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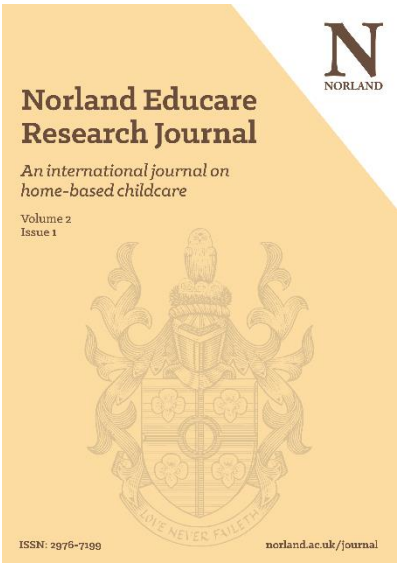
Sleep interventions for infants under two years old: a PRISMA-informed scoping review

Lisa Gentle[a, b], Catherine Linney[b] and Janet Rose[c]

[a] Norland College, [b] Joint first authors, [c] Norland College



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Abstract

This PRISMA scoping review identifies and summarises 13 research papers, published between 2011 and 2021, specific to interventions aimed at improving the sleep of infants from birth to two years of age. The aim was to identify trends in study characteristics, overarching outcomes and recommendations, and to extract and make further suggestions for professional training and practice. Relevant literature often provides contradictory guidance, and caregivers increasingly seek individualised support via the growing sleep consultancy industry. Papers examining the efficacy, safety and parental perception of a variety of approaches to improving infant sleep – including cry it out, controlled crying, camping out, bedtime fading and educational interventions – were sourced. Findings suggested that authors most commonly recommended supporting caregivers with education about developmentally appropriate sleep, cues for tiredness, settling techniques, positive sleep

Corresponding author: Lisa Gentle lisa.gentle@norland.ac.uk

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routines, how to increase homeostatic sleep pressure and how to use moderate behavioural interventions if problems remain after the infant reaches six months of age. Outcomes also suggested this combination is safe, can improve infant sleep as well as main and secondary caregiver wellbeing, and helps caregivers improve their understanding of whether their infant has a sleep problem. Based on the scoping review outcomes, the authors recommend the routine inclusion of evidence-based information about common patterns of infant sleep and different approaches to supporting sleep in the professional training of early years and healthcare professionals. This has the potential to facilitate evidence-based individualised support for caregivers with their infant's sleep, promote safe selection and use of interventions, and improve infant, primary and secondary caregiver sleep quality and wellbeing.

Keywords: infant sleep, attachment, behavioural sleep intervention, sleep education, sleep training

Introduction

The current situation

Between 10% and 30% of infants have a parent-reported sleep problem, such as frequent waking and excessive night crying (Mindell *et al.*, 2006; Byars *et al.*, 2012; Whittall *et al.*, 2021). Infant sleep is mediated by many factors, including parent–infant relationship, context, and environmental and cultural variations, which include how sleep problems are defined and perceived (Sadeh and Anders, 1993; Sadeh *et al.*, 2011). Infant sleep issues can affect caregiver sleep quality; long-term sleep problems are associated with various physical and psychological symptoms, including increased risk of perinatal mental ill health, heart disease, depression and cancer, as well as lower socio-economic status (Public Health England, 2018; Smith and Bone, 2023). It is important to note that research of this type is complicated by bidirectional effects and numerous contributing factors. For instance, while specific maternal practices have been identified as predictors of infant sleep, infant night-time distress also influences maternal practices (Philbrook and Teti, 2016). Understanding and improving sleep across the lifespan is therefore important at the individual, family and government levels. This paper has reduced the enormity of this task by conducting a PRISMA scoping review (PRISMA-ScR) of research relevant to the improvement of sleep in infants up to two years of age.

Demand for sleep support is growing. There are companies and charities offering sleep advice and support, often for a fee (for instance, Possums for Mothers and Babies Ltd. (2020) and Sleeping Bunnies (2023)). Infant sleep consultations in Canada reportedly cost $250 to $450 in 2015, potentially reinforcing the previously highlighted relationship between socio-economic status and sleep inequality (Hall *et al.*, 2015). There is now pressure on companies to provide support; the infant sleep support that Meta provides to its employees prompted *Glamour* magazine to publish an article demanding other companies do the same (London and Ross, 2023). Private companies tend to combine moderate behavioural sleep interventions with additional recommendations based on relational approaches, such as attachment or mindfulness-based interventions. However, their services are unregulated, potentially leaving caregivers and infants vulnerable to improper advice. Likewise, caregivers attempting to navigate published guidance about infant sleep have access to a wide variety of articles, books, blogs, podcasts, online courses and government sources, which vary in their impartiality, guidance and author background (for example, Canapari, 2019; The Sleep Charity, 2020; healthdirect Australia, 2021a; 2021b; 2021c; NHS, 2021; 2023; The Lullaby Trust, 2023; Walker and Canapari, 2023; Weissbluth, 2023). In 2021 Norland conducted an unpublished informal review of 22 popular books about infant sleep (Rose *et al.*, 2021). Each book was selected on the basis of it being popular with parents and professionals and available via Amazon. The reviewers found that only

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five of the 22 books contained properly cited academic sources. It was also difficult to ascertain whether some authors had qualifications and experience relevant to infant sleep, and some advocated cry it out without citing supporting evidence. These factors may contribute to the problem of inconsistent and contradictory recommendations.

Despite the varying recommendations, there is a general consensus that sleep interventions are not recommended for use with infants under six months of age. This is because newborn sleep is initially evenly distributed across each 24-hour period, circadian rhythms begin to emerge at about two or three months of age, and the longest daily continuous sleep episode of about six hours emerges at approximately six months of age (Douglas and Hill, 2013; Patel *et al.*, 2022a). Gold (2017) highlighted that a 'one size fits all' approach may be problematic when it comes to supporting children's sleep. For example, infants with sensory processing difficulties may need more soothing and a gentler transition to independent sleeping than a neurotypical infant, or may have an opposite need whereby typically soothing activities, such as rocking, might be stimulating rather than calming. She also emphasised that sleeping independently is a 'skill' and that, prior to at least four months of age, a baby is "too immature from a neurological perspective to self-soothe" (Gold, 2017, p. 215).

