ORIGINAL ARTICLE

Knowledge, Practice and Barriers in Surgical Site Infections Prevention Among Nurses in a Malaysian Public Hospital

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ABSTRACT

Introduction: Surgical Site Infections (SSIs) are a significant concern in healthcare, contributing to patient morbidity, prolonged hospital stays, and increased healthcare costs. Nurses play a critical role in the prevention of SSIs through the implementation of evidence-based infection control practices. This study aims to assess the knowledge, practices, and barriers faced by nurses in preventing SSIs, and to explore identify the relationship between their knowledge and practical adherence to preventive measures. **Methods:** A cross-sectional study was conducted among nurses in a Malaysian public hospital between January and June 2024. Data was collected using a self-administered questionnaire adapted from previous studies, which confirmed its validity and reliability. Spearman's correlation test was employed to determine the relationship between knowledge and practice. **Results:** A total of 219 respondents participated in the study, with a mean age of 36.91 years (SD = 5.88). The mean knowledge score was 71.73 (SD = 14.17), with 28.3% demonstrating high knowledge, 21% moderate, and 50.7% low. The mean practice score was 28.58 (SD = 1.86), with 97.3% showing good practices in SSI prevention. No significant correlation between knowledge and practice was found (r = -0.072, p = 0.287). The primary barrier to adherence was an inadequate supply of surgical consumables. **Conclusion:** Findings revealed that nurses had below-average knowledge in preventing SSIs but demonstrated good adherence to prevention measures. No significant correlation was observed between knowledge and practice. These results highlight the need for targeted interventions to improve both knowledge and practice in SSI prevention among nurses.

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INTRODUCTION

Surgical site infections (SSIs) are prevalent hospital-acquired infections (HAIs), occurring within 30 days of surgery or up to one year after prosthesis implantation (1, 2). They constitute 14% of all HAIs and can affect up to 30% of surgical procedures (3). SSIs significantly compromise patient health, increase hospitalisation costs, and prolong stays, with estimated rates of occurrence among surgical patients around 11% (4, 5). Previous studies in Malaysia have reported SSIs rates ranging from 11.7% to 17.18% (6-8). SSIs arise when microorganisms, primarily bacteria, infiltrate the body through surgical incisions (9).

Despite being largely preventable, SSIs remain a significant concern, with nurses playing a crucial role in infection prevention measures such as hand washing,

aseptic techniques, and preoperative strategies (10-12). However, studies highlight inadequate practices among nurses (13-15), despite their strong knowledge base, which typically correlates with more effective prevention activities (15). In Malaysia, nurses demonstrate good knowledge of SSI preventive measures, but this knowledge does not consistently translate into practice (16). This study aims to assess nurses' knowledge, practices, and barriers in SSIs prevention, and to examine the relationship between their knowledge and practices.

MATERIAL AND METHODS

A cross-sectional study was conducted between January and June 2024 at a public hospital in West Peninsular Malaysia, involving nurses from the obstetrics and gynaecology ward, surgical ward, orthopaedic ward, General Operation Theatre (GOT), Major Operation Theatre (MOT), and neurology ward. This hospital is one of the major public hospitals, serving a large number of patients and offering a wide range of health services. The iscross-sectional design offers a snapshot of the variables of interest, enabling analysis of the relationships between them. Convenience sampling was employed to recruit respondents due to its cost-effectiveness and ability to mitigate time constraints. Inclusion criteria were registered nurses working in the selected areas for a minimum of three months and present during data collection. They were excluded if they were nursing administrators, educators or ward managers. The sample size was estimated using the Raosoft Sample Size Calculator. For a total population of 328 nurses, with a 5% margin of error, 95% confidence interval, 50% response distribution, and accounting for a 20% dropout rate, the estimated sample size was 214.

Respondents completed a self-administered questionnaire consisting of sociodemographic data, knowledge and practice of SSI prevention, and barriers to adherence. The knowledge questionnaire, adapted from WHO (12) and Sickder et al. (17), consisted of 25 multiple-choice questions with "1" for correct and "0" for incorrect answers, converted to percentages. Scores below 70 indicated low knowledge, 70-80 moderate knowledge, and above 80 high knowledge. The practices questionnaire, adapted from Sickder et al. (17) and Mohsen et al. (18), included 10 items on a 3-point scale from 1 (never practiced) to 3 (always practiced). Scores ranged from 10-30, with 10-15 indicating poor practice, 16-23 moderate practice, and 24-30 good practice. The barriers questionnaire, adapted from Mohsen et al. (18), comprised 11 items scored on a 3-point scale (1 for "disagree", 2 for "unsure", and 3 for "agree"). Validity and reliability were confirmed in a pilot study (Cronbach's alpha = 0.88 - 0.90).

