REVIEW ARTICLE

IMPROVEMENT OF SAFETY IN OPERATING THEATRES BY TRAINING AND TEAMWORK

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ABSTRACT

Medical incidents in public hospitals in Hong Kong have persisted for years. The operating theatres are one of the places where medical accidents occur, especially affecting service quality. The surgical team is a substantial cause of medical incidents, possibly because of human mistakes, environmental, equipment, and system failures. Not all surgery departments will implement uniform working styles. The Hospital Authority may set a management plan to unify practice and to identity the problems faced. Therefore, the government and Hospital Authority should focus on human resources, especially in terms of professional training and retention of staff. After all, surgery is a task of teamwork.

KEYWORDS

operating theatres, quality improvement, public hospital, medical incidents, surgical safety checklist, retain healthcare staff, teamwork

INTRODUCTION

Approximately 200,000 operations were performed in the operating theatres of Hong Kong public hospitals from 2018 to 2019. [1] The Hospital Authority (HA) had started to promote the "Surgical Safety Policy" in 2009 and acted according to the World Health Organization (WHO) framework of "Safe Surgery Saves Life". Medical incidents, arising from the operating theatres in surgery and interventional procedures have involved the wrong patient or body part, retained instruments or other materials, which accounted for almost half of the sentinel events (Figure 1). [2, 3] This article will review the quality improvement of operating theatres in Hong Kong public hospitals.

FIGURE 1. YEARLY DISTRIBUTION OF SENTINEL EVENTS BY CATEGORY (FROM 2007 TO 2016) [3, 4]
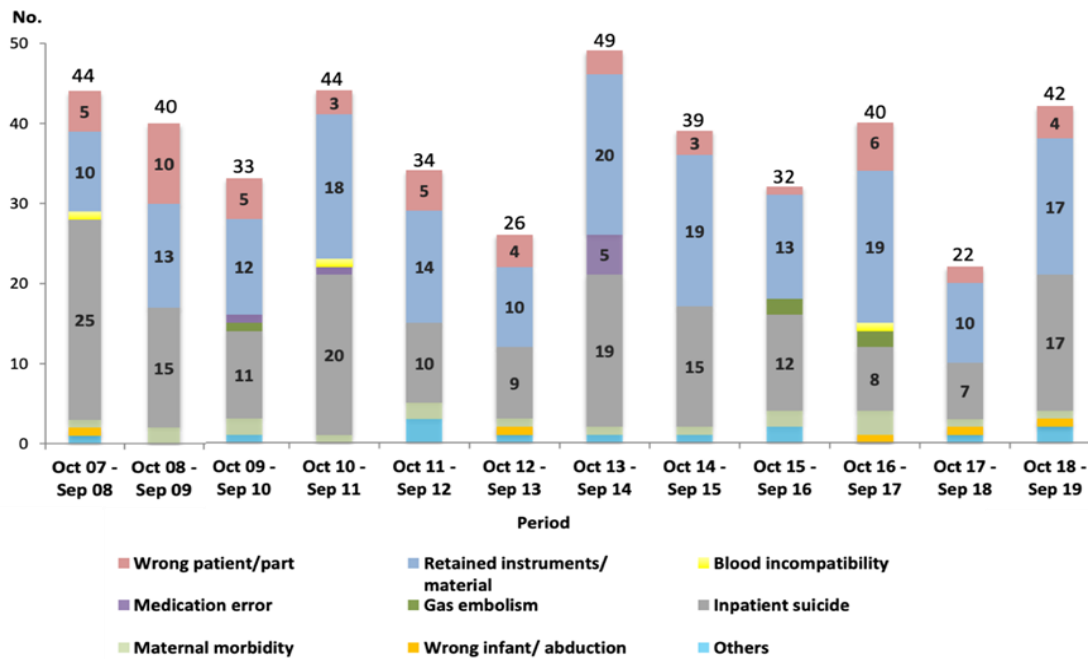
SURGICAL SAFETY CHECKLIST