Behavioural sleep interventions

Behavioural sleep interventions (BSIs) make up a large proportion of the approaches investigated, but while they are popular with some parents, others find them concerning. BSI is an umbrella term for interventions rooted in behavioural psychology which vary widely in approach but commonly claim to encourage self-soothing and self-regulation, and to eventually reduce the need for parental involvement in getting infants to sleep. Standard (unmodified) extinction, commonly known as 'cry it out', aims to teach infants to fall asleep independently and decrease crying frequency by removing all parent interaction at sleep time and during night crying (Blampied and France, 1993; Mindell *et al.*, 2006; Meltzer, 2010; Blunden and Dawson, 2020; Whittall *et al.*, 2021). Many caregivers are concerned by the prolonged infant crying associated with cry it out, and report increased stress and concerns about potential long-term impacts on infants (France, 1994). This can lead to poor adherence and reinforce crying, because the intermittent reinforcement results in longer bouts of crying to elicit parental responses (Thomas *et al.*, 2014). This is particularly evident during the commonly experienced post-extinction burst, in which infant distress increases prior to improvement (Blunden *et al.*, 2011; Blunden *et al.*, 2016). Moderate BSIs aim to avoid this problem by being more responsive and include the following:

- Controlled crying, also known as graduated extinction, controlled comforting, checking in and 'systematic ignoring – minimal check' (SI-mc) (Matthey and Črnčec, 2012; Price *et al.*, 2012a; Hall *et al.*, 2015; Kahn *et al.*, 2020), refers to caregivers placing their infant alone in the sleep space and periodically attending with minimal interaction, leaving the room for increasingly longer intervals until the infant falls asleep (Blunden and Dawson, 2020). The aim is to reduce infant dependence on parents for going to sleep (Meltzer and Mindell, 2014).
- Camping out (also referred to as 'parental presence – minimal check' or PP-mc) most commonly refers to caregiver passive presence throughout the night, often with the caregiver sleeping beside the infant's cot but having minimal interaction with them and gradually removing their presence (Matthey and Črnčec, 2012; Price *et al.*, 2012a; Kahn *et al.*, 2020).
- Bedtime fading (also known as the no-cry technique) refers to the temporary adjustment of the child's bedtime to later in the evening with the aim of increasing their physical urge to sleep. Once good sleep habits develop, the routine is gradually brought forward until it is realigned with the caregiver's preferred time. This process increases the infant's homeostatic pressure to sleep so they readily fall asleep and develop good sleep habits (Dewar, 2023).

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Attachment theory and its relevance to sleep interventions

Attachment theory is sometimes incorporated into infant sleep research in response to caregiver concerns about the possibility of some BSIs (notably cry it out and controlled crying) detrimentally influencing their relationship with their infant and reducing the likelihood of them sharing a secure relationship. Attachment theory is founded on the assumption infants have evolved to seek proximity with, and care from, their significant caregivers to ensure their survival and development (Bowlby, 1969; 1977). An infant with a 'secure' attachment pattern with a caregiver is strongly inclined to seek proximity with them for comfort, seek their guidance and use them as a secure base from which to explore, and is confident they will be responsive to their needs (Bowlby, 1988). This secure pattern develops from a history of consistent caregiver sensitivity to infant signals and communication (Main, 2000). In contrast, infants with an insecure anxious–avoidant attachment pattern tend to repress their expression of emotions and needs, while infants with an insecure anxious–ambivalent (sometimes called anxious–resistant) pattern are preoccupied with their caregivers and can become extremely distressed during separations, but are not comforted or become angry when reunited with them (Mikulincer and Shaver, 2018). Avoidance is associated with a history of consistent caregiver rejection, and the resistant–ambivalent pattern with caregiver unpredictability. Infant insecure attachment is predictive of poorer physical health in adulthood, including a greater likelihood of inflammation-related illnesses and higher cardiometabolic risk (Puig *et al.*, 2013; Farrell *et al.*, 2019).

Unfortunately, attachment research outcomes are sometimes misinterpreted for several reasons, including differing underlying concepts and variations in the academic use of terms among different schools of thought (Duschinsky *et al.*, 2021). In addition, attachment terminology is used in everyday language but with different meanings (Waters *et al.*, 2013). This can result in well-meaning misinterpretations of attachment outcomes, such as the belief that all cues must be met with immediate responses, and the incorrect perception that attachment research outcomes suggest sleeping babies need uninterrupted maternal presence to develop a secure attachment pattern (for example, Aldort (2010) and Drozd *et al.* (2022)).

Attachment research outcomes are nuanced regarding sleep; a longitudinal comparison between 40 infants with sleep problems and 60 without found persistent sleep problems after one year were associated with an ambivalent attachment pattern (Morrell and Steele, 2003). This is interesting because infants with this pattern have greater difficulty with emotional regulation than secure or avoidant infants. Other factors influencing sleep were parental difficulties with setting the infant limits, parental perception of the infant having a difficult temperament, maternal anxiety and depression, and parental reliance on physical comforting to transition the infant to sleep. This suggests a combination of factors influence sleep behaviours and highlights the importance of support for caregivers with managing infant sleep, and with their anxiety and depression.

A meta-analysis of attachment-based infant sleep research found resistant attachment was associated with greater likelihood of parental reported sleep problems when compared with other infants (Simard *et al.*, 2017). Actigraphy data (gathered via a device worn on the child's wrist or ankle for 72 hours to monitor the number of wrist or ankle movements) was compared with a sleep diary kept by mothers during the same period. The differences between parental perceptions of wakefulness were unsupported by actigraphy results. This may suggest either that caregivers of resistantly attached infants might be more concerned about, or sensitive to, their infant's night-time cues than caregivers of secure or avoidant infants, or that their infants are less able to self-soothe or more likely to signal distress. Either way, the finding supports the argument that sleep research using parental reports of infant sleep may be misleading (Werner *et al.*, 2008).

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Overall, attachment research outcomes relevant to infant sleep appear more likely to suggest that an overarching pattern of inconsistent and inaccurate responses to cues is associated with sleep problems, rather than suggesting sleep issues are symptomatic of a failure to respond to all night-time cues for contact. The concept of using a secure base as a source of comfort includes consistent caregiver sensitivity to infant cues, which informs context-dependent accurate responses and leads to the child's affect regulation (Waters and Waters, 2006; Waters and Roisman, 2019). Infants cannot always have their wishes met, but sensitive caregivers use "foresightful nudging" rather than coercion to help them learn this, such as the use of bedtime routines (Bretherton, 2013, p. 467). This differs from providing the same response every time a child cries and suggests approaches should be cue appropriate but take account of context and the infant's developmental stage.

