

Evaluation of Infection Control Practices in the Operating Theater

Dr. Wedyan Abass Mohammed Witwit¹, Dr. Israa Haitham Murtadha² and Dr. Rouaa Ahmed Abdulsahab³

¹M.B.Ch.B., C.A.B.H.S. (Family Medicine), F.A.B.H.S. (Clinic. Nutr. Fellowship). Iraqi Ministry of Health, Medical City Health Directorate, Kidney Disease and Transplant Center, Baghdad, Iraq.

²M.B.Ch.B., F.I.C.M.S. (Family Medicine), Geriatric Subspecialty Arab Board, Iraqi Ministry of Health, Al-Karkh Health Directorate, Al-Karama General Hospital, Baghdad, Iraq.

³M.B.Ch.B., C.A.B.H.S. (Family Medicine), Iraqi Ministry of Health, Al-Rusafa Health Directorate, Baghdad, Iraq.

Abstract: Objective: To assess the infection control practices in the operating theater in terms of healthcare workers in healthcare and to evaluate their personal attributes, training level, awareness of the guidelines, and behavioral preventive factors. Method: The research was carried out on a population of 230 healthcare professionals in the operation department (specialized and resident surgeons, nurses, anesthetists, and anesthesia assistants). The age, sex, years of experience, occupation, and IPC-related knowledge and practices of the participants were measured using a structured questionnaire. Analyses of data were qualitative in nature, and the variations between occupations were investigated (regression analysis was also used and is reported in the study). Results: Participants' mean age was 35.3 ± 7.3 years (range 22–60); 66.1% were male. Fewer than 30.9% (71/230) had been trained on IPC, and even fewer (11.3%, 26/230) had been given a national IPC guideline (48.3% had heard about one). Correct awareness/practice was reported to be high on several core measures including hair shaving indicated (95.2%), antiseptic skin preparation with povidone iodine (97.3%), hand position post-surgical scrub (95.2%), short nails (99.1%), cap use (100%), surgical gown (100%), sterile gloves (99.1%). There were still some gaps (e.g. 53.1% used electrical shavers; 51.6% recommended patients to shower with antiseptic; and 23.0% washed scrub suits in the same department). There were observed occupational variations in training and in receiving guidelines. As an example, diploma nurses showed the highest IPC training (78.8%), and some categories of anesthetists showed the lowest (17.5%). The measures related to the risk of infection were ambivalent: 91.3% were vaccinated against the hepatitis B virus, and 63.9% participants were vaccinated against the risk of infectious diseases (HBV: 41.3%). Completion of 3 doses of hepatitis B vaccine was 71.7%. Conclusion: The research found that IPC training and access to national guidelines had significant gaps, and the practice of recommended operating theaters varied among studies. The IPC training should be reinforced and standardized, the distribution of materials on national guidelines should be enhanced, and the focus on specific occupation-related practices in healthcare must intensify in all healthcare occupations.

Keywords: Infection Control, Operating Room, Healthcare Providers, Surgical Infection Prevention, National Guidelines, Antiseptic Use, Training, Hepatitis B Immunization, Hbv/Hcv Screening.

INTRODUCTION

Postoperative infections are a significant morbidity and also a cause of mortality in patients. The second form of hospital-acquired infection that is widely seen in most developed and developing countries is wound infections [Beldi, G. *et al.*, 2009]. Due to the fact that improper infection control and principles of sterile technique in the complex of operating rooms may lead to wound infection, it is essential to apply the principles of infection control, as well as the principles of sterile technique usage. [Bowdle, A. *et al.*, 2020; BOYERS, S. P. 1991; Sharma, A. *et al.*, 2020]

Despite the progress in surgical techniques and antibiotic therapy, wound infection is still a major source of postoperative morbidity and mortality. As per the data of the National Nosocomial Infection Surveillance System (NNIS), surgical site infections (SSIs) comprise about 15 percent of the nosocomial infections in the USA (United States of America) [Anita McCutcheon, J., & Rees Doyle, G. 2015]. As it upturns the tissues' healing/repair, infection postpones the healing

process of tissues; consequently, the concept of infection control and Sterile technique are quite demanding and shall be strictly applied in order to suppress the transmission of organisms that transmit infection. [Link, T. *et al.*, 2016]

