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Implementation of the WHO surgical safety checklist in a West African teaching hospital: a quality improvement initiative

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Abstract

Background: This study aimed to evaluate the implementation of a surgical safety checklist (SSCL) at an academic hospital in Ghana.

Methods: The WHO SSCL was locally adapted and introduced in all surgical cases at Cape Coast Teaching Hospital (CCTH), Ghana. A chart audit of 2.5% of surgical cases over 12 months was conducted. The main outcome measures included: 1. Percentage of cases where the SSCL was present, 2. Percentage complete, 3. Where the SSCL was incomplete, percentage complete at each critical point (before induction of anesthesia, before skin incision, and before leaving the operating theater), 4.Information missing in incomplete charts.

Results: One hundred surgical cases were evaluated. The SSCL was present in 93% (95% CI 88%-98%) of cases reviewed, but complete in only 21% (95% CI 10.5%- 29.0%) of all cases, and 3.6% (95% CI -3.3%-13.0%) of C-sections. The last part of the checklist was most likely to be completed. The most common missing information was patient demographics.

Conclusion: The SSCL was introduced at CCTH over 1.5 years. While uptake was high, the majority of cases were incomplete. This QI activity informed a revision of the SSCL and a strategy for periodic evaluation to facilitate its sustainable use.

Key Words: patient safety, quality improvement, anaesthesia

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INTRODUCTION

Kybele Inc. is a non-profit organization based in North America dedicated to improving maternal care worldwide. Kybele has demonstrated improvements in maternal and neonatal care in low middle-income countries by implementing successful changes in the local environments.[1] It has had a prominent presence in Ghana since 2004.

Cape Coast Teaching Hospital (CCTH) is located in Cape Coast, Central Region, in Ghana. In 2015, it completed its transition from a community to a teaching hospital. That year, there were 2854 births. Maternal mortality ratio (MMR) was 1,111 per 100,000 live births, an increase from 772 per 100,000 live births in 2014.[2] By comparison, the country-wide MMR in 2015 was 319.[2] The primary causes of maternal deaths were hypertensive disorders of pregnancy, hemorrhage and sepsis, accounting for over 90% of MMR. There were 984 caesarean deliveries representing 33% of total surgeries at CCTH. Institutional surgical deaths were defined (at CCTH) as deaths in the operating theatre or recovery room. There were eight in 2015.[2]

The local hospital management identified a need to improve maternal care and pursued a collaboration with Kybele Inc. This collaboration was designed to address maternal and newborn health, anesthesiology and critical care needs at CCTH. The program was an expansion of an existing collaboration between Kybele, Inc. and the Ghana Health Service (GHS) which began in January 2007.[1] The two cooperated in the development of a quality improvement initiative at CCTH which resulted in the Maternal and Newborn Quality Improvement Action Group (MNQIAG). The ultimate objective of this group is to reduce maternal and newborn morbidity and mortality through an innovative, systematic quality

improvement approach designed to build local organizational capacity and health facility systems. The purpose of the MNQIAG is to coordinate quality improvement initiatives related to Maternal Newborn care at CCTH. One such strategy was the introduction of the surgical safety checklist in caesarean deliveries.

The World Health Organization set out the "Safe Surgery Saves Lives" programme in 2008 detailing a number of goals to improve surgical safety.[4] As part of this programme, WHO encouraged the use of a surgical safety checklist (SSCL) in a model that is simple, widely applicable and measurable. The SSCL is a cost-effective tool that aims to enhance patient safety by improving communication in the operating room. Use of the SSCL has been shown to reduce surgical morbidity by one third and surgical mortality by half.[5] Despite this evidence, there are still places in the world where it has not been introduced. CCTH is a center where the checklist had not been implemented.

Based on previous evidence[5], the WHO Surgical Safety Checklist was proposed as a process to improve the delivery of care while reducing inefficiencies within the CCTH operating theaters. Initially its introduction was planned for caesarean deliveries only due to the focus of the collaboration with Kybele on improving obstetrical care. Based on feedback from the Departments of Anesthesia and Obstetrics and Gynecology, the project evolved to include all surgical cases. The current quality improvement initiative was developed in order to evaluate the process of implementation of the SSCL at CCTH and to develop strategies for improved uptake and completion of the SSCL. The current report adheres to the SQUIRE 2.0 (Standards for Quality Improvement Reporting Excellence) guidelines.[6]

Materials and Methods

Context: This was a quality improvement activity intended to introduce the surgical safety checklist to Cape Coast Teaching Hospital and to evaluate its implementation over time to completion. A multidisciplinary team consisting of an obstetrician/gynaecologist (MM), certified registered anaesthetist (HT) and an operating room nurse (EMQ) at CCTH led the CCTH/Kybele adaptation of the checklist[4] to suit the specific context of CCTH. For the remainder of the manuscript, "SSCL" will be used to refer to the version of the surgical safety checklist that was implemented at CCTH.

