

The growing use of the WHO Safe Childbirth Checklist: Lessons learned at the Yaounde Gyneco-Obstetric and Pediatric Hospital, Cameroon

Julius Sama DOHBIT

Universite de Yaounde I

Namanou Ines Emma WOKS (✉ emmawoks@gmail.com)

Hopital gyneco-obstetrique et pediatrique de Yaounde <https://orcid.org/0000-0003-3793-6737>

Carlin Héméry KOUDJINE

Universite de Yaounde I

Willy TAFEN

Hopital gyneco-obstetrique et pediatrique de Yaounde

Pascal FOUMANE

Universite de Yaounde I

Lucienne BELLA ASSUMPTA

Hopital gyneco-obstetrique et pediatrique de Yaounde

Rosemary Nkemdilim OGU

University of Port Harcourt

Fru Fobuzshi ANGWAFO III

Hopital gyneco-obstetrique et pediatrique de Yaounde

Research article

Keywords: Checklist, childbirth, eclampsia, maternal, complications

Posted Date: April 9th, 2020

DOI: <https://doi.org/10.21203/rs.2.14441/v4>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published at BMC Pregnancy and Childbirth on July 8th, 2021. See the published version at <https://doi.org/10.1186/s12884-021-03966-4>.

Abstract

Background: Safe childbirth remains a daunting challenge, particularly in low middle income countries, where most pregnancy-related deaths occur. Cameroon's maternal mortality rate, estimated at 529 per 100,000 live births in 2017 is significantly high. Adherence to essential birth practices by birth attendants is key to improving pregnancy outcomes. The WHO Safe Childbirth Checklist (SCC) was designed as a tool to improve the quality of care provided to women giving birth. It was implemented at the Yaounde Gynaeco-Obstetric and Paediatric Hospital in order to improve quality of care. The purpose of this study was to determine the adoption rate of the SCC and its association with maternal (eclampsia, perineal tears, post-partum haemorrhage) and neonatal (foetal death, neonatal asphyxia and neonatal death) complications, six months after introduction at the maternity.

Methods: A retrospective study was conducted from January – June 2018. Six months was chosen because research conducted on the SCC in India showed that adherence to essential birth practices was optimal within this period. Data collection sheets were used to document information from delivery records. The Chi square test was used to compare categorical variables, while the student's T test was used to compare continuous variables.

Results: Out of 1611 deliveries conducted, only 1001 records could be traced, giving 38% of missing data. Twenty-five records were excluded. During the study period, checklists were used in 828 clinical notes, giving an adoption rate of 84.8%. Fewer cases of severe pre-eclampsia/eclampsia were associated with the use of SCC (2.1% Vs 5.4%, $p = 0.017$). The difference in the proportion of perineal tears, post-partum haemorrhage, stillbirths, neonatal asphyxia and neonatal deaths observed between the checklist and non-checklist groups was not statistically significant.

Conclusion: Our results suggest that the SCC program is a cost effective intervention that could potentially reduce maternal mortality and morbidity, most of reduction coming from prevention of severe pre-eclampsia, eclampsia in low-middle income countries.

Background

Achieving the desired reduction in global maternal mortality rate to less than 70 per 100,000 live births is at the top of the 2030 Sustainable Development Goals' (SDG) healthcare targets [1]. Maternal mortality is a global health problem of great importance, as the World Health Organization (WHO) reported 295 000 deaths in 2017, ascribed to pregnancy and childbirth complications [2]. Majority of these women died in Low-Middle Income Countries (LMIC) of preventable causes. Moreover, for each maternal death case, many more women experience life-threatening complications or Severe Maternal Morbidity (SMM) [3]. Cameroon's Maternal Mortality Ratio (MMR), estimated at 529 per 100,000 live births in 2017 is still unacceptably high [4]. More than 50% of these deaths are due to haemorrhage, hypertensive disorders, and sepsis [5,6].

The main factors responsible for SMM and preventable maternal deaths are; limited access to care, poor quality services and poverty [7]. A multi-country study conducted in LMIC reported that closing the quality gap would produce substantial benefits in maternal and neonatal health at current levels of access and utilization of healthcare services [8]. Therefore, reducing maternal mortality and morbidity in Cameroon hinges on identifying and improving services that are critical to the health of women and girls, including; Antenatal Care, Emergency Obstetric and new-born Care (EmONC), quality healthcare before, during and after childbirth and family planning services [9–12]. However, evidence from a study done in Sub-Saharan Africa indicates that there exists a gap between practice by healthcare providers and WHO-recommended interventions in women experiencing SMM and mortality [13].