There are several organisms exposed in the operating room complex environment, thus the patient runs the risk of having infections, which may attract various sequelae, including sepsis, which is a lethal postoperative complication. [Cosgrove, M. S. 2015]

The operation room staff might be implicated in the transmission of infection, and hence the operation room staffs that do not practice or execute the sterile technique critiques can move the infection onto the patients. [Arrowsmith, V. A. *et al.*, 1996; Loftus, R. W. *et al.*, 2011]

All patients should have safe working practices that include known or suspected infection. The concept on which this is practiced is that of

Standard Precautions [Fernandez, P. G. *et al.*, 2015]. The blood and body fluids of all patients should be regarded as the source of potential danger of bloodborne viruses [Segal, S. *et al.*, 2019]. Standard precautions evaluate the task that has to be performed and not the person that should receive care [Megeus, V. *et al.*, 2015]. This study was focused on evaluating the infection prevention practice of health workers in the operating theater of Baghdad Teaching Hospital.

METHOD

Data collection

The data were gathered through an interview using each of the Health workers in the operating theater and by completing a prepared questionnaire.

Questionnaire

A questionnaire developed based on the national guide of infection prevention in Iraq health institutes 2009, where the questionnaire consisted of 33 questions divided into sections including 1) general information about health workers as age, occupation, and period working in the operating theater, 2) infection prevention training & hearing or reading national guideline, 3) preoperative preparation as pre-operative need for shaving, timing & methods of shaving, 4) measures of infection control as, 5) screening of infectious disease & vaccination & completion of all doses of vaccination including each of the assistant staff, questions (Q) 4, 5, 6, 7, 8, 9, 10, 11, 13, and 14 about preoperative hair removal & surgical scrub, the anesthetist (specialized, resident, assistant) were excluded by Q (4, 5, 6, 7, 8, 9, 14). Surgical scrub/patient preoperative: two surgical opinion supervisors, besides the supervisor was necessary to affect the determination of whether the items in the questionnaire was the right ones and representative of the subject being studied, and most items were answered with (yes), (no), or (don't know). There were some open-ended questions that were to be opened and other ones had several choices.

Ethical issues

The Scientific Council of Family Medicine provided the agreement on the protocol of the study. Permission of the administration of Baghdad teaching hospital was secured. All participants gave verbal consent upon explanation of the purpose of the study to the health workers, and the latter were requested to narrate their practice. The participants were made aware that

they have a choice of whether to participate or not in this study and were also free in their responses.

The SPSS version 20 (Statistical Package of the Social Sciences) was the input/output and analysis package applied to the data. Discrete variables are also given in numbers and percentages, and the continuous variables in terms of their mean and standard deviation. The significance of the association between discrete variables is tested using the chi-square test of independency. This score is a sum of the number of questions the respondent answers, in a manner that is matched IC guideline. Number of questions for all samples (except for anesthetist staff and other assistant staff): 21 questions (Q4-Q21). While anesthesia staff, the number of questions was 11 (Q10-Q13 and Q15-Q21). The unconfounded (adjusted) associations between scores and personal characteristics were determined using multivariate analysis where results with a linear regression model using ((enter)) method extrapolated p value of significant influence of predictors (factors) on scores, variables in the equation of multivariate linear regression model: age, continuous, sex; male coded as 1 and female as 2 years of experience; continuous, trained on IC; yes All the p values were two sided and asymptotic.

