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REVIEW ARTICLE

Obstetrics

Impact of the WHO safe childbirth checklist on birth attendant behavior and maternal-newborn outcomes: A systematic review and meta-analysis

María Fernández-Elorriaga[1,2] | Jocelyn Fifield[1] | Katherine E. A. Semrau[1] | Stuart Lipsitz[1] | Danielle E. Tuller[1] | Carol Mita[3] | Chelsea Cho[1] | Heather Scott[4] | Ayda Taha[5] | Neelam Dhingra-Kumar[5] | Allisyn Moran[4] | Rose L. Molina[1,6]

[1]Ariadne Labs at Brigham and Women's Hospital and the Harvard T H Chan School of Public Health, Boston, Massachusetts, USA

[2]Nursing Department, Medical School at Autonomous University of Madrid, Madrid, Spain

[3]Countway Library, Harvard Medical School, Boston, Massachusetts, USA

[4]Maternal, Newborn, Child and Adolescent Health and Ageing Department, World Health Organization, Geneva, Switzerland

[5]WHO Patient Safety Flagship World Health Organization, Geneva, Switzerland

[6]Department of Obstetrics and Gynecology, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Correspondence
Rose L. Molina, 330 Brookline Avenue, Kirstein 3, Boston, MA 02215, USA.
Email: rmolina@bidmc.harvard.edu

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Abstract

Background: The intrapartum period is critical for reducing maternal and perinatal morbidity and mortality. The WHO's Safe Childbirth Checklist (SCC) was designed as a reminder of the most critical, evidence-based practices (EBPs) to improve quality care and reduce preventable complications and deaths.

Objective: To assess the impact of SCC on birth attendant behavior and maternal and newborn health outcomes.

Search Strategy: A systematic review and meta-analysis was performed searching across five databases from 2009 to 2023.

Selection Criteria: We included randomized controlled trials, quasi-experimental studies, and pre/post studies.

Data Analysis: A meta-analysis yielded a pooled estimate of relative risk (RR) for adherence to and effectiveness of the SCC.

Main Results: Of 1070 articles identified, 16 were included. Use of the SCC increased adherence to EBPs by 65% (RR 1.65; 95% confidence interval [CI] 1.34–2.02). The behaviors that improved the most were danger sign counseling (RR 12.37; 95% CI 1.95–78.52; $P=0.008$) and pre-eclampsia management (RR 3.43; 95% CI 1.33–8.88; $P=0.011$). There was moderate evidence for stillbirth reduction (RR 0.89; 95% CI 0.80–0.99; $P=0.034$).

Conclusion: There is moderate evidence demonstrating the effectiveness of the SCC in reducing stillbirths and improving adherence to EBPs.

KEYWORDS
childbirth, evidence-based practices, maternal and newborn care, maternal and newborn safety, maternal health, quality of care, safe childbirth checklist

1 | INTRODUCTION

Despite significant improvements in maternal and perinatal health in recent years, far too many women and newborns die or suffer preventable complications worldwide. Most maternal and perinatal deaths occur within the first 24 h after birth. Therefore, improving safety during childbirth and the immediate postpartum period is critical for reducing overall maternal-newborn morbidity and mortality.[1] Complications—such as eclampsia, obstructed labor, and hemorrhage—occur in approximately 20% of otherwise uncomplicated pregnancies.[1,2] Additionally, maternal and neonatal morbidity and mortality often have preventable causes, such as low birth weight, prematurity, sepsis, and asphyxia among newborns, and hemorrhage, infection, and high blood pressure among women.[3–6] In 2009, the World Health Organization (WHO) developed the Safe Childbirth Checklist (SCC), a tool designed for birth attendants to perform the most critical peripartum evidence-based practices (EBPs) to improve the quality of maternal and newborn care. The WHO SCC is a 29-item checklist that is divided into four pause points (PPs)—on admission, just before pushing or cesarean, within 1 h after birth, and upon discharge—and targets the major contributors to stillbirth and maternal and newborn mortality.[7] In 2010, the first version of the SCC was piloted in nine countries.[1] Since 2012, over 34 research groups across the world have implemented and assessed the uptake and effects of the SCC, generating more than 100 peer-reviewed publications.[1,8]

Although there is evidence demonstrating the association between the use of SCC and improved adherence to EBPs, the impact of SCC on maternal and neonatal morbidity and mortality across settings remains unknown. One systematic review published in 2020 found moderate evidence to support the effectiveness of the SCC on stillbirth reduction and adherence to some EBPs such as management of pre-eclampsia and infection and use of partograph.[9] The systematic review noted low−/very-low-quality evidence of the impact of the SCC on maternal and early neonatal death. More studies about the SCC have been published since the 2020 systematic review, and there is an opportunity to evaluate the evidence to inform redesigning the SCC in collaboration with the WHO to integrate new evidence-based guidelines and ameliorate barriers to implementation.

The aim of this study is to assess the impact of SCC on birth attendant adherence to EBPs and maternal and newborn health outcomes. We acknowledge the spectrum of gender identities of people with the reproductive capacity for pregnancy and birth, including transgender and gender-diverse people, as well as adolescent girls. In this paper, we use the term "women" to be consistent with the literature.

2 | MATERIALS AND METHODS

2.1 | Selection criteria

Eligible study designs included randomized controlled trials (RCTs), quasi-experimental studies, and pre/post studies. There were no restrictions on facility type or country. We included research articles published from 2009 onward with full text available. Studies also had to meet the participant/population, intervention(s)/exposure(s), comparator(s)/control, and outcomes described below.

The review included papers focusing on outcomes related to the woman or newborn, and/or birth attendant at the time of childbirth.

The SCC was designed to help birth attendants adhere to EBPs before, during, and after birth and ultimately improve maternal and newborn health outcomes.

The comparison group was women, newborns, and/or birth attendants who received or delivered standard childbirth care without the SCC.

Studies were included if they measured any of the following outcomes (see Table 1):

2.2 | Search strategy

We conducted a systematic review and meta-analysis according to the updated PRISMA 2020 Statement reporting guidelines for reporting systematic reviews[10,11] and Cochrane updated guidelines.[12] The review protocol was registered on PROSPERO (CRD42023448194).[13]

Studies were identified by searching Medline/PubMed (National Library of Medicine, NCBI), Embase (Elsevier, embase.com), the Cumulative Index to Nursing and Allied Health Literature (CINAHL Complete, EBSCOhost), Global Health (C.A.B. International, EBSCOhost), and Global Index Medicus (World Health Organization, www.globalindexmedicus.net) on May 5, 2023. Controlled vocabulary terms (i.e. MeSH, Emtree, CINAHL Subject Headings, CABI Thesaurus) were included when available and appropriate.

