2 minutes; post-test – 10 minutes; and follow up – 20 minutes, in crib (starting 1 hour after treatment). • All infants were observed 4 times within 10 days. KC intervention: • Infants were undressed and placed on the mother's chest in a flexed position with skin-to-skin contact while both were covered lightly by blankets. Mothers sat in an armchair in a silent and semi-dark corner of the NICU, with a temperature of 22–23°C.	• Neurobehavioural assessment – naturalistic observation method was adopted from the Newborn Individualized Developmental Care and Assessment Program (NIDCAP), with scoring adapted by the study authors – recording sheet of 74 behavioural items. • Observations were carried out by 2 trained researchers who had established inter-rater reliability of 98%.	• The infant's pain reaction while being held in K is different in quality and quantity from C. • During the BT+K session, there was a decrease in motor disorganisation and extension movements and an increase in attention signs, both negative and positive. • Significant neurobehavioural changes were sustained in the follow-up period after K in comparison with the within-crib care intervention sessions. • K, as compared with within-crib condition, led to a decrease in stressful neurobehavioural signs after BT procedures. • Higher heart rates in K sessions.	Grade A – High. Comments: • Demographics (and regressions) re infant characteristics not reported in detail. There is a brief reference to suggest that some control for infant gestational age was conducted without impacting the result trends. • Given that these were very young infants, it could be that 'age' difference was not considered a significant factor.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Fewell and Claussen (2000).	Cohort study. Aim: to use developmental milestone data gathered in context of a larger investigation to report developmental fine and gross motor trajectories over the first 2 years of life, trying to identify whether cocaine has a short-term/ long-term harmful effect on motor skills. Recruited from local hospitals, substance abuse. Inclusion criteria: infants aged 6–24 months, prenatally identified as being exposed to cocaine at birth or in first 6 months of life, had to have complete data set of assessments at the 4 age periods. Exclusion criteria: significant physical, neurological or medical problems which led to them not being included in other programmes. 73 children. Mean birthweight 2881g. Mean gestational age 38.3 weeks. Male:female ratio = 47:53. Majority African-American. United States of America.	Intervention was not examined in this study; however, it was reported that all children were receiving some degree of developmental intervention (3–25 hours per week).	Gross and fine motor skills using Peabody developmental assessment. Assessment at: 6, 12, 18 and 24 months.	Fine and gross motor skill scores were below normative scores. A main effect for age was scores decreasing as children increased in age (p=0.001). Scores were different from one another (gross and fine motor) at each testing age. Indication that fine motor quotient scores decreased more than the comparable gross motor scores. T-tests showed significant differences between the 2 skill types: fine motor skills were higher at the first 2 testing periods and lower at the last 2 periods.	Grade C – Low. Comments: • Short time period – don't know whether the trend continues. • Too many variables: parenting, lifestyle, other drugs. • It supports other evidence, but needs a more rigorous approach, particularly now the prevalence of neonatal abstinence syndrome has increased so dramatically. • Outcome measure used was standardised in the 1970s, therefore relevance 40 years later is questionable. • Only 1 measure used, therefore result could be related to this rather than cocaine exposure.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Flacking and Dykes (2013).	Ethnography. Aim: to explore parents' practices and experiences of feeding their preterm infant, particularly in relation to the environment. Recruitment via 4 NICUs with strategy of maximum variation and purposeful sampling. Inclusion: baby born before 37 weeks' gestational age. Exclusion: mothers and fathers who had temporary or long-term medical and mental complications, did not speak English or Swedish and who did not want to participate. 52 mothers, 19 fathers and 102 staff were observed and interviewed. Swedish babies' mean birthweight = 1735g and LOS was 44 days on average. English babies' mean birthweight = 1825g and LOS was 46 days on average. Sweden and UK.	• NICU A (Sweden): practised family-centred couplet care where the parents are never separated from their baby and from very early the family have their own rooms and the baby stays in with them with wireless monitoring. • NICU B (Sweden) and NICU C (England): occasionally have beds for parents by the incubators, there are reclining chairs or cots by most incubators and have designated rooms for parents. • NICU D (England): few comfortable chairs and only 4 parent rooms that are allocated for the 24 or 48 hours pre-discharge only.	In-depth exploration of the impact of place and space on parents' experiences and practices related to feeding their preterm babies on the NICU. Eleven months of participant observation of activities on the NICUs with particular reference to interactions between NICU staff, mothers, fathers and babies related to infant feeding. Observations were made during day and night shifts over a period of 3 months in Sweden (May–July 2009), 6 months in England (Sept 2009–Feb 2010) and 2 further months in Sweden (March– April 2010).	• The womb (available in NICU A) – a place where parents and their baby were together as an absolute entity and where no interruption of physical closeness had taken place after birth; the family moved to the 'womb' straight after birth. Parents' complete ownership of the room was taken for granted by staff and parents. • The hotel room (some in NICU B and C, with variable availability) – a room that mothers themselves asked for or were offered for longer periods. Large variations in policies on babies staying in the parents' room with regard to the baby's medical state. • The safe corner – a private space with a chair identified as the mother's and never removed. • The musical chair (NICU D) – a space with too few facilities. No reclining chairs and placement of chairs and screens made it difficult for parents to use them.	Grade C – Low. Upgraded due to: • This study was well executed and provides very valuable information and insights that are relevant to occupational therapy practice. Comments: • First author had worked in neonatal care for more than 10 years and was a native Swede, bringing some familiarity and preconceptions. • Research was conducted in an overt manner in which the first author used a moderate level of participation which may have influenced the behaviour of the people who were studied (although habituation was observed over time).

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Franck et al (2012).	Qualitative research part of an RCT. Aim: to understand parents' perceptions and feelings of having participated in an RCT and to further refine the conceptual representation of the parental experience of involvement in infant pain management (or lack thereof) and the influencing factors. Recruitment via 4 regional NICUs. 169 respondents. 84 from intervention group in original RCT. 85 from control group in original RCT. UK.	Parental perceptions and pain management.	Written free-text comments in response to open-ended questions on the Parent Attitudes about Neonatal Pain (PAiN) survey.	• Parents expressed strong preferences for more information about all aspects of infant pain care, improved timing of information-giving and involvement opportunities. • They further desired increased sensitivity and consistency in infant caregiving and increased use of specific pain-relieving interventions by NICU staff. • Contextual factors such as parents' emotional state and the communication and support from NICU staff influenced parents' ability to achieve their desired level of involvement.	Grade C – Low. Comments: • Richer and more detailed analysis could have occurred with different recruitment (purposive) and different methods of data collection (interviews). • Authors employed thematic analysis to treat data from open-ended responses from a questionnaire, which raises issues about the qualitative nature of the study. • No information about forming the questions and their final form. • No mention of whether specific qualitative design such as grounded theory used.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Franck et al (2011).	Randomised controlled trial. Aim: to assess the effect of parental involvement in pain management on parents' stress, parental attitudes on infant pain and involvement, nursing pain assessment and parenting competence and role attainment post-discharge. Recruitment via 4 NICUs. Inclusion: all parents of infants admitted to the NICUs who were older than 16 and who could read and speak English. Exclusion: parents with documented psychological or psychiatric conditions, and those of infants expected to transfer to another hospital within 10 days of admission. 169 parents. Intervention = 84. Control = 85. UK.	• As part of usual care, parents in both the intervention and control groups received a detailed booklet with generic information about NICU care. • Parents in the intervention group received an additional booklet that provided evidence-based information about pain and comforting infants in the NICU. • Intervention group parents also received 2 visits from a research nurse to show them how to apply the techniques described in the booklet. • Parents were encouraged to ask nurses caring for their infant if they required additional instruction. • Parents in the control group also received 2 visits from a research nurse to listen to what parents had to say about their NICU experience.	• Primary outcome: PSS:NICU, a self-report instrument that measures NICU-related parent stress. • Secondary outcomes: parental views on infant pain and its treatment as measured by the Parent Attitudes About Infant Nociception survey. • Post-discharge outcomes: parental confidence and competence in infant caregiving activities via the Self-efficacy in Infant Care Scale; and parental perceptions of role attainment via the What Being a Parent of a New Baby Is Like–Revised. • Additional measures included the Spielberger State-Trait Anxiety Index, Edinburgh Postnatal Depression Scale, and Measure of Support social support scale. • Demographic information. • Clinical data were collected from the medical charts of infants on admission, with each research nurse visit, and at discharge.	• No differences were found between groups in PSS:NICU scores. • Significant differences favouring the intervention group were found for satisfaction with pain information, parents shown infant pain cues and comforting techniques, nursing pain assessment, and parent preference for involvement during painful procedures. • Role attainment after discharge was higher for the intervention group than for the control group. • Both the intervention and control groups highly valued attention to infant pain and wanted information and involvement.	Grade A – High. Comments: • Interpretation/generalisability should be conducted with caution because of the imbalances in baseline characteristics between the groups and the loss to follow up over the study period. • The study measures relied on parent self-report, and the authors recommend the inclusion of direct observation in future studies. • Issues with random allocation into groups, though acknowledged and well justified.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Fucile et al (2020).	Pilot explorative study. Aim: to understand the goals of parents whose infant was in the NICU to enhance collaboration and communication between parents and health professionals. Recruitment: convenience sampling from parents with infant in NICU at Kingston Health Sciences Centre. 13 parents. UK.	• Questionnaire disseminated to understand specific goals of parents to address parental concerns and needs.	• Goals of parents in NICU as measured using a questionnaire.	• Emerging themes: feeding and weight gain; eliminate medical equipment; successful hospital discharge. • A total of 40 goals were recorded. • Understanding the goals of parents whose infant was in the NICU can enhance communication between parents and healthcare team, aiding the implementation of a family-centred practice.	Grade C – Low. Comments: • Study adds to the body of literature supporting family-centred practice in the NICU by demonstrating individualised goals of parents and how they can be used by healthcare providers to manage attainment of those goals and facilitate family-centred care.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ganadaki and Magill-Evans (2003).	Observation, analytical design, pilot cohort study. Aim: to observe any differences between fathers' and mothers' interaction pattern and in turn whether this affected how the child interacted with each parent. Recruitment via convenience sample from early intervention programmes and other programmes at a rehabilitation hospital. 10 families with 10 children with motor delays. Child male:female ratio = 3:2. Mean age of children = 21.8 months. Each mother–father pair resided together, were Canadians, and were not recent immigrants. Canada.	Impact of mother and father interaction patterns.	• Parent–child interaction measured via the Nursing Child Assessment Teaching Scale (NCATS). • Gross Motor Function Classification System for Cerebral Palsy (GMFCS). • Individual parent–child interactions of mothers and fathers were videotaped in their homes where the parent did an activity with the child from a standardised list of tasks a little above the child's developmental skills. • NCATS used to score the interaction from the videotape. • Immediately following the videotaped session the researcher scored the child's gross motor function.	• Mothers scored statistically significantly higher than fathers on the Caregiver score, $t(9)=3.83$, $p=0.004$ (via paired t-test). • Differences between parents on the Caregiver subscales: fathers scored significantly lower than mothers on the Caregiver Contingency scale ($p=0.006$) and on the Cognitive Growth Fostering subscale, ($p<0.001$). • Children obtained similar Total Child scores whether interacting with their mothers or their fathers. • Parents obtained lower Caregiver scores than those reported for parents interacting with typically developing children.	Grade D – Very low. Downgraded due to: • Small sample of convenience. • All participants were voluntary. • Dyads were assessed at only 1 point in time. • The adult sample was homogeneous. • Videotaping the parent–child interactions may have influenced the mothers' performance. Comments: • Did not allow an examination of the complex inter-correlations of family variables. • Development of the NCATS was based on mother–child dyads and may not capture fathers' unique interactions.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gathwala et al (2008).	Randomised controlled trial. Aim: to determine whether the implementation of kangaroo care (KC) to low birthweight infants would promote mother–baby interaction and attachment. Inclusion: birthweight of <1800g, stable cardiopulmonary status, Apgar score of >7 at 1 and 5 minutes, tolerating enteral feeds and maintaining temperature. Exclusion: infants who were sick, unstable or with major congenital malformations were excluded. Mothers who were unwell and unable to come and those who refused consent were also excluded. 100 infants. 50 in control group. 50 in experimental group. India.	KC: mother wore a front-open gown and sat in an inclined posture with the baby positioned inside her dress between her breasts. The baby was naked except for a cap and nappy, and the gown covering its trunk and extremities. KC occurred for at least 6 hours per day in no more than 4 sittings. The KC was given for a minimum of 1 hour at a time and continued for as long as it was comfortable for baby and mother. When not receiving KC the babies received standard care under a warmer or incubator. Control: standard care, with mothers able to visit, touch and handle their babies.	Structured maternal interview to assess attachment of mothers to their babies using attachment questions, where a higher score indicated a greater attachment.	• The duration of hospital stay was significantly shorter in the KC group (3.56±0.57 days) compared with control group (6.80±1.30 days). • The total attachment score (24.46±1.64) in the KC group was significantly higher than that obtained in control group (18.22±1.79, p<0.001). In KC group, mother was more often the main caretaker of the baby, was significantly more involved in care-taking activities like bathing, diapering, sleeping with their babies, and spent more time beyond usual care taking. They went out without their babies less often and only for unavoidable reasons. They derived greater pleasure from their babies.	Grade A – High. Comments: • Imprecise methodological reporting re blinding of researchers. • Lack of information about ethical approval process. • Male/female ratio. • Structured maternal interview is an unvalidated tool and therefore can't be assumed to be able to measure maternal–infant attachment – this is a construct that can be formally assessed at 18 months of age.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gibbins et al (2015).	Qualitatively driven mixed-methods study. Aim: to understand how healthcare professionals (HCPs) assess and manage procedural pain for tiny and underdeveloped preterm infants. Inclusion: HCPs who worked greater than 0.5 full-time equivalent, had a minimum of 1 year of professional experience in the NICU and spoke English. 59 participants. Healthcare professionals from different disciplines across 5 Level III neonatal units. Canada.	Procedural pain assessment.	To understand how HCPs assess and manage procedural pain for tiny and underdeveloped preterm infants through focus groups and a brief questionnaire.	Study helped elucidate the perspectives of HCPs that provide direct care to ELGA infants on procedural pain. Pain in ELGA infants hospitalised in the NICU is complex, unpredictable, and challenging to assess and manage. HCPs strongly believed in the ELGA infants' capacity for pain or, more precisely, nociception and appreciated that the physiological and behavioural responses could compromise the physiological stability of the infant in the intensive care environment. HCPs indicated that relative to other aspects of neonatal care, pain management is very important.	Grade C – Low. Comments: • Sample size for the quantitative component driven by the qualitative component, but a larger sample size for the survey would have strengthened the results. • Over half of participants were nurses, which limits the generalisability of the findings beyond the study settings and the nursing profession.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gibbs et al (2016).	Qualitative study. Aim: to explore the experiences that enable parents to participate in occupations associated with the role of parenting in a neonatal intensive care unit (NICU). Recruitment: over a 9-month period, purposive intensity sampling approach following information sheets to parents whose infants had spent most of their admission in a single Level 3 NICU in a large urban centre. Inclusion: (a) being a parent of an infant born prematurely (less than 32 weeks' gestation, weighing less than 1,500g birthweight, requiring invasive and non-invasive ventilation for a minimum of 7 days while in the NICU, and a length of stay greater than 4 weeks), (b) having been discharged from the NICU 3–6 months prior, and (c) being an English speaker. 6 parents (3 couples) of preterm infants. UK.	• Semi-structured in-depth interviews with parents of preterm infants, conducted in own homes after discharge. • Interview guide was designed to assist in the unfolding of the participants' stories using 3 key time points: during pregnancy, during the NICU admission and after discharge to home.	• A paradigmatic analysis of narrative semi-structured interviews, capturing experiences that enable parents of preterm infants in a NICU to participate in occupations associated with the role of parenting.	• 6 themes were identified: anticipating occupations versus reality, needing emotional resilience, working to reclaim the parental role, navigating the NICU occupation–environment transactions, building and maintaining relationships with staff, and revisioning the future. • The themes give an indication of the occupational disruption associated with the premature birth and admission to an NICU, the occupational transitions that occur as parents seek to come to terms with their NICU experiences and seek ways to reclaim an alternative parental role, and the resultant occupational adaptation as parents prepare to take their infant home and prepare for their new reality of being the parents of a preterm infant. • The use of an occupation-based approach moves parents' involvement in the NICU beyond basic caregiving occupations. • It highlights the importance of providing opportunities for nurturing and caring for their infants in ways that are meaningful to their identity as a parent.	Grade C – Low. Comments: • Limitations of the study relate to sampling and recruitment. • Robust study outlining opportunities for occupational therapists to identify interventions to enable parenting occupations in the NICU.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gibbs et al (2015).	Meta-ethnographic synthesis. Aim: to synthesise qualitative research addressing parenting experiences in the NICU and explore the concept of parenting as an occupation as a means of supporting parent engagement. Inclusion: addressed parenting experiences in NICU using any type of qualitative approach provided it was primary research and that qualitative methods had been used for data collection and analysis, 1990–2013. Exclusion: unpublished and non-English. 35 studies critically appraised. 453 participants. 311 mothers. 142 fathers. Countries of studies included: Australia, Canada, Ireland, Norway, Sweden, UK, United States of America.	Parenting experiences.	None.	8 themes emerged from the synthesis: • Relinquishing the anticipated role of parent. • Feeling vulnerable and powerless. • Juggling roles and responsibilities. • Claiming an alternative parental role. • Navigating environmental boundaries. • Developing partnerships with staff. • Coming to know the baby. • Adapting to parenting. The synthesis indicates that viewing parenting involvement in the NICU from an occupation-centred perspective provides clinicians with a process of understanding occupational adaption of parenting a preterm infant.	Grade A – High. Comments: • Studies included were conducted in developed, Westernised countries, therefore author points out the relation to transferability of the findings. • Restricted to studies published in English, may impact on cultural relevance.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gmmash and Effgen (2019).	Online survey. Aim: to explore practices used by physiotherapists and occupational therapists in early interventions for infants at risk of cerebral palsy. Recruitment: via snowball sampling from August 2017 to March 2018. Inclusion: occupational or physical therapists who have provided early intervention services to children under the age of 3 in the US. 269 physiotherapists and occupational therapists (33% occupational therapists). United States of America.	• Online survey was developed, reviewed by experts and piloted.	• None.	• Less than 25% use the General Movement Assessment, an MRI or Hammersmith Infant Neurological Examination to predict cerebral palsy. • 57% reported infants at risk for cerebral palsy receive therapy once a week. • 89% said parents' goals were the most important factor in individualising the EI programme. • 75% provide parents with home programmes, but only 31% make this individualised. • 73% never or rarely use outcome measures to prioritise parents' goals. • 60% never assess environmental enrichment.	Grade C – Low. Comments: • Limitations include not discussing length of experience of participants, sampling bias, truthfulness of the respondents, and using questions developed by the authors. • Authors suggest, based on best practice, therapists do not incorporate sufficient strategies for goal-oriented interventions, comprehensive parent education and optimum environmental enrichment.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gouna et al (2013).	Cohort study. Aim: to compare breathing patterns and respiratory variables measured in the supine, left lateral and prone positions in preterm infants. Recruitment over 6 months in a single NICU; convenience sample. Inclusion: gestational age 26–30 weeks, spontaneous breathing with nasal continuous positive airway pressure therapy and mild respiratory failure, defined as an oxygen requirement of 22–35% to maintain arterial oxygen saturation (SpO_2) between 88% and 95%, pH >7.24, and $PaCO_2$ <6 mm Hg. Exclusion: circulatory failure, receipt of vasoactive drugs, and periventricular leukomalacia (PVL) or intraventricular haemorrhage (IVH). 19 infants. Mean gestational age = 27 weeks. Infants studied at mean postnatal age of 17 days. France.	Each infant was successively placed, in random order, in the supine, left lateral and prone positions. The body positions were stabilised in a nest, with the infant's head positioned towards the midline in the supine and left lateral positions. The nest provided a semi-flexed posture in the infants placed on the left side (tucked position).	