RESULTS

The enrolled health workers of various specialties in this study were 230; the average age of participants in this study was 35.373 years, with a range of 22-60 years. Further distribution of age, it was classified into 5 categories, more than half of participants (56.5%) were aged 30-39 years, 20.9% aged 20-29 years, 16.1% aged 40-49 years, 5.7% aged 50-59 years, and 0.9% aged ≥ 60 years. The ratio of males to participants of the study was 66.1, and females was 33.9. In operating theater, 36% of participants included in the study who were 2-5 years of work category in operating theater, 32% of them who were 6-10 years of work category in the operating theater, 26% of them in work category more than 10 years and 6% in their one year work category and its mean years of work was 8.2 gallons at the range of 1-3 The prevalent type of occupation spatiality was resident surgeon that represented 43.5% of the occupation specialties in operating theater, 15.7% specialized surgeon, 14.3% nurse-diploma, 8.3% nurse-less than diploma, 6.5% assistant of anesthesia, 5.2% other assistant staff, 3.5% resident anesthetist and 3% specialized anesthetist. Table 1 and Figure 1 demonstrated all these findings.

Table 1: Personal characteristics of study sample.

Variable	value	%
Age (year); min-max	22-60	
Age (year); mean ± SD	35.3±7.3	
Age Group (year) 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
Years of work in an operating theater; min-max	1-33	
Years of work in the operating theater; mean ± SD	8.2±6.0	
Years of work in operating theater n %		
• Up to 1	12	6.0
• 2-5	72	36.0
• 6-10	64	32.0
• > 10	52	26.0
Occupation n %		
• Specialized Surgeon	36	15.7
• Resident Surgeon	100	43.5
• Nurse-Diploma	33	14.3
• Nurse-less than a diploma	19	8.3
• Other assistant staff	12	5.2
• Specialized Anesthetist	7	3.0
• Resident Anesthetist	8	3.5
• Assistant of Anesthesia	15	6.5