The resulting checklist was piloted in three elective caesarean deliveries of varying levels of complexity and one pediatric general surgery case. This took place in February 2016 during one of the two annual visits from the Kybele team. The SSCL team demonstrated its use before induction of anesthesia (the circulating nurse confirms the patient's identity and procedure and conducts the first portion of

Figure 1: Initial Surgical Safety Checklist developed at CCTH (February 2016)

PATIENT DETAILS Last name: First name: Date of birth: Folder number: Procedure: **BEFORE INDUCTION OF ANAESTHESIA (with at least nurse and anesthesia)** Has the patient confirmed her identity, procedure and consent? ☐ Is the anaesthesia machine and medication check complete? ☐ Is the pulse oximeter on the patient and functioning? ☐ Are there any allergies? Yes No Is there a difficult airway or aspiration risk? Yes No If yes, is there equipment/assistance available? ☐ Is there a risk of >500ml blood loss? Yes No If Yes, is IV access adequate and is the patient crossmatched? ☐	**BEFORE SKIN INCISION** **Quiet Time-Out** **(Nurse, anaesthetist and surgeon)** Has the patient's name, procedure and incsion site been confirmed? ☐ Have all team members introduced themselves by name and role? ☐ Are there any allergies? Has antibiotic prophylaxis been given within the last 60 minutes? Yes Not applicable How long will the case take? Is there a risk of >10cc/kg of blood loss? Yes No If yes, is the patient crossmatched? Yes No Are there any patient-specific concerns? Are there any anticipated critical events? Yes No If yes, wehat are they? **To Nursing Team:** Are the packs sterile? ☐ Are there any equipment issues or any concerns? Yes No	**BEFORE PATIENT LEAVES OPERATING ROOM** **(Nurse, anaesthetist and surgeon)** Name of th eprocedure confirmed Instrument, sponge and needle counts completed ☐ Specimen labelled (read specimen labels aloud, including patient name) ☐ Are any equipment problems to be addressed? Yes No If yes, please specify: Does the patient need transfucion postopertaively? Yes No If yes, is the patient crossmatched? Yes No
Specific to Cesarean Section:		
Is fetal heart beat present? Yes No	Is tubal litigation to be performed? Yes No Is cord blood necessary? Yes No	

DATE (DDMMYY): _____ **NAME:** _____ **SIGNATURE:** _____

the checklist), before skin incision (the surgeon conducts the second portion of the checklist), and before the patient leaves the operating room (the circulating nurse finalises the checklist). After the checklist was piloted, changes were made to further adapt the content to CCTH. The resulting SSCL is shown in Figure 1.

The checklist was then used by CCTH clinical staff as part of usual clinical care for all surgical patients and was printed on the back of surgical sponge count sheets, which were present already in all surgical cases, to facilitate its use.

Measures: To assess the use of the SSCL after its introduction, a post-implementation review of randomly selected surgical charts was conducted from November 2016 to November 2017. Approximately 300 surgeries were performed per month at CCTH in 2016. In order to not overwhelm the evaluation team, but to create enough knowledge of the process of implementation, we set out to audit the use of the SSCL in approximately 2.5% of cases per month over a 12-month period, which would amount to approximately eight cases per month.[7] In 2016, 1113 caesarean deliveries were performed at CCTH.[2] As part of our audit, we set out to evaluate 2.5% of caesarean deliveries, amounting to 2-3 charts per month over a 12 months period.

The Kybele team also observed four additional cases after implementation of the checklist (in November 2017) and documented qualitatively any deficiencies in adherence. A load of four cases was felt to be realistic in the context of the short visits by the Kybele team and the breadth of the Kybele mission (thus limiting the human and time resources that can be dedicated to a single project). Two members of the Kybele team (AM, VR) directly observed the four cases and recorded how the SSCL was used in real time.

Ethical approval: Approval of this quality improvement project was provided by the Cape Coast Teaching Hospital Ethical Review Committee on November 30th, 2017, reference number CCTHERC/RS/EC/2017/47. Informed consent was not required as this was part of a quality assurance activity.