The "Surgical Safety Checklist" was launched in 2008 and has become an essential part of the surgical practice. Its goal is to ensure the safety of surgical procedures and reduce the mortality rate by adopting better communication culture and teamwork. The checklist is divided into three phases, including before induction of anaesthesia, before skin incision and before the patient leaves operating theatre [5]. Each phase is a separate part during the general flow of work. The surgical team must complete the checklist at each of the critical timings before and during the surgery as well as before leaving the operating theatre. The checklist is intended to facilitate the surgical team to confirm important and essential information regarding the right patient and surgical site. The nurses and anaesthetists must thoroughly confirm the identity of patients, the marked surgical site, and known allergies before induction of anaesthesia. Furthermore, to avoid the incidents of critical events, all surgeons should anticipate such and similar occurrences, like possible and approximate blood loss, and plan for the emergency response or non-routine steps. [6]

Although the checklist has been implemented internationally, its effectiveness in the reduction of mortality rates has been questioned as some studies have found mixed outcomes from its implementation. For example, the implementation of checklist in Scotland through the

Scottish Patient Safety Programme has found a substantial decrease of mortality rates in patients undergoing surgical intervention, while hospitals in South Carolina which completed a collaborative, unit-based implementation protocol successfully have achieved a 22% reduction in mortality rates. [7, 8] The implementation of the Checklist in 101 hospitals in Ontario, Canada was not associated with significant reductions in surgical complications or mortality rate during three months of adoption. [9]

CURRENT SITUATION IN HONG KONG

REPORT OF SENTINEL EVENTS AND SERIOUS UNTOWARD EVENTS

In Hong Kong, the Sentinel Event (SE) Policy was implemented in 2007 and the report of Serious Untoward Event (SUE) was incorporated in 2010. [3] The reports of SE and SUE in hospitals aim to identify and review the underlying causes of incidents, and to make recommendations for improvement on patient safety. There are nine categories in SE, including retained instruments, inpatient suicide, wrong patient or body part, and so on. While SUE includes medication error and patient misidentification leading to death.

There were 403 SE incidents reported from October 2007 to September 2018 and the number had decreased from 40 to 22 from October 2016 to September 2018 (Figure 1). [3]

Throughout the years, the category of retained instruments or material, inpatient suicide and wrong patient or part accounted for the most frequent reported SE, which are about 88% of all SE incidents from 2007 to 2019. Among the top three categories, retained instruments or material has remained the most reported category since 2007 and this contributed to higher sentinel events in operating rooms compared to other departments in public hospitals.

Medication errors and surgical procedures of medical incidents are the most concerns as they may result in serious and permanent loss of patient's body functions and even death. Although the number of SE has reduced and maintained less than 50 cases each year after the implementation of SE policy, it has not indicated a continuous drop of incidents throughout the years. The healthcare environment is considered to be very complicated and thus difficult to achieve zero medical incidents. Nonetheless, the effectiveness of existing mechanisms and the management of medical incidents still have room for improvements.

HUMAN RESOURCES

There were 14,651 doctors and 56,723 nurses in Hong Kong up to the end of 2018. [10] The ratio of doctor and nurse to the population is around 1: 511 and 1: 312. According to the survey conducted by the Department of Health, more doctors worked in private sector than those who worked in HA (Figure 2). [11] As public hospitals provide over 80% of all inpatient beds for the entire Hong Kong population, the supply of less than 50% of active doctors in public sectors does not meet the upsurge in service demand. [12] The ratio of doctors to population in Hong Kong is much less desirable, compared with Japan and Australia. This means that Hong Kong physicians need to take care of more patients (Table 1). The government must have a long-term health care manpower planning to recruit more healthcare staff, especially doctors, to work in public hospitals so that the service quality and surgical safety can be assured. It was suggested to have an average of 3.4 doctors for every 1,000 people by the Organisation for Economic Cooperation and Development but the current ratio in Hong Kong is only around 1.9. The shortage of doctors creates heavy workload to them and may increase the chance of medical incidents.