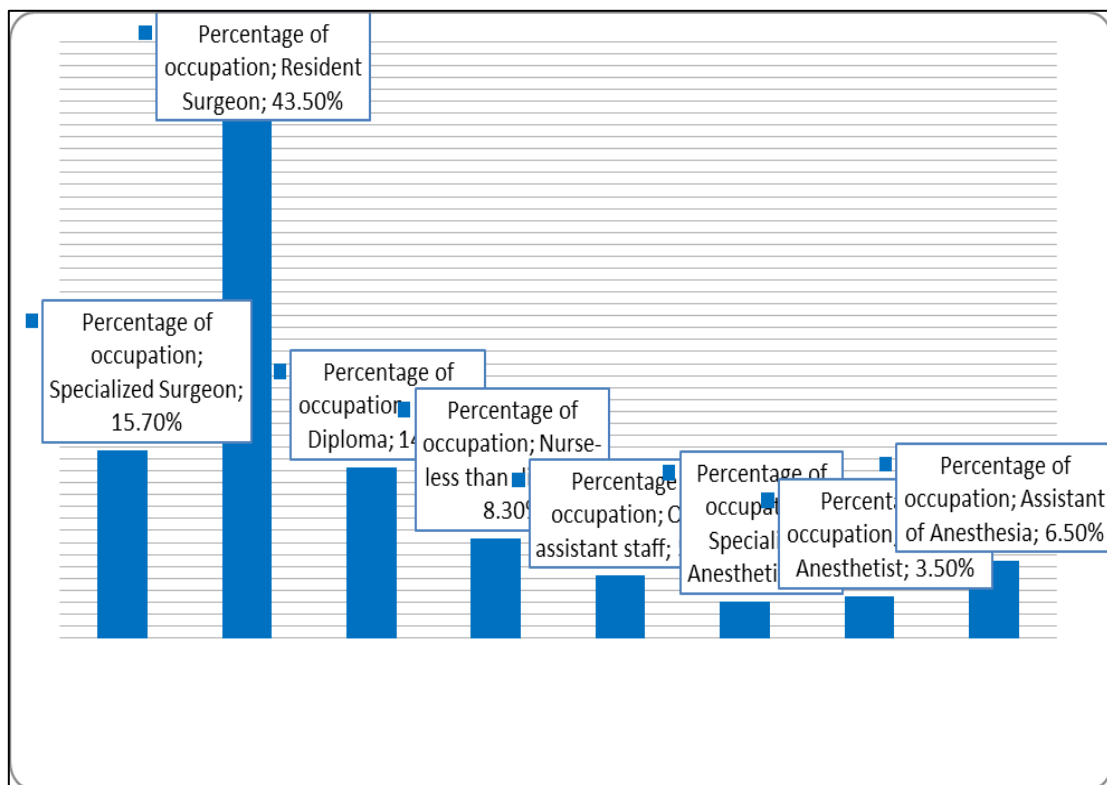


Figure 1: Distribution of study participant according to their occupation.

Infection control practice training was provided to about 30.9% (30.9) and 11.3% (11.3) of the workers in the study operating theaters, which were given a copy of the national infection control guideline; on the other hand, 48.3% (48.3) of the workers had not received a copy of the national infection control guideline. Most of the workers of the operating theater that had contact with surgical operation (95.2%) were aware that preoperative shaving is required, 53.1 percent of workers were aware that tool of shaving is electrical shaver and 79.8 percent of workers were aware that time needed to perform surgical scrub was 2-5 minutes and 25. Most of the workers, who were in contact with surgical operations (95.2%), believed that after surgical scrub, keeping the hands away will be maintained, 70.2% of them were aware that brushing scrub on nails is to be used. The majority of the study participants (89.9) were aware of the fact that wearing arm and hand jewelry was prohibited in the operating theater, 99.1 percentage of the participants wore a surgical mask, 99.1 percentage of the participants had short nails, and 100 percent had a cap that completely covered their hair. All the workers who were in contact

with surgical operations (100%) used surgical gowns. On the other hand, of all the workers in the study, 96.5% of them wore sterile gloves, 93.9% of them wore shoe covers/slippers, and 93.5% of them kept the number of people to what was required. The majority of study participants (85.2) believed that the wearing of the uniform was not permissible outside of the theaters, 69.1% of them were aware that one should change whenever possible after coming in contact with bloody or body fluid and only 23% of them had laundry at the same department, 86.5% considered that the theater operation area should be disinfected after each operation and only 2.2. On the issue of screening of infectious disease, 63.9% participants in the study undertook total screening tests, 41.3% undertook HBV & HCV tests only, 22.2% undertook virology tests only and the rest 0.4% undertook Beta hemolytic streptococci tests only. The study participants (91.3) were mostly vaccinated against hepatitis B, and only three-point five-six (71.7) study participants had completed three doses of hepatitis B vaccine. Table 2 and Figures 2 and 3 demonstrated all these findings.

Table 2: Distribution of appropriate responses to questionnaire items.

Items	N	%
Received training on infection control practice	71/230	30.9
Received a copy of the national infection control guideline	26/230	11.3
Not received a copy, but heard there is a national guideline on infection control	111/230	48.3
Preoperative hair shaving is indicated	179/188	95.2
The tool of shaving is an electric shaver	100/188	53.1
The time of preoperative shaving is just before the operation	150/188	79.8
Advise the patient to shower with an antiseptic before the operation	97/188	51.6
The antiseptic skin preparation used is povidone iodine	183/188	97.3
Time needed to perform a preoperative surgical scrub is 2-5 minutes	125/188	66.5
The substance used for surgical scrub is povidone iodine	47/188	25
After a surgical scrub, hands are kept up and away from the body	179/188	95.2
Use of a brushing scrub for nails is indicated	132/188	70.2
Wearing arm and hand jewelry is not allowed	196/218	89.9
Wearing a surgical mask	216/218	99.1
Keeping nails short	228/230	99.1
Wear a cap that fully covers the hair	218/218	100
Use a surgical gown	188/188	100.0
Wear sterile gloves	222/230	96.5
Wear a shoe cover or slipper	216/230	93.9
Limit the number of personnel to the necessary	215/230	93.5
Wearing the uniform is not allowed outside the theater	196/230	85.2
The step following surgical suit exposure to bloody or body fluid is to change whenever possible	159/230	69.1
Launder the scrub suit at the same department	53/230	23.0
Disinfect the surfaces of the theater after each operation	199/230	86.5