Poor quality of care (QoC) can occur because of the know-do gap, whereby healthcare providers' actions diverge from knowledge of evidence-based recommendations [14,15]. According to the WHO, inadequacies in QoC provided in hospitals is responsible for poor progress maternal and neonatal health indicators despite increased geographical coverage [16]. Consequently, maternity services need to ensure standard QoC in order to achieve expected health outcomes in women and their new-borns [17]. Identifying and instituting cost-effective interventions that can improve the quality and safety of childbirth is beneficial. Facility-based checklist interventions have been successfully used to help practitioners translate recommendations into high-quality patient care [18].

This WHO Safe Childbirth Checklist (SCC) is a facility-based reminder tool comprised of 29 essential birth practices, which target major causes of maternal deaths, stillbirths and neonatal deaths [19]. The SCC was designed to help health workers adhere to evidence-based practices associated with improved maternal and neonatal outcomes at critical moments of delivery [20]. It is arranged into four pause points (or moments of care); on admission, just before pushing or caesarean, within one hour after birth, and shortly before discharge. The BetterBirth trial in India reported an increase in providers' adherence to essential birth practices after two months of peer coaching in primary level facilities [21]. Moreover, another study conducted in India also showed significant improved adherence to practices, six months post-training in the intervention arm [22].

Maternal and neonatal mortality rates are key indicators of the health system's strength [23]. The institution of strategies which have proven potential to increase adherence to essential birth practices is necessary to prevent pregnancy-related complications and deaths in health facilities. The SCC was recently introduced at the Gynaecology and Obstetrics service of the Yaoundé Gynaeco-Obstetric and Paediatric Hospital (YGOPH). This study assessed the utilization frequency of the SCC at YGOPH and its association with obstetric and neonatal complications during the six-month period following its introduction and training.

Methods

Aim of the study

- **Primary Objective**

To determine the frequency of the SCC's use and its association with maternal and neonatal complications at the Yaoundé Gynaeco-Obstetric and Paediatrics Hospital (YGOPH), Cameroon.

- **Primary Outcome measure**

Frequency of the SCC's use and its association with maternal (eclampsia, perineal tears, post-partum haemorrhage) and neonatal (intrapartum foetal death, neonatal asphyxia and neonatal death) outcomes. This was censored at six months after introduction of the checklist at the maternity of the YGOPH, Cameroon.

- **Secondary Objectives**

To evaluate the completion rate of the SCC during the first six months of implementation at the YGOPH, Cameroon.

- **Secondary Outcome measure**

The completion rate of checklists used, censored at the sixth month of implementation.

Study design

We carried out a retrospective study at the Gynaecology and Obstetrics Service of the YGOPH.

Study setting

Cameroon has a pyramidal health system. The YGOPH is at the top of the pyramid as a tertiary referral hospital specialized in maternal and child care. It has one of the busiest maternities in the country, with over 3 000 deliveries done yearly, amongst which 32% are caesarean births.

The Gynaecology and Obstetrics service has three units: two inpatient units (maternity and inpatient Gynaecology) and one ambulatory Gynaecology unit. This service had 11 Gynaecologists/Obstetricians, one General Practitioner and 56 nursing staff during the study. Vaginal births are conducted at the maternity unit, and it is comprised of 13 admission beds.

Of the nursing staff, 20 are posted to the maternity. They are; 16 Skilled Birth Attendants (SBA), one nurse specialized in reproductive health, one State Registered Nurse (SRN), one Nursing Assistant (NA) and one Certified Nurse (CN). Two of these (a SRN and a SBA) are unit heads at the maternity.

The characteristics of participants

Inclusion criteria

All patients who gave birth at the YGOPH from January to June 2018 with delivery records or clinical notes at the archives of Gynaecology and Obstetrics Service were assessed for eligibility. The *clinical note or delivery record* is the primary tool used to document care, communicate plans and provide guidance for follow-up treatment and care of a patient.

