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Review Article

Immediate or early skin-to-skin contact after a Caesarean section: a review of the literature

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Abstract

The World Health Organization and the United Nations International Children's Emergency Fund recommends that mothers and newborns have skin-to-skin contact immediately after a vaginal birth, and as soon as the mother is alert and responsive after a Caesarean section. Skin-to-skin contact can be defined as placing a naked infant onto the bare chest of the mother. Caesarean birth is known to reduce initiation of breastfeeding, increase the length of time before the first breastfeed, reduce the incidence of exclusive breastfeeding, significantly delay the onset of lactation and increase the likelihood of supplementation. The aim of this review is to evaluate evidence on the facilitation of immediate (within minutes) or early (within 1 h) skin-to-skin contact following Caesarean section for healthy mothers and their healthy term newborns, and identify facilitators, barriers and associated maternal and newborn outcomes. A range of electronic databases were searched for papers reporting research findings published in English between January 2003 and October 2013. Seven papers met the criteria. This review has provided some evidence that with appropriate collaboration skin-to-skin contact during Caesarean surgery can be implemented. Further evidence was provided, albeit limited, that immediate or early skin-to-skin contact after a Caesarean section may increase breastfeeding initiation, decrease time to the first breastfeed, reduce formula supplementation in hospital, increase bonding and maternal satisfaction, maintain the temperature of newborns and reduce newborn stress.

Keywords: skin-to-skin contact (SSC), kangaroo care (KC), Caesarean/Cesarean section, Baby Friendly Health Initiative (BFHI), breastfeeding, operating theatre, operating room.

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Introduction

Skin-to-skin contact (SSC) describes the placement of a naked infant, occasionally with a nappy or a cap on, on the mothers bare skin, and the exposed side/back of the infant covered by blankets or towels (UNICEF 2011). The term kangaroo care (KC) is generally discussed in relation to SSC with premature infants and care provided in Neonatal Intensive Care Units (UNICEF 2010). SSC is more generalised, as it includes care for healthy term infants. SSC is recommended immediately after birth for at least 1 h for all women, or until after the first breastfeed, and if breastfeeding, SSC should continue until after the first breastfeed; however, it is also recommended to be implemented anytime thereafter, and can be provided for any length of time (Overfield *et al.* 2005; UNICEF 2011).

The Baby Friendly Health Initiative (BFHI), developed by the World Health Organization (WHO) and

UNICEF, recommends that all babies should have access to immediate SSC contact following vaginal birth, and as soon as the mother is alert and responsive after a Caesarean section (World Health Organization & UNICEF 2009; Baby Friendly Health Initiative 2012). Immediate SSC after a Caesarean using spinal or epidural anaesthetic is achievable because the mother remains alert; however, after a general anaesthetic, the newborn should be placed skin-to-skin as soon as the mother is alert and responsive (World Health Organization & UNICEF 2009). It is recommended that SSC be facilitated immediately after birth, as this is the time when the newborn is most likely to follow his/her natural instincts to find and attach to the breast and then breastfeed (World Health Organization & UNICEF 2009; Baby Friendly Health Initiative 2012). Health professional routines should not disturb SSC (Overfield *et al*. 2005; World Health Organization & UNICEF 2009; Widstrom *et al*. 2011), in order to facilitate the newborn to follow nine distinct natural behaviours (Widstrom *et al*. 2011; Crenshaw *et al*. 2012). These behaviours include the birth cry, relaxation, awakening, activity, crawling, resting, familiarisation, suckling and sleeping (Widstrom *et al*. 2011; Table 1).

Table 1. Nine instinctive newborn behaviours

Phases	Behaviours
1. Birth cry	The cry immediately after birth
2. Relaxation	Resting, no activity
3. Awakening	Begins to make small movements of head and shoulders
4. Activity	Starts rooting, pushing with limbs
5. Crawling	Starts moving on the mothers chest, approaching the breast
6. Resting	Resting, may move mouth and suck hands (at any time)
7. Familiarisation	Licking and the nipple and areola
8. Suckling	Suckling at the breast
9. Sleeping	Resting, with eyes closed

Adapted from Crenshaw *et al*. (2012) and Widstrom *et al*. (2011).

Benefits of SSC

There are many advantages associated with SSC provided soon after birth. SSC helps maintain newborn thermoregulation (Hewitt *et al*. 2005; Overfield *et al*. 2005; Mercer *et al*. 2007; Walters *et al*. 2007; Gabriel *et al*. 2010) and blood glucose levels (Hewitt *et al*. 2005; Overfield *et al*. 2005; Walters *et al*. 2007); decreases the risk of jaundice (Overfield *et al*. 2005); reduces the stress of birth (Ferber & Makhoul 2004); encourages bonding between the mother and newborn (Overfield *et al*. 2005; Mercer *et al*. 2007); and encourages longer duration of breastfeeding (Overfield *et al*. 2005; Mercer *et al*. 2007; Gabriel *et al*. 2010).

Moore *et al*. (2012), in a systematic review, shows that early SSC increases breastfeeding duration following a normal vaginal birth. It is important to determine whether this is also true following a Caesarean section (Moore *et al*. 2012). There is evidence that women who give birth by Caesarean section are less likely to initiate breastfeeding and report more difficulties while establishing breastfeeding (Hauck *et al*. 2011). Hospitals generally do not provide SSC between the mother and newborn immediately after a Caesarean section. Implementing policies that promote mother/newborn contact will benefit the mother and newborn (Spear 2006). More staff may be

Key messages

- Skin-to-skin contact can be facilitated in the operating theatre during Caesarean surgery.
- Barriers to providing skin-to-skin contact in the operating theatre can be overcome.
- Skin-to-skin contact in the operating theatre has the potential to improve breastfeeding outcomes and maternal satisfaction.
- Skin-to-skin contact may reduce maternal pain, improve parent/newborn contact and communication, and keep the mother and newborn physiologically stable.
- Further research is needed to explore the provision of skin-to-skin contact in the operating theatre during Caesarean surgery, and the short- and long-term outcomes.

needed to facilitate SSC in the operating room and in recovery (Dabrowski 2007); however, one medical centre discovered that when they implemented immediate SSC, it reduced staff workload because of mothers having fewer breastfeeding challenges during their hospital stay (McKeever & Fleur 2012).

