

IMPACT OF UTILIZING THE WHO SAFE CHILDBIRTH CHECKLIST ON REDUCING MATERNAL AND PERINATAL DEATH: A SYSTEMATIC REVIEW AND META-ANALYSIS

Lemi Belay Tolu, MD¹, Tadesse Urgie, MD¹, Balkachew Nigatu, MD¹, Thomas Mekuria, MD¹

ABSTRACT

BACKGROUND: The World Health Organization (WHO) Safe Childbirth Checklist (SCC) is a 29-item checklist designed to address the primary cause of maternal death, intrapartum stillbirth, and early neonatal death. The objective of this review was to locate literature reporting on the effect of utilizing the WHO safe childbirth checklist on maternal and perinatal death.

METHODS: We searched MEDLINE, google scholar, Cochrane Central Register of Controlled Trials (CENTRAL), met-Register of Controlled Trials (m-RCT) (www.controlled-trials.com), ClinicalTrials.gov (www.clinicaltrials.gov) and the WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/stop/search/en) to retrieve all available comparative studies published in English after 2008. Two reviewers did study selection, critical appraisal, and data extraction independently. We did a random or fixed-effect meta-analysis to pool studies together and effect estimates were expressed as an odds ratio. Quality of evidence for major outcomes was assessed using the Grading of Recommendations, Assessment, development, and evaluation (GRADE).

RESULTS: We retained two cluster randomized trials and three pre-and-post intervention studies reporting on WHO SCC's. The WHO SCC utilization reduced still birth (OR =0.92[95% CI 0.87-0.96]). However, the utilization of the checklist had no impact on early neonatal death (OR=1.07[95%CI [1.01-1.13]) and maternal death (OR =1.06[95% CI 0.77-1.45]).

CONCLUSION: WHO SCC was effective in reducing stillbirth. Moderate quality of evidence indicates that WHO SCC reduce stillbirth, whereas low and very low quality of evidence suggests that WHO SCC has no impact on maternal and early neonatal death, respectively. A lot of things might contribute to perinatal and maternal death. Therefore, it is imperative to contextually modify the checklist (WHO safe childbirth checklist) to address major events contributing to intrapartum maternal death, still birth and early neonatal death.

KEY WORDS: Maternal health, Newborn health, WHO Safe Childbirth Checklist, maternal mortality, perinatal mortality.

(The Ethiopian Journal of Reproductive Health; 2021; 13;27-37)

INTRODUCTION

The World Health Organization (WHO) estimates nearly 2,87,000 maternal deaths, 1 million intrapartum related stillbirths, and 3 million newborn deaths during the neonatal period per year ¹. As a solution, the World Health Organization (WHO) has introduced a safe childbirth checklist (SCC) in 2008, a 29-item evidence-based essential childbirth practice to help health-care workers to deliver consistently high quality maternal and perinatal care ². The WHO Safe Childbirth Checklist (SCC) incorporates major causes of maternal death, intrapartum stillbirth, and early neonatal death and expected to have an impact on maternal and perinatal morbidity and mortality ³.

One observation study reported that SCC has no impact on perinatal or maternal mortality ³. Another prospective interventional study conducted at a tertiary care hospital in India found that implementation of a safe childbirth checklist has no impact on maternal or neonatal mortality reduction. However, there was increased partograph use, antibiotic administration, and active management of the third stage of labour ⁴. The Better-Birth trial in north India, where peer coaching was used to increase adherence of workers to WHO SCC at sub-district and primary health care facilities, reported a significant increase in health care worker's adherence to essential practices. However, the study indicated that the utilization of the tool didn't reduce perinatal and maternal death ⁵.

A recent quasi-experimental study conducted in the Rajasthan district of India found out that implementation of SCC program potential averts 40,000 intrapartum deaths per year, the most reduction being from prevention of stillbirths ⁶. Contradicting results from different studies on WHO SCC's impact on maternal and perinatal death despite an improvement of essential practices mandates searching for robust evidence on the effectiveness of SCC implementation on reduction of maternal and perinatal deaths. Therefore,

this systematic review is aimed to investigate the effectiveness of utilizing the WHO safe childbirth checklist on improving maternal and perinatal deaths (still births and early neonatal death).

