



## Awareness and Knowledge of Surgical Wound Infections Among Physicians in Hospitals of Riyadh City: Cross-Sectional Study.

Samer A. Alzahrani<sup>1</sup>, Mohammed Fahad Bin Muammar<sup>2\*</sup> , Ahmed Abdulrahman Alolah<sup>3</sup>, Mohammed Abdullah Almutawa<sup>4</sup>, Anmar Yasser Alshibely<sup>5</sup>, Mohammed Faleh Alharbi<sup>6</sup>, Raghad Khalid Alammari<sup>7</sup>

<sup>1,3</sup>College of Medicine, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia

<sup>2\*</sup>College of Medicine, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia

<sup>4</sup>College of Medicine, Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia

<sup>5</sup> College of Medicine, King Saud bin Abdulaziz University, Jeddah, Saudi Arabia.

<sup>6</sup> College of Medicine, AlQassim University, Qassim, Saudi Arabia

<sup>7</sup>College of Medicine, Almaarefa University, Riyadh, Saudi Arabia

**Abstracts:** Surgical site infections (SSI) are considered one of the leading preventable causes of morbidity and mortality among postoperative patient's worldwide, and increasing awareness and knowledge regarding surgical site infection will improve the quality of care. This study aims to use the appropriate tools to assess and analyze the level of awareness and understanding regarding surgical wound infection among medical and surgical interns, residents, specialists and consultants working in Riyadh city hospitals and how each of them plays a crucial role in providing the optimal healthcare for patients and prevent any unwanted devastating complications. Additionally, the objective of this study is to provide the necessary data to help identify the gaps in the participants understating of surgical site infections. In which a cross-sectional study was conducted between March 2022 and October 2022. The Data was collected using a 20-Item multiple-choice questionnaire which was adopted and validated from a previous study. The questionnaire was randomly distributed among physicians working in Riyadh city hospitals. The sample study included 390 participants who completed the questionnaire in 5 minutes on average. The analyzed data showed that 74.8 % of the responders are medical interns, 18.2% are residents, 5.8% are specialists, and 0.12% are consultants. The Results of the study showed that only 3% of all participants have a high level of knowledge and awareness regarding surgical site infection, while the rest of the responders have moderate to low levels of knowledge and awareness regarding the subject. And we recommend improving the awareness and understanding regarding surgical site infection by offering more courses and events on infection control and prevention; in turn, it would decrease the length of hospital stay, improve healthcare out, decrease morbidity and mortality rates and economic costs caused by surgical site infection.

**Keywords:** Wound Infection, Prevention of Infections, Post-Operative Complication, Surgical Site Infection (ssi), Awareness. Healthcare Workers.

### \*Corresponding Author

Mohammed Fahad Bin Muammar , College of Medicine,  
Imam Mohammad Ibn Saud Islamic University, Riyadh,  
Saudi Arabia

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## 1. INTRODUCTION

Surgical site infection (SSI) is a common postoperative complication that can lead to serious consequences or even death. The US Centers for Disease Control and Prevention (CDC) has established criteria defining SSI as a surgical site infection that occurs at or near the surgical incision within one month of surgery or within three months if prosthetic material was implanted during surgery. SSI can be divided into 3 types: superficial incisional SSI, deep incisional SSI, and organ or space infection SSI<sup>1</sup>. SSIs account for up to 20% of healthcare-associated infections (HCAI), they are also the most common nosocomial infection in surgical patients, accounting for 38% of nosocomial infections, and it is the most frequent HCAI in low-income countries<sup>2,3</sup> and results in approximately 20,000 potentially preventable deaths each year<sup>4</sup>. About 40% to 60% of these infections are preventable<sup>5</sup>. Many protocols and methods were established to prevent SSI and reduce the incidence of postoperative complications, which include preoperative antibiotic prophylaxis, skin preparation including hair removal and a shower with regular soap or chlorhexidine, maintenance of intraoperative normothermia, and wound irrigation performed at the end of the procedure in most cases with saline<sup>6-8</sup>. Identifying the risk factors of SSI can help physicians improve the quality of care, which include advanced age, male gender, obesity, previous spinal surgery, malnutrition, diabetes, smoking, spinal trauma, corticosteroid use, spinal instrumentation, posterior surgical approach, tumor resection, sacral surgery, conventional open spinal surgery instead of endoscopic tubular surgery, increased estimated blood loss, and prolonged operative time<sup>9</sup>. Recognizing the signs and symptoms of SSI is a crucial part of the diagnosis and treatment process, which include pus or discharge, unpleasant odor, fever, chills, redness, and pain<sup>10</sup>. Empiric antibiotic therapy should be initiated after a treatable surgical infection is identified, as microbiologic data may not be available until 48-72 hours to guide the targeted therapy<sup>6</sup>.

