Received: 4 September 2023 | Revised: 22 January 2024 | Accepted: 23 January 2024

DOI: 10.1111/jocn.17053

SCOPING REVIEW

Journal of Clinical Nursing WILEY

Scoping review of systematic reviews of nursing interventions in a neonatal intensive care unit or special care nursery

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Abstract

Aim(s): To identify, synthesise and map systematic reviews of the effectiveness of nursing interventions undertaken in a neonatal intensive care unit or special care nursery.

Design: This scoping review was conducted according to the JBI scoping review framework.

Methods: Review included systematic reviews that evaluated any nurse-initiated interventions that were undertaken in an NICU or SCN setting. Studies that reported one or more positive outcomes related to the nursing interventions were only considered for this review. Each outcome for nursing interventions was rated a 'certainty (quality) of evidence' according to the Grading of Recommendations, Assessment, Development and Evaluations criteria.

Data Sources: Systematic reviews were sourced from the Cochrane Database of Systematic Reviews and Joanna Briggs Institute Evidence Synthesis for reviews published until February 2023.

Results: A total of 428 articles were identified; following screening, 81 reviews underwent full-text screening, and 34 articles met the inclusion criteria and were included in this review. Multiple nursing interventions reporting positive outcomes were identified and were grouped into seven categories. Respiratory 7/34 (20%) and Nutrition 8/34 (23%) outcomes were the most reported categories. Developmental care was the next most reported category 5/34 (15%) followed by Thermoregulation, 5/34 (15%) Jaundice 4/34 (12%), Pain 4/34 (12%) and Infection 1/34 (3%).

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Funding information
Australian College of Neonatal Nurses, Grant/Award Number: P00027437

Conclusions: This review has identified nursing interventions that have a direct positive impact on neonatal outcomes. However, further applied research is needed to transfer this empirical knowledge into clinical practice.

Implications for the profession and/or patient care: Implementing up-to-date evidence on effective nursing interventions has the potential to significantly improving neonatal outcomes.

Patient or public contribution: No patient or public involvement in this scoping review.

KEYWORDS
neonatal intensive care, nursing interventions, scoping review, special care

1 | INTRODUCTION

Seventeen per cent of babies require admission to a Neonatal Intensive Care Unit (NICU) or Special Care Nursery (SCN). Babies are admitted to an NICU or SCN if they require specialised care and treatment that is available in the postnatal ward. Babies who are admitted to these settings are often born preterm or with low birth weight, have health problems or have a difficult birth (Australian Institute of Health and Welfare, 2023). A significant proportion of the staff in ICUs are nurses (Azadi et al., 2020; Lee et al., 2017). Neonatal nurses are fundamental to the provision of safe and effective nursing care. Their role is multifaceted, attending to and supporting the complex needs of the infant and family in the neonatal unit (Kenner & McGrath, 2004). NICU and SCN nurses provide various treatments and nursing care to newborns, including oxygen therapy, mechanical ventilation, maintenance of vital signs, nutritional supplementation, infection prevention (Lee et al., 2020) and pain prevention and management (Kim, 2020). Key roles for neonatal nurses include providing direct care to newborns and families through education, advocacy, research, participation in shaping neonatal health policy and inpatient and health systems management. The uniqueness of the neonatal nursing role as instrumental in influencing neonatal outcomes has been well identified (Benzies et al., 2020; Sherenian et al., 2013; Spence et al., 2006). However, there is a paucity of global data that has objectively identified and measured the effectiveness of neonatal nursing interventions (Fanelli et al., 2020; Ismail et al., 2020).

This project came about because of limited readily available evidence that outlined the unique characteristics of neonatal nursing care and its impact on the short- and long-term outcomes of neonates admitted to neonatal intensive and special care units. During an Australian College of Neonatal Nurses (ACNN) Research Special Interest Group (SIG) workshop with the intent of generating a list of essential neonatal nursing research priorities, it became evident that workforce demands and challenges dominated as a perceived significant issue that impacts upon the delivery of neonatal nursing clinical care, education and research activity. A subsequent delve into the literature revealed a paucity of information about the Australian Neonatal Nurse workforce; therefore, another workshop was held with key workforce academics and the New South Wales Chief Nursing Officer to discuss and identify the components of the best practice framework for generating objective data and information to support workforce improvements. At this workshop, it was acknowledged that there is a paucity of objective evidence on neonatal nursing interventions, that are performed by nurses, and been shown to have a positive (statistically significant) impact on neonatal outcomes. Innovation and developments in neonatal nursing should be underpinned by a robust evidence base. It is important that the contribution of neonatal nurses make to patient care is identified to inform the development and evaluation of innovative and sustainable healthcare services and interventions. Therefore, this comprehensive scoping review of systematic reviews arose from the need to seek clarity on neonatal nurses' contribution to neonatal outcomes.

What does this paper contribute to the wider global community?

- Nurses play a pivotal role in the neonatal intensive care unit and special care nursery settings, the paper identifies nursing interventions that are effective and have been shown to improve the outcomes of neonates and their families, supporting evidence-based practice in a neonatal intensive care unit and special care nursery setting.
- The body of nursing knowledge regarding the impact of nursing interventions remains limited, this review has identified high-quality evidence, that should be operationalised for use in clinical practice and research.
- There is a need for implementation research to progress the uptake of evidence in the clinical setting.

2 | AIMS

The objective of this scoping review was to identify existing high-quality, up-to-date evidence on the effectiveness of nursing interventions (practices) in NICUs or SCNs. The following specific aims were formulated:

1. Identify and synthesise nursing interventions conducted in an NICU or SCN.
2. Identify and synthesise nursing interventions that resulted in a positive outcome/s according to the certainty (quality) of the evidence.

3 | METHOD

Scoping reviews are regarded as the best tool to determine the scope or coverage of a body of literature (Munn et al., 2018). Thus, the general purpose for conducting scoping reviews is to identify and map the available evidence. This scoping review was conducted according to the JBI scoping review framework reporting recommendations (Peters et al., 2020) and involved the following steps: (1) identifying the research question/aims for the scoping review, (2) identifying relevant studies for the review by using inclusion and exclusion criteria, (3) study selection, (4) extracting and charting the data for the review and (5) collating, summarising and reporting results of the scoping review. Each outcome for intervention was rated a 'certainty of evidence' according to the Grading of Recommendations, Assessment, Development and Evaluation tool (Schunemann et al., 2013).