Have had an infectious disease recently (Responses: yes; caught the flu)	5/230	2.2
Performed screening for infectious diseases:		
Total performed	147/230	63.9
HBV & HCV	95/230	41.3
Virology	51/230	22.2
Beta-hemolytic Streptococci	1/230	0.4
Receive vaccination for hepatitis B	210/230	91.3
Completed 3 doses of hepatitis B vaccine	165/230	71.7

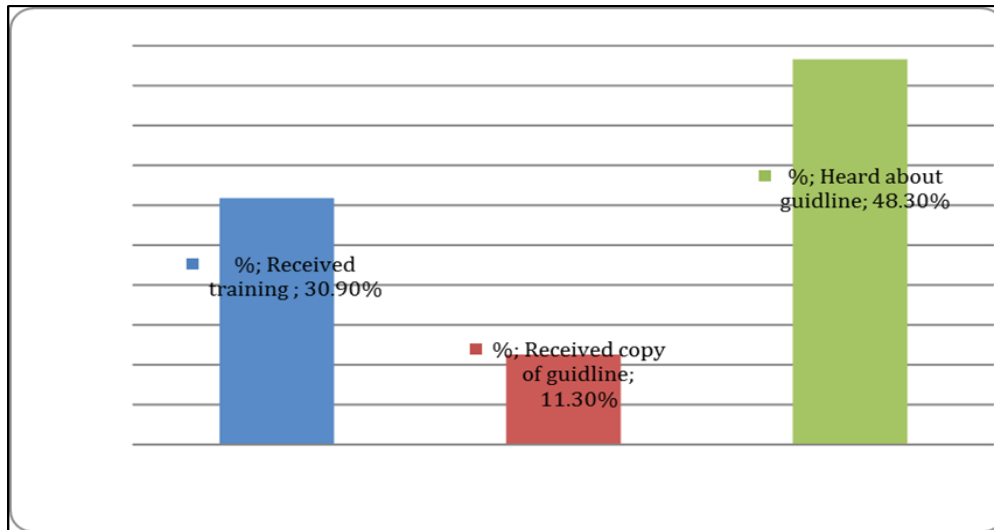


Figure 2. Distribution of study sample according to infection control training and guidelines.

Occupation specialty was also majorly different in the operating theater in terms of training on IC ($p < 0.001$), 91.7% of other assistant staff was trained on IC, followed by nurse-diploma (78.8%) and nurse-less diploma (68.4%). Occupation specialty differed greatly between the Operating Theater in terms of issues that received IC guideline ($p = 0.003$), with the prevalent specialty group being

nurse-less diploma (36.8%). Quite a differentiation in occupation specialties in the Operation Theater in terms of hearing about guideline ($p = 0.007$), the most frequent specialty group was nurse-less diploma (63.2%), then specialized surgeons (61.1%). All these findings were shown in Table 3.

Table 3: Distribution of study sample according to occupation and to having been trained, given a copy of the infection control guideline, or heard about the guideline.

Occupation	Total N	Trained on IC		Received the IC guideline		Heard About IC guideline	
		n	%	n	%	n	%
● Specialized Surgeon	36	5	13.9	4	11.1	22	61.1
● Resident Surgeon	100	16	16.0	7	7.0	46	46.0
● Nurse-Diploma	33	26	78.8	7	21.2	19	57.6
● Nurse (<diploma)	19	13	68.4	7	36.8	12	63.2
● Other assistant staff	12	11	91.7	1	8.3	4	33.3
● Specialized Anesthetist	7	0	0.0	0	0.0	2	28.6
● Resident Anesthetist	8	0	0.0	0	0.0	0	0.0
● Assistant of Anesthesia	15	0	0.0	0	0.0	6	40.0
Total	230	71	30.9	26	11.3	111	48.3
P-value		< 0.001		0.003		0.007	

The occupation specialties of the Operation Theater did not differ significantly with screening of infections ($p = 0.15$), Table 4. Significant difference was also not noted between occupation

specialties in the Operation Theater in terms of receiving hepatitis vaccine ($p = 0.176$), Table 4. When it came to occupation specialty in the operation theater, a significant difference was

determined in the completion of three hepatitis vaccine doses ($p = 0.005$), where the table showed

that the majority were specialized surgeons, Table 4.