Ethical approval was obtained from the Research Ethics Committee of the University of Technology MARA (FERC/FSK/MR/2023/00371) and the Medical Research Ethics Committee of the Malaysian Ministry of Health (NMRR ID-24-00763-LUY [IIR]). Potential respondents were informed that participation was voluntary, and informed consent was obtained before data collection. Data confidentiality was ensured throughout the study. Data were analysed using IBM SPSS version 25. Descriptive statistics were employed to assess knowledge, practices, and barriers to adherence, presented as frequencies and percentages. Spearman's correlation test was used to determine the relationship between knowledge and practice, with a significant level set at a P-value of 0.005.

RESULTS

Table I presents the characteristics of the 219 respondents. Approximately one-third (31.5%) were from the GOT. The mean age was 36.91 years (SD = 5.88), with over half (58.0%) aged 30-39 years old. Few respondents (19.6%) had attended Infection Prevention (IP) training. Notably, 82.2% reported the availability of and adherence to IP guidelines in their institution.

Knowledge and Practice Regarding the SSIs Prevention

The mean knowledge score for SSIs prevention among respondents was 71.73 (SD = 14.17), with 28.3% demonstrating high knowledge. In terms of practice, the mean score was 28.58 (SD = 1.86), and 97.3% showed good practice. However, no significant correlation was found between knowledge and practice ($r = -0.072$, $P = 0.287$). See Tables II and III for details.

Items assessing the purpose of pre-operative skin preparation, surgical hand washing, methods for disinfecting surgical sites, prophylactic antibiotics, and optimal agent for pre-operative showering to prevent infections garnered correct response rate of 90.0% and above. However, four items mainly related to pre-operative skin preparation had notably lower correct response rates, all below 40%. Regarding practice, five items we consistently rated 90% or higher. These included using a face mask during wound dressing, washing hands, ensuring hand hygiene, employing aseptic techniques, and use sterilized dressing materials.

Barriers to Adherence in the SSIs Prevention

Table IV depicts perceived barriers to adherence in SSIs prevention. None of the respondents answered 'unsure' to the items assessed. The primary barrier to adherence was inadequate supply of surgical consumables (caps, masks, scrubs and antiseptic solutions) (58.4%).

DISCUSSION

Our study revealed a lack of knowledge about SSI prevention among nurses, with less than one-third of respondents answering questions correctly. However, their practices were commendable, with the majority

Table I: Characteristics of the respondents (n = 219)

Variables	Frequency (n)	Percentage (%)	Mean (SD)
Age			36.91 (5.88)
25-29 years old	22	10.1	
30-39 years old	127	58	
40-49 years old	66	30.1	
50-54 years old	4	1.9	
Gender			
Male	19	8.7	
Female	200	91.3	
Ethnic			
Malay	194	88.6	
Chinese	2	0.9	
Indian	10	4.6	
Others	13	5.9	
Educational level			
Diploma	212	96.8	
Degree	7	3.2	
Working area			
Orthopaedic	38	17.3	
Surgical	23	10.5	
Obstetrics and gynaecology	44	20.1	
GOT	69	31.5	
MOT	14	6.4	
Neurology	31	14.2	
Total working experience in current ward (years)			
Less than 5	76	34.8	
6-10	58	26.5	
11-15	54	24.6	
16-20	24	10.9	
21-25	6	2.9	
Above than 25	1	0.5	
Have attend infection prevention training			
Yes	43	19.6	
No	176	80.4	
Availability of infection prevention guideline			
Yes	180	82.2	
No	39	17.8	
Used of infection prevention guideline			
Yes	181	82.6	
No	38	17.4	
Knowledge of SSIs prevention			71.73 (14.17)
Low	111	50.7	
Moderate	46	21	
High	62	28.3	
Practice in SSIs prevention			28.58 (1.86)
Poor	0	0	
Moderate	6	2.7	
Good	213	97.3	