Existing systematic reviews

While there are reviews specific to particular sleep approaches, there seems to be a lack of overarching systematic reviews examining diverse approaches to improving infant sleep. A recent umbrella review included five systematic reviews (Drozd *et al.*, 2022), four of which were referred to as behavioural approaches but incorporated information about sleep, tiredness cues, settling and positive bedtime routines. The fifth was described as an intuitive approach and recommended immediate responses to all crying. Authors concluded that consistent bedtime routines, educating parents about infant sleep, differentiating responses according to situation, minimising interaction during sleep onset and night-time waking, and parental preferences were valuable elements in improving sleep. This outcome is important because it resembles the previously reported attachment research findings and highlights similarities between behavioural and relational approaches. This overlap suggests labelling an approach 'behavioural' or otherwise can be reductionist and misses opportunities to acknowledge intervention complexities. The current review paper aims to take a step towards addressing this by presenting research outcomes in a way that identifies how approaches within studies differ and overlap rather than comparing BSI outcomes. It is hoped this will inform future systematic reviews that are more appropriate for making recommendations regarding research quality.

Background and aims of the present research

The current review re-examines data from an unpublished scoping review conducted as part of a short-term project funded by Norland (Linney, 2021). A PRISMA-ScR approach informed the literature search with the aim of identifying research published between 2011 and 2021 that was specific to the use of cry it out and controlled crying in infants between birth and two years of age (Tricco *et al.*, 2018; PRISMA, 2023). The following research questions were devised for the purpose of the present study and the literature was reconsidered in light of them:

1. What interventions have been researched relevant to sleep and crying in infants under two years of age and what are the study characteristics?
2. What are the overarching outcomes of the sleep interventions included in the scoped studies?
3. What recommendations do literature authors make and what are the implications for professional training and practice?

Methodology

The previously discussed unpublished scoping review (Linney, 2021) used a PRISMA-ScR approach to source the literature used for this paper (PRISMA, 2023). PRISMA-ScRs are commonly used to present

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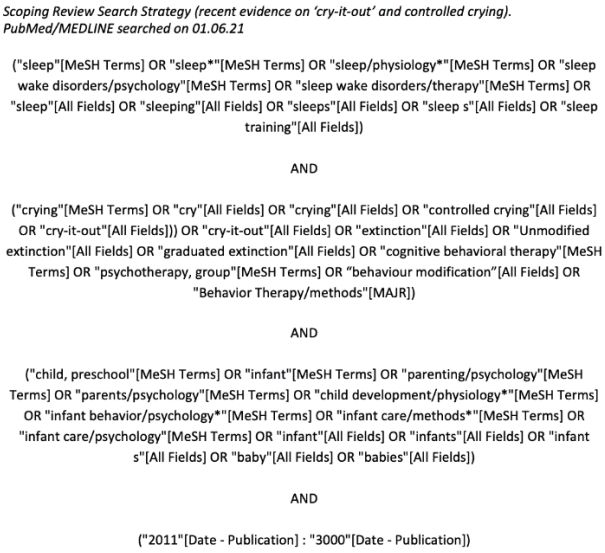
the range and characteristics of existing literature, summarise their findings, identify gaps, and inform the structuring of subsequent literature reviews; it is beyond their scope to critically appraise the methodology or bias of individual studies (Tricco *et al.*, 2018). This paper adheres to the PRISMA-ScR approach.

The aim of the original review was to identify research published between 2011 and 2021 specific to the use of cry it out and controlled crying in children between birth and two years of age. Figure 1 contains the search strategy used for that purpose. In contrast, the present paper presents the reported approaches of each study and the patterns of findings, and addresses the three research questions presented in the 'Background and aims of the present research' section of this paper.



Scoping Review Search Strategy (recent evidence on 'cry-it-out' and controlled crying). PubMed/MEDLINE searched on 01.06.21

("sleep"[MeSH Terms] OR "sleep*"[MeSH Terms] OR "sleep/physiology*"[MeSH Terms] OR "sleep wake disorders/psychology"[MeSH Terms] OR "sleep wake disorders/therapy"[MeSH Terms] OR "sleep"[All Fields] OR "sleeping"[All Fields] OR "sleeps"[All Fields] OR "sleep s"[All Fields] OR "sleep training"[All Fields])

AND

("crying"[MeSH Terms] OR "cry"[All Fields] OR "crying"[All Fields] OR "controlled crying"[All Fields] OR "cry-it-out"[All Fields])) OR "cry-it-out"[All Fields] OR "extinction"[All Fields] OR "Unmodified extinction"[All Fields] OR "graduated extinction"[All Fields] OR "cognitive behavioral therapy"[MeSH Terms] OR "psychotherapy, group"[MeSH Terms] OR "behaviour modification"[All Fields] OR "Behavior Therapy/methods"[MAJR])

AND

("child, preschool"[MeSH Terms] OR "infant"[MeSH Terms] OR "parenting/psychology"[MeSH Terms] OR "parents/psychology"[MeSH Terms] OR "child development/physiology*"[MeSH Terms] OR "infant behavior/psychology*"[MeSH Terms] OR "infant care/methods*"[MeSH Terms] OR "infant care/psychology"[MeSH Terms] OR "infant"[All Fields] OR "infants"[All Fields] OR "infant s"[All Fields] OR "baby"[All Fields] OR "babies"[All Fields])

AND

("2011"[Date - Publication] : "3000"[Date - Publication])

Figure 1 **Search strategy**

The literature search was conducted in June 2021, and the titles, abstracts and full text papers were screened against the inclusion and exclusion criteria (Table 1).

Table 1 **Inclusion and exclusion criteria**

Inclusion criteria	Exclusion criteria
Infants aged under two years old	Infants aged over two years old
Focused on sleep training	Not focused on sleep training
Focused on infant crying	Not focused on infant crying
Qualitative or quantitative studies	Not original research
Published 2011 to 2021	Published pre-2011
Published in English	Not published in English

Figure 2 presents the paper screening process. Reasons for paper exclusion were recorded during a full text screening. Based on this process, 13 papers were identified that met the inclusion criteria.