The search strategies were designed and carried out by a health sciences librarian (CM). For searching purposes, no language restriction was applied. A publication date limit was applied to include studies published from 2009 onward to correspond with the development of the WHO Safe Childbirth Checklist. The exact search terms used for each of the databases are provided in Appendix S1.

2.3 | Data extraction (selection and coding)

Using Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia), two reviewers (JF and CC) independently screened the titles and abstracts of the search results using the predetermined inclusion criteria. Two reviewers then reviewed full-text articles using the inclusion and exclusion criteria. Disagreements were resolved by a third reviewer for both rounds of review. Exclusion reasons were noted for all papers not accepted. Reviewers extracted data from eligible studies using a data extraction tool that captured study populations, participant demographics, interventions, study methods, and outcomes related to the review objectives. To ensure consistency, 20% of the articles were extracted by two reviewers; discrepancies were resolved through discussion

TABLE 1 Outcomes and measurement criteria for inclusion of studies in the review.

Outcome	Measured by:
Birth attendant behavior	Adherence to SCC: • Overall CCS • By pause point Adherence to EBPs (main causes of maternal and perinatal mortality): • pre-eclampsia management (PP1) • partograph use (PP1) • oxytocin administration just after birth (PP2) • newborn resuscitation (PP2) • early breastfeeding initiation (PP3) • blood loss assessment after birth (PP3) • danger sign counseling (PP4) • blood loss assessment prior to discharge (PP4)
Maternal health	Maternal mortality: before discharge through 42 days after pregnancy Maternal morbidity: • need for a transfusion • hysterectomy for infection or bleeding • eclamptic seizure • postpartum hemorrhage
Newborn health	Perinatal mortality: • stillbirth (after 28 weeks of pregnancy and before or during the childbirth) • early neonatal mortality (first 7 days of life) • neonatal mortality (after the 7th day but before the 28th day of life) Neonatal morbidity: • preterm births • asphyxia • sepsis

2.4 | Assessment of risk of bias

Risk of bias assessment of methodological quality was performed by two reviewers (ME, JF), who independently assessed included studies for the risk of bias. Discrepancies in ratings were resolved through discussion. Risk of bias assessments for RCTs were conducted using the Cochrane risk-of-bias tool for randomized trials (RoB 2).[12,14] For any interventions that did not use randomized allocation or for observational studies, the Risk of Bias in Non-randomized Studies-of Interventions (ROBINS-I) tool was used to assess direction of confounding and selection bias.[15]

2.5 | Data synthesis

Following title and abstract review, full-text review, and data extraction, the analysis team conducted a meta-analysis to obtain a pooled estimate over the individual studies of the relative risk (RR) for treatment (SCC use) versus control (standard of care) for all dichotomous outcomes. The meta-analysis technique used[16] derived the pooled estimate as a weighted average of the relative risk estimates from the individual studies. The "weights" used in the meta-analysis were proportional to the inverse of the variance of the estimated relative risk from each study; the approach also accounted for a random effect for each study. The meta-analysis technique also allowed for a 95% confidence interval (CI) for the pooled relative risk, as well as a *P* value for the null hypothesis that the pooled relative risk equals 1. A forest plot was used to display the relative risk for each individual study as well as the overall pooled estimate. A DerSimonian and Laird[17] test for heterogeneity of intervention effect among the studies was also used. A *P* value of randomized study effect greater than 0.05 corresponded to heterogeneity between studies.

We used the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach and four categories (high, moderate, low, and/or very low), as defined by the GRADE working group, to assess certainty of evidence. To summarize the evidence to make recommendations and dissemination, we used the GRADEpro GDT free web tool.[18,19]

3 | RESULTS

3.1 | Study selection and characteristics

In the initial query, 1290 records were retrieved from database searches on May 5, 2023, resulting in 1089 unique records after removing duplicates using Deduklick (Risklick, Bern, Switzerland) and EndNote (Clarivate, Philadelphia, PA, USA) software. Eighteen additional duplicates were identified during import to Covidence systematic review software, and one more duplicate was identified manually, resulting in 1070 references for screening. After title