3.1 | Inclusion criteria

This scoping review considered systematic reviews that evaluated any nursing intervention (nurse-initiated) and were undertaken in an NICU or SCN setting. Studies that reported one or more positive outcomes related to the nursing interventions were only considered for this review. This scoping was restricted to systematic reviews published in the Cochrane Database of Systematic Reviews and JBI Evidence Synthesis journal as dedicated systematic review publication journals. No restrictions were placed on the year of publication to capture all available systematic reviews. Reviews published in languages other than English were excluded.

3.2 | Study selection

A comprehensive search of quantitative systematic reviews and meta-analysis of the Neonatal Review Group, Cochrane Database of Systematic Reviews and JBI Evidence Synthesis journal was conducted in June 2022 and updated in February 2023.

As the starting point, all reviews published in the Neonatal Review Group of Cochrane were identified. For identification of relevant systematic reviews published in the JBI Evidence Synthesis journal, a broad search for relevant quantitative reviews using subject headings: infant; neonate; neonatal; nursing; and quantitative was performed. Following the searches, all identified citations were collated and uploaded into EndNote 20 (The EndNote Team, 2013) and duplicates were removed. Potentially relevant sources were retrieved in full, and the full text of selected citations was assessed in detail by two or more independent reviewers. Systematic reviews of interventions not regarded as nursing-related, for example, haematology, pharmaceutical and medical procedures were excluded. We also excluded reviews with no included trials (empty reviews), and reviews with insufficient evidence to measure treatment effect. No date limits were applied, and all reviews were published in English.

The results of the search are presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) flow diagram (Page & Moher, 2017) (Figure 1). We identified 428 records (394 Cochrane reviews, 34 JBI Evidence Synthesis reviews) at the title screening stage, 102 records were screened at the abstract stage and a full-text review was undertaken on 81 records (80 Cochrane reviews, 1 JBI Evidence Synthesis review). Data were extracted from the full-text reviews and entered in Microsoft Excel®. Reasons for the exclusion of the full-text articles that did not meet the inclusion criteria are reported in Figure 1. The data extracted included the following details: authors, title of the systematic review, date of publication, intervention, comparison, number of participants, number of included studies, statistical methods, effect size, level of heterogeneity, outcome measures, certainty of evidence and other additional comments. The draft extraction form was piloted, and additional relevant identified data were included prior to full data extraction.

The rigorous methods used in Cochrane and JBI systematic reviews are recognised internationally as the highest standard in evidence-based health care and, therefore, further quality assessment was not performed. Each outcome for intervention was rated a 'certainty of evidence' according to the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) criteria (Schünemann et al., 2022). The certainty (or quality) of evidence is the extent to which we can be confident that the effect is likely to be accurate and was classified as 'high certainty of evidence', 'moderate certainty of evidence', 'low level of evidence' and 'very low level of evidence.' Interpretation of the four levels of evidence was:

High—very confident that the true effect lies close to that of the estimate of the effect;

Moderate—moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different;

Low—confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect;

Very low—very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect (Schünemann et al., 2022).

In addition to the research team, a panel of 13 neonatal experts (experienced neonatal clinicians and researchers) was convened and independently assessed the reviews at the title screening stage and again at the full-text screening for eligibility, to confirm the nursing intervention reviews to be included in the scoping review.