Review question(s)

The review sought to locate international literature reporting on the impact of WHO SCC utilization. Specifically, the review questions were:

- What is the effectiveness of the WHO safe childbirth checklist on improving maternal death?
- What is the effectiveness of the WHO safe childbirth checklist on reducing perinatal death?

METHODS

This systematic review was prepared using PRISMA reporting guidelines (S2 table) for systematic reviews ⁷. The review was conducted per Cochrane handbook for a systematic review of interventions ⁸, and a prior protocol registered in PROSPERO 2019, CRD42019137092 available at https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=137092. During the conduct of the review, we considered the following inclusion criteria:

Participants

For the sake of this review, we considered health professionals directly involved in the care for mothers and newborns during labour, delivery, and post-partum periods and mothers and newborns in any health care settings.

Intervention

The intervention we considered for this review was the utilization of the WHO safe childbirth checklist by health professionals.

Comparator

The comparator considered for this review was labouring mothers and newborn care without WHO safe childbirth or any other structured checklist.

Outcomes:

The outcomes considered for this review were the incidence of early neonatal death, stillbirth and maternal death.

Early neonatal death (END): Death of newborn within seven days of delivery.

Stillbirth: Intrapartum foetal death after the admission of the patient for labour and delivery. Studies that included foetal death before admission of the patient to a health facility were excluded. For this review, we defined perinatal death as intrapartum stillbirth and newborn death within seven days of delivery

Maternal death: the death of mothers caused by obstetric related events within the health facilities.

Maternal morbidity: blood transfusion, hysterectomy, maternal sepsis, postpartum bleeding, and maternal seizure.

Types of studies

This review considered all studies with comparative designs, such as randomized controlled trials (RCTs), and, before and after studies published from 2008 to November 11/2019(the day literature search was done) in English. This date range was selected because the WHO safe childbirth checklist was introduced in 2008 ².

Search strategy

An initial limited search of MEDLINE was undertaken, followed by an examination of the text words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles. A second search using all identified keywords and index terms was then undertaken across all included databases. Thirdly, the reference list of all identified reports and articles was searched for additional studies. The data basis searched were: MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL), met-Register of Controlled Trials (m-RCT) (www.controlled-trials.com), ClinicalTrials.gov (www.clinicaltrials.gov) and the WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictrp/search/en). Likewise, a search for grey literature was conducted using Google Scholar, Open-Grey (System for Information on Grey Literature in Europe) (www.opengrey.eu/), and WHO websites. A detailed search strategy for MEDLINE was provided in a supplementary file (S1 table).

Study selection

Following the search, all identified citations were loaded into EndNote, and duplicates were removed. Two independent reviewers screened titles and abstracts for assessment against the inclusion criteria for the review. The full texts of potentially eligible studies were retrieved and assessed in detail against the inclusion criteria by two independent reviewers.

Assessment of methodological quality

Eligible studies were critically appraised by two independent reviewers for methodological quality, using Cochrane risk of bias assessment tool from Rev man ⁸. All disagreements that arose were resolved through discussion and, there was no requirement for a third reviewer. All studies regardless of the results of their methodological quality were undergone data extraction, and the results of critical appraisal were reported in narrative form and a table.

Data extraction and synthesis

We extracted data using the Rev Man version 5.3. The relevant information such as population characteristics, authors, study setting, study design, publication year, interventions, and summary of the findings was extracted. Where necessary, we asked primary authors to provide additional information on the articles. Studies were pooled in a statistical meta-analysis using Rev Man version 5.3. Effect sizes were expressed as odds ratios (for dichotomous data), and their 95% confidence intervals were calculated for analysis. We assessed heterogeneity statistically using the Tau² and I² tests. We considered I² tests above 50% as indicative of significant heterogeneity. Besides, the statistical heterogeneity among studies was checked in terms of study settings, sample size, and study design. We conducted leave out analyses by excluding studies with very large or very low effect estimates and different study designs. Also, we compared the random and fixed-effects model, and the decision was made based on the best-fitting model to the data ⁹.