• Respiratory variables were recorded for 3 hours in each body position, after feeding when infants were in quiet sleep. • Infant sleep state SpO_2, transcutaneous $PaCO_2$, heart and respiratory rates, and arterial blood pressure were monitored continuously. • Volume calculated from the integration of a series of 10 leak-free respiratory cycles. • Volume (Vt), rib cage contribution to Vt (%RC), phase angle between abdominal and thoracic movements, respiratory rate, and inspiratory time.	• Fraction of inspired O_2 was similar in the 3 positions for 19 infants. • Arterial O_2 saturation and Vt were higher in the left lateral and prone positions than in the supine position ($p<0.05$). • The phase angle between abdominal and thoracic movements was lower and rib cage contribution to Vt was higher in the left lateral and prone positions than in the supine position ($p<0.05$). • Dynamic elevation of end-expiratory lung volume was greater in the supine position than in the left lateral and prone positions ($p<0.05$). • Results demonstrate that the left lateral position, as well as the prone position, improve pulmonary function by optimising ventilatory strategy and lung volume.	Grade C – Low. Comments: • The effect of the right lateral position was not studied. In preterm infants, gastroesophageal reflux is increased in the right lateral position. • Study population was limited to preterm infants with mild respiratory failure managed with NCPAP; unable to confirm whether or not the effects of body position are similar in other populations of preterm infants. • No investigation of the role of body position on ventilation distribution.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gramszlo et al (2020).	Mixed methods study. Aim: to identify parents' preferences for goals and structure of intervention programmes to support the psychosocial needs of families impacted by congenital heart disease (CHD). Recruitment: an independent consultant purposively selected 25 families based on diversity of clinical and demographic characteristics from a list of 156 eligible families. Inclusion: child must have had cardiac surgery with cardiopulmonary bypass at less than 6 months of age at Nemours/ Alfred I. duPont Hospital for Children between 2012 and 2014. 34 participants: 20 mothers, 14 fathers. United States of America.	• Parents participated in a 1-hour semi-structured individual interview with a paediatric psychologist or psychology fellow. • Semi-structured interview. • Card sort.	• Stressors and supports associated with receiving a diagnosis of CHD. • Parental coping strategies. • Thoughts on family support programmes. • Parental priorities for goals and structure of psychosocial programmes.	• Parents reported that psychosocial interventions should support partnership in their child's care, promote self-care, facilitate communication with providers, prepare parents for challenges after hospitalisation, provide education about child neurodevelopment and help parents engage social support. • Parents reported needing formalised support across care, brief intervention models, in-person individualised or small group support, and involvement of multidisciplinary providers and peer mentors in the delivery of interventions.	Grade B –Moderate. Upgraded: • This study followed a well-designed mixed methods methodology highlighting the importance of individualised, continuous psychosocial care towards reducing stress and mitigating the impact of parental anxiety and depression on child outcomes. Comments: • Qualitative and mixed methods research advantageous in identifying the heterogeneous psychosocial needs of diverse groups. • Researcher–participant relationship not very clearly stated.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Grenier et al (2003).	Retrospective analysis of cohort data. Aim: to examine whether a relation exists between preterm infant position and the frequency of motor-based self-regulatory and stress behaviours. Recruitment via single NICU. Inclusion: infants born between 23 and 30 weeks' gestation and medically stable. Exclusion: infants who were considered non-viable by the neonatologist, had a congenital anomaly, active sepsis at assessment, parents under investigation by Department of Children, Youth and Families, or whose mother had a psychiatric diagnosis. 15 participants. Male:female ratio = 7:8. United States of America.	Retrospective analysis of videotaped observations of infant caregiving at 3 points: baseline, caregiving and recovery.	The behaviours coded for this study were categorised as self-regulatory or stress in nature based on definitions used in other studies. The conditions coded included time period (before, during or after caregiving), infant position (supine, side-lying or prone), the presence of nesting (rolled blankets, boundaries created by blankets and a heat shield, any other detectable boundary) and infant state of arousal.	Self-regulatory behaviours: • The position in which the highest self-regulatory behaviour ratio (mean) score occurred was side-lying un-nested; the lowest score occurred when participants were in the prone nested position. • There was a statistically significant relation between position and self-regulatory behaviours ($p<0.001$). Stress behaviours: • Overall position and the ratio of stress behaviours were significantly related ($p<0.001$). • The position in which the highest stress behaviour ratio (mean) score was obtained was side-lying un-nested; the lowest score was obtained in prone nested.	Grade C – Low. Comments: • Small sample size. • Heterogeneous group. • Unbalanced number of observations for each position. • Variables possibly affecting infants' behaviour not discussed. • Lack of random assignment of infant positioning.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gund et al (2013).	Randomised controlled trial. Aim: to investigate whether the use of video conferencing or a web application improves parents' satisfaction in taking care of premature infants at home, whether it decreases the need for home visits and nurses' attitudes to it. Inclusion: all families with preterm babies treated at a Swedish hospital who were to be assigned to healthcare at home. Exclusion: limited/no Swedish language skills, no access to PC internet connection, parents did not want to use camera/PC. 34 families. Sweden.	• Standard care, web application (n=12). • Standard care (n=13). • Video conference and standard care (n=9). • Web application allowed nurses and parents to communicate and exchange health-related information. They could also enter details about the infant. • Video conference conducted using Skype.	• Whether parents' satisfaction in taking care of their premature infant at home while using IT resources decreases the need for home visits. • Parents completed questionnaires, a selection were interviewed and nurses completed a questionnaire.	• Parents found applications and Skype could be useful. • Some nurses were reluctant to use ICT. Overall, the families were satisfied with the use of ehealth applications, but it remained a challenge for the nurses to accept its use in daily clinical practice.	Grade C – Low. Downgraded due to: • Small sample size. • Lack of randomisation process. • Lack of interview protocol. • Lack of reasoning on the nurses' attitude not to answer parents' messages. • No reference to ethical approval process. Comments: • Access to internet and PC. • Nurses' attitude to using ICT. • Lack of consistency with nurses. • Lack of robust statistical data as only using rating scale.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Gustafson et al (2016).	Quasi-experimental study. Aim: to evaluate the effect of parent presence during multidisciplinary rounds on NICU-related parental stress. Recruitment: from university-affiliated, 24-bed NICU located within children's hospital. 132 parents of 90 infants admitted to NICU for first time (46 control, 86 experimental). United States of America.	• Parents in the experimental group were offered opportunity to participate in multidisciplinary rounds on their infants. • They completed a 'parental presence on rounds preference card' to alert team for following day. • Control group experienced regular parental support (bedside discussions and formal MDP meetings on parental request).	• Parent Stressor Scale:NICU (PSS:NICU) on Study Days 0 and 3 to measure parental stress in NICU.	• PSS:NICU scores decreased significantly in the experimental group between Study Days 0 and 3 (mean ± standard error [*SE*]=−0.24 ± 0.07, p<0.001), but the change was not significantly different between the control and experimental groups (mean ± *SE*=−0.12 ± 0.10, p=0.25). • The PSS:NICU Parental Role Alteration subscale decreased by the largest margin in the experimental group (mean ± *SE*=−0.42 ± 0.09, p<0.0001), but the change was not significantly different between groups (mean ± *SE*=−0.26 ± 0.14, p=0.06).	Grade C – Low. Comments: • Limitations include researchers only taking stress analysis data on day 0 and day 3 which might not be enough time to experience rounds thoroughly, gain confidence, and for this to be reflected in stress response. • More helpful data seemed to come from more qualitative open-ended survey, which could help locally.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Hake-Brooks and Anderson (2008).	Randomised controlled trial. Aim: to assess whether exclusive breastfeeding rates would be higher and longer for dyads experiencing kangaroo care (KC). Recruitment: via 2 NICUs. Inclusion (infants): 32–36 weeks' gestation, 1300–3000g at birth, 5-minute Apgars of ≥6 and healthy enough to experience KC; (mothers): English speaking, ≥18 years, anticipating singleton birth and healthy enough to experience KC. Exclusion (mothers): known drug users during pregnancy, eclampsia, uncontrolled seizure disorder, severe depression, or maternal disease requiring transport to an intensive care unit post-birth, mental illness refractory to treatment; (infants): condition that prevents KC, severe congenital abnormality. 66 mothers and infants. KC = 36. Control = 30. United States of America.	• Randomly assigned group within 10 minutes of birth. • Throughout the 5 days in hospital protocol mothers in KC group were encouraged to experience KC as soon as possible post-birth, as often and for as long as possible. • KC between mother and diaper-clad infant, placed on the chest of the mother and covered across the back with a blanket or the mother's clothing. A cap was used if needed for warmth. Nurse researchers assisted the mothers with initial breastfeeding experiences, taught them to recognise subtle infant feeding cues and encouraged them to provide self-regulatory feedings whenever they observed these cues. • Lactation consultants available for mothers in both groups.	• Breastfeeding status (exclusivity and duration) at hospital discharge and at 1, 5, 3, 6, 12 and 18 months as measured by the Index of Breastfeeding Status. • Kangaroo care holding time was recorded using 2 instruments, a contact log and the Index of Mother–Infant Separation (I-MIS).	• KC dyads, compared with the control dyads, breastfed significantly longer (5.08 months vs 2.05 months, p=0.003). • KC dyads also breastfed more exclusively at each measurement (p=0.047). • More KC dyads than control dyads breastfed at full exclusivity (100% breast milk, index of breastfeeding status levels 1 and 2) at discharge and at 1.5, 3 and 6 months. • Mean contact KC contact per day was 4.47 hours.	Grade A – High. Comments: • Control group had less attention from the nurse researchers. • Follow up after discharge to gauge exclusivity and duration was self-reported by the mothers. • Many mothers in both groups had stopped breastfeeding by the time of hospital discharge. • Some statistical significance but no stated confidence intervals.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Harrison et al (2007).	Qualitative. Aim: to describe how mothers feel their therapists help them learn about their child with special needs, and how their learning is affected by their relationship with their child's therapist(s). Recruitment via therapy staff at the centre. Inclusion: birth mother of a child diagnosed with a disability at birth, fluent in English, unknown to the primary researcher (a physiotherapist at the centre), and their child had to have been receiving therapy services at the centre for at least 6 months. 9 participants. All married and living with spouse. Children ranged from 19 months to 5 years, average 3.5 years. Families involved in therapy service from 16 months to 4 years, average 2.5 years. Canada.	Receipt of paediatric services.	Maternal experiences explored via a semi-structured interview. Questions focused on experiences of therapy, their relationship with their child's therapist and impressions of how they learned from their therapist.	Mothers in this study found that a positive relationship with their therapist enhanced their learning. 3 main themes identified: • Relationship (therapist's relationship with child, valuing their expertise and emotional support). • Learning (learning in a variety of ways and the relationship influenced the successfulness of learning). • A different journey: life's lessons.	Grade C – Low. Comments: • Mothers who were not satisfied with the services provided by the centre may have chosen not to participate for risk of censure. • Service users who have been involved with services for less time may have different perspectives re the therapeutic relationship. • Sample is homogenous, so transferability needs to be considered. • The research considers only mothers' perspectives.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Hatfield et al (2020).	Systematic review. Aim: to systematically review findings from published randomised controlled trials that tested the effects of behavioural and environmental procedural pain management interventions on behavioural pain response in preterm infants. Recruitment: studies between 2013 and 2017. Inclusion: English-language, original, peer-refereed, randomised controlled clinical trials published within the past 5 years, study intervention behavioural and environmental, outcome pain measurement score from valid and reliable pain scale. 14 randomised controlled trials.	• RCTs evaluated pain from painful diagnostic and treatment procedures infants experienced during standard care in the NICU. • These included heel lance, venipuncture 23-gauge needle, endotracheal suctioning, and laser treatment of retinopathy of prematurity.	• The Premature Infant Pain Scale measuring behavioural and physiological pain. • Neonatal Infant Pain Scale. • Bernese Pain Scale for Neonates. • Also measured: quiet sleep occurrences, limb and trunk extension, self-soothing behaviours, heart rate, heart rate variability, low frequency area of heart rate which reflects sympathetic activity, respiratory frequency, LF/HF ratio, grimacing, crying, cortisol, oxygen saturation.	• Across all age groups, facilitated tucking, oral sucrose and kangaroo care decreased behavioural and physiological pain response alone and in combination with other behavioural and environmental interventions.	Grade B – Moderate. Downgraded due to: • Reporting of results confusing and the RCTs included were extremely diverse, making it difficult to draw firm conclusions. Comments: • Quality of evidence was low.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Head (2014).	Literature review. Aim: to review literature addressing the effect of kangaroo care on the neurodevelopment of preterm infants. Inclusion: articles published in English between 2003 and 2013. Some RCTs, primary research articles, meta-analyses and reviews.	Kangaroo care (KC).	Long-term impact of KC on cognitive outcome in preterm infants.	Although limited evidence for longer-term benefits, authors suggest kangaroo care may be an appropriate strategy for improving neurodevelopment: • Improves early environmental conditions. • Modifies stress. • Improves organised sleep. • Encourages positive maternal–infant attachment.	Grade B – Moderate. Upgraded due to: • Thorough literature search and results.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Hintz et al (2008).	Retrospective sub-analysis of a large cohort study. Aim: to determine special outpatient services use, need, associated factors, and neurodevelopmental and functional outcomes among extremely preterm infants at 18 to 22 months' corrected age. Recruitment at National Institute of Child Health and Human Development (NICHD) Neonatal Research Network site. Inclusion: <1000g birthweight at less than 28 weeks' GA, survived to discharge, neurodevelopmental follow up within 18–22 months' corrected age, and born at recruitment sites between 1 January 1997 and 31 December 2000. 2,315 participants. United States of America.	Special outpatient service (SOS): • Social work. • Visiting nurse. • Medical specialty. • Early intervention. • Speech and language services. • Occupational therapy and physical therapy. • Neurodevelopmental and behavioural services.	• SOS use since hospital discharge and the current need for SOS. • Questionnaire administered to parent/caregiver at follow up asking for information about socioeconomic status, family status, receipt of special outpatient services.	• 54.7% used more than 3 SOS by 18–22 months, and 19.1% used 6–7 SOS. • The need for any SOS was reported by approximately 37%. • Sepsis, birthweight, postnatal corticosteroid use, bronchopulmonary dysplasia and periventricular leukomalacia or grade 3 or 4 intraventricular haemorrhage are commonly associated with adverse neurodevelopmental outcomes and were also associated with the use of >5 SOS. • Male sex was associated with the need for any SOS. • SOS was common even among those with mild developmental impairment (39.7%) and mild cerebral palsy (42.2%).	Grade C – Low. Comments: • Families may have interpreted SOS differently. • Possible recall bias when asking parents to recall SOS use. • Number of SOS contacts not recorded. • Perceived SOS need was based on caregiver report only. • No fiscal analysis of SOS use, but findings add to the long-term economic consequences of prematurity already identified in the literature. • Characteristics of missing infants not explored. • Not clear if some services are more available in some areas or to some groups than others. • Occupational therapy and physiotherapy not considered separately.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Hughes et al (2016).	Systematic review and meta-review. Aim: to identify interventions that improve the motor development of preterm infants. Inclusion: premature infants born at ≤37 weeks' gestation; intervention that aims to enhance infants' development; interventions that continue or start once the infant has been discharged from hospital; control group from premature population; measure of motor development at ≤5 years; randomised controlled trials; controlled trials; cohort/ comparison studies. Exclusion: full-term infants only; no intervention; conducted only in neonatal unit before initial hospital discharge; comparison group only full-term infants; no measure of motor development preschool (≤5 years); review papers; no new data; case studies or case reports; protocol or development publications.	• Systematic search of 17 electronic databases. • Articles screened by 3 reviewers.	• The outcome of interest was motor skills assessment scores. • Meta-analysis conducted using standardised mean differences on studies.	• 42 publications which reported results from 36 trials (25 randomised controlled trials and non-randomised studies) with a total of 3,484 infants met the inclusion criteria. • The meta-analysis found positive effects at 3 months (mean 1.37; confidence interval 0.48–2.27), 6 months (0.34; 0.11–0.57), 12 months (0.28; 0.07–0.49). • At 3 months, there was a large and significant effect size for motor-specific interventions (2.00; 0.28–3.72) but not generic interventions (0.33; −0.03 to −0.69).	Grade A – High. Comments: • The findings suggest that parenting interventions implemented by healthcare professionals have positive effects on motor skills.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Hwang et al (2013).	Randomised controlled trial. Aim: to compare traditional home visiting (THV) with routines-based early intervention (RBEI) with children who have or are at risk of developmental delay. Inclusion: children <36 months of age and with a Z-score on the Comprehensive Developmental Inventory for Infants and toddlers of less than –1 for at least 1 domain. Exclusion: children who received aggressive treatment, e.g. botox injections or with a progressive disease. RBEI group = 19 (though 4 cases were lost): Male:female ratio = 2:1. THV group = 19 (though 3 cases were lost): Male:female ratio = 5:3. Taiwan.	Comparison of routines-based early intervention (coaching in self-care and routines) treatment versus traditional home visiting. The study period was divided into stages: Stage I: baseline (3 months). Stage II: pre-intervention. Stage III: mid-term intervention. Stage IV: post-intervention. Stage V: follow up. The children were assessed with norm-referenced measures at all 5 time points by a blinded assessor. 2 home visitors trained in the appropriate assessments conducted initial interviews with families immediately following the pre-intervention assessment. Helped families to set goals at stages II and III, measured goals at stages III and stage IV. They made bi-weekly home visits during the 6-month intervention period.	Baseline, 6-month intervention and 6-month follow up. Primary outcomes: outcomes related to meaningful daily functions, which reflected children's capability and performance, the family's perceptions and satisfaction with the children's changing abilities, PEDI – Chinese version, Goal Attainment Scale (GAS), Canadian Occupational Performance Measure (COPM) and the routines-based interview. Secondary outcomes: the traditional domains of measurement of child development in cognitive, language, gross motor and fine motor skills – Comprehensive Development Inventory for Infants and Toddlers (CDIIT), the Carolina Curriculum for Infants and Toddlers with Special Needs – Chinese version (CCITSN-C).	31 children analysed. PEDI showed RBEI group had faster progress rate in self-care functions and independence in social functions in first 3 months' treatment and at 6 months' follow up. GAS showed same at 3 months' treatment for RBEI group. RBEI was more effective than THV in promoting functional outcomes and reaching family-centred goals. Both treatment approaches supported children's developmental domains. RBEI took same amount of time as THV, so should not be a cost implication.	Grade B – Moderate. Downgraded due to: • Poor reporting of results and analysis. • Small sample size. • Heterogeneity of children with or at risk of developmental delay resulted in large within-group variation. • Lack of non-treatment group. • Ethically not possible to limit access to services for the study. • Timing of assessments varied due to uncontrollable, but documented, factors. Comments: • Families and the home visitors could not be blinded.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ideishi et al (2010).	Qualitative design. Aim: to explore perspectives of the therapist's role in care co-ordination between early intervention (EI) and medical services. Parent recruitment via EI parent training workshop and parent meeting. Therapist recruitment through local continuing education course. Service co-ordinator recruitment via professional networks in the Child Find agency. Parent inclusion: at least 1 child <5 years who was currently enrolled in EI programmes. Provider inclusion: work with special health needs children. 50 participants. 16 parents. 34 healthcare providers. United States of America.	Perspectives of the role of therapists.	Focus groups and parent questionnaire on child's disability.	• Therapists often interpreted medical information for parents. • Parents needed to act as a bridge between providers, who have little time to communicate with other providers. • Different approaches by different providers often confused parents. • Community-based therapists emphasised supporting the family's social and emotional needs more so than hospital-based therapists. • Conflicting views and recommendations from therapists can confuse parents. • Therapists did not have much concrete knowledge about what other therapists provide.	Grade D – Very low. Comments: • Purposive sample therefore may not be truly representative of all parents with children enrolled in EI programmes or all therapists working in hospitals or community-based EI settings. • Majority of parents were mothers (n=11) and 10 out of 16 were white. • No analysis of the group of participants' characteristics provided.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ingram et al (2016).	Quasi-experimental before and after study. Aim: to investigate whether introducing Train-to-Home, a parent-centred neonatal discharge package, increased parental confidence in caring for their infant, reduced length of hospital stay and reduced post-discharge use of hospital resource. Recruitment via 4 local neonatal units (LNUs) between October 2012 and August 2013 and October 2013 to August 2014. Inclusion: infants born between 27 and 33 weeks' gestational age. Exclusion: mothers <16 years of age and infants with major congenital anomalies. 128 families in pre-intervention group. 117 families in intervention group. UK.	