Potential risk of skin-to-skin care

Moore *et al*. (2012) state there are no known negative effects of SSC contact. Authors have presented cases where healthy term newborns have needed to be resuscitated because of apnoea and hypotonia while having SSC, and in some, very rare, circumstances, newborns have even died (Dageville *et al*. 2008; Nakamura & Sano 2008; Andres *et al*. 2011; Poets *et al*. 2011; Fleming 2012; Gnigler *et al*. 2013; Pejovic & Herlenius 2013). Andres *et al*. (2011) and Poets *et al*. (2011) estimated that in the first day of life, between 2.5 and 2.6 healthy term newborns out of 100 000 births have apparent life-threatening events, and between 1.1 and 1.7 newborns out of 100 000 births die because of these events. The majority of these incidents occur within 4 h after birth (Gnigler *et al*. 2013). Some of these events may have been caused by the obstruction of the newborns airway, associated with SSC and the newborn being in a prone position (Dageville *et al*. 2008; Andres *et al*. 2011; Gnigler *et al*. 2013; Pejovic & Herlenius 2013). Staff should ensure safe newborn positioning during SSC, for example, making sure the newborns nares are visible and monitor the baby frequently in the first few hours after birth (Nakamura & Sano 2008; Andres *et al*. 2011; Poets *et al*. 2011; Gnigler *et al*. 2013; Pejovic & Herlenius 2013). Authors also recommend that all mothers of newborns should be educated about the importance of letting staff know if there are any changes in their newborns (Poets *et al*. 2011; Gnigler *et al*. 2013; Pejovic & Herlenius 2013). Caution is also advised after a Caesarean section because of the newborns having a significant increased risk of lower Apgar scores, respiratory problems and hypoglycaemia soon after birth (Karlstrom *et al*. 2013). Despite this risk, SSC between mother and child after birth is highly recommended because of its many benefits (Dageville *et al*. 2008; Andres *et al*. 2011; Fleming 2012; Gnigler *et al*. 2013; Pejovic & Herlenius 2013). The aim of this review is to evaluate existing evidence on the facilitation of immediate or early (within 1 h) SSC following Caesarean section for healthy term newborns and identify facilitators, barriers and associated maternal and newborn outcomes.

Method

Search strategy

A detailed search was performed using the following databases: CINAHL (EBSCOhost), Health Collection (Informit, RMIT), PubMed (NCBI, US National Library of Medicine), Embase (Ovid, Wiley Online Library (John Wiley & Sons), Medline (OvidSP, Wolters Kluwer), Cochrane, Health Source, Scopus, Wiley, Health & Medical Complete (ProQuest) and Joanna Briggs Institute. The search terms in the title, abstract or keywords included skin-to-skin and birth, skin-to-skin and Caesarean/Cesarean, skin-to-skin and breastfeeding, kangaroo care and birth, kangaroo care and caesarean/cesarean, kangaroo care and breastfeeding, breastfeeding and caesarean/cesarean. To obtain more recent studies, included papers were published in the last decade (January 2003 and October 2013), published in English and peer reviewed. Opinion pieces, case studies, poster presentations and abstracts were excluded.

Selection process

During the first search, 6746 papers were identified (Fig. 1). After removing duplicates, 2106 papers remained. A further 1730 were removed after reading the titles and several abstracts because they were not relevant to the research topic (e.g. discussed cancer care, skin diseases), they were not available in English, only the abstracts were accessible, or they were not a research paper. The remaining 376 papers were specifically reviewed in relation to SSC. For the purpose of this literature review, immediate SSC was defined as SSC provided in the first few minutes after a Caesarean section and early SSC was defined as SSC provided within 1 h after a Caesarean section.

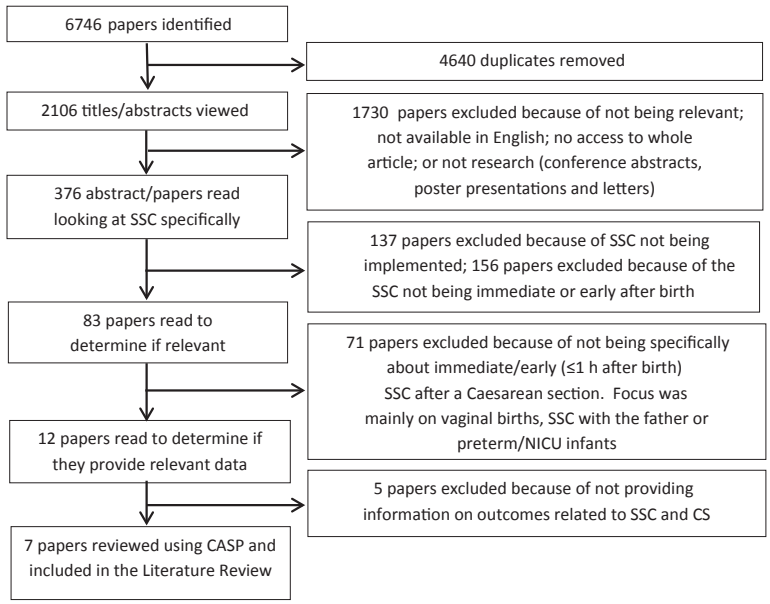

Fig. 1. Flow chart of search strategy.

The abstracts of the remaining papers were read, and several of these papers were read in full, to determine if SSC was implemented, and if it was immediate or early. There were 137 papers excluded as they did not discuss the implementation of SSC, and 156 papers were excluded because although SSC was implemented it was not immediate or early after birth. The remaining 83 papers were read in full to determine if they specifically discussed immediate or early SSC with the birth mother after a Caesarean section. The majority (71) were excluded because they discussed vaginal births only, SSC with the father only or SSC with preterm and NICU newborns. Of the 12 papers remaining, five papers were excluded because SSC was not implemented immediately or soon after Caesarean sections, or, even though they provided immediate SSC, they did report on findings specifically related to Caesarean section. Seven papers were found examining immediate or early SSC after a Caesarean section for term healthy newborns (Tables 2,3).

Quality assessment

Seven papers were critiqued using questions from two Critical Appraisal Skills Programme (CASP) tools focused on qualitative research (Critical Appraisal Skills Programme International Network 2013a) and randomised controlled trials (Critical Appraisal Skills Programme International Network 2013b). Each study was read multiple times, and was specifically analysed using the CASP questions (Tables 2,3). If the research article met the required criteria, a point is given. The qualitative research articles have the potential to reach 10 points because there are 10 qualitative research CASP score questions (Critical Appraisal Skills Programme International Network 2013a), while the randomised controlled trials have the potential to reach 11 points because there are 11 randomised controlled CASP questions (Critical Appraisal Skills Programme International Network 2013b). The CASP questions focus on finding out what the results of the research are, discovering if the results are valid and determining if the results are relevant to the broader community (Critical Appraisal Skills Programme International Network 2013a,b).