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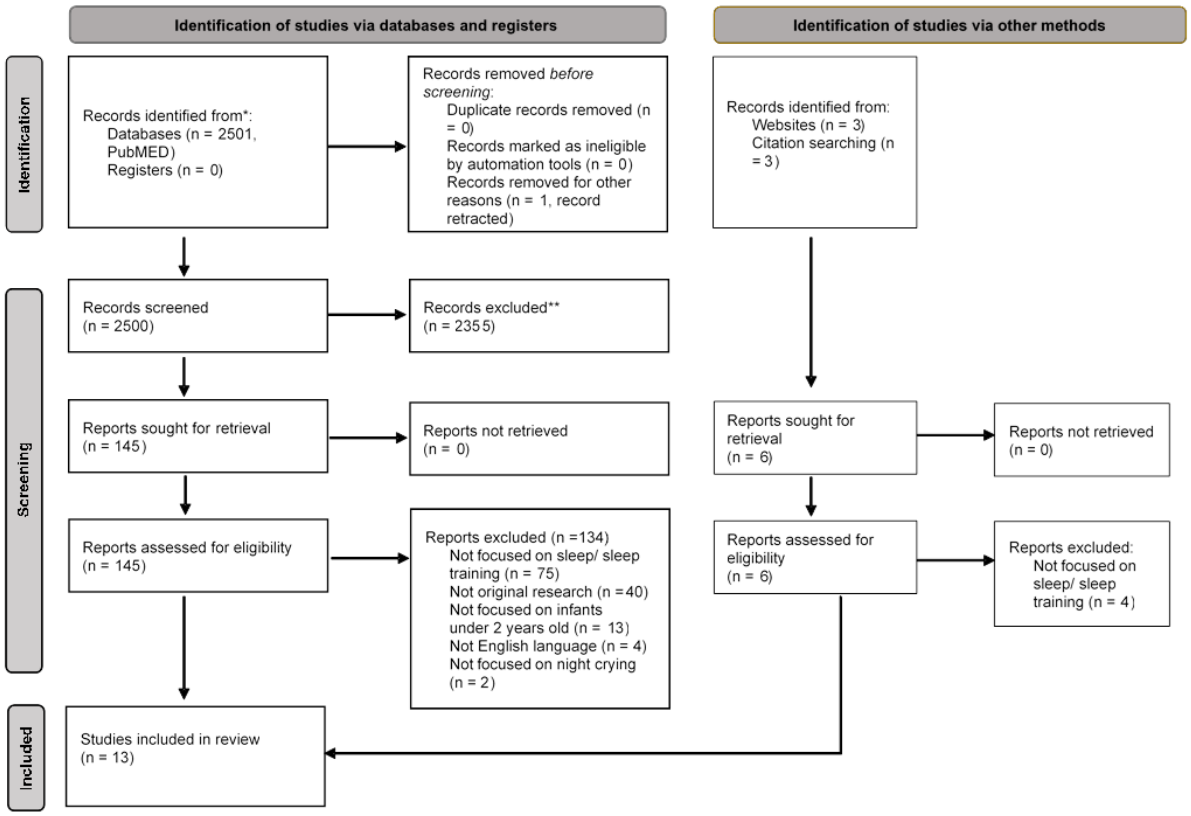

Figure 2 **PRISMA diagram of the review process (informed by Page *et al.*, 2021)**

Results

The findings for research question 1 (study characteristics) are summarised in Tables 2 to 8. The tables present papers thematically by intervention or examination type, and the columns are headed to show which research question the detailed information is relevant to. Summaries of the findings relevant to research question 2 are interspersed between the relevant tables. The tables are followed by a summary of the results for research question 3 (i.e., recommendations and implications for professional training and practice). This method of tabulation highlights nuanced differences between interventions with the same name but necessitates the inclusion of some studies more than once in tables. Where interventions have been compared, signposts have been included to reduce replication.

What interventions have been researched relevant to sleep and crying in infants under two years of age and what are the study characteristics? (Research question 1)

The studies employed a variety of methodological approaches, including randomised controlled trials and follow-ups of these (n=5), observational (n=1), longitudinal (n=4), single case replication (n=1) and parental perception surveys without other measures (n=2). The geographical location of studies is restricted in terms of cultural diversity: 11 studies were reported in 13 papers from primarily English-speaking countries (i.e., Australia, Canada, New Zealand, US, Israel and England). Scoped studies lacked a standardised approach to the application and assessment of interventions, and to the assessment of infant sleep, and most examined only mothers or primary caregivers. Tables 2 to 8 contain detailed information about the interventions and characteristics of each study (see column headings for signposts to each research question). In summary, cry it out (n=2), cry out (n=1),

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controlled crying (n=3), camping out (n=2), bedtime fading (n=1) and educational interventions (n=6) were examined. Educational interventions and support were used most frequently, sometimes in conjunction with BSIs. Parental perception of BSI efficacy was also examined (n=4) (two of these examinations included additional measures).

What are the overarching outcomes of the sleep interventions researched by the scoped studies? (Research question 2)

The use of cry it out and cry out

Table 2 contains two papers examining the impact on infants of using cry it out and one examining cry out (defined in the paper as 'delayed responsiveness'). An investigation into the impact on maternal–infant synchrony found infant crying often reduced after three days but infant cortisol level remained consistent, which suggests the behavioural improvement was not indicative of infants learning to manage their internal stress level (Middlemiss *et al.*, 2012). However, maternal cortisol level did reduce, which resulted in maternal–infant asynchrony. Examination of the characteristics of early and late adopters of cry out in Alberta found socio-economically advantaged women with raised depressive symptoms were most likely to use the method (Giesbrecht *et al.*, 2020).

In light of the previously reported findings of reductions in infant crying and maternal cortisol, the method may be useful if caregivers are depressed and feeling overwhelmed. Relevant to this is the third finding that use of cry it out at 18 months (but not before) was associated with maternal sensitivity (Bilgin and Wolke, 2020). All authors suggested caregiver sensitivity to the situation and infant are important. One author suggested further investigation of the potential impact of maternal–infant dysregulation is needed (Middlemiss *et al.*, 2012). Another recommended neither leaving the infant to cry it out nor responding immediately to all cues, but rather suggested the responsive adaptation of caregiver attendance to need, context and the infant's ability to self-regulate (Bilgin and Wolke, 2020).