• After a discharge date had been estimated, parents received a train with 5 carriages labelled breathing, feeding, growth, temperature and sleeping. Using criteria, parents would change each carriage from red to amber to green as a sign of infant readiness for discharge. • Parents were given leaflets with gestation-appropriate questions for staff linked to the 5 carriages. • Each week the discharge date range on the train would narrow. • Semi-structured telephone interviews were conducted 8–10 weeks post-discharge to explore perceptions of the unit and the intervention. • Focus groups conducted with nursing staff and telephone interviews conducted with senior LNU staff.	• Parental self-confidence via the Perceived Maternal Parenting Self-Efficacy (PMP S-E), which parents completed soon after admission to the LNU, shortly before discharge and 8 weeks post discharge. • Healthcare resource use questionnaire developed to record healthcare contacts. These data were collected via telephone at 4 and 8 weeks post discharge.	• The intervention and pre-intervention groups were well matched, but metabolic, endocrine, gastroenterological and neurological problems were more prevalent in the pre-intervention group. • PMP S-E scores were not significantly different between the groups, and while the intervention groups' maternal scores were slightly higher at discharge compared to baseline, this was not significantly so. • More infants in the intervention group were discharged as mixed fed (bottle and breast) and fewer were exclusively bottle fed. • Significantly more infants from the pre-intervention group attended emergency departments post-discharge (p=0.03) and had a higher associated cost (£3,400 vs £2,200, respectively; p=0.03). • Most families found the intervention helpful and enjoyed using it. • While nursing staff generally found the intervention useful, some voiced concern the discharge dates were too optimistic.	Grade C – Low. Comments: • Limitations include lack of time to implement the intervention, the methodology meant no randomisation. • The reduced visits to the emergency department are more notable because this coincided with the introduction of the 111 service, which encouraged more people to go to hospital. • During the intervention phase, all LNUs were working towards WHO/UNICE Baby Friendly Initiative accreditation and so were encouraging and supporting mothers to breastfeed.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Johnston et al (2011).	Randomised crossover design (each infant serving as their own control). Aim: to test paternal vs maternal kangaroo care (KC) to reduce pain from heel lance. Recruitment via 3 NICUs. Inclusion: preterm neonates born between 28 and 36 weeks' gestation who were expected to stay in the NICU for at least 2 blood sampling procedures, without major congenital anomalies, grade III or IV IVH, or PVL; without surgical interventions; not receiving parenteral analgesics or sedatives within 72 hours; and for whom both parents gave informed consent and would be available during the daytime when elective blood sampling was done. 75 infants. Canada.	• Kangaroo care during heel lance. • At least 15 minutes before the heel lance, the assigned parent would then place the infant in the KC position and would maintain that position before, during, and at least 15 minutes after the procedure. • Repeated-measures analysis of variance for PIPP scores was conducted in 30-second blocks at 30, 60, 90 and 120 seconds after lancing of the heel.	• Heart rate. • Oxygen saturation. • Preterm Infant Pain Profile (PIPP) – captured via video-recording. The indicators for the PIPP are changes from baseline in maximum heart rate, minimum oxygen saturation level, and proportion of time that 3 upper facial actions of brow bulge, eye squeeze and nasolabial furrow are displayed. • Parent questionnaire: (1) How many times had they provided KC before the study session? (2) How did they feel when they were providing KC during the heel lance procedure? (3) Would they do it again? (4) Would they recommend it to other parents?	There were significant results only at 30 (mean difference, 1.435 [95% confidence interval, 0.232–2.632]) and 60 (mean difference, 1.548 [95% confidence interval, 0.069–3.027]) seconds, with higher PIPP scores in paternal KC. Mothers provide marginally more comfort when providing KC to their preterm neonates than do fathers. Although the effect size was not large, the difference was statistically significant. This supports the hypothesis that there is something unique about the comfort of a mother's contact over and above that of another caring adult. The actual scores on the PIPP in both KC conditions are lower than PIPP scores for the incubator condition reported in other studies. Parents were positive about doing KC during a painful procedure, and all would recommend it to other parents.	Grade A – High. Comments: • The scheduling of blood work at a time that the selected parent could provide KC was challenging and resulted in losing many cases (mainly due to fathers being unavailable during 'business hours'). • The way in which the analyses were conducted, necessary because of sporadic loss of data across the session, may have resulted in the few significant results by chance. • Although the coders were blind to the intervention, neither parents nor staff were. • There remain some controversies regarding pain assessment in non-verbal infants, with conflicting results depending on parameters used.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kadlec et al (2005).	Descriptive-correlational (qualitative aspects). Aim: to examine caregiver–child interaction qualities associated with activities representative of daily routines by children born premature and very low birthweight (VLBW) with and without white matter disorder (WMD) as well as children born full-term and healthy. Recruitment via larger cohort in a study of the effects of white matter disorder (WMD) on infant neuromotor functioning. Inclusion: gestational age <32 weeks, birthweight <1500g, white matter disorder confirmed at birth or 1 month, or both. 36 infant–caregiver dyads. 3 groups: • Caregivers and their children born prematurely and VLBW with WMD. • Caregivers and their children born prematurely and VLBW without WMD. • Caregivers and full-term, healthy children. United States of America.	Videotapes made of interaction between caregiver and child engaging in dressing and snack activities, and the interactions were rated by 10 expert clinicians.	Main outcome was caregiver–child interaction, including qualities of caregivers' socioemotional and task-related behaviour and children's affective behaviour during parent–child interaction.	• The children with WMD scored significantly lower on the cognitive and motor Bayley Scales of Infant Development – II (BSID-II) indices, which indicates an increased risk for developmental difficulties. • The correlations between caregiver positive engagement and caregiver directiveness within the 3 groups indicate that raters perceived unique patterns of relations between child and caregiver behaviours during functional tasks. • For caregivers of children born VLBW with WMD, the association between directiveness and positive engagement during the tasks was large and significant (r=0.63). • Findings suggest caregivers may be adjusting the level of their social and emotional assistance to the level of their children's abilities.	Grade C – Low. Comments: • Small sample size which limited power to detect true differences between groups. • Sample was limited to primarily Caucasian middle-class dyads, which limits the generalisability of findings to these groups. • Interaction took place in the laboratory, which is not a natural setting. • Subjective information based on the opinion of 'experts'.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kasparian et al (2019).	Systematic review. Aim: to identify, synthesise and critically appraise published evidence on the efficacy and cost-effectiveness of mental health interventions delivered in neonatal, paediatric or cardiac intensive care units for parents of infants with CHD. Inclusion: controlled trials of mental health interventions for parents of infants aged 0–12 months with congenital anomaly requiring intensive care unit admission; trials involving infants with any type of structural congenital anomaly requiring surgery. Exclusion: studies with mixed samples where outcomes were not reported separately or where <50% of the sample comprised infants with a congenital anomaly were excluded; case studies, non-peer-reviewed studies. 5 studies included in review.	• All interventions commenced within 2 weeks of infant intensive care unit admission. • 3 interventions delivered by a psychologist – 1 with cardiac nurse specialist, 1 with research team, 1 with paediatric palliative care team and 1 by PICU nursing staff. • All interventions except 1 aimed to reduce parental stress or anxiety. • Other components included collaborative goal setting, shared decision making, emotional expression and parental skills training.	• Primary outcome measures: anxiety as defined by scores on a validated self-report, or diagnostic status based on clinical interview. • Secondary outcomes: depressive symptoms, psychological stress or distress, health-related quality of life, adjustment and coping responses, attachment-related outcomes, family-related outcomes.	• Overall studies reported on data from 339 participants, with sample sizes ranging from 38 to 108 participants. • All studies reported on data for mothers (n=311) and only 1 trial for fathers (n=28). • All interventions engaged parents face to face but each had a distinct therapeutic approach. • 4 out of 5 trials demonstrated efficacy in reducing maternal anxiety, although quality of evidence was low. • Positive results also found for maternal coping, mother–infant attachment, parenting confidence and satisfaction with clinical care, as well as infant mental development at 6 months. • Mixed results found for maternal depression and infant feeding. • No evidence of efficacy found for improving parent, infant or family quality of life, physical health or length of infant hospital stay.	Grade A – High. Comments: • Relevant studies included. • Appropriate level of quality assessment of studies.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kim et al (2017).	Quasi experimental study with a control group. Aim: to explore the effects of father massage on physiological responses of the infant and father–infant attachment. Recruitment: infants and their fathers were selected from the neonatal intensive care unit (NICU) of a university's general hospital. Inclusion: Fathers – consent of the participant, visit to the NICU within 2 days of their infant's birth, and no infection or skin disease. Infants – admission to the NICU, stable vital signs, no genetic anomalies, congenital heart malformations and/or central nervous system dysfunction, not a candidate for surgery, and birth above 30 weeks' gestational age. Control group: 20 neonate–father dyads. Experimental group: 20 neonate–father dyads. South Korea.	• Infants in the experimental group received tactile stimulation (infant massage) for one 10-minute period per day, for 5 consecutive days. • Effectiveness of tactile stimulation by fathers on their infants' physiological responses such as oxygen saturation levels, heart rates (HRs) and respiration rates (RRs) were measured. • Fathers' perceived levels of attachment to infants in the NICU were measured by the Paternal Attachment Scale, previously developed by the lead researcher.	• To measure the effects of tactile stimulation on the infant's physiological status. • Measure effect of intervention on paternal attachment.	• Overall, found that tactile stimulation by fathers significantly stabilised infants' physiological status, including oxygen saturation levels, HRs and RRs ($t=2.138$, $p<0.039$; $t=2.348$, $p<0.024$; $t=3.461$, $p<0.001$, respectively) with effect size ranged 0.67–1.10 and increased paternal attachment levels ($t=3.982$, $p<0.001$) with large effect size (1.29). • Pilot study suggests that tactile stimulation by the father may be regarded as an important and potentially useful intervention for the care of infants in the NICU.	Grade C – Low. Comments: • Downgraded due to being an observational study with limitations in transferable applicability and potential bias.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kochan et al (2019).	Randomised controlled trial. Aim: to evaluate the effect of elevated midline head position on cardiopulmonary function and incidence of periventricular/ intraventricular haemorrhage (PIVH). Inclusion: extremely low birthweight (ELBW) infants (birthweight <1000g) admitted to the neonatal intensive care unit at the Children's Hospital of The King's Daughters in Norfolk, Virginia; only infants that could be randomised, placed into FLAT or ELEV position, and undergo an admission cranial ultrasound (US) within 4 hours of birth. Exclusion: congenital anomalies. 180 infants. United States of America.	• ELBW infants were randomised to FLAT (flat, supine) or ELEV (supine, bed elevated 30 degrees) for 96 hours. Cardiopulmonary function, complications of prematurity and the occurrence of PIVH were documented.	• Cardiopulmonary function, complications of prematurity and the occurrence of PIVH were documented.	• No significant differences were seen in the incidence of bronchopulmonary dysplasia (BPD) or other respiratory complications. • The ELEV group developed significantly fewer grade 4 haemorrhages (p=0.036) and survival to discharge was significantly higher in the ELEV group (p=0.037).	Grade B – Moderate. Downgraded due to: • Preliminary trial does not explore other controls within the study. • Elevation angle needs further exploration (acknowledged the 30 degree angle was identified based on practicalities). • Acknowledges it is suggestive of a relationship between elevation and reduced PIVH and survival rather than conclusive. • Further research needed.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kostandy et al (2008).	Pilot prospective crossover study. Aim: to assess the effect of kangaroo care (KC) on crying responses to pain. Recruitment via 1 Level II NICU. Inclusion: healthy mothers and infants of singleton birth, 30–32 weeks' GA, 2–9 days after birth, no signs of heel tissue inflammation as measured by the Neonatal Skin Condition Score, either NPO or fed by bolus feed and were being cared for in an incubator. All mothers spoke English and agreed to participate. Exclusion: congenital anomaly, grade III or IV IVH, history of surgery, history of drug exposure and any tissue breakdown or inflammation of either heel. 10 infants. Male:female ratio = 1:1. United States of America.	• Randomly assigned to having heel stick either in KC or in the incubator. • Infants assigned to 2 sequences: Day 1 – heel stick in KC, after 30 minutes of prone skin contact upright between maternal breasts. Infant remained in KC during procedure. • Day 2– heel stick in incubator, inclined at 30–40 degrees in prone for 30 minutes prior to warming and heel stick. Mothers not present. • 20-minute recovery for both sequences. • Each infant had heel stick in both sequences: KC then incubator and incubator followed by KC.	• Videotapes of baseline, heel warming, heel stick and recovery phases were independently scored for audible and inaudible crying times. • The audible and inaudible crying times for each subject in each phase were summed and the mean between the scorers' values was analysed by repeated-measures analysis of variance (ANOVA).	• Crying time differed between the study phases on both days (p=0.001). • When in KC as compared with the incubator, crying time was less during the heel stick (p=0.001) and recovery (p=0.01) phases.	Grade C – Low. Comments: • Small sample size as pilot due to limited funding. • Previous exposure to KC of infants prior to study. • Potential bias of research assistants and NICU staff. • No follow up of infants. • Minimal statistical evidence. • Maternal presence per se, as differentiated from KC, may have also influenced pain responses.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kraljevic and Warnock (2013).	Systematic review. Aim: to assess how effective early information and behavioural interventions are in reducing maternal anxiety, depression, stress, parenting stress and/or post-traumatic stress disorder (PTSD) symptoms for mothers who experience psychological trauma associated with premature birth. Inclusion: articles had to be an original intervention RCT-designed study, written in English, abstract available online, focus on preterm infants' mothers, consist of interventions implemented soon after admission in the NICU, and report on maternal depression and/or anxiety and/or stress and/or PTSD symptom outcomes. 8 studies. 1,005 mothers.	Mothers in the intervention group received educational and behavioural therapeutic sessions, while those allocated to the standard care control group received standard NICU care. Maternal sensitivity training was incorporated in most of the 8 study interventions. The training typically involves providing the mother education and demonstration of infant care including feeding, soothing and recognition of infant cues. It was incorporated to enhance a mother's ability to accurately identify the preterm infant's cues and signals and to respond to the infant in developmentally appropriate ways.	Reducing maternal anxiety, depression, stress, parenting stress and/or PTSD symptoms via the following measures: • Parent Stress Index. • Parent Stressor Scale: Neonatal Intensive Care Unit (PSS:NICU). • State-Trait Anxiety Inventory. • Stanford Acute Stress Reaction Questionnaire. • Davidson Trauma Scale. • Perinatal PTSD Questionnaire.	• Findings provide evidence of early onset of significant depression, anxiety, parenting stress and symptoms of acute stress disorder (ASD) and PTSD during infant stay in the NICU in mothers of VLBW, very premature infants. • Half were effective in reducing baseline levels of between 1 and 3 outcomes of psychological trauma. The 2 interventions that targeted reduction in ASD and/or PTSD were not effective. • Because the interventions varied considerably, not possible to draw conclusions of treatment effect based on similarity by frequency of type of intervention.	Grade B – Moderate. Downgraded due to: • Heterogeneity and methodological issues of studies cause difficulty in ascertaining whether this style of interventions is effective. Comments: • Marked underreporting and evidence of internal validity issues. • Substantial differences among the study interventions and variation in types and numbers of maternal outcomes of psychological trauma that were assessed, including differences in time points and measurement. • Substantial heterogeneity and evidence of suboptimal methodological quality precluded meta-analysis. • No unpublished studies or non-English-language studies included. • Outcomes limited to depression/anxiety/parenting stress/ASD/PSD.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Lai et al (2016).	Systematic review. Aim: to assess the effectiveness of co-bedding compared with separate (individual) care for stable preterm twins in neonatal nursery in promoting growth and neurodevelopment and reducing short- and long-term morbidities, and to determine whether co-bedding is associated with significant adverse effects. Inclusion: randomised controlled trials with randomisation by twin pair and/or by neonatal unit. Exclusion: cross-over studies.	• Criteria and standard methods of the Cochrane Collaboration and the Cochrane Neonatal Review Group. • Comprehensive search of the Cochrane Central Register of Controlled Trials, MEDLINE, via Pub Med, EMBASE, and the Cumulative Index to Nursing and Allied Health Literature using the following search terms: (Nurseries OR Neonatal nursing OR NICU) AND (cobed* OR (co bed*) OR (bed shar*) OR (co sleep*).	• Primary outcomes: growth, apnoea, bradycardia, neurobehaviour. • Secondary outcomes included: number of twin pairs with sepsis, average number of days between twin pairs to reach full enteral feed, number of twin pairs with feed intolerance, number of twin pairs for whom cessation of co-bedding is required for other clinical reasons, all-cause neonatal mortality, average length of hospital stay between pairs, average cost of care between twins, SIDS in one or both twins.	• Only 5 studies provided data for analysis. • Each study reported outcomes differently, data for most outcomes were effectively contributed by a single study. • Study authors reported no differences between co-bedded twins and twins receiving separate care in terms of rate of weight gain, episodes of major disturbances in their breathing, heart rate or oxygenation level (apnea, bradycardia, or desaturation episodes), length of hospital stay and occurrence of infection. • Quality of evidence low.	Grade A – High. Comments: • The results can be applied to the local population, but as the evidence is inconclusive, no practice recommendations can be generated from the review. • Analysis is precise, but pooled means and confidence intervals cross the mean difference in terms of positive or negative effects for all outcomes from the pooled studies, and so no trends as to treatment effects confirmed.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Legendre et al (2011).	Systematic review. Aim: to research current literature documenting the short-term effects (medical and developmental) of developmental care and the Newborn Individualized Developmental Care and Assessment Program (NIDCAP). Inclusion: studies that included infants <37 weeks' gestation receiving care in NICU, study objectives of NICU intervention to improve short-term outcomes, published 1990–2009. Exclusion: focus on long-term outcome of developmental care. 15 articles included. Most articles were RCTs with 2 cohort studies.	Developmental care and NIDCAP.	• Short-term medical and physiological outcomes. • Neurodevelopmental outcomes. • Sleep outcomes.	Short-term medical and physiological outcomes: • 4 studies show improved medical outcomes, while 5 studies show no improvements. Neurodevelopmental outcomes: • Improvement in infant behavioural organisation in NIDCAP groups, including state regulation, attention and motor control. Sleep outcomes: • 1 showed better self-regulation and fewer sleep–wake cycles and improved awake time to engage with environment. Second study showed improved wake periods by 34 weeks' GA.	Grade B – Moderate. Downgraded due to: • Lack of discussion of statistics. • Lack of information on how wide a search conducted. • Exclusion of studies on long-term outcomes. • Both RCTs and non-randomised retrospective studies included. No meta-analysis conducted. • Descriptive analysis of findings impacted by inconsistency in the measurement and delineation of developmental care. Comments: • Lack of blinding. • Lack of reliable outcome measures. • No distinct definition of developmental care results in variations in assessment, treatment and provision.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Lekskulchai and Cole (2001).	Randomised controlled trial. Aim: to examine motor performance of infants who received a programme designed to facilitate motor development. Inclusion: gestational age <37 weeks, who were free of congenital abnormalities and genetic disorders. Exclusion: infants who subsequently underwent surgery for any reason or developed serious illnesses including hydrocephalus, periventricular leukomalacia, intraventricular haemorrhage III or IV, ventricular dilatation or retinopathy of prematurity stage III and above. 84 infants (27 comparator). Thailand.	• A modified follow up developmental physiotherapy programme. • The number of activities per month and aims of activities were the same for each intervention infant at each specific age. • 12 activities for infants at 40 weeks post-conceptional age and at 1, 2 and 3 months adjusted age, with 3 activities introduced in each month. • The primary caregiver carried out the intervention, after demonstration and practice session.	• Test of infant motor performance (TIMP).	The intervention group showed the greatest improvement: • Comparison of groups at 40 weeks and 4 months: significant results, both at 40 weeks ($p<0.001$) and at 4 months adjusted age ($p<0.001$). • At 40 weeks post-conceptional age, tests indicated that the intervention group did not score significantly higher than the control group ($p=0.998$) but these 2 groups scored significantly lower than the comparative group ($p<0.001$). • At 4 months adjusted age tests indicated that the intervention group scored significantly higher than the control group ($p<0.001$), and no longer differed significantly from the comparative group ($p=0.167$). Results suggest that the infants who received the motor developmental programme showed significantly greater improvement in motor performance during the study period.	Grade A – High. Comments: • Study power not reported. • Effectiveness relied on caregivers' understanding and co-operation to complete the home programme. • Programme was modified specifically for infants in Thailand where authors acknowledge child-rearing style is different from that of Western countries. • Control group input (identified as consultation) was not clearly discussed or identified. • Dated article with no specific mention of occupational therapy.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Liaw et al (2012).	