GOT = General Operation Theatre; MOT = Major Operation Theater; SSIs = surgical site infections

Table II: Responses on items of knowledge regarding the prevention of SSI (n = 219)

No	Items	Frequency (Percentages)	
		Correct	Incorrect
1	Which one is the best method for pre-operative shaving	75 (34.2)	144 (65.8)
2	When is the best time for pre-operative hair removal	83 (37.9)	136 (62.1)
3	Which one is the best agent for pre-operative skin preparation	70 (32.0)	149 (68.0)
4	What is the purpose for pre-operative skin preparation	215 (98.2)	4 (1.8)
5	How would you disinfect surgical site infection	199 (90.9)	20 (9.1)
6	Which one is true answer for prophylaxis antibiotics	210 (95.9)	9 (4.1)
7	When should you administer prophylaxis to surgical patient	176 (80.4)	43 (19.6)
8	What is the purpose of pre-operative showering	178 (81.3)	41 (18.7)
9	What is the best skin agent for pre-operative showering to prevent surgical site infection	197 (90.0)	22 (10.0)
10	Which one is correct for the malnourished surgical patient	134 (61.2)	85 (38.8)
11	What are laboratories in assessing patient's nutritional status	61 (27.9)	158 (72.1)
12	What is the correct level of blood sugar which enhances function of white blood cell adequate to prevent SSI	141 (64.4)	78 (35.6)
13	What is the best antiseptic solution to disinfect the surface of dressing trolley	132 (60.3)	87 (39.7)
14	Which is the correct purpose for surgical hand washing	216 (98.6)	3 (1.4)
15	Which are the correct steps of hand washing	180 (82.2)	39 (17.8)
16	Which one is the correct answer for the benefit of wound dressing	196 (89.5)	23 (17.8)
17	When do you change the surgical wound dressing	147 (67.1)	72 (32.9)
18	How do you select dressing solution	205 (93.6)	14 (6.4)
19	What is the purpose of maintenance of normal nutritional status for surgical patients	193 (88.1)	26 (11.9)
20	What kinds of diet should be provided for the post-operative patients	211 (96.3)	8 (3.7)
21	Which one is the correct answer for surgical patients with compromised immune system	143 (65.3)	76 (34.7)
22	How do you prevent infection of patients with immunodeficiency disorder	107 (48.9)	112 (51.1)
23	Which statement is correct for diagnosis of surgical site infection	91 (41.6)	128 (58.4)
24	Which answer is a good sign of no surgical site infection	175 (79.9)	44 (20.1)
25.	Which laboratory is used to ensure SSI	192 (87.7)	27 (12.3)

adhering to guidelines. This knowledge finding is consistent with studies from Ethiopia, Egypt, and Iraq, which similarly reported poor knowledge among nurses but contrasting good practices (14, 18, 19). Conversely, a previous study in Malaysia found that 85.3% of nurses had good knowledge of SSI prevention (16). Factors such as educational background, years of service, and training history in infection prevention significantly influenced nurses' knowledge, highlighting the need for further analysis of these factors in our study (14).

While previous studies have often highlighted inadequate SSI prevention practices among nurses (11, 13, 19), our findings challenge this by demonstrating that nurses in our study scored highly in SSI prevention practices. Past research has suggested that better knowledge correlates with improved practices (5, 19). However, we did not find a significant relationship between nurses' knowledge and their actual practices, consistent with local findings (16). This discrepancy may be attributed to the work environment, where

Table III: Responses on items of practice regarding the prevention of SSI (n = 219)

No	Items	Frequency (Percentage)		
		Never Practice	Sometimes Practice	Always Practice
1	I wash my hands before and after changing wound dressing and touching the surgical site	0 (0.00)	5 (2.3)	214 (97.7)
2	I wash my hand before wearing sterile gloves	0 (0.00)	16 (7.3)	203 (92.7)
3	I perform pre-operative shaving right before surgery	0 (0.00)	100 (45.7)	119 (54.3)
4	I administer pre-operative prophylactic antibiotic within one hour before surgery	0 (0.00)	63 (28.8)	156 (71.2)
5	I advise my patient to take pre-operative showering or bathing with antimicrobial agents	0 (0.00)	48 (21.9)	171 (78.1)
6	I use sterilized dressing materials for cleansing surgical wound dressing	0 (0.00)	9 (4.1)	210 (95.9)
7	I use an aseptic technique during surgical wound dressing	0 (0.00)	10 (4.6)	209 (95.4)
8	I assess and monitor surgical site condition	0 (0.00)	27 (12.3)	192 (87.7)
9	I separate infected from non-infected cases during dressing	0 (0.00)	27 (12.3)	192 (87.7)
10	I use a face mask during cleansing surgical wound dressing	0 (0.00)	5 (2.3)	214 (97.7)

