

## **Use of the WHO Surgical Safety Checklist in low and middle income countries: a review of the literature**

### **Abstract**

A wealth of research now exists surrounding use of the WHO surgical safety checklist. This paper reviews the literature regarding checklist use in developing countries. Results identify a lack of available literature specific to developing countries despite this potentially being where the greatest impact could be observed. Unique challenges of checklist use are discussed and opportunities for future research focusing on use of the checklist in developing countries suggested.

**Keywords** WHO checklist, LMIC, developing, global population

### **Introduction**

It is nearly 10 years since the WHO surgical safety checklist was developed to help improve surgical morbidity and mortality (Haynes et al 2009). The international consultation to design the checklist was attended by participants from low, middle, and high income countries to help ensure global applicability (Weiser et al 2010). One of the features of the design encouraged by the Safe Surgery Programme team responsible was modification to fit with local contexts and circumstances, thus making its use applicable on a global scale (Weiser et al 2010).

During previous work to evaluate the impact of the WHO checklist on theatre departments it was found that relatively little of the available literature retrieved from database searches provided information on the checklist's use in low and middle

income countries (LMICs) (Cadman 2016). This has also been highlighted by others (Ellis et al 2017) who have also commented how variations in successful implementation will be context-dependent (Yuan et al 2012). It was therefore decided to pursue this area further to assess just how the checklist is being put into practice in such countries and any unique obstacles they face in comparison to high income countries (HICs).

## **Method**

The databases CINAHL Complete, MEDLINE and Scopus were searched using the key terms: checklist, surgical, theatre, and perioperative. Key terms were searched utilising Boolean operators in the 'Title' field to maintain the focus of the study. Searches were not limited to English language as given the focus of the study it was anticipated that studies may be published in non-English language journals. Given that papers were likely to identify the individual country the research applied to, rather than its income level, it was difficult to filter for this during the initial search stage. Once search results were retrieved, papers were screened on the basis of whether they were carried out in a LMIC as classified by the World Bank (2017), or whether they discussed the checklist's use in LMICs. Database searches were performed to retrieve articles from 2009 when the checklist was first implemented, up to May 2017. Citation chaining was carried out where appropriate and critical appraisal of studies was undertaken using the CASP critical appraisal tool (CASP UK 2017).

## **Results**

Initial searches retrieved a total of 814 papers, however this was reduced to 487 on removal of duplicates. Remaining titles were then screened for relevance leading to 32 which were then screened by abstract leaving 25 full text papers for consideration. 16 of these papers were identified as relating specifically to LMICs meeting inclusion criteria for this review. No further papers were identified through citation chaining or other sources. Critical appraisal of papers retrieved deemed all 16 of a suitable quality for the purpose of this review.

## **Discussion**

Results from the literature search demonstrate that there is a lack of research in relation to the WHO checklist in LMICs in comparison to the vast amount of literature relating to research being carried out in HICs to build the evidence base with regards to the checklist's use in practice. Whilst some of this knowledge and evidence from HICs is still applicable and transferable to LMICs, the literature suggests that LMICs appear to have separate additional issues surrounding implementation and utilisation unique to their developing context that need to be considered. These will now be discussed.

### **Introduction of new processes and practices**

One of the key factors influencing the use and success of the checklist identified from many of the studies related to new processes and practices. For several of the hospitals included, there were no existing protocols in place for carrying out items included on the checklist that in HICs would be considered standard practice such as instrument counts, site marking, and administration of antibiotics (Aveling et al 2013, Basford et al 2014, Mody et al 2014, Lilaonitkul et al 2015,). This meant that as well

introducing the process of the checklist, other practices had to be changed and a new way of working introduced. Prior to checklist introduction, swab and instrument counts were not carried out at all in hospitals in the study by Aveling et al (2013) and Basford et al (2014). Mody et al (2014) report that intra-operative counts were introduced as part of a quality improvement project surrounding the checklist, whilst Lilaonitkul et al (2015) comment on how there was no formal way of recording the counts, and Ellis et al (2017) acknowledge that whilst counts were done, they were poorly performed leading to the intervention of the introduction of an instrument/swab count table on the reverse of the checklist to aid compliance. Lilaonitkul et al (2015) also describe how in addition to no formal record of counts, there was not only no instrument list to check against but also no standardised instrument pack for procedures.

