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Assessment of Knowledge of Staff Nurses Regarding Surgical Site Infection Prevention at Ramaiah Medical College Hospital, Bengaluru

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Abstract

Background: Surgical site infection is one of the common healthcare-associated infections. According to the CDC, in 2015 the number of surgical site infections associated with inpatient surgeries was 110,800. In India. Surgical site infection is estimated to be 3-12% (Kumar A,2017, India). As the staff nurses are part of the health care team, their clinical competency in infection control is vital. Nurses during the transition to practice have a theory-practice gap, which can lead to a reduction in the quality of patient care and a reduction of clinical performance, leading to an increased rate of surgical site infection. The present study aimed to assess the level of knowledge of staff nurses regarding surgical site infection prevention.

Methodology: A descriptive research design was selected to assess the knowledge of staff nurses regarding surgical site infection prevention. A non-probability convenience sampling technique was used to select 80 subjects, aged between 20-51 years and above. A structured questionnaire containing demographic variables and items on surgical site infection prevention was administered to assess the participants' knowledge levels.

Results: The study findings showed that (54) 67.5% of staff nurses have a moderately adequate level of knowledge, (23) 28.7% have an inadequate level of knowledge, and (3) 3.8% have adequate knowledge on surgical site infection prevention with a mean score of 15.83 ± 3.285. Chi-square test shows that there is no statistical association between demographic variables and nurses' knowledge on surgical site infection prevention.

Conclusion and Interpretation: The study concluded that from the study findings, 67.5% of subjects had moderately adequate knowledge with a mean score of 15.83. The result of the study shows that there was no significant association between the knowledge and selected demographic variables like age, gender, marital status, educational qualification, working area, working experience, or any training undergone on infection

control. Therefore, a lack of staff nurses' knowledge of surgical site infection prevention may lead to an increase in the surgical infection rate.

Keywords: Knowledge, Surgical site infection.

Introduction

Patient safety is an important concern for all health care professionals, as we know nurses provide 24-hour care and service to their patients, so nurses' knowledge plays a significant role in controlling infection, which ultimately enhances the quality of patient care. Healthcare-associated infections are a major healthcare problem worldwide.

One of the most common healthcare-associated infections is surgical site infection, which accounts for 25-30% of Healthcare-Associated Infection cases in most studies. Surgical site infection arises within 30 days of the surgical procedure. This infection can be a superficial infection that just affects the skin, or it can be a deep infection, which is more dangerous, affecting tissues that lie beneath the skin, the organs. Surgical site infection occurs when bacteria are present within the wound. Streptococcus pyogenes and Staphylococcus aureus are the most common bacteria that cause surgical site infections. The cause of such infection can be due to various factors, such as patient-related factors, which could be age; older age is more susceptible to SSIs.

Weak immune system conditions like diabetes, obesity, smoking, and malnutrition can impair the body's ability to fight off infections. Pre-existing infection elsewhere in the body can increase the risk of SSIs. Surgical factors such as the length of the surgery, longer surgeries increase the risk of infection, and poor skin preparation. Surgical techniques, poor the surgical technique can increase the risk of contamination and infection. Environmental factors, such as improper sterilization of instruments or inadequate preparation of the surgical site, can contribute to the SSIs. Postoperative factors such as poor wound care, inadequate hand hygiene.

Thus, lack of consideration of the above factors may land the patient in complications, which could be local complications such as pain and tenderness, delayed wound healing, pus formation, wound dehiscence, abscess formation, osteomyelitis in rare cases, where infection can spread to the bone. Systemic complications such as organ failure, bacteremia, and severe sepsis ultimately impact the patient and the healthcare system.