Prospective cohort study. Aim: to explore the effects of 24-hour caregiving, positioning and non-nutritive sucking (NNS) use in the NICU on preterm infants' sleep–wake states and to identify the factors associated with infants' state changes. Recruitment via 1 Level III neonatal unit. Infant inclusion: gestational age 27–37 weeks and PMA 27–37.5 weeks, post-birth age 3–28 days, and disease condition acceptable for observation (illness severity indicated by the Neonatal Therapeutic Intervention Scoring System [NTISS] score <21). Nurse inclusion: employed in the unit for >18 months, familiar with preterm infant care based on standardised NICU procedures, and agreed to be observed while caring. 30 infants. Male/female ratio = 1:1. Mean gestational age = 31.53 weeks. Mean birthweight 1624.8g. Taiwan.	Observed infant states during standard caregiving and positioning activities, which were clustered/group based on the nature of caregiving and degree of intrusion: (a) No caregiving/no caregiving stimuli/no interaction. (b) Social interaction (gentle; comforting behaviours). (c) Routine caregiving (usual nursing and medical activities but not intrusive or stressful). (d) Intrusive caregiving, as in (c), but moderately to severely stressful or intrusive and painful to infant.	• Illness severity – Neonatal Therapeutic Intervention Scoring System. • NICU caregiving, positioning and NNS, measured by a caregiving coding scheme.	• The occurrences of quiet sleep (QS) increased when infants received no caregiving, social interaction, non-nutritive sucking (NNS) and were laterally positioned. However, QS significantly decreased and fussy or crying state increased when infants received routine and intrusive caregiving. • In this study, social interactions increased the occurrences of QS, AS (active sleep) and transition states. • While social interaction is necessary, it must be based on the infants' cues to avoid becoming stressful.	Grade C – Low. Comments: • Infant state changes in response to caregiving and the environment varied greatly at each observation so caution needed with interpretation. • Other factors such as noise, light, incubator humidity, and emergency treatment may have influenced infant states that were not measured in this study. • A larger sample would allow certain infant characteristics, such as GA and illness severity, to be blocked in analysis to better control factors that might influence outcome variables. • The short-term design limited determination of long-term outcomes for healthy, stable infants, so caution needs to be exercised when extrapolating to preterm infants with perinatal and postnatal complications.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Liu et al (2010).	Cohort study. Aim: to examine the NICU Network Neurobehavioral Scale (NNNS) as a predictor of negative medical and behavioural findings from 1 month to 4.5 years of age. 1,248 infants, part of the Maternal Lifestyle Study, a longitudinal study of children at risk due to factors such as prenatal exposure to cocaine and other substances and prematurity. 658 infants in the group exposed to maternal drug use. 730 infants in the comparison group. Groups matched by gestational age categories, child gender, race and ethnicity. Mothers were recruited from 4 urban university-based centres and were mostly African-American. United States of America.	Examination of predictors.	• Infants were assessed on the NNNS at 1 month of age at a clinic. Information was collected on medical outcomes including risk of cerebral palsy and any neurological condition by doctor's examination at the 1-, 4-, 8-, 12-, 24- and 36-month clinic visits. • The Bayley Scales of Infant Development – II was administered at 12, 24 and 36 months. • The Child Behaviour Checklist was administered to the mothers at the 36-month visit. • School readiness evaluated at 4 years with the Developmental Indicators for Assessment of Learning. • At 4.5 years the Wechsler Preschool and Primary Scale of Intelligence was used to measure child IQ.	NNNS scores used to create 5 discrete profiles that showed statistically significant associations with prenatal drug exposure, GA and birthweight, head ultrasound, neurological and brain disease findings and abnormal scores on measures of behavioural problems, school readiness and IQ through to 4.5 years of age. Authors suggest the NNNS profiles discriminate among infants with medical and behavioural problems to 4.5 years of age who would not have been identified on the basis of medical and demographic factors alone.	Grade D – Very low. Downgraded due to: • Poor reporting of the population. • Many confounding factors, such as drug exposure, preterm birth, admission to neonatal unit etc., were not reported and would have a direct effect on score on the NNNS at 1 month of age. • The actual focus of the study does not seem to be reported in the results. The authors change their hypothesis slightly in the results section. • Unclear what type of study recruited from. • Insufficient information about the blinding of administrators. Comments: • No details of how many infants were followed up at each appointment. • No details on how population was identified. • The 5 profiles were developed in a sample of children with prenatal exposure to cocaine and other substances which could limit generalisability. • Would be important to show predictive validity of NNNS in older children beyond 4.5 years.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Lotfalipour et al (2019).	Randomised controlled trial. Aim: to determine the effect of infant massage conducted by the mother on the mother's mood. Recruitment: via the hospital. Inclusion: mother to infant born 30–37 weeks' gestation age, spoke Persian and minimal level of literacy. Exclusion: mothers with a mental or chronic illness, or the infant has a congenital anomaly, severe respiratory disease or needs a ventilator. 52 mothers. 26 in each group. Iran.	• Training in massage therapy consisted of an educational pamphlet, a training movie and a 30-minute in-person training session. • Mothers then massaged their infants for 15 minutes 5 days a week. • Massage was conducted in 3 phases from head to toe and front and back, with the infant wearing only a nappy. • Infants in the control group received routine care.	• Profile of mood states (POMS) was used to measure depression, anxiety, confusion, anger, fatigue and ability of the mother. • For the intervention group, data were collected before and after the intervention. • For the control group, data were collected at admission and prior to discharge.	• The groups significantly differed on place of residence and educational level (p=0.001). • Mothers had similar mood scores when first collected, but differed significantly after the intervention, with the intervention group reporting a better mood (intervention group's mood score = 118.92 ± 3.45 while the control group's was 141.73 ± 6.1 [p<0.001]). • Mean scores in the control group varied significantly by mother's age (p=0.046) and infant sex (p=0.002).	Grade C – Low. Downgraded due to: • Lack of blinding, small sample size (though a power calculation showed this to be the necessary sample size), and no description of standard care to see if it is comparable to the UK. Comments: • Limitations include the differences between the groups and that cultural focus on the infant's sex that may have impacted results. • No indication whether mothers were instructed on infants' cues and thus could understand if massage was stressful for the infant.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ludington-Hoe et al (2004).	Randomised controlled trial. Aim: to assess whether kangaroo care improved heart rate, oxygen saturation rate and abdominal skin temperature outcomes. Inclusion: 33–35 weeks' gestation and nearing discharge, appropriate weight for gestation, in open cribs at a Level II NICU, no condition known to affect dependent measures and had not received any medication for at least 24 hours prior to study. 24 infants. 11 in treatment group. 13 in control group. Stratified by sex to control predominance of respiratory distress in males. United States of America.	• 3 inter-feeding intervals (with feeding scheduled every 3 hours for all subjects) constituted pre-test and post-test periods. • All periods were observed in 1 day. • The inter-feeding intervals varied from 2.75 to 3.25 hours and each period began as soon as the nurse related that the feeding was complete. • Infant was placed upright chest to chest between mother's breasts. • Mothers sat cot side in a stationary chair, infants wore only a nappy, mothers were allowed to interact quietly with the infants but most rested or fell asleep. • Control group received standard care.	• Heart rate, respiratory rate, oxygen saturation and abdominal skin temperature were manually recorded every minute. • Apnea, bradycardia, periodic breathing, regular breathing were captured continuously on pneumocardiogram printout. • Mean cardiorespiratory and temperature outcomes recorded.	• Healthy preterm infants in continuing care and under appropriate maternal clothing tolerated 3 hours of KC and remained stable. • Control infants showed no significant changes in any outcome measures across the 3 periods. • The KC group showed changes from period to period for HR (p=0.01), AT (p=0.03), SaO_2 (p=0.04). Apnea, bradycardia and periodic breathing were absent. • Regular breathing increased for infants receiving KC compared with infants receiving standard care.	Grade A – High. Comments: • No statistically significant results discussed. • Small sample size. • Test period in 1 day.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Madlinger-Lewis et al (2015).	Randomised controlled trial. Aim: to investigate the effects of a new positioning device compared with traditional positioning methods used with preterm infants. Recruited infants from 1 Level III neonatal unit. Inclusion: infants born at or before 32 weeks' gestational age. Exclusion: infants with congenital abnormalities. Random assignment with stratification by age. Enrolled 100 infants (92 in final sample). Male:female ratio = 39:53. Mean age: 28.7 ±2.7 weeks. United States of America.	Infants were randomised into standard positioning or the use of the Dandle Roo positioning aid for the duration of their stay on the neonatal unit. All staff received training in the new product before the research began and additional training was provided throughout the intervention period. Parents also received training in the use of the product. Time out of the positioning aid was recorded.	Measured neurobehaviour using NICU Network Neurobehavioral Scale (NNNS) and feeding outcomes using Neonatal Oral Motor Assessment (NOMAS). Assessed at term age.	92 infants' results analysed. Infants in new positioning systems demonstrated less asymmetry of reflex and motor responses on the NICU Network Neurobehavioral Scale than those positioned using traditional methods. NNNS: intervention group had less asymmetry than the control group. No other differences noted with exception of infants with cerebral injury who showed less self-regulation in the trial group compared with the traditional group. NOMAS: no significant differences.	Grade B – Moderate. Downgraded due to: • Poor statistical analysis. • Significant time out of the positioning aid. • No clear description of traditional positioning. • Generic positioning device that does not allow for individualisation based on medical status and gestational age. Comments: • Gestational age at birth was different across groups and had to be controlled for. • The alternative positioning aid is not suitable to use during medical procedures so not used when the baby needed to be observed. • The positioning aid was introduced 6 months prior to study and staff opinion may have affected its use. • The results may not be transferable to units with lower-risk babies. • Very high-risk, fragile infants increase confounding medical complications that may affect neurobehavioural status.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Magill-Evans et al (2002).	Longitudinal observational study. Aim: to compare the cognitive and language development of 10-year-old children born preterm to children born at term. Recruitment criteria at birth was 2-parent families who spoke and read English within 1 hour's drive of city. Inclusion: birthweight >1500g (and appropriate for GA), a singleton birth, no history of seizures, no congenital malformations, and able to breathe without ventilator within 7 days. Preterm infants also had a GA at birth <37 weeks. 43 infants – 20 preterm and 23 full-term. Higher proportion of preterm males than in term group. Canada.	Comparing cognitive and language development.	• Parent demographics via questionnaire. • IQ scale – Wechsler Intelligence Scale for Children (WISC-III). • Language scale (expressive and receptive) – Clinical Evaluation of Language Fundamentals 3 (CELF-3). • The Life Experiences Survey (LES) was answered by each parent to identify negative family experiences as these might have an impact on the child's development.	The children born preterm had subtle delays. They scored significantly lower on Performance IQ and the CELF-3. The subtests on which they had lower scores appear to require visual-spatial skills.	Grade C – Low. Comments: • Homogeneous (ethnically and demographically) sample. • Relatively small sample size with multiple statistical comparisons. • Authors suggest that the results must be replicated with larger and less homogeneous samples to determine if the pattern of results reported here are typical of the wide range of healthy preterm low birthweight children and to eliminate other possible explanations for the pattern of results. • 59 families originally recruited but 43 participated. No information on the 16 families that did not participate.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Maguire et al (2018).	Qualitative focus groups. Aim: to understand how experts successfully feed infants with Neonatal Abstinence Syndrome (NAS) during withdrawal. Recruitment: via flyers in lounges of 3 Level III NICUs. Inclusion: self-identified expert nurses, occupational therapists and speech therapists in feeding infants going through withdrawal. 12 participants. 10 registered nurses. 2 speech therapists. United States of America.	• 4 focus groups conducted. • These reflected on infants that had been challenging to feed, reasons why the participants thought they were successful, how they know when they won't be successful, how they get a fussy infant to feed, and general tips they have for mothers.	• Not applicable.	• Optimal medication management: appropriate pharmacological management was considered a baseline requirement for successful feeding. • Follow the infant's cues and be flexible with technique: learn and understand the infant's cues, and different techniques may be needed for different infants, depending on their individual style and needs. • Calm and comfortable: need to ensure the mother is comfortable; ensure the infant is calm through positioning, calming their body and rigidity, decreasing stimulation, swaddling, burping, and supporting the infant's disorganised sucking ability. • Nurture the relationship: encourage caregivers to be there and build their confidence, encouraging mothers to be with their baby as much as possible, and developing trust with mothers and adopting a non-judgemental attitude.	Grade C – Low. Comments: • Limitations include no explanation of sampling methodology, little data analysis, breastfeeding and rooming in were not considered, the specific region's treatment of drug addiction which may limit the generalisability of findings.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Maitra et al (2014).	Systematic review. Aim: to determine whether low birthweight (LBW) or preterm birth leads to difficulties in mental, neuro-musculoskeletal and movement-related school tasks. Inclusion: disseminated or accessible in English between 2000 and December 2012; original studies; included only children between ages 0 and 21 who were born LBW or preterm; existence of a healthy, typically developing comparison group; mental, neuro-musculoskeletal and movement-related functions tested using standardised and non-standardised cognitive and motor skills assessments; and test scores (standard deviations and means) available for effect size calculation. 40 studies – 6,553 children born LBW or preterm and 24,624 typically developing children.	Relationships between birthweight and school tasks.	Explored impact of LBW and preterm birth on school tasks. Outcomes considered were: • Mental functions assessments: IQ; attention; executive function (working memory, processing speed, inhibition, etc.); emotional-behavioural characteristics; and academic areas of reading, maths, and spelling. • Assessments in neuro-musculoskeletal and movement-related functions: visual-motor, perceptual-motor, hand skill, sensory-motor, and motor co-ordination and control.	Children born LBW exhibited considerable difficulties in mental ($p<0.0001$) and neuro-musculoskeletal and movement-related tasks ($p<0.001$) compared with children of normal birthweight. Children born preterm also exhibited significant difficulties compared with full-term children in mental, neuro-musculoskeletal, and movement-related tasks ($p<0.0001$).	Grade A – High. Comments: • Did not include unpublished studies and articles in languages other than English. • Did not give a summary of papers included. • Possibility of publication bias.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Månsson et al (2019).	Randomised controlled trial. Aim: to evaluate the impact on parental stress of an individualised neonatal parent support programme. Recruitment: between March 2014 and November 2015. Inclusion: parents to infants born before 37 gestational weeks, who ended the care period in HNHC and able to communicate in Swedish or English. Exclusion: parents to infants born at another hospital and later (>3 days postnatal age) admitted to the NICU where study took place. Control group, n=130 (60 mothers, 58 fathers); intervention group, n=101 (49 mothers, 49 fathers). Sweden.	• The programme focused on person-centred communication and consisted of 4 individual nurse–parent dialogues during the infants' hospitalisation.	• Parental stress was measured using the Swedish version of the Parental Stressor Scale: Neonatal Intensive Care Unit.	• Total stress scores did not vary significantly between the control and intervention groups for mothers or fathers. • However, on item level, some were significantly more distressed for mothers in the control group.	Grade A – High. Comments: • All staff in NICU received person-centred communication before the start of the study, but a limitation might be the nurses did not have possibility to use new communication style for longer period before start of study. • Another limitation might be that the number of preterm infants is limited.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Matricardi et al (2013).	Randomised controlled trial. Aim: to examine the effects of a parental intervention to reduce stress levels during hospitalisation of their very preterm infant, taking into account differences between mothers and fathers. Inclusion: ≤32 weeks' gestational age, singleton births, no congenital malformations, >3 weeks' hospital stay expected, parents' mother-tongue Italian. Exclusion: parents <18 years of age, manifest psychiatric and/or mental disorder, drug addiction or single-parent families. 42 participants. Italy.	Each couple in the intervention group met the unit's physical therapist 8 times in sessions lasting 1 hour, from 31 to 36 weeks' postmenstrual age of their infant. The main aim of the intervention was: (i) to increase parental ability to observe their infant and (ii) to improve the physical contact between parents and their infant to encourage parent–infant proximity. Intervention was based on an approach including the joint observation method and infant massage provided by both parents. Infant massage introduced on the fourth session. Control group received standard care.	Socio-demographic questionnaire – parental age, years of study and occupational status were obtained for both parents. Infants' clinical conditions – the Score for Neonatal Acute Physiology Perinatal Extension-II (SNAPPE-II) was calculated at birth as an indicator of the infants' clinical condition. Parental self-reported stress – the levels of stress of both parents were assessed by a self-report measure (Parental Stressor Scale: NICU) at 2 different times of assessment: a week after the infant's admission (Time 1) and at infant's discharge (Time 2).	Stress scores in intervention group decreased (p=0.014). The intervention seemed effective in promoting parents' understanding of the behaviour of their infant and in strengthening their sense of parenting. Mothers showed higher levels of stress than fathers in all 3 PSS:NICU scales, and mothers' scores on the PRA scale were markedly higher than fathers, indicating that mothers experienced more stress associated with the marginalisation of their parental role. Suggests that parental intervention based on joint observation and infant massage reduced stress levels in parents.	Grade B – Moderate. Downgraded due to: • Relatively small sample size, which may affect reliability. • There was no attempt to control the variation of individual scores of parents between Time 1 and Time 2. Comments: • Results are based on mean scores of groups. • Intervention combined joint observation and massage, so not able to establish effectiveness of either individually.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
McAnulty et al (2010).	Randomised controlled trial. Aim: to explore the continuity of NIDCAP effectiveness into school age, and to test the predictability of newborn period brain function measures to school-age neuropsychological results. Inclusion: ≤29 weeks' gestational age, birthweight ≤1250g, conceived spontaneously; singleton; mechanical ventilation onset within the first 3 hours after birth and lasting >24 hours in the first 48 hours; alive at 48 hours; absence of chromosomal or other major genetic anomalies and congenital infections; family member with some English language skill; and living within the greater urban area. 22 infants. Experimental group n=11. Control group n=11. United States of America.	• NIDCAP interventions received by the experimental group. • Intervention began from admission to the NICU to 2 weeks' corrected age (CA). • The standard care for the control group infants included efforts towards primary care nursing, individual staff-dependent parent inclusion, and the by then standard and uniform shielding of incubators with blankets; dressing of infants in T-shirts, the use of side and foot rolls; and liberal provision of pacifiers. Encouragement of holding and breastfeeding an infant were staff dependent.	• Demographic and medical history information at 8 years' corrected age (CA) obtained by parent interview. • Additional information was obtained from the paediatricians' offices and children's hospital medical records. • All children measured and weighed, and age at testing was also assessed. • Children assessed at 8 years CA with a comprehensive battery of neuropsychological measures. • Children assessed by EEG in the Eyes Closed (ECL) alert state. ECL EEG was collected in 2-minute segments for a total of 12 minutes.	• At 8 years CA, NIDCAP children demonstrated significantly better spatial visualisation and mental control. • The EEG-derived measures of cortical connectivity also successfully differentiated E-group from C-group children and corroborated the neuropsychological findings in terms of the neural pathways implicated. • The neurobehavioural and neurophysiological measures in the newborn period better predicted neuropsychological functioning at 8 years CA than the medical/ demographic background and medical outcome variables.	Grade B – Moderate. Downgraded due to: • Small sample size may lead to imprecision of the findings. Comments: • In the original intervention study, no efforts were made to prevent spillover and contamination effects from experimental to control group care. Therefore, any significant experimental effects identified have to be interpreted as conservative, since they exceed all control group contamination effects. • The generalisability of these findings is limited by the small sample size. • Exact mechanisms of NIDCAP effectiveness remain to be discovered.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