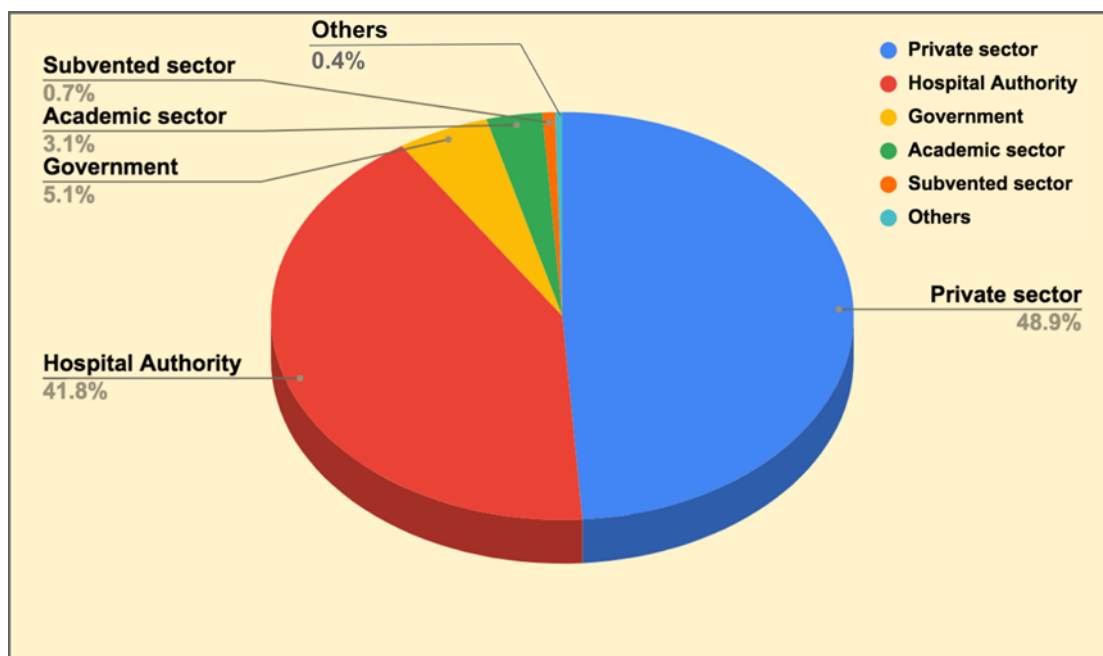**FIGURE 2. DISTRIBUTION BY SECTOR FOR HONG KONG DOCTORS IN 2015 [11]**

TABLE 1. RATIO OF DOCTORS TO POPULATION IN DIFFERENT COUNTRIES

	HONG KONG [13]	JAPAN [14]	AUSTRALIA [15]
RATIO	1:519	1:416	1:255
YEAR OF REPORT	2017	2016	2015

CAUSES OF MEDICAL INCIDENTS IN OPERATING THEATRES

IMPORTANT PARTS OF SAFETY AND QUALITY IMPROVEMENT IN OPERATING ROOM

Understanding the process flow map of operating theatres can assist in the evaluation of the possible causes of medical incidents in operating theatres. There are five important parts regarding safety and quality improvements in the operating rooms (Figure 3 and 4). [16] The first critical point is to standardise surgery scheduling which can lead to a reduction of scheduling errors. The second point is to improve surgical materials management. Poor materials management may lead to out of stock or expired inventory if there are non-scheduled order materials. Thirdly, it should include a verification of pre-operative preparation, just in case some of the surgeons may advance the pre-operative workup variably and the staff must confirm the follow up procedure. After that, the verification of the patient's preoperative antibiotics, consent, site marking is very important. Such errors are the causes of the medical incidents in operating theatres, such as the wrong surgical site. The last part is the co-operation between the surgeon and the anaesthesiologist, and this is essential to the surgery. For example, if the surgeon does not arrive at the operating theatre on time, it will result in unnecessary time under anaesthesia and delay of surgical procedure. [16]