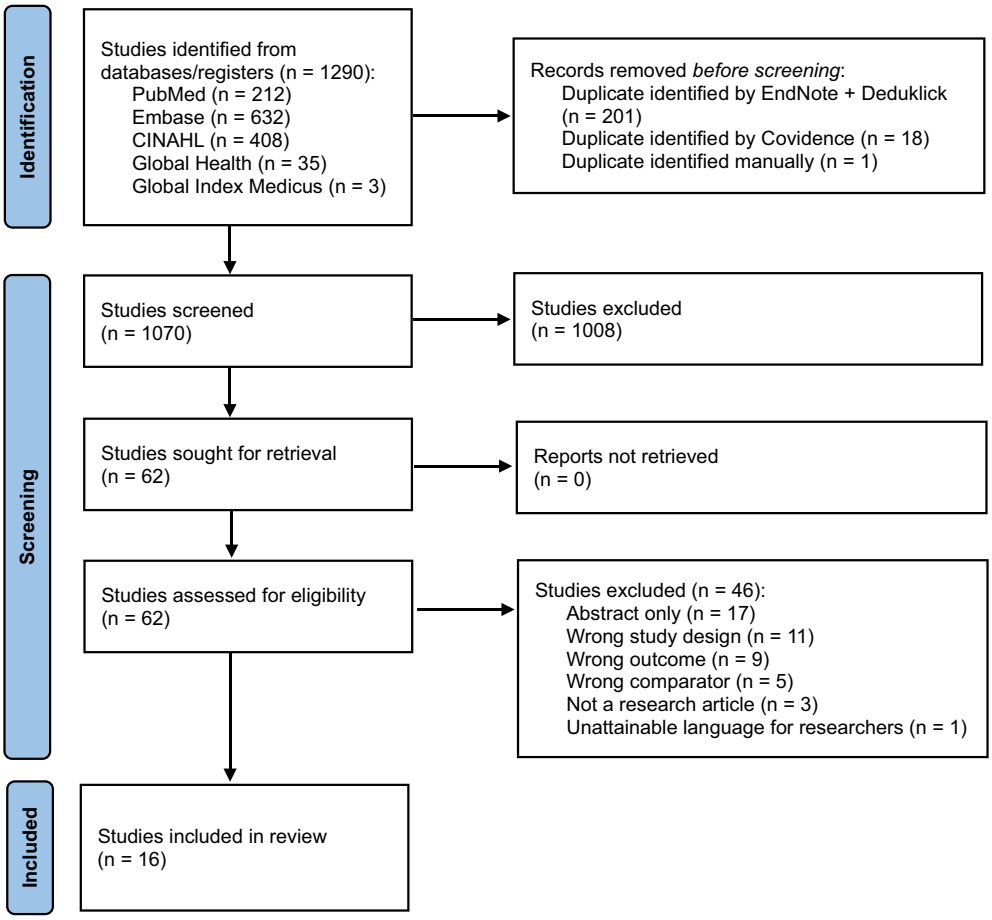


FIGURE 1 PRISMA diagram for study selection in the WHO Safe Childbirth Checklist systematic review and meta-analysis.

and abstract screening, 1008 studies were excluded, and 62 papers remained for full-text review. During full-text screening, 46 papers were excluded due to full text not being available or due to inappropriate outcome, comparison, or study design. The remaining 16 studies were analyzed (Figure 1).

The included studies were published from 2012 to 2023, and eight (50%) were published in the last 5 years. The identified studies included three (19%) cluster RCTs,[20–22] four (25%) quasi-experimental studies,[23–26] and nine (56%) pre/post intervention studies[27–35]. Nine studies (56%) were done in Asia, four (25%) in Africa, two (12%) in South America, and one (6%) in Europe. The studies took place in a wide range of facility settings, from primary level health facilities to tertiary level and maternity hospitals. Regarding study outcomes, 15 (93%) studies assessed adherence to SCC or to any EBP, and eight (50%) reported on at least one health outcome. Ten (62%) studies had fewer than 500 study participants, three (18%) studies had 500–1000 participants, and three (18%) studies included more than 1000 participants. Data collection was carried out through medical record review in seven (44%) studies, direct observation in five (31%) studies, both methods in three (19%) studies, and health worker interviews in one (6%) study (Table 2).

3.2 | Risk of bias assessment

Risk of bias assessment was conducted for all studies. Cochrane RoB 2 was used for RCTs with the following results:

For allocation (selection bias), all three studies were cluster RCTs. The Kaplan et al.[21] and Semrau et al.[22] studies have fairly good allocation concealment. Achola et al.[20] does not have strict randomization because, due to country and facilities characteristics, sites were partially selected and allocated. Nevertheless, once a facility was selected, a small sample of medical records was randomly selected.

Due to the nature of the intervention, blinding of participants or personnel (performance bias) was not done in any of the studies. However, birth attendants were incentivized for each SCC completed in one of the countries,[20] which reviewers classified as a high risk of bias.

In Achola et al.[20], there is no information about outcome blinding (detection bias) and it is not possible to predict whether some outcomes were affected by knowledge of the intervention received.

Attrition bias was not detected in any of the three studies and none of the studies presented bias for selective reporting.

TABLE 2 Characteristics of the included studies in systematic review on the impact of the WHO Safe Childbirth Checklist on birth attendant behavior and maternal-newborn outcomes.

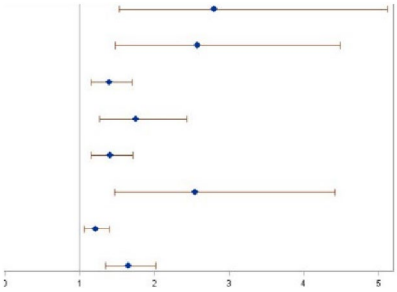
				Outcomes							
				Adherence			Health				
							Mortality		Morbidity		
Paper	Study design	Setting/country	Number of participants	SCC	PP	EBP	Mth	Nb	Mth	Nb	Assess by
Abawollo 2021[27]	Pre/post intervention	Primary HC—Ethiopia	Interv: 187		✓	✓					Interviews to HWs
			Ctrl: 247								
Achola 2022[20]	Cluster RCT	Health facilities +referral Hs—Kenya and Uganda	Interv: 129		✓						SCC and medical records
			Ctrl: 143								
Albolino 2018[28]	Pre/post intervention	1 H—Italy	Interv: 98		✓	✓					SCC and medical records
			Ctrl: 141								
DaSilva Gama 2020	Quasi-experimental	1 H (state reference unit/high-risk)—Brazil	Interv: 360						✓		Medical records
			Ctrl: 360								
Hirschhorn 2015[29]	Pre/post intervention	2 HC + 1 district women's H—Uttar Pradesh, India	Interv: 409		✓	✓					Observation
			Ctrl: 624								
Kabongo 2017[30]	Pre/post intervention	Gobabis District H—Namibia	Interv: 798	✓		✓		✓			SCC and medical records
			Ctrl: 686								
Kaplan 2021[21]	Cluster RCT	32 H and community HC—Aceh, Indonesia	Interv: 1483 (obs. 216)	✓	✓	✓	✓	✓			Observation and medical records
			Ctrl: 3599 (obs. 137)								
Kumar 2016[24]	Quasi-experimental	16 facilities—Rajasthan, India	Interv: 960	✓	✓	✓					Observation
			Ctrl: 960								
Li 2023[31]	Pre/post intervention	3ry H Chongqing University—China	Interv: 2891	✓	✓			✓	✓	✓	Medical records
			Ctrl: 3096								
Mudhune 2020[32]	Pre/post intervention	4 facilities Nchelenge District—Zambia	Interv: 777	✓	✓	✓					Observation
			Ctrl: 570								

TABLE 2 (Continued)