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Table 2 **Summary of papers examining the use of cry it out and cry out**

Research question 1 (RQ1): **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Research recommendations and implications for professional training/practice**	**Citation**
Cry it out (intervention delivered by trained nurses, not caregivers)	New Zealand Five-day residential behavioural training programme examining changes to infant–mother synchrony. Mother–infant dyads (n=25) (infants aged 4–10 months) spent their days together in reciprocally oriented activities. Nurses responsible for infant night-time/nap-time care. Infant and maternal cortisol samples collected on days 1 and 3. Nurses documented duration of infant behavioural distress.	All infants exhibited behavioural distress on day 1; crying decreased by day 3 despite infants still experiencing roughly the same level of distress (evidenced by raised cortisol levels). Mothers were physiologically attuned to their infants at the beginning of the programme, but maternal cortisol levels decreased, resulting in asynchrony between infant–mother cortisol levels.	Highlights importance of infant behavioural cues as a foundation for synchrony in maternal–infant physiological attunement. Infants were not learning how to internally manage their stress. Maternal stress reduced, so cry it out may be useful in emergency situations.	Middlemiss *et al.*, 2012
Survey of parental use of cry out (defined as delayed responsiveness) with some follow-up measures to assess	Canada Longitudinal study: survey and follow-up laboratory assessment for some participating dyads.	Use of cry out associated with white mothers with relatively higher income and lower use of relational strategies to soothe infant (for example, less cuddling, carrying and	Findings are unclear. May suggest delayed responsiveness was selected because of particular needs or that infant sensitivity to maternal cues at six months	Giesbrecht *et al.*, 2020

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features associated with its use	Mothers (n=1,826) completed a questionnaire about use of cry out during infant's first year. A subsample (n=137) participated in laboratory assessments of interaction at six months and attachment at 20 months.	taking the child into the parental bed). Use was associated with higher problematic behaviour at three months but lower at 12 months. There was no significant relationship with measures of maternal sensitivity or infant–maternal attachment. Infants of mothers using cry out were more responsive to maternal verbalisations, facial expressions and soothing during an interaction task at six months.	was associated with responsive caregiving differentiated to situation (rather than the same response to all cues). Teaching caregivers about selective use of delayed responsiveness, taking contextual features and infant need into account, may be useful.	
Survey of parental reported use of cry it out with follow-up measures	England Longitudinal study examining the relationship between parental reported use of cry it out and infant–maternal attachment, infant behaviour and maternal sensitivity. Infants (n=178; preterm n=73) and their mothers. Assessment at term, three months, six months and 18 months using maternal	63.4% reported never leaving their infant to cry it out at term; this reduced over time to 36.9% at 18 months. Greater maternal sensitivity was significantly associated with leaving infants to cry it out at 18 months but not before.	The reported associations are weak; authors do not recommend leaving the infant to cry it out or responding immediately. They suggest an intuitive parenting approach whereby maternal responses are adapted to their infant's ability to self-regulate (therefore age and	Bilgin and Wolke, 2020

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	reports of cry frequency/duration and regularity of cry it out. At 18 months: strange situation procedure (SSP) used to assess infant–maternal attachment pattern, supplemented with two observer-rated infant behavioural assessments and parent-rated infant behaviour. Maternal sensitivity was assessed at three and 18 months of age.	Leaving infants to cry it out a few times at term was significantly associated with less crying duration at 18 months but not less frequency.	developmental stages are factors for consideration).	

Controlled crying, camping out, bedtime fading and educational interventions

The remaining investigations into the use of BSIs (rather than parental perception of their use) were for moderate approaches with some form of support. Controlled crying was compared with camping out, bedtime fading and educational interventions (Table 3). Each intervention was associated with significant improvements in maternal mental health. Importantly, camping out (Tables 3 and 4) was as effective as controlled crying but preferable for infants with separation anxiety, and less likely than controlled crying to lead to post-intervention deterioration of infant sleep (Matthey and Črnčec, 2012; Kahn *et al.*, 2020). A comparison between controlled crying, bedtime fading and education (Tables 3 and 5) found that bedtime fading effectively reduced the time for infants to get to sleep and that all three approaches were effective (Gradisar *et al.*, 2016). Notably, education was as effective as BSIs in the long term, and bedtime fading shared the strongest relationship with improvements in maternal mood and stress.

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Table 3 **Summary of papers comparing controlled crying with other interventions**

RQ1: **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Research recommendations and implications for professional training/practice**	**Citation**
Controlled crying (with practical demonstration of intervention, written guidance and the opportunity to ask questions a few days later)	Australia Single case replication design study: examined SI-mc (systematic ignoring with minimal check – controlled crying) or PP-mc (parental presence with minimal check – camping out). Families (infants aged 16–18 months) (n=16) randomised to either intervention. Nightly diary, sleep bother subscale and change questionnaire used to record sleep and changes. The Edinburgh Depression Scale, Hospital Anxiety and Depression Scale, and Experience of Motherhood Questionnaire used to assess maternal mood and experiences. Infant Emotional Health Questionnaire also used. Most measures completed at baseline, at three weeks post-intervention and at a four- to five-month follow-up.	Although controlled crying was as effective as camping out, it was associated with deterioration of sleep in some infants at follow-up (whereas camping out was not). Both treatments were effective at decreasing infant sleep problems (in a third to half of families by three weeks post-intervention and nearly all by follow-up); both resulted in improvements in mothers' mood, and neither disrupted infant emotional health.	Health services can offer a choice of strategies to parents. The camping-out strategy is an effective alternative to controlled crying.	Matthey and Črnčec, 2012

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Controlled crying (with individualised treatment session)	Australia Randomised controlled trial (RCT): comparing the impact of graduated extinction, bedtime fading and a control group receiving sleep education about infant and parent sleep/wakefulness, stress, and later child emotional/behavioural problems. Infants (n=43) with parental reported sleep problems (aged 6–16 months). Seven-day sleep diaries, activity monitors and maternal depressed mood and stress questionnaire used alongside parental saliva cortisol analysis on two days. Parents were interviewed for 90 minutes about the infant's medical and sleep history.	All groups (including controls) enjoyed significant improvements in maternal stress from pre-treatment to 12-month follow-up. Maternal stress improved moderately in all groups at 12 months; but at one month the reduction in stress was moderate in the graduated extinction group, large in the bedtime fading group and largely unchanged in the education group. At 12 months maternal mood improvement was most strongly associated with the bedtime fading group.	Sleep education is as effective as BSIs in the long term (12 months) but marginally less effective at one month post-intervention. Alongside education, the use of bedtime fading is likely to quickly reduce the time it takes for infants to get to sleep due to homeostatic pressure. Graduated extinction may then be introduced to reduce night-time wakefulness, if necessary.	Gradisar *et al.*, 2016
Controlled crying with support from a clinical psychologist	Israel Parallel group RCT examining the moderating role of infant separation anxiety on checking in and camping out. Infants with paediatric insomnia (n=91, aged 9–18 months) were randomised to either a checking-in-based or a camping-out-based intervention.	Improvement in sleep following both interventions which was maintained at follow-up; no change in separation anxiety following treatment; greater benefit for infants with high separation anxiety in camping out compared with checking in.	Study suggests infant separation anxiety should be considered when recommending BSIs. Camping out is preferable to graduated extinction for infants with separation anxiety.	Kahn *et al.*, 2020

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	Actigraphy was used the week prior to and three weeks following the onset of treatment. Lab assessment of infant separation anxiety and completion of Brief Infant Sleep Questionnaire. A clinical psychologist provided an individualised treatment session and parents received phone calls three and seven days later. Lab and home assessments were repeated one month and six months after initial session.	Parental perception of sleep improvement was greater than actual improvement recorded via actigraphy.		