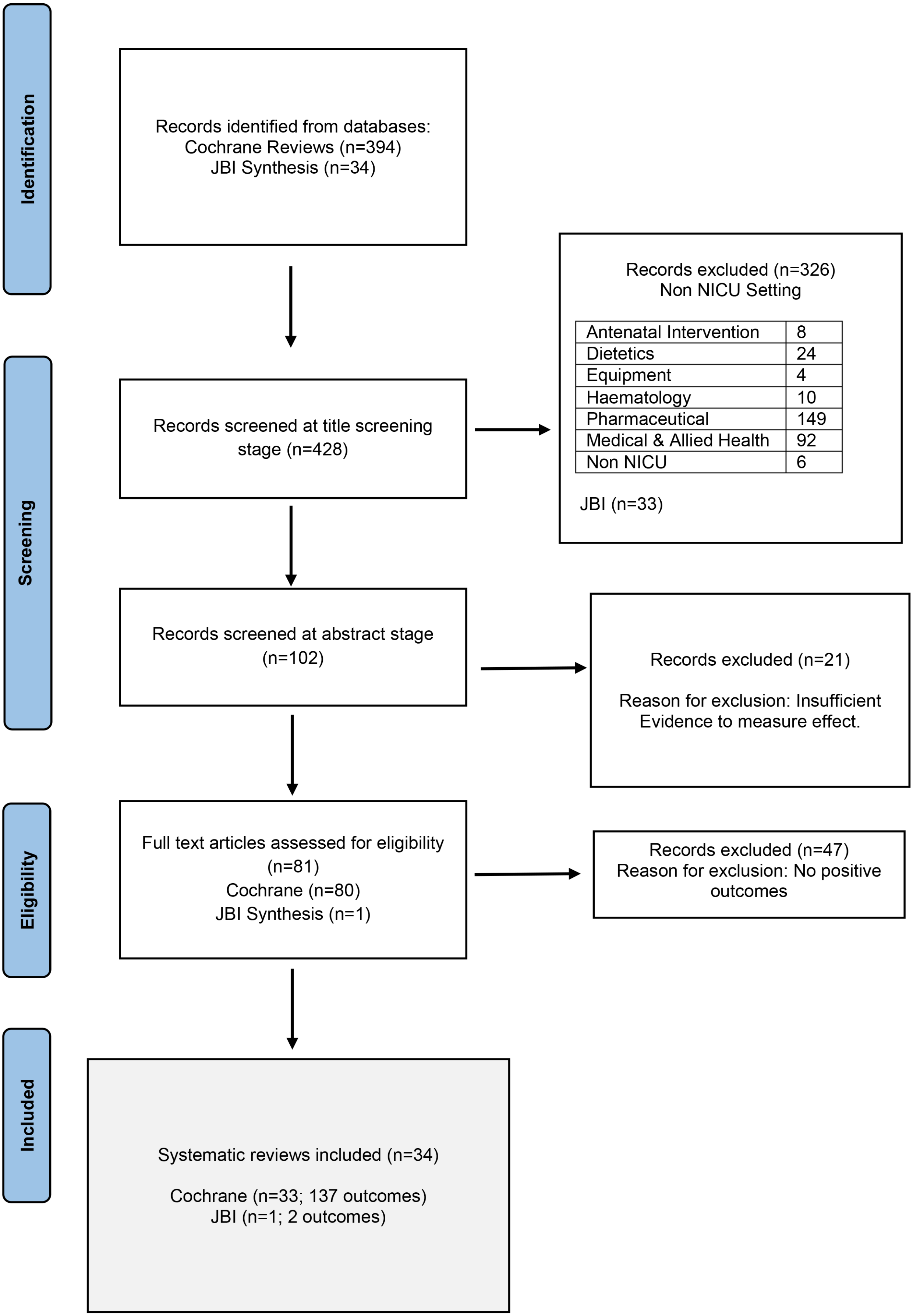

FIGURE 1 Preferred reporting items for systematic reviews flowchart. [Colour figure can be viewed at wileyonlinelibrary.com]

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4 | RESULTS

From the 81 eligible reviews, a total of 34 systematic reviews (Cochrane review = 33, JBI = 1) reported one or more positive outcomes of nursing intervention. The results of the search are presented in the PRISMA-ScR flow diagram (Figure 1).

The (*n* = 34) positive outcomes are reported in the following categories: Jaundice, Nutrition and Feeding, Infection, Respiratory, Pain, Developmental Care and Thermoregulation. Respiratory 7/34 (20%) and Nutrition 8/34 (23%) were the most reported categories. Developmental care was the next most reported category 5/34 (15%) followed by Thermoregulation, 5/34 (15%) Jaundice 4/34 (12%), Pain 4/34 (12%) and Infection 1/34 (3%). Of the (*n* = 139) reported outcomes from the (*n* = 34) reviews, (*n* = 12) were rated as high certainty of evidence, (*n* = 75) were rated as moderate certainty of evidence, (*n* = 38) were rated as low certainty of evidence and (*n* = 14).

4.1 | Jaundice

Four Cochrane reviews (Horn et al., 2021; Lai et al., 2017; Okwundu et al., 2012; Van Rostenberghe et al., 2020) identified nursing interventions shown to be effective for preventing or treating jaundice with positive outcomes (*n* = 10) having moderate to very low certainty of evidence. The use of prophylactic phototherapy in preterm or low birth weight infants identified three outcomes with moderate certainty of evidence, indicating a reduction in exchange transfusion rates, slight improvement in neurodevelopmental impairment rates and lower rates unconjugated serum bilirubin >10 and >15 mg/dL (normal value < 15 mg/dL). Intravenous fluid supplementation decreased the duration of phototherapy, need for exchange transfusion and level of serum bilirubin. The use of sunlight or alternative reflective curtains significantly reduced incidence of bilirubin levels in the first 4–8 h and shorter hospital stay. However, these outcomes had low to very low certainty of evidence (see Table 1).

4.2 | Nutrition and feeding

Eight Cochrane reviews (Edwards et al., 2021; Flint et al., 2016; Foster et al., 2016; Greene et al., 2016; Muelbert et al., 2019; Nasuf et al., 2018; Watson & McGuire, 2016; Weston et al., 2016) identified 21 positive outcomes related to nutrition and feeding with high to very low certainty of evidence. There was moderate to high certainty of evidence to support the use of oral dextrose gel for outcomes: prevention of hypoglycaemia and major neurological disability, and oral dextrose gel as a treatment for hypoglycaemia to reduce mother–infant separation and increase in exclusive breastfeeding after hospital discharge. There was low to very low certainty of evidence for responsive feeding (3 outcomes), cup feeding (3 outcomes) and oral stimulation (6 outcomes). There was low to very low certainty of evidence for non-nutritive sucking (3 outcomes) and very low certainty of evidence for exposure to the smell and taste of milk and oropharyngeal colostrum (see Table 2).

TABLE 1 Evidence for interventions to prevent jaundice.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Prophylactic phototherapy Prophylactic phototherapy versus standard care (Okwundu et al., 2012)	Preterm or low birth weight infants <37 weeks gestation and <2500 g	Reduction in need for exchange transfusion	RR .22 [.15 to .34]	Large	Moderate
		Improvement in neurodevelopmental impairment	RR .85 [.74 to .99]	Small	Moderate
		Lower rates unconjugated serum	RR .27 [.22 to .33]		Moderate
Intravenous fluid Fluid supplementation versus no fluid supplementation for neonatal unconjugated hyperbilirubinemia (Lai et al., 2017)	Newborn infants with unconjugated hyperbilirubinemia	Duration of phototherapy (h)	MD −10.7 [−15.55 to −5.85]	Medium	Low
		Number of infants who required exchange transfusion	RR .39 [.21 to .71]	Medium	Low
		Serum bilirubin (μmol/L) (4 h of age)	MD −34 [−52.29 to −15.71]	Small	Low
Reflective materials during phototherapy Phototherapy with reflective curtains compared to phototherapy alone (Van Rostenberghe et al., 2020)	Newborn infants with unconjugated hyperbilirubinemia	Decline in bilirubin at 4 to 8 h (μmol/L)	MD −14.61 [−19.80 to −9.42]	Medium	Low
		Decline in bilirubin (first measurement)	MD −29.08 [−31.93 to −26.22]	Medium	Very low
		Duration of hospital stay (hours)	MD −41.08 [−45.92 to −36.25]	Medium	Very low
Sunlight With or without filters or amplification versus no treatment (Horn et al., 2021)	Low-risk term and late preterm infants	Incidence of jaundice	RR .61 [.45 to .82]	Medium	Very low

Abbreviations: MD, mean days; RR, risk ratio.