The certainty of the quality of evidence was assessed using a software package (Grade pro) developed by

the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) ¹⁰, group for the following outcomes: neonatal death, stillbirth, and maternal death.

RESULTS

The search yielded a total of 458 records. After removing duplicates, 130 documents were retained for further examination. After screening the titles and abstracts, 9 papers were retained for full-text review. Based on pre-defined inclusion criteria, five records were included in the systemic review.

From four studies excluded by reason, two (Delaney et al 2017 ¹¹ and Kara et al 2017 ¹²) reported on the impact of peer coaching on adherence to WHO SCC and one study (Patabendige, M and Senanayake, H. 2018 ¹³) reported effects of Sri-Lanka context-specific modified WHO Safe Childbirth Checklist on adherence to WHO SCC. One cross-sectional

study was excluded because of the non-comparative nature of the study (Patabendige, M and Senanayake, H. 2015 ¹⁴).

Characteristics of included studies

All the five studies included compared WHO SCC use to none use of WHO SCC. Among the five studies included in this review, Varghese et al(6) and Semrau et al ¹⁵, reported on the finding of a randomized cluster trial conducted in India. Also, another two pre-and-post intervention studies were conducted in India (Spector et al. 2012 ³, and Varaganti et al. 2018 ⁴). One pre-and-post intervention studies was conducted in Namibia (Kabongo et al. 2017 ¹⁶. One study was conducted at a tertiary health facility (Varaganti et al 2018 ⁴) whereas two (Kabongo et al. 2017 ¹⁶, and Varghese et al. 2019 ⁶) at the district health facility, the other two studies (Semrau et al. 2017 ¹⁵ and Spector et al. 2012 ³) at the subdistrict health facility (Table 1).

Table 1: Characteristics of included studies.

Study ID.	Study design	Setting/country.	Participants	Number of participants in Intervention (WHO SCC)/comparison (Without WHO SCC) groups	Outcomes
Kabongo et al 2018(16)	pre-and-post intervention.	District hospital /Namibia	Labouring mothers and newborns.	Intervention: 1526 Comparasion:1401	Perinatal outcome.
Semrau et al 2017(15)	Cluster randomized.,	Subdistrict hospital and primary and community health centers/India.	Labouring mothers and newborns.	Intervention: 1048 Comparasion:1090	perinatal outcome, maternal death, and morbidity.
Spector et al 2012(3)	pre-and-post intervention.	Subdistrict hospital /India.	Labouring mothers and newborns.	Intervention: 639 Comparasion:405	Perinatal outcome. Maternal death.
Varaganti et al. 2018(4)	pre-and-post intervention	Tertiary hospital /India.	Labouring mothers and newborns.	Intervention: 620 Comparasion:635	Maternal death. Perinatal outcome.
Varghese et al., 2019(6)	Cluster -randomized.	District/secondary level facility/India	Labouring mothers and newborns.	Intervention: 77231 Comparasion:59800	-Stillbirth. -Early neonatal death.

The methodological quality of the included studies Five of the Included studies were judged to be risk for allocation concealment, whereas three and two of included studies were judged to be high and low risk for random allocation respectively (Fig 1).

Allocation

There is no central allocation in five of the included studies. Two studies were cluster-randomized (Varghese et al. 2019⁶ and Semrau et al. 2017¹⁵),. Three studies pre-and-post intervention studies (Kabongo et al. 2017¹⁶, Spector et al. 2012³ and Varaganti et al. 2018⁴) (Fig 1).

Incomplete outcome data (Attrition Bias)

Five of the included studies were at low risk of attrition bias (Fig 1).

Blinding of participants (performance Bias)

Blinding of health professionals is not possible in all studies as it involves training and introduction of the checklist. Still, two of the studies are cluster randomized with similar data collection for both control and intervention facilities (Varghese et al. 2019⁶ and Semrau et al. 2017¹⁵). Three studies collected data by observation of health workers practice which might have introduced hawthorn effect Kabongo et al. 2017¹⁶, Spector et al. 2012³, and Varaganti et al 2018⁴) (Fig 1).