### 1.1 Objective

In the literature, there are a lot of studies regarding the level of awareness and knowledge of SSI all around the world. Still, there are no published studies that assessed or analyzed the level of awareness and knowledge of SSI among Riyadh city physicians. So our objective in this study is to provide well assessed and analyzed data regarding the level of knowledge and awareness regarding surgical site infection among medical doctors working in Riyadh city hospitals.

## 2. MATERIALS AND METHODS

### 2.1 Study Design and Sampling

A cross-sectional hospital-based study was conducted from March 2022 till October 2022 to assess awareness and knowledge about surgical wound infections among surgical and medical and surgical consultants, specialists, residents and interns working in Riyadh city hospitals. The sample size was determined using The Raosoft sample size calculator (Raosoft Inc., Seattle, WA, USA). Considering a confidence interval of 95% and a 5% margin of error, the minimum sample size was calculated as 377. However, we increased our sample size to 390, considering the chances of incomplete data.

### 2.2 Data collection

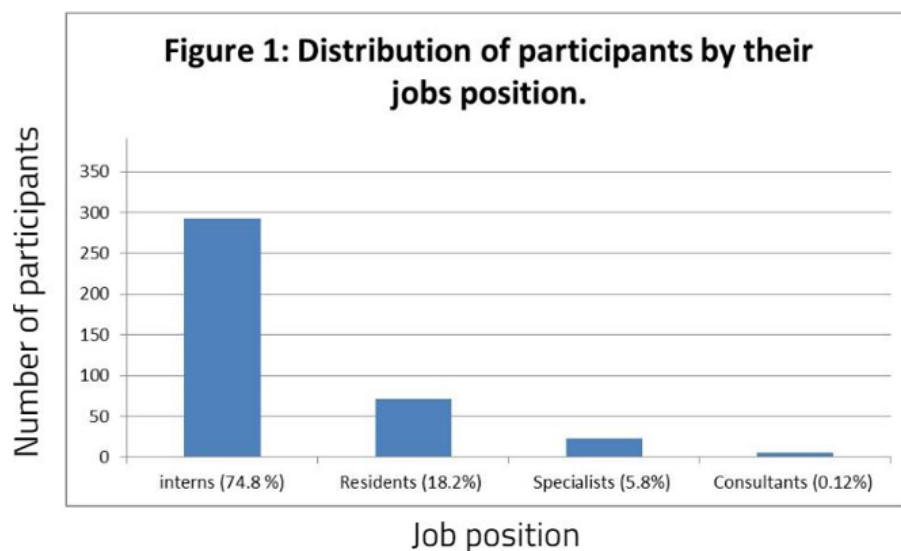
The data was collected using a self-administered, anonymous 20-item electronic multiple-choice questionnaire that was adopted and validated from a previous study conducted in King Abdulaziz University Hospital, Jeddah, Saudi Arabia<sup>11</sup>. The questionnaire consists of three segments. The first segment contains the study's title and an informed consent form. The second segment includes the participant's position information and a yes/no question about whether the participant is currently working in hospitals in the city of Riyadh. Finally, the third segment contains a 20-item multiple-choice question about SSI to determine the level of awareness and knowledge about this topic.

## 3. STATISTICAL ANALYSIS

Participants were ranked based on the percentage of correct answers to the social insurance questions. There are 3 categories: good knowledge  $\geq 80\%$ , moderate knowledge 79% to 51%, and low knowledge  $\leq 50\%$ . Data entry and analysis were performed with the statistical software package (SPSS) version 23 (IBM Corp., Armonk, NY, USA) using 95% CI.

## 4. RESULTS

A total of 390 participants completed the questionnaire, 74.8 % (292) are interns, 18.2% (71) are residents, 5.8% (23) are specialists, and 0.12% (5) are consultants (Figure 1).