Table 4: Distribution of study sample according to screening of infectious diseases, receiving the HB vaccine, and completion of 3 doses of the vaccine

Occupation	Total	Screened for Infections		Received HB Vaccine		Completed 3 doses of HB Vaccine	
	N	N	%	N	%	N	%
• Specialized Surgeon	36	23	63.9	33	91.7	31	86.1
• Resident Surgeon	100	60	60.0	92	92.0	66	66.0
• Nurse-Diploma	33	26	78.8	30	90.9	23	69.7
• Nurse (<diploma)	19	11	57.9	19	100.0	16	84.2
• Other assistant staff	12	8	66.7	9	75.0	8	66.7
• Specialized Anesthetist	7	5	71.4	5	71.4	5	71.4
• Resident Anesthetist	8	4	50.0	8	100.0	6	75.0
• Assistant of Anesthesia	15	9	60.0	14	93.3	10	66.7
Total	230	146	63.5	210	91.3	165	71.7
P value		0.150		0.176		0.005	

If correct answers were taken, the average score of the specialized surgeons was 17.2 plus two, resident surgeons 16.2 plus two and three, nurse-

diploma 17.2 plus two, and nurse-less diploma 17.3 plus two, table 5 and figure 4.

Table 5: Descriptive statistics for the correct answers score according to each occupation.

Occupation	N	Number of Questions	Minimum	Maximum	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

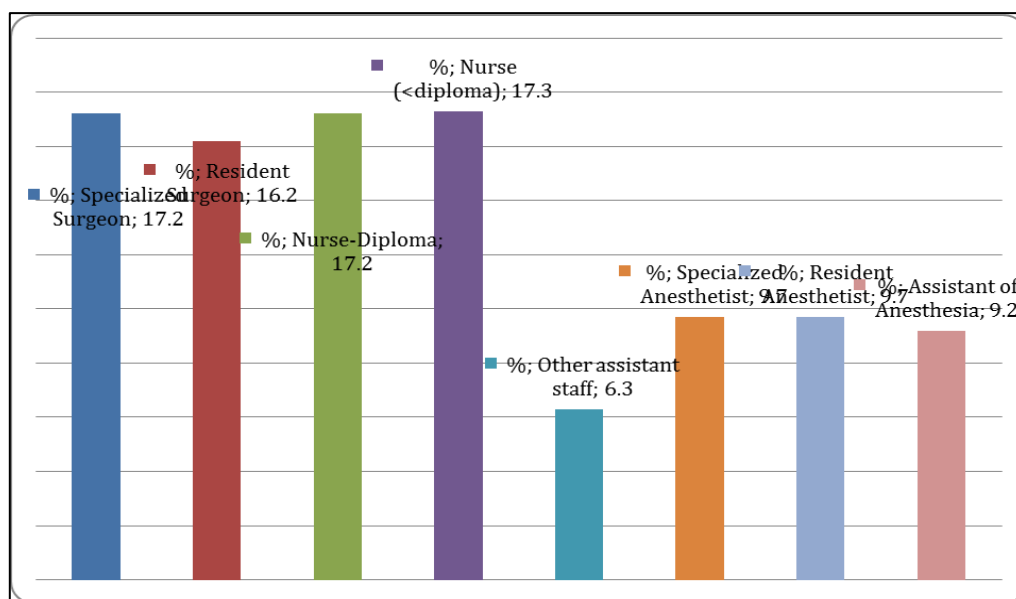


Figure 3. Distribution of occupation of study participants according to mean scores of correct answers.