Blinding of outcome assessment

Data collectors didn't know intervention and control facilities in two studies (Varghese et al. 2019⁶ and Semrua et al. 2017¹⁵). In two studies data collectors were not blinded but used a pre-defined checklist and unlikely to affect the outcome of the study (Kabongo et al. 2017¹⁶, and Spector et al. 2012³). However, investigators were involved in data collection in Kabongo et al. 2017¹⁶ study and data collection methods not reported by Varaganti et al. 2018⁴ (Fig 1).

Selective reporting (reporting bias)

Four studies used a pre-defined data collection protocol, and all outcomes of interest were reported. One study didn't use a clear study protocol (Varaganti et al. 2018⁴) (Fig 1).

Other potential sources of bias

Two cluster-randomized studies considered design effect during a sample size calculation, had a control group, and had similar baseline similarity in terms of health professionals (Varghese et al. 2019⁶ and Semrua et al. 2017¹⁵). Three of the studies were pre-and-post-intervention without a control group and didn't consider the design effect. Still, all had similar baseline health professionals (Kabongo et al. 2017¹⁶, Spector et al. 2012³, and Varaganti et al. 2018⁴) (Fig 1).

	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Random sequence generation (selection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Kabongo 2017	-	-	-	-	+	+	-
Semrau 2017	-	+	+	+	+	+	+
Spector 2012	-	-	+	-	+	+	+
Varaganti 2018	-	-	?	-	+	?	-
Varghese 2019	-	+	+	-	+	+	+

Fig 1: Risk of bias summary: review authors' judgments about each risk of bias item for each included study.

REVIEW FINDINGS

1. Stillbirth

Utilization of WHO SCC by health professionals reduces fresh stillbirth by 8% compared to none use of WHO SCC (OR 0.92, 95% CI 0.87-0.96, I²= 0%, five studies, 299,952 participants, moderate quality of evidence) (Fig 2).

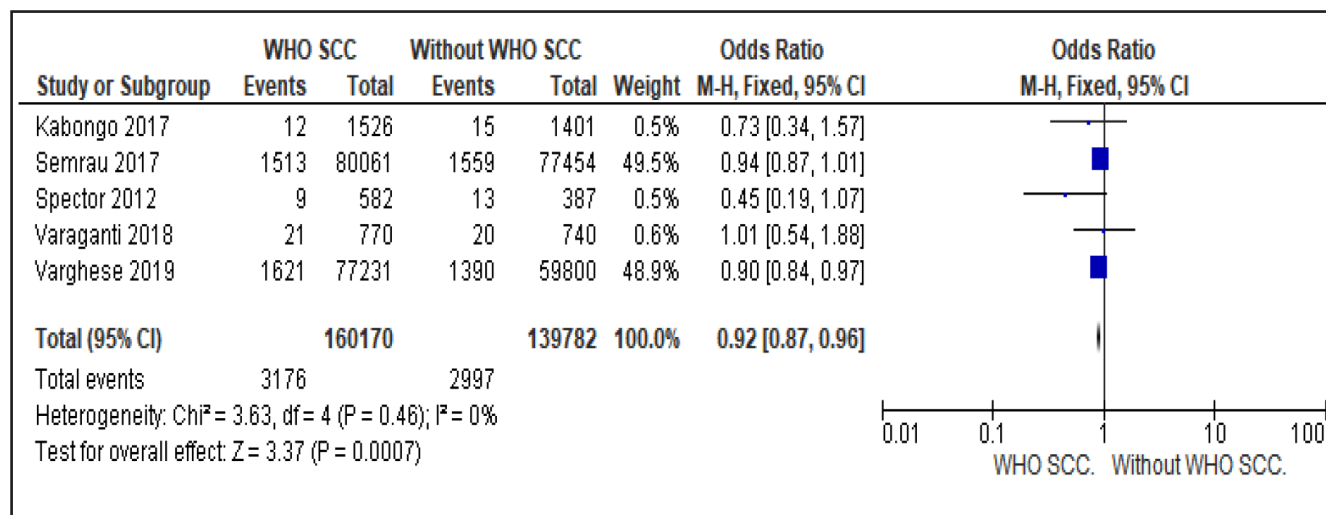


Fig 2: Forest plot of comparison: 1 WHO SCC use and None use., outcome: 1.6 Stillbirth.