Exclusion criteria

- Women with incomplete clinical notes (without the delivery route mentioned)
- Delivery records of women who delivered in other facilities and were referred to YGOPH in post-partum
- Women admitted in the maternity for observation or medical reasons (malaria in pregnancy, urinary infection in pregnancy, threatened preterm labour) without ensuing delivery
- Women referred from YGOPH to other institutions to give birth
- Women who gave birth \leq 22 weeks of gestation

Procedure

Implementation of the SCC

The management of the Gynaecology and Obstetrics Service introduced the SCC program mid December 2017. An illustrative presentation was done by an Obstetrician, to the Gynaecology and Obstetrics service staff, at the monthly service meeting on using the SCC as part of care delivery. Pilot testing of the SCC later started at the maternity. The nursing staff of the maternity used the SCC, during the pilot phase, from December 2017 to February 2018 under supervision of the two maternity unit heads daily and the chiefs of service weekly.

The official launching of the SCC was done at a seminar organized during the first week of March 2018. During this one day workshop, a refresher course was done on using the checklist and modifications to the safe childbirth checklist were proposed. The modified SCC 29-items, but the criterion for administration of antibiotics in premature rupture of membranes was changed from more than 18 hours to above six hours. However, only one was retained. After this seminar, the maternity unit heads attached the SCC to existing and new delivery records of individual patients. After this seminar, supervision continued daily by the unit heads and weekly by the hospital nursing directors.

Data collection tools

We collected the following information from the patients' clinical notes:

- Identification: code, age, place of residence
- Past history: obstetric, surgical, medical
- Completion rate of the checklist for each parturient and new-born
- Clinical notes with used checklists and without used checklists
- Obstetric and neonatal complications

Statistical analysis

This was done using the SPSS version 23.0 software. The association between qualitative variables expressed in frequencies and percentages was investigated using the Chi square or Fisher's exact test. The student's T test and Mann Whitney tests were used to investigate the association between quantitative variables. Multivariate analysis was done using binary logistic regression to eliminate potential confounders in the association between the utilization of the checklist and birth outcomes. Results were considered statistically significant at $P < 0.05$.

Ethics approval and consent to participate

After obtaining administrative authorization and ethical approval from the Institutional Review Board of YGOPH, we began the study. Data collection was done with strict respect of the principle of confidentiality. The rationale of the study was clearly explained to every staff with consent obtained. The identity of every participant was concealed through consecutive numbering.

Results

The mean age of our study population was 28 ± 6 years, ranging from 15 to 44 years. The most represented age group was 25-29 years. Majority of our population was multiparous. (See Table 1) Three peripartum pathologies were common in the medical history of parturients: hypertension, gestational diabetes and postpartum haemorrhage. The most frequent was hypertension. (See Table 1) Caesarean sections were the most frequent surgical procedures previously performed on women. The proportion of caesarean records without used checklists was greater than corresponding proportion of vaginal birth records. (See Table 3)

There were a total 1611 births during the study period. However, only 1001 records could be traced, giving 38% of missing data. Twenty-five records were excluded: seven abortions, nine pregnancy-related pathologies discharged before childbirth and nine cases referred to other facilities. During the study period, 828 records contained used checklists, giving an adoption rate of 84.8%. (See Table 2) Furthermore, there was an increase in adoption rate over time, with a peak at 93.9% in May and June. We documented the highest proportion of clinical notes with unused checklists in January and February.

The completion rate of the SCC's pause points; just before pushing (or before caesarean) and within one hour after birth was low from the January to May (consistently below 10%). However, from May to June, this value increased. The other two pause points; on admission and before discharge were completed in over 60% of used checklists during the first five months.

Of 976 delivery records retained, the YGOPH registered 149 patients with maternal complications during the study. Amongst which, 25 were cases of severe pre-eclampsia/eclampsia, 42 had Acute Foetal Distress (AFD), 65 got perineal tears and seven presented with Post-Partum Haemorrhage (PPH). The difference in proportion of maternal complications between checklists and non-checklists cases was not statistically significant. (15.3% Vs 14.9%, $p = 0.883$) (See Table 3) Further monthly analysis revealed that the percentage of adverse maternal outcomes rose during the first four months from 7.2% to 20.7% and then dropped to 6.9% during the last two months amongst cases with filled checklists. (See Figure 1) A significant reduction in the onset of severe pre-eclampsia/eclampsia was associated with the use of checklists (2.1% Vs 5.4%, $p = 0.017$). Conversely, there was no significant difference between the checklist and non-checklist categories for patients with AFD, perineal tears and PPH. Table 4 shows a multivariate analysis of socio-demographic and clinical history of patients along with adjusted odds ratios and fewer severe pre-eclampsia/eclampsia cases associated with adoption of the SCC intervention.