Funding: This quality improvement activity is part of an ongoing collaboration between Kybele Inc. and CCTH to reduce maternal and neonatal mortality. No additional funding was contributed for this project specifically.

Analysis: Use of the SSCL was evaluated and the results calculated as percentage of charts where the SSCL was present and percentage of charts where the SSCL was present and complete. The incomplete SSCLs were then evaluated in order to distinguish if particular parts of the SSCL are more likely than others to be utilized.

Among those charts where the SSCL was incomplete, we examined each critical point in time (before induction of anesthesia, before skin incision, before the patient leaves the theater). Completion at each of these critical times was calculated as percentage of those charts where the checklist was used but was incomplete. Statistical significance was determined using McNemar's test for dependent proportions, with a p-value less than 0.05 representing statistical significance. The most common areas of missing information were assessed and the results shown as percentage of cases where the SSCL was present on the chart but was incomplete.

Results

We randomly selected 120 chart numbers to audit, of which 20 charts were missing. We evaluated the use of the SSCL in 100 total surgical charts, which met our criteria of approximately 2.5% of surgical cases. Out of these, 28 were caesarean deliveries, which also met our criteria of 2.5% of caesarean section cases, and the rest were a mix of surgical specialties including general surgery (24 cases), otolaryngology (12 cases), urology (12 cases), orthopedic surgery (12 cases), and other (plastic surgery, ophthalmology, neurosurgery for a total of 24 cases). The chart review included both elective and emergency surgeries.

The SSCL was present on 93% (95% CI 88%-98%) of the charts, 92.9% (95% CI 83.5%-102.5%) of C-sections and 93.1% (95% CI 87.1%-98.9%) of non-C-section charts. It was complete in only 21% (95% CI 10.5%-29.0%) of cases, which included 3.6% (95% CI -3.3%-13.0%) of Cesareans and 27.8% (95% CI 17.5%-38.1%) of non-Cesareans cases.

We analyzed the charts where the checklist was present but incomplete. In those cases, Part 1, conducted before induction of anesthesia, was complete in 31.9% of cases (95% CI 21.2%-42.7%; n=72). Part 2, conducted before skin incision, was completed in 34.7% (95%CI 23.7%-45.7%). Part 3, before the patient leaves the operating theater, was complete in 65.3% of cases (95% CI 54.3%-76.3%). While there was no difference between completion rates of

Table 2: Utilization of the SSCL when it was incompletely filled out

	Part 1 (Before Induction of Anaesthesia)	**Part 2 (Before Skin Incision)**	**Part 3 (Before leaving the theater)**
All cases (N=72)	31.9% (21.2%-42.7%)	34.7% (23.7%-45.7%)	65.3% (54.3%-76.3%)*
C-sections (N=25)	28.0% (10.4%-45.6%)	28.0% (45.6%-10.4%)	68.0% (49.7%-86.3%)*
Non C-sections (n=47)	34.0% (20.5%-47.6%	38.3% (24.4%-52.2%)	63.8% (50.8%-76.9%*

[a]Proportions represent number of cases where the checklist was filled out at a critical point divided by cases where the checklists was present on the chart but incomplete and shown as n% (95% CI)

*p<0.05 (McNemar's test for dependent proportions)

Part 1 and Part 2, Part 3 was significantly more likely to be completed than either Part 1 (OR 3.0, 95% CI 1.5-5.8) or Part 2 (OR 4.1, 95% CI 1.8-9.4). This trend persisted when we analyzed Cesareans and non-Cesarean cases separately (Table 1).

The most common themes in incomplete charts are shown in Table 2. Date of birth was not completed most often. Critical information such as estimated blood loss, antibiotic prophylaxis, documentation of allergies, patient specific concerns and need for postoperative transfusion was also found to be incomplete.

The Kybele team directly observed four randomly selected cases (two cesarean sections, a limb amputation and a nephrectomy) and documented qualitatively how the checklist was conducted. It was found that the checklist was not conducted at the appropriate pause times in the case. Additionally, not everyone paused to attend to the checklist. Some checklist items were filled out on paper without actual verbal communication about it amongst team members. Often, the surgeon would leave the theater before Part 3 was completed. These findings were consistent across the cases observed.

DISCUSSION

Summary: This study illustrates a model of implementation of a WHO adapted surgical safety checklist at an academic referral hospital in West Africa. The staff were provided with information and training and subsequently a locally-developed checklist was introduced. The local staff took on an active role in the development and distribution of the checklist and printed it on the back of sponge count sheets which were already present on all surgical charts, making the SSCL more convenient and cost-effective. Subsequently, we found high uptake of the SSCL on the charts reviewed. Unfortunately, we found that in most cases the SSCL was not complete and adherence in practice was suboptimal.