Amongst these individual processes that directly linked to an item on the checklist and so required introduction, there were also more complex processes that needed to be introduced to ensure the successful implementation and use of the checklist. Aveling et al (2013) inform us that their study hospital did not have any established audit procedures, and that the introduction of the checklist was one of the first safety initiatives introduced with staff having had little prior exposure to the idea of promoting safety. Similarly, Lilaonitkul et al (2015) commented on an overall lack of basic infrastructure. Leifso (2014) describes in the Ethiopian and Uganda hospitals included in her work that no formal training for perioperative staff existed, with continuing education being virtually unknown. These aspects relating to the processes surrounding education are significant barriers to establishing and supporting new procedures within the working theatre environment. The importance

of such continuing support is reported in the study by Epiu et al (2016). This study surveyed anaesthetists in Uganda, Tanzania, Kenya, Rwanda, and Burundi, and comments that while there was an awareness of the checklist, none of the hospitals involved had anyone responsible for ensuring the checklist was used.

Taking all of the above into consideration, improvements in patient outcomes is likely to be due to a cumulative effect of introducing new processes to address the issues raised above, along with the checklist, rather than the checklist alone, hence why greater improvements are often seen when introducing the checklist in hospitals in LMICs.

### **Limited resources**

Limited resources were seen as a key barrier to completing points of the checklist in a number of the papers reviewed. The lack of pulse oximeters for monitoring of patients is raised in 4 papers (Kasatpibal et al 2012, Yuan et al 2012, Aveling et al 2013, Leifso 2014) with Kim et al's (2015) study demonstrating that provision of this vital monitoring equipment led to increased compliance and improvement for patients following an initial study by Kwok et al (2013) at the same site in Moldova. Lack of other basic equipment and supplies such as markers for surgical site marking, gauze, clippers for hair removal, suction, blood pressure cuffs, batteries, pen and paper, water and oxygen prevented other aspects of the checklist being followed (Kasatpibal et al 2012, Yuan et al 2012, Aveling et al 2013, Basford et al 2014, Leifso 2014, Lilaonitkul et al 2015, Santana et al 2016,). An unreliable electricity supply (Aveling et al 2013) and problematic decontamination and sterilisation process (Leifso 2014) have a direct impact on the ability to carry out parts of the

checklist to improve patient safety and are likely experienced by many LMICs yet are taken for granted in developed countries. Lack of available staff was a factor reported in two papers (Kasapibal et al 2012, Lilaonitkul et al 2015) with authors stating that there was no one to carry out or complete the checklist form. In relation to staffing, the turnover of staff was an issue for some. Lilaonitkul et al (2015) and Basford et al (2014) commented on the international links, and therefore overseas volunteers that their sites (in Uganda and Ethiopia respectively) benefitted from. However, they also comment it is not representative of rural community hospitals, and once volunteers had left there was little or no support for continued use of the checklist. Leifso (2014) and Ellis et al (2017) both state how economic migration following staff training increased staff turnover.

Another key problem experienced was related to the availability of antibiotics and the policies surrounding their administration (Yuan et al 2012, Aveling et al 2013, Mody et al 2014, Lilaonitkul et al 2015). In Yuan et al's (2012) study, the supply of antibiotics was outside of the hospital's control and so availability was a key problem. There was no existing protocol for antibiotic prophylaxis in the sites included in the studies by both Aveling et al (2013) and Mody et al (2014), with sites in Aveling et al's study delaying use of antibiotics. The reasoning behind this was that the site had such a short supply that if it was used for prophylaxis they would not have availability for those that did develop post-operative infections. Surgical site infections are a key patient safety issue, and the cumulative effect of the lack of resources (appropriate decontamination and sterilisation, antibiotics, gauze and water to clean and dress wounds) that could prevent them should be a great concern.