TABLE 2 Evidence for nutrition and feeding interventions.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Oral dextrose gel Dextrose gel compared with placebo for prevention of hypoglycaemia (Edwards et al., 2021)	Newborn infants	Hypoglycaemia	RR .87 [.79 to .95]	Large	High
		Major neurological disability at 2 years of age or older	RR .21 [.05 to .78]	Medium	Moderate
Oral dextrose gel Dextrose gel compared with placebo and no treatment (Weston et al., 2016)	Newborn infants	Separation from mother for treatment of hypoglycaemia	RR .54 [.31 to .93]	Medium	Moderate
		Exclusive breastfeeding after discharge (WHO definition)	RR 1.10 [1.01 to 1.18]	Medium	Moderate
Responsive feeding Responsive feeding versus scheduled feeding (Watson & McGuire, 2016)	Preterm infants	Weight change during study period (g/kg/day)	MD −1.36 [−2.44 to −.29]	Medium	Low
		Time to establishment of full oral feeds	MD −5.53 [−6.80 to −4.25]	Medium	Low
Non-nutritive sucking Non-nutritive sucking versus no non-nutritive sucking for physiologic stability and nutrition (Foster et al., 2016)	Preterm infants	Gavage to full oral feeding (days)	MD −5.51 [−8.20 to −2.82]	Small	Low
		Length of hospital stay (days)	MD −4.59 [−8.07 to −1.11]	Medium	Low
		Start oral feeding to full oral feeding (days)	MD −2.15 [−3.12 to −1.17]	Small	Very low
Cup feeding Cup feeding versus other forms of supplemental enteral feeding (Flint et al., 2016)	Newborn infants unable to fully breastfeed	Not breastfeeding at hospital discharge	RR .64 [.49 to .85]	Medium	Low
		Not fully breastfeeding at hospital discharge	RR .61 [.52 to .71]	Medium	Low
		Not breastfeeding at 6 months	RR .83 [.72 to .95]	Medium	Very low
Oral stimulation Oral stimulation intervention versus other non-oral intervention (Greene et al., 2016)	Preterm infants	Time (days) to achieve exclusive oral feeding	MD −9.01 [−10.30 to −7.71]	Medium	Low
		Total hospital stay (days)	MD −2.94 [−4.36 to −1.51]	Medium	Low
		Duration (days) of parenteral nutrition	MD −8.70 [−15.46 to −1.94]	Small	Low
Oral stimulation intervention versus standard care (Greene et al., 2016)	Preterm infants	Days to full oral feeding	MD −5.22 [−6.86 to −3.59]	Medium	Low
		Total hospital stay (days)	MD −5.26 [−7.34 to −3.19]	Medium	Very low
		Duration (days) of parenteral nutrition	MD −5.30 [−9.73 to −.87]	Small	Very low
Exposure to the smell and taste of milk to accelerate feeding Exposure to the smell and taste of milk with tube feeds compared to no exposure (Muelbert et al., 2019)	Preterm infants	Time to first discharge home (days)	MD −3.89 [−7.03 to −.75]	Medium	Very low
Oropharyngeal colostrum Oropharyngeal colostrum versus control (water, saline, no intervention) (Nasuf et al., 2018)	Preterm infants	Days to full enteral feed	MD −2.58 [−4.01 to −1.14]	Medium	Very low
		Receiving any breast milk at discharge to home	RR .61 [.38 to .97]	Small	Very low

4.3 | Infection

One Cochrane review (Austin et al., 2015) on the use of prophylactic oral/topical antifungal agents identified two outcomes with moderate certainty of evidence: reduction in invasive fungal infections for very low birth weight and extremely birth weight infants (see Table 3).

4.4 | Respiratory

Seven Cochrane reviews (Askie & Henderson-Smart, 2001; Dol et al., 2018; Ho et al., 2020; Jardine et al., 2011; Pritchard et al., 2001; Subramaniam et al., 2021; Taylor et al., 2011) identified 27 outcomes with high to very certainty of evidence. The reviews reported prophylactic or very early initiation of continuous positive airway pressure (CPAP), when compared to mechanical ventilation showed a reduced risk of bronchopulmonary dysplasia at 36 weeks, combined outcome of death and bronchopulmonary dysplasia and failed treatment. There were improved outcomes when CPAP was used compared to supplemental oxygen for respiratory distress. Tracheal suctioning without disconnection and preoxygenation identified seven outcomes with strong confidence in the stability of neonatal vital signs with decreased bradycardic episodes, reduction in hypoxemia and recovery time in minutes when tracheal suctioning is completed without disconnection (see Table 4).

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TABLE 3 Evidence for prevention of invasive fungal infection.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Prophylactic oral/topical antifungal agents					
Oral/topical non-absorbed antifungal prophylaxis versus placebo or nothing to prevent invasive fungal infection (Austin et al., 2015)	Very low birth weight infants	Incidence of invasive fungal infection (All VLBW) infants	RR .20 [.14 to .27]	Large	Moderate
		Incidence of invasive fungal infection (All ELBW) infants	RR .12 [.06 to .26]	Medium	Moderate

4.5 | Pain

Four systematic reviews (Johnston et al., 2017; Shah et al., 2012; Shah & Ohlsson, 2011; Stevens et al., 2016) identified 27 outcomes with moderate to high certainty of evidence for outcomes on pain. Pain response during venepuncture compared to heel lance in infants who did not receive a sweet-tasting solution displays strong evidence that infants receiving a sweet-tasting solution have lower behavioural pain scores and a reduced need for more than one skin puncture. Studies confidently suggest that skin-to-skin and/or breastfeeding during procedural pain events significantly reduces Premature Infant Pain Profile (PIPP) and neonatal infant pain scale (NIPS) behavioural pain scores and duration of cry (s). The evidence also strongly suggests oral breast milk is more beneficial in pain score and cry reduction than sweet-tasting solution, however, sweet-tasting solution also significantly improves painful experiences in comparison with standard care (see Table 5).

4.6 | Developmental care

Five (Conde-Agudelo et al., 2016; Morag & Ohlsson, 2016; Rivas-Fernandez et al., 2016; Symington & Pinelli, 2006; Vickers et al., 2004) Cochrane reviews identified 31 positive outcomes with low to moderate certainty of evidence. Infant positioning for ventilated newborns as shown by moderate-quality evidence that prone position significantly stabilises oxygenation (PO_2 and SpO_2) and reduces the incidence of desaturations. Kangaroo mother care showed strong confidence in the reduction of mortality, infection rates, hypothermia. Continuous Kangaroo mother care is strongly recommended, however, any amount of time of Kangaroo mother care has also been shown to improve weight gain, breastfeeding at discharge and breastfeeding at 3 months of age.