Table 4 **Summary of papers comparing camping out with other interventions**

RQ1: **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Research recommendations and implications for professional training/practice**	**Citation**
Camping out (with a practical demonstration of intervention and written guidance)	Full details: Table 3.	Equally effective as controlled crying but was not associated with deterioration of infant sleep at follow-up (whereas controlled crying was).	Health services can offer a choice of strategies to parents. It is likely the camping-out strategy is an effective alternative to controlled crying.	Matthey and Črnčec, 2012

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Camping out with support from a clinical psychologist	Full details: Table 3.	Greater benefit for infants with high separation anxiety in camping out compared with checking in.	Camping out preferable to graduated extinction for infants with separation anxiety.	Kahn *et al.*, 2020

Table 5 **Summary of papers comparing bedtime fading with other interventions**

RQ1: **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Research recommendations and implications for professional training/practice**	**Citation**
Bedtime fading (with individualised treatment session)	Full details: Table 3.	Bedtime fading shared the strongest relationship with improvements in maternal mood and stress.	Educating caregivers about sleep is as effective as BSIs in the long term. Alongside education, bedtime fading is likely to quickly reduce the time it takes for infants to get to sleep due to homeostatic pressure. Graduated extinction may then be introduced to reduce night-time wakefulness, if necessary.	Gradisar *et al.*, 2016

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The impact of sleep education

Sleep education was examined as an intervention, offered alongside BSIs and sometimes used as a control condition (Table 6). Education was associated with a broad range of benefits, including improvements in caregiver wellbeing and infant sleep, when used alone or in conjunction with moderate BSIs (Price *et al.*, 2012b, 2012a; Symon *et al.*, 2012; Hall *et al.*, 2015; Gradisar *et al.*, 2016; Symon and Crichton, 2017). Importantly, use of an educational intervention led to a significant increase in maternal confidence and pleasure in being a mother, and decreased frustration, depression, anxiety and stress (Symon and Crichton, 2017). An RCT of an educational intervention found significant improvements in primary caregiver fatigue, depressed mood, sleep quality, limit-setting and confidence in managing infant sleep, and a reduction in their anger about sleep (Hall *et al.*, 2015). Secondary caregivers experienced improvements in limit-setting, their sleep quality and fatigue, and their confidence about sleep management.

Actigraphy results supported the effect reported in the introduction (i.e., that parental perception of sleep improvement is sometimes greater than actual improvement) (Hall *et al.*, 2015; Kahn *et al.*, 2020). This might have been because the infants had learned to self-soothe, meaning caregivers were unaware they had woken, or because caregiver education had resulted in more realistic expectations and acceptance of their infant's sleep patterns. The increase in reported maternal pleasure is interesting because, from an attachment perspective, a key aspect of secure interaction is shared delight (Bretherton, 2013).

Table 6 **Summary of papers comparing the impact of sleep education (sometimes coupled with BSIs)**

RQ1: **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Recommendations and implications for professional training/practice**	**Citation**
Written guidance, 24/7 access to support-line phone number	Full details: Table 3.	Educating caregivers of infants with sleep problems about sleep was as effective as BSIs in the long term (12 months) but marginally less effective at one month post-intervention.	Educating caregivers of infants with sleep problems about sleep is as effective as BSIs in the long term. Alongside education, bedtime fading is likely to quickly reduce the time it takes for infants to get to sleep due to	Gradisar *et al.*, 2016

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			homeostatic pressure. Graduated extinction may then be introduced to reduce night-time wakefulness if necessary.	
An educational consultation and access to a website	Australia Educational intervention: one 45-minute consultation with specially trained GP or nurse to deliver written and verbal information about normal infant sleep patterns, sleep cues, the role of learning, the role of tiredness and problems with over-tiredness, and the recommendation of a 'cold turkey' approach (undefined BSI). Mothers and their infants (aged between 6 and 12 months) (n=80). The Depression Anxiety Stress Scale 21 (DASS21) and the number of nocturnal awakenings assessed to find whether effectiveness of infant sleep interventions led to an improved sense of maternal wellbeing.	Significant reductions in infant waking and maternal depression, anxiety and stress.	Training healthcare professionals to provide support and evidence-based information about infant sleep and strategies is a cost-effective way to improve infant sleep and maternal mental health, particularly in those with post-natal depression.	Symon *et al.*, 2012
Educational intervention (two-hour taught group	Canada RCT	No difference between intervention and control group for mean change in	Training community nurses to deliver evidence-based information at post-natal	Hall *et al.*, 2015

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session and four support calls over two weeks)	Intervention group: received two-hour taught session about normal sleep and BSIs. Telephone calls from nurses to reinforce training and provide support twice weekly for two weeks. Control group: received information about BSIs. Families (infants aged six to eight months) (n=235) randomised to comparison or intervention group. Outcomes assessed at commencement and six weeks later using parental reports and actigraphy. Families received information about normal infant sleep, importance of routines and safety risks, and taught how to use BSIs.	wakes or long-wake episodes but a significant increase in the longest sleep time for those in the educational intervention group. There were also significant improvements in caregiver fatigue, sleep quality, limit-setting, confidence in managing sleep, depressed mood and anger about sleep; secondary caregivers experienced improvements in confidence about sleep management, limit-setting, sleep quality and fatigue, but not anger. Six weeks post-intervention: no difference between intervention and control group for mean change in wakes or long-wake episodes (actigraphy results). However, there was a significant increase in the longest sleep time in intervention group infants.	groups could improve caregiver understanding about normal infant sleep behaviours, help infants sleep longer, reduce parental concern about night wakings, support safe use of interventions where necessary, and benefit primary and secondary caregiver mood, sleep quality and fatigue.	