## **Cultural differences**

Whilst a hierarchical culture within the theatre environment is often reported as problematic within developed countries (Conley et al 2011, Fourcade et al 2012, Aveling et al 2013, O'Connor et al 2013, Russ et al 2013, Gagliardi et al 2014, Bergs et al 2015, Cadman 2016, Yu et al 2017) it appears to be more pronounced in LMICs due to societal norms. Aveling et al (2013) reports on their study site in Africa, that nurses are often young females who are socialised to be submissive. These nurses are therefore unlikely to question a surgeon's decision or practice. The external sociological context in the same study is shadowed by corruption and injustice with little protection to vulnerable low status individuals and so this furthers acts upon the perceived hierarchy. In Yuan et al's (2012) study, they remark that the 'entrenched hierarchy and relational dynamics' possibly resulted in limiting the effectiveness of the checklist in theatre.

Two studies comment on the cultural barrier to completing the team introduction at the start of the checklist (Kasapibal et al 2012, Melekie and Getahun 2015) as in both cultures (Thai and Ethiopian) people only introduce themselves on first contact. Kasapibal et al (2012) then go on to explain that as a culture Thai people are shy and humble about publicising their roles and so this further would impede the introduction of the checklist. Another aspect of the checklist which goes against Thai culture is that of site marking as they do not make marks on other people (Kasapibal et al 2012) with touching someone on the head being considered rude (Kachru & Smith 2008) resulting in low compliance.

Awareness and attitude to a culture of safety in general is commented on in some studies. The problems encountered in the study by Epiu et al (2016) are suggested to be more a reflection of the culture, attitude and awareness of the checklist and its purpose. Delgado Hurtado et al (2012) also report a lack of awareness of the existence of the checklist and so subsequent safety culture. However, Kim et al (2015) show that a change in safety culture can be achieved through an appropriate implementation strategy of the checklist and so this is something that others can learn from. Prakash et al (2014) explain that in developing countries such as theirs (India), where the expense of surgery is high and so not readily available, the relevance of the checklist is deemed too limited to be considered a public health issue and so it remains a challenge to improve surgical safety.

### **Other factors affecting checklist use**

The remaining two papers retrieved (Askarian et al 2011, Patel 2014), along with those already cited all showed similar issues regarding checklist use as is often found with research from HICs such as those surrounding education, implementation, and design of the checklist. Some of the papers reviewed identified issues potentially affecting checklist use that did not fit within the above themes and in some instances were unique to that country at the specific time the study was carried out. For example, in Brazil, during the time of Santana et al's (2016) study, patient safety laws were established and so will have directly impacted on the latter part of the study most likely through staff conforming to implementation of the checklist. In Liberia at the time of Yuan's study (2012), there was an ongoing rift between surgeons and administration due to a change in surgeons' pay scale which subsequently led to surgeons resisting implementation of the checklist.



## **Limitations**

The limitations of this review are, as with all review studies, the limitations of the included studies themselves. A Hawthorne effect needs to be allowed for in those studies which included observational data. The key limitation of this review in terms of assessing use of the checklist in LMICs is the very limited amount of research available.

## **Conclusions**

This review has identified problems faced by LMICs in their implementation of the checklist as well as a relative lack of available research with regards to the implementation and outcomes in LMICs. The lack of research is potentially attributable to a lack of resources, infrastructure, and funding to undertake the necessary research and these are also key barriers in terms of implementation of the checklist.

In terms of checklist implementation, problems included the lack of resources to actually fulfil items of the checklist such as pulse oximetry, markers, and antibiotics. These have been identified as barriers by other studies (Funk et al 2010, Lavy et al 2011, Kwok et al 2013) and is unique to LMICs. An absence of interventional clinical systems such as equipment counts and site marking, both aspects that are standard practice in many HICs including the UK, was identified in many of the studies. This point may also explain the greater impact on morbidity and mortality in LMICs observed in the original checklist study by Haynes et al (2009). Introducing the WHO

checklist would have involved introducing the other safety measures such as site marking and instrument counts thus resulting in a cumulative effect. In HICs which already carried out these processes, the smaller impact observed is most likely because it is purely from the introduction of the checklist alone. This difference in use of interventions being standard practice identifies an opportunity for education and implementation of patient safety measures that would be relatively low cost but largely beneficial.