Figure 2 highlights the frequency of neonatal complications encountered during the study and its association with the SCC's use. Amidst the 98 clients with adverse foetal and neonatal outcomes, 40 (4.1% of births) had stillbirths, 45 (4.6%) developed neonatal asphyxia, while three (0.3%) died within the first 48 hours of life. Stillbirth, neonatal asphyxia and neonatal death rates were not statistically different between checklist and non-checklist groups. (See Figure 2)

Discussion

In our study, the mean adoption rate of the SCC over a six-month period was 84.8% (828/976 files). This value is twice as high as the adoption rate (45.8%) reported in a tertiary care setting in Sri Lanka during a two-month prospective observational study, conducted in 2013 [24]. According to table 2, there are approximately 370 deliveries conducted in two months by a staff of 20, meanwhile at De Soysa Women's Hospital (DSWH), in Sri Lanka, this ratio of births to number of workers is significantly higher. Therefore, the greater workload and short duration of study at the DSWH could have contributed to this difference in adoption rates.

Our evaluation study found that the SCC-based intervention at the YGOPH is associated with a statistically significant difference (2.1% Vs 5.4%, $p = 0.017$) in cases of severe pre-eclampsia/eclampsia between checklist and non-checklist groups. As concerns the mechanism by which this occurred, a quasi-experimental study done in Rajasthan, India from 2013 – 2015 observed a positive behavioural change in health care providers associated with the implementation of the SCC. The greatest difference (64%) was reported in early identification, management and timely referral of cases of pre-eclampsia [25].

However, the Better-Birth study, a cluster-randomized, controlled trial in Uttar Pradesh, India, found no significant impact of the SCC intervention on maternal morbidity or mortality [26]. It is important to highlight the fact that although both studies are based on the SCC, they differ in some key aspects. The Better-Birth study facilities were a combination of primary health care facilities and community health centres, whereas ours is a tertiary-level facilities with better infrastructure and human resource capacity.

Figure 1 shows a progressive decline in the proportion of maternal complications with the use of the SCC overtime. Checklists were attached to clinical notes. The percentage of adverse maternal outcomes dropped to 6.9% during the last two months amongst cases with filled checklists. As described in previous studies, the use of the SCC with regular coaching or supervision improves adherence to essential birth practices, thereby resulting in fewer complications when providers have adequate skills alongside availability of supplies [21,22].

Stillbirth, neonatal asphyxia and neonatal death rates were not statistically different between checklist and non-checklist groups, as shown in figure 2. Non-adherence to the following essential birth practices [27,28](See table 5), such as those least checked in our study (confirming if mother needed to start antibiotics during labour or after delivery, seeking an assistant during labour, checking the availability of mother and baby's essential delivery supplies, abnormal bleeding control after birth, early breastfeeding, baby's referral, special care, monitoring and the new-born's need for antibiotics) affect quality of care and consequently neonatal outcomes [16].

Study limitations

This is a retrospective study. We had no influence on the quality of data entered into the delivery records. However; measure taken to minimize this limitation was comparison with data in delivery registers and service reports. The study was only carried out in one facility because it was a pilot research work.

Only 1001 delivery records out of 1611 could be traced during the study period, giving 38% of missing data. We currently have a paper-based archiving system and one of the limitations associated with this is the occasional losses of files in the patient record circuit. However, the hospital is in the process of computerizing medical records, so this problem will be short lived.

The most obvious consequence of the convenience sampling method used is sampling bias. As a result, our sample is not representative of the general population of women who gave birth at our facility. The minimum sample size was attained; therefore the results are sufficiently powered to detect precise associations and differences between the groups studied. Since, the main aim of this study was to compare outcomes in cases where the checklist was used and not used; the sampling bias doesn't affect the quality of our results and conclusions [29].

Conclusion

Increasing utilization of the checklist was confirmed and maternal morbidity significantly reduced overtime, mainly through the prevention of eclampsia. The latter indicates the use of the childbirth checklist as an indicator of quality performance in maternal and reproductive health. From the positive results obtained, we intend to continue using this this reminder tool and get other health facilities on board.

Perspectives

The hospital is transitioning to electronic medical records which will help in better archival and resolve some of the shortcomings above.