**Fig 1: Distribution of participants by their jobs position**

#### 4.1 Knowledge about surgical wound infections

The results showed that 234 (60%) participants correctly defined SSI according to criteria developed by the CDC, which is an infection related to an operative procedure occurring at or near the surgical incision within 14 days of the procedure. A total of 193 (49.5%) responders could differentiate between SSI classifications. In addition, 174 (44.6%) of our sample study identified the most common isolated organisms associated with SSI. Results also show that 296 (75.9%) respondents identified the ideal time to give prophylactic antibiotics. Regarding the established probability of contracting SSI, only 110 (28.4%) doctors could give the correct answer which was 1 - 3%. Meanwhile, 218 (55.8%) of participants knew the recommended preoperative antibiotics. Half of the questionnaire takers 221 (56.8%) were able to identify the correct definition of a clean-contaminated wound. But only 140 (36%) physicians had good knowledge regarding risk factors. Likewise, 159 (40.7%) are familiar with the CDC recommendations regarding preoperative SSI prevention. On the other hand, Prophylactic antibiotics should be

discontinued within 24 to 48 hours after surgery which was only known by 156 (40%) responders. Additionally, half of the participants have good knowledge regarding preoperative hair preparation. Furthermore, 344 (88.2%) doctors have correctly identified the factors that would impair the wound healing process. And regarding the most commonly used marker to assess nutritional status was identified by 346 (87%) participants. 347 (89%) respondents knew that the purpose of preoperative skin cleansing was to reduce skin vulnerability to flora and therefore reduce the incidence of SSI.

#### 4.2 Awareness regarding surgical site infection

A total of 351 (90%) doctors were able to recognize the signs and symptoms of SSI. And regarding SSI complications, it was recognized by 350 (89.7%) participating medical doctors. Furthermore, almost half of doctors 225 (57.7%) knew that more than half of all SSIs are caused by superficial SSI. Lastly, more than half of the sample study is aware of the hand hygiene technique and surgical scrubbing steps (Table 1).

**Table 1: Questionnaire-based survey assessing the level of awareness and knowledge regarding SSI among physicians working in Riyadh city hospital. Which was conducted between March 2022 and October 2022.**

Questions	Chooses	Statistics n (%)
Definition of SSI according to the United States CDC	A. Infection related to an operative procedure that occurs at or near the surgical incision within 14 days of the procedure.	A. 234 (60%) B. 78 (20%) C. 39 (10%) D. 39 (10%)
	B. Infection related to an operative procedure that occurs at or near the surgical incision within 60 days of the procedure.	
	C. Infection related to an operative procedure that occurs at or near the surgical incision within 90 days of the procedure.	
	D. Infection related to an operative procedure that occurs at or near the surgical incision within 30 days of the procedure, or within 1 year if prosthetic material is implanted at surgery	
SSIs are classified into incisional SSIs, which can be superficial, deep or organ/space SSIs. Superficial SSI means	A. Infection involving the epidermis and dermis layers only.	A. 115 (29.5%)
	B. Infection involving both only the skin and subcutaneous tissue.	B. 193 (49.5%)
	C. Infection involving fascial and muscle layers.	C. 67 (17.2%) D. 15 (3.8%)