McAnulty et al (2009).	Randomised controlled trial. Aim: to assess the effect of NIDCAP on medical outcome, behavioural and electrophysiological function. Recruitment via 1 NICU, Level III after delivery at a high-risk perinatal tertiary care centre. Inclusion: <29 weeks' gestational age, <1250g birthweight, conceived spontaneously, mechanical ventilation within the first 3 hours for >24 hours, deemed viable by neonatologist, some knowledge of English. Exclusion: chromosomal and major genetic anomalies and/or congenital infection. 107 singleton infants. United States of America.	Provision of NIDCAP (structured individualised environments) with weekly neurobehavioural observations through hospital stay to 2 weeks' corrected age (CA). Control group received standard care.	Medical, neurobehavioural and neurophysiological status at 2 weeks' CA and growth and neurobehavioural status at 9 months' CA. Assessments performed by 2 independent examiners purposefully blinded to infants' background and group status and videotaped for reliability checks. Assessments used included Assessment of Preterm Infants' Behaviour, Prechtl Neurological Examination of the Full-Term Newborn Infant, neuro-EEG, Pediatric Complication Scale, Better Bayley Scales of Infant Development scores for both the Mental and Psychomotor Index.	Treatment group had significant reduction in major medical morbidities of prematurity. At 2 weeks' CA the treatment group had significantly improved neurodevelopmental (behaviour and electrophysiology) functioning. At 9 months' CA the treatment group had: • Medical: significantly healthier ($p<0.02$) than the control group; fewer medical diagnoses (based on the Pediatric Complication Scale); better absolute growth ($p<0.06$) and better body weights ($p<0.03$), and higher weight percentiles ($p<0.05$). • Behavioural: better Bayley Scales of Infant Development scores for both the Mental and Psychomotor Index ($p=0.0005$).	Grade A – High. Comments: • Need for up-to-date sample as the third phase of this trial was 1990–1992. • The earliest start for NIDCAP was 48 hours after birth and further study may be beneficial to review early intervention. • This study was to 9 months' CA and further longer-term outcomes of a large sample would be of value. • Although there was a clear attempt to time-match subjects in the treatment and control group to account for variations in practice over the 8-year study period, it remains somewhat unclear how similar 2 interventions were during the latter stages, and the risk of contamination bias.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Melnyk et al (2006).	Randomised controlled trial. Aim: to evaluate the efficacy of an educational-behavioural intervention programme designed to enhance parent–infant interactions and parent mental health outcomes. Recruitment via 2 NICUs. Inclusion criteria: All parents 18 years of age and over who could read and speak English, who had not had another infant admitted to the NICU, and whose infants were gestational age of 26 to 34 weeks, birthweight of 2500g and appropriate for gestational age, anticipated survival, singleton, no severe handicapping conditions. 260 parents or caregivers (mainly mothers) of preterm infants. Treatment group n=147. Comparison group n=113. Infant male:female ratio = 63:67. Mean gestational age of the premature infants was 31.3 weeks; mean birthweight was 1650g. United States of America.	Creating Opportunities for Parent Empowerment (COPE) provides parents with information on: (1) Premature infants' appearance and behavioural characteristics and how parents can participate in their care and facilitate development; and. (2) Audiotaped and written information along with prescribed activities to help parents implement information. Phase I occurred 2–4 days after the infants' admission to the NICU; Phase II occurred 2–4 days after the first intervention; Phase III occurred 1–4 days before discharge; Phase IV was delivered in the parents' home 1 week after infant discharge. Comparison programme: series of audiotapes and written information delivered at the same times as the 4 phases of the COPE programme that provided information about hospital services, discharge information given to all parents and information regarding immunisations.	(1) Infant length of stay (LOS); number of days in the NICU. (2) Parental Emotional: • State-Trait Anxiety Inventory to assess anxiety. • Beck Depression Inventory (second edition) (BDI-II) to measure depressive symptoms. • Parental Stressor Scale-Neonatal Intensive Care (PSS-NICU) to assess parental stress in the NICU. (3) Parent Functional: the 15-item Index of Parental Behaviour to assess the quality of parent–infant interaction in the NICU. (4) Parental beliefs: the 18-item Neonatal Intensive Care Unit Parental Belief Scale (NICU PBS) to measure parents' beliefs about their premature infants and their parental role during hospitalisation.	Final sample: 245 mothers, 145 fathers and their 247 preterm infants. COPE group: 3.8-day shorter NICU length of stay and 3.9-day shorter total length of hospital stay. Mothers reported significantly less overall parental stress in the NICU; no differences between the groups on fathers' reports of stress in the NICU. Within 2–4 days after the phase I intervention in the NICU, mothers and fathers in the COPE programme reported significantly higher parental beliefs about their role and what characteristics and behaviours to expect from their premature infants; differences continued 4–7 days before their infant's discharge from the NICU. Parents in the COPE programme had more positive parenting interactions with their preterm infants in the NICU (when controlling for site, trait anxiety and gestational age). At 2 months' corrected infant age, mothers in the COPE programme reported significantly less state anxiety and depressive symptoms; no differences found for fathers.	Grade A – High. Comments: • Infants included were in the majority >1500g. • 2 NICUs limit generalisability. • Study effects are worthwhile but need to consider younger, smaller, sicker infants and exact specifics of intervention and the longer-term effects.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Melnyk et al (2001).	Randomised controlled trial – pilot. Aim: to evaluate the Creating Opportunities for Parent Empowerment (COPE) programme in terms of maternal coping and infant cognitive development. Inclusion: mothers ≥18 years, infants had gestational age of 26 to 36 weeks and <2500g, could speak and read English; delivered their infant at the hospital; lived within a 1-hour distance from the hospital; and had a singleton birth. Exclusion: infants had a positive drug screen or a life-threatening complication in the first 24 hours after birth. 42 mothers. Mean age 27.9 years. Mean gestational age of infants was 31.7 weeks. Mean birthweight 1613g. United States of America.	The COPE programme is an educational-behavioural intervention in 4 phases: (a) Audiotaped and written infant behaviour information with photographs that focused on common characteristics and behaviours of premature infants (infant behaviour information [IBI] and parent role information [PRI] that provided parents with strategies for becoming involved in their infant's care, enhancing quality of interaction with their infant, and facilitating their infant's development). (b) Parent activities, in the form of a 4-phase workbook, to assist mothers in implementing the experimental information. Intervention began 2–4 days post-birth and continued until 1 week post-discharge.	• Infant cognitive outcome – Bayley Scales of Infant Development-II (BSID-II) at 3 and 6 months of age. • Mother's emotional coping outcome – the State-Trait Anxiety Inventory, Profile of Mood States, Parental Stressor Scale: NICU. • Mother's functional coping outcome – Maternal-infant interaction scale, Nursing Child Assessment Feeding Scale, Home observation of measurement of the environment. • Process of maternal coping – Parent Belief Scale (NICU).	• COPE infants had significantly higher mental development scores at 3 months' corrected age than did the comparison infants and this difference widened at 6 months' corrected age. • COPE mothers were significantly less stressed by the NICU sights and sounds and had significantly stronger beliefs about what behaviours and characteristics to expect from their premature infants.	Grade A – High. Comments: • The BSID-II, used at 3 and 6 months infant age, is better at correctly identifying children with later normal IQs than at identifying who would later be cognitively delayed. • The low internal consistency reliability of the baby subscale of the Parental Beliefs Scale. Further refinement and pilot testing important. • Small sample size. • For power of 0.8, a sample of 144 infants would be required – therefore necessary to conduct full-scale study. Require continued follow up to determine the intervention's longer-term effects.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Milgrom et al (2019).	Randomised controlled trial. Aim: to assess effectiveness of a Mother Infant Transaction Program (MITP) type intervention (Premie Start) by comparison group who received standard care . Recruitment: via 2 neonatal intensive care units (NICU) in Melbourne, Australia. Inclusion: women who delivered at <30 weeks' gestation at the NICUs were approached when infants were 30–32 weeks' postmenstrual age. Exclusion: insufficient spoken and written English, triplets or higher multiples, infants with congenital abnormalities, infants or mothers judged to be too severely medically ill to participate by their attending physicians, maternal drug and alcohol abuse or dependence, or residing >100 km from Melbourne. 123 very preterm and extremely preterm infants allocated to either a parent sensitivity intervention (PremieStart, n=60) or to standard care (n=63). Australia.	• The intervention reported in this paper is part of a larger study. • Intervention Group – Premie Start parent sensitivity training programme while in NICU with 9 sessions delivered in 1 week and a booster home session plus standard NICU procedure and care. • Control group – standard NICU procedures and care. • When all children were 2 and 4.5 years' corrected age, parents completed the Child Behavior Checklist (CBCL). • General development was assessed at 2 years with the Bayley Scales of Infant Development (Bayley-III). • At 4.5 years, cognitive functioning was assessed with the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III) and executive functioning with the NEPSY-II.	• Behavioural outcomes at 2 and 4.5 years using Total Problems Score and the Internalising and Externalising syndrome subscales of the Child Behavior Checklist (CBCL). • General development at 2 years using Bayley Scales of Infant & Toddler Development (Bayley-III). • Cognitive outcomes at 4.5 years using Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III).	• Participant retention at both follow-ups was relatively high with data returned for 107 children (87%) at 2 years and 96 children (78%) at 4.5 years. • Treatment adherence in the intervention group 100%. • At 2 years of age, after controlling for key baseline covariates, no significant between-group differences were detected on the Bayley-III Cognitive, Language or Motor composites. • At 4.5 years of age no significant between-group differences on the WPPSI-III Full Scale IQ, Verbal IQ, Performance IQ or Processing Speed. • No evidence that an early stress-reduction intervention led to sustained benefits in behavioural or cognitive outcomes for children born very preterm and extremely preterm. • Advances in the quality of neonatal intensive care may mean that MITP-type interventions now have limited additional impact on preterm infants' long-term neurobehavioural outcomes. • The gestational age of infants and the exact timing of intervention may also affect its efficacy.	Grade A – High. Comments: • Limitations include main outcome measures of behaviour was from parental reporting.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Mitha et al (2019).	Cohort study. Aim: to analyse hospital unit characteristics and breast milk feeding (BMF) policies associated with BMF at discharge for infants born at 32–34 weeks' gestation. Recruitment: via all maternity units in 25 French regions (21/22 metropolitan regions and 4 overseas regions) and children in this study were part of the EPIPAGE-2 cohort study. Recruited from 2 May to 5 June 2011. Inclusion: children born at 32–34 weeks' gestation, admission to the same Level III or IV perinatal centre during the first week of life and survival to hospital discharge. Exclusion: infants born from HIV-positive mothers were excluded. 883 infants (717 mothers) included in the study. France.	• Structured questionnaires collecting information at both the unit and individual level. • Unit questionnaires explored units' policies and their association with practices; they were based on self-reported declarations, under the responsibility of the team manager. • Individual maternal questionnaires included sociodemographic and pregnancy data. • Data also collected at infant level around main characteristics, birthweight and any neonatal treatments.	• The main outcome measure was BMF at discharge (yes/no), defined as an infant being fed, exclusively or partially, with breast milk at discharge. • Methods of breast milk administration (breast or bottle) were also reported.	• Overall, 59% (490/828) of infants received BMF at discharge (27% to 87% between units). • Rates of BMF at discharge were higher with kangaroo care, early involvement of parents in feeding support, unit training in a neurodevelopmental care programme, and in regions with a high level of BMF initiation in the general population. • Creating synergies by interventions at the unit and population level may reduce the variability in BMF.	Grade C – Low. Comments: • Requires further specific detail to be extracted to make it more relatable to practice. • The results show that there is a likely association with the 'higher performing' neonatal units and breast-feeding rate at discharge. • There are varying details that contribute to 'higher performing' units.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Morelius et al (2015).	Randomised controlled trial. Aim: to assess the effect of continuous SSC on salivary cortisol, parental stress, depression and breastfeeding. Recruitment via 2 NICUs from 2008 to 2012. Inclusion: 32–35 weeks' gestation, singleton, vaginal birth, mothers were healthy and able to speak and read Swedish. 37 families. Sweden.	• 1 group had continuous SSC. • The other group received standard SSC.	• Salivary cortisol reactivity measured in infants during a nappy change at 1 month corrected age. • Ainsworth's sensitivity scale. • Parents completed the Swedish Parenthood Stress Questionnaire (SPSQ) and Edinburgh Postnatal Depression Scale (EPDS). • Questions on health and breastfeeding.	• On average, the experimental group undertook 19 hours of SSC, while the control group undertook 7 hours. • Continuous SSC decreases infants' cortisol reactivity in response to handling. • Improves concordance between mother and infant's salivary cortisol levels.	Grade A – High. Comments: • The study participants were all informed about the study prior to randomisation and this may have impacted on high level of SSC in control group. • Not possible to include a control group that did not practise skin-to-skin as not ethical.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Mouradian et al (2013).	Mixed-methods quasi-experimental. Aim: to reduce parent stress in the NICU through participation in an art-based occupation group. Parents recruited when infants admitted to a Level 3 NICU over a 5-month period. Inclusion: parents aged 18–45 years. 45 participants. United States of America.	Weekly intervention group for 2 hours (consistently ran over a 5-month period). Non-directive and open-ended group. Art-based activity – scrapbooking: staff showed parents the art supplies available and a notebook of sample scrapbook pages. Additional samples were also posted on the walls. The principal investigator and Oklahoma Infant Transition Program team members were present throughout the session to assist with the supplies and equipment and to provide non-directive suggestions and support at parent request. Parents could stay for any length of time they chose.	State-based anxiety inventory (STAI) – administered immediately prior to and immediately after the art-based group. Qualitative phenomenological interview – parent perceptions of participating in the group.	45 participants, but post-group STAI completed for only 40 parents. Statistically significant reduction in mean state anxiety of 12.7 points (clinically significant for approximately 25% of parent participants). Statistically significant reduction in trait anxiety of 2.6 points (clinically significant for 5% of parent participants). The activity and/or group interaction element was successful as a brief intervention for short-term reduction of parent anxiety.	Grade C – Low. Comments: • Results cannot be generalised to younger parents. • Lack of comparison group leaves open possibility that placebo or other effects contributed to reduction in anxiety. • Cannot be sure what aspect of the intervention is responsible for the anxiety reduction. • Potential bias due to the interviewer administering the STAI and facilitating the group; possible desire of parent to please the interviewer. • Unable to know the length of time that state anxiety was reduced and cannot predict potential long-term benefits.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Mu et al (2020).	Qualitative systematic review. Aim: to synthesise the available qualitative evidence on the experiences of parents who have used kangaroo care (KC) for preterm infants in an NICU. Inclusion: original study using qualitative methodology or mixed methods; a focus on the experiences of KC among the parents of preterm infants in an NICU; a focus on preterm infants with a gestational age ranging from 24 to 37 weeks; published in English or Chinese. 9 papers included from 5 countries, published 2007–2018.	Not applicable.	• Parental role/experience of kangaroo care through lived experiences.	• 3 studies focused on the father's perspective, 5 focused on the mother's perspective and 1 on both parents' perspectives. • 5 synthesised findings were developed from the 10 categories, into which the 54 findings had been grouped into themes as follows: sense of emptiness of parent's role, barriers in the translation of parental roles in KC, preparation enhances parental role expectations, KC enhances parental competency, and encouragement and support from family and friends.	Grade A – High. Comments: • Will provide updated information for recommendations pertaining to SSC and parent support. • Appraisal and aggregation process was robust and thorough.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Nakano et al (2010).	Cohort study. Aim: to quantitatively evaluate how a positioning programme influences the movement patterns of preterm infants. Recruitment via 2 NICUs. Inclusion: birthweight >25th and <90th percentile, uneventful pregnancy and delivery, Apgar score of <7 at 5 minutes and the absence of obvious neurological abnormalities, severe sepsis, chromosomal defects or metabolic disorders. 12 infants, 6 in each group. First NICU (positioning group): gestation age 25–32 weeks, birthweight 811–1562g. Second NICU (control group): gestation age 26–33 weeks, birthweight 925–2364g. Japan.	The positioning group: the infants were positioned with a positioning mat developed at the hospital. The mat is made of cloth with a pre-cut quilted surface and attached Velcro. It is used to wrap and enclose the infant to maintain upper and lower extremities in a flexion posture. The mat was used in supine, prone and side-lying depending on the condition of the infant. The control group received no positioning.	Spontaneous infant movements videotaped when infant was 38–39 weeks postmenstrual age. Reflective markers were attached to the infant's wrists and ankles in supine and filmed from above when they were awake and moving good-humouredly. Filmed for 5–10 minutes. Quantitatively investigated how the programme influenced movement patterns for as long as a month after the programme was terminated.	• The velocity of the movements of the positioning group was more varied than the non-positioning group. • The hands of the infants in the positioning group approached each other to a greater extent than those in the non-positioning group (p=0.022). • The variations in the velocity of the right foot were greater in the positioning group than non-positioning group (p=0.041). • Concludes that infants in the positioning group exhibited a pattern of movements similar to that of full-term infants.	Grade C – Low. Comments: • Bias not considered. • No significant outcome data. • No discussion of dropout rate for infants followed up 1 month later. • Did not follow up control group for comparison. • Confounding factors not considered. • Subjective outcomes. • Only used 2 minutes and 40 seconds of each video for data, with no reason given as to why, who chose or who analysed the data. • Small sample size. • Non-generalisable results.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Nassef et al (2020).	Qualitative semi-structured interviews. Aim: to explore parental experiences of therapeutic hypothermia (TH) in infants with hypoxic ischaemic encephalopathy following perinatal asphyxia. Recruitment: via hospital (convenience sample). Inclusion: infant had undergone whole or partial TH in the NICU of the recruiting hospital. 14 parents. 7 mothers. 7 fathers. Median age = 35. Sweden.	• Interviews took place between 2 and 7 months after birth, were conducted face to face and took between 40 and 90 minutes.	• Not applicable.	• Parents described the experience of TH for their infants as life altering. • Many were concerned about the prognosis of their infants after TH, worried that the infants would survive. • Most parents were satisfied with the care they received and thought family-centred care made them feel informed and cared for. • 1 parent was dissatisfied with the information received and felt more information was needed on what the process was and why the NICU practised family-centred care. • Parents felt hospital staff were competent and were grateful for their care. • Parents described the rewarming of their infants as a new beginning, with indescribable joy when their infant awoke.	Grade C – Low. Comments: • Limitations include a small sample size from 1 hospital, the length of time from TH to interviewing some of the parents. • 1 of the authors cared for 3 of the infants, and it is unclear if they also interviewed the parents.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Nordhov et al (2010).	Randomised controlled trial. Aim: to analyse whether the Mother–Infant Transaction Program (MITP) leads to more nurturant child-rearing attitudes. Inclusion: birthweight <2000g without congenital abnormalities. Mothers must speak Norwegian. Exclusion: triplets Healthy term newborns from hospital's well-baby nursery were also recruited. 146 infants. Male:female ratio = 53:47. Norway.	Intervention was a modified version of the Mother–Infant Transaction Program. 8 trained nurses in 1-hour daily sessions with parents and infants on 7 consecutive days starting a week prior to discharge and follow up at 3, 14, 30 and 90 days with same nurse.	Child-Rearing Practices Report (CRPR) (Norwegian version) was given to mothers at 12, 24 and 36 months.	Mothers in intervention group reported significantly more nurturant attitudes at 12 and 24 months. Significant change in restrictive and nurturant attitudes over time. Similar levels of change across both term and preterm groups indicate that changes in child-rearing attitudes develop independently of EI intervention and birth status.	Grade A – High. Comments: • Lack of baseline assessment at randomisation time on parental child-rearing attitudes. • Fathers did not complete all sessions. • CRPR questionnaire was developed in 1965 and may not reflect parental child-rearing issues in 2009. • Only Scandinavian sample – transferability across cultures needs to be considered.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Obeidat et al (2009).	Descriptive systematic review. Aim: to determine the efficacy of facilitated tucking as non-pharmacological pain management in preterm infants. 5 papers included. All used crossover design with preterm infants, observing them while using facilitated tucking and without. Preterm infants' age ranged from 23 to 36 weeks; the sample size was 12 to 40; and the most frequent source of pain used to evaluate pain control was heel stick or endotracheal suctioning.	Facilitated tucking is the gentle positioning of preterm infants with arms and legs in a flexed, midline position close to body while the infant is in either a side-lying or prone position.	Outcome measures used to evaluate the efficacy of facilitated tucking were: • The Premature Infant Pain Profile (PIPP), which measures behavioural responses (crying, grimacing, etc.). • Physiological heart rate (HR). • $SaO_{2.}$ • Post-conceptual age. • Neonatal Infant Pain Scale (NIPS).	The following were statistically significant: • Lower HR in 4 of 4 studies. • Increase in SaO_2 in 3 of 4. • Sleep–wake state in 4 of 5. • PIPP scores in 2 of 3. • A difference in median NIPS scores in 1 of 1. The studies reviewed here provide important preliminary findings that suggest facilitated tucking may be beneficial to preterm infants in attenuating their responses to painful procedures.	Grade B – Moderate. Downgraded due to: • Paper included crossover studies, but all had methodological concerns and none RCT. No meta-analysis able to be conducted. Descriptive analysis of findings impacted by inconsistency in the research designs of the original studies. • Search strategy unclear. Comments: • Methodological limitations of the original studies limiting the generalisability, including small sample sizes (some not powered), and/or tools without established validity; and by using a crossover design, the importance of the 'washout period' and whether there was a carry-over effect was not addressed.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
