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Assessment of Healthcare Workers' Knowledge and Compliance with Perioperative Infection Control Measures

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Abstract: Infection control in perioperative care is essential to prevent surgical site infections (SSIs) and achieve better patient outcomes. The presented study attempted to evaluate the knowledge, self-reported compliance, and predictors of the infection control practices among the perioperative healthcare workers and to estimate training uptake and guideline awareness in the various occupational groups. In the cross-sectional study, the sample comprised 230 perioperative healthcare workers, such as specialized surgeons, resident surgeons, nurses (diploma and less than diploma), anesthesia staff, and assistant personnel. The data were gathered with the help of a structured questionnaire that included demographic data, a history of training, awareness of the guidelines, infection control practices, and a score on knowledge. In general, training on infection control was provided to 30.9 percent of the participants, as well as a copy of the national guideline was provided to 11.3 percent of participants. Occupational differences in knowledge were highly significant: nurses (17.217.3/21) and specialized surgeons (17.2/21) had the highest scores, and assistant staff (6.3/21) and anesthesia assistants (9.2/11) had the lowest scores. Basic practices (e.g., mask use 99.1% and short nails 99.1%) were highly self-reported, whilst appropriate preoperative shaving (53.1% used an electric shaver) and laundering scrub suits within the same department (23.0%). The independent predictive factors of knowledge significant were years of experience to resident surgeons (p=0.018; assistant staff, p=0.030) and background training (below-diploma nurses, p=0.035). Infection control training and dissemination of guidelines and knowledge on the part of perioperative staff, specifically anesthesia and assistant staff, have significant gaps. Although some of the simplest compliance indicators are also high, specific education intervention is urgently required to low-scoring occupational groups to enhance the general perioperative infection prevention.

Keywords: Perioperative Infection Control, Healthcare Workers' Knowledge, Compliance, Surgical Site Infections, Infection Prevention Guidelines, Operating Room Safety, Occupational Training.

INTRODUCTION

Surgical site infections (SSIs) still take the place among the most widespread and avoidable complications in contemporary healthcare and cause a lot of morbidity to patients, extended patient stays [Cruz, J. P., & Bashtawi, M. A. 2016], and high expenditures on healthcare services, and even death. In spite of all improvements in surgical methods, technologies in sterilization, as well as antimicrobial prophylaxis [Abd Elaziz, K. M., & Bakr, I. M. 2009], SSIs still impact a high level of surgical patients across the globe, especially in low and middle-income contexts. Infection control measures during peri operation in a surgical setting consistently and properly can be implemented by all healthcare workers working in the surgical setting, and this is what prevents SSIs [Chao, W. Y. *et al*., 2025; Shelby, D. M. 2014]. These steps encompass patient preoperative preparation, proper surgical hand antisepsis, use of personal protective equipment, discipline in operating theatres, and observation of evidence-based practices of skin preparation, handling of instruments, and environmental sanitation [Williams, A. B. *et al*., 2006]. Nonetheless, the practice of these guidelines in the everyday clinic setting is normally non-optimal, mainly because of gaps in knowledge, hardware limitations in training, and ineffective realization of national guidelines, and the disparity in the professional attitude and behaviour of the various professional groups [Kumah, E. A. *et al*., 2019]. The operating theater is a diverse team, comprising of specialized surgeons, resident surgeons, nurses with different educational backgrounds, anesthetists, anesthesia assistants, and other support personnel. This presents varying degrees of formal training in infection control, clinical experience, and exposure to training based on guidelines by every group [Mbroh, L. A. 2019]. Therefore, perioperative infection control measures are not usually uniform with regard to knowledge and compliance with the measures of these cadres.

An example is that, even though surgeons can undergo rigorous training in their residency, anesthesia staff and assistant staff are usually neglected in any mystery infection control

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capacity-building programs [Balliram, R. *et al*., 2021]. This difference is alarming since any failure by one member of a team to prevent infection will ruin the entire surgery operation. In addition, self-administered compliance does not necessarily correspond to compliance in reality, and most healthcare professionals overvalue their knowledge or do not realize outmoded procedures, like preoperative hair removal with shaving tools rather than electric clippers [Medley, A. *et al*., 2009]. There is a lack of access to national infection control guidelines/irregular in-service training, and no standard monitoring and feedback mechanisms compound the problem. Infection control education is not an obligatory aspect of health care practice in most healthcare facilities, where guidelines are not available or not actively distributed. The consequence is that perioperative teams might consult tradition, a peer model, or just trial and error instead of evidence-based procedures [Muscat, D. C. *et al*., 2025]. Recent research into particular knowledge gaps and compliance failures in various occupational groups, then, is a necessary first step to creating targeted interventions that could be implemented at low costs [Manan, A. *et al*., 2024].