All of the papers, except Hung & Berg (2011), had high CASP scores (Tables 2,3). The research methods and designs were clear and appropriate, and the research was conducted ethically. Finigan & Davies (2004) and Crenshaw *et al*. (2012) achieved the highest possible CASP scores (Table 3). A couple of the CASP questions for randomised controlled trials

Table 2. Summary of quantitative papers included in the review

Reference location	Participants study design	Aim	Inclusion criteria	SSC data/outcomes	Other outcomes	Randomised controlled trial CASP score
Gouchon *et al.* (2010) Italy, Turin Pinerolo Hospital	$n = 34$ mother/newborn pairs after an ECS: • $n = 17$ SSC group • $n = 17$ control group (normal care – no SSC) Experimental, non-inferiority adaptive trial • Temperature and BF data recorded • IBAT	To assess the safety and compare mothers' and newborns' temperatures with or without SSC and the benefits of SSC on BF and satisfaction	Mother: ECS Local-regional anaesthesia, Primiparous or multiparous Newborn: Full term, Apgars at 1 and 5 min ≥ 7	Initiation in SSC group: Early initiation, within 1 h after birth if not contraindicated Duration in SSC group: 1 × newborn = nil SSC 4 × newborns ≤ 30 min 2 × newborns = 30–60 min 10 × newborns ≥ 120 min Mean: 82.9 min Interrupted: Not recorded	• SSC within 1 h after a ECS did not place the newborns at risk of hypothermia • SSC group attached to the breast average 21 min earlier than control group • BF at discharge ○ SSC: 9 exclusive, 3 predominant ○ Control: 9 exclusive, 2 predominant • BF at 3 months: ○ SSC: 8 exclusive, 3 predominant ○ Control: 5 exclusive, 3 predominant • SSC group were satisfied with their care • All the BF newborns sucked well at the first BF	Randomised controlled trial CASP score: 9/11 0 = lowest quality, 11 = highest quality
Nolan & Lawrence (2009) United States, Florida Hospital	$n = 50$ mother/newborn pairs after an ECS: • $n = 25$ NIMS group • $n = 25$ control group (brief or no physical contact) Randomised controlled trial implementing a NIMS protocol • Medical records reviewed • Survey • Newborn respiratory rate, temperature, and salivary cortisol measurements • Maternal pain scores	To pilot test a NIMS protocol which aimed to minimise maternal-newborn separation after a CS.	Mother: Repeat ECS, Regional anaesthesia, No signs of spontaneous labour, Multiparous Newborn: Singleton, Term, Live birth	Initiation in NIMS group: Early SSC. No actual time recorded – stated that the actual time to the first breastfeed was 40–60 min after birth. SSC was performed before this; however, only 21 out of the 25 babies breastfed. Duration in NIMS group: Mean duration 33 min Interrupted: Not interrupted	• There were no significant changes in maternal perception of their birth, pain scores and anxiety levels • Newborn temperature at 1 h were significantly higher in the NIMS group ($P < 0.05$) – no other results were significant • Newborn respiratory rates from birth to discharge from the PACU were significantly lower in the NIMS group ($P \leq 0.05$) – no other results were significant • Newborn salivary cortisol levels were higher in the NIMS group on admission to the PACU • Time to first BF: NIMS mean 50 min, control mean 112 min • BF initiation: NIMS 21/25 = 84%, control 15/25 = 60% • BF at discharge (of those who initiated): NIMS 19/21 = 90%, control 13/15 = 87% • BF rates at 4 weeks after discharge (of those who initiated): NIMS 16/21 = 76%, control 8/15 = 53%	Randomised controlled trial CASP score: 8/11 0 = lowest quality, 11 = highest quality

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Table 2. Continued

Reference location	Participants study design	Aim	Inclusion criteria	SSC data/outcomes	Randomised controlled trial	Randomised controlled trial CASP score
Velandia *et al.* (2010) Sweden, Stockholm Hospital	*n* = 37 parent/newborn pairs after a planned CS: • *n* = 17 SSC with their mother (15 men control) • *n* = 20 SSC with their father (20 women control) Part of a larger randomised controlled trial • Audio/video recorded	To explore and compare parent/newborn vocalisation when the newborn is placed SSC after a planned CS	Mothers: Planned CS, Willing to provide SSC, Healthy, Uncomplicated pregnancy, Primiparous Fathers: Willing to provide SSC Newborns: Term Healthy Apgar ≥ 7 at 1 min	Initiation: Mothers: Immediate SSC Fathers: Immediate SSC Duration: Mothers: 30 min Fathers: • 5 min with mother • Then 25 min with the father Interrupted: Mothers: Not interrupted Fathers: Interrupted	Newborn solicitation increased over time ($P = 0.32$). Significant differences: • The parent that had SSC vocalised more that if they did not have SSC. • Newborns cried less and relaxed earlier if they had SSC with their father • Newborns 'whined' less if they had SSC with their mother	Randomised controlled trail CASP score: 9/11 0 = lowest quality, 11 = highest quality
Velandia *et al.* (2010) Sweden, Stockholm Hospital	*n* = 37 parent/newborn pairs after a planned CS: • *n* = 17 SSC with their mother (15 men control) • *n* = 20 SSC with their father (20 women control) Part of a larger randomised controlled trial • Audio/video recorded	To investigate differences of breast-seeking and crying behaviour between male and female newborns in SSC contact with their mother or father after a CS.	Mothers: Planned CS, Willing to provide SSC, Healthy, Uncomplicated pregnancy, Primiparous Fathers: Willing to provide SSC Newborns: Term Healthy Apgar ≥ 7 at 1 min	Initiation: Mothers: Immediate SSC Fathers: Immediate SSC Duration: Mothers: 30 min Fathers: • 5 min with mother • Then 25 min with the father Interrupted: Mothers: Not interrupted Fathers: Interrupted	Significant differences: • Females started rooting and showing breast massage movements earlier than males • Newborns started to BF earlier if they had continual SSC with the mothers • Females cried more than males in SSC with either parent • Mothers used more touching behaviour towards their newborn compared with fathers and touched females less than males • Fathers directed less speech towards females compared with males.	Randomised controlled trail CASP score: 9/11 0 = lowest quality, 11 = highest quality

BF, breastfeed/breastfed; CASP, Critical Appraisal Skills Programme; CS, Caesarean section; ECS, elective Caesarean section; IBAT, Infant Breastfeeding Assessment Tool; LATCH scores, Latch, Audible swallowing, Type of nipple, Comfort, Hold (positioning); NIMS, obstetric nursing intervention protocol aimed to minimise maternal-infant separation); OT, operating theatre; PACU, post-anaesthesia care unit; PRECESS Method, Practice, Reflection, Education and training, Combined with Ethnography for Sustainable Success; SSC, skin-to-skin care; VB, vaginal birth; 0/0, number of participants involved/total number of participants (e.g. 5/6 BF = five participants BF/out of six total participants).