Paper	Study design	Setting/country	Number of participants	Outcomes							
				Adherence			Health				
							Mortality		Morbidity		
				SCC	PP	EBP	Mth	Nb	Mth	Nb	Assess by
Nababan 2017[33]	Pre/post intervention	Magura District H—Bangladesh	Interv: 157	✓		✓					Observation
			Ctrl: 153								
Semrau 2017[22]	Cluster RCT	120 facilities, 24 districts—Uttar Pradesh, India	Interv: 79798 (Obv 1009)	✓	✓	✓	✓	✓	✓		Observation and medical records
			Ctrl: 77347 (Obv 1007)								
Sousa 2022[25]	Quasi-experimental	1 tertiary H + 1 secondary H—Brazil	Interv: 720			✓			✓	✓	Medical record
			Ctrl: 720								
Spector 2012[34]	Pre/post intervention	Subdistrict birth center—Karnataka, India	Interv: 795	✓		✓	✓	✓			Observation and medical records
			Ctrl: 499								
Tuyishime 2018[35]	Pre/post intervention	Masaka District H—Rwanda	Ctrl: 75004 Interv: 389	✓	✓	✓					Observation
			Ctrl: 391								
Varghese 2019	Quasi-experimental	Rajasthan—India	Interv: 77239			✓		✓			Medical record
			Ctrl: 59800								

Abbreviations: Ctrl, control; EBP, evidence best practices; Fclts, facilities; H, hospital; HC, health center; Interv, intervention; Mth, mother; Nb, newborn; Obs, observations; PP, adherence by pause point; SCC, overall Safe Childbirth Checklist adherence.

TABLE 3 Forest plot comparison of overall WHO Safe Childbirth Checklist adherence and evidence-based practice (EBP): Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Kumar 2016[24]	57/231	153/233		2.79 (1.53–5.12)
Li 2023[31]	963/3096	2316/2891		2.58 (1.48–4.49)
Mudhune 2020[32]	342/570	653/777		1.40 (1.15–1.71)
Nababan 2017[33]	61/153	110/157		1.75 (1.26–2.43)
Semrau 2017[22]	526/1198	695/1127		1.41 (1.15–1.72)
Spector 2012[34]	169/499	685/795		2.55 (1.47–4.42)
Tuyishime 2018[35]	180/391	218/389		1.22 (1.06–1.40)
Combined	2294/6138	4832/6369		1.65 (1.34–2.02)

Abbreviations: CI, confidence interval; RR, relative risk.

[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.0566.

We did not detect other biases in the three studies. However, only medical records were used to determine SCC compliance rates (no observational data collection) in Achola et al.,[20] and the definition of SCC completion was not clear.

Pooled analysis of all cluster-RCTs showed that all assessed criteria have at least 50% low risk of bias, except blinding of participants and personnel, which had more bias risk or uncertainty because use of the SCC did not allow for blinding.

The risk of bias assessment for the 13 non-RCT studies was conducted using the ROBINS-I tool.[36] Each study was individually assessed, and information was aggregated into a global risk of bias assessment. Ten (77%) of the studies had a moderate or serious overall risk of bias, largely due to measurement of outcomes and lack of data in one of the study groups; only three studies were classified as low risk. In one of the studies,[31] we were not confident that the outcome assessment was comparable across groups because SCC use differed among birth attendants. Two studies[27,33] present a serious risk of confounding due to the selection of participants and moderate risk of missing data and measurement of outcomes due to not achieving the stated sample size and data collection methods. Da Silva Gama et al.,[23] Kumar et al.,[24] and Spector et al.[34] all had a low overall risk of bias (see Appendix S2). There were a wide range of facilities who implemented the SCC, and variability in terms of numbers of participants, type of data collection, risk of bias, and risk of confounding.

3.3 | Synthesis of results

Five (31%) of all studies assessed adherence to the SCC by PP, while seven (44%) studies assessed overall adherence. Two (12%) studies did not present sufficient data to include in the meta-analysis.[21,30] All studies reported improved adherence to SCC (Table 3). Adherence to each of the four PPs shows increased compliance with the SCC (Table 4) with best results in PP4 (RR 1.35; 95% CI 1.19–1.54; $P<0.001$), despite there being few studies and heterogeneity among study outcomes. In the seven studies of overall SCC adherence, adherence to EBPs was 1.65 (95% CI 1.34–2.02) times more likely than without SCC. Test for heterogeneity shows that there was moderate heterogeneity among studies, with consistent results.

We examined adherence to eight EBPs (two in each of the four PPs). Six of the EBPs relate to care for women and two for newborns. The EBP that was assessed in the largest number of studies was partograph use, in11 (69%) studies, whereas blood loss assessment was reported in the smallest number of studies. Only four (25%) studies assessed blood loss soon after birth (PP3), and five (31%) studies assessed blood loss before discharge (PP4). Six out of the eight EBPs that were measured showed significantly improved adherence with the use of the SCC.

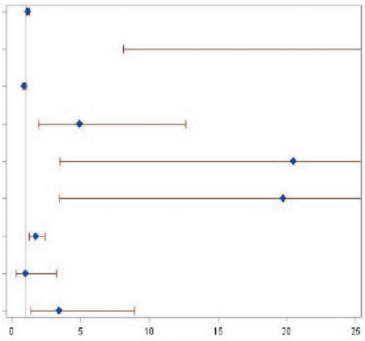
- *Pre-eclampsia management* (*PP1*): Eight studies evaluated pre-eclampsia assessment, and 75% showed significant increased adherence. However, in some studies[22,29,33] there is a wide confidence interval. The pooled RR for this outcome was 3.43 (95% CI 1.33–8.88; $P=0.011$), and there was no heterogeneity among studies (Table 5).
- *Partograph use (PP1):* Eleven (69%) studies assessed partograph use, and half of them showed significant improvements in its use, with a final combined RR of 2.06 (95% CI 1.12–3.79; $P=0.021$). There was no heterogeneity among these studies (Table 6).
- *Oxytocin administration (PP2)*: Final combined data of eight studies show that in settings where SCC has been implemented, oxytocin administration after childbirth was 1.51 (95% CI 1.11–2.05; $P=0.009$) times more likely than without SCC, and there was heterogeneity among studies (Table 7).
- *Newborn resuscitation* (*PP2*): No significant difference was found between the control and intervention groups regarding neonatal bag and mask preparation (RR = 1.40, 95% CI 0.96–2.03; $P=0.077$) (Table 8).
- *Breastfeeding initiation* (*PP3*): Of the studies that reported on breastfeeding, 70% (n = 7) showed significant improvements in breastfeeding rates during the first hour after childbirth. A meta-analysis showed a combined RR of 1.54 (95% CI 1.18–2.02; $P=0.002$) with no heterogeneity among studies (Table 9).