List Of Abbreviations

EBP: Essential Birth Practices, **HGOPY/YGOPH:** Yaounde Gynaeco-Obstetric and Paediatric Hospital, **LMIC:** Low-Middle Income Countries, **SCC:** Safe Childbirth Checklist, **SMM:** Severe Maternal Morbidity, **WHO:** World Health Organization

Declarations

Ethical considerations

After obtaining administrative authorization and ethical approval from the Institutional Review Board of YGOPH, we began the study. Data collection was done with strict respect of the principle of confidentiality. The rationale of the study was clearly explained to every staff with consent obtained. The identity of every participant was concealed through consecutive numbering.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are available from the corresponding author on request.

Competing interests

The authors declare that they have no competing interests.

Funding

None

Authors' contributions

SJD: introduction of the checklist at the YGOPH, manuscript revision, director and correction of work, **NIEW:** data interpretation, write up of first manuscript, literature search, **CHK:** study design, data collection, **WT:** data analysis, manuscript revision **PF:** director of the intervention and research work, manuscript revision **BAL:** data analysis, manuscript revision, **RNO:** research conception, introduction of the checklist at the YGOPH, manuscript revision, **AIIF:** research conception, supervisor of the research work, final corrections of the manuscript

All authors read and approved the final manuscript.

Acknowledgements

The authors will like to thank the staff of maternity of the the Yaounde Gynaeco-Obstetric and Paediatric Hospital and the Chiefs of Service for their cooperation during the study.

References

1. Goal 3 .. Sustainable Development Knowledge Platform [Internet]. [cited 2020 Mar 21]. Available from: <https://sustainabledevelopment.un.org/sdg3>
2. Maternal mortality [Internet]. [cited 2020 Mar 21]. Available from: <https://www.who.int/news-room/fact-sheets/detail/maternal-mortality>
3. Grobman WA, Bailit JL, Rice MM, Wapner RJ, Reddy UM, Varner MW, et al. Frequency of and factors associated with severe maternal morbidity. *Obstet Gynecol.* 2014 Apr;123(4):804–10.
4. Maternal mortality ratio (modeled estimate, per 100,000 live births) - Sub-Saharan Africa, World | Data [Internet]. [cited 2020 Mar 21]. Available from: <https://data.worldbank.org/indicator/SH.STA.MMRT?locations=ZG-1W>
5. Global causes of maternal death: a WHO systematic analysis - The Lancet Global Health [Internet]. [cited 2020 Mar 21]. Available from: [https://www.thelancet.com/journals/langlo/article/PIIS2214-109X\(14\)70227-X/fulltext](https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(14)70227-X/fulltext)
6. Tebeu P-M, Halle-Ekane G, Da Itambi M, Mbu RE, Mawamba Y, Fomulu JN. Maternal mortality in Cameroon: a university teaching hospital report. *Pan Afr Med J [Internet].* 2015 May 7 [cited 2020 Jan 23];21. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4561158/>
7. Kyei-Nimakoh M, Carolan-Olah M, McCann TV. Access barriers to obstetric care at health facilities in sub-Saharan Africa—a systematic review. *Syst Rev [Internet].* 2017 Jun 6 [cited 2020 Mar 21];6. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5461715/>
8. Chou VB, Walker N, Kanyangara M. Estimating the global impact of poor quality of care on maternal and neonatal outcomes in 81 low- and middle-income countries: A modeling study. *PLOS Med.* 2019 Dec 18;16(12):e1002990.
9. Kadia RS, Kadia BM, Dimala CA, Aroke D, Vogue N, Kenfack B. Evaluation of emergency obstetric and neonatal care services in Kumba Health District, Southwest region, Cameroon (2011–2014): a before-after study. *BMC Pregnancy Childbirth.* 2020 Feb 11;20(1):95.
10. Leke R. Reducing Maternal Mortality Through the Prevention of Unsafe Abortion and Their Complications in Cameroon. *Int J Gynecol Clin Pract.* 2018 Dec 19;5.
11. Stover J, Ross J. How Increased Contraceptive Use has Reduced Maternal Mortality. *Matern Child Health J.* 2009 Sep 1;18.
12. Nour NM. An Introduction to Maternal Mortality. *Rev Obstet Gynecol.* 2008;1(2):77–81.
13. Alemu FM, Fuchs MC, Martin Vitale T, Abdalla Mohamed Salih M. Severe maternal morbidity (near-miss) and its correlates in the world's newest nation: South Sudan. *Int J Womens Health.* 2019 Mar 19;11:177–90.
14. Leonard KL, Masatu MC. Professionalism and the know-do gap: exploring intrinsic motivation among health workers in Tanzania. *Health Econ.* 2010 Dec;19(12):1461–77.
15. Das J, Holla A, Das V, Mohanan M, Tabak D, Chan B. In urban and rural India, a standardized patient study showed low levels of provider training and huge quality gaps. *Health Aff Proj Hope.* 2012 Dec;31(12):2774–84.
16. WHO | What is Quality of Care and why is it important? [Internet]. WHO. [cited 2019 Dec 31]. Available from: http://www.who.int/maternal_child_adolescent/topics/quality-of-care/definition/en/
17. Organization WH, OECD, Bank IB for R and DW. Delivering quality health services: a global imperative for universal health coverage [Internet]. World Health Organization; 2018 [cited 2019 Dec 31]. Available from: <https://apps.who.int/iris/handle/10665/272465>
18. Hales BM, Pronovost PJ. The checklist—a tool for error management and performance improvement. *J Crit Care.* 2006 Sep;21(3):231–5.
19. (1) (PDF) Improving Maternal Health: The Safe Childbirth Checklist as a Tool for Reducing Maternal Mortality and Morbidity [Internet]. ResearchGate. [cited 2019 Sep 23]. Available from: https://www.researchgate.net/publication/331119605_Improving_Maternal_Health_The_Safe_Childbirth_Checklist_as_a_Tool_for_Reducing_Maternal_Mo
20. Spector JM, Lashoer A, Agrawal P, Lemer C, Dziekan G, Bahl R, et al. Designing the WHO Safe Childbirth Checklist program to improve quality of care at childbirth. *Int J Gynaecol Obstet Off Organ Int Fed Gynaecol Obstet.* 2013 Aug;122(2):164–8.
21. Molina RL, Neal BJ, Bobanski L, Singh VP, Neville BA, Delaney MM, et al. Nurses' and auxiliary nurse midwives' adherence to essential birth practices with peer coaching in Uttar Pradesh, India: a secondary analysis of the BetterBirth trial. *Implement Sci.* 2020 Jan 3;15(1):1.
22. Kumar S, Yadav V, Balasubramaniam S, Jain Y, Joshi CS, Saran K, et al. Effectiveness of the WHO SCC on improving adherence to essential practices during childbirth, in resource constrained settings. *BMC Pregnancy Childbirth.* 2016 08;16(1):345.