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		Parental reports of reduced night wakings in intervention group were unsupported by actigraphy results, suggesting caregiver understanding of normal sleep may have changed or they were less anxious about infant cues.		
Educational intervention delivered by trained nurses and access to a website (follow-up study to Symon *et al.*, 2012)	Australia Verbal and written information included normal sleep patterns, cues, fatigue impairment and the role of infant learning and sleep strategies. Mothers (n=80) attended a 45-minute consultation with a GP or nurse trained in sleep. Of these, 49 engaged in the second clinical interview, contributing to the findings about confidence, pleasure and frustration. Depression Anxiety Stress Scale, clinical review and maternal reported night-time awakenings assessed at baseline and follow-up.	Educational intervention led to a significant increase in maternal confidence and pleasure in being a mother, and decreased frustration, depression, anxiety and stress.	Consultations are cost- and time-effective and can improve maternal and infant wellbeing, and are particularly helpful for post-natal depression or low confidence.	Symon and Crichton, 2017

Five years after their original RCT, researchers compared infants previously subject to controlled crying or camping out alongside nurse education (grouped into one variable) with infants who had not experienced sleep interventions (Price *et al.*, 2012a) (Table 7). The study included the measurement of cortisol levels alongside other measures,and suggested that neither of the two moderate BSIs in conjunction with education were associated with long-term

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differences in this biological stress marker. Lack of statistical differences between interventions and controls resulted in them being combined into one and a subsequent analysis of the relationship between sleep issues at seven months and at six years being conducted (Price *et al.*, 2012b). The results suggested no meaningful relationship, implying parental education alone and combined with moderate BSIs is useful in the short to medium term and neutral in the long term.

Table 7 **Summary of papers about education with grouped BSIs**

RQ1: **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Recommendations and implications for professional training/practice**	**Citation**
RCT follow-up investigating long-term benefits of controlled comforting or camping out with nurse education vs usual care	Australia Follow-up using families (n=225) who had used controlled comforting or camping out. Controlled comforting and camping out were grouped into one variable and compared with the control group. This phase: a variety of questionnaires relevant to emotional, relationship, behaviour and sleep problems, home-based assessment around sixth birthday, and two cortisol samples.	No significant differences between intervention and control groups for any outcome, including child emotional problems and conduct behaviour, sleep problems/habits, psychosocial functioning, child–parent closeness, attachment, and parental depression, stress and anxiety scores.	Using the moderate BSIs had no long-term harmful or beneficial effects but was useful in addressing infant sleep problems and maternal depression in the short to medium term. Education for parents about normal sleep may help prevent problems developing. Infants with early trauma or who are anxious may benefit from camping out.	Price *et al.*, 2012a
RCT follow-up investigating whether	Australia	Sleep problems at seven months old were not	Addressing sleep problems when they arise can reduce	Price *et al.*, 2012b

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sleep problems at seven months old predict sleep, and other, problems at six years old	Questionnaire-based follow-up: participants were in a homogenous group regardless of whether they had used a moderate BSI or not. Parents (n=326) who had reported sleep problems at three points before 24 months old. Child Sleep Habits and various questionnaires (sleeping patterns, maternal mental and global health, quality of life, and child–parent relationship).	predictive of sleep problems at six years old.	adverse child and maternal outcomes in the short to medium term.	

Parental use and perception of BSI efficacy

Table 8 contains a summary of two papers that investigated parental use and perception of BSI efficacy. Loutzenhiser *et al.* (2014) found that 70% of caregivers used controlled crying prior to six months, with only 15% eliminating night waking; in addition, poor success was associated with lack of support. A further survey reported greater success but found 17.3% of caregivers used BSIs when the infant was one month old or less, and most used them between three and five months (Honaker *et al.*, 2018). This low success rate and early use of cry it out reinforce, in light of the findings specific to Table 3, the importance of supporting and educating caregivers to understand infant sleep and how to use moderate BSIs, which may be preferable to cry it out. The combined findings suggest early caregiver use of BSIs may signal misconceptions about aspects of infant sleep or a need for support in addressing their own sleep deprivation or wellbeing.

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Table 8 **Summary of papers surveying retrospective parental perceptions**

RQ1: **Intervention and characteristics**	**RQ1:** **Characteristics**	**RQ2:** **Outcome**	**RQ3:** **Recommendations and implications for professional training/practice**	**Citation**
Survey of parental perception of controlled-crying efficacy	Canada Parental perception of the success of controlled crying was assessed via a parenting website survey. Parental (n=411) perception of improvements in infant sleep (aged 6–12 months) assessed through responses to six questions.	Of the 49.6% of parents using controlled crying, 70% first used it before their infant was six months old, 14% reported night waking was eliminated, and 41.7% reported it did not reduce night wakings. BSI efficacy was lower than is observed in research populations. Parents with lower levels of support reported lower levels of effectiveness and found the technique more stressful for their child.	Outcomes highlight the important roles of: 1) infants being at least six months old before BSIs are used 2) support and education about infant sleep being provided to caregivers.	Loutzenhiser *et al.*, 2014
Survey of parental perception of BSI efficacy	US Online survey: parents (n=652) of children aged 1–18 months belonging to a Facebook infant sleep support group reported their experiences of using BSIs (including modified extinction/controlled crying (49.5%),	17.3% of parents used BSIs when the infant was aged one month old or less; most used them for the first time between three and five months. No significant differences in parental perception of infant crying	Paediatric health professionals can help caregivers develop realistic expectations about infant sleep and help them choose suitable interventions.	Honaker *et al.*, 2018

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	unmodified extinction/cry it out (34.9%), parental presence with continual support (10.3%) and parental presence with no support/camping out (9.8%). Retrospective reporting of experiences up to one year previously was allowed.	intensity or parental stress. 83% of parents reported success. Parents were more likely to endorse consistent bedtime routines after using an intervention.		

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What recommendations do literature authors make and what are the implications for professional training and practice? (Research question 3)

No authors suggested education or moderate BSIs should not be used, but many recommended the gentler alternatives to cry it out and controlled crying. Education and support for caregivers alongside the use of BSIs (if they remained necessary) was the most consistent recommendation across studies (Price *et al.*, 2012a; Symon *et al.*, 2012; Loutzenhiser *et al.*, 2014; Hall *et al.*, 2015; Gradisar *et al.*, 2016; Symon and Crichton, 2017; Honaker *et al.*, 2018). In most instances, authors suggested professionals should receive specialist training to support caregivers with understanding infant sleep and appropriate use of evidence-based BSIs.