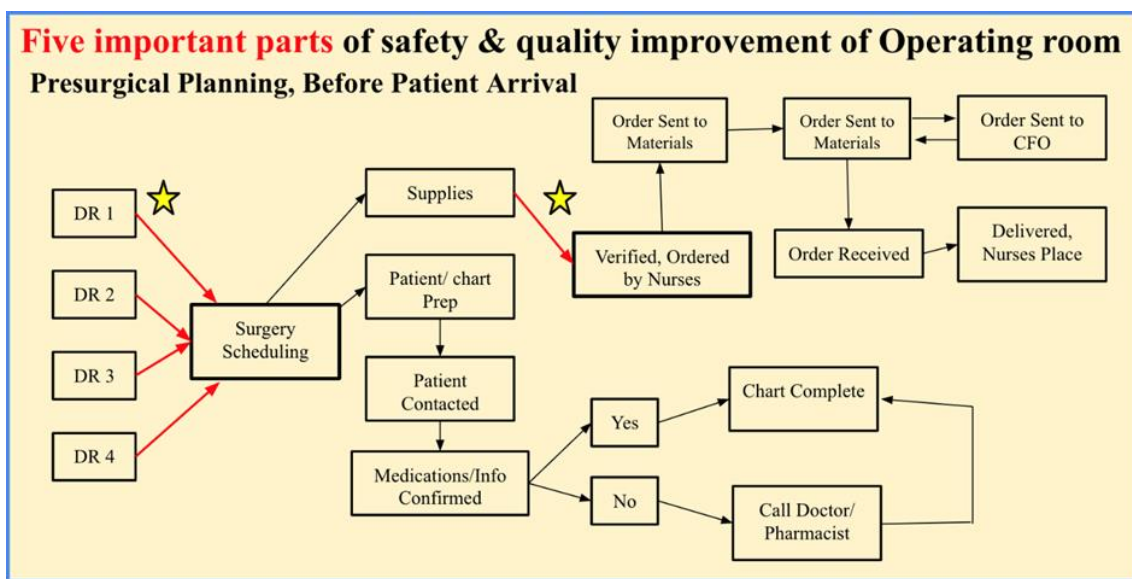**FIGURE 3. PROCESS MAP OF PRESURGICAL PLANNING, BEFORE PATIENT ARRIVAL**
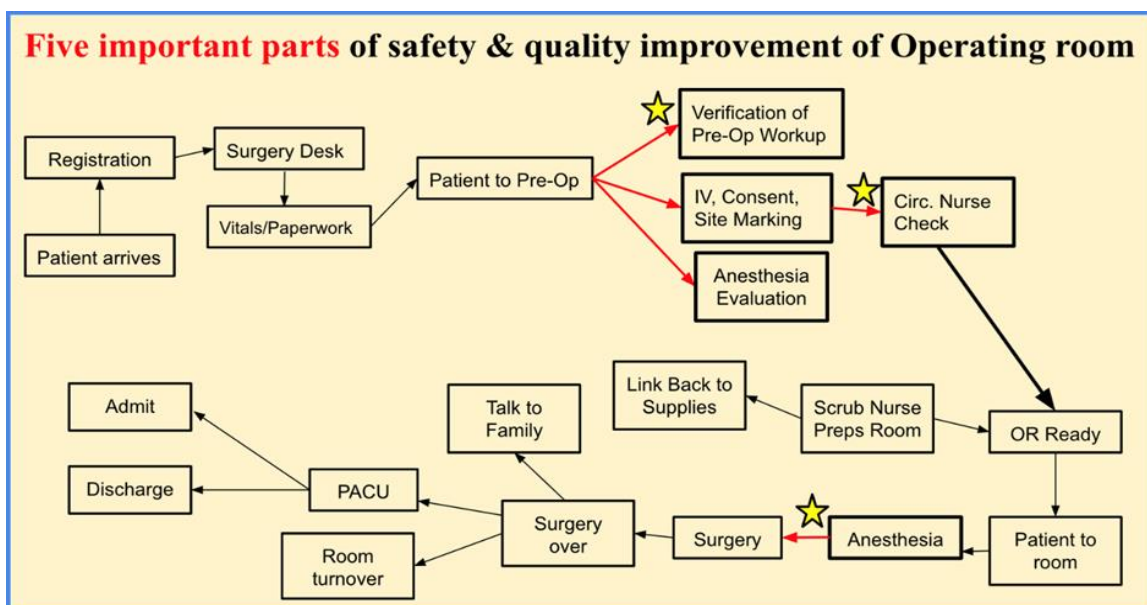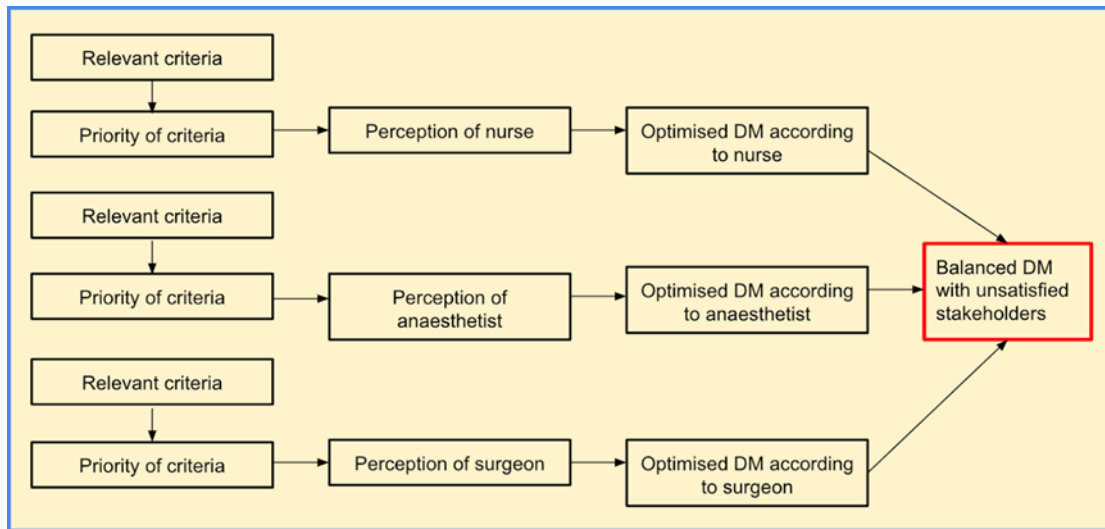