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Table 3. Summary of qualitative papers included in the review

Reference location	Participants study design	Aim	Inclusion criteria	SSC data/outcomes	Other outcomes	Qualitative CASP score
Crenshaw *et al*. (2012) United States, Southwest Medical Centre	Stage 1 Staff (no numbers) $n = 11$ mother/newborn pairs: • $n = 5$ ESC • $n = 6$ VB PRECESS method – descriptive observational • Analysis of SSC rates – review of hospital records Stage 2 SSC: $n = 360$ mother/newborn pairs: • $n = 180$ CS • $n = 180$ VB BF: $n = 2301$ mother/newborn pairs Comparison: Monthly SSC and exclusive BF (6 months) – review of hospital records	To use a programme to improve SS rate and describe the rate of SSC and exclusive BF at hospital discharge	Stage 1 Staff: Working in the medical centre Mothers: English speaking, > 18 years old, Agreed to have and able to provide SSC immediately after birth (≤ 2 min), Primiparous or multiparous CS: Elective Newborns: Healthy Stage 2: Mothers: Excluded if indicated they did not want to BF	Stage 1 Initiation: VB: 6/6 = 100% immediate SSC ECS: 4/5 = 80% immediate SSC 1/5 = 20% early SSC Duration in CS group: Mean 82 min Interrupted: 3/11 = 27% interrupted Stage 2: Initiation pre/post programme: All participants: Pre: 35/60 = 58% Post: 250/300 = 83% $P < 0.000$ VB: Pre: 28/30 = 93% Post: 139/150 = 93% no difference CS: Pre: 7/30 = 23% Post: 116/150 = 77% $P < 0.000$ Time initiated not recorded Duration: not recorded Interrupted: not recorded	Stage 1 VB participants: • 4/6 planned to BF • 3/4 = 75% of those who planned to BF exclusively BF at discharge ECS participants: • All planned to BF • 3/5 = 60% exclusively BF at discharge Stage 2 Exclusively breast milk fed pre/post programme: All participants: Pre: 194/373 = 52% Post: 988/1928 = 51% no difference Barriers to SSC: Lack of staff	Observational method CASP score: 10/10 0 = lowest quality 10 = highest quality
Finigan & Davies (2004) UK, England	$n = 6$ mother/newborn pairs: • $n = 1$ CS • $n = 5$ VB van Manen's interpretive phenomenonology • Audio-taped diaries • Interviews	To explore six women's lived experiences of SSC shortly after birth	Had to have SSC within 30 min of birth, SSC lasting ≥ 1 h Mothers: Primiparous or multiparous 21–36 years old	Initiation: CS: Immediate initiation in the operating theatre VB: Immediate to early SSC , initiated SSC within 30 min of birth Duration: ≥ 1 h Interrupted: Not interrupted	Five themes: • Immediate feelings of bonding • Touching and stroking the baby • Eye-to-eye contact and getting to know the newborn • Natural, instinctive behaviour • Not wanting to let go	Phenomenology CASP score: 10/10 0 = lowest quality 10 = highest quality
Hung & Berg (2011) United States, California Hospital	Staff (no numbers) $n = 32$ mother/newborn pairs after a CS: • $n = 10$ Pre-project • $n = 22$ Post-project Implementation of a quality improvement project to minimise maternal-newborn separation – Plan, Do, Study, Act Model for Improvement • Hospital compilation of data recorded pre and post-implementation of the project	To describe a quality improvement project that promotes early SSC contact in the operating theatre, with the aim to increase success of BF initiation after a CS	Staff: Working in the Hospital Mothers: Those who had a CS Newborns: Good respiratory effort at birth, HR > 100 beats per minute, pink lips and trunk, good muscle tone	Initiation: Pre-project: Early SSC • 0–30 min: Nil • 30–90 min: 20% • 90–360 min: 40% Post-project: Immediate or early SSC • First 3 months after project ○ SSC 0–30 min: 45% ○ SSC 30–90 min: 23% ○ SSC 90–360 min: 23% • First 9 months after project ○ SSC in the OT 60% ○ SSC <90 min 70% Duration: Not recorded Interrupted: Not recorded	First 9 months Post Project: • LATCH scores (range 0–10, low-high) ○ SSC in OT – Score: 8.0 ○ SSC > 90 min – Score: 7.7 ○ SSC > 4 h or non – Score: 7.6 • Formula supplementation ○ SSC in OT – 33% supplemented ○ SSC <90 min, not in OT – 42% supplemented ○ SSC > 90 min or no SSC – 74% supplemented • Maternal positive feedback • Challenges: ○ Staff Initially reluctant/fearful ○ Staff assignment	Qualitative improvement project CASP score: 9/10 0 = lowest quality 10 = highest quality

BF, breastfeed/breastfed; CASP, Critical Appraisal Skills Programme; CS, Caesarean section; ECS, elective Caesarean Section; IBAT, Infant Breastfeeding Assessment Tool; LATCH scores, Latch, Audible swallowing, Type of nipple, Comfort, Hold (positioning); NIMS, Obstetric nursing intervention protocol aimed to minimise maternal-infant separation; OT, operating theatre; PACU, post-anaesthesia care unit; PRECESS Method, Practice, Reflection, Education and training, Combined with Ethnography for Sustainable Success; SSC, skin-to-skin care; VB, vaginal birth; 0/0, number of participants involved/total number of participants (e.g. 5/6 BF = five participants BF/out of six total participants).