TABLE 4 Comparison of adherence to checklist at each pause point: Intervention versus control (relative risk and 95% CI).

	PP1	PP2	PP3	PP4
Study	**RR (95% CI)**	**RR (95% CI)**	**RR (95% CI)**	**RR (95% CI)**
Abawollo 2021[27]	1.05 (0.99–1.11)	1.26 (1.10–1.43) **	1.43 (1.16–1.76) **	1.30 (1.11–1.52) **
Achola 2022[20]	1.10 (1.04–1.17)**	1.17 (1.07–1.28) **	1.19 (1.07–1.32) **	1.28 (1.11–1.48) **
Mudhune 2020[32]	1.36 (1.13–1.63 **	1.56 (0.92–2.67)	1.46 (0.87–2.43)	1.40 (1.08–1.81) **
Semrau 2017[22]	–	54 (5.17–563.61) **	–	–
Tuyishime 2018[35]	0.98 (0.38–2.55)	1.09 (0.79–1.51)	1.26 (0.91–1.75)	1.79 (1.19–2.69) **
Combined	1.09 (1.04–1.13) **	1.36 (0.93–1.98)	1.24 (1.14–1.35) **	1.35 (1.19–1.54) **
TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986)				
P value random study effect	0.3405	0.3751	0.8817	0.7955

Abbreviations: CI, confidence interval; RR, relative risk.
**$P < 0.01$.

TABLE 5 Forest plot comparison of preeclampsia management (PP1) with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Da Silva Gama 2020	269/360	307/360		1.14 (1.06–1.23)
Hirschhorn 2015[29]	1/624	54/335		160.00 (8.09–3162.74)
Kaplan 2021[21]	102/108	125/151		0.88 (0.74–1.05)
Kumar 2016[24]	35/240	175/236		4.93 (1.93–12.61)
Nababan 2017[33]	6/153	129/157		20.50 (3.47–121.06)
Semrau 2017[22]	11/1009	219/1007		19.73 (3.42–113.90)
Spector 2012[34]	218/405	596/638		1.73 (1.25–2.39)
Tuyishime 2018[35]	90/106	81/95		1.01 (0.31–3.25)
Combined	732/3005	1685/2979		3.43 (1.33–8.88)

Abbreviations: CI, confidence interval; RR, relative risk.
[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.0181.

- *Blood loss assessment* (*PP3*): No significant difference was found between the control and intervention groups with RR = 1.24 (95% CI 0.98–1.57; $P = 0.070$) (Table 8) and there was heterogeneity among studies.
- *Blood loss assessment (PP4)*: Most studies did not report on blood loss assessment before discharge. Of those that did, pooled data analysis showed a small increase in this EBP adherence with RR of 1.19 (95% CI 1.08–1.32; $P < 0.001$). Nevertheless, there was substantial heterogeneity among studies, making the results not conclusive (Table 10).
- *Danger sign counseling* (*PP4*): Six studies assessed danger sign counseling. Although the results did show an increase in danger signs counseling at discharge, the data are widespread with overall RR of 12.37 (95% CI 1.95–78.52), pointing to low precision in the effect size. In addition, there was heterogeneity among study effect results (Table 11).

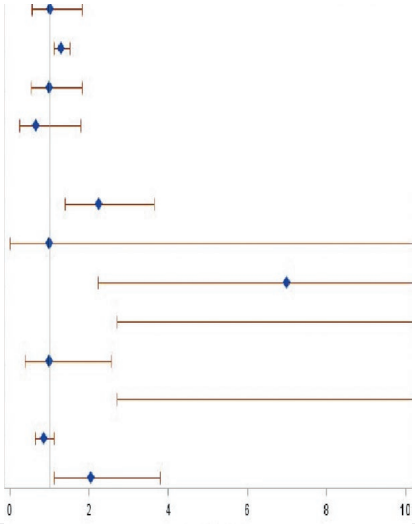
Only three studies[21,22,31] collected the severe maternal morbidity, such as seizure or eclampsia, postpartum hemorrhage, blood transfusion, sepsis, hysterectomy, and asphyxia. Therefore, a meta-analysis was not performed. None of the five outcomes assessed in the largest study[22] found any significant improvement between intervention and control group. One study[23] found a non-significant decline in the percentage of women suffering from pre-eclampsia with severe features from 30.6% pre-intervention to 21.1% post-intervention. Li et al.[31] assessed postpartum hemorrhage and maternal sepsis and found a significant decrease in postpartum infection from 0.8% to 0.4% ($P = 0.02$) (Table 12). None of the included studies reported on neonatal sepsis, prematurity, or low birth weight.

Three studies[21,22,34] presented results about maternal mortality, all with non-significant results and a combined RR of 1.07 (95% CI 0.76–1.50) (Table 13). Findings from the five studies that recorded stillbirths[21,22,26,30,34] showed consistent reduction in stillbirth with use of the SCC with a pooled RR of 0.89 (95% CI 0.80–0.99; $P = 0.034$) (Table 14).

Only two studies[22,26] reported on perinatal mortality and neither of them demonstrated reduction with SCC use (Semrau et al.[22]: RR = 1.02, 95% CI 0.93–1.12 and Varghese et al.[26]: RR = 1.00). Of the

TABLE 6 Forest plot comparison of partograph use (PP1) with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Abawollo 2021[27]	201/247	154/187		1.01 (0.56–1.83)
Albolino 2018[28]	106/141	96/98		1.30 (1.11–1.52)
Hirschhorn 2015[29]	1/624	0/335		1.00 (0.55–1.83)
Kaplan 2021[21]	21/92	16/108		0.65 (0.24–1.79)
Kumar 2016[24]	1/205	123/237		520.00 (13.15–20554.92)
Mudhune 2020[32]	177/570	544/777		2.26 (1.39–3.65)
Nababan 2017[33]	0/153	0/157		1.00 (0–1020823.6)
Semrau 2017[22]	0/1009	7/1007		7.00 (2.23–21.98)
Sousa 2022[25] (H1)	15/360	169/360		11.17 (2.70–46.14)
Sousa 2022[25] (H2)	316/360	314/360		0.99 (0.38–2.56)
Spector 2012[34]	15/405	272/638		11.21 (2.71–46.43)
Tuyishime 2018[35]	59/106	45/95		0.85 (0.64–1.12)
Combined	912/4272	1740/4359		2.06 (1.12–3.79)



Abbreviations: CI, confidence interval; RR, relative risk.