O'Brien et al (2018).	Randomised controlled trial. Aim: to analyse the effect of Family Integrated Care (FICare) on infant and parent outcomes, safety and resource use. Recruitment: from Oct 1, 2012, 26 sites randomly assigned to provide FICare or standard care. Inclusion: infants born at 33 weeks' gestation or earlier, had no or low-level respiratory support; parents given informed consent for enrolment; parents in the FICare group had to commit to be present for at least 6 hours a day, attend educational sessions and actively care for their infant. Intervention group: 895 infants. Control group: 891 infants. Canada, Australia, New Zealand.	• Family Integrated Care group.	• Primary outcome, analysed at the individual level, was infant weight gain at day 21 after enrolment. • Secondary outcomes were weight gain velocity, high-frequency breastfeeding (≥ 6 times a day) at hospital discharge, parental stress and anxiety at enrolment and day 21, NICU mortality and major neonatal morbidities, safety and resource use (including duration of oxygen therapy and hospital stay).	• At day 21, weight gain was greater in the FICare group than in the standard care group (mean change in *Z* scores –0.071 (SD 0.42) *vs* –0.155 (0.42); p<0.0002. • Average daily weight gain was significantly higher in infants receiving FICare than in those receiving standard care (mean daily weight gain 26.7g (SD 9.4) *vs* 24.8g (9.5); p<0.0001.	Grade A – High. Comments: • No cost analysis undertaken. • Given growth is an important determinant of neurodevelopmental outcomes in preterm infants, increased weight gain and enhanced high-frequency breastfeeding in FICare group are important improvements in preterm care that might have long-term benefits for infant health. • Improved psychological wellbeing of parents in FICare group could translate to better long-term mental health for parents, infant–parent bonding.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Oostlander et al (2019).	Scoping review. Aim: to identify non-pharmacological interventions to treat neonatal abstinence syndrome (NAS) that are within the scope of occupational therapy. Inclusion: peer-reviewed publication in English, intervention completed in the NICU, include discussion of the intervention that focused on the infant. Exclusion: exclusively qualitative methodology. 45 studies – 3 excluded because used a qualitative methodology.	• Interventions at the infant level included swaddling, positioning, handling and maintaining temperature stability.	• Outcome measures varied across studies.	• Prone positioning recommended overall, though 3 stated supine should be used to reduce sudden infant death syndrome. • Swaddling found to reduce crying, decrease startle response and improve length of sleep. • Gentle handling recommended. • Keeping temperature stable can reduce irritability. • Suggestion low lighting helps reduce signs of NAS • Quiet environment with calm, soothing voices recommended. • 1 study recommended the smell of the mother or other calming scents while another recommended aromatherapy. • Non-nutritive sucking agents recommended to reduce stress and promote self-soothing behaviours. • The type of bed and its mechanism seems to have an effect on symptoms during the withdrawal period. • Massage by a trained professional or mother recommended to reduce symptoms. • Skin-to-skin contact suggested to be beneficial. • Providing parental education led to numerous benefits (13 studies).	Grade B – Moderate. Downgraded due to: • As a scoping review, it was not conducted as rigorously as a systematic review, providing only descriptive summary of studies. Comments: • Limitations include most studies having low levels of evidence.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Orovec et al (2019).	Cohort study – secondary analysis. Aim: to report and present data on neonatal pain exposure, pain management, and pain assessment and documentation throughout a cohort of preterm infants' entire hospitalisation in NICU, and which factors are associated with increased used of pain-relieving interventions. Inclusion: infants born at less than 37 weeks' gestational age. 242 stable preterm neonates. Canada.	• Not applicable.	• Number of painful procedures experienced/pain exposure by neonate (documented pain score). • Type of procedure. • Pain-relieving interventions used.	• The 242 neonates underwent a total of 10,469 painful procedures (4,801 tissue breaking and 5,667 non-tissue breaking, with only 56.6% and 12.2% having a documented pain score using the Premature Infant Pain Profile, respectively). Average pain exposure was 43 with a median of 32 (10-576) per entire hospital stay. • Documented pain score and greater postnatal age were associated with higher use of a pain-reducing intervention and lower gestational age, first day, first week, higher illness severity, non-tissue-breaking and night-time procedures were associated with lower use of a pain-reducing intervention. • Use of a pain-relieving intervention was documented in 58.5% of procedures. • Sucrose was the most commonly used pharmacological intervention and non-nutritive sucking the most common non-pharmacological intervention.	Grade C – Low. Comments: • Findings are consistent with similar studies in terms of incidence. • Key infant demographic variables considered.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Orton et al (2009).	Systematic review. Aim: to assess early intervention programmes' effect on cognitive and motor development. Inclusion: RCTs or quasi-RCTs of early developmental intervention programmes reporting motor or cognitive outcomes; in English or where translator available; infants born <37 weeks' GA with no major congenital abnormalities; intervention started <12 months of age; performed at home, hospital or community centre; focus on parent–infant relationship, infant development or both; outcome assessed using motor and/or cognitive measures. 18 studies met inclusion criteria, but only 11 suitable for meta-analysis.	Variety of interventions, including: • Physical therapy. • Occupational therapy. • Psychology. • Neurodevelopmental therapy. • Parent–infant relationship enhancement. • Infant stimulation. • Infant development. • Developmental care. • Early intervention education.	The motor and cognitive outcomes from early intervention programmes on infant, preschool and school-age children. Motor outcomes measured via the Bayley Scales of Infant Development Psychomotor Developmental Index (second edition) and Griffiths Mental Development Scale: Locomotor subscale (Table SIII).	Infant age – studies on cognitive outcome showed those with early developmental intervention scored a mean developmental quotient 0.42 higher than infants receiving standard follow up. Only 1 study with motor outcome showed significant difference in favour of intervention group. Preschool age – cognitive outcome for those with early intervention was shown as the mean IQ was 0.42SD higher than children receiving standard follow up. No studies were available for motor outcomes. School age – cognitive outcome showed no difference. Motor outcome showed no difference and there are no studies available for the adolescent age group.	Grade A – High. Comments: • Addresses early intervention as one broad approach; although this is legitimate given that its focus was rather on specific outcome measures, the findings do not allow one to ascertain which programmes (and what ingredients) are more effective as opposed to others. • Criterion of less than 37 weeks is a large group and does not allow narrowing of data such as very low birthweight infants. • Studies considered are not specified as to where they were carried out. • Only 9 of the 18 studies were considered high quality.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Petteys and Adoumie (2018).	Randomised controlled pilot study. Aim: to examine the impact of parent education and participation in mindfulness-based neurodevelopmental care on parent outcomes (stress, bonding and satisfaction) and infant length of stay (LOS). Recruitment: large Level III neonatal intensive care unit (NICU). Convenience sample of 55 parent–infant dyads.	Parent training in mindfulness-based neurodevelopmental care.	• Parametric and non-parametric statistical tests examined differences in and between study groups in demographics and dependent study variables (stress, bonding, satisfaction and LOS). • Descriptive statistics were calculated for infants and parents and compared between treatment groups. • Statistical tests (independent and paired t tests, χ^2 tests and Mann–Whitney U tests) were used to examine for differences.	• No statistically significant differences in parent outcomes were seen between groups. • Experimental group (EG) parents showed a significant reduction in stress scores from enrolment to discharge ($p<0.012$). • EG infants had significantly shorter LOS ($p<0.026–0.047$) than control.	Grade B – Moderate. Downgraded due to: • Small-scale study, no confidence intervals reported.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Pickler et al (2013).	Qualitative, drawn from larger RCT. Aim: to establish if there is an effect from the environment (open-bay and single family rooms) on volume of feed taken in infants born at 30–32 weeks. 87 infants. Male:female ratio = 43:44. Age = 30–32 weeks' gestational age. Some babies were in a single family room and others in the open-ward unit. United States of America.	Volume of feed and environment relationships.	Data collected at each scheduled feeding for 87 preterm infants from the first oral feed until discharge. Data included the prescribed volume of feeding and volume consumed, the infant's level of wakefulness and the nurse's perception on light and sound. Time of day of feeding also recorded. Data collected over 4 years 2007–2010 (5,111 feeds from the original ward and 5,802 from the single-family rooms [SFR]).	• Light and sound were rated significantly lower in the SFR. • Feeding times of 9am, 12 noon and 3pm were associated with the highest perceived levels of light and sound, regardless of unit design ($p<0.0001$). • Moderate light levels and feeding times of 12, 3 and 6am were associated with improved feeding outcomes. • Infants consumed a greater proportion of their prescribed feeding volume when fed in the open ward and when awake before feeding.	Grade C – Low. Comment: • Nurses' perceptions only; no measurements as such of light and sound. • Single healthcare facility rather than multiple so challenging to generalise. • Level of wakefulness is based on brief training and nurses' perception. • Feeding 'performance' was volume, which although important is not necessarily indicative of quality. • Twins cared for together in single family rooms so duplication of environmental recordings.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Pineda et al (2020).	Prospective longitudinal study. Aim: to determine the relationship between infant medical factors and early neurobehaviour, and the relationship between early neurobehaviour at 30 weeks' postmenstrual age (PMA) and neurobehaviour at term-equivalent age. Recruitment: preterm infants enrolled on third day of life from 75-bed Level III-IV NICU in midwestern US. Inclusion: born ≤30 weeks' estimated gestational age (EGA). Exclusion: known or suspected congenital anomaly, or not expected to survive. 88 very preterm infants. United States of America.	• Premie-Neuro, 24-item neurologic examination appropriate for infants 23–37 weeks' PMA.	• Neurobehavioural performance, evaluated at 30 weeks' PMA using Premie-Neuro, and at term-equivalent age (between 37 and 41 weeks) using NICU Network Neurobehavioral Scale (NNNS) and the Hammersmith Neonatal Neurological Evaluation (HNNE).	• Lower Premie-Neuro scores at 30 weeks' PMA related to being more immature at birth ($p=0.01$; $\beta=3.87$). • The presence of patent ductus arteriosus (PDA; $p<0.01$; $\beta=-16.50$) and cerebral injury ($p<0.01$; $\beta=-20.46$); and prolonged exposure to oxygen therapy ($p<0.01$; $\beta=-0.01$), endotracheal intubation ($p<0.01$; $\beta=-0.23$), and total parenteral nutrition ($p<0.01$; $\beta=-0.35$). • After controlling for EGA, PDA and number of days of endotracheal intubation, lower Premie-Neuro scores at 30 weeks' PMA were independently related to lower total HNNE scores at term ($p<0.01$; $\beta=0.12$) and worse outcome on the NNNS with poorer quality of movement ($p<0.01$; $\beta=0.02$) and more stress ($p<0.01$; $\beta=-0.004$), asymmetry ($p=0.01$; $\beta=-0.04$), excitability ($p<0.01$; $\beta=-0.05$) and suboptimal reflexes ($p<0.01$; $\beta=-0.06$).	Grade B – Moderate. Upgraded due to: • A prospective longitudinal study with 88 infants and recognised neurological assessments used by therapists in the NICU. • The results were of note in that medical factors did impact on early neurobehavioural scores and additionally had an impact on term-equivalent scores. • Targets developmental therapy early in the NICU.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Pineda et al (2018).	Cohort study. Aim: to define predictors of parent presence and holding in the NICU and to understand if this affects early neurobehaviour and developmental outcomes at ages 4 and 5. Recruitment: via NICU as part of a larger study on positioning. Inclusion: infants born ≤32 weeks' gestational age. Exclusion: infants with a congenital anomaly or not expected to live. 81 infants (100 initially). USA.	• Parents were encouraged to hold their infant, either in their arms or skin-to-skin, if the infant was medically stable. • Holding was not encouraged when infants were on oscillatory ventilation and/or when chest tubes were in place.	• Parent NICU presence and holding (arms and skin-to-skin) tracked while infant in NICU. Nurses documented presence and holding every 3 hours or at end of 12-hour shift. • The NICU Network Neurobehavioural Scale (NNNS) (without the Habituation scale) and Dubowitz Optimality Scale at 35 weeks' postmenstrual age or when medically stable, whichever was the later. • ASQ-3 completed by the parent at age 4–5 years.	• 100% had neurobehavioural testing prior to discharge. • 43% had ASQ-3 at age 4–5. • Parents were present at the NICU an average of 4 days per week and held their children an average of 2.8 days per week. • Greater participation was found among mothers who were white, married, employed, older, who had family support, fewer children, provided breast milk or whose infants needed fewer medical interventions. • More holding was related to the following on the NNS: better reflex development (p=0.02), less asymmetry (p=0.03). • More holding was related to the following on the AQS-3: better gross motor development (p=0.03) and fine motor development (p=0.048).	Grade C – Low. Comments: • Limitations include small sample size, single-site study, and that nurses may have documented parent presence differently and did not document the quality and quantity of interactions. Additionally, only 43% of sample participated in follow up at age 4–5. • Confounding factors such as other ways of parental involvement and medical stability of the infant were not accounted for. • Study was in an urban area with a diverse sample and less economic means. • Consideration needed for different support mechanisms in place for parents in the US versus the UK.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Pineda et al (2017).	Integrative review. Aim: to identify evidence for sensory exposures for very preterm infants in the NICU in relation to the impact on their neurodevelopmental outcomes and parent outcomes. Inclusion: studies published in English, methodology of systematic reviews, RCTs, quasi-experimental, crossover or single-group repeated measure studies, studies about infants born ≤32 weeks' gestation hospitalised in the NICU and had a quantifiable sensory-based intervention commencing prior to 36 weeks' postmenstrual age. Exclusion: published before 1995, fewer than 30 participants and no a priori power calculation conducted, outcome of pain or breastfeeding. 88 studies.	• Unimodal and multimodal sensory-based interventions.	• Relevant outcome measures included infant behavioural outcomes, infant physiology, maternal mental health and parental outcomes.	• Massage found to positively impact mother–infant interaction (1 study). • Kangaroo care improved cognitive development (1 study), lessened parental depressive symptoms (3 studies), higher maternal self-esteem (1 study), and better mother–infant interaction (2 studies). Other studies showed no effect on these outcomes. Inconsistent findings on temperature stability and physiology outcomes. • Auditory and visual interventions showed inconsistent or no significant findings. • 8 studies on auditory, tactile, vestibular and visual interventions showed mixed findings on infant developmental outcomes, but positive outcomes for maternal stress and depression. • Little evidence on long-term outcomes from sensory interventions.	Grade A – High. Comments: • Limitations include some studies having a limited description of intervention, process, or characteristics of population, publication bias, limited generalisability of many studies, and heterogeneity of studies resulted in a descriptive summary. • Authors note while limited evidence, very few risks uncovered to conducting sensory interventions.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Pineda et al (2015).	Cohort study. Aim: to assess whether neonatal social characteristics are related to autism risk when assessed at term corrected and 2 years. Recruitment via NICU and enrolled by third day of life. Inclusion: <30 weeks' gestational age and no known congenital anomaly. 62 infants. Male:female ratio = 16:15. United States of America.	Examining social characteristics.	• Neonatal neurobehaviour and social characteristics were assessed with NICU Network Neurobehavioral Scale at term age equivalent. • The Modified Checklist for Autism in Toddlers (M-CHAT) and The Bayley Scales of Infant and Toddler Development, third edition were used to identify risk factors for autism at 2 years.	• Atypical social interactions were not observed among infants who later screened positive for autism. • The presence of gaze aversion and endpoint nystagmus was related to better developmental outcomes.	Grade C – Low. Comments: • Small sample size. • The M-CHAT has been criticised for over-identifying ASD risk in premature infants. • Social interaction factors assessed during a neurobehavioural exam and not naturally occurring. • NNNS was not designed to investigate individual factors that impede early neurobehavioural function, so challenging to distinguish ASD risk from other developmental impairment. • Definitions of visual skills and social interaction in the current study may differ from other reports. • Relationships with many social interaction variables, increasing the chance of finding an association that does not actually exist. • Sample not followed for long enough or looked at in depth.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Price and Miner (2009).	Qualitative. Aim: part of a larger ethnographic study that examined how occupation and occupation-based practices emerge in the practices of experienced occupational therapists who are peer-nominated and self-espoused to practise from an occupation-based perspective. Recruitment via therapist in larger study. 1 mother and infant participated. United States of America.	Observations of an occupational therapist working with a mother and infant using an occupation-centred approach.	None.	2 key themes identified as being reflective of NICU occupation-centred practice: • Negotiating the meaning of parenting and parenting co-occupations. • Providing opportunities for parenting co-occupations.	Grade D – Very low. Comments: • Lacks some details of overarching study's methods, but these are reported elsewhere. • Single case study with an atypical case – the fact that the infant was very likely to die would have been known at the outset but this was underplayed in the discussion, although it would surely have influenced the therapist.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Richardson et al (2020).	Scoping review. Aim: to map evidence of parent-targeted educational interventions about infant procedural pain delivered throughout the perinatal period. Inclusion: any type of literature that included parents receiving education about infant pain management in the perinatal period (antenatal up to 6 weeks' postpartum). Exclusion: studies not related to pain, delivered outside the perinatal period or aimed at healthcare providers. 9 studies. Canada, UK and Brazil.	• Interventions included breastfeeding, skin-to-skin, facilitated tucking, sucrose, topical anaesthetic, non-nutritive sucking, holding, and deep breathing and distracting. • Educational component included written, video, multimodal, or a combination of the above plus discussion, role playing and pictorial information. • Dose duration ranged from 6 to 45 minutes. • 6 studies included follow up.	• Outcomes included parental knowledge, self-efficacy, parental involvement in procedural pain management, stress, anxiety, postnatal depression, role attainment, pain assessment documentation and measure of social support. • A variety of tools was used to measure outcomes.	• Parental knowledge, self-efficacy, parental involvement in procedural pain management, role attainment and pain assessment documentation were all shown to have increased after interventions. • Parental stress, anxiety, postnatal depression and social support showed no significant differences.	Grade C – Low. • Downgraded due to being a scoping review and not a full systematic review. Comments: • Limitations include lack of discussion of intervention fidelity in studies, the small number of studies with heterogeneity in design, and 1 study was a published conference abstract. • Most studies were conducted by 1 set of researchers and focused on vaccination pain. • Mothers were often the majority of respondents, despite both parents being eligible in nearly all the studies.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ross and Browne (2013).	Systematic review. Aim: to ascertain the evidence on breastfeeding rates, eating skill or feeding problems, and growth outcomes in preterm infants at the time of NICU discharge. 61 articles reviewed; 55 in final analysis. Published within the past 10 years, all in English.	Reviewing evidence related to feeding.	• Breastfeeding outcomes at discharge and after. • Feeding outcomes at discharge and after. • Growth outcomes at discharge.	• Sweden utilises a range of methods that effectively improves breastfeeding rates (KMC, non-nutritive sucking, tube feeding instead of bottle feeding to establish breastfeeding). Post-discharge, it also has the best outcome for exclusive breastfeeding. Overall, rates decline across the first year of birth. • At discharge infants are not fully orally feeding or are eating with difficulty co-ordinating sucking/swallowing and breathing. Most successfully nipple feed after 36 weeks' gestation, with the most preterm achieving this at a later age. • Preterm infants have delayed skills attainment even after correcting for prematurity. • Feeding problems reported by parents are prevalent and evident after discharge. • Parents introduce solids to their infants earlier than recommended.	Grade B – Moderate. Downgraded due to: • Not enough detail about papers reviewed. • Could have searched more databases. • Doesn't comment on the quality of the articles included. • Doesn't address any limitations of review. Comments: • Exclusive breastfeeding not well defined as can mean different things in different studies.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Sajaniemi et al (2001).	Cohort study. Aim: to assess whether occupational therapy intervention affects cognitive skills and attachment patterns for extremely low birthweight infants. Inclusion: born between 1 January 1991 and 31 December 1994 and admitted to NICU. Exclusion: infants with major neurological problems. 115 infants. Male:female ratio = 48:57. Finland.	• A weekly occupational therapy session (60 minutes) provided at home for infants between 6 months and 12 months. • Therapy programmes consisted of: parents being taught to adapt sensory environment and stimulation to address babies' sensory modulation problems; parents being taught handling strategies to promote normal sensorimotor development.	• Bayley Scales of Motor Development/mental development index at 2 years. • Wechsler Preschool and Primary Scale of Intelligence – Revised Finnish translation (WPPSI) at 4 years to assess cognitive function. • Preschool assessment of attachment ages 2–4.	• Impact on Bayley's scores in both groups (p=0.001). • Each additional pre-perinatal risk factor reduced score by 3.46 points. • At 4 years cognitive scores were significantly higher in intervention group (<p=0.05, <p=0.02). • Boys' risk factor score and cognitive scores at 2 years were significantly lower (p=0.001); boys' verbal performance in intervention group was better at 4 years. • Attachment patterns altered significantly (p<0.04) with more normative patterns in the intervention group.	Grade C – Low. Comments: • No discussion of ethics approval. • No discussion of how parents were randomly allocated. • No acknowledgement of limitations to study. • No acknowledgement of all confounding factors.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Santos et al (2017).	A quantitative, quasi-experimental study. Aim: to compare the effect of sleeping position on physiological and behavioural responses in preterm infants. Recruitment: via a neonatal intensive care unit (NICU) and sample calculation was performed by the program GPower 3.1. Inclusion: preterm infants admitted to NICU from June 2016 to March 2017, who were of a gestational age ≤32 weeks, with no congenital anomalies. Exclusion: preterm infants whose parents or legal guardians did not give consent; or infants with a clinical diagnosis or treatment that would make it impossible to change position, such as an umbilical arterial catheter in situ. 24 preterm newborns from a NICU in a university hospital in southern Brazil. Brazil.	• Preterm infants were randomised anonymously with a simple draw, by throwing a dice. • 6 preterm infants were allocated to each position: right side position, supine position, left side position and prone position. • The physiological and behavioural variables were evaluated before, during and after positioning. • All variables were evaluated 30 minutes before the beginning of the procedure, during the 3-hour study period, and 30 minutes after the intervention.	