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Compliance with Health and Safety Standards in Selected Operating Rooms of Public and Private Hospitals in Baghdad, Iraq: A Cross-Sectional Comparative Audit

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Abstract

Background: Operating rooms are among the most demanding areas of a hospital because infection control, sterilization, environmental conditions, equipment, staffing, documentation, and teamwork have to work together. This study examined how well selected health and safety requirements were being followed in operating rooms in public and private hospitals in Baghdad, Iraq. **Methods:** We conducted an observational cross-sectional audit in eight hospitals, four public and four privates, from 1 March to 28 April 2026. One operating room from each hospital was assessed with a structured checklist containing 30 indicators. An indicator received a score of 1 when the requirement was met and 0 when it was not. For each hospital, the compliance percentage was obtained by dividing the number of compliant indicators by 30 and multiplying the result by 100. Means, sample standard deviations, minimum and maximum values, and range widths were then summarized for the two sectors. **Results:** The public hospitals had compliance values between 53.3% and 100.0%, whereas the corresponding range in the private hospitals was 66.7%-90.0%. The mean compliance was 80.8% (SD 21.8%) for the public hospitals and 77.5% (SD 10.0%) for the private hospitals, giving a difference of 3.3 percentage points. The wider spread among the public hospitals was more noticeable than the difference between the two means. Problems were repeatedly noted in sterilization monitoring, ventilation, fire safety, hand-hygiene facilities, staffing, training records, and clinical documentation. The audited hospitals differed considerably in their level of compliance, and the public/private classification by itself did not account for that variation. The findings point to the need for audits at facility level, written corrective-action plans, and follow-up assessments. Since the hospitals were purposively selected and only one operating room was assessed in each, these results should be viewed as a local descriptive audit and not as an estimate of compliance across all hospitals in Baghdad.

Keywords

Operating Room;
Patient Safety;
Infection Prevention and Control;
Sterilization;
Health and Safety Standards;
Baghdad;
Iraq



1. Introduction

An operating room is a setting in which several demanding activities take place at once. Anesthesia, invasive procedures, instrument processing, environmental cleaning, infection prevention, equipment management, and decisions by different members of the team all have to be coordinated. Patient safety therefore depends on the way these processes work together, not on a single intervention. The World Health Organization (WHO) identifies surgical-site infection prevention, safe anesthesia, safe surgical teams, and measurement of surgical services as important elements of safer surgery (World Health Organization [WHO], 2009b).

The WHO Surgical Safety Checklist was developed to help surgical teams verify critical steps and communicate during the procedure. Its implementation manual places additional emphasis on leadership, staff involvement, training, multidisciplinary participation, local adaptation, and feedback (WHO, 2009a). In practice, the checklist is one component of a wider safety system; it cannot replace the systems and resources needed to provide safe surgical care.

Prevention of surgical-site infection extends across the whole perioperative period. WHO guidance brings the preoperative, intraoperative, and postoperative measures together and stresses the need to adapt recommendations to local health-system conditions (WHO, 2018). The Centers for Disease Control and Prevention (CDC) provides related recommendations, while perioperative professional guidance also emphasizes standardized practice, environmental safety, and quality monitoring (Centers for Disease Control and Prevention [CDC], 2017; Association of periOperative Registered Nurses [AORN], 2021).

Safe perioperative practice also depends on the physical environment. Ventilation, hand-hygiene facilities, fire protection, sterilization arrangements,

emergency equipment, patient and waste movement, and staffing all influence how consistently safety procedures can be carried out. AORN describes its perioperative standards as evidence-based guidance for safe patient care and workplace safety (AORN, 2021).

Public and private hospitals in Baghdad do not necessarily operate under the same administrative or resource conditions. Examining individual facilities can therefore reveal practical problems that may be hidden by a simple comparison of ownership categories. This study assessed selected health and safety requirements in four public and four private hospitals in Baghdad and described the pattern of compliance across the audited facilities.

2. Materials and Methods

2.1 Study design and setting

A cross-sectional observational study was conducted in Baghdad, Iraq, from 1 March to 28 April 2026. Eight hospitals were included: four public hospitals (Ibn Al-Nafees Hospital, Neurosurgery Hospital, Ibn Al-Haitham Hospital, and Al-Kindi Hospital) and four private hospitals (Al-Jarrah Hospital, Al-Taj Private Hospital, Al-Ameer Private Hospital, and Baghdad Private Hospital). One functioning and accessible operating room was assessed in each hospital using purposive selection.

2.2 Audit instrument

For the audit, a structured checklist was prepared from national and international health and safety requirements. The tool contained 30 indicators distributed across ten areas: infrastructure and engineering standards, infection control, sterilization, ventilation, equipment, human resources, standard operating procedures, waste management, safety measures, and key performance indicators. Each indicator was assigned 1 when the requirement was met and 0 when it was not.

The analysis uses the hospital-level scores available in the study records. The available material did not document formal psychometric validation of the checklist or inter-rater reliability testing, so these measures are not presented.