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are 'Were the patients, health workers and study personnel "blind" to treatment?' and 'Can the results be applied to the local population?' (Critical Appraisal Skills Programme International Network 2013b). The randomised controlled trials in this review did not score a point for either of these questions because the participants and some researchers were not blind to the treatment (SSC), and the results cannot reliably be applied to other populations, because of the small sample sizes (Nolan & Lawrence 2009; Gouchon *et al*. 2010; Velandia *et al*. 2010, 2012; Table 2). Nolan & Lawrence (2009) also received a lower score because the groups that were studied were not similar – the newborns in the intervention group had a significantly higher birthweight than the control group (Table 2). The lowest CASP score was given to Hung & Berg (2011) because there was insufficient information on the quality improvement programme to conduct a full CASP analysis; however, the method and design were clear and appropriate, and there was a clear statement of findings (Table 3).

Limitations of the papers reviewed

The limitations of the included papers are the small sample sizes and missing data in the quantitative studies. There was a lack of consistency across the papers. It is also important to note that Hung & Berg (2011) stated that their aim was to demonstrate the progress of the implemented programme, not show an association between immediate or early SSC and breastfeeding. Nolan & Lawrence (2009) stated that their research was significantly underpowered because of the numbers of participants. Furthermore, SSC was not always provided as recommended by the WHO and UNICEF, and there were differences in time to initiation and length of SSC in the analysed papers.

Findings

The included papers focused on programmes that implemented SSC immediately or soon after a Caesarean section, and reported on either the experience of immediate or early SSC, parent/newborn interaction or newborn outcomes following Caesarean sections. Out of the seven papers, four papers discussed the provision of immediate SSC in the operating theatre (Finigan & Davies 2004; Velandia *et al*. 2010, 2012; Crenshaw *et al*. 2012). Hung & Berg (2011) indicated that 9 months after the implementation of their project, the majority of mothers and newborns had immediate or early SSC within 30 min in the operating theatre. Gouchon *et al*. (2010) reported that newborns in the intervention group had brief contact with their mother at birth, then were taken away for routine care; however, they were reunited with the mother in recovery within 1 h from birth for early SSC. Nolan & Lawrence (2009) stated that they only provided cheek-to-cheek contact for a short period of time in the operating theatre; however, they did encourage early SSC within the first hour after birth in the post-anaesthetic care unit (PACU). Three studies focused on the implementation and/or outcomes of programmes that promoted immediate or early SSC after a Caesarean section (Nolan & Lawrence 2009; Hung & Berg 2011; Crenshaw *et al*. 2012). Finigan & Davies (2004) study focused on mother's lived experiences of immediate or early SSC. Gouchon *et al*. (2010) compared mothers and newborns' temperatures with or without early SSC after a Caesarean section. The other two research papers, by the same authors, specifically explored parent/newborn vocalisation during immediate SSC after a Caesarean section (Velandia *et al*. 2010) and the differences between male and female newborns with breast-seeking behaviour and crying (Velandia *et al*. 2012).

The seven papers included in this review used varying methods and designs. The four papers that reported on randomised controlled trials included a pilot study by Nolan & Lawrence (2009), two Velandia *et al*. (2010, 2012) papers, which reported on data from the same randomised controlled trial, and an experimental non-inferiority trial by Gouchon *et al*. (2010), which was used to help establish if a new treatment is similar to or no worse than a current treatment (Scott 2009). Crenshaw *et al*. (2012) utilised a qualitative descriptive observational method using video-ethnography and interaction analysis. Finigan & Davies (2004) used a qualitative approach informed by van Manen's Interpretive Phenomenol-

ogy. Lastly, Hung & Berg (2011) used a quality activity approach using Plan Do Study and Act (PDSA) Model for Improvement.

In some cases, only the appropriate sections of individual papers were included in the review. For example: of the six participants in the Finigan & Davies (2004) study, there was only one that had a Caesarean section; therefore, only quotes from that participant were included.

Description of SSC in the included papers

SSC was described in all the papers in this review (except the Nolan & Lawrence 2009 study) as: the placement of a newborn in a chest-to-chest, SSC position with the mother. Nolan & Lawrence (2009) defined SSC in a chest-to-chest position, in the underarm position or in the cradle position. Velandia *et al*. (2010, 2012) included SSC with the father. All of the papers stated that either blankets or towels, which were sometimes warmed, covered the exposed side/back of the newborn. Some studies mentioned there was the option to put on a nappy (Nolan & Lawrence 2009; Gouchon *et al*. 2010), or a cap, on the newborns' head (Nolan & Lawrence 2009; Gouchon *et al*. 2010; Hung & Berg 2011; Crenshaw *et al*. 2012). The papers had varying time to initiation and duration of SSC (Tables 2,3).

The implementation of immediate or early SSC in the operating theatre

Two studies evaluated programmes to help implement immediate or early SSC in the operating theatre. Hung & Berg (2011) evaluated a Plan, Do, Study, Act (PDSA) Model and Crenshaw *et al*. (2012) evaluated Practice Reflection, Education and training, Combined with Ethnography for Sustainable Success (PRECESS) Immersion Method. Nolan & Lawrence (2009) evaluated a nursing intervention protocol designed to minimise maternal-infant separation (NIMS), which implemented early SSC in PACU, not the operating theatre; however, it encouraged staff to keep the newborn in contact with the mother or within sight of the mother intra-operatively and post-operatively. The PDSA model involved consulting staff about barriers and solutions to providing early SSC, observing SSC in the operating theatre in another hospital, developing a flow chart, piloting SSC in the operating theatre, making relevant adjustments to the flow chart where needed, educating and encouraging staff in providing SSC and collecting data to monitor improvements (Hung & Berg 2011). Crenshaw *et al*.'s (2012) PRECESS method involved educating staff about the nine instinctive stages during immediate SSC, staff mentoring, sharing video recordings of mothers and newborns when having SSC, reflection on and analysis of these recordings and reviewing medical records to see if there were any changes in immediate SSC rates.

Hung & Berg (2011) and Crenshaw *et al*. (2012) compared SSC data pre and post the implementation of their programmes. Hung & Berg (2011) reported that SSC rates in the operating theatre, within 30 min of the Caesarean section, increased from zero per month to 45% at 3 months and 60% at 9 months after the implementation of the PDSA model; however, these statistics were collected from a small sample size – there was only an average of 22 Caesarean births per month where the programme was implemented. Crenshaw *et al*. (2012) reported that after the implementation of their programme, 80% of women had immediate SSC in the operating theatre in stage 1 of their research; however, they did not report on SSC initiation time in stage 2 of their research. Nevertheless, they did confirm a significant increase in SSC initiation, from 23% to 77%, for those who had a Caesarean section.