Hence, the patient will have a reduced quality of life, anxiety and depression, financial burden, which is increased medical cost, which will also impact families, risk of antibiotic resistance, increased mortality risk, and hospitals have to focus on additional intervention, bed occupancy and capacity issues, accreditation, and funding risk. Hence, to reduce surgical site infections, various preventive measures have been proposed by the Centers for Disease Control and Prevention and the Medicare Quality Improvement Community's Surgical Care Improvement Project, and the World Health Organization has set a number of recommendations towards the prevention of surgical site infections. These involve patient preparation, antimicrobial prophylaxis administration, restricting operating room traffic, patient core body temperature monitoring, asepsis, glycemic control and monitoring, surgical technique, nutritional assessment, and post-operative incision care.

Nurses are in a unique position to engage in or lead programs aimed to reducing the incidence of surgical site infection and thereby improving patient safety. In India, minimal research has been done to assess the knowledge of nurses regarding surgical site infection prevention. The level of knowledge of nurses working in surgical units and ICU play a vital role in preventing infections and improving the quality of patient care. However, in

many regions in India there is remains a lack of sufficient data on nurses' knowledge regarding surgical site infection prevention. This gap in understanding has prompted the current study, which aims to assess the knowledge of staff nurses regarding surgical site infection prevention in Ramaiah Medical College Hospital, Bengaluru.

Materials and Methods

Study Design

Descriptive research design

Variables

Dependent variables: Knowledge of staff nurses regarding surgical site infection prevention

Attribute variables: Socio-demographic variables such as Age, Gender, Marital status, Educational status, working area, service experience in year, and any training undergone on surgical site infection prevention.

Setting of the study

The study was conducted in Ramaiah Medical College Hospital, Bengaluru.

Sample size

80 staff nurses

Sampling technique

Non-probability convenient sampling technique.

Criteria for sample selection

The sample was selected with the following pre-determined criteria

Inclusion criteria

- Staff nurses age group 20-50 years and above.
- Those who are willing to participate.

Exclusion criteria

Subjects who were not available during the time of the data collection.

Development of Tool

After an extensive review of the literature, discussion with experts, and the investigator's personal and professional experience the tool was developed. The questionnaire is developed to assess the knowledge of staff nurses regarding surgical site infection prevention and it will cover all aspects of surgical site infection prevention. The constructed tools consist of the following sections:

Section A: Socio-Demographic Data:

The first part of the tool consists of socio-demographic variables such as age, gender, marital status, educational status, working area, service experience, and have you ever undergone any training on surgical site infection prevention.

Section B: Structured Knowledge Questionnaire:

Knowledge questionnaire regarding the surgical site infection prevention. The content validity of the questionnaire was ascertained by experts and guides in nursing and various fields of medicine.

Content Validity

The draft blueprint of the research tool, along with the study's objectives, was shared with a panel of experts for content validation. Content validity was assessed by four physicians and nine nursing faculty members. Their recommendations were carefully reviewed, and appropriate modifications were made to the tool based on their feedback.

Reliability

Post-validation reliability of the tool was done. The knowledge questionnaire was administered to 5 samples. The report of the tool was established by using the Cronbach's alpha method. The variance of each item and the variance of the tool were calculated. A reliability score of r= 0.810 was achieved, confirming that the tool is reliable.

Ethical Clearance

Ethical approval was granted by the University Ethics Committee for Human Trials at Ramaiah University of

Applied Sciences in January 2025 (Reference no: EC-24/112-PG-RINER)

Pilot Study

The pilot study was conducted at Essential Hospital, Bengaluru. A total of 10 subjects were selected using a non-probability convenient sampling technique based on the selected criteria. On completion of the pilot study, it was found that the study was feasible and practicable to conduct the main study.

Data Collection Procedure

The main study was conducted from 6th February to 8th February 2025. Prior formal approval was secured from the Principal of M.S. Ramaiah Institution of Nursing Education and Research, the Associate Dean of Ramaiah Medical College Hospital, and the Nursing Superintendent of Ramaiah Medical College Hospital, Bengaluru. The data collection tool was prepared and reviewed for content validity by subject matter experts, followed by further refinement. Participants were selected using a non-probability convenience sampling technique. The student researcher introduced themselves, explained the purpose of the study to each participant, and obtained written informed consent. Participants were assured that all data would be kept confidential. Eighty participants were chosen through non-probability convenience sampling, and a self-administered questionnaire was distributed. The average time for completing the questionnaire was approximately 10–15 minutes. Participants were requested to complete all sections of the questionnaire fully. Confidentiality was ensured by omitting participants' names from the research tool.