Table IV: Responses on items regarding barriers to adherence in the prevention of SSI (n = 219)

No	Items	Frequency (Percentage)	
		Disagree	Agree
1	Inadequate supply of surgical consumables (cap, mask, scrub, antiseptic solution)	91 (41.6)	128 (58.4)
2	Lack of supervision of hospital infection control committee	138 (63.0)	81 (37.0)
3	Inadequate knowledge about disinfection and sterilizing techniques	105 (47.9)	114 (52.1)
4	Lack of training about measures for the prevention of surgical site infection in hospital	107 (48.9)	112 (51.1)
5	Lack of providing Evidence-based recommendations on measures for the prevention of surgical site infection in hospital	121 (55.3)	98 (44.7)
6	Unsuitable nurse-patient ratio	100 (45.7)	119 (54.3)
7	Lack of a professional model	129 (58.9)	90 (41.1)
8	Poor integration of research findings in practice	137 (62.6)	82 (37.4)
9	Nurses do not have enough time	106 (48.4)	113 (51.6)
10	Nurses lack the required skills	150 (68.5)	69 (31.5)
11	Some measures for the prevention of surgical site infection are not nurses' responsibilities	131 (59.8)	88 (40.2)

supervision and institutional routines strongly influence practice, independent of theoretical knowledge levels. Strengthening SSI prevention efforts should, therefore, include continuous training, regular audits, and feedback mechanisms to effectively maintain and elevate these standards effectivelywhile sustaining good nursing practices and fostering a positive attitude toward SSI prevention efforts (20).

Administering pre-operative prophylactic antibiotics within one hour before surgery is crucial for reducing SSIs risk (15). In our study, nearly 30% of nurses reported inconsistent adherence to this practice. Similarly, advising patients to use antimicrobial agents before surgery was inconsistently followed. These findings imply that nursing care activities may influence observed practices more than overall guideline adherence. Future studies should focus on specific work settings to accurately assess SSI prevention practices.

In this study, the inadequate supply of surgical consumables and antiseptic solutions, coupled with an unsuitable nurse-patient ratio, emerged as primary barriers to guideline adherence. Research has shown that adequate personal protective equipment significantly enhances nursing practices, with an odds ratio of 3.4 (14). Additionally, access to infection prevention guidelines and presence of professional role models have been associated with improved nursing practices (14, 18). These findings underscore the critical need for enhanced resource allocation, appropriate staffing levels, and continuous access to infection prevention resources. To enhance nursing practice in Malaysia, prioritising resource management, implementing professional development programs, and strengthening policy support are promising strategies that will empower nurses to deliver safer, high-quality care.

The strength of our study lies in its large sample size and the inclusion of nurses from diverse clinical settings, offering a broad perspective on nursing practices. However, this diversity may introduce variability in responses, making uniform conclusions challenging. The study's single-center design and convenience sampling further limit the generalisability of the findings, as they may not reflect nurses' experiences in other settings or regions. Additionally, the reliance on a self-administered questionnaire could lead to recall bias, potentially affecting the accuracy of reported knowledge and practices. Despite these limitations, the study provides valuable insights and highlights areas for further research.

CONCLUSION

The study revealed that nurses' knowledge of SSIs prevention in a public hospital in West Peninsular Malaysia was below average, despite observing a higher level of practice without a significant association between the two. The major barriers to adherence with SSIs prevention was inadequate supply of surgical consumables and antiseptic solutions. Regular, comprehensive educational programs of SSIs prevention are recommended to enhance knowledge and reinforce practice standards among nurses. Future studies should consider multicenter approaches and select specific

clinical settings to accurately measure knowledge and practice based on workplace nursing care activities.

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