As highlighted in the introduction, the cry it out approach causes concern among some; biological infant–mother asynchrony following cry it out led the authors of a study to suggest further similar research into education interventions as an alternative (Middlemiss *et al.*, 2012). Other authors suggested that rather than being a binary choice in which either infants are left to cry it out or caregivers respond to infants every time, maternal responses should be adapted to infant and caregiver need, development and context (Bilgin and Wolke, 2020). This was noted as particularly relevant for infants with separation anxiety or a history of trauma, where camping out was suggested as preferable to cry it out and controlled crying (Price *et al.*, 2012a; Kahn *et al.*, 2020). A comparison between controlled crying, bedtime fading and education (Tables 3 and 5) resulted in authors recommending the combined approach of education alongside bedtime fading with the introduction of controlled crying if sleep remained an issue (Gradisar *et al.*, 2016).

The combined outcomes suggest educational interventions informing good bedtime routines, bedtime fading and appropriate use of moderate BSIs (where necessary) appear to be safe and effective. This recommendation is likely to be appropriate for infants with separation anxiety or a history of trauma if bedtime fading and camping out are the chosen BSIs. As highlighted in the introduction, sleep training is now generally not recommended for use with infants under six months old, unless there is a particular need. However, the lack of face-to-face evidence-based support available to parents means they may be unaware of the relevance of infant developmental stage to sleep behaviours, be exposed to misleading information, might misinterpret normal sleep behaviours as problematic and may exacerbate sleep problems with inconsistent responses. This is particularly concerning if primary caregivers or secondary caregivers are vulnerable (for instance, if they are prone to anxiety or depression or are sleep deprived). Training professionals who work directly with caregivers about infant sleep could be beneficial to the wellbeing, sleep and confidence of primary and secondary caregivers and, importantly, increase their enjoyment of the time they share with their infant.

Discussion

Infant sleep interventions are important at the individual, family and governmental levels. This review found caregiver education from trained professionals had a significant positive impact on infant sleep and main and secondary caregiver wellbeing, and facilitated safe use of moderate BSIs. Moderate BSIs were generally recommended instead of cry it out and were found to be safe and effective when used with infants who are at least six months old. However, education and use of bedtime fading to increase homeostatic pressure for sleep negated the need for BSIs in some cases. Where BSIs were necessary, camping out was identified as preferable for use with infants with separation anxiety or a history of trauma.

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Disparities between actigraphy results and caregiver-reported reduction in night waking suggests the adjustment of caregiver expectations and acceptance of infant sleep patterns may be an important benefit of educational interventions. Therefore, information about normal sleep patterns should be provided alongside information about boundary-setting, sleep routines, the use of bedtime fading and how to use moderate BSIs safely. This has the potential to help caregivers develop context-appropriate consistent sleep routines, boundaries and responses appropriate to their infant's developmental stage, without concern about long-term adverse effects. This could increase the likelihood of sensitive, context-dependent caregiver responses to infant cues, mitigate the previously reported problems associated with inconsistent BSI use and support the development of conditions associated with secure attachment relationships.

The emergence and growth of the sleep consultant industry in combination with the outcomes of this scoping review suggest many caregivers are seeking, and would benefit from, mentoring from rigorously trained professionals prior to, and following, the birth of their infant. Pre-birth education is important, because the scoping task found a number of caregivers use BSIs before the recommended six months of age. For instance, one study found that 70% of parents who were using controlled crying without expert help had used it before the infant was six months old and reported lower-than-expected success rates (Loutzenhiser *et al.*, 2014). Another found that 17.3% of its research population had tried BSIs before the infant was one month old and that most parents used BSIs when infants were aged between three and five months (Honaker *et al.*, 2018). Reliable information has the potential to mitigate the risk of inconsistent or inappropriate caregiver responses that may, in turn, make their infants more difficult for them to care for. In addition, well-supported caregivers are more likely to enjoy parenting and perceive improvements in physical and psychological wellbeing, which is likely to benefit their infant.

Most of the included studies used nurses to deliver educational interventions; however, numerous professionals are well placed to do this, including health visitors, nannies and early years professionals. Providing these professionals with rigorous training about evidence-based approaches to improving infant sleep means caregivers could access regulated free or affordable support and education. This could empower caregivers to choose and safely use situation-appropriate evidence-based approaches, provide a community-based safety net, address socio-economic sleep inequalities and improve caregiver and infant physical and psychological wellbeing.

There are some limiting features of this review. The search was conducted in 2021, meaning only research published between 2012 and 2021 has been reported on, and the small number of papers identified (13) focused on BSIs due to the search criteria. Findings are restricted in terms of cultural diversity; this could be for several reasons, including publication bias towards particular perspectives or the search being restricted to include only papers written in English. More recent studies may include factors not identified in the current review. A strength of the review is the attention paid to the nuance and overlap of seemingly competing approaches, which is commonly overlooked.

Given the importance this review has placed on support and education for caregivers from trained professionals, a systematic literature review examining factors contributing to successful caregiver mentoring and improvements in infant sleep would prove valuable. Future reviews should examine research quality, researcher bias and rigour, because these are beyond the scope of this study, which is a limitation associated with PRISMA-ScR. Since moderate BSIs are consistently found to be safe, future reviews might choose to take a similar approach to this one and examine the nuance of outcomes and the most effective ways of supporting and educating caregivers, rather than continuing to attend to whether moderate BSIs are safe and effective.

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Conclusion

The scoping review outcomes have resulted in preliminary recommendations for policy, professional training, future research and professional practice. While some assume attachment-based interventions include only relational aspects and BSI studies include only extinction-based methods, examination of the homogenous body of research suggests this is not the case. Indeed, effective programmes from both academic fields commonly include recommendations that professionals trained in evidence-based approaches should provide caregivers with information about developmentally appropriate sleep, cues for tiredness, settling techniques, positive sleep routines, how to increase homeostatic sleep pressure and how to use moderate BSIs (where necessary) at a developmentally appropriate time. Short-term examinations and longitudinal research suggest this is a safe combination associated with improvements to infant sleep and caregiver wellbeing in the short term, and with neutral long-term outcomes.

The support and education of caregivers were consistently associated with significant improvements in infant sleep and caregiver wellbeing; future work should identify specific elements for inclusion in the training of relevant professionals and review how best to ensure all caregivers are provided with high-quality evidence-based training relevant to the improvement of infant sleep. For instance, it may be beneficial to include training during antenatal sessions and health visitor visits, and to ensure early years professionals working with families are equipped to provide evidence-based advice. The identification of specific factors for inclusion in standardised training is important; this should be informed by a literature review examining a variety of relational and moderate BSI-based approaches and should exclude outcomes from poor-quality research.

Finally, labelling interventions as specifically behavioural or attachment based risks nuances being overlooked by individuals inexperienced at interpreting relevant outcomes or those reading only titles or abstracts. This suggests a need to reframe the way sleep research is conceptualised and presented.

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