FIGURE 4. PROCESS MAP OF DAY OF SURGERY

FACTORS OF MEDICAL INCIDENTS IN OPERATING THEATRES

There are several factors which may cause intra-operative stress to negatively influence the judgment, decision making, and communication of surgeons. [17] Human, environmental, equipment, and system component failures are the four main elements affecting the quality of the surgical procedures in the operating room. First, safe surgery is important and medical incidents are highly related to human errors since the surgeon's performance will directly affect the surgical process. Therefore, the knowledge and personal factors of the surgeon become the crucial determinant for the safety and quality of surgery. The complexity of the procedure, dealing with unstable patient and unprepared equipment frequently occur that causes surgeons to work under high pressure. [18] Poor equipment quality and noisy environmental disturbance may affect the process of surgery. For example, the surgeons need to properly follow a series of steps in the tranquil area and they also need to use the appropriate equipment during the procedure. Likewise, the anaesthesia team and the nursing staff should cooperate appropriately with the surgeon because all staff involved in an operation are interdependent and they should avoid making communication mistakes during surgery. [19]

DECISION MAKING IN TEAMWORK

Unplanned surgery sometimes occurs due to emergencies, such as car accidents. There are two main factors that influence the decision-making of unplanned surgery, including the shortage of human resources and materials and the lack of capacity in operating theatres. [20] Medical staff may bring unstructured decision-making in the operating theatres. Inter-professional and interpersonal dynamics among surgeons, anaesthetists, and nurses are essential during unplanned surgery. All parties have different concerns on efficient schedule of the unplanned surgery arising from their interests and this affects their decision making (Figure 5). The surgeons have the interest to schedule patients that suit their own agenda. For the anaesthetists, working hours are based on an hourly basis, and so their interest is in efficient scheduling. For the nurses, they have fixed hours of shift duties and want to prefer an efficient schedule during the fixed hours. Therefore, a comprehensive schedule plan for the relevant parties concerned can improve decision-making in operating theatres.