However, there is very little research representing this part of the global population and because of the differing practices it is difficult, and somewhat unfair, to compare LMICs with HICs. Whilst the research shows that improvements can be made in LMICs it also shows that the checklist can only be effective if it can be implemented adequately on some level and at present the research shows that this is not the case for everyone. Though some countries will be able to reduce barriers through minor modifications to the checklist, for others it is not that simple and will require great investment in terms of education, practice development, and resources. Unfortunately, in some LMICs, due to the infrastructure and/or context, some of these changes are not easily addressed and are going to take far longer to implement as factors are outside of hospitals' control. The question therefore has to be asked as to how applicable the checklist is at present to a population that currently lacks the resources, facilities and infrastructure to actually implement it properly? Subsequently, how is the checklist then applicable to a global population if a large proportion cannot use it as intended to achieve the desired outcomes and improvements in patient safety? Until these issues are resolved through education and financial investment in providing adequate resources in these developing

countries it is difficult to gauge the impact of the checklist on a global theatre population as a whole. However, the little research that has already been carried out in such countries implies that the checklist has a greater potential to impact and improve patient outcomes, particularly with regards to patient safety. Such improvements could be achieved through using the checklist as a tool to initiate and implement changes in practice to help maintain new standards of safety.

### **Future research**

In contrast to HICs, in LMICs there is a severe lack of research in relation to all aspects of checklist use which needs to be addressed. To continually advocate the checklist as applicable to a global population such research needs to be a priority. This research needs to include the impact on patient outcomes specific to LMIC to provide the evidence base of the significance of the improvements that can be made. Different educational and implementation strategies also need researching in the LMIC context so that hospitals in LMICs can evaluate which approach to introducing the checklist may work best for them. This would also provide some guidance of how to address barriers from experience gained in a similar context. Ultimately this may lead to an increased utilisation of the checklist to benefit more patients.

### **References**

Askarian M, Kouchak F, Palenik CJ 2011 Effect of surgical safety checklists on postoperative morbidity and mortality rates, Shiraz, Faghihy Hospital, a 1-year study. *Quality management in health care* 20 (4) 293-297 [online] Available from: <https://web.a.ebscohost.com> [Accessed May 2017]

Aveling E-L, McCulloch P, Dixon-Woods M 2013 A qualitative study comparing experiences of the surgical safety checklist in hospitals in high-income and low-income countries **BMJ open** 3:e003039 [online] Available from: <https://web.a.ebscohost.com> [Accessed May 2017]

Basford T, Reshamwalla S, McAuley J, Allen NH, McNatt Z, Gebremedhen YD 2014 Implementation of the WHO Surgical Safety Checklist in an Ethiopian referral hospital **Patient safety in surgery** 8 (16) DOI 10.1186/1754-9493-8-16 [online] Available from <https://pssjournal/biomedcentral.com> [Accessed July 2017]

Bergs J, Lambrechts F, Simons P, Vlayen A, Marneffe W, Hellings J, Cleemput I, Vandijck 2015 Barriers and facilitators related to the implementation of surgical safety checklists: a systematic review of the qualitative literature **BMJ quality & safety** 24 (12) 776-786 [online] Available from: <https://qualitysafety.bmj.com/> [Accessed July 2017]

Cadman V 2016 The impact of surgical safety checklists on theatre departments: a critical review of the literature **Journal of perioperative practice** 26 (4) 72-71

CASP UK 2017 **Critical Appraisal Skills Programme (CASP) Making sense of evidence** [online] <http://www.casp-uk.net/> [Accessed August 2017]

Conley DM, Singer SJ, Edmondson L, Berry WR, Gawande AA 2011 Effective surgical safety checklist implementation **Journal of the American college of**