Four studies reported on the challenges of providing immediate or early SSC in the operating theatre (Nolan & Lawrence 2009; Gouchon *et al*. 2010; Hung & Berg 2011; Crenshaw *et al*. 2012). The main challenge focused around staff such as fear of change and a lack of sufficient staff. Hung & Berg (2011) noted that the staff were initially reluctant, and resistant to change, however, became more positive after education. They stated that educating all staff was a challenge (Hung & Berg 2011). Two studies noted that it was hard to implement immediate or early SSC in the operating theatre because of a shortage of staff (Nolan & Lawrence 2009; Crenshaw *et al*. 2012). Gouchon *et al*. (2010) stated that they did not need any extra

Table 4. Recommendations for implementation of immediate skin-to skin contact in the operating theatre

Pre-implementation:
• Write a protocol with the collaborative effort of staff, including midwives, managers, doctors, anaesthetists, paediatricians and other operating theatre/recovery staff
• Education of staff
Antenatal period:
• Education for mothers and their support people
Prior to commencement of the Caesarean section:
• Discuss with operating theatre staff and the mother the potential of having SSC
• Confirm with the mother whether she wants SSC and where (in the operating theatre, in recovery, on the ward)
• Have one nurse/midwife for the mother, and one midwife/nurse for the newborn
• Assess the operating theatre and determine if equipment needs to be moved to provide room for SSC
• Has the mother's gown been undone, arms removed from the sleeves?
• Be aware of the placement of equipment: IV lines, oxygen saturation probe
After the newborn is delivered:
• Does the newborn appear to be responding appropriately? If so, commence SSC
• The newborn is placed in a transverse position on the mothers bare chest
• The newborn is dried
• Warm blankets cover the newborn
• Apgar observations made
• Teach the father how to help support the newborn
• Continually observe the newborn to determine if the newborns airway is patent – Are the newborns nares visible? Is the newborn centrally pink? Is the newborns respiratory rate stable?
In recovery:
• Remember if injections are to be given to the newborn, ensure these are given while having SSC

Adapted from Hung & Berg (2011) and Crenshaw *et al.* (2012).

staff to implement early SSC after a Caesarean section, and there was no need for extra resources. However, SSC in the operating theatre was not always possible in this study because of the distance of the operating theatre from the obstetrics department. Crenshaw *et al*. (2012) further stated that it is important to address safety concerns before implementing immediate SSC in the operating theatre.

The safe implementation of immediate or early SSC in the operating theatre was described in two of the seven papers (Hung & Berg 2011; Crenshaw *et al*. 2012; Table 4).

Immediate or early SSC and mother/newborn emotional well-being

The emotional well-being of mothers and their newborns was discussed in all of the reviewed papers. There was a focus on bonding, the newborn's relaxed state and stress levels, and maternal satisfaction with care.

Following Caesarean sections, mothers perceived that immediate or early SSC helped them bond with their babies. Finigan & Davies (2004) revealed that immediate or early SSC helped mothers feel an immediate bond with their newborn. One mother described believing that immediate SSC after her Caesarean section: 'created a special bond between us' (Finigan & Davies 2004). In other studies, women's comments revealed that immediate or early SSC after a Caesarean section helped them feel close to their newborn (Nolan & Lawrence 2009; Gouchon *et al*. 2010; Hung & Berg 2011).

Women's perceptions of having immediate or early SSC was documented in four studies (Finigan & Davies 2004; Nolan & Lawrence 2009; Hung & Berg 2011; Crenshaw *et al*. 2012). Nolan & Lawrence (2009) stated that there was no significant difference in maternal perception of birth or anxiety levels on admission and discharge from the PACU between those who had early SSC or not. Quotes revealed that immediate or early SSC can make a Caesarean birth special, and the majority spoke positively of their experience of having SSC in the operating theatre (Nolan & Lawrence 2009; Hung & Berg 2011; Crenshaw *et al*. 2012). One mother stated:

I didn't know that I was going to lift my baby out of my abdomen, but just putting my arms underneath him and lifting up and placing on my chest, I'll never forget, it was so natural. All I wanted to do was pick him up, nurture him straight away and put him to my breast (Finigan & Davies 2004).

Four papers discussed the relaxed state of the newborn with immediate or early SSC. 'My baby calms down right away when I put him to my chest. I don't know if it's related to holding him skin-to-skin during the cesarean – but I think it is' (Crenshaw *et al*. 2012). Newborns were found to relax quicker and cried less when they had immediate SSC with their father after an initial 5 min with their mother compared with having immediate and continuous SSC with the mother; however, there were no significant differences in the time these newborns slept immediately after birth (Velandia *et al*. 2010). Female newborns were found to have cried more than male newborns (Velandia *et al*. 2012). Both of these Velandia (Velandia *et al*. 2010, 2012) papers mention that their results are not conclusive because of their small sample sizes. Nolan & Lawrence (2009) also collected newborn salivary cortisol samples at birth, on admission to the PACU and discharge from the PACU. A study by Gitau *et al*. (2001) confirmed that that when compared with newborns born by a normal vaginal birth, newborns born by an planned Caesarean section had lower levels of cortisol at birth, and were therefore more susceptible to respiratory distress and transient tachypnoea because the surge of stress hormones at birth helps mediate the clearing of newborns lungs. The newborns that had early SSC in the Nolan & Lawrence (2009) study only had higher cortisol levels on admission to the PACU, but not on discharge. These results need to be viewed with caution because of the small sample size and because of the lack of samples that could be analysed.

Immediate SSC and parent/newborn communication

Velandia *et al*. (2010, 2012) reported on video recordings and analysis of 37 parent/newborn interactions immediately after a Caesarean section. Mothers and fathers talked significantly more to their newborn during immediate SSC if they were the one providing it, and only after the parent communicated with the newborn did the newborn begin communicating also (Velandia *et al*. 2010). The newborns communicated, using soliciting calls (short, contact-seeking, ringing sounds p.194), on average 2 min earlier with the father compared with the mother (Velandia *et al*. 2010). There was no difference between length of communication towards the newborn if they were male or female with SSC mothers; however, SSC fathers talked significantly more to male newborns (Velandia *et al*. 2012). The authors stated that the results may have been influenced by disturbance of the parent–newborn interaction because of the activities in the operating theatre, and the observer was not blinded to the SSC (Velandia *et al*. 2010, 2012). No other studies were found that discussed parent and newborn communication during or following immediate or early SSC.