Statistical Methods

Statistical analysis for the study was done by using IBM version 20. The results obtained are discussed in the following areas:

Section A: Frequency and percentage distribution of socio-demographic characteristics.

Section B: Frequency and percentage distribution of knowledge levels on surgical site infection prevention.

Section C: Analysis of the association between knowledge of surgical site infection prevention and selected socio-demographic variables using the chi-square test.

Results

Section-A N=80

Table 1:

Sn.	Socio-demographic variables	Frequency	Percentage (%)
1.	Age in years		
	20-30years	49	61.25
	31-40years	27	33.75
	41-50years	3	3.75
	51 years and above	1	1.25
2.	Gender		
	Male	27	33.75
	Female	53	66.25
3.	Marital Status		

	Single	42	52.5
	Married	38	47.5
4.	Educational Status		
	Diploma in Nursing	47	58.75
	Bachelor in Nursing	29	36.25
	Post Basic BSc Nursing	4	5.0
5.	Working area		
	Surgical ward	10	12.5
	Postoperative ward	16	20.0
	Orthopedic ward	13	16.25
	Acute general ward	10	12.5
	Intensive care unit	31	38.75
6.	Service experience (in years)		
	0-5 years	40	50.0
	6-10 years	28	35.0
	11-15 years	4	5.0
	16-20 years	6	7.5
	Above 20 years	2	2.5
7.	Have you ever undergone any training on surgical site infection prevention?		
	Yes	54	67.5
	No	26	32.5

Table depicts that the majority of the subjects, 61.25% were in the age group 20-30 years old, and 66.25% were female. Table depicts that 52.5% of the subjects are single, and 58.75% have completed a diploma in nursing. Table 3 depicts that 38.75% of the subjects are working in intensive care unit, whereas 50.0% of subjects have 0-5 years of experience. Table depicts that 67.5% of the subjects have undergone training on surgical site infection control.

Section-B

Table 2: Frequency and Percentage Distribution of Staff Nurses Regarding Level of Knowledge in Surgical Site Infection Prevention N=80

Level of Knowledge -			
Sn.	Level of knowledge	Frequency	Percentage (%)
1.	<50 inadequate	23	28.7
2.	51-75% moderately adequate	54	67.5
3.	>75% Adequate	3	3.8

Table 2 illustrates the frequency and percentage distribution of staff nurses' knowledge levels regarding surgical site infection prevention. The results show that most participants (67.5%) possessed a moderate level of knowledge, while (28.7%) demonstrated inadequate knowledge, and (3.8%) had an adequate level of knowledge.

Table 2.1 Mean and Standard Deviation of Knowledge Regarding Surgical Site Infection Prevention N=80

	Minimum Score	Maximum Score	Mean	Std. Deviation
Knowledge	3	22	15.83	3.285

Table 2.1 shows that the mean score was 15.83 with a standard deviation of 3.285.

Section-C

Table 3: Association of Level of Knowledge with Selected Socio-Demographic Variables Such As Age, Gender, Marital Status N=80

Sn.	Socio-demographic variables	Knowledge			Chi-square test	P value
		Adequate Knowledge	Inadequate Knowledge	Moderately knowledge		
1. Age group						
a)	20-30years	1	13	35	4.243 df =6 NS	.544
b)	31-40 years	2	8	17		
c)	41-50 years	0	2	1		
d)	50 years and above	0	0	1		
2. Gender						
a)	Male	2	5	20	3.199 df=2 NS	.185
b)	Female	1	18	34		
3. Marital Status						
a)	Single	1	1	28	.600 df=2 NS	.713
b)	Married	2	10	26		

NS= not significant, df= degree of freedom

Table 3 depicts that there is no significant association between knowledge regarding surgical site infection prevention and age (χ^2=4.243, p=.544), gender (χ^2=3.199, p=.185), and marital status(χ^2=.600, p=.713).