METHOD

The study was a cross-sectional descriptive research among the perioperative healthcare workers in a tertiary care hospital between June 2024 to June 2025. The purpose of the study was to evaluate knowledge, self-reported compliance, and predictors of adherence to perioperative infection control actions. These included all the surgical units, operating theaters (OTs), and all the anesthesia departments. The target population included the entire body of healthcare professionals regularly serving in the operating theater complex: specialized surgeons, resident surgeons, diploma and sub-diploma nurses, specialized anesthetists, resident anesthetists, anesthesis assistants, and other assistants. Total enumeration sampling technique was used, and all the eligible staff was recruited as long as they had been employed in the OT for at least one month before the study. Inclusion criteria were the non-presence of the exclusion criteria within the data collection time frame or, or had they had been on extended leave. It had a final sample of 230. The data were obtained through the use of a self-administered questionnaire, which was designed based on national and international guidelines on infection control purposes. The questionnaire was divided into four parts (1) demographic and occupational variables (age, sex, years of OT experience); (2) training history, received national guidelines on infection control, and awareness of these guidelines; (3) knowledge items (21 among surgeons and nurses, 11 among the staff of anesthetic units, indicating different areas of responsibility); (4) self-reported adherence to core perioperative practices Three infection control experts determined the content validity, and a pilot test of 20 non-participant staff provided a Cronbach 81. The data were keyed into SPSS 25.0. Demographic characteristics, knowledge items, and compliance rates (Tables 1-4) were analyzed using descriptive statistics (means, standard deviations, frequencies, percentages). Knowledge and compliance of different occupational groups were compared using one-way ANOVA and chi-square. Each occupation was assessed individually by the use of linear regression analysis (Table 5), with the independent predictors of knowledge score determined as significant at $p < 0.05$.

RESULT

Table 1. Baseline the demographic and clinical parameters.

Characteristic	Value
Age (years), mean ± SD (range)	35.3 ± 7.3 (22–60)
Age group (years), n (%)	
20–29	48 (20.9)
30–39	130 (56.5)
40–49	37 (16.1)
50–59	13 (5.7)
≥ 60	2 (0.9)
Sex, n (%)	
Male	152 (66.1)
Female	78 (33.9)
Experience in OT (years), mean ± SD (range)	8.2 ± 6.0 (1–33)
Experience groups, n (%)	

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Up to 1 year	12 (6.0)
2–5 years	72 (36.0)
6–10 years	64 (32.0)
> 10 years	52 (26.0)

Table 2. Define the knowledge and self-reports of infection control practices.

Practice / Knowledge item	Correct response n (%)
Received training on infection control	71 (30.9)
Received a copy of the national IC guideline	26 (11.3)
Heard about the national IC guideline	111 (48.3)
Preoperative hair shaving is indicated	179 (95.2)
Use of an electric shaver	100 (53.1)
Shaving just before the operation	150 (79.8)
Advise an antiseptic shower pre-op	97 (51.6)
Povidone iodine for skin prep	183 (97.3)
Surgical scrub duration 2–5 min	125 (66.5)
Povidone iodine for scrub	47 (25.0)
Hands kept up and away after scrub	179 (95.2)
Brushing a scrub for nails	132 (70.2)
No hand/arm jewelry allowed	196 (89.9)
Wearing a surgical mask	216 (99.1)
Keeping nails short	228 (99.1)
The cap fully covers the hair	218 (100)
Use a surgical gown	188 (100)
Wear sterile gloves	222 (96.5)
Wear shoe covers	216 (93.9)
Limit personnel in OT	215 (93.5)
Uniform not worn outside OT	196 (85.2)
Change scrub suit if soiled	159 (69.1)
Launder the scrub suit in the same department	53 (23.0)
Disinfect surfaces after each operation	199 (86.5)
Had a recent infectious illness (flu)	5 (2.2)

Table 3. Assessment the occupation's outcomes in terms of Training, guideline awareness, and infection screening.