RECOMMENDATIONS

ENHANCEMENT OF TRAINING IN SAFETY

Before any operation begins, the nurses of the surgical team must ensure that all essential documents are available and duly completed, including the consent form and identification tags. [21] They should also prepare surgical equipment and materials carefully, review all documents and make sure that the whole surgical team understand the intended procedure and the marking of the operative site. A complete preoperative verification

process can prevent the surgical team from missing details or inconsistencies to avoid unnecessary human errors. Therefore, regular training on the proper procedure of Surgical Safety Checklist and the compliance of conducting the post-procedure checking guidelines should be organised for staff working in the operating theatres. Adequate training could ensure that staff are familiar with the checking technique of the procedures and will increase their awareness of the critical steps of surgical procedures to avoid medical incidents in operating theatres.

IMPROVE COMMUNICATION AND TEAM BUILDING

Communication and a sense of working as a team can provide stronger support to staff, especially the juniors. resulting in fewer mistakes and more resilience which in turn improve the overall safety. [22] Senior staff and consultants can also provide advice and execute better supervision to junior staff and specialty trainees so that they can be more involved in the running of the surgical wards and the process of operations. The junior members will learn how to manage specific situations. In addition, the timely assistance of the anaesthesia team and communication among the surgeons, anaesthetists and nurses can help to avoid mistakes during the operations to ensure patient safety. [23] For example, an electronic screen can be placed in the operating room to record the medical history, complete operation sequence of each patient and facilitate the operating room staff. This may strengthen the communication among team members, and they can understand their tasks more clearly from the update displays on screen and facilitate the efficiency of the operation. Both the National Academy of Medical Sciences and the Joint Commission have suggested that the lack of teamwork is the major cause of inefficiencies and medical errors in the operating rooms. [24] Therefore, surgical excellence demands teamwork. All surgical teammates must offer their greatest professional ability and co-operate with each other to achieve a successful operation.

ADOPTION OF SHORTER SHIFT

Standard working hours can protect workers' rights and adequate rest time is very important for health care staff. Making mistakes in decisions by health care staff is caused by sleep-deprivation. [25] Tiredness and fatigue can contribute to human errors by affecting decision making. A balance of a working schedule and rest time is essential in protecting both healthcare workers and patient safety. With reference to the European Working Hours Regulation legislation, sufficient rest time for doctors could reduce fatigue and improve their own safety and that of patients. [21] Medical staff working shorter shifts are less likely to make serious medical errors comparing with working frequent shifts of 24 hours. [26] Therefore, HA should consider shorter shift instead of frequent shift with frequent overtime work so as to increase work satisfaction and quality of care.

REAL-TIME OBSERVATION DURING SURGERY

To effectively reduce the surgical incidents in operating theatres, real-time observation by the senior medical staff with a checklist during surgery is useful. [27] The occurrence of adverse events was decreased 30% after the adoption of real-time observation due to the senior who can oversee the surgical activity. Therefore, the completion of Surgical Safety Checklist can be enhanced for reduction of surgical incidents. Furthermore, senior medical staff acting as observer can utilise Observational Teamwork Assessment for Surgery for assessing the communication, leadership, cooperation, coordination and team monitoring among surgeons, nurses and anaesthetists. [28] Observer can rate on the above five behaviours for understanding the room for improvement in the operating theatres. The assessment is crucial to identify the issues in the operating theatres to optimise the surgical procedure. Follow up discussion with the surgical staff on the identified problems during surgery can be conducted.

CONCLUSION

The ideal quality of the operating theatres is principally due to the professional surgical team and proper operating environment. Heavy workload can lead to professional surgical teams working in stressful mentality causing higher chance of medical incidents. Therefore, the government and Hospital Authority must aim to improve the quality of the operating theatres in terms of professional training and retention of staff. Effective quality improvement in the operating room is expected to minimise the medical error.

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