An important strength of this project was the involvement of the local team in its development and implementation. In addition, charts were selected randomly over a year which provided a more accurate representation of its true use. Selecting charts from a shorter period of time just before or during a visit by the Kybele team may have led to an overestimation of its use. Lastly, evaluating 2.5% of surgical charts randomly did not overwhelm the evaluation team and allows for a process of continuous evaluation by the local staff even after the collaboration with Kybele concludes.

Interpretation: The high uptake on charts was probably largely due to local Anesthesia leadership, who oversaw that the physical checklist was added to the charts. Unfortunately, in most of these, the SSCL was incomplete. Particularly in Cesarean sections, the SSCL was complete in only 3.6% suggesting that there was little buy in from the surgical team. Cesareans are the most common surgery performed at CCTH. In the two emergency Cesareans we reviewed, the SSCL was not present on the chart. We discussed this finding with the obstetrical team, who felt that in an emergency setting there is no time to do the checklist. With ongoing education and use, the perception around the time commitment to do the SSCL, and its importance especially in emergency or complex cases, will become more apparent and will lead to improved utilization over time.

When the SSCL was used suboptimally, it was Part 3 that was most likely to be filled out (before the patient left the operating room). Observation of four randomly chosen cases showed that the surgeon often left the room first and the checklist was done by the circulating nurse. It is possible that the circulating nurse felt more comfortable requesting the attention of the room after the surgeon left, alluding to hospital hierarchy as a possible barrier to proper use. Other contextual factors may have contributed to this finding, including lack of familiarity with the SSCL, a perception that the SSCL is not important, and time pressures. The exact wording and cultural relevance of the SSCL may also have been a factor. We explored the themes that were incomplete most often and altered the SSCL based on the results of this QI initiative, in order to improve compliance. Date of birth was missing in 35% of total surgical charts evaluated. Recording patient demographics ensures that the procedure is done on the correct patient. At CCTH, many patients may not know their date of birth, therefore the local partners suggested replacing this item with age. Critical considerations such as estimated blood loss and patient specific concerns were frequently missing in surgical charts.

Table 2: Themes in Incomplete Charts

Theme	N charts	% of charts*
Date of birth	33	35%
Other identifying patient information	20	22%
Estimated blood loss	22	24%
Patient specific conerns/anticpated critical events	11	12%
Equipment concerns	11	12%
Antibiotic prophylaxis	9	10%
Specimen labelling	8	9%
Sterile packs	6	6%
Need for postopertaive transfusion	4	4%
Postoperative conerns	3	3%

*Percentages are calculated as proportion of total surgical cases where the checklist was present on the chart

Antibiotic prophylaxis was often not documented, a relevant point at CCTH where 26% of maternal deaths are attributed to sepsis [8]. Estimated blood loss was missing in 24% of evaluated charts. It was felt that a more clinically relevant question would be: "Is there a risk of excessive blood loss?". Whether there were patient specific concerns and/or anticipated critical events was not documented in 12% of charts evaluated. They were listed as two separate items, both prior to skin incision, and the local team felt that this was redundant. The item "Are there any anticipated critical events?" was removed. Specimen labelling was not documented in 9% of charts. To ensure this item was checked even in surgeries where a specimen was not sent to pathology, the answer option for this question was changed to include a checkbox for "not applicable". Lastly, the checklist was reformatted to allow for more writing space when postoperative concerns are identified before the patient leaves the room. The revised SSCL is shown in Figure 2. Using this QI project as template, an evaluation team was developed that will periodically assess how the SSCL is used and adjust it as needed to better serve the local patient population after the collaboration with Kybele concludes.

The WHO Surgical Safety Checklist has been adopted in a number of hospitals across the world however most reports come from upper middle and high-income countries.[9,10,11,12,13,14,15] Few studies report on its implementation in low income settings. White et al. (2017) reported on a four-day pilot to implement the SSCL at Dolisie Hospital in the Congo.[16] They were unable to evaluate uptake but commented that the most important barriers to implementation were lack of support and differences between training and actual surgical milieu. At Felege Hiwot hospital in Ethiopia, Ellis et al. (2017) implemented a stepwise SSCL program that resulted in an uptake rate of 94% in general surgery cases and 100% in OBGYN cases at one year.[17] Similar to our project, their strategy was also locally driven, and the authors identified local support as one of the key components of a successful program. A prospective study of elective general surgeries in Karachi, Pakistan showed checklist use in 20% of cases at 1 year. At four years, use increased to 90%.[18]

The literature on implementation of a surgical safety checklist in LMICs is sparse. However, existing studies typically found high uptake, in keeping with our results. But to be effective, the SSCL must not only be present, but must be fully completed, at the appropriate times in the surgical process, by the appropriate members of the surgical team and there must be real time communication prior to checking it off. When problems are identified, the SSCL should trigger a management plan. Further research is needed on compliance with the checklist in real time and on strategies to improve adherence and patient outcomes.