	D.	Infection involving internal organs manipulated during operation.	
Which is true about SSI classification	A.	Deep incisional SSI is more common than superficial incisional SSI and organ/space SSI.	A. 60 (15.3%)
	B.	Deep organ SSI occurs within 60 days after operation.	B. 25 (6.4%)
	C.	Superficial incisional SSI accounts for more than half of all SSIs.	C. 225 (57.7%)
	D.	Superficial incisional SSI occurs within 14 days after operation	D. 80 (20.6%)
One of the most common isolated organisms in SSI	A.	Staphylococcus aureus.	A. 150 (38.4%)
	B.	Streptococcus pyogenes.	B. 20 (5.1%)
	C.	Escherichia coli.	C. 46 (11.7%)
	D.	A+C	D. 174 (44.6%)
The best time for administering prophylactic antibiotics	A.	Within 60 minutes prior to surgery.	A. 296 (75.9%)
	B.	Within 90 minutes prior to surgery.	B. 80 (20.5%)
	C.	Within 120 minutes prior to surgery.	C. 10 (2.5%)
	D.	Within 180 minutes prior to surgery	D. 4 (1%)
Chances of developing SSI are	A.	1-3%	A. 110 (28.2%)
	B.	3%-5%	B. 163 (41.7%)
	C.	10%-5%	C. 92 (23.5%)
	D.	15%-20%	D. 25 (6.4%)
All the following preoperative antibiotics are commonly used except	A.	Cefazolin	A. 15 (3.8%)
	B.	Cefoxitin	B. 7 (1.7%)
	C.	Vancomycin	C. 150(38.4%)
	D.	Fidaxomicin	D. 218 (55.8%)
Which statement is correct about wound classification	A.	Wound created in herniorrhaphy is considered as a clean-contaminated wound	
	B.	Appendicular abscess is considered as a contaminated wound.	A. 40 (10.2%) B. 29 (7.4%)
	C.	Clean-contaminated wound is defined as an incision under sterile condition, entrance of a hollow viscous with no active infection.	C. 221 (56.8%)
	D.	Bowel obstruction with enterotomy and spillage of contents is considered as a dirty wound	D. 100 (25.6%)
Which one of these risk factors is least associated with SSI	A.	Prolonged preoperative stay.	A. 102 (26.1%)
	B.	Hairy skin.	B. 140 (35.8%)
	C.	Poor postoperative glycemic control.	C. 55 (14.1%)
	D.	Type of wound.	D. 93 (23.8%)
Complications of SSI include which of the following	A.	Increased cost of care	A. 18 (4.6%)
	B.	Death	B. 12 (3%)
	C.	Fistula formation	C. 10 (2.5%)
	D.	All of the above	D. 350 (89.7%)
The CDC recommendations for the prevention of SSI include which of the following	A.	Preoperative showering with antimicrobial soaps.	A. 159 (40.7%)
	B.	Blood glucose target level of less than 250 mg/dl.	B. 113(28.9%)
	C.	Maintaining mild hypothermia.	C. 72 (18.4%)
	D.	Advising patients to shower at least 1 day prior to surgery	D. 46 (11.7%)
Infected wounds can exhibit which one of these presentations	A.	Sweet smell	A. 4 (1%)
	B.	Purulent pus	B. 351 (90%)
	C.	Normothermia	C. 26 (6.6%)
	D.	Painlessness	D. 9 (2.3%)
Prophylactic antibiotics are discontinued after surgery within	A.	4 to 8 hours	A. 59 (15.1%)
	B.	12 to 18 hours	B. 122 (31.2%)
	C.	24 to 48 hours	C. 156 (40%)
	D.	72 to 96 hours	D. 53 (13.5%)
Regarding hair removal for surgical patients, when is the best time	A.	Just prior to surgical incision	A. 210 (53.8%)
	B.	The night prior to surgery	B. 23 (5.89%)
	C.	2 hours prior to surgery	C. 65 (16.6%)
	D.	30 minutes prior to surgery.	D. 92 (23.5%)
Regarding hair removal for surgical patients, it's best done by	A.	Shaving	A. 122 (31.2%)
	B.	Clipping	B. 219 (56.1%)
	C.	Waxing	C. 31 (7.9%)
	D.	Electrolysis	D. 18 (4.6%)

Which one of these factors impairs wound healing	A. Steroid use B. Hyperthermia C. Exposure to water D. Protein-rich food	A. 344 (88.2%) B. 22 (5.6%) C. 18 (4.6%) D. 6 (1.5%)
In assessing nutritional status for a surgical patient, which statement is correct	A. Serum albumin level is the most commonly used marker to assess nutritional status. B. Serum magnesium is a preferred marker over serum albumin. C. Assessing the patient through inspection and further examination should be enough. D. Poor nutritional status is not considered as a risk factor for SSI	A. 221 (56.6%) B. 53 (13.5%) C. 82 (21%) D. 34 (8.7%)
Based on World Health Organization, the fourth step in hand hygiene technique is	A. Rub hands palm to palm B. Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa. C. Palm to palm with fingers interlaced. D. Backs of fingers to opposing palms with fingers interlocked.	A. 92 (23.5%) B. 258 (66.1%) C. 23 (5.8%) D. 17 (4.3%)
The first step in surgical scrubbing is	A. Ensure that your sleeves are at least two to three inches above your elbows. B. Remove any watches and rings from your hands C. Open out your gown pack onto a clean table, only grabbing the outermost edges to maximize the sterile field. D. Adjust water flow and temperature.	A. 109 (27.9%) B. 238 (61%) C. 22 (5.6%) D. 21 (5.3%)
The purpose of pre-operative skin cleansing is	A. To achieve a good-looking skin B. To reduce risk of skin cancer C. To achieve a faster operation D. To reduce the burden of skin flora, thus reducing risk of SSI	A. 7 (1.79%) B. 5 (1.28%) C. 31 (7.9%) D. 347 (88.9%)

