FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 10 No. 23, December, 2026, pp 321 – 326
DOI: https://doi.org/10.33003/fjs-2026-1023-6540

Self-Reported Preoperative Skin Preparation Practices and Perceived Surgical Site Infection among Nursing Staff in the Female Surgical Ward, Murtala Muhammad Specialist Hospital, Kano, Nigeria

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Received: 05 Oct. 2026
Accepted: 11 Nov. 2026
Published: 17 Nov. 2026

ABSTRACT

Surgical site infection (SSI) is a common healthcare-associated infection, and preoperative skin preparation is an important preventive measure. This study aimed to assess preoperative skin preparation practices, guideline compliance, perceived barriers and reported SSI occurrence among nursing staff in the female surgical ward of Murtala Muhammad Specialist Hospital, Kano. A descriptive cross-sectional survey was conducted using a structured questionnaire. Of 92 questionnaires distributed, 86 (93.5%) were analysed using SPSS version 25. Descriptive and inferential statistics were applied at $p < 0.05$. Razor shaving was the predominant hair-removal method (97.7%), while alcohol was the most commonly reported antiseptic (82.6%). Most hair removal occurred the night before surgery (67.4%). Most respondents (73.3%) had no previous SSI prevention training. Agreement with guideline-related practices ranged from 55.8% to 70.9%. Major barriers included inadequate supplies (95.3%), staff shortages (89.5%) and inadequate training (79.1%). Overall, 91.9% reported observing SSI frequently or very frequently. Compliance scores correlated weakly and negatively with reported SSI frequency ($\rho = -0.219$, $p = 0.043$). Previously trained respondents had significantly higher compliance scores ($p = 0.009$). Gaps existed between reported practices and recommended guidelines. Training, adequate supplies, standardised protocols and supervision are recommended to improve compliance. Patient-level SSI surveillance is necessary to establish actual SSI occurrence.

Keywords: Preoperative skin preparation, Surgical site infection, Hair removal, Antiseptics, Nursing, Nigeria.

INTRODUCTION

Surgical site infection (SSI) is an infection at or near a surgical incision within 30 days of an operation, or within one year when an implant is placed (Rezaei *et al.*, 2025). It is among the commonest healthcare-associated infections and leads to delayed wound healing, longer hospital stay, higher costs and, in severe cases, death (Brown & Oliveira, 2026). The burden is heavier in low- and middle-income countries, where infrastructure and infection-prevention resources are often limited (Okomo *et al.*, 2026). A prospective study across 53 Nigerian hospitals reported that 26.4% of patients had an SSI within 30 days of abdominal surgery (Collaborative, 2026).

Preoperative skin preparation is a modifiable step in SSI prevention. World Health Organization (WHO) recommendations advise an alcohol-based antiseptic containing chlorhexidine for skin preparation, preoperative bathing, and no routine hair removal; where hair must be removed, clippers are preferred to razors (Ademuyiwa *et al.*, 2022). Trials and meta-analyses generally favour chlorhexidine-alcohol over povidone-iodine, although the size of the benefit varies by procedure and setting (Drugeon *et al.*, 2026). Antiseptic choice is only part of the process: the way it is applied, including contact and drying time, also matters (Quon *et al.*, 2025).

Guidelines do not guarantee adherence. A survey of Nigerian surgeons found wide variation in pre-incision skin antisepsis (Surani, 2025). Studies of nurses in Ethiopian hospitals link access to and use of infection-prevention guidelines with better SSI-prevention practice (Tura & Ayalew, 2026). The Donabedian framework offers a useful lens: resources and organisation (structure) shape the care delivery process, which in turn shapes patient outcomes (Alamri *et al.*, 2025).

Murtala Muhammad Specialist Hospital is a major referral hospital in Kano State, but there is little documented evidence on how preoperative skin preparation is done in its female surgical ward or how staff see its link to SSI. The objectives of this study were to: (1) identify the skin preparation methods reported in the ward, (2) assess reported agreement with guideline-related practices and the barriers to them, and (3) examine how compliance relates to reported SSI occurrence, prior training, experience and qualification.