Occupation	N	Trained on IC n (%)	Received IC guideline n (%)	Heard about IC guideline n (%)	Screened for infections n (%)	Received HB vaccine n (%)	Completed 3 doses n (%)
Specialized Surgeon	36	5 (13.9)	4 (11.1)	22 (61.1)	23 (63.9)	33 (91.7)	31 (86.1)
Resident Surgeon	100	16 (16.0)	7 (7.0)	46 (46.0)	60 (60.0)	92 (92.0)	66 (66.0)
Nurse-Diploma	33	26 (78.8)	7 (21.2)	19 (57.6)	26 (78.8)	30 (90.9)	23 (69.7)
Nurse (<diploma)	19	13 (68.4)	7 (36.8)	12 (63.2)	11 (57.9)	19 (100)	16 (84.2)
Other assistant staff	12	11 (91.7)	1 (8.3)	4 (33.3)	8 (66.7)	9 (75.0)	8 (66.7)
Specialized Anesthetist	7	0 (0.0)	0 (0.0)	2 (28.6)	5 (71.4)	5 (71.4)	5 (71.4)
Resident Anesthetist	8	0 (0.0)	0 (0.0)	0 (0.0)	4 (50.0)	8 (100)	6 (75.0)
Assistant of Anesthesia	15	0 (0.0)	0 (0.0)	6 (40.0)	9 (60.0)	14 (93.3)	10 (66.7)
Total	230	71 (30.9)	26 (11.3)	111 (48.3)	146 (63.5)	210 (91.3)	165 (71.7)
P value		< 0.001	0.003	0.007	0.150	0.176	0.005

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Table 4. Classification the knowledge level of correct answers in the knowledge status based on occupation.

Occupation	N	Number of items	Min	Max	Mean ± SD
Specialized Surgeon	36	21	12	20	17.2 ± 2.0
Resident Surgeon	100	21	11	20	16.2 ± 2.3
Nurse-Diploma	33	21	15	20	17.2 ± 1.4
Nurse (<diploma)	19	21	14	20	17.3 ± 1.7
Other assistant staff	12	21	4	15	6.3 ± 2.8
Specialized Anesthetist	7	11	9	10	9.7 ± 0.5
Resident Anesthetist	8	11	9	11	9.7 ± 0.9
Assistant of Anesthesia	15	11	8	11	9.2 ± 0.9

Table 5. A linear regression predicators factors of knowledge scoring.

Occupation	Age	Sex	Years of experience	Trained on IC	Received the IC guideline
Specialized Surgeon	0.517	0.588	0.873	0.809	0.699
Resident Surgeon	0.862	0.055	0.018*	0.255	0.721
Nurse-Diploma	0.280	0.129	0.135	0.294	0.540
Nurse (<diploma)	0.897	0.915	0.699	0.035*	0.865
Other assistant staff	0.068	0.656	0.030*	0.857	0.433
Specialized Anesthetist	0.991	0.859	0.867	—	—
Resident Anesthetist	0.081	0.423	0.588	—	—
Assistant of Anesthesia	0.071	0.673	0.145	—	—