• The pain response was measured by the Neonatal Infant Pain Scale (NIPS) and the behavioural response was checked by the Neonatal Behaviour Assessment Scale (NBAS). • Physiological responses, heart rate and peripheral oxygen saturation were verified by the Omnimed Omni 612 multiparameter monitor, while the researcher (physiotherapist) observed and counted the respiratory rate for 1 minute, once per hour during the intervention period.	• During the intervention, heart rate decreased in right side position, supine position and prone position. • The respiratory rate reduced in all positions and peripheral oxygen saturation remained stable in most positions. • Behavioural scores were reduced in supine, left side and prone positions. • There was a significant reduction between the beginning and the end of the intervention in the right-side position group (p=0.03), between the beginning and during the procedure in the supine position group (p=0.01). • Although the prone position did not present a significant reduction, it was likely to present a reduction between the beginning and during the intervention (p=0.07).	Grade B – Moderate. Comments: • Results are transferable to local population/context.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Shoghi et al (2018).	Randomised controlled clinical trial. Aim: to understand if massage affects the emotional attachment of mothers to their preterm infants admitted to the NICU. Inclusion: first-time mothers of infants born between 34 and 37 weeks' gestational age; ability to be present in the NICU 24 hours a day; conception without in-vitro fertilisation or years of infertility; no maternal alcohol or drug addiction; birthweight lower than 2.5 kg; ability to breastfeed; clinical stability of infant; no phototherapy for infant. 40 mothers and 40 infants. 20 in control group. 20 in intervention group. Mean gestational age at birth: 35 weeks. Iran.	• Massage began between the fifth and seventh days of hospitalisation. • Mothers in intervention group provided with educational booklet and CD on massage produced by the Iranian Ministry of Health. A training video was also shown, followed by 2 1-hour training sessions on an infant mannequin in the presence of a research team member. Further sessions were provided if needed, and a 24-hour helpline established. • Infants in the intervention group received massage 3 times a day for 15 minutes for 5 days. • Control group received no training on massage and received routine care.	• Completion of a demographic questionnaire prior to starting intervention. • Mother–infant attachment: Avant maternal attachment behaviours scale conducted prior to start, and then on first, third and fifth days of intervention for intervention group. • For both groups, maternal attachment was measured by 15 minutes of direct observation using a chronometer by a team member who was blinded to allocation. Observation was conducted prior to breastfeeding.	• Mean score for attachment between the mothers and their infants at baseline was not significantly different. • There was a significant difference between attachment scores on fifth day of the massage intervention: 57.76 ± 4.20 for the intervention group and 46.23 ± 4.35 ($p<0.001$).	Grade B – Moderate. Downgraded due to: • No mention of how randomised and no discussion of confounding variables. Comments: • Limitations include a member of the research team present during attachment assessments which may have affected the behaviours of the mothers, NICU noise during attachment assessment and small sample size.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Skene et al (2019).	Participatory action research. Aim: to develop, implement and evaluate family-centred interventions to promote parental involvement in a neonatal intensive care unit. Inclusion: parents aged 18 years+ following infants' admission to NICU if minimum stay of 10 days expected and baby 27+ weeks' gestation. Exclusion: most vulnerable infants, if infant required palliative care or if unable to communicate in English. 10 nurses participated in Phase 1. 4 nurses participated in Phase 2. 8 parents participated in Phase 1. 24 parents participated in Phase 2. 10 parents participated in Phase 3. UK.	• Improved skin-to-skin and unlimited parental presence at the cot side.	• Nurse perception of FCC care within the unit. • Parental perception of FCC care.	• Nurses reported positively on improvements in Family-Centred Care, most notably information sharing with parents, providing family support, enabling parental participation in care and improved competence supporting parents in caregiving.	Grade D – Very low. Downgraded due to: • Limited rigour and validity, high probability of bias. Comments: • Research didn't clearly relate to the initial aim, so not particularly valuable. • Suggests it might not be transferable to other NICUs due to individual setting of research. • Effects of bias needed more critical examination.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Soleimani et al (2020).	Systematic review. Aim: to review the effects of developmental care in neonatal intensive care unit (NICU) setting on mental and motor development of preterm infants. Search strategy consisted of text words, such as premature, preterm, low birthweight and Bayley; and relevant medical subject headings (MESH). Exclusion: articles not written in English. Iran.	• Searched PubMed, EMBASE, CINAHL, Scopus, Web of Science and Cochrane library until October 8 2017, and included randomised controlled trials that assessed effects of developmental care in NICU on mental and motor development of preterm infants at 12 and 24 months of age, using the Bayley scale of infant development in this systematic review. • Data were pooled by random effects model and standardised mean difference (SMD) with 95% confidence intervals (CI), calculated for meta-analysis.	• After screening only including relevant studies with a randomised controlled trial methodology.	• 21 studies were eligible to be included in the systematic review; however, only 13 had data suitable for meta-analysis. • According to statistical analysis, developmental care in NICU improved mental developmental index (MDI) (standardised mean difference [SMD] 0.55, 95% confidence interval [CI] 0.23–0.87; p<0.05) and psychomotor developmental index (PDI) (SMD 0.33, [CI] 95% CI 0.08–0.57; p<0.05) of BSID at 12 months of age and PDI at 24 months of age (SMD 0.15, 95% CI –0.02–0.32; p<0.1) of preterm infants. • However, the benefit was not detected at 24 months of age on MDI (SMD 0.15, 95% CI –0.05–0.35; p=0.15).	Grade B – Moderate. Downgraded due to: • Only used 1 specific developmental assessment as a way of controlling and comparing the literature. • Only 13 articles reviewed. Comments: • Limitations included excluding articles not in English. • Adds to the body of evidence that developmental care is beneficial.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Spencer-Smith et al (2012).	Randomised controlled trial. Aim: to determine the longer-term effectiveness of the programme by reviewing caregivers and children at preschool age. Recruitment at term-equivalent age from January 2005 to January 2007. Inclusion: born <30 weeks' gestational age with no major congenital abnormalities. Exclusion: living outside 100km radius of hospital or did not speak English. 120 children. Intervention group = 61. Control group = 59. Follow-up sample reduced to 105. Australia.	VIBeS Plus home-based preventative care programme, which aims to educate primary caregivers about evidence-based interventions for improving infant self-regulation, postural stability, co-ordination and strength, parent mental health, and the parent–infant relationship. 9 home visits for 1.5–2 hours over first year of life targeting infant development, parental mental health and parent–infant relationship. Control group had standard care, although this varied.	At 4 years corrected age: • Cognitive (Differential Ability Scale). • Behavioural (Behaviour Assessment for Children). • Motor (Movement Assessment Battery for Children). • Caregiver mental health (Hospital Anxiety and Depression Scale) assessment. Primary caregivers completed parent-rated questionnaires to evaluate pre-schooler behaviour and self-rated questionnaires to assess their own mental health and social risk. Assessors were blind to treatment allocation.	Little evidence in difference with cognitive/motor function between pre-schoolers. Intervention group had lower scores for child internalising behaviour, although the proportion at risk for internalising problems was similar in both groups. No further differences in behavioural scores found. Caregivers in intervention group had fewer anxiety symptoms, but little evidence of difference in depressive symptoms.	Grade A – High. Comments: • Caregiver mental health and child behaviour were assessed by caregiver reports. • Additional ratings from preschool teachers would provide greater confidence in the study findings and insight into child behaviour in a social setting. • Larger sample to examine influence of sex of child on outcomes, as well as the examination of successful components of such interventions.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Spittle et al (2015).	Systematic review. Aim: to compare the effectiveness of early development intervention programmes over time. 25 studies: 19 RCTs. 5 quasi-RCTs. 1 cluster analysis.	Most interventions aimed to improve cognitive and/or motor outcomes, with focus on parent–infant relationship and/or infant development. Most began post-hospital discharge.	Comparison of the effectiveness of early developmental intervention programmes provided post-hospital discharge to prevent motor or cognitive impairments in preterm (<37 week) infants.	Variability with regard to focus and intensity of treatment, participant characteristics and length of follow up. Cognitive outcomes: • Meta-analysis led to conclusion that treatment improved cognitive outcomes in infancy and preschool age but not for school age. Motor outcomes: • Meta-analysis of 12 studies showed significant positive outcomes for early developmental interventions at infancy only – though effect was small. No effect was noted on rate of CP among survivors. Limited information on long-term follow up of motor outcomes; little effect noted.	Grade A – High. Comments: • Not possible to blind the treatment provided. • Only 1 study had a comparison treatment. • Parental support may affect outcomes around parent–infant relationship which cannot be accounted for. • Sample size not adequate in all. • Limited heterogeneity in content, focus and intensity of treatment limits results. • Need longer-term follow up of high-quality RCTs. • Measurement tools may not be sensitive enough to detect changes in motor performance and to identify minor neurological issues. • Review did not investigate effects on behaviour, parental outcomes, function, activity levels or participation.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Spittle et al (2007).	Systematic review. Aim: to review studies on early intervention programmes (EI) that assessed cognitive and/or motor ability. Inclusion: preterm <37 weeks, no major congenital abnormalities, developmental programmes started within the first 12 months of life. 16 studies, 6 RCTs.	Early intervention programmes which started in the first 12 months of life, focus on parent – infant relationship and/or infant development and a component for delivery post-discharge from hospital. The early intervention programmes included in the review varied in content, frequency of intervention and focus of intervention. Frequency and duration of intervention programmes ranged from 4 sessions over 1 month to weekly sessions for 12 months followed by bi-weekly sessions for a further 2 years. The majority began post-discharge.	Motor and/or cognitive development outcomes. Cognitive and motor outcome data were pooled into 3 age bands: infant (0–2 years), preschool (3 to <5 years), or school age (5 to <17 years). If studies reported data at more than 1 time point within an age band, data from the latest assessment were used.	Interventions improved cognitive outcome at infant and preschool age. Interventions improved motor outcomes slightly at infant age, but not statistically significant. School-age children receiving early intervention did not score significantly higher than children who received standard follow up for motor or cognitive outcomes.	Grade A – High. Comments: • It addresses EI as one broad approach; although this is legitimate given that its focus was on specific outcome measures, the findings do not allow one to ascertain which programmes (and what ingredients) are more effective as opposed to others. • Previous studies measured disability using a medical framework and more recent measures consider functional outcome, which may produce different results re cognitive and motor outcomes. • More specific selection of high-risk populations. • Targeting specific interventions to assess results and in particular motor outcomes.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Stark et al (2020).	Cohort study. Aim: to understand the long-term developmental outcomes of infants who received hypothermia for Hypoxic Ischemic Encephalopathy (HIE). Recruitment: via a hospital from January 2011 to March 2014. Inclusion: infants presenting with HIE who received hypothermia. 30 infants. South Africa.	• None.	• The Strive Towards Achieving Results Together (START) was used to assess developmental outcomes from birth to 3 years. • The Early Childhood Developmental Criteria (ECDC) was used to assess cognitive, fine motor and gross motor outcomes at 4 and 5 years of age for typically developing children. • Children with cerebral palsy (CP) were assessed by the Gross Motor Function Classification System – Expanded and Revised (GMFCS-E&R). • Children were assessed at 3, 6, 9, 12, 18, 24, 36, 48 and 60 months.	• 2 infants were lost to follow up, so 28 infants' data were analysed. • 5 children who presented typical development did not attend all follow-up appointments. Researchers assumed they continued to typically develop. • 2 children with cerebral palsy died during the follow-up period. • 20 children presented with typical development while 8 presented with CP. • Severe HIE is significantly associated with CP (p=0.0005). • START showed average development in all areas, aside from dips in gross motor at 36 months, fine motor at 9, 24 and 36 months, and at 24 months with activities of daily living (ADLs). • By 5, according to ECDC results, gross motor skills had developed best, followed equally by fine motor skills and cognitive development. • Poorer results on form and number concepts by 5 year olds may indicate effects of HIE.	Grade D – Low. Downgraded due to: • Clustered cares are detrimental, therefore the study put infants under unnecessary stress; lack of information about type of cares and therefore possible variable that means unable to interpret results, and lack of observational recording of infants' behavioural and physiological responses. Comments: • Limitations include START was not intended to be an assessment tool, so had to be adapted by the researchers and relies on a parent's report of the child's abilities, small size of the study, lack of exact socioeconomic data and education level of parent, and lack of high-quality early childhood education available to the children.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Suarez et al (2018).	Qualitative. Aim: to describe each participant's lived experience while exploring common themes across the participants. Recruitment: mothers in a larger-scale study of the impact of combined occupational and music therapies invited to complete interviews. Inclusion: mothers with established relationship with the researcher. 4 participants in opiate substance abuse recovery programme and baby born with neonatal abstinence syndrome (NAS). United States of America.	• Semi-structured interviews ranging from 30–60 minutes as series of open-ended questions.	Thoughts on: • Best things about being a mother. • Challenges related to being a mother. • Comparison of relationship with their baby compared to their own mothers. • Healthcare experience throughout pregnancy, labour and delivery. • Any other thoughts on the topic.	Themes from the interviews include: • Deep love for the baby. • The baby as motivation to stay sober. • Determination to make the relationship between mother and child different from the one the mother had experienced with her own mother.	Grade C – Low. Comments: • Further research into experiences of mothers with opiate addiction needed. • Study involving diverse ethnic group needed. • Study provides an expression of parents' perspectives and motivating factors but does not provide results which could add weight to current practice. • Lack of robust statement of findings.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Sucharew et al (2012).	Cohort study. Aim: to evaluate the impact of low-level prenatal and early childhood exposure to a variety of environmental toxicants on child health and development. Recruitment via 9 participating clinics that provided neonatal care. Inclusion: pregnant women aged over 18 years. Exclusion: multiple births. Of 389 singleton births, 355 examined at 5 weeks of age. Part of a wider study: 'The Health Outcomes and Measures of the Environment (HOME) Study'. United States of America.	Exposure to environmental toxins.	Assessment at 5 weeks of age on the NNNS and at 12, 24 and 36 months on the BSID-II. The Behaviour Assessment System for children – 2 (BASC2) was completed by parents at 24 and 36 months to look at children's behavioural problems. The research team used latent profile analysis (LPA) to classify neurobehavioural responses. Created an algorithm that divided NNNS scores into 3 profiles: • Social/easy-going. • Difficult/high-arousal. • Hypotonic. Compared the allocation into these 3 profiles against the BSID-II scores at 12, 24 and 36 months and with BASC2 at 24 and 36 months to see if profiled scores on the NNNS are a predictor for later developmental issues.	Using the raw scores it was found that the hypotonic profile infants had a significantly lower PDI on the BSID-II compared with both the social/easy-going and high-arousal/difficult infants. Hypotonic infants also had a lower mean externalising score compared with the social/easy-going group. No significant differences were observed between the social/easy-going and high-arousal/difficult groups for the neurobehavioural outcomes.	Grade C – Low. Comments: • Only followed up to 3 years of age. • Only used with term, healthy infants. • Maternal drug use was based on parental report and not on drug testing.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Swift and Scholten (2010).	Qualitative, phenomenological design using grounded theory principles. Aim: to develop an exploratory model from the data to identify considerations for NNU staff that could be incorporated into daily practice to improve family-centred care. Inclusion: in NNU between January and June 2003; feeding difficulties persisting post 35 weeks' gestational age; at 36 weeks infant able to take less than 40% feeds orally; born post 29 weeks' gestation; birthweight greater than 1000g; singletons. Exclusion: Grade IV IVH; referred to youth and family services while in unit; cleft palate syndrome; diagnosed with neurological deficit; cystic leukomalacia; residing outside metropolitan area; non-English-speaking parents; mothers <18 years at time of birth. 9 mothers and 2 fathers. Australia.	Development of an exploratory model.	Describe the experiences of both mothers and fathers who had a child in the neonatal unit with a feeding difficulty at 36 weeks' gestational age.	• Core theme identified from parental experiences was the desire to take the baby home. Feeding difficulties prevented this from occurring, shifting the focus of feeding from parent–child interaction to one of intake and weight gain. • Article identifies importance for health professionals to support interactive feeding experiences. • An exploratory model was developed from the data identifying considerations for neonatal unit staff that could be incorporated into daily practice to improve family-centred care.	Grade C – Low. Comments: • Small sample size – unclear if reached saturation point. • Mother:father ratio unequal (9:2). • Limited geographical area and only 1 unit included. • No discussion of researcher potential bias/influence. • No information on how infants are now feeding and whether there are ongoing difficulties that could influence the parents' interviews.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Symington and Pinelli (2006).	Cochrane systematic review. Aim: to review evidence on developmental care. Inclusion: randomised trials where elements of developmental care were compared with routine care for preterm infants and that measured clinically relevant outcomes, in English or where translator available. 36 studies with 2,220 participants.	Developmental care and associated practices were categorised under the following 4 intervention groupings for the review purpose: • Positioning. • Clustering of nursery care activities. • Modification of external stimuli. • Individualised developmental care interventions.	• Neurobehavioural development as measured by standardised instruments, including Bayley Scales of Infant Development, Neurobehavioral Assessment of the Preterm Infant, Assessment of Preterm Infants' Behaviour. • Weight gain. • Length of hospital stay. • Length of mechanical ventilation. • Physiological parameters including heart rate, oxygen saturation. • Other clinically relevant outcomes.	Overall, the results indicate that developmental care interventions demonstrate some benefit to preterm infants with respect to: • Improved short-term growth and feeding outcomes. • Decreased respiratory support. • Decreased length and cost of hospital stay. • Improved neurodevelopmental outcomes to 24 months' corrected age. All other outcomes were conflicting; the variability could be attributed to small sample sizes; lack of assessor blinding as a major methodological flaw in half of the studies; or variations in outcome measurement.	Grade A – High. The quality rating refers to the conduct of the systematic review. The methodological quality of the included studies should be carefully considered. Comments: • Need for more high-quality RCTs to assess the effects of developmental care. • This was an ambitious systematic review which offered a broad coverage of the topic; potentially stricter selection criteria which go beyond the design employed (e.g. RCT) to mitigate for the great variability in the methodological rigour of the reviewed studies (e.g. mention of blinding procedures). • The lack of blinding of the assessors was a significant methodological flaw in half of the studies. • Primary studies predominantly focus on short-term outcomes only. • Lack of long-term neurodevelopmental follow-up data and use of consistent outcome measures.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Symington and Pinelli (2002).	Cochrane systematic review. Aim: to review evidence on individualised developmental care programmes. Inclusion: randomised trials in which elements of developmental care are compared with routine nursery care for infants <37 weeks' gestation and that measured clinically relevant outcomes. Reports were in English or a language for which a translator was available. 31 eligible RCTs.	4 groups of developmental care interventions: • Positioning – nesting, swaddling, prone. • Clustering of nursery care activities. • Modification of external stimuli – vestibular, auditory, visual, tactile. • Individualised developmental care – NIDCAP, other individualised interventions.	• Neurobehavioural development as measured by standardised instruments, including Bayley Scales of Infant Development, Neurobehavioral Assessment of the Preterm Infant, Assessment of Preterm Infants' Behavior. • Weight gain; weight at discharge. • Length of hospital stay; age at discharge; cost of hospital stay. • Length of mechanical ventilation. • Physiological parameters including heart rate, oxygen saturation. • Other clinically relevant outcomes such as feeding, growth, sleep–wake states.	Developmental care interventions showed some benefit to preterm infants with respect to improved short-term growth outcomes, decreased respiratory support, decreased incidence of moderate to severe chronic lung disease, decreased length and cost of hospital stay, and improved neurodevelopmental outcomes to 24 months' corrected age. These findings were based on 2 or 3 small trials for each outcome.	Grade A – High. Comments: • Although a number of other benefits were shown, those results were from single studies with small sample sizes. • The lack of blinding of the assessors of the outcome variables was a significant methodological flaw in half of the studies. • The costs of the interventions and personnel were not considered in any of the studies. • This was an ambitious systematic review which offered a broad coverage of the topic; potentially stricter selection criteria which go beyond the design employed (e.g. RCT) to mitigate for the great variability in the methodological rigour of the reviewed studies. • Need consistent outcome measures for long-term outcomes for high-risk preterm infants.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Thomson et al (2020).	