Developmental care utilising the Newborn Individualised Developmental Care and Assessment Program (NIDCAP) for promoting development and preventing morbidity in preterm infants (nesting, swaddling, tactile stimulation, vestibular and auditory stimulation identified ($n=15$) outcomes with strong confidence). Several small studies show reduced length of hospital stay and lower hospital charges as well as a reduction in CPAP and subsequent Chronic Lung Disease (CLD). NIDCAP practices also improve growth including weight and head circumference and improved developmental scores at 9 months of age (Als et al., 2012; see Table 6).

4.7 | Thermoregulation

Five Cochrane reviews (Jacobs et al., 2013; Laroia et al., 2007; McCall et al., 2018; New et al., 2011; Sinclair, 2002) identified ($n=20$) outcomes with moderate to high certainty of evidence. Studies suggest that transfer of preterm infants from an incubator to open cot at lower body weight (<1700) improved daily weight gain (g/kg/day) and reduced post-menstrual age at discharge and subsequently

TABLE 4 Evidence for respiratory interventions.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Prophylactic or very early initiation of continuous positive airway pressure (CPAP) Prophylactic CPAP compared to mechanical ventilation for preventing morbidity and death (Subramaniam et al., 2021)	Preterm infants	Bronchopulmonary dysplasia at 36 weeks	RR .89 [.80 to .99]	Large	Moderate
		Combined outcome of death and bronchopulmonary dysplasia	RR .89 [.81 to .97]	Large	Moderate
		Failed treatment	RR .49 [.45 to .54]	Large	Low
Continuous positive airway pressure (CPAP) CPAP compared to supplemental oxygen for respiratory distress (Ho et al., 2020)	Preterm infants	Mortality	RR .53 [.34 to .83]	Medium	Moderate
		Pneumothorax occurring after allocation	RR 2.91 [1.38 to 6.13]	Medium	Low
		Treatment failure (death/use of ventilatory support)	RR .64 [.5 to .82]	Medium	Very low
		Treatment failure (death or use of ventilatory support by early or late application) <24 h	RR .66 [.49 to .9]	Small	Very low
		Use of assisted ventilation	RR .72 [.54 to .96]	Medium	Very low
Tracheal suctioning Suctioning without disconnection versus with disconnection (Taylor et al., 2011)	Intubated ventilated neonates	Heart rate decreases >10%	RR .61 [.40 to .93]	Medium	Moderate
		Bradycardia (HR < 100 bpm)—all weights	MD .38 [.15 to .92]	Medium	Moderate
		Hypoxia (SaO_2 < 90%)—all weights	MD .48 [.31 to .74]	Medium	Moderate
Preoxygenation for tracheal suctioning Suctioning with preoxygenation versus without preoxygenation (Pritchard et al., 2001)	Intubated, ventilated newborn infants	Hypoxemia end of first suction (TcPO2 < 40 mmHg).	RR .18 [.05 to .69]	Small	Moderate
		Hypoxemia end of second suction (TcP02 < 40 mmHg)	RR .23 [.08 to .66]	Small	Moderate
		Hypoxemia 120 s post-suction (TcP02 < 40 mmHg)	RR .1 [.01 to .69]	Small	Moderate
		Recovery time in minutes	MD −2.12 [−3.82 to −.42]	Small	Moderate
Withdrawal of nasal continuous positive airway pressure (NCPAP) 1. Directly Off versus Period off (no cannulae) 2. Directly Off versus Period off (plus cannulae oxygen) 3. Periods off—no cannulae versus plus cannulae oxygen (Jardine et al., 2011)	Preterm infants	Duration of hospital stay (days) (1)	MD −4.40 [−4.44 to −.36]	Medium	Moderate
		Duration of hospital stay (2)	MD −12.60 [−12.66 to −.54]	Small	Moderate
		Duration of hospital stay (days) (3)	MD −8.20 [−8.26 to −8.14]	Medium	Moderate
		Time to successfully coming off NCPAP altogether (1)	MD −5.40 [−5.74 to −5.06]	Medium	Moderate
		Time to successfully coming off NCPAP altogether (2)	MD −9.40 [−9.83 to −8.97]	Small	Moderate
		Time to successfully coming off NCPAP altogether (3)	MD −4.0 [−4.45 to −3.55]	Medium	Moderate
		Duration of oxygen therapy (days) (1)	MD −15.60 [−16.26 to −4.94]	Medium	Moderate
		Duration of oxygen therapy (days) (2)	MD −11.0 [−11.66 to −10.34]	Small	Moderate
		Duration of oxygen therapy (days) (3)	MD 4.60 [3.85 to 5.35]	Medium	Moderate
Discontinuation of oxygen Gradual versus abrupt discontinuation of oxygen (Askie & Henderson-Smart, 2001)	Preterm/LBW infants	Retrolental fibroplasia (any)	RR .22 [.07 to .68]	Small	Moderate
What is the impact of Helping Babies Survive training on neonatal outcomes? skill-based learning using simulation, learning exercises and peer-to-peer training of healthcare providers in low-resource areas (Dol et al., 2018)	Neonates	Fresh stillbirth rate	OR .66 [.52 to .85]	Large	Low
		First-day mortality	OR .70 [.51 to .98]	Large	Low

reduced length of hospital stay. Studies investigated the use of double wall incubators and servo-control abdominal skin temperature leading to strong confidence in reduced oxygen consumption and death in very low birth weight infants.