23. Pinzón-Flórez CE, Fernández-Niño JA, Ruiz-Rodríguez M, Idrovo ÁJ, Arredondo López AA. Determinants of performance of health systems concerning maternal and child health: a global approach. *PLoS One*. 2015;10(3):e0120747.
24. 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 Childbirth*. 2015 Feb 4;15:12.
25. 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. *Matern Health Neonatol Perinatol*. 2019 Mar 1;5(1):3.
26. Semrau KEA, 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. *N Engl J Med*. 2017 Dec 14;377(24):2313–24.
27. Bayou G, Berhan Y. Perinatal Mortality and Associated Risk Factors: A Case Control Study. *Ethiop J Health Sci*. 2012 Nov;22(3):153–62.
28. Ngoc NTN, Meriardi M, Abdel-Aleem H, Carroli G, Purwar M, Zavaleta N, et al. Causes of stillbirths and early neonatal deaths: data from 7993 pregnancies in six developing countries. *Bull World Health Organ*. 2006 Sep;84(9):699–705.
29. Rothman KJ, Gallacher JEJ, Hatch EE. Why representativeness should be avoided. *Int J Epidemiol*. 2013 Aug;42(4):1012–4.

Tables

Table 1: Socio-demographic and clinical characteristics of the study population

	Frequency (n)	Percentage (%)
Age		
15 - 19 years	73	7.5
20 -24 years	189	19.4
25 - 29 years	311	31.9
30 - 34 years	214	21.9
35 - 39 years	153	15.7
≥ 40 years	35	3.6
Unknown	1	0.1
Total	976	100.0
Parity		
1-2	520	53.3
3-4	217	22.2
≥ 5	81	8.3
Unknown	158	16.2
Total	976	100.0
Previous pathology		
	Frequency (n)	Percentage (%)
Hypertensive disorders	34	3.5
Gestational diabetes	2	0.2
PPH	3	0.3
None	937	96.0
Total	976	100.0
Mode of birth		
	Frequency (n)	Percentage (%)
Vaginal birth	807	82.7
Caesarean birth	169	17.3
Total	976	100.0