[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.0217.

three studies that measured neonatal mortality,[21,31,34] there was no detected reduction with SCC use (RR 1.46, 95% CI 0.50–4.27) (Table 15). All the mortality outcomes analysis presented variation across the studies.

The GRADE approach was used to assess certainty of the evidence. Nine outcomes were evaluated, and five of them met the GRADE category of moderate certainty. We are moderately confident about the estimated effect shown by the meta-analysis for: stillbirth, adherence to SCC, partograph use, oxytocin administration just after childbirth, and breastfeeding initiation during the first hour after birth. The remaining four outcomes—maternal mortality, pre-eclampsia assessment, blood loss assessment, and danger sign counseling—received a GRADE category of low certainty. Therefore, our confidence in the impact of SCC on these four outcomes is weak and remains unanswered (Table 16).

4 | DISCUSSION

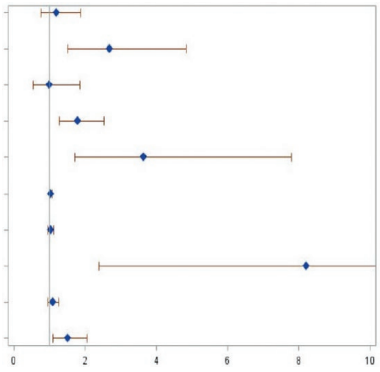
This systematic review and meta-analysis includes seven additional peer-reviewed publications published over a longer range of years than the previous systematic review.[9] Our review also provides information not previously analyzed, such as adherence to the overall SCC and adherence at each of the four PPs, which help contextualize the extent to which the SCC was implemented in the different studies analyzed. We found that the SCC has been implemented and evaluated across the globe in a variety of settings based on the published peer-reviewed literature. The true spread of the SCC in current use is likely much higher given the barriers and time lag in getting rigorous evaluation studies published in the peer-reviewed literature.

We found that adherence to the SCC was overall higher in intervention compared with control groups, with variation in adherence by PP. Interestingly, the overall adherence to SCC appeared to be driven by adherence in PP3 and PP4, which are both completed after birth. These findings bring into question the extent to which the SCC is used during labor and birth versus the immediate postpartum period. In some settings, women arrive in health facilities in active labor, which limits the time available for birth attendants to adhere to all PPs.[37] Although the immediate postpartum period is an important period for detecting complications, there remains an opportunity to enhance adherence to EBPs in the moments during labor and birth.

When we examined adherence to specific EBPs, we found that there was increased adherence to all with some variation across individual EBPs. For example, danger sign counseling at discharge had the highest adherence, followed by partograph use and pre-eclampsia management. These findings indicate that the SCC is not necessarily uniformly used across all PPs and EBPs. There are some EBPs that may be easier to follow than others, which has important implications for behavior change management and supportive implementation of the SCC.

Regarding health outcomes, we found that few studies collected maternal, perinatal, and newborn morbidity and mortality. Additionally, of the three studies that did measure maternal and neonatal mortality, two measured in-facility mortality and one measured mortality up to 7 days after birth. The only outcome with moderate evidence was reduction in stillbirth across five studies. The mechanism by which stillbirth was reduced is likely through more attentive care in the intrapartum period, as prompted by partograph use and regular assessments. Yet, these behaviors were not necessarily enough to reduce other maternal and neonatal adverse outcomes. This may be due to the technical

TABLE 7 Forest plot comparison of oxytocin administration (PP2) with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Albolino 2018[28]	7/10	10/12		1.19 (0.75–1.87)
Hirschhorn 2015[29]	188/523	391/403		2.69 (1.50–4.83)
Kaplan 2021[21]	67/70	61/64		0.99 (0.53–1.85)
Kumar 2016[24]	117/240	212/240		1.79 (1.27–2.53)
Semrau 2017[22]	154/1041	549/1019		3.64 (1.70–7.79)
Sousa 2022[25](H1)	330/360	344/360		1.04 (1.01–1.08)
Sousa 2022[25](H2)	287/360	297/360		1.03 (0.96–1.11)
Spector 2012[34]	33/388	402/583		8.20 (2.38–28.27)
Tuyishime 2018[35]	76/92	84/98		1.09 (0.95–1.25)
Combined	1259/3094	2350/3139		1.50 (1.10–2.05)

Abbreviations: CI, confidence interval; RR, relative risk.

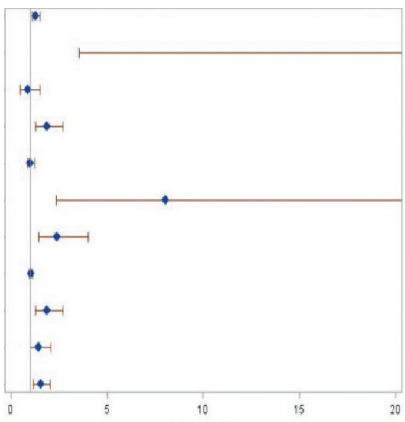
[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.0665.

TABLE 8 Comparison of newborn resuscitation (PP2) and blood loss assessment (PP3) with and without the WHO Safe Childbirth Checklist: Intervention versus control.

	Newborn resuscitation (PP2)			Blood loss assessment (PP3)		
Study	SCC No, n/N	SCC Yes, n/N	*P* value	SCC No, n/N	SCC Yes, n/N	*P* value
Kaplan 2021[21]	NA	NA	NA	66/70	105/110	0.821
Kumar 2016[24]	14/46	84/101	0.026	164/240	218/240	<0.001
Nababan 2017[33]	NA	NA	NA	152/153	157/157	0.318
Semrau 2017[22]	1036/1042	1017/1018	0.320	NA	NA	NA
Spector 2012[34]	232/388	576/583	<0.001	58/388	533/538	<0.001
Tuyishime 2018[35]	69/92	69/98	0.984	–	–	–

Abbreviations: PP, pause point; SCC, Safe Childbirth Checklist.