2.3 Data collection

Information was collected mainly by direct observation in the operating rooms. Where records were available, sterilization logs, staff training records, and maintenance documents were also reviewed. The audit concentrated on observable practices and on the availability or functioning of selected systems and equipment. No patient-identifying information was collected.

2.4 Outcome measure and statistical analysis

The primary outcome was hospital-level compliance with the 30 checklist indicators. Compliance was calculated as (number of compliant indicators / 30) × 100. For each sector, the four hospital percentages were used to calculate the mean, sample standard deviation (SD; denominator n-1), minimum, maximum, and range width. Because the sample contained only four purposively selected hospitals in each sector, inferential testing was not undertaken. The analysis was therefore descriptive and was not intended to estimate a population effect or establish statistical significance.

2.5 Data-quality control

Review of the transcribed item-level material showed several formatting and transcription inconsistencies, including a duplicated handwashing value and one checklist cell with a non-binary entry. Since these entries could not be considered sufficiently reliable, the manuscript presents the eight hospital totals and percentages instead of the affected item-level tables. The original signed audit sheets should be checked against the reported totals before submission, and any discrepancy should be resolved

and documented. This step is important for maintaining an auditable and reliable dataset.

3. Results

3.1 Hospital-level compliance

Sector	Hospital	Score	Compliance (%)
Public	Ibn Al-Nafees Hospital	29/30	96.7
Public	Neurosurgery Hospital	30/30	100.0
Public	Ibn Al-Haitham Hospital	22/30	73.3
Public	Al-Kindi Hospital	16/30	53.3
Private	Al-Jarrah Hospital	20/30	66.7
Private	Al-Taj Private Hospital	22/30	73.3
Private	Al-Ameer Private Hospital	27/30	90.0
Private	Baghdad Private Hospital	24/30	80.0

The highest compliance was recorded in Neurosurgery Hospital (100.0%), followed by Ibn Al-Nafees Hospital (96.7%) and Al-Ameer Private Hospital (90.0%). Al-Kindi Hospital had the lowest score, at 53.3%. In Al-Taj Private Hospital, 22 of the 30 indicators were compliant, giving 73.33%, which is reported as 73.3%.

3.2 Public-private descriptive comparison

Sector	n	Mean (%)	SD (%)	Range (%)	Range width
Public hospitals	4	80.8	21.8	53.3-100.0	46.7
Private hospitals	4	77.5	10.0	66.7-90.0	23.3

Mean compliance was 80.8% among public hospitals and 77.5% among private hospitals, a difference of 3.3 percentage points. The public-sector SD was more than twice the private-sector SD, and its range was also approximately twice as wide. Thus, the main feature separating the two groups in this sample was the degree of variation between hospitals rather than their average compliance.

3.3 Commonly reported gaps

Area	Audit finding
Continuous staff training documentation	Absent or insufficient in most hospitals.
Sterilization monitoring	Gaps in monitoring or documentation of sterilization processes in several hospitals.
Ventilation	HEPA-filtered ventilation was not consistently available across hospitals.
Fire safety	Functional fire-alarm systems were absent in several assessed hospitals.
Hand-hygiene infrastructure	Insufficient stations and/or lack of touchless systems

Area	Audit finding
	were repeatedly reported.
Staffing	Incomplete anesthesia/nursing team availability was reported in several hospitals.
Clinical documentation	Incomplete surgical and anesthesia records were reported in some institutions.
Patient/waste flow and isolation	Deficiencies were reported in several hospitals, raising concern about cross-contamination.

4. Discussion

The eight operating rooms showed a wide spread in compliance. The public-sector mean was somewhat higher than the private-sector mean (80.8% versus 77.5%), but the public hospitals also showed much greater variation. The highest and lowest scores were both found in the public group, whereas the private hospitals occupied a narrower range. On this basis, the data do not support the view that either ownership sector consistently performs better.

The sector comparison should be interpreted cautiously. There were only four hospitals in each group, one operating room was assessed per hospital, and the facilities were purposively selected. The 3.3-percentage-point difference in the means cannot be interpreted as an ownership effect because the study was not designed or powered to test such an effect. What the data show more clearly is variation between individual facilities in both sectors.

The weaknesses identified in sterilization monitoring are important from an infection-prevention

perspective. The presence of sterilization equipment alone does not show that the process is adequately controlled. Monitoring, maintenance, documentation, and staff competence all contribute to a reliable sterilization system. This interpretation is consistent with WHO guidance, which treats surgical-site infection prevention as a coordinated set of measures throughout the perioperative period (WHO, 2018).

Ventilation and other environmental controls also require attention. The finding that HEPA-filtered ventilation was not consistently available should not be interpreted as proof that every assessed room failed its applicable engineering requirement. The appropriate ventilation arrangement depends on the room's design and function and on the technical standard used for assessment. Nevertheless, the finding supports a more formal review of operating-room environmental conditions and documented corrective action where needed.

Fire protection and hand-hygiene facilities are closely linked to day-to-day clinical practice. Safety procedures are difficult to maintain when emergency systems are not functional or when adequate hand-hygiene facilities are unavailable. The repeated gaps in these areas suggest that quality improvement should address both the availability of the required infrastructure and its regular inspection and maintenance.