2. Early neonatal death

There is no statistically significant difference in early neonatal death with or without WHO SCC utilization (OR 1.07, 95% CI 0.88-1.28, I² = 50% five studies, 293,467 participants, very low quality of evidence). Random effect meta-analysis was utilized for this outcome because of heterogeneity (I² = 50%) (Fig 3).

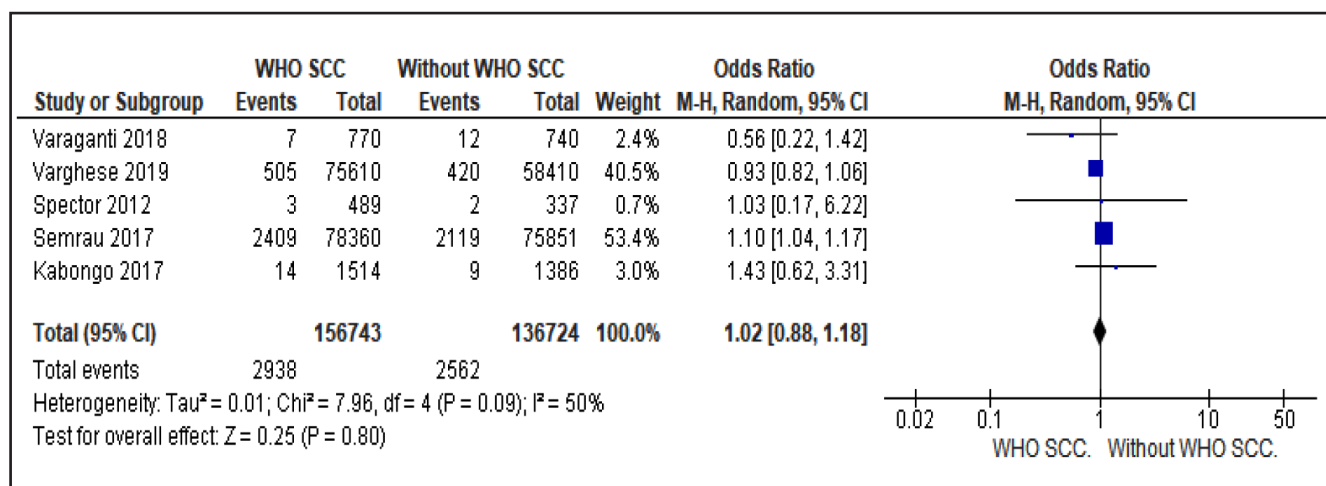


Fig 3: Forest plot of comparison: 1 WHO SCC use and None use., outcome: 1.7 Early neonatal death.

3. Maternal death

There is no statistically significant difference in maternal death with or without WHO SCC utilization (OR 1.06, 95% 0.77-1.57, I² = 0% three studies, 159,934 participants, low quality of evidence) (Fig 4).

4. Maternal morbidity

One study (Semrau et al 2017 (15)) reported that WHO SCC utilization has no statistical significant impact on maternal seizure (OR 0.93, 95% 0.66-1.30), PPH (OR 0.94, 95% 0.91-0.98), maternal sepsis (OR 1.02, 95% 0.98-1.07), peri partum hysterectomy (OR 1.02, 0.54-1.95) and blood transfusion (OR 0.99, 0.89-1.11).