2: Frequency and proportion of checklist use

Month	Groups		Proportion	Total
	check-list use	Non-checklist		
January	110	53	67.5	163
February	162	48	77.1	210
March	122	13	90.4	135
April	113	13	89.7	126
May	130	8	94.2	138
June	191	13	93.6	204
Total	828	148	84.8	976

Table 3: Association between the use of the checklist and obstetric outcomes

Mode of birth	Checklist Group (N1=828)	Non-checklist group (N2=148)	Total	P-value*
Vaginal birth	699 (84.4%)	108 (73.0%)	807 (82.7%)	0.001
Caesarean birth	129 (15.6%)	40 (27.0%)	169 (17.3%)	
Total	828 (100.0%)	148 (100.0%)	976 (100.0%)	
Maternal complications	Checklist group (N1=828)	Non-checklist group (N2=148)	Total	P-Value
Yes	127 (15.3%)	22 (14.9%)	149 (15.3%)	0.883
No	701 (84.7%)	126 (85.1%)	827 (84.7%)	
Total	828 (100.0%)	148 (100.0%)	976 (100.0%)	
Eclampsia/Severe pre-eclampsia	Checklist group (N1=828)	Non-checklist group (N2=148)	Total	P-Value
Yes	17 (2.1%)	8 (5.4%)	25 (2.6%)	0.017
No	811 (97.9%)	140 (94.6%)	951 (97.4%)	
Total	828 (100.0%)	148 (100.0%)	976 (100.0%)	
Acute foetal Distress	Checklist group (N1=828)	Non-checklist group (N2=148)	Total	P-Value
Yes	38 (4.6%)	4 (2.7%)	42 (4.3%)	0.418
No	804(95.4%)	130(97.3%)	934(95.7%)	
Total	828 (100.0%)	148 (100.0%)	976 (100.0%)	
Perineal Tears	Checklist group (N1=828)	Non-checklist group (N2=148)	Total	p-Value
Yes	59 (7.1%)	6 (4.1%)	65 (6.7%)	0.167
No	769 (92.9%)	142 (95.9%)	911 (93.3%)	
Total	828 (100.0%)	148 (100.0%)	976 (100.0%)	
Post partum Haemorrhage	Checklist group (N1=828)	Non-checklist group (N2=148)	Total	p-Value
Yes	7 (0.8%)	0 (0.0%)	7 (0.7%)	0.262
No	821 (99.2%)	148 (100.0%)	969 (99.3%)	
Total	828 (100.0%)	148 (100.0%)	976 (100.0%)	

Table 4: Multivariate analysis of variables with significant association to the checklist's utilization

Variable	Severe preeclampsia/ eclampsia (Adjusted Odds Ratio): Yes/No	CI 95%	P value
Age	1.025	0.59 - 1.78	0.930
< 24 years			
24 - 34 years			
> 34 years			
Parity	3.011	1.09 - 8.34	0.034
Nulliparous			
Multiparous			
History of hypertension in pregnancy	2.696	0.59 - 12.41	0.203
Utilization of the checklist	0.372	0.15 - 0.90	0.029
History of hypertension	9.946	1.40 - 70.90	0.022

Table 5: List of 29 Essential Birth Practices from the World Health Organization Checklist

List of Essential Birth Practices from the World Health Organization Checklist

On admission

1. Assess mother's need for referral
2. Start partograph
3. Assess mother for criteria to start antibiotics
4. Assess mother for signs of pre-eclampsia/eclampsia or the need to administer magnesium sulfate and antihypertensive treatment
5. Ensure availability of supplies to clean hands and wear gloves for each vaginal exam confirmed

6. Encourage birth companion to be present at birth
- Confirm that mother or companion will call for help during labor if needed

Just before pushing (or before Cesarean)

9. Assess mother for criteria to start antibiotics
10. Assess mother for signs of pre-eclampsia/eclampsia or the need to administer magnesium sulfate and antihypertensive treatment
11. Confirm essential supplies for mother at bedside
12. Confirm essential supplies for baby bedside
13. Identify assistant and confirm readiness to help at birth if needed

Soon after birth (within 1 hour)