Age, sex, and training does not have any considerable effect on IC, and the presence of a copy of the IC guideline on the score of correct answers ($P > 0.05$, table 6). The greater the

experience of resident surgeons, the higher the score and the longer the working period of nurses (less than a diploma), the greater the impact on the score is negative ($P < 0.05$, Table 6).

Table 6: P values for the linear regression analysis

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 ^A	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 ^B	0.857	0.433
Specialized Anesthetist	0.991	0.859	0.867	--- ^C	--- ^C
Resident Anesthetist	0.081	0.423	0.588	--- ^C	--- ^C
Assistant of Anesthesia	0.071	0.673	0.145	--- ^C	--- ^C

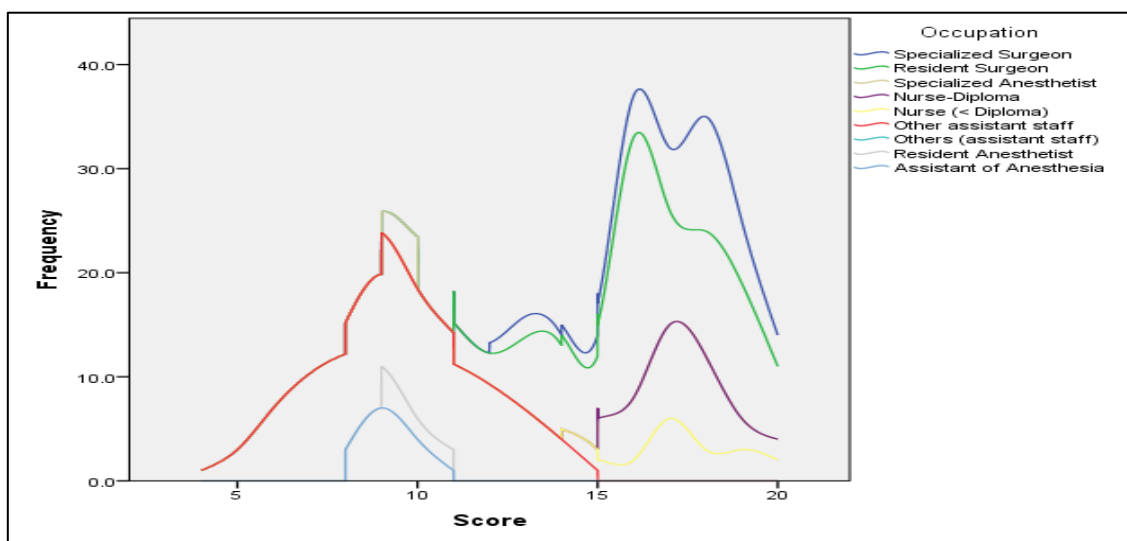


Figure 4: Line distribution of participants for scores according to occupation.

DISCUSSION

Surgical site infection may also impact a lot on a patient life quality. They are suspected to be related to a high level of morbidity and prolonged hospitalization. Moreover, the surgical site infections leave a significant financial toll on healthcare givers. The development of surgery and anesthesia has led to the fact that patients at higher risk of surgical site infections are now considered to undertake surgery. Moreover, the rising number of infections in primary care are now being observed as a result of patients being sent home earlier due to day case and fast-track surgery. It has been indicated that no fewer than fifty percent of surgically encountered complications are preventable. Efforts to establish measures aimed at hindering a surgical site infection or the occurrence of anesthesia-related mishaps motivated before have proved effective in curbs the Allergic failures. The literature on teamwork in surgery is also on the rise, and high-functioning teams record much lower levels of believable

incidents. The average respondent age was equal to 35.36 means 7.27 with the age range of 30-39 years (active age) being the largest. Two-thirds of them (66.1) were males, with 33.9% of them being females. The average number of years worked in the operating theater was 8.2 6.0, and the majority of the surgeons specializing were residents (43.5%). These personnel features of the study subjects matched with the findings of other studies in South Africa, except in the case of gender features. The percentage of those who received training on how to control infections was only a third (30.9) of the respondents. 46 percent of the workers in the operations theater in the study performed South Africa were trained on the aspect of IC, and 81 percent of the workers in the operations theater in the UK. The scrub nurse is able to enhance his/her knowledge of any new method by attending infection control workshops so as to avert infections. Few of the study participants were provided with a copy of national IC guidelines (11.3% of them), and half of the