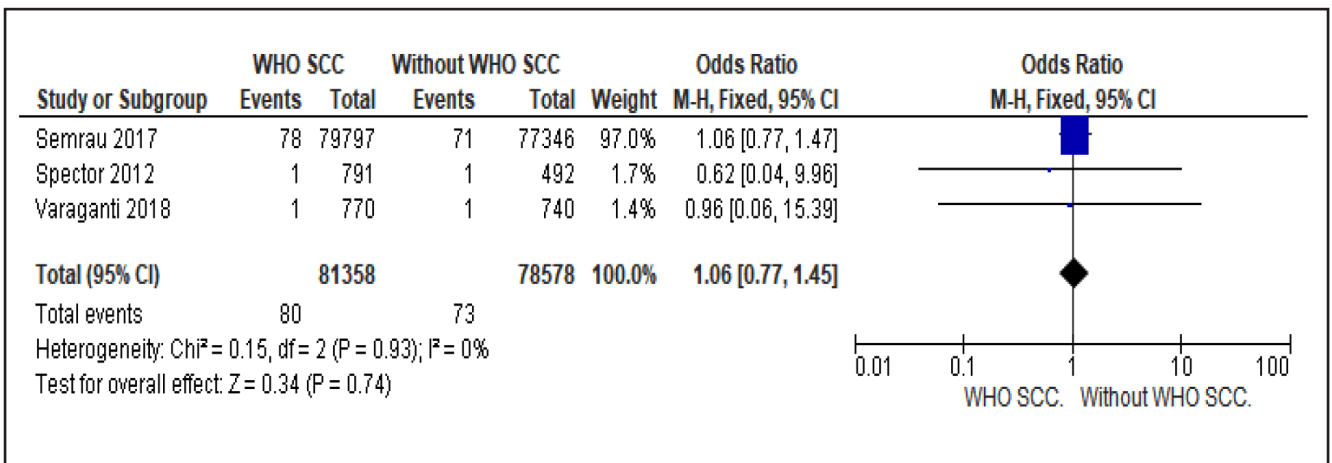


Fig 4: Forest plot of comparison: 1 WHO SCC use and None use. Outcome: 1.7 Maternal death.

Methodological quality was assessed for three of the outcomes using the GRADE approach (Shown in table 2 below). The outcome stillbirth was assigned moderate-quality evidence scores. The outcome maternal death was assigned low-quality evidence scores, where-as early neonatal death outcome was assigned very low-quality evidence scores (Table 2).

Table 2: Summary of Finding (SOF) table

Summary of Findings (SOF)

WHO SCC compared to Usual care without WHO SCC for laboring mothers and newborn evaluation and management

Patient or population: health professionals, laboring mothers, and newborns.

Setting: sub-district, district, and tertiary health care.

Intervention: WHO SCC

Comparison: Usual care without WHO SCC

Outcomes	Anticipated absolute effects*		Relative effect (studies)	No. of participants evidence(GRADE)	The certainty of the
	(95% CI) The risk with Usual care without WHO SCC	(95% CI) The risk with WHO SCC			
Still birth.	21 per 1,000	20 per 1,000 (19 to 21)	OR 0.92 (0.87 to 0.96)	299952 (5 RCTs)	⊕⊕⊕○ MODERATE ^a
Early neonatal death	19 per 1,000	20 per 1,000 (19 to 21)	OR 1.07 (1.01 to 1.13).	293467 (5 RCTs)	⊕○○○ ^c VERY LOW ^{a, b,}
Maternal death.	1 per 1,000	1 per 1,000 (1 to 1)	OR 1.06 (0.77 to 1.45)	159936 (3 RCTs)	⊕⊕○○ LOW ^{c, d}

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio; RR: Risk ratio

GRADE Working Group grades of evidence

High certainty: We are very confident that the actual effect lies close to that of the estimate of the impact

Moderate certainty: We are moderately confident in the effect estimate: The real impact is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The actual impact may be significantly different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The exact result is likely to be substantially different from the estimate of effect

Explanations

a. Two clusters -randomized, three pre-and-post intervention studies were included. Downgraded one level for risk of bias of included studies.

b. Lowered one level for inconsistent outcomes across studies.

c. Wide and statistically non-significant confidence interval.

d. One cluster-randomized trial and two pre-and -post-intervention studies were included. Downgraded one level for risk of bias of included studies.