14. Assess mother for abnormal bleeding
15. Assess mother for criteria to start antibiotics
16. Assess mother for signs of pre-eclampsia/eclampsia or the need to administer magnesium sulfate and antihypertensive treatment
17. Assess baby's need for referral
18. Assess baby for criteria to start antibiotics
19. Assess baby's needs for special care/monitoring
20. Initiate skin-to-skin contact and breastfeeding (if mother and baby are well)

21. Confirm that mother/companion will call for help if danger signs present

Before discharge

22. Confirm stay at facility for 24 hours after delivery
23. Assess mother for criteria to start antibiotics
24. Assess mother's blood pressure
25. Assess mother for abnormal bleeding
26. Assess baby for criteria to start antibiotics
26. Establish good breastfeeding practices before discharge
28. Discuss and offer family planning options to Mother
29. Arrange follow-up and confirm Mother/Companion will seek help if danger signs are present after discharge

Figures

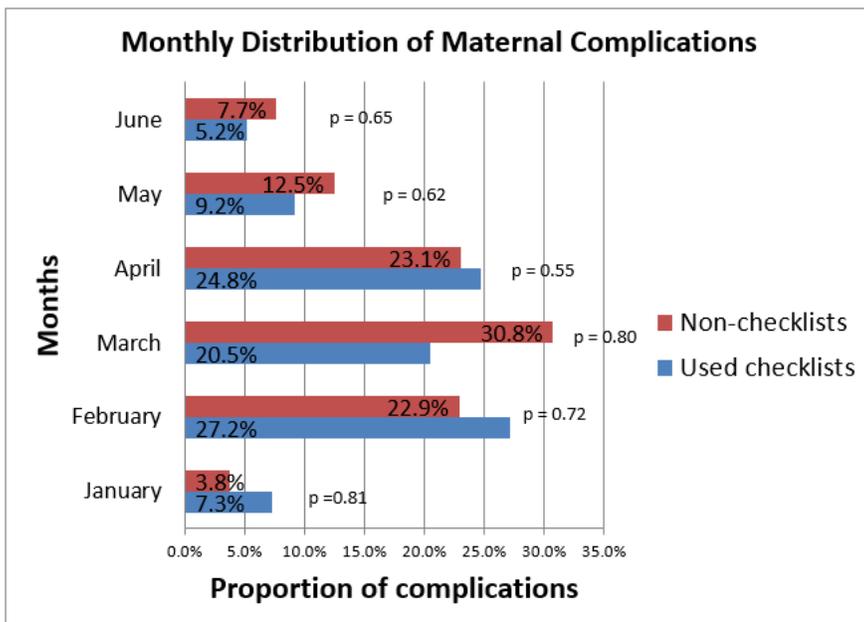


Figure 1

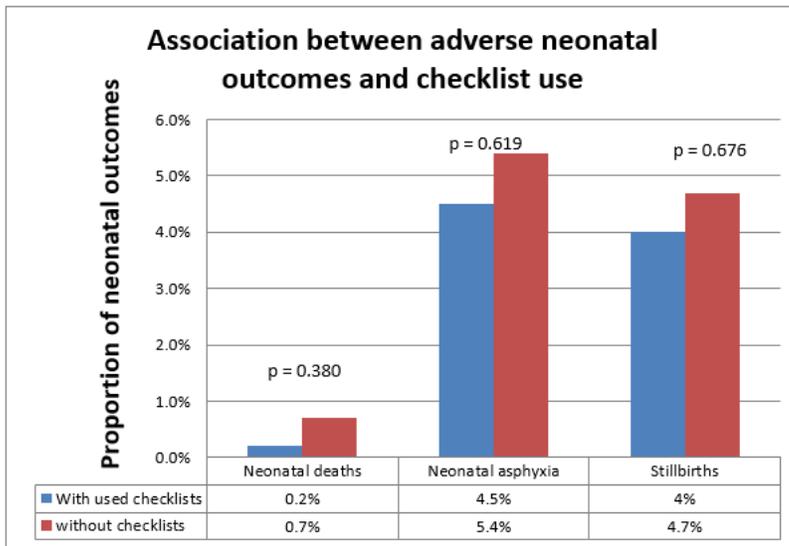


Figure 2

Association between adverse neonatal outcomes and checklist use

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryFigure1Evolutionofthecompl.pdf](#)
- [SupplementaryFig2Evolutionofcompl.pdf](#)