Moderate-quality studies strongly suggest the use of plastic wrap or bags in preterm and/or low birth weight infants. Outcomes show stable core body temperature on admission and 1 h post-admission, reduction in hypothermia and hyperthermia events on admission as

TABLE 5 Evidence for interventions to prevent and treat pain.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Procedural pain relief Breastfeeding or breast milk for procedural pain (Shah et al., 2012)	Neonates	Percentage of time crying (breastfeeding vs. oral sucrose)	MD −41.5 [−48.01 to −34.99]	Medium	Moderate
		Duration of crying (s) (breastfeeding vs. no intervention)	MD −41.34 [−49.53 to −33.15]	Medium	Moderate
		Neonatal Infant Pain Scale (NIPS) (breastfeeding vs. no intervention)	MD −4.7 [−5.68 to −3.72]	Medium	Moderate
		Neonatal Facial Coding Score (NFCS) (breastfeeding vs. no intervention)	MD −4.2 [−5.14 to −3.26]	Medium	Moderate
		Duration of crying (s) (supplemental breastmilk vs. placebo)	MD −8.67 [−12.32 to −5.02]	Medium	Moderate
		Neonatal Infant Pain Scale (NIPS) (supplemental breast milk vs. placebo)	MD 1.07 [.33 to 1.81]	Medium	Moderate
		Neonatal Facial Coding Score (NFCS) at 3 min (supplemental breastmilk vs. control)	MD −.47 [−.9 to −.04]	Medium	Moderate
Pain response Venepuncture (VP) versus heel lance (HL) for blood sampling (Shah & Ohlsson, 2011)	Infants who did not receive a sweet-tasting solution	Behavioural pain scores for VP versus HL	MD −.76 [−1.00 to −.52]	Medium	Moderate
		Need for more than one skin puncture (heel lance)	RR .29 [.18 to .46]	Medium	Moderate
Procedural pain relief Skin-to-skin care compared to no intervention, sucrose or other analgesics or additions to simple SSC such as rocking (Johnston et al., 2017)	Neonates	Heart rate during a painful procedure	MD −10.78 [−13.63 to −7.93]	Medium	Very Low
		Premature Infant Pain Profile Score (PIPP) at 30 s after a painful procedure	MD −3.21 [−3.94 to −2.47]	Medium	Moderate
		NIPS—Proportion of infants in low or no pain during procedure	MD .10 [.06 to .15]	Medium	Very low
		NIPS—infants in no pain during recovery	RR .35 [.26 to .44]	Medium	Moderate
		Duration of cry (s) following heel lance	MD −34.16 [−42.86 to −25.45]	Small	Moderate
		Duration of cry (s) following IM injection	MD −8.83 [−14.63 to −3.02]	Small	Moderate
Procedural Pain Relief for Heel Lance Sucrose (24%) + NNS compared with water + NNS or a pacifier dipped in sucrose compared with a pacifier dipped in water for heel lance-associated pain (Stevens et al., 2016)	Neonates	PIPP 30 s after health lance	MD −1.70 [−2.13 to −1.26]	Small	High
		PIPP 60 s after heel lance (term and preterm infants)	MD −2.14 [−3.34 to −.94]	Small	High
Procedural Pain Relief for Heel Lance Sucrose (24%) compared with sucrose (24%) + NNS for pain associated with heel lance (Stevens et al., 2016)	Neonates	Revised NFCS	MD .43 [.23 to .63]	Small	Moderate
		Percentage increase in HR	MD 2.29 [.44 to 4.14]	Small	Moderate
		Decrease in oxygen saturation in blood %	MD .48 [.10 to .86]	Small	Moderate
Procedural Pain Relief for Heel Lance Sucrose (24%) compared with sucrose (24%) + swaddling for pain associated with heel lance (Stevens et al., 2016)	Neonates	Revised NFCS	MD .40 [.19 to .61]	Small	Moderate

(Continues)

TABLE 5 (Continued)

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Procedural Pain Relief for Heel Lance Sucrose (24%) compared with sucrose (24%)+NNS+swaddling for pain associated with heel lance (Stevens et al., 2016)	Neonates	Revised NFCS	MD .43 [.23 to .63]	Small	Moderate
		Percentage increase in HR	MD 3.25 [1.43 to 5.07]	Small	Moderate
		Decrease in oxygen saturation in blood %	MD .79 [.44 to 1.14]	Small	Moderate
Procedural Pain Relief for Venepuncture Sucrose (24%–30%) compared with control (sterile water or no treatment) for pain associated with venepuncture (Stevens et al., 2016)	Neonates	PIPP score during venipuncture	MD 2.79 [−3.76 to −1.83]	Small	High
Procedural Pain Relief for IM injection Intramuscular injection (term infants): sucrose (20%–25%) versus water or no intervention (Stevens et al., 2016)	Neonates	PIPP during IM injection (term infants)—Infants of non-diabetic and diabetic mothers	MD −1.05 [−1.98 to −.12]	Small	High
Procedural Pain Relief for Bladder Catherisation Sucrose (24%) compared with sterile water for pain associated with bladder catheterisation (Stevens et al., 2016)	Neonates	Change in DAN score	MD −2.43 [−4.50 to −.34]	Small	Moderate
		Infants crying at maximal catheter insertion	MD −.51 [−.81 to −.22]	Small	Moderate
Procedural Pain Relief for ROP examination ROP examination: sucrose (24%–33%) (sucrose or sucrose+NNS) versus control (water or water+NNS) (Stevens et al., 2016)	Neonates	PIPP score during eye examination	MD −2.15 [−2.86 to −1.43]	Small	Moderate

well as reduction of risk of pulmonary haemorrhage through hospital stay for infants less than 29 weeks' gestation.

Therapeutic hypothermia for newborns with hypoxic ischaemic encephalopathy identified five outcomes with strong confidence in the significant reduction of death or major disability including neurodevelopmental disability and cerebral palsy (see Table 7).

5 | DISCUSSION

This review is the first phase of the Neonatal Nursing Outcome Measures Project being undertaken by a collaboration of Australian neonatal nurse researchers. To our knowledge, this is the first scoping review to identify evidence from systematic reviews on the effectiveness of interventions in a neonatal intensive care unit or special care nursery. The next phase will link the identified neonatal nursing outcome measures to neonatal care standards to facilitate evidence-based neonatal care practice.

Key strengths of this scoping review were the systematic searching techniques, prioritising high-quality systematic reviews using specific neonatal nursing outcome measures. The whole project team was involved in independently screening the literature search results. In addition to the research team, a panel of 13 neonatal experts (experienced neonatal clinicians and researchers) was convened and independently assessed the reviews at the title screening stage and again at the full-text screening for eligibility.

Cochrane and JBI are highly regarded as two of the main systematic review databases available, but this scoping review has identified a limited number of reviews specifically related to nurse-initiated neonatal nursing practices. These databases assist in bringing together all the evidence on a specific topic to assist clinicians in easily assessing evidence and making health decisions. Cochrane provides high-quality information for clinicians, patients or carers, researchers or policymakers (4). However, systematic reviews are now commonly published in many journals which means that clinicians must perform lengthy searches.