group who did not obtain a copy of a copy of IC guidelines heard about them (48.3%). These are the rates that are similar to the South Africa investigation. These observations are contrary to the USA study, which indicated that each personnel member needed to be given written policies and guidelines regarding the activities of infection prevention and control measures. In addition to this, it was confirmed by the WHO that a hospital-associated infection prevention manual of instructions and practices in patient care is a valuable resource and needs to be easily accessible to the HCWs and updated regularly. Moreover, HCWs are supposed to be empowered with appropriate knowledge, skills, and attitudes to good practice in infection control. Such a finding is not consistent with WHO guidelines on infection control, according to which it is significant to ensure that the personnel is made aware of how nosocomial infection can be spread so that the occurrence of infection can be prevented. The current research has shown that the majority (95.2) of the subjects (with the experience of commission to surgical operations) were aware of the significance of hair shaving; nearly half of them were aware that hair shaving should be carried out using electricity, and 79.8% of them perceived that it should be done before the operation. These findings were similar to the results of a Canadian study. This study revealed that almost all of the health workers wore surgical masks, surgical caps, and surgical gowns, and kept nails short; most of them wore shoe covers, sterile gloves, limited personnel in the theater, and wore uniform outside the theater. Findings are in line with WHO recommendations and are also in agreement with the findings of Bangladesh study. Most of the respondents in the current study (97.3%) are aware of using iodine povidone in skin preparation. Yet, the minority of them (25%) are aware of using iodine poultice in surgical scrub, 95.2% of them know that they should not have their hands in contact with the body. The hands are the most critical pathways of nosocomial pathogen transmission, and pre-positioning of hands just before each. Every direct patient-related procedure/contact, and following any procedure or contact that might lead to hands becoming contaminated, there is still not sufficient evidence to be sure that what strategies that enhance hand hygiene, but compliance seems to have an impact. This study established that fewer than two in every three participants (63.9 percent) screened their infectious diseases totally, 41.3 percent of the participants tested for hepatitis B, and 71.7 percent

of the participants took 3 doses of the hepatitis B, this could be due to forgetting about the dosage schedule, not knowing, and laziness and negligence, respectively. Part of these findings was similar to those of a study conducted in Pakistan (2009), where the complete hepatitis B prevalence rate was 62.07% among health workers, and the screening rate of infectious diseases was 61.9%. Yet, the hepatitis B testing rate was 80.5%.

CONCLUSION

In the teaching hospital of Baghdad, a low percentage of health workers was trained on the program on infection control, less percentage of them were provided with a copy of the infection control guideline, and less percentage of them heard about it. Health workers were observed to have good practice in their areas of wearing surgical gowns, masks, hair removal, shoe covers, and nail care. Inadequate practice of surgical scrubbing, iodine, and povidone. The Baghdad Teaching Hospital operating theaters have more than half of the health workers that are not hepatitis B virus tested, and the training does not focus on all the occupational specialties; focus is put on others who are assistant staff and nurses, and this causes training flaws in other specialties. A high correlation to complete hepatitis B vaccination was registered between the occupation of health workers and the health workers' complete vaccination. The average of the responses was conditional upon the occupation and experience of health workers. The analysis of the linear regression indicated that experience and longer time in operating theaters were great factors in the operation of health workers with respect to infection control in the practice and behavior of such workers.

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Source of support: Nil; **Conflict of interest:** Nil.

Cite this article as:

Witwit, W. A. M., Murtadha, I. H. Abdulsahab, R. A. "Evaluation of Infection Control Practices in the Operating Theater." *Sarcouncil journal of Medical sciences* 5.4 (2026): pp 1-10.