Table 3.1: Association of Level of Knowledge with Selected Socio-Demographic Variables Such As Educational Status, Working Area, Total Working Experience. N=80

Sn.	Socio-demographic variables	Knowledge			Chi-square	P value
		Adequate knowledge	Inadequate knowledge	Moderate knowledge		
4. Educational status						

a)	Diploma in Nursing	1	14	32		
b)	Bachelor in Nursing	2	8	19	1.349	.846
c)	Post Basic BSc Nursing	0	1	3	df=4 NS	
5.	Working area					
a)	Surgical ward	0	2	8	10.576	.224
b)	Postoperative ward	0	1	15	df=8 NS	
c)	Orthopedic ward	1	4	8		
d)	Acute medical ward	0	3	7		
e)	Intensive care unit	2	13	16		
6.	Total working experience (in years)					
a)	0-5 years	2	11	27	5.821	.621
b)	6-10 years	1	7	20	df=8 NS	
c)	11-15 years	0	3	1		
d)	16-20 years	0	1	5		
e)	Above 20 years	0	1	1		

NS= not significant, df= degree of freedom

Table 3.1 depicts that there is no significant association between knowledge regarding surgical site infection prevention and socio-demographic variables such as educational status(χ^2=1.349, p=.846), working area(χ^2=10.576, p=.224), and total year of experience(χ^2=5.821, p=.621).

Table 3.2: Association of Level of Knowledge with Selected Socio-Demographic Variables, Such as Any Training Undergone on Infection Control. N=80

Sn.	Socio-demographic variable		Knowledge		chi-square test	P value
		Adequate knowledge	Inadequate knowledge	Moderately knowledge		
7.	Any training undergone on infection control?					
a)	Yes	3	1	33	3.663	.142
b)	No	0	85	21	df=2 NS	

NS= not significant, df= degree of freedom

Table 3.2 depicts that there is no significant association between knowledge regarding surgical site infection prevention and socio-demographic variables such as training undergone on surgical site infection prevention(χ^2=3.663,p=.142).

Discussion

The findings of the study revealed that among 80 samples, 54 (67.5%) had a moderate level of knowledge, 23 subjects (28.7%) had an inadequate level of knowledge, and 3 samples (3.8%) had an adequate level of knowledge. The mean score was 15.83 and the standard deviation was ±3.285, indicating moderate overall knowledge among participants. These results align with several previous studies assessing nurses' knowledge of surgical site infection prevention.

The prevalence of a moderate knowledge level among staff nurses in this study aligns with several previous investigations into healthcare professionals' understanding of SSI prevention. For instance, a study by Sharma et al. (2020) found similar results, highlighting that while nurses possess foundational knowledge, there are often gaps in specific, advanced, or updated guidelines related to SSI prevention. This consistent finding across various studies suggests a universal need for continuous education and reinforcement of best practices in this critical area of patient care.

Furthermore, the mean knowledge score of 15.83 and the moderate standard deviation observed in our study are comparable to the average scores reported in other literature Devi & Kumar, (2018). This consistency underscores a common baseline of knowledge among nursing professionals concerning SSI prevention, potentially stemming from standardized nursing curriculum and basic in-service training. The fact that only a small percentage (3.8%) demonstrated adequate knowledge might reflect the dynamic nature of infection control guidelines and the challenge of consistently incorporating the latest evidence-based practices into daily routines. This resonates with the observations of Singh & Kaur (2022), who emphasized that while nurses are often aware of general hygiene and sterile techniques, their understanding of nuances like appropriate antibiotic prophylaxis, skin preparation agents, and environmental controls can be variable.

The results, therefore, strongly suggest that while staff nurses have a reasonable grasp of SSI prevention principles, there is ample room for improvement to elevate their knowledge to an "adequate" level. This moderate understanding could be attributed to a foundational education in infection control, but perhaps an infrequent or insufficient updating of knowledge through continuing education programs or hospital-specific training initiatives.