DISCUSSION

This systematic review attempted to locate available evidence on the impact of WHO SCC utilization on maternal and perinatal deaths. Studies included in the review were two cluster randomized trials and three pre-and-post intervention studies. The studies did not undergo proper random allocation and allocation concealment and were judged to be at high risk of bias because of poor design.

Moderate quality of evidence indicates that utilization of WHO SCC by health professionals reduces fresh stillbirth by 8% compared to none use of WHO SCC. Five studies reported on the outcome still birth. Fixed effect meta-analysis was employed since the studies were homogenous and consistent.

Low quality of evidence indicates that the utilization of WHO SCC has no impact on maternal death. Only three studies reported on the outcome maternal death and fixed effect meta-analysis was used to pull studies together. Further studies are needed as only three primary studies were combined which might not reveal small changes since maternal death is a rare event. Very low quality of evidence indicates that the utilization of WHO SCC has no impact on early neonatal death. Five studies reported on the outcome early neonatal death. We used random effect meta-analysis to pull studies together because of moderate heterogeneity of included studies. Besides, moderate heterogeneity with $I^2 = 50\%$, the primary studies included are of poor-quality mandating further well-designed studies.

Only one randomized cluster study (Semrau et al. 2017¹⁵) reported that WHO SCC utilization has no statistically significant impact on maternal seizure, PPH, maternal sepsis, peripartum hysterectomy, and blood transfusion. This mandates further study to provide evidence on the impact of WHO SCC on maternal morbidity reduction. In this review the extent and quality of utilization of the checklist by professionals was not assessed which might be one reason creating difference in effects between early neonatal death and still birth. Additionally, the studies reporting on outcome early neonatal death were heterogenous and of poor quality. However,

the review highlights the need to use structured checklist (WHO safe childbirth checklist) for intrapartum follow up of labour and delivery.

CONCLUSIONS

Implications for practice

WHO SCC was effective in reducing stillbirth. Moderate quality of evidence indicates that WHO SCC reduce stillbirth, whereas low and very low quality of evidence suggests that WHO SCC has no impact on maternal and early neonatal death, respectively. A lot of things might contribute to perinatal and maternal death. Therefore, it is imperative to contextually modify the checklist (WHO safe childbirth checklist) to address major events contributing to intrapartum maternal death, still birth and early neonatal death.

Implications for research

Number of included studies were limited and of poor quality. The evidence regarding the effect of utilizing WHO SCC on early neonatal death has moderate heterogeneity and only three studies reported on maternal death. Hence, further well-designed studies with modified checklist are needed to provide evidence on WHO SCC's impact on the maternal and perinatal death.

List of abbreviations

END: Early Neonatal Death

GRADE: Grading of Recommendations, Assessment, Development, and Evaluation

OR: Odds Ratio

RCT: Randomized Controlled Trials

SCC: Safe Childbirth Checklist

SOF: Summary of Finding

WHO: World Health Organization.

DECLARATIONS

Ethics approval and consent to participate

Not applicable

Consent to publish

Not applicable

Availability of data and materials

The datasets used and/or analysed is contained within the manuscript and available from the corresponding author on reasonable request.

COMPETING INTERESTS

The authors declare no conflict of interest in this review.

FUNDING

Authors did not get any funding support from any organization for this systematic review.

AUTHORS' CONTRIBUTION

All authors have read and approved the manuscript

Conceptualisation : LBT, TU, BN

Data curation : LBT, TU, BN

Formal analyses : LBT, TU, BN

Funding acquisition : NA.

Investigation : LBT, TU, BN

Methodology : LBT, TU, BN

Project administration : LBT, TU, BN

Ressources : LBT, TU, BN

Software : LBT, TU, BN

Supervision : LBT, TU, BN

Validation : LBT, TU, BN

ACKNOWLEDGMENTS

We are thankful to Saint Paul's Hospital Millennium Medical College centre of excellency for reproductive health (SP HMMC COE) for coordinating training on systematic review.