Figure 2: Revised surgical safety checklist (November 2017). The modified sections based on local feedback are highlighted

PATIENT DETAILS Last name: First name: Age: Folder number: Procedure: **BEFORE INDUCTION OF ANAESTHESIA (with at least nurse and anesthesia)** Has the patient confirmed her identity, procedure and consent? ☐ Is the anaesthesia machine and medication check complete? ☐ Is the pulse oximeter on the patient and functioning? ☐ Are there any allergies? Yes No Is there a difficult airway or aspiration risk? Yes No If yes, is there equipment/assistance available? ☐ Is there a risk of excessive blood loss? Yes No If Yes, is IV access adequate and is the patient crossmatched? ☐	**BEFORE SKIN INCISION** **Quiet Time-Out (Nurse ,anaesthetist and surgeon)** Has the patient's name, procedure and incsion site been confirmed? ☐ Have all team members introduced themselves by name and role? ☐ Are there any allergies? Has antibiotic prophylaxis been given within the last 60 minutes? Yes Not applicable How long will the case take? Is there a risk of excessive blood loss? Yes No If yes, is the patient crossmatched? Yes No Are there any patient-specific concerns? If yes what are they? **To Nursing Team:** Are the packs sterile? ☐ Are there any equipment issues or any concerns? Yes No	**BEFORE PATIENT LEAVES OPERATING ROOM (Nurse, anaesthetist and surgeon)** Name of th eprocedure confirmed Instrument, sponge and needle counts completed ☐ Specimen labelled (read specimen labels aloud, including patient name) Yes NA Are any equipment problems to be addressed? Yes No If yes, please specify: Are there any concerns in the immediate postoperative period? Yes No If yes, please specify: Does the patient need transfucion postopertaively? Yes No If yes, is the patient crossmatched? Yes No
Specific to Cesarean Section:		
Is fetal heart beat present? Yes No	Is tubal litigation to be performed? Yes No Is cord blood necessary? Yes No	

DATE (DDMMYY): _____ **NAME:** _____ **SIGNATURE:** _____

Limitations: This is a small QI activity with inherent limitations. In order to maintain a feasible process of evaluation while extracting useful information, only 2.5% of surgical charts were evaluated, including 2.5% of caesarean section charts. Ideally, more charts would be audited and more cases would be directly observed. However, evaluating 100 charts and four surgical cases did help delineate important patterns in the SSCL process and ultimately guided how it would be used in the future.

We were only able to evaluate how the checklist was conducted in four cases due to the nature of the Kybele biannual trips. This is a limitation of our project. However, these cases were randomly chosen without advanced notice in order to capture normal behaviour as much as possible. A possible Hawthorne effect cannot be excluded however it is important to note that even when directly observed, the surgical team did not implement the checklist appropriately. Some items were checked off without being communicated thereby not taking advantage of the intended usefulness of assuring readiness at each critical point. To address this important deficiency, the Kybele team presented this information to stakeholders including OBGYN staff, medical and house officers in November 2017 with the goal of improving real time adherence.

Conclusions: This quality improvement activity demonstrated a model of implementation of the SSCL in an under-resourced area where it had not been used before. A key aspect in SSCL program development is local leadership and multidisciplinary support. The SSCL represents a low-cost strategy to reduce surgical morbidity and mortality but current literature is lacking in reports of its implementation in LMICs. The CCTH model can be adapted in other settings to introduce the SSCL, monitor its utilization over time, develop a data collection system and enhance surgical care without placing undue burden on local resources. We encourage researchers in LMICs to use the current model or develop new strategies of implementation of the SSCL and to report on their findings.

Authors contributions: AM, MM, HT, RG, HS and VR contributed to all aspects of the design. AM had overall responsibility for this project and VR had supervising responsibility. AM and VR conducted the data analysis. RG coordinated the collaboration between CCTH and Kybele Inc., including this project. MM, HT, BQ and NA developed the SSCL and coordinated its printing and distribution. All authors gave approval for the final version of the manuscript.

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