Immediate or early SSC and maternal pain

Three studies in the review addressed the issue of maternal pain (Nolan & Lawrence 2009; Hung & Berg 2011; Crenshaw *et al*. 2012). Nolan & Lawrence (2009) recorded women's pain scores using a 0–10 numeric pain rating scale and compared the early SSC group with the non-SSC group at 1, 2 and 4 h after birth. The women in the early SSC group reported lower pain scores at all points in time after birth; however, overall difference between the groups was not significant ($P = 0.493$). The authors stated that this may be due to data missing and the small sample size of the study (Nolan & Lawrence 2009). Hung & Berg (2011) quoted a mother who described her experience, after the anaesthesia started wearing off, of forgetting about the pain of the Caesarean section because she was so happy having SSC with her newborn. Crenshaw *et al*. (2012) quoted a nurse anaesthetist: 'This mother focused on her baby instead of on surgery. Maybe mothers need fewer medications during the repair when they hold their baby skin-to-skin'. Further research is needed to determine if immediate or early SSC has an impact on the level of pain experienced by women.

Early SSC and maternal/newborn physiological stability

Two studies analysed maternal and newborn physiological stability after a Caesarean section (Nolan & Lawrence 2009; Gouchon *et al*. 2010). One study reported that there were no significant differences between the early SSC and control groups in maternal temperature while holding the newborn for 2 h (Gouchon *et al*. 2010). Two studies reported newborn physiological stability, including thermoregulation and respiratory rates (Nolan & Lawrence 2009; Gouchon *et al*. 2010). The differences in newborn temperatures within the first 2–3 h between the early SSC groups and the non-SSC groups were not significant in either study (Nolan & Lawrence 2009; Gouchon *et al*. 2010). However, Nolan & Lawrence (2009) found the newborns that had early SSC had significantly lower respiratory rates compared with the control group when the data was combined from birth to the PACU ward discharge. The early SSC newborns also had significantly higher temperatures a 1 h when compared with the control group (Nolan & Lawrence 2009). There were limitations in both of these studies that may have affected the results. Nolan & Lawrence (2009) reported missing data for both of the newborn measures and there was a significant difference in birthweight between the SSC and control groups. The earliest initiation of SSC in the Gouchon *et al*. (2010) paper was 41 min after the Caesarean.

Immediate or early SSC and newborn feeding outcomes

The majority of the papers provided data on breastfeeding outcomes or formula supplementation (Nolan & Lawrence 2009; Gouchon *et al*. 2010; Velandia *et al*. 2010, 2012; Hung & Berg 2011; Crenshaw *et al*. 2012). Nolan & Lawrence (2009) stated that when compared with the non-SSC group, the immediate or early SSC group had 24% more mothers initiate breastfeeding and they breastfed an hour earlier on average. Gouchon *et al*. (2010), similarly, found that after the initial separation for a mean of 51 min, babies who had early SSC attached to the breast an average of 21 min earlier. Velandia *et al*. (2012) found that there were no significant differences between the sex of the newborn with initiation time of breastfeeding; however, female newborns that had immediate SSC with the mother breastfed significantly earlier. According to a LATCH (Latch, Audible Swallowing, Type of Nipple, Comfort and Hold) breastfeeding score in Gouchon *et al*. (2010), where there were 34 participants, both the early SSC and non-SSC group sucked well at the first breastfeed.

Hung & Berg (2011) found that artificial formula supplementation in the hospital was decreased by 41% when immediate or early SSC was implemented in the operating theatre compared with mother–newborn pairs who did not have SSC by 90 min. However, this study was reporting on the implementation of a programme promoting immediate or early SSC and was not claiming to show an association between SSC and outcomes. (Hung & Berg 2011).

At discharge, Gouchon *et al*. (2010) found that there were a similar number of participants exclusively and predominantly breastfeeding. Nolan & Lawrence (2009) found that, of those who initiated breastfeeding, 90% in the early SSC group were breastfeeding at discharge compared with 87% of those who did not have SSC. In stage 2 of the Crenshaw *et al*. (2012) study, where initiation time was not recorded, there was no significant changes in exclusive breastfeeding rates. In stage 1 of the same study, it was found that if the newborn went through all the nine stages of SSC, there was an improvement in exclusive breastfeeding rates at discharge (Crenshaw *et al*. 2012).

Nolan & Lawrence (2009) found that there was no significant differences in rates between the early SSC and non-SSC groups at 4 weeks after discharge. There was a marginal improvement in longer term breastfeeding rates in Gouchon *et al*. (2010); however, this was not significant. Despite this, the majority of women in the Gouchon *et al*. (2010) study indicated that they were convinced that early SSC improved their breastfeeding, and would recommend it to others.

When comparing immediate SSC between the mother and the father after a Caesarean section, Velandia *et al*. (2010) found that babies reached the father's breast/nipple in a shorter time frame than

those with their mother. They stated that this may be due to the chlorhexidine that was applied to the mother's chest before surgery, which confuses the newborn. There were no differences in breast massaging movements if immediate SSC was provided by the mother or father; however, female newborns made massaging movements and rooted significantly earlier than male newborns (Velandia *et al*. 2012).

Discussion

There is evidence that SSC after a normal birth has a positive impact on the mother and her newborn (Ferber & Makhoul 2004; Hewitt *et al*. 2005; Overfield *et al*. 2005; Mercer *et al*. 2007; Walters *et al*. 2007; Gabriel *et al*. 2010; Moore *et al*. 2012), and that it can improve breastfeeding outcomes (Moore *et al*. 2012). The seven papers in this review highlight some of the benefits of providing SSC immediately, or soon after a Caesarean section, including physiological stability and emotional well-being of mothers and their newborns, potential reduction in maternal pain, increase in parent and newborn communication, and an improvement in breastfeeding outcomes (Finigan & Davies 2004; Nolan & Lawrence 2009; Gouchon *et al*. 2010; Velandia *et al*. 2010, 2012; Hung & Berg 2011; Crenshaw *et al*. 2012). Hung & Berg (2011) and Crenshaw *et al*. (2012) also provided detailed information on how to facilitate immediate or early SSC in the operating theatre. There were no disadvantages of immediate or early SSC after a Caesarean section observed in the review papers, other than the need for more staff to implement it, and the fear of implementing it if no education is given.

An opinion piece by Phillips (2013) supports the finding that immediate SSC following a Caesarean section potentially reduces the mothers perception of pain. This has also been observed after vaginal birth in a study by Walters *et al*. (2007), who stated that mothers were distracted from the pain with perineal repair when they had SSC, while the results of another study stated that there was no reduction in suturing pain when the mothers had SSC (Gabriel *et al*. 2010).