While our study indicates a moderate level of knowledge, it is important to acknowledge studies that present a more optimistic or, conversely, a more concerning picture of nurses' knowledge regarding SSI prevention. For example, a study conducted by Al-Qahtani et al. (2021) in a high-resource setting reported a significantly higher proportion of nurses demonstrating adequate knowledge (over 60%). This discrepancy could be attributed to several factors, including differences in the educational backgrounds of the nurses, the frequency and quality of in-service training programs provided by the healthcare institutions, and the availability of resources and updated guidelines. In more developed healthcare systems, nurses might have better access to continuous professional development, specialized training in infection control, and readily available evidence-based protocols, leading to a higher overall knowledge level.

Conversely, some studies have highlighted a more alarming deficit in knowledge. For instance, Roy & Das, (2019) found that a substantial majority (over 50%) of nurses had an inadequate level of knowledge regarding specific aspects of SSI prevention, particularly concerning the appropriate use of personal protective equipment and the nuances of sterile field maintenance. This stark contrast with our findings, where inadequate knowledge was present in 28.7% of participants, could be due to variations in research methodologies, sample populations (e.g., newly graduated nurses versus experienced staff), or the specific tools used to assess knowledge. It is also possible that cultural factors, workload pressures, or a lack of emphasis on continuing education in certain regions might contribute to lower knowledge scores in some studies compared to ours.

The presence of these contrasting findings underscores the multifaceted nature of nursing knowledge and the influence of contextual factors. While our study found a "moderate" baseline, the existence of studies with both higher and lower reported knowledge levels emphasizes the need for tailored educational interventions that consider the specific needs and environments of different nursing populations. It highlights that knowledge levels are not static and can be significantly influenced by ongoing educational opportunities and the prevailing infection control culture within healthcare facilities.

The association between the study variable and socio-demographic factors was examined using the Chi-square test. The present study's results indicated that, at P>0.05, the calculated Chi-square values were lower than the table values across all socio-demographic variables. Hence, no significant association was found between knowledge and factors such as age, gender, marital status, educational qualifications, work area, years of experience, or any prior training on surgical site infection.

The absence of a significant association between knowledge and various socio-demographic variables in our study is consistent with some existing literature. For instance, several studies have similarly reported that factors such as age, gender, and marital status do not consistently predict knowledge levels in healthcare professionals regarding infection control practices. A study by Al-Tamimi & Al-Amri (2019) on nurses' knowledge of infection control in a hospital setting also found no significant correlation between demographic variables like age and gender and their knowledge scores, suggesting that basic professional education might homogenize foundational understanding irrespective of these personal attributes.

Furthermore, our finding that educational qualifications did not significantly associate with knowledge levels, despite variations in diploma versus bachelor's degrees, resonates with research indicating that initial nursing education provides a baseline of knowledge, and subsequent knowledge acquisition might be more dependent on continuous professional development rather than the degree itself. Khan et al. (2021) similarly observed that while higher education is generally beneficial, the specific context of in-service training and access to updated guidelines often plays a more critical role in maintaining current knowledge on rapidly evolving topics like infection prevention.

The lack of association with years of experience and specific work areas (e.g., surgical vs. intensive care units) is particularly noteworthy. One might intuitively expect nurses with more experience or those working directly in surgical environments to possess higher knowledge due to greater exposure. However, our findings suggest that mere exposure or longevity in the profession does not automatically translate into superior knowledge of SSI prevention. This could imply that without structured, ongoing education and reinforcement, knowledge may not significantly improve over time or with specific clinical exposure. This aligns with the perspective of Patel & Shah, (2018), who argued that passive learning through experience alone is often insufficient to keep pace with evolving evidence-based practices in infection control.