**surgeons** 212 873-879 [online] Available from: <http://sciencedirect.com> [Accessed May 2017]

Delgado Hurtado JJ, Jimenez X, Peñalongo MA, Villatoro C, de Izquierdo S, Cifuentes M 2012 Acceptance of the WHO Surgical Safety Checklist among surgical personnel in hospitals in Guatemala city **BMC health services research** 12 (169) [online] Available from <https://www.biomedcentral.com> [Accessed May 2017]

Ellis R, Nor AIM, Pimentil I, Bitew Z, Moore J (2017) Improving surgical and anaesthesia practice: Review of the use of the WHO Safe Surgery Checklist in Felege Hiwot referral hospital, Ethiopia **BMJ quality** 6:u207104.w6251 DOI 10.1136/bmjquality.u207104.w6251 [online] Available from <http://qir.bmj.com> [Accessed June 2017]

Epiu I, Tindimwebwa JVB, Mijumbi C, Ndarugirire F, Twagirumugabe T, Lugazia ER, Dubowitz G Chokwe TM 2016 Working towards safer surgery in Africa; a survey of utilization of the WHO safe surgical checklist at the main referral hospitals in East Africa **BMC Anesthesiology** 16 (60) DOI 10.1186/s12871-016-0228-8 [online] Available from <https://www.biomedcentral.com> [Accessed May 2017]

Fourcade A, Blache J-L, Grenier C, Bourgain J-L, Minivelle E 2012 Barriers to staff adoption of a surgical safety checklist **BMJ quality & safety** 21 191-197 [online] Available from: [www.qualitysafety.bmj.com](http://www.qualitysafety.bmj.com) [Accessed July 2017]

Funk LM, Weiser TG, Berry WR, Lipsitz SR, Merry AF, Enright AC, Wilson IH, Dziekan G, Gawande AA 2010 Global operating theatre distribution and pulse oximetry supply: an estimation from reported data ***The lancet*** 376 1055-1061 [online] Available from: <https://sciencedirect.com> [Accessed May 2017]

Gagliardi AR, Straus SE, Shojania KG, Urbach DR, Courvoisier DS 2014 Multiple factors influence adherence and outcomes associated with surgical safety checklists: A qualitative study ***PLoS ONE*** 9 (9) e108585 [online] Available from: [www.ncbi.nlm.nih.gov/pmc/](http://www.ncbi.nlm.nih.gov/pmc/) [Accessed July 2017]

Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat A-HS, Dellinger EP, Herbosa T, Joseph S, Kibatala PL, Lapitan MCM, Merry AF, Moorthy K, Reznick RK, Taylor B, Gawande AA 2009 A surgical safety checklist to reduce morbidity and mortality in a global population ***The New England journal of medicine*** 360 (5) 491-499

Kachru Y, Smith LE (2008) **Cultures, contexts and world Englishes** New York, Taylor & Francis

Kasatpibal N, Senaratana W, Chitreecheur J, Chotirosniramit N, Pakvipas P, Junthasoepun P 2012 Implementation of the World Health Organization Surgical Safety Checklist at a University hospital in Thailand ***Surgical infections*** 13 (1) 50-56 [online] Available from: <https://web.a.ebscohost.com> [Accessed July 2017]

Kim RY, Kwakye G, Kwok AC, Baltaga R, Ciobanu G, Merry AF, Funk LM, Lipsitz SR, Gawande AA, Berry WR, Haynes AB 2015 Sustainability and long-term effectiveness of the WHO Surgical Safety Checklist combined with pulse oximetry in a resource-limited setting. Two year update from Moldova **JAMA surgery** 150 (5) 473-479 [online] Available from: <https://web.a.ebscohost.com> [Accessed July 2017]

Kwok AC, Funk LM, Baltaga R, Lipsitz SR, Merry AF, Dziekan G, Cionau G, Berry WR, Gawande AA 2013 Implementation of the World Health Organisation Surgical Safety Checklist, including introduction of pulse oximetry, in a resource-limited setting **Annals of surgery** 257 633-639