TABLE 9 Forest plot comparison of breastfeeding initiation (PP3) with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

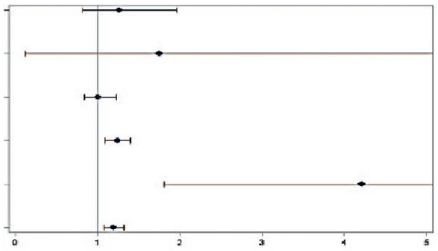
Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Abawollo 2021[27]	177/247	173/187		1.29 (1.11–1.51)
Hirschhorn 2015[29]	16/522	262/409		21.33 (3.53–128.97)
Kaplan 2021[21]	35/66	51/110		0.87 (0.50–1.51)
Kumar 2016[24]	110/237	203/236		1.87 (1.29–2.70)
Nababan 2017[33]	152/153	157/157		1.01 (0.83–1.23)
Semrau 2017[22]	47/1014	369/1000		8.02 (2.36–27.29)
Sousa 2022[25](H1)	91/360	219/360		2.40 (1.43–4.02)
Sousa 2022[25](H2)	95/360	98/360		1.03 (0.96–1.10)
Spector 2012[34]	196/388	553/583		1.88 (1.30–2.73)
Tuyishime 2018[35]	32/92	47/98		1.45 (1.01–2.08)
Combined	950/3439	2132/3500		1.54 (1.18–2.02)

Abbreviations: CI, confidence interval; RR, relative risk.

[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.0092.

and systems-level infrastructure required to address complications that were out of scope of the SCC. The SCC itself does not provide decision support or guidance for managing specific life-threatening complications, such as management of postpartum hemorrhage or eclamptic seizure. Rather, the SCC was designed around preventive behaviors, such as assessing bleeding

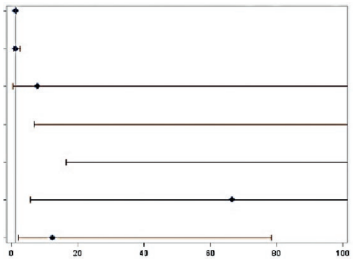
TABLE 10 Forest plot comparison of blood loss assessment (PP4) with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control n/N	Intervention n/N)	RR plot	RR (95% CI)
Kaplan 2021[21]	15/21	26/29		1.27 (0.82–1.96)
Kumar 2016[24]	96/236	168/240		1.75 (0.12–25.2)
Nababan 2017[33]	152/153	157/157		1.01 (0.83–1.23)
Spector 2012[34]	272/338	488/489		1.24 (1.09–1.41)
Tuyishime 2018[35]	14/101	58/98		4.22 (1.81–9.82)
Combined	549/849	897/1013		1.19 (1.08–1.32)

Abbreviations: CI, confidence interval; RR, relative risk.

[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.3187.

TABLE 11 Forest plot comparison of danger sign counseling (PP4) with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (IC 95%)
Abawollo 2021[27]	175/247	171/187		1.29 (1.11–1.49)
Kaplan 2021[21]	14/22	30/36		1.30 (0.66–2.54)
Kumar 2016[24]	15/236	113/240		7.83 (0.42–144.45)
Nababan 2017[33]	1/153	108/157		106.15 (6.83–1648.59)
Spector 2012[34]	0/338	436/489		892.00 (16.43–48425.42)
Tuyishime 2018[35]	1/101	66/98		66.70 (5.64–788.22)
Combined	207/1097	924/1207		12.37 (1.95–78.52)

Abbreviations: CI, confidence interval; RR, relative risk.

[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.0882.

TABLE 12 Comparison of maternal and newborn morbidity with and without the WHO Safe Childbirth Checklist: Intervention versus control.*

	Semrau 2017[22]		Da Silva Gama 2020		Li 2023[31]	
Health outcomes	SCC No, % (*N*)	SCC Yes, % (*N*)	SCC No, % (*N*)	SCC Yes, % (*N*)	SCC No, % (*N*)	SCC Yes, % (*N*)
Seizure or eclampsia	0.10 (77257)	0.10 (79706)	30.60 (360)	21.10 (360)	NA	NA
Postpartum hemorrhage	7.60 (77198)	7.20 (79648)	NA	NA	1.90 (3096)	1.70 (2891)
Blood transfusion	0.80 (77254)	0.80 (79697)	NA	NA	NA	NA
Sepsis	5.00 (77018)	5.10 (79459)	NA	NA	0.80 (3096)	0.40* (2891)
Hysterectomy	<0.10 (77252)	<0.10 (79705)	NA	NA	NA	NA
Asphyxia	NA	NA	NA	NA	1.20 (3096)	1.10 (2891)

Abbreviations: PP, pause point; SCC, Safe Childbirth Checklist.

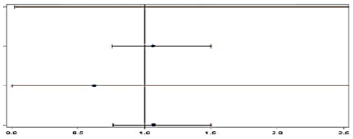
*$P < 0.05$.

and blood pressure, with minimal guidance for comprehensive management of complications.

This systematic review and meta-analysis provides critical insights for redesigning the SCC and its implementation. Since the SCC's original development in 2009 and global dissemination in 2015, there have been multiple WHO guidelines published relevant to the moments around childbirth. These include the Labor Care Guide,[38] Postnatal Care Guidelines,[39] and Postpartum Hemorrhage Guidelines.[40,41] Therefore, there are opportunities to incorporate these guidelines into practice through redesigning the SCC and distinguishing EBPs that should be done for every birthing person and newborn every time and which EBPs should be done when complications arise.

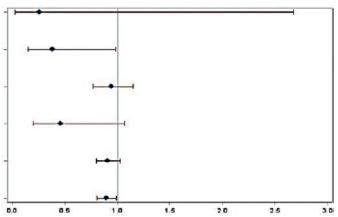
Our findings should be interpreted in the context of the study limitations. The settings in which the SCC was implemented and evaluated vary widely both in geography and health system infrastructure. Therefore, it is challenging to draw generalizable conclusions

TABLE 13 Forest plot comparison of Maternal Mortality with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Kaplan 2021[21]	0/3599	1/2179		5.00 (0.02–1178.04)
Semrau 2017[22]	71/77346	78/79797		1.06 (0.76–1.50)
Spector 2012[34]	1/492	1/791		0.62 (0–125.12)
Combined	72/81437	80/82767		1.07 (0.76–1.50)

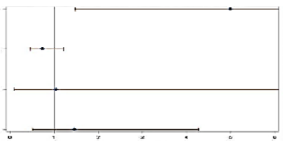
Abbreviations: CI, confidence interval; RR, relative risk.
[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.2861.