MATERIALS AND METHODS

Study Design and Setting

It was a descriptive cross-sectional survey in the female surgical ward of Murtala Muhammad Specialist Hospital, a secondary-level referral hospital in Kano State, Nigeria. The ward provides preoperative and postoperative care for female patients undergoing general, obstetric and gynaecological and other surgical procedures.

Participants and Sampling

The study population was the nursing staff working in the ward (N = 120). Using the Krejcie and Morgan (1970) table, a sample of 92 was required at a 95% confidence level and 5% margin of error. Respondents were selected by systematic sampling. Nursing staff working in the ward during the data collection period who gave written informed consent were

included. Staff who were on leave or otherwise absent during data collection, or who declined to participate, were excluded.

Instrument

Data were collected with a researcher-developed structured questionnaire with five sections. Section A covered socio-demographic and training data (age, sex, marital status, qualification, years of experience, prior SSI or skin-preparation training); Section B, methods of preoperative skin preparation (hair-removal method and timing, antiseptic agents, place of preparation, person responsible); Section C, agreement with ten guideline-related statements (strongly agree to strongly disagree), summed into a compliance score, plus challenges to compliance (multiple responses allowed); Section D, SSI as observed by the respondent (frequency, estimated proportion of patients, signs, timing); and Section E, six statements and one summary item on perceived links between skin preparation and SSI.

Statements were scored from 1 (strongly disagree) to 4 (strongly agree), so higher scores indicate greater agreement. Summed scores therefore ranged from 10 to 40 for the compliance scale and from 6 to 24 for the perception scale.

Validity and Reliability

Face and content validity were assessed by experts in nursing and research methodology, and the instrument was revised after their feedback. Test–retest reliability was assessed in about 10% of the sample size at a similar facility outside the study, giving a correlation coefficient of 0.78. Internal consistency of the ten-item compliance scale in the study sample was low (Cronbach's $\alpha = 0.452$), and this is considered in the interpretation of results.

Data Collection

Data were collected over four weeks by the researcher with trained research assistants, after informed consent. Of 92 questionnaires distributed, 86 were complete and included in the analysis (93.5%); six incomplete questionnaires were excluded.

Data Analysis

Data were entered and analysed in SPSS version 25. Frequencies, percentages, means, standard deviations and medians described the data. Because compliance scores were ordinal and not assumed to be normally distributed, we used Spearman's rank correlation to relate compliance scores to reported SSI frequency and estimated SSI proportion, the Mann–Whitney U test to compare scores by training status, and the Kruskal–Wallis test to compare scores by years of experience and professional qualification. Items that allowed multiple responses are reported as percentages of respondents, so they do not sum to 100%. Significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Kano State Ministry of Health ethics review committee, NHREC approval number: NHREC/17/7682. Participation was voluntary, written informed consent was obtained, responses were anonymous, and data were used for research only.

RESULTS AND DISCUSSION

Results

Table 1: Characteristics of Respondents (n = 86)

Characteristic	Category	n	%
Age (years)	20–29	27	31.4
	30–39	39	45.3
	40–49	15	17.4
	50 and above	5	5.8
Sex	Female	48	55.8
	Male	38	44.2
Marital status	Single	34	39.5
	Married	45	52.3
	Widowed	6	7.0
	Divorced	1	1.2
Qualification	RN	24	27.9
	RN/RM	27	31.4
	BNSc	27	31.4
	MSc	8	9.3
Experience	1–5 years	46	53.5
	6–10 years	22	25.6
	Above 10 years	18	20.9
Training in SSI prevention or skin preparation	Yes	23	26.7
	No	63	73.3

Eighty-six nursing staff were analysed. Most were aged 30–39 years (45.3%), 55.8% were female, 52.3% were married, and 53.5% had 1–5 years of experience (Table 1). Only 26.7% had received training in SSI prevention or preoperative skin preparation.