This review indicates that early SSC keeps newborns and mothers physiologically stable (Nolan & Lawrence 2009; Gouchon *et al*. 2010). A recent Cochrane review stated that newborn respiratory rates are more stable when SSC is facilitated after a vaginal birth (Moore *et al*. 2012). There are many other studies that confirm the finding that SSC keeps newborns warmer, albeit after a vaginal birth in these instances (Bystrova *et al*. 2007; Mercer *et al*. 2007; Walters *et al*. 2007; McCall *et al*. 2010). Bystrova *et al*. (2007) examined SSC following vaginal birth, and demonstrated that early SSC can help maintain the mother's temperature.

A Cochrane review found that SS is likely to improve breastfeeding outcomes after a vaginal birth (Moore *et al*. 2012). It is important to find ways to improve breastfeeding rates after a Caesarean section because surgical birth is known to reduce initiation of breastfeeding (Dashti *et al*. 2010; Zanardo *et al*. 2010; Hauck *et al*. 2011; Thu *et al*. 2012), increase the length of time before the first breastfeed (Örün *et al*. 2010; Pandey *et al*. 2010; Patel *et al*. 2010; Senarath *et al*. 2010; Prior *et al*. 2012; Zanardo *et al*. 2012; Hazir *et al*. 2013), reduce the incidence of exclusive breastfeeding (Dashti *et al*. 2010; Thu *et al*. 2012; Zanardo *et al*. 2012), significantly delay the onset of lactation (Scott *et al*. 2007) and increase the likelihood of supplementation (Parry *et al*. 2013). This review provided some evidence about the benefits of immediate or early SS after a Caesarean section including an increase in initiation, a decreased time to initiation and a reduction of formula supplementation in hospital (Nolan & Lawrence 2009; Gouchon *et al*. 2010).

The papers in this review revealed that women viewed their immediate or early SSC experience as positive (Finigan & Davies 2004; Nolan & Lawrence 2009; Gouchon *et al*. 2010; Velandia *et al*. 2010, 2012; Hung & Berg 2011; Crenshaw *et al*. 2012). Failure to consider the emotional well-being of mothers and newborns, and provide ways to help promote emotional well-being, leads to poorer health outcomes (Brown & Lumley 2000). Women who have had a Caesarean section are significantly less likely to rate their birth as positive, compared with those who have had a vaginal birth (Chalmers *et al*. 2010), and are more likely to have significantly higher anxiety levels (Paul *et al*. 2013). There is some evidence that there is a relationship between having a Caesarean section

and depressive symptomatology (Xie *et al*. 2011; Zainal *et al*. 2012); however, Sword *et al*. (2011) provides conflicting evidence. Some research has demonstrated that SSC may reduce depressive feelings in the first few weeks after a vaginal birth (Bigelow *et al*. 2012), yet Gabriel *et al*. (2010) does not support this finding. Despite this, it is important to facilitate SSC after any type of birth because mothers enjoy it. In qualitative studies, mothers state that they feel closer to their newborn when they have SSC and that they enjoy having SSC (Finigan & Davies 2004; Byaruhanga *et al*. 2008; Finigan 2010; Blomqvist & Nyqvist 2011; Thukral *et al*. 2012).

This review provides evidence that immediate SSC is feasible in the operating theatre. This is supported by other authors who state that with pre-planning, SSC can be successfully provided in the operating theatre (Spear 2006; Senarath *et al*. 2007; Smith *et al*. 2008; Spradlin 2009; Elliott-Carter & Harper 2012; Mangan & Mosher 2012; Duffy & Conrad 2013; Phillips 2013). Many authors state that collaboration between all health professionals is required in order to address any issues before implementation of SSC in operating theatre, including the need for extra staff (Spear 2006; Hung & Berg 2011; Elliott-Carter & Harper 2012; Mangan & Mosher 2012). The staff need to be educated and trained on how to implement SSC in the operating theatre (Senarath *et al*. 2007; Spradlin 2009; Hung & Berg 2011; Crenshaw *et al*. 2012; Elliott-Carter & Harper 2012; Phillips 2013) and parents need to be educated about SSC so that they can make an informed choice about their care (Smith *et al*. 2008; Duffy & Conrad 2013). As highlighted by Hung & Berg (2011), newborn safety is important; therefore, newborns need to be observed by parents and staff while having SSC in the first few hours after birth because of the small risk of apnoea when in the prone position during SSC (Poets *et al*. 2011).

The WHO states that the BFHI should be implemented in all hospitals (World Health Organization 2007). Immediate SSC after a normal birth has been shown to be beneficial for both the mother and the newborn. Considering that women who have a Caesarean section have less circulating oxytocin (Nissen *et al*. 1996), which aids in the bonding process (Feldman *et al*. 2007) and are less likely to initiate breastfeeding (Prior *et al*. 2012), the facilitation of immediate SSC is even more important for this cohort of women (Nissen *et al*. 1996; Elliott-Carter & Harper 2012; Prior *et al*. 2012). If maternity services are not able to provide immediate or early SSC following a Caesarean section, more than 30% of women and their newborns from Brazil, the United States, Mexico, Iran, Argentina, Italy, Korea, the Dominican Republic, Australia, Chile, Paraguay, Cuba, Portugal, Uruguay and Malta, may miss out on the potential benefits conferred by SSC because in these countries, Caesarean section rates are greater than 30% (World Health Organization 2010). It is important that hospitals facilitate this option for all women following birth regardless of the mode of birth.

Conclusion

It appears that SSC can be provided safely and immediately in the operating theatre with the collaboration and education of staff, mothers and partners. There is some evidence, albeit minimal, demonstrating an increase in maternal and newborn emotional well-being, increase in parent/newborn communication, reduction in maternal pain/anxiety, stabilised physiological stability for the mother and newborn and improved breastfeeding outcomes with immediate or early SSC following a Caesarean section. This review highlights the urgent need for further research on facilitators, barriers, outcomes and experiences of immediate SSC during a Caesarean section, so that more evidence can be gathered on how to effectively and safely provide SSC in the operating theatre and to discover the short-term and long-term outcomes of providing it. If maternity services are not able to provide immediate SSC following a Caesarean section, many women and their newborns may miss out on the potential benefits conferred by SSC. To help fill the gap shown in the above literature review, further research regarding immediate SSC is planned.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

JS, guided by HD, VS and EB, performed the literature search, determined which papers fit the criteria, and compiled the data. All the authors collaborated in writing and critically reviewing the paper.

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