*The most important finding of our study is that out of the total of 390 participants, only 36 (9.2%) physicians had a good level of knowledge and awareness, 241 (61.8%) had a moderate level, 113 (29%) had poor level of knowledge and awareness regarding SSI (Table 2).*

**Table 2: Distribution of participants according to the level of awareness and knowledge regarding surgical site infections (n = 390).**

Level of knowledge	Participants
Good knowledge n (%)	36 (9.2%)
Moderate knowledge n (%)	241 (61.7%)
Poor Knowledge n (%)	113 (28%)

## 5. DISCUSSION

The CDC defines surgical site infections as infections associated with a surgical procedure that occurs at or near the surgical incision within 30 days of the procedure or within 90 days if prosthetic material is implanted during surgery<sup>1</sup>. SSI increases postoperative morbidity and mortality and is the most common preventable complication after surgery<sup>12</sup>. There are many published studies assessing awareness and knowledge of SSI, but most of these studies have been conducted among nurses, and there needs to be more studies among physicians. Although nurses play a crucial role in preventing SSI, the medical team also consists of physicians who play a critical role in patient care. A total of 390 participants were included in our study, which is almost twice the size of the sample used by Tschelaut et al., a study that examined Australian surgeons; knowledge of preoperative antimicrobial stewardship to prevent surgical site infections with 119 respondents<sup>13</sup>. The present study showed that (60%) of the participants knew the correct definition of SSI, which agrees with the results of the study by Labeau et al., which showed that about (55%) of clinicians can correctly define SSI in terms of the CDC definition<sup>14</sup>. More than half the study sample knew the proper classification of the SSI, which is consistent with findings of Albishi et al<sup>11</sup>. The results of Albishi

et al., that a quarter of clinicians know that the incidence of SSI is between 1-3% which agrees with our findings that (28.4%) of all clinicians knew the correct answer<sup>11</sup>. Almost half of the respondents (44.6%) in our study correctly identified the isolated organisms responsible for SSI, compared to the results of Albishi et al. with (25.2%) of respondents in their study<sup>11</sup>. However, the clinician's knowledge of the best time to remove hair was (55%), which is consistent with the results of Labeau et al<sup>14</sup>. A total of 390 clinicians were included in our study and the main finding was that more the half of the study sample (61.8%) had moderate knowledge about SSI. These results are consistent with another study conducted among 119 physicians in King Abdulaziz University Hospital, Jeddah, Saudi Arabia, which concluded that (63%) had moderate knowledge regarding SSI<sup>11</sup>. These results are also consistent with another study conducted in two tertiary hospitals in Port-Harcourt, Nigeria. They concluded that there needs to be more awareness and knowledge regarding SSI<sup>15</sup>.

## 6. CONCLUSION

Our study concluded that almost half of the study participants were found to have moderate to poor levels of awareness and knowledge regarding surgical site infection, and we recommend improving it by offering more courses and events

on infection control and prevention. In turn, it would decrease the length of hospital stay, improve healthcare, and decrease morbidity and mortality rates and economic costs caused by SSI.

## 7. AUTHORS CONTRIBUTION STATEMENT

The authors confirm their contribution to the paper as follows: study conception and design: Samer Ahmed Alzahrani. Data collection and analysis: Raghad Khalid Alammari, Anmar Yasser Alshibel, and Mohammed Faleh Alharbi. Draft manuscript preparation: Mohammed Fahad Bin Muammar, Ahmed Abdulrahman Alolah and Mohammed Abdullah Almutawa. All the authors reviewed the results and approved the final version of the manuscript.

## 8. ACKNOWLEDGMENTS

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## 9. ETHICAL APPROVAL

The Institutional Review Board (IRB) approval number 299/2022 was obtained from the IRB Committee of Al-Imam Muhammad Ibn Saud Islamic University. Furthermore, written consent was received from the participants for conducting and publishing the study.

### 9.1 Abbreviations

SSI: Surgical site infection.

CDC: Centers for Disease Control and Prevention.

## 10. CONFLICT OF INTEREST

Conflict of interest declared none.

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