Lavy C, Sauven K, Mkandawire N, Charian M, Gosselin R, Ndiokubwayo JB, Parry E 2011 State of surgery in tropical Africa: a review **World journal of surgery** 35 262-271 [online] Available from: <https://link.springer.com> [Accessed May 2017]

Leifso G 2014 Making a difference: using the Safe Surgery Checklist to initiate continuing education for perioperative nurse in low-income settings **ORNAC journal** 32 (1) 12-27 [online] Available from: <https://web.a.ebscohost.com> [Accessed July 2017]

Lilaonitkul M, Kwikiriza A, Ttendo S, Kiwanuka J, Munyarungero E, Walker IA, Rooney KD 2015 Implementation of the WHO Surgical Safety Checklist and surgical swab and instrument counts at a regional referral hospital in Uganda - a quality improvement project **Anaesthesia** 70 1345-1355 [online] Available from: <https://web.a.ebscohost.com> [Accessed May 2017]

Melekie TB, Getahun GM 2015 Compliance with Surgical Safety Checklist completion in the operating room of University of Gondar Hospital, Northwest Ethiopia ***BMC research notes*** 8 (361) DOI 10:1186/s13104-015-1338-y [online] Available from: <https://web.a.ebscohost.com> [Accessed May 2017]

Mody G, Taha BW, Mubiligi J, Mpunga T, Musavuli J, Rutaganda E, Riviello R, Hirschhorn LR 2014 Systems-based quality improvement as a tool to implement the Surgical Safety Checklist in Rwanda ***Rwanda medical journal*** 71 (1) 9-14 [online] Available from: <https://doaj.org/> [Accessed May 2017]

O'Connor P, Reddin C, O'Sullivan M, O'Duffy F, Keogh I 2013 Surgical checklists: the human factor ***Patient safety in surgery*** 7:14 [online] Available from: <http://biomedcentral.com> [Accessed May 2017]

Patel KG, Eberlin KR, Vyas RM, Hamdan US 2014 Use of safety measures, including the modified World Health Organization Surgical Safety Checklist, during international cleft missions ***The cleft palate-craniofacial journal*** 51 (5) 597-604 [online] Available from: <https://web.a.ebscohost.com> [Accessed July 2017]

Prakash P, Baduni N, Sanwal MK, Sinha SR, Shekhar C 2014 Effect of World Health Organization Surgical Safety Checklist on patient outcomes in a tertiary care hospital of Delhi ***International medical journal*** 21 (4) 376-378 [online] Available from: <https://web.a.ebscohost.com> [Accessed July 2017]



Russ S, Rout S, Sevdalis N, Moorthy K, Darzi A, Vincent C 2013 Do safety checklists improve teamwork and communication in the operating room? A systematic review ***Annals of surgery*** 258 (6) 856-871

Santana HT, de Freitas MR, Ferraz EM, Evangelista MSN 2016 WHO Safety Surgical Checklist implementation evaluation in public hospitals in the Brazilian Federal District ***Journal of infection and public health*** 9 586-599 [online] Available from: <https://web.a.ebscohost.com> [Accessed May 2017]

Weiser TG, Haynes AB, Lashoher A, Dziekan G, Boorman DJ, Berry WR, Gawande AA 2010 Perspectives in quality: designing the WHO Surgical Safety Checklist. ***International journal for quality in health care*** 22 (5) 365-370

World Bank 2017 **World Bank country and lending groups** [online] Available from <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> [Accessed July 2017]

Yu X, Huang Y, Guo Q, Wang Y, Ma H, Zhao Y; on behalf of the Relaunch and Implementation of Operating Room Surgical Safety Checklist (RIORS) study group 2017 Clinical motivation and the surgical safety checklist ***The British journal of surgery*** 104 (4) 472-479 [online] Available from: <https://onlinelibrary.wiley.com/> [Accessed July 2017]

Yuan CT, Walsh D, Tomarken JL, Alpern R, Shakpeh J, Bradley EH 2012  
Incorporating the World Health Organization Surgical Safety Checklist into practice in  
two hospitals in Liberia *The joint commission journal on quality and patient  
safety* 38 (6) 254-260