CORRESPONDING AUTHOR

Lemi Belay, MD

Department of Obstetrics and Gynecology, St. Paul's
Hospital Millennium College

Email: lemi.belay@gmail.com

REFERENCES

1. Simon JL, Daelmans B, Boschi-Pinto C, Aboubaker S, Were W. Child health guidelines in the era of sustainable development goals. *The BMJ*. 2018;362 %U <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6081993/>.
2. WHO | WHO Safe Childbirth Checklist [updated 2019/08/09/12:21:32. Available from: <http://www.who.int/patientsafety/topics/safe-childbirth/childbirth-checklist/en/files/642/en.html>.
3. Spector JM, Agrawal P, Kodkany B, Lipsitz S, Lashoher A, Dziekan G, et al. Improving quality of care for maternal and newborn health: prospective pilot study of the WHO safe childbirth checklist program. *PloS one*. 2012;7(5):e35151.
4. Varaganti N, Sangabathula H, Guthi VR. Effectiveness of safe child birth checklist on maternal and perinatal outcomes in tertiary level hospitals. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2018.
5. Kara N, Firestone R, Kalita T, Gawande AA, Kumar V, Kodkany B, et al. The BetterBirth Program: pursuing effective adoption and sustained use of the WHO Safe Childbirth Checklist through coaching-based implementation in Uttar Pradesh, India. *Global Health: Science and Practice*. 2017;5(2):232-43.
6. Varghese B, Copas A, Kumari S, Bandyopadhyay S, Sharma J, Saha S, et al. Does the safe childbirth checklist (SCC) program save newborn lives? Evidence from a realistic quasi-experimental study, Rajasthan, India. *Maternal health, neonatology and perinatology*. 2019;5:3.
7. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*. 2009;6(7 %U <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2707599/>).
8. Higgins JP, Green S. *Cochrane handbook for systematic reviews of interventions*: John Wiley & Sons; 2011.
9. Tufanaru C, Munn Z, Stephenson M, Aromataris E. Fixed or random effects meta-analysis? Common methodological issues in systematic reviews of effectiveness. *International journal of evidence-based healthcare*. 2015;13(3):196-207.
10. GRADEpro G. GRADEpro guideline development tool [software]. McMaster University. 2015;435.
11. Delaney MM, Maji P, Kalita T, Kara N, Rana D, Kumar K, et al. Improving adherence to essential birth practices using the WHO safe childbirth checklist with peer coaching: experience from 60 public health facilities in Uttar Pradesh, India. *Global Health: Science and Practice*. 2017;5(2):217-31.
12. Kara N, Firestone R, Kalita T, Gawande AA, Kumar V, Kodkany B, et al. The BetterBirth Program: Pursuing Effective Adoption and Sustained Use of the WHO Safe Childbirth Checklist Through Coaching-Based Implementation in Uttar Pradesh, India. *Global health, science and practice*. 2017;5(2):232-43.
13. Senanayake HM, Patabendige M. Piloting of WHO Safe Childbirth Checklist using a modified version in Sri Lanka. 2018;11(1):896.
14. Patabendige M, Senanayake H. Implementation of the WHO safe childbirth checklist program at a tertiary care setting in Sri Lanka: a developing country experience. *BMC pregnancy and childbirth*. 2015;15:12.
15. Semrau KE, Hirschhorn LR, Marx Delaney M, Singh VP, Saurastri R, Sharma N, et al. Outcomes of a coaching-based WHO safe childbirth checklist program in India. *New England Journal of Medicine*. 2017;377(24):2313-24.
16. Kabongo L, Gass J, Kivondo B, Kara N, Semrau K, Hirschhorn LR. Implementing the WHO Safe Childbirth Checklist: lessons learnt on a quality improvement initiative to improve mother and newborn care at Gobabis District Hospital, Namibia. *BMJ open quality*. 2017;6(2):e000145.

Supporting information

S1 Table: Search strategy for the MEDLINE database. It indicates a detailed search strategy for PubMed.

S2 Table: PRISMA checklist. It describes the review against the checklist for the PRISMA reporting guideline.