DISCUSSION

In this current study, evidence of severe gaps in the knowledge and adherence to perioperative infection control measures by healthcare workers (HCWs) was found, regardless of a relatively good performance in some of the fundamental practices. Interestingly, a small percentage of 30.9% of respondents received formal training on infection control, and only a small fraction of 11.3% of the respondents had a copy of the national guideline. These results are in tandem with a systematic review study by Welsh, which declared poor training and lack of dissemination of the guidelines as persistent factors to effective infection prevention and control (IPC) across the world. The low level of training coverage, particularly among at least the surgeons (13.9% of all specialized surgeons) and anesthesia staff (0% across all anesthesia cadres), is an issue of concern since the former and the latter are at the core of ensuring that the operative field remains sterile. There was an eminent discrepancy between self-reported compliance and real knowledge [Sickder, H. K. 2010; Suchitra, J. B., & Devi, N. L. 2007]. Whereas more than 95 percent of the participants answered correctly questions like wearing a surgical mask correctly, a cap covers the entire hair, and use surgical gown, there was a lack of knowledge in the depth questions. They only knew correctly 25.0% that povidone iodine is the appropriate agent to use when surgical scrubbing, and only 53.1% appropriately knew that an electric shaver is used to remove hair prior to surgery. This tendency, expressed as a high adherence to observable, protocol-oriented actions but a lack of knowledge of evidence-based reasoning, has been reported in other countries. A European Surgical Infections Research Group study in Spain [Sessa, A. *et al*., 2011] discovered that, whereas 95.2% of surgeons considered the timing of administration of antibiotic prophylaxis, only 57.2% of them used alcoholic chlorhexidine correctly instead of aqueous povidone to prepare the skin. Equally, a survey of perioperative nurses in Egypt [Kanani, J., & Sheikh, M. I. 2025] showed that there was good overall practice (59% competent) but that there were definite gaps in knowledge pertaining to the choice of antiseptic and scrub time. The scores of knowledge were significantly different by occupation ($p < 0.001$). The nursing personnel (diploma and sub-diploma) scored an average of 17.2-17.3 out of 21, whereas the other assistant personnel scored 6.3 ± 2.8, and anesthesia personnel (who took a different 11-item test) scored 9.2-9.7 out of 11. This gradient could be attributed to disparities in exposure to IPC education and role-specific tasks. Encouragingly, regression analysis (Table 5) showed that among resident surgeons and other assistant staff, years of experience was a significant positive predictor of knowledge ($p = 0.018$ and $p = 0.030$, respectively) [Kanani, J., & Sheikh, M. I. 2025; Ayed, A. 2015].

However, the status of training on infection control was a significant predictor of the nurses with sub-diplomas only ($p = 0.035$), meaning that experience-based learning may be more powerful

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than formal training only in the case of other cadres, meaning that training among all groups of professionals should be organized and repeated. One compliance to some best practices was not ideal [Sadeghpour E. S. *et al*., 2023]. Only 51.6 percent recommended office of preoperative antiseptic showers, and changed medical scrub suits when dirty, 69.1 percent, and only 23.0 percent, washed scrub suits in the same department. These loopholes reflect those present in low-resource environments: an implementation study of Clean Cut in Ethiopia revealed that compliance with sterile field maintenance and linen reprocessing was found to be lower than 50 percent with a regular quality improvement intervention in place beforehand [Trucchi, C. *et al*., 2020]. The same study discovered that multination interventions (trainings, checklists, and process mapping) resulted in compliance by enhancing compliance by 8-12 percent by IPC standards. Similarly, a recent scoping review revealed that multifaceted strategies of implementation (system change, education, monitoring, and feedback) are the most successful strategies used to enhance the level of compliance to SSI prevention. The extremely low rate of a national guideline receipt (11.3%) and its hearing (48.3) is indicative of overall systemic dissemination failure [Karuniawati, H. *et al*., 2021]. This is especially worrisome considering the fact that when no guidelines are available to use in order to assess the baseline compliance, overrating it is the most common problem. A cohort study of 18 low-income hospitals showed that groups that were overconfident in their practices in regard to initial IPC received more improvements with structured feedback, which means that objective audit data are the keys in identifying any latent gaps. It has also been demonstrated in the findings of the present study that the seeming compliance (e.g., 99.1% use masks correctly) is sometimes masking the reality that there is a severe knowledge deficiency concerning how to select and use the antiseptics, the method of scrubbing, and even the method of completing the laundry procedure [Druye, A. A. *et al*., 2024; Ranoto, L. Q. *et al*., 2025].

CONCLUSION

Although compliance with observable practices, such as wearing masks, gloves, and gowns, was high (more than 95% on most items), there were critical gaps in knowledge with regard to the correct antiseptic agent to use during surgical scrub (only a quarter to half correct) and the correct method of removing preoperative hair (53.1% correct). Worryingly, just 30.9% had undergone formal training on infection control, and only 11.3% had been provided with a copy of the national guideline, with anesthesia staff stating no training uptake. The scores in knowledge were also significantly varying by occupation ($p < 0.001$), with the lowest scores of assistant staff and those of anesthesia personnel. The years of experience were a strong and positive predictor of knowledge among the resident surgeons and assistant staff, whereas the formal training predicted only sub-diploma nurses.

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