Training documentation was another recurring concern. WHO guidance on implementation of the Surgical Safety Checklist emphasizes education and training alongside leadership, multidisciplinary participation, local adaptation, and continuing feedback (WHO, 2009a). In the operating room, continuing education is more meaningful when attendance is documented, competence is assessed, and the results of audits are fed back to staff.

The findings also underline the limitations of relying on a checklist alone. A checklist can support communication and help staff verify important safety steps, but it cannot substitute for functioning

sterilization systems, appropriate environmental controls, emergency preparedness, adequate staffing, maintenance, or complete clinical records (Haynes et al., 2009; WHO, 2009a). Its value is therefore greater when the results are incorporated into the hospital's broader quality-improvement process.

The study has some practical strengths. A common 30-indicator framework was applied to all participating hospitals, and the results are presented at hospital level. The limitations, however, need to be considered when interpreting the findings. Only one operating room was assessed in each hospital; the hospitals were purposively selected; and patient outcomes and surgical-site infection rates were not collected. Procedure-level observations were not undertaken, and formal reliability testing of the checklist was not documented. The transcription inconsistencies identified during review also make reconciliation with the original signed audit sheets necessary before submission. These factors limit generalizability, although the audit can still serve as a useful facility-level baseline for quality improvement.

5. Conclusions

The audited operating rooms differed considerably in their compliance with the selected health and safety requirements. Public hospitals had a slightly higher descriptive mean, but their scores were much more variable than those of private hospitals. The pattern cannot reasonably be attributed to ownership alone. The recurring concerns were sterilization monitoring, ventilation, fire safety, hand-hygiene facilities, staffing, training documentation, and clinical records. Regular facility-level audits, followed by documented corrective action, are therefore likely to be more useful than conclusions based simply on sector.

6. Recommendations

Use a standardized operating-room audit tool that reflects applicable Iraqi requirements as well as recognized international guidance on surgical safety and infection prevention.

Repeat the audit at defined intervals and record a corrective-action plan for each item that remains non-compliant.

Strengthen sterilization quality assurance by using validated processes, routine monitoring, proper equipment maintenance, competency assessment of staff, and complete records.

Assess ventilation according to the technical requirements applicable to each operating room and document any engineering correction that is required.

Maintain functioning fire-detection, alarm, and emergency-response systems and include their condition in routine safety checks.

Improve hand-hygiene facilities by ensuring adequate sinks, supplies, and suitable fixtures.

Establish documented continuing-education and competency programs for surgical, anesthesia, nursing, and technical personnel.

Ensure that appropriate anesthesia and nursing staff are available during surgical activity.

Improve surgical and anesthesia records and use the audit findings within the hospital's quality-improvement activities.

Before submission, check the reported hospital totals against the original signed audit sheets and retain a verified final dataset for future audit or review.

7. Ethical Considerations

The study was carried out with formal institutional authorization from the University of Uruk. Official university letters were addressed to the relevant

health directorates and participating institutions to permit the field visits and collection of information. The work consisted of observing operating-room standards and reviewing selected institutional records. No patient-identifying information was collected.

8. Generative AI and AI-Assisted Technologies

During preparation of this manuscript, generative artificial intelligence tools were used for language editing, structural refinement, consistency checking, and verification of arithmetic calculations. They were not used to generate, fabricate, or modify study observations, hospital scores, or source data. The author reviewed and approved the final manuscript and remains responsible for the accuracy of the reported findings, their interpretation, and the integrity of the data and references.

9. Author Contributions

Saad Taleb Mohammed Ridha Al-Zubaidi: academic supervision, study oversight, scientific review, interpretation of findings, manuscript preparation, and final approval of the submitted version.

10. Conflict of Interest

The author declares no conflict of interest.

12. References

- Association of periOperative Registered Nurses. (2021). Guidelines for perioperative practice. AORN, Inc.
- Centers for Disease Control and Prevention. (2017). Guideline for the prevention of surgical site infection. U.S. Department of Health and Human Services. <https://www.cdc.gov/infection-control/hcp/preventing-surgical-site-infections/>
- Haynes, A. B., Weiser, T. G., Berry, W. R., Lipsitz, S. R., Breizat, A.-H. S., Dellinger, E. P., Herbosa, T., Joseph, D., Kibata, P. L., Little, B. B., Lapitan, P. M., Mendez, C., Merry, A. F., Moorthy, K., Reznick, R. K., Taylor, B., & Gawande, A. A. (2009). A surgical

safety checklist to reduce morbidity and mortality in a global population. *New England Journal of Medicine*, 360(5), 491-499. <https://doi.org/10.1056/NEJMsa0810119>

World Health Organization. (2009a). Implementation manual WHO surgical safety checklist 2009: Safe surgery saves lives. <https://www.who.int/publications/i/item/9789241598590>

World Health Organization. (2009b). WHO guidelines for safe surgery 2009: Safe surgery saves lives. <https://www.who.int/publications/i/item/9789241598552>

World Health Organization. (2018). *Global guidelines for the prevention of surgical site infection* (2nd ed.). <https://www.who.int/publications/i/item/9789241550475>