Evaluation focusing on multicomponent nursing outcomes is considered to enhance quality nursing care delivery (1). From a total of ($n=394$) Cochrane reviews and ($n=34$) JBI Synthesis reviews, we only identified ($n=81$) systematic reviews related to nursing interventions in neonatal care settings. In addition, we only identified ($n=34$) reviews reporting one or more positive neonatal nursing outcome measures. From the included reviews a preliminary set of core nursing interventions had statistically significant positive outcomes. Respiratory and nutrition interventions were reported most common positive neonatal

TABLE 6 Evidence for developmental care interventions.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Infant position Prone compared with supine position (Rivas-Fernandez et al., 2016)	Newborn ventilated	Oxygenation: PO_2	MD 5.49 [2.92 to 8.05]	Medium	Moderate
		Desaturations	OR .11 (.04 to .31)	Medium	Moderate
		Oxygenation: SpO_2	MD 2.18 [1.13 to 3.24]	Medium	Moderate
Kangaroo mother care Kangaroo mother care versus conventional neonatal care to reduce morbidity and mortality (Conde-Agudelo & Diaz-Rossello, 2016)	Low birth weight infants	Mortality at latest follow-up	RR .67 [.48 to .95]	Large	Moderate
		Severe infection/sepsis at latest follow-up—stabilised infants	RR .5 [.36 to .69]	Large	Moderate
		Hypothermia at discharge or at 40–41 weeks' post-menstrual age—stabilised infants	RR .28 [.16 to .49]	Medium	Moderate
		Weight gain at latest follow-up (g/day)—stabilised infants	MD 4.08 [2.3 to 5.86]	Large	Moderate
		Any breastfeeding at discharge or at 40–41 weeks' post-menstrual age—stabilised infants	RR 1.2 [1.07 to 1.34]	Large	Moderate
		Mortality—Intermittent KMC (subgroup)	RR .59 [.19 to 1.81]	Medium	Moderate
		Mortality—Continuous KMC (subgroup)	RR .60 [.38 to .96]	Large	Moderate
		Any breastfeeding at 1–3 months' follow-up—stabilised infants	RR 1.17 [1.05 to 1.31]	Large	Low
Cycled light in the intensive care unit Cycled light (CL) compared with continuous bright light (CBL) (Morag & Ohlsson, 2016)	Preterm or low birth weight infants	Length of stay (days) (CL from 32 weeks)	MD −12.66 [−21.00 to −2.33]	Small	Low
		Length of stay (days) (Cl from birth)	MD −16.48 [−26.16 to −6.79]	Small	Low
		Days on ventilators (CL from birth)	MD 18.20 [−31.40 to −3.00]	Small	Low
Developmental care for promoting development and preventing morbidity in preterm infants (Symington & Pinelli, 2006)	Nesting versus no nesting	Length of hospital stay (days)	MD 8.1 [.06 to 16.14]	Small	Low
	Swaddling versus no swaddling	Morgan Neonatal Neurobehavioral Exam	MD 6.2 [2.62 to 9.78]	Small	Low
	Tactile stimulation versus control (during awake time)	Days to full oral feeding	MD −7.0 [−10.95 to −3.05]	Small	Low
		Length of stay (days)	MD −3.89 [−7.07 to −.71]	Small	Low
	Vestibular and auditory stimulation versus Control	Growth—weight gain to 36 corrected gestational age—grams	MD 46.0 [17.07 to 74.93]	Small	Low
		Growth – HC gain to 36 Corrected gestational age—cm/week	MD .26 [.14 to .38]	Small	Low
		Length of stay (days)	MD −6.5 [−16.74 to 3.74]	Small	Low
	NIDCAP versus Control	Days of ventilation	MD −8.30 [−15.82 to −.77]	Small	Low
		Days on CPAP	MD −17.1 [−29.54 to −4.66]	Small	Low
		Age at oxygen withdrawal (post-conceptional age in weeks)	MD −5.90 [−8.37 to −3.43]	Small	Low
		Chronic lung disease—Mod Severe	MD .42 [.19 to .93]	Small	Low
		Hospital charges ($1000)	MD −91.0 [−173.00 to −7.00]	Small	Low
		Bayley Mental Development Index—MDI (9 months corrected age)	MD 16.43 [10.49 to 22.36]	Small	Low
		Bayley Psychomotor Development Index—PDI (9 months corrected age)	MD 19.53 [11.83 to 27.23]	Small	Low
		Prechtl Total Score at 2 weeks corrected age	MD −20.97 [−30.07 to −11.87]	Small	Low
Massage for promoting growth and development of preterm and/or low birth weight infants (Vickers et al., 2004)	Preterm and/or low birth weight infants	Daily weight gain (g/day)	MD 5.06 [3.45 to 6.67]	Small	Low
		Length of stay (days)	MD −4.45 [−6.48 to −2.43]	Small	Low

TABLE 7 Evidence for interventions for thermoregulation.