Table 2: Reported Skin Preparation Practices (n = 86)

Practice	Response	n	%
Hair-removal method*	Razor shaving	84	97.7
	Clipping	5	5.8
	Depilatory cream	7	8.1
	No hair removal	1	1.2
Antiseptic agent*	Alcohol	71	82.6
	Chlorhexidine-alcohol	18	20.9
	Povidone-iodine	11	12.8
	Chlorhexidine gluconate (aqueous)	3	3.5
	Savlon	1	1.2
Timing of hair removal	Night before surgery	58	67.4
	Immediately before surgery (theatre)	27	31.4
	On admission, regardless of surgery date	1	1.2
Place of skin preparation	Ward	76	88.4
	Preoperative holding area	5	5.8
	Operating theatre	5	5.8
Person mainly responsible	Ward nurse	62	72.1
	Theatre nurse	21	24.4
	Surgeon	3	3.5

*Multiple Responses Allowed; Percentages Do Not Sum to 100%.

Reported Skin Preparation Practices

Razor shaving was reported by 97.7% of respondents, clipping by 5.8% and depilatory cream by 8.1%; one respondent (1.2%) reported no hair removal (Table 2). Alcohol was the most commonly reported antiseptic (82.6%), followed by chlorhexidine-alcohol (20.9%) and povidone-iodine (12.8%). Hair removal was usually done the night before surgery (67.4%), skin preparation took place mostly in the ward (88.4%), and ward nurses were most often responsible (72.1%). Hair-removal method and antiseptic items allowed more than one answer.

Table 3: Agreement with Guideline-Related Practices (n = 86)

Statement	Agree or strongly agree, n	%
Clipping is preferred over shaving	61	70.9
Skin preparation is done close to the time of incision	59	68.6
Sterile gloves are used during skin preparation	59	68.6
Skin is assessed for existing infection before preparation	58	67.4
Standard hospital protocol is available and followed	56	65.1
Antiseptic is applied from the incision site outward	56	65.1
Hair is removed only when it interferes with the surgical site	55	64.0
Preoperative antiseptic bathing or showering is done	54	62.8
Skin preparation is routinely documented	50	58.1
Antiseptic is allowed to dry completely	48	55.8

Agreement (strongly agree or agree) with the ten statements ranged from 55.8% to 70.9% (Table 3). It was highest for preferring clipping to shaving (70.9%) and lowest for allowing antiseptic to dry completely (55.8%) and routine documentation (58.1%). Agreement that clipping is preferred (70.9%) contrasts with the 97.7% who reported razor use.

Table 4: Reported Challenges to Following Guidelines (n = 86; Multiple Responses)

Challenge	n	%
Inadequate supplies or antiseptics	82	95.3
Shortage of staff	77	89.5
Inadequate training	68	79.1
Time constraints	61	70.9
Lack of standard protocol	50	58.1

The most frequently reported challenges were inadequate supplies or antiseptics (95.3%), staff shortage (89.5%), and inadequate training (79.1%), followed by time constraints (70.9%) and lack of a standard protocol (58.1%) (Table 4).

Table 5: Reported SSI Occurrence and Perceived Link with Skin Preparation (n = 86)

Variable	Response	n	%
How often SSI is observed	Very frequently	51	59.3
	Frequently	28	32.6
	Occasionally	5	5.8
	Rarely	2	2.3
Estimated share of postoperative patients with signs of SSI	Less than 5%	6	7.0
	5–10%	51	59.3
	11–20%	25	29.1
	Above 20%	3	3.5
	Not sure	1	1.2
Usual time signs are seen	Within 48 hours	3	3.5
	3–7 days	62	72.1
	8–14 days	20	23.3
	After 30 days	1	1.2
Agree razor use raises SSI risk versus clipping	Agree or strongly agree	69	80.2
Agree poor compliance contributes to higher SSI rates in the ward	Agree or strongly agree	60	69.8
Perceived relationship between skin preparation and SSI	Strong	57	66.3
	Moderate	29	33.7

These findings reflect respondents' observations and estimates, not SSI confirmed in patients. Seventy-nine respondents (91.9%) said they saw SSI very frequently (59.3%) or frequently (32.6%), and 59.3% estimated that 5–10% of postoperative patients showed signs of SSI (Table 5). Purulent discharge (91.9%) and redness (89.5%) were the signs most often reported, and 72.1% usually saw signs 3–7 days after surgery. All respondents perceived a relationship between skin preparation and SSI, which 66.3% rated as strong and 33.7% as moderate. Agreement was highest that razor use raises SSI risk compared with clipping (80.2%) and lowest for timing of preparation (58.1%); the six-item perception scale had a mean of 17.50 of 24.