Perhaps the most striking finding in this category is the lack of significant association with "any prior training on surgical site infection." This suggests that simply having undergone some form of training does not guarantee a higher knowledge level compared to those who have not. This could imply that the quality, content, recency, or methodology of the training received might be more

impactful than the mere fact of having received it. It might also suggest that some training programs are not effectively designed to translate into measurable, sustained knowledge improvement across all participants. Conversely, a substantial body of research contradicts some of our findings, particularly regarding the influence of educational qualifications, years of experience, and prior training on knowledge levels. Many studies have consistently demonstrated a positive association between higher educational attainment (e.g., Bachelor of Science in Nursing vs. Diploma) and superior knowledge of infection control practices, including SSI prevention. For example, Johnson & Smith (2020) found that nurses with a bachelor's degree consistently scored higher on infection control knowledge assessments, attributing this to a more comprehensive curriculum and a stronger emphasis on evidence-based practice in higher education programs. This contrasts with our study, where educational status did not show a significant association.

Similarly, the impact of years of experience on knowledge is a frequently debated topic in the literature, with many studies reporting a significant association. While our study found no such link, Wang et al. (2019) reported that nurses with more than five years of experience demonstrated significantly higher knowledge scores regarding surgical hand hygiene and sterile technique compared to their less experienced counterparts. This could be due to a cumulative effect of exposure to diverse clinical scenarios, problem-solving, and reinforced practices over time. The discrepancy with our findings might stem from differences in the specific knowledge domains assessed, the clinical environments, or the overall learning culture within the respective healthcare settings.

Perhaps the most significant contradiction lies in the association with prior training. Numerous studies unequivocally support the notion that specific, targeted training programs on infection control significantly enhance nurses' knowledge. For instance, a meta-analysis by Brown & Davies (2022) concluded that educational interventions, including workshops and in-service training on SSI prevention, consistently led to a statistically significant improvement in nurses' knowledge scores. The fact that our study found no such association with "any prior training" is a critical point of divergence. This could imply that the training received by participants in our study was either not comprehensive enough, not regularly updated, or perhaps not effectively retained. It underscores the importance of not just providing training, but ensuring its quality, relevance, and impact through effective pedagogical methods and regular reinforcement.

These contradictions highlight the complex interplay of various factors influencing knowledge acquisition and retention among nursing professionals. Differences in healthcare systems, educational standards, access to continuous professional development, and the specific design and implementation of training programs can all contribute to the variability observed across studies. Our findings, while unique in their non-associations, serve as a valuable data point, suggesting that in this particular context, the mere presence of these socio-demographic variables or generic training might not be sufficient drivers of advanced knowledge in SSI prevention. Instead, a more nuanced approach to education and ongoing professional development might be required to elevate knowledge levels across the board.

The present study was supported by a study conducted by Mahmoud N et al regarding knowledge of surgical site infection prevention among staff nurses at Jordan University (2017) result showed that there is no statistically significant association between nurse's

knowledge and socio-demographic variables such as between age, gender, marital status, educational qualification, working area, working experience, any training undergone on infection control.

Limitations

The current study had the following limitations:

- The accuracy of socio-demographic data depended on the participants' responses.
- The number of participants was small.
- The duration allocated for the study was short.
- Participation was influenced by the staff nurses' readiness to take part in the research.

Conclusion

- The present study revealed that most participants, 49 (61.25%), belonged to the 20–23 years age group, with the majority, 53 (66.25%), being female.
- In terms of marital status, 42 (52.5%) of the participants were single, and 47 (58.75%) had obtained a Diploma in Nursing.
- Regarding their work area, most of the respondents, 31 (38.75%), were employed in the Intensive Care Unit, and 40 (50.0%) had 0–5 years of professional experience.
- Further, 54 (67.5%) of the participants had received training on surgical site infection control.
- In this study, A total of 80 staff nurses were taken from Ramaiah Medical College Hospital. Most nurses demonstrated an adequate understanding of surgical site infection prevention. The results showed that 67.5% of the nurses had a moderate level of knowledge, while 28.7% had inadequate knowledge.
- The average knowledge mean score was 15.83, with a standard deviation of 3.285. Chi-square value findings revealed that there is no significant association between socio-demographic variables and knowledge regarding surgical site infection prevention.

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