Intervention comparison	Population	Outcome	Statistical difference	Study size	Certainty of evidence
Transfer of preterm infants from incubator to open cot Lower body weight (<1700 g) compared to at a higher body weight (>1700 g) (New et al., 2011)	Preterm infants	Daily weight gain (g/kg/day)	MD 2.66 [1.37 to 3.95]	Medium	High
		Postmenstrual age at discharge	MD −.90 [−1.32 to −.48]	Medium	High
		Length of hospital stay (days)	MD −5.41 [−8.77 to −2.05]	Medium	High
	Infants birth weight ≥1000 g	Daily weight gain (g/kg/day)	MD 2.61 [1.24 to 3.97]	Medium	High
		Proportion of infants having at least one episode of low temperature requiring overhead heater use	RR .45 [.21 to .97]	Medium	High
		Postmenstrual age at discharge	MD −.54 [−.94 to −.15]	Medium	High
		Length of hospital stay (days)	MD −6.15 [−9.20 to −3.10]	Medium	High
Plastic wrap or bag Plastic wrap or bag compared with routine care Interventions to prevent hypothermia at birth (McCall et al., 2018)	Preterm and/or low birth weight infants	Core body temperature (°C) on admission to NICU or upto 2 h after birth (<37 weeks' gestation)	MD .58 [.50 to .66]	Large	Moderate
		Hypothermia on admission to NICU: core body temperature < 36.5°C or skin temperature < 36°C (<37 weeks' gestation)	RR .67 [.62 to .72]	Large	Moderate
		Core body temperature (°C) 1 h after initial NICU admission temperature was taken (<37 weeks' gestation)	MD .36 [.25 to .47]	Medium	Moderate
		Hyperthermia on admission to NICU: core body temperature > 37.5°C (<37 weeks' gestation)	RR 3.91 [2.05 to 7.44]	Large	Moderate
		Pulmonary haemorrhage (within hospital stay) <29 weeks	RR .60 [.38 to .95]	Medium	Moderate
Maintaining abdominal skin temperature at 36°C Incubator servo-controlled body temperature compared with setting a constant incubator air temperature (Sinclair, 2002)	Low birth weight infants	Death	RR .72 [.54 to .97]	Medium	Moderate
		Death (VLBW)	RR .66 [.48 to .90]	Medium	Moderate
Reducing heat loss Double wall versus single wall incubator (Laroia et al., 2007)	Very low birth weight infant	Oxygen consumption	RR −.59 [−1.09 to −.09]	Small	Moderate
Death or long-term major neurodevelopmental disability Therapeutic hypothermia versus standard care (Jacobs et al., 2013)	Encephalopathic asphyxiated newborn infants	Death or major disability in survivors assessed	RR .75 [.68 to .83]	Large	Moderate
		Mortality by method of cooling	RR .75 [.64 to .88]	Large	Moderate
		Major neurodevelopmental disability by method of cooling	RR .77 [.63 to .94]	Large	Moderate
		Major neurodevelopmental disability in survivors assessed, by method of cooling	RR .67 [.55 to .80]	Medium	Moderate
		Cerebral palsy in survivors assessed	RR .66 [.54 to .82]	Medium	Moderate

nursing outcome measures followed by developmental care, thermoregulation, jaundice, pain and sepsis, respectively.

Of the ($n = 139$) outcomes, ($n = 12$) were high quality, ($n = 75$) were moderate quality, ($n = 38$) were low quality and ($n = 14$) were very low quality. In addition to these very low to low-quality SRs, assessment of individual RCT study quality is likely to have varied between SR authors causing disparity in the quality of evidence available to report ($n = 52$) SRs with ($n = 414$) nursing outcomes that did not identify a positive neonatal nursing outcome measure.

Short-term nursing outcome measures identified in this review included improved feeding, weight gain, reduced hospital stay, reduction in pain, reduced parental separation and thermoregulation. It is evident that most repeatedly reported nursing outcome is reduction in length of hospital stay. This finding underlines that quality nursing care reduces the length of stay in the hospital as reported earlier (Nikuee et al., 2020) and in turn reduces parental separation. In addition, reduced hospital stay may decrease nurses' workload resulting in cost-effective healthcare delivery

(Bowers & Cheyne, 2016). Long-term outcomes such as neurodevelopmental status, and chronic health conditions were not reported in the selected reviews. Overall, the findings from SRs with no or minimal positive outcomes (effectiveness) indicate that further high-quality trials are needed, with larger sample sizes, longer follow-up times and the use of well-defined and validated nursing outcome measures.

We recognise there were many systematic reviews identified with significant positive outcomes in leading nursing care areas withdrawn due to errors thus reducing the available data and quality of evidence. It was also noted many of the reviews have not been updated in the last 10 years, emphasising the need for collaborations to update systematic reviews post the impact COVID has had on all aspects of nursing research.

5.1 | Strengths and limitations

Both a strength and limitation of this scoping review was its comprehensive scope which included a wide range of neonatal nursing outcomes and a broad definition (all neonates), however, limited the depth of analysis and discussion. Due to the broad definition of 'neonate', ill-defined populations of neonates were likely to dilute the findings. The whole project team was involved in screening the literature search results and reviewing each systematic review care topic bundle, although a limitation was that only one author conducted data extraction.

We recognise that this scoping review has only included Cochrane and JBI systematic reviews, but as these are the two regarded as gold standard, and the project being undertaken with time and budget constraints our team decided this would be the focus of our study. Further research is required to strengthen the effectiveness of outcomes associated with developmental care, sepsis and jaundice outcomes for neonatal care. Scoping reviews and umbrella reviews will become increasingly important to again make it easy for clinicians to easily access the available evidence.

6 | CONCLUSION

This review identified nursing interventions that have a direct positive impact on neonatal outcomes. Further applied research is required to transfer this empirical knowledge into clinical practice.

7 | RELEVANCE TO CLINICAL PRACTICE

Nurses play a pivotal role in the NICU and SCN settings, the paper identifies nursing interventions that are effective and have been shown to improve the outcomes of neonates and their families, supporting evidence-based practice in an NICU/SCN setting. Based on our findings from the systematic reviews pertaining to evidence for effective nursing outcomes, this scoping review suggests that the most promising areas of nursing intervention and effective outcome measures are pain, thermoregulation, respiratory care and feeding/nutrition. These areas have greatest effect on death, disability, hospital length of stay, sepsis rates, breastfeeding outcomes and mental health. Nursing interventions need to be adequately systematised so that they can be integrated into daily practice. To facilitate their replication and for improved outcomes, it is recommended to execute evidence-based interventions as a care bundle rather than an individual approach (de Bijl-Marcus et al., 2020).

8 | FUTURE RESEARCH

The next stage of this project will be to outline and undertake an Implementation Science project with the aim to translate the interventions graded high to moderate certainty of evidence into neonatal nursing care. Given the increasing number of systematic reviews in numerous journals, it is recommended that they are further synthesised into scoping and/or umbrella reviews to make it easier for neonatal nurses to readily access current evidence to inform their practice.

FUNDING INFORMATION

This Scoping Review was funded by the Australian College of Neonatal Nurses P00027437.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest in relation to the research, authorship and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

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How to cite this article: Foster, J., Pathrose, S. P., Briguglio, L., Trajkovski, S., Lowe, P., Muirhead, R., Jyoti, J., Ng, L., Blay, N., Spence, K., Chetty, N., & Broom, M. (2024). Scoping review of systematic reviews of nursing interventions in a neonatal intensive care unit or special care nursery. *Journal of Clinical Nursing*, *33*, 2123–2137. https://doi.org/10.1111/jocn.17053