Table 6: Associations with Overall Compliance Score

Comparison	Test	Result	p
Reported SSI frequency (n = 86)	Spearman's ρ	−0.219	0.043
Estimated share of patients with SSI (n = 85)	Spearman's ρ	0.052	0.637
Training: yes (n = 23, mean 30.43, SD 4.08, median 30) vs no (n = 63, mean 27.89, SD 3.35, median 27)	Mann–Whitney U	U = 991	0.009
Experience: 1–5 y (n = 46, mean 27.89), 6–10 y (n = 22, mean 29.91), above 10 y (n = 18, mean 28.67)	Kruskal–Wallis	H = 5.828	0.054
Qualification: RN (n = 24, mean 28.25), RN/RM (n = 27, mean 27.67), BNSc (n = 27, mean 29.63), MSc (n = 8, mean 29.00)	Kruskal–Wallis	H = 4.429	0.219

Compliance score correlated weakly and negatively with reported SSI frequency (ρ = −0.219, p = 0.043), but not with the estimated proportion of patients with SSI (ρ = 0.052, p = 0.637, n = 85) (Table 6). Respondents with prior training had higher compliance scores than those without (median 30 vs 27; U = 991, p = 0.009). Scores did not differ significantly by years of experience (H = 5.828, p = 0.054) or by qualification (H = 4.429, p = 0.219).

Discussion

The findings revealed important gaps in preoperative skin preparation practices among nursing staff. Although some respondents demonstrated awareness of recommended practices, actual clinical practices were not always consistent with established guidelines. This was particularly evident in the use of razor shaving, which was reported by 97.7% of respondents, despite 70.9% agreeing that clipping is preferable. This finding suggests a gap between knowledge and clinical practice.

The high prevalence of razor shaving is consistent with the findings of DaCanal (2025), whose Cochrane systematic review established that razor shaving increases the risk of surgical site infection compared with clipping. Their review also found that razor shaving increases the likelihood of skin injuries, which may facilitate bacterial colonisation. Similarly, Saxena *et al.* (2024) recommended avoidance of routine hair removal; but where necessary, clippers should be used instead. The similarity between these findings highlights the need to improve adherence to evidence-based hair-removal practices in the study setting.

Regarding antiseptic agents, alcohol was the most commonly reported preparation (82.6%), while only 20.9% reported using chlorhexidine-alcohol. This finding raises concerns about the selection of appropriate antiseptic preparations. This is in line with the report of Yang *et al.* (2024) who recommended alcohol-based chlorhexidine solutions for surgical site skin preparation because of their effectiveness in reducing SSI compared with aqueous preparations. Therefore, the reported use of alcohol without confirmation of its composition suggests a possible gap in adherence to recommended antiseptic practices.

Another important finding was that skin preparation was predominantly performed in the ward (88.4%), with ward nurses identified as the personnel mainly responsible (72.1%). Although this demonstrates the important role of ward nurses in preoperative care, it also raises concerns about the consistency of infection prevention procedures outside the operating theatre. This corroborates the report of Witwit *et al.* (2026) who distinguished between preoperative bathing, which may occur outside the operating theatre, and surgical

site skin preparation, which should be performed within the operating theatre before incision. This distinction is important when interpreting the findings because ward-based patient preparation should not be confused with the final surgical site antisepsis procedure.

Furthermore, the study revealed moderate agreement with recommended skin preparation practices, ranging from 55.8% to 70.9%. Agreement was lowest regarding allowing antiseptic solutions to dry completely (55.8%) and routine documentation of skin preparation (58.1%). These findings suggest that important aspects of recommended procedures may not receive sufficient attention. This is supported by Mortada *et al.* (2024), who emphasize that alcohol-based antiseptic solutions must be allowed to dry completely before incision to reduce fire-related risks and ensure safe surgical practice. Similarly, proper documentation is important for monitoring adherence to infection prevention protocols.