TABLE 14 Forest plot comparison of Stillbirth with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Kabongo 2017[30]	10/686	3/798		0.26 (0.02–2.67)
Kaplan 2021[21]	69/3599	16/2179		0.38 (0.15–0.98)
Semrau 2017[22]	1559/77454)	1513/80061		0.94 (0.77–1.15)
Spector 2012[34]	13/387	9/582		0.46 (0.20–1.07)
Varghese 2019	1390/59800	1621/77239		0.91 (0.80–1.02)
Combined	3041/141926	3162/160859		0.89 (0.81–0.99)

Abbreviations: CI, confidence interval; RR, relative risk.
[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.3065.

TABLE 15 Forest plot comparison of Neonatal Mortality with and without the WHO Safe Childbirth Checklist: Intervention versus control.[a]

Study	Control, n/N	Intervention, n/N	RR plot	RR (95% CI)
Kaplan 2021[21]	0/3599	0/2179		5.00 (1.47–17.02)
Li 2023[31]	38/3096	1/2891		0.73 (0.44–1.20)
Spector 2012[34]	2/337	3/489		1.03 (0.09–11.82)
Combined	40/7032	4/5559		1.46 (0.50–4.27)

Abbreviations: CI, confidence interval; RR, relative risk.
[a]TEST for heterogeneity (equal Relative Risk across studies) (Dersimonian & Laird,1986); *P* value random study effect: 0.3103.

without attending to the importance of context-specific implementation approaches for use of the SCC. Inherently, systematic reviews are subject to publication bias, data quality, and implementation experiences may be missed as we had relatively strict study design inclusion criteria. There are also gaps in assessment of maternal and perinatal outcomes that limit our ability to draw conclusions and truly understand the impact to the SCC or how we might seek to improve its impact.

In conclusion, the SCC can be an important behavior change tool for EBPs during labor, childbirth, and the immediate postpartum period across settings around the world. Based on our findings, there is moderate evidence showing the SCC's effectiveness in reducing stillbirth and improving adherence to EBPs, including partograph use, oxytocin administration just after childbirth, and breastfeeding initiation during the first hour after birth. Evaluation of context-specific implementation approaches for the SCC are needed. Given the recent publication of other evidence-based guidelines, there is an opportunity to redesign how to close the "know-do" gap by optimizing use of the SCC, and ensuring high-quality care for all birthing women and newborns during childbirth.

TABLE 16 Summary of findings and certainty assessment of evidence on the WHO Safe Childbirth Checklist systematic review and meta-analysis. [a]

Outcome	Anticipated absolute effects (95% CI)		RR (95% CI)	No. of patients (studies)	Certainty
	Risk without SCC	Risk with SCC			
Maternal mortality	1 per 1000	1 per 1000 (1–1)	RR 1.07 (0.76–1.50)	164 204 (2 RCT+ 1pre/post)	⨁⨁◯◯ Low [a,b,c]
Stillbirth	21 per 1000	19 per 1000 (17–21)	RR 0.89 (0.81–0.99)	302 785 (2 RCT + 1 quasiExp+2 pre/post)	⨁⨁⨁◯ Moderate [c]
Adherence to SCC (overall)	374 per 1000	617 per 1000 (501–755)	RR 1.65 (1.34–2.02)	12 507 (1 RCT + 1 quasiExp+5 pre/post)	⨁⨁⨁◯ Moderate [d,e]
Pre-eclampsia assessment (PP1)	244 per 1000	836 per 1000 (324–1000)	RR 3.43 (1.33–8.88)	5984 (2 RCT + 2 quasiExp+4 pre/post)	⨁⨁◯◯ Low [b,c,e,f]
Partograph (PP1)	213 per 1000	440 per 1000 (239–809)	RR 2.06 (1.12–3.79)	8631 (2 RCT + 2 quasiExp+7 pre/post)	⨁⨁⨁◯ Moderate [b,c,f]
Oxytocin administration (PP2)	407 per 1000	614 per 1000 (452–834)	RR 1.51 (1.11–2.05)	6233 (2 RCT + 2 quasiExp+4 pre/post)	⨁⨁⨁◯ Moderate [c]
Breastfeeding initiation (PP3)	276 per 1000	425 per 1000 (326–558)	RR 1.54 (1.18–2.02)	6939 (2 RCT + 2 quasiExp+5 pre/post)	⨁⨁⨁◯ Moderate [c]
Blood loss assessment (PP4)	647 per 1000	770 per 1000 (698–854)	RR 1.19 (1.08–1.32)	1862 (1 RCT + 1 quasiExp+3 pre/post)	⨁⨁◯◯ Low [b,d,f]
Danger sign counseling (PP4)	189 per 1000	1000 per 1000 (368–1000)	RR 12.37 (1.95–78.52)	2304 (1 RCT + 1 quasiExp+4 pre/post)	⨁⨁◯◯ Low [b,d,e,f]

Note: Downgraded explanations: are given as table foot notes.

Abbreviations: CI, confidence interval; PP, pause point; RCT, randomized controlled trial; RR, relative risk; SCC, Safe Childbirth Checklist.

[a]Information size is small due to few cases of maternal mortality.

[b]95% CI is wide and statistically non-significant.

[c]Only 2 RCT.

[d]Only 1 RCT.

[e]Difference in outcome definition.

[f]High level of heterogeneity between studies' results.

AUTHOR CONTRIBUTIONS

RM, KEAS, and JF conceived the scope of the review, and CM developed and ran the literature search. MFE, JF, and CC reviewed studies for inclusion. MFE wrote the first draft of the report with input from JF, RM, and KEAS. SL conducted the statistical analysis. All authors made substantial contributions to the critical review, editing, and revision of the manuscript. All authors had full access to all the data in the study, approved the final version of the manuscript, and had final responsibility for the decision to submit for publication.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Researchers wishing to undertake additional analyses of the data are invited to contact the corresponding author. The study protocol and analysis plan are available on PROSPERO at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=448194. Additional Supporting Information may be found online in the supporting information tab for this article.

ORCID

Rose L. Molina https://orcid.org/0000-0001-7977-7960

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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