Meta-ethnographic systematic review. Aim: to identify when, how and in what situations and events allowed parents to feel emotionally close to their infant in the NICU. Inclusion: qualitative or mixed-methods studies looking at parents of infants admitted to the NICU, with outcomes about parents' intimacy, love and affection for their infants, published 1990 onwards in English, Italian, Swedish, Danish or French. 34 studies. 670 parents. 17 countries.	• Not applicable.	• When, how and in what situations/events parents felt emotionally close to their infant while in the NICU.	• Embodied connections: physical contact was perceived as essential to emotional closeness, being able to spend time together as a family, and retaining a sense of connection even when unable to be physically present, such as leaving a photo or calling for an update. • Inner knowing: positive health signs and development about their infants allowed them to feel emotionally closer, along with understanding the processes and expectations of the NICU and their infant's condition. • Evolving parental role: being able to input into the health and wellbeing of their infant through activities such as breastfeeding, washing and changing nappies; and having their parental role acknowledged and valued by healthcare staff helped parents feel emotionally close to their infants.	Grade A – Very high. Comments: • Limitations include only 1 study focusing on low-income parents, and ethnicity was often missing.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Vittner et al (2019).	Randomised crossover design study. Aim: to examine relationships between parental engagement and salivary oxytocin and cortisol levels for parents participating in skin-to-skin contact (SSC) intervention. Recruitment: convenience sampling via a neonatal intensive care unit (NICU) in Connecticut. 28 stable preterm infants, mothers and fathers participated between November 2015 and June 2016. United States of America.	• SSC intervention over a 3-day time frame. • Parental engagement was measured at discharge using the Parental Risk Evaluation Engagement Model Instrument (PREEMI). • Saliva samples for oxytocin and cortisol levels were collected 15 minutes pre-SSC, 60 minutes during-SSC and 45 minutes post-SSC.	• Relationships between parental engagement composite scores and salivary oxytocin and cortisol levels.	• A significant negative correlation between paternal engagement and paternal oxytocin levels ($r=-0.43$; $p<0.03$) and a significant negative correlation between infant oxytocin levels and maternal engagement ($r=-0.54$; $p<0.004$) were present. • Infant oxytocin levels increased during SSC, maternal engagement scores significantly decreased at discharge ($\beta=-.04$; $p<0.01$). • Linear regression, adjusting for infant oxytocin and cortisol levels, showed that as paternal oxytocin levels increased, there was a significant decrease in paternal engagement ($\beta=-.16$; $p<0.03$) and as paternal cortisol levels increased, there was a significant decrease in paternal engagement ($\beta=-68.97$; $p<0.05$). • Significant relationships between parent engagement at NICU discharge and salivary oxytocin and cortisol levels during SSC early in the NICU stay.	Grade B – Moderate. Downgraded due to: • Pilot study, no comparison group, no one blinded to study.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Vittner et al (2018).	Randomised crossover. Aim: to examine changes that occur in infant and parent salivary oxytocin (OT) and salivary cortisol (SC) levels during skin-to-skin contact (SSC) and whether SSC alleviates parental stress and anxiety while also supporting mother–father–infant relationships. Recruitment: convenience sampling. Inclusion: infants 30–34 weeks' gestational age at birth and between 3 and 10 days old at start of study; receiving either nothing by oral or on intermittent feeds to control for feeding effects on heart rate variability. Inclusion: Parents had to be >18 years; English speaking. Exclusion: infants intubated and receiving mechanical ventilation; known congenital anomalies; severe periventricular/ intraventricular haemorrhage; undergone minor/major surgery; receiving sedation or vasopressors or analgesics to control effect of sedative medication; history of depression. 28 preterm infants and parents. United States of America.	• 60-minute SSC session.	• Saliva samples were collected from infants, mothers and fathers on days 1 and 2 (1/ parent) for OT and cortisol measurement pre-SSC, during a 60-minute SSC session and a 45-minute post-SSC session. • Parental anxiety was measured at the same time points. • Parent–infant interaction was examined prior to discharge on day 3 via video for synchrony and responsiveness using Dyadic Mutuality Coding.	• Salivary OT levels increased significantly during SSC for mothers ($p<0.001$), fathers ($p<0.002$) and infants ($p<0.002$). Infant SC levels decreased significantly ($p<0.001$) during SSC as compared to before and after SSC. • Parent anxiety scores were significantly related to parent OT and SC levels. • Parents with higher OT levels exhibited more synchrony and responsiveness ($p<0.001$) in their infant interactions.	Grade A – High. Comments: • Intervention is already in use, this provides further evidence of its benefits to try to ensure increased provision for infants and families in the NICU.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Waitzman et al (2014).	Qualitative design. Aim: to examine content validity of the Infant-Driven Feeding Scales. Recruitment of purposefully selected occupational therapists, speech and language therapists (SLTs), nurses and physiotherapists who were considered to be experts. Inclusion (at least 1 of the following): provision of care to infants in a highly ranked NICU; publications on the topic of infant feeding; presentations at national conferences on the topic of infant feeding; recognition by colleagues for their extensive practice experience with premature infants. 35 identified; 12 consented; 10 completed Round 1 and 8 Round 2. Occupational therapist = 5. Speech and language therapist = 3. Physiotherapist = 1. Neonatal nurse = 1. United States of America.	Asked to complete Round 1 of the survey where the 3 areas were examined: Readiness, Quality and Caregiver Techniques Scale. Consensus agreement set as 65%. If items did not score 65% they were re-written by the authors, and participants asked to comment again in Round 2 of the study.	Item 5 in Readiness needed re-wording to obtain 87.5% consensus agreement in Round 2. All other items in feeding readiness scored over 65%. There was good consensus in Quality with no items having to be re-written. There was good consensus in Caregiver Techniques Scale.	Using the Delphi survey method, the wording of the Infant-Driven Feeding Scales has evolved in terms of language but the message and content have remained the same. This project provided additional evidence to support the content validity of the scale.	Grade D – Very low. Comments: • Poor return from original 35 participants identified. May not be representative of the larger group of neonatal practitioners. • Biased selection of clinicians. • Conflict of interest by authors. • US occupational therapy role differs from the UK.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Wallin and Eriksson (2009).	Systematic review. Aim: to assess the effects of individualised developmental care on the psychomotor development, neurological status, medical outcomes and parental perceptions of premature infant. Inclusion: RCT, intervention group was subject to NIDCAP observation on a regular basis followed by recommendations for care. Exclusion: various types of historical design because implementation of NIDCAP occurred at the same time as did many other changes in medical and nursing practice. 12 articles. Each study of medium quality. Studies took place in the United States of America and Sweden.	NIDCAP's aim is to provide adequate stimulation to premature infants, gestational age less than 37 weeks. NIDCAP requires extensive training of neonatal staff to observe infants' behaviour at intervals over 7–10 days and these observations form the basis for an individual care plan. The infant is observed at 2-minute cycles before, during and after a care procedure. Observations of respiration, colour and visceral parameters, motor functions, facial features, state and attention were conducted.	The effects on the premature infant regarding psychomotor development, neurological status, medical/nursing care outcomes and parental perceptions during the inpatient period.	• Results showed a trend for positive findings with the NIDCAP group for cognitive and motor development. • Positive effects of NIDCAP were reported in 7 articles from the 6 RCTs. • Some studies had a large number of outcome variables and these were analysed using bivariate analyses, implying a risk for mass significance. • A common feature was the low number of participants and thus low statistical power.	Grade B – Moderate. Downgraded due to: • Studies were medium quality with large numbers of outcome variables and small numbers of participants, so not statistically significant results. • Not able to conduct meta-analysis. • Descriptive analysis impacted by variability of outcome measurement and methodological structure of the original studies. Comments: • Methodological shortcomings. • Unclear tool for inclusion of studies. • Review authors suggest that the shortcomings in design and method of studies reviewed are too apparent to support far-reaching claims on the effectiveness of the method.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ward et al (2000).	Qualitative. Aim: to explore the perceptions of 3 occupational therapists and 3 parents regarding occupational therapy services provided in the neonatal intensive care unit. Recruitment via Level 3 NICUs representing geographically diverse regions in Virginia. Occupational therapist inclusion: licensed to practise in Virginia, NICU staff member, provide primary oral motor feeding intervention to premature infants. Parent inclusion: received oral motor feeding intervention from NICU occupational therapist, discharged between 22 November 1998 and 6 January 1999. 3 occupational therapists. 3 parents with infants who had been admitted to the NICU. United States of America.	Measuring perceptions of neonatal occupational therapists and parents.	Occupational therapy themes: • The role of the occupational therapist. • Types of training provided for families. • Time spent with parents. Parent themes: • Occupational therapy intervention and treatment. • Time spent with occupational therapist. • Perceptions of occupational therapy service.	• Both occupational therapists and mothers reported that training was provided on a variety of topics, including oral stimulation and reading infant cues. • They agreed that the most common methods of training used were hands-on training and demonstration. • Although mothers were satisfied with the training received, they reported a concern over the lack of time available for training. The occupational therapists reported having this same concern.	Grade C – Low. Comments: • The parents interviewed consisted exclusively of mothers. Fathers may have provided different perceptions of occupational therapy services received in the NICU. • 1 selected hospital did not have any infants who met the study criteria, therefore families from only 2 of the proposed hospitals were utilised. • The researchers were unable to observe 1 occupational therapist providing oral motor feeding intervention due to a low census at her facility. • Small sample size and 1 US state.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Watkins et al (2014).	Retrospective analysis of cohort data. Aim: to investigate the association between receipt of physical and occupational therapy services delivered between 9 months and 2 years and preschool motor performance. Inclusion: very low birthweight (VLBW) children who seemed to be meeting typical motor milestones, no diagnosed mobility impairment, <1500g, and 'walking while holding onto furniture' on 9-month assessment. Exclusion: mother <15 years of age, child adopted, died before 9 months, had congenital anomalies, known upper or lower extremity mobility impairments indicated on the 9-month caregiver questionnaire. 500 children. United States of America.	Receipt of physical or occupational therapy services between 9 months and 2 years.	Improved preschool-age motor ability using: • Early Screening Inventory-Revised. • Bruininks–Oseretsky Test of Motor Proficiency. • Movement Assessment Battery for Children.	• VLBW children who received physiotherapy or occupational therapy were 1.70 times as likely to skip 8 steps (95% CI 0.84, 3.44) compared with the untreated group and 30% more likely to walk 6 steps backwards (95% CI 0.63, 2.71), although not statistically significant. • Little effect of therapy on other endpoints found. • Providing therapy to VLBW children during early childhood may improve select preschool motor skills involving complex motor planning.	Grade C – Low. Comments: • The ECLS-B data provided only a crude measure of therapy receipt over c.15-month period, so the intensity or precise duration of therapy could not be ascertained. The resulting bias could have attenuated associations between therapy and motor outcomes. • No information available about the participants' physical environment. No information available on children's participation in movement programmes. • Study participants with incomplete data had lower scores on a socioeconomic scale, which could have influenced the conclusions. • The sample size limited statistical precision.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
White-Traut et al (2013).	Randomised controlled trial. Aim: to examine the impact of H-HOPE (Hospital to Home: Optimising the Infant's Environment) intervention on mother–infant interaction patterns. Recruitment via 2 NICUs. Infants' inclusion: born between 29 and 34 weeks' GA; no major health problems. Infants' exclusion: presence of congenital anomalies, necrotising enterocolitis, brain injury, chronic lung disease, history of prenatal illicit drug exposure or positive toxicology screen. Mothers' inclusion: at least 2 social-environmental risk factors, less than high school education, >18 years old, history of mental illness, family income <185% of federal poverty definition, >1 child under 24 months, ≥4 children under 4 years old, live in a disadvantaged neighbourhood. Mothers' exclusion: illicit drug user, not the legal guardian, HIV positive. 198 infants. Male:female ratio for infants = 53:47. United States of America.	Infant-directed auditory, tactile, visual and vestibular-rocking stimulation (ATVV) component: Auditory (infant-directed motherese voice), tactile (moderate touch stroking or massage) and visual (eye-to-eye) stimulation followed by 5 minutes of vestibular stimulation (horizontal rocking). ATVV administered for 10 minutes. Begun when infant reached 32 weeks' PMA and administered by the mother or a nurse-community advocate (when mother unavailable) twice daily for 5 days per week prior to feeding. After hospital discharge the mother continued twice daily until the infant reached 1 month corrected age. Nurse provided education and social support for mothers through individualised participatory guidance, 2 hospital visits, 2 home visits and 2 phone calls after discharge. Control: infants received standard care and mothers received educational information and 4 phone calls after the infant's discharge.	Nursing Child Assessment Satellite Training (NCAST) feeding scale was used to assess maternal and infant behaviours during a breast or bottle feeding at 6 weeks' corrected age. The mother–infant interaction during a 5-minute play (standardised instruction given by the nurse) was measured via the Dyadic Mutuality Code (DMC). Levels of mutuality in interaction were measured via: mutual attention, positive affect, mutual turn-taking, maternal pauses, infant clarity of cues, maternal sensitivity to cues and responsiveness. Play and feeding sessions were video-recorded for inter-rater reliability. All health problems of infants were assessed by the Problem-Oriented Perinatal Risk Assessment Scale.	Of 198 mother–infant dyads enrolled, only 149 retained for the 6-week CA visit, 142 had valid data for mother–infant interaction during feeding (H-HOPE = 66 and Attention Control = 76) and 142 had valid data for mother–infant interaction during play. Mother–infant interaction during feeding: • Mean total NCAST was marginally higher ($p<0.10$) for the H-HOPE group. • H-HOPE subscale for infants had significantly higher scores ($p=0.05$). • Mothers who were anxious performed worse on the NCAST than those with low trait anxiety. • Mother–infant interaction during play: H-HOPE group exhibited high responsivity on DMC score; marginally significant ($p=0.055$). Overall, indicated motherinfant interaction is foundational in building the infant's capacity to engage in social interaction and normal development.	Grade A – High. Comments: • Limitations due to economic situation and ethnicity of sample is risk of bias. • No clear information on the 2 hospitals involved was provided. • The NCAST has well-established reliability and validity for term and preterm infants. • DMC instrument has good reliability and validity. • No data on measured maternal post-traumatic stress symptomology. • Limited/reduced participants with complete data.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Winston (2015).	Qualitative component of a mixed-methods study. Aim: to examine the lived experience of mothers who are mothering a young child with feeding concerns. 5 participants. All married women between 26–41 years of age with children 12–36 months. All concerned about issues relating to feeding. Interviews conducted in the home. United States of America.	Lived experiences of mothers.	The experience and perception of mothers around mealtime issues of infants where concerned about feeding.	5 themes emerged: • Feeling supported. • Seeking support. • Range of emotions/feelings. • Dealing with the system. • Complexity of feeding. Only 2 of these themes were discussed in this paper: • Dealing with the system. • Complexity of feeding. These were chosen as they revealed strong connections with the maternal work of negotiating the mealtimes.	Grade D – Very low. Comments: • No information re participant recruitment. • No information re interview process or content, or who conducted it. • No mention of ethics. • No limitations outlined and difficult to identify the limitations because of so many unanswered questions regarding the study itself.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Witt Mitchell et al (2015).	Systematic review. Aim: to review evidence of prevalence and type of sensory processing disorder (SPD) in children aged birth–3 years born preterm. Inclusion: peer-reviewed articles published in English since 1990 that provided evidence of SPD in children aged birth–3 years born preterm and/or with low birthweight. 45 articles.	Type and prevalence of sensory processing disorder.	Presence of sensory processing disorders in infants born preterm or low birthweight.	A substantive proportion of the findings suggest that children aged birth–3 years born preterm may be at risk for sensory processing dysfunctions. Evidence of sensory modulation disorder, specifically sensory over-responsivity, was most prominent.	Grade B – Moderate. Downgraded due to: • Paper did not include RCTs. • No meta-analysis able to be conducted. Descriptive analysis impacted by inconsistency in the measurement and delineation of sensory processing disorders in the original studies. Comments: • Excluded unpublished literature and non-English studies. • Results were based on inferences drawn from a variety of types of data. • Many of the studies tested relatively small convenience samples. • Studies included a variety of measures – which impacts on ability to draw conclusions.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Zarem et al (2013).	Quantitative. Aim: to identify neonatal nurses' (RN) and neonatal therapists' (speech, physical and occupational) perceptions about different methods of positioning used in the study site NICU. Survey sent by email to 242 neonatal nurses and 16 neonatal therapists employed in a 75-bed Level 3 NICU. 68 neonatal nurses. 8 neonatal therapists. United States of America.	Perceptions on positioning for preterm infants in the NICU, including the use of commercial products.	Neonatal nurses and therapists' perceptions on positioning were measured through an online survey.	• Results demonstrated that both neonatal nurses and therapists agree positioning is important for the wellbeing of preterm infants. They differed in their perceptions about the use of the Sleep Sack and whether infants sleep well in traditional methods. • Years of experience was not associated with perceptions about positioning. • The Dandle Roo was reported to be the most beneficial for use in the NICU, the easiest to use, and best at placing the infant in good alignment.	Grade C – Low. Comments: • Relatively small sample size with unequal distribution between nurses' and therapists' responses. • Need more free responses to get more detailed opinions on why certain positioning devices are more beneficial. • Single site. • Unclear if commercial influence.

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Zargham-Boroujeni et al (2017).	Randomised controlled trial. Aim: to study the effect of breastfeeding and massage on infant pain during venipuncture. Recruitment: via convenience sampling at a cluster of hospitals. Inclusion: infants aged >34 weeks, conscious, able and experience of breastfeeding, no limb paralysis, no major congenital abnormalities, relaxed, not crying before venipuncture and the need for venipuncture. Exclusion: milk aspiration or apnoea. 75 infants. 25 in each group. Iran.	• Infants were randomly assigned to the following groups: massage, breastfeeding or control. • Power calculation indicated 21 per group needed. • Nurse administering venipuncture was blind to allocation. • If in the breastfeeding group, breastfeeding began until the researcher saw active sucking and then continued for 3 minutes before administering venipuncture. • If in the massage group, efflorage massage technique was administered on venipuncture site for 3 minutes and then venipuncture conducted. • All venipunctures were recorded and pain scored by a researcher blinded to allocation.	• Pain via the Neonatal Infant Pain Scale during the first 30 seconds of venipuncture.	• Median pain scores were significantly different among the groups. Massage = 0.92, breastfeeding = 4.84 and control = 6.16, $p<0.01$.	Grade A – Very high. Comments: • It is not clear what care the control group received and how many, if any, infants dropped out of the study.

Source	Design and participants	Intervention	Outcomes	Results	Quality and comment
Zelkowitz et al (2011).	Randomised controlled trial. Aim: to determine the effect of a brief skills-based intervention (cues programme) on anxiety in mothers of very low birthweight infants. 2 centres. Inclusion: singleton infant >1500g; mothers speak and read English or French; able to sign informed consent; reside within 90 minutes' drive of hospital. Exclusion: not caring for infant on discharge; unstable medical condition that may result in death; congenital abnormality/sensory handicap; likely to be discharged in less than 4 weeks; multiples; exclusion of sharing a room. Intervention group: n=60 (50 post-intervention). Control group: n=61 (51 post-intervention). Canada.	The Cues and Care trial tests intervention designed to reduce anxiety and develop sensitive interaction skills among mothers of VLBW infants. • 6 sessions of 45–75 minutes each. • First 2 sessions: mothers learn strategies to reduce anxious feelings. • Remaining 4 sessions: mothers taught to recognise and interpret infant's interaction cues and respond sensitively. • First 5 sessions took place in NICU, 1–2 sessions per week. • Last session occurred in mother's home post-discharge. • Teaching methods include: informal discussion, exploration of mother's own experience, rehearsal of strategies for managing anxiety, viewing/discussing DVD. Control group: mothers received 6 contacts with a researcher – met and discussed topics related to newborn care such as immunisation and safety.	• Symptoms of maternal anxiety (STAI). • Perinatal post-traumatic stress and depression (Perinatal Posttraumatic Stress Disorder Questionnaire (PPQ)). • Mother's beliefs about parenting – NICU Parental Beliefs Scale (PBS). • Mother's interactive behaviour – videotaped interaction. • The infant's illness severity during the NICU hospitalisation was measured with the Revised Nursery Neurobiological Score.	• Results indicate that both a brief, skill-based intervention for mothers of VLBW infants and an attention control condition showed similar effects. Both groups exhibited significant reductions in levels of anxiety in the immediate post-intervention period. • 2 groups did not differ on measures of stress related to their NICU experience, symptoms of post-traumatic stress disorder, or depression. • Cues and Care mothers were equally sensitive in interaction with their infants. • Availability of a supportive intervener, proactive in reaching out to mothers and providing information and reassurance, may be important in the success of early interventions in the NICU.	Grade A – High. Comments: • Limited support for intervention. • 19% of participants lost to the study after randomisation (though reasons provided for dropouts). • Only trialled with a percentage of mothers. • Course variability with babies.

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