The challenges identified in this study provide further explanation for the observed gaps in clinical practice. Inadequate supplies or antiseptics (95.3%), staff shortages (89.5%) and inadequate training (79.1%) were the most frequently reported barriers. These findings closely agree with Niyomugabo *et al.* (2024), who investigated SSI prevention practices and barriers in Rwandan hospitals. Their study identified shortages of antiseptic materials, inadequate training, lack of clear guidelines, and high workload as important barriers to implementing recommended SSI prevention practices. The similarity between the two studies suggests that challenges affecting SSI prevention in resource-constrained healthcare settings extend beyond individual healthcare workers and are also related to institutional and health system limitations. This indicates that improving compliance requires not only staff education but also adequate supplies, appropriate staffing, and accessible standard operating procedures.

Regarding SSI occurrence, 91.9% of respondents reported observing surgical site infections frequently or very frequently, while 59.3% estimated that between 5% and 10% of postoperative patients developed signs of infection. Purulent discharge (91.9%) and redness (89.5%) were the most frequently reported signs. These findings indicate that SSI is perceived by nursing staff as an important postoperative problem in the study setting. However, they should be interpreted cautiously because they represent respondents' observations and estimates rather than confirmed patient-level SSI prevalence.

Importantly, 80.2% of respondents agreed that razor shaving increases SSI risk compared with clipping, while all respondents perceived a relationship between skin preparation and SSI occurrence. These perceptions are supported by DaCanal (2025), who found that razor shaving was associated with a higher risk of SSI than clipping. Nevertheless, SSI development is multifactorial and may also be influenced by patient characteristics, surgical procedures, antimicrobial prophylaxis and other infection prevention practices.

The association analysis further revealed a weak but statistically significant negative correlation between compliance scores and reported SSI frequency ($\rho = -0.219$, $p = 0.043$). This suggests that respondents with higher compliance scores tended to report lower frequencies of SSI. However, no significant relationship was observed between compliance scores and the estimated proportion of postoperative patients with SSI ($\rho = 0.052$, $p = 0.637$). The difference may reflect the subjective nature of respondents' observations and estimates. Therefore, these findings should not be interpreted as evidence of a direct causal relationship between compliance and SSI occurrence.

An additional important finding was that respondents who had received previous training in SSI prevention or skin preparation had significantly higher compliance scores than those without previous training ($p = 0.009$). This finding supports the importance of continuous professional education in improving adherence to recommended infection prevention practices. It also agrees with the report of Mele *et al.* (2021), whose participants identified inadequate training as a major barrier to SSI prevention and recommended formal training for healthcare workers involved in surgical care. However, professional experience and academic qualification were not significantly associated with compliance scores in the present study. This suggests that regular, targeted training may be more important for maintaining current clinical practices than relying solely on years of experience or academic qualifications.

CONCLUSION

Self-reported preoperative skin preparation in this ward departs from recommended practice, most clearly in razor use, antiseptic drying and documentation. The respondents identified shortages of supplies, staff and training as barriers. Prior training was associated with higher compliance scores, and compliance was weakly associated with lower reported SSI frequency. Since SSI was not confirmed in patients and all data were self-reported, the findings describe reported practice and perceived burden, not SSI incidence or the effect of any practice.

RECOMMENDATIONS

Given the findings of this study, the following recommendations are made:

i. Hospital management should provide regular, competency-based training and refreshers on evidence-based skin preparation and SSI prevention;
ii. The hospital should maintain a reliable supply of appropriate antiseptics (preferably chlorhexidine-alcohol) and hair clippers;
iii. A written skin preparation protocol should be issued, made available in the ward and theatre, and its responsibilities assigned;
iv. Supportive supervision and periodic audits should be introduced, with routine documentation of each preparation;
v. SSI surveillance should be strengthened with standard case definitions, clinical assessment and postoperative follow-up; and
vi. Future multicentre studies should combine staff surveys with direct observation and prospective patient follow-up, and use a validated compliance tool.

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