

## Impact of surgical wound dressing practices on surgical site infections in Rwanda: A Preliminary study to inform a large randomized controlled trial

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### ABSTRACT

**INTRODUCTION:** Wound dressing is one of the most frequent procedures in surgical wards, ranging from simple to complex dressings. The aim of this study was to describe wound care practices and assess variability in wound dressing among surgical care providers in Rwanda.

**METHODS:** A mixed-method study was conducted in three Rwandan hospitals among surgical health professionals (surgeons, GPs, and nurses). A questionnaire assessing knowledge, attitudes, and practices regarding wound dressing was administered, followed by a focused group discussion. Data analysis was done using Stata software and thematic analysis for qualitative responses. The study aimed to explore the professionals' perspectives on wound dressing principles. Findings were analyzed through frequency tables and thematic interpretation to assess knowledge and practice.

**RESULTS:** A total of 98 health professionals participated in the study, including 69 nurses, 17 GPs, and 12 surgeons, with a median age of 32.5 years. The median knowledge score on wound dressing was 6.7, with 47.96% scoring low ( $\leq 50\%$ ). Knowledge disparities were found between healthcare providers: significant differences in knowledge were found between surgeons and nurses ( $p < 0.001$ ) but not between GPs and nurses ( $p = 0.11$ ). Regarding attitudes, 83.67% believed locally made gauze could prevent surgical site infections, and 23.47% were uncomfortable leaving closed wounds undressed. Most (78.57%) always used locally made gauze, with 54% choosing dressings based on availability.

**CONCLUSION:** There is considerable variability in the knowledge, attitudes, and practices related to wound dressing among healthcare professionals in Rwanda. To improve and standardize wound care, the implementation of standardized guidelines, multi-disciplinary training, and ongoing professional development is needed for improved health care outcomes.

**Keywords:** Wound Dressing, Rwanda, Surgical Site Infection, Wound Care Practices

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## INTRODUCTION

Over 300 million surgical wounds are made every year worldwide, and 25-30 % of post-operative complications are surgical site infections [1]. Surgical site infections (SSI) are a major source of morbidity and mortality worldwide and the leading healthcare-associated infection in the developing world [2]. The burden is disproportionately felt in low- and middle-income countries (LMICs) and especially in Africa, where the rate of post-operative SSI has been documented as high as 30.9% [3]. In Rwanda, like in many LMICs, SSIs often develop after patients are discharged from care, and geographic and financial barriers can prevent patients from following up during the postoperative period [4]. Failure to return or a delayed return to care among patients with SSI is linked with poor health outcomes, including sepsis, need for re-operation, death, and an increase in healthcare costs [5].

It is a standard practice to cover wounds with different types of dressings after surgery. These dressings range from simple to complex dressings, with some being commercially provided and others made locally by clinicians. Dressing changes are the most frequent procedure in surgical wards and represent more than 50% of the nursing workload in Developing countries.

Wound dressing practices may not necessarily reduce the risk of SSIs. Prior studies suggest that the choice of dressing type may have more influence on cost, exudate control, and patient comfort rather than on prevention of SSI [1,3]. Despite their widespread use, there is a lack of high-quality evidence linking specific dressing types to reduced SSI rates, particularly in LMIC contexts where dressings are not covered by insurance, creating a significant economic burden on patients and hospitals.

In Rwanda, surgical wounds are routinely covered using a mix of locally available and commercially sourced dressing materials, yet no standardized national guidelines exist to inform best practices. This variability, combined with the country's representative LMIC healthcare environment, makes Rwanda an ideal setting for a preliminary investigation into the knowledge, attitudes and practice of wound dressing and SSI outcomes. This study is designed to generate essential baseline data on dressing practices in Rwandan hospitals,

with the specific aim of informing the design of a future large-scale randomized controlled trial (RCT). Our hypothesis is that there is variation in types of wound dressing attitude and SSI rates in this context. Understanding these associations will be critical to developing cost-effective, evidence-based guidelines tailored to resource-constrained settings.

## METHODS

### Study design and Settings

This was a mixed-method study with a sequential explanatory design. A cross-sectional survey was undertaken among surgical healthcare providers, including surgeons, general practitioners, and nurses working in surgical departments of three hospitals in the network of spokes of Global Surgery Research Hub Rwanda: CHUK, Kibungo, and Kibogora from August 2021 to March 2022 to produce preliminary data to inform a large randomized controlled trial on wound dressing practices in low and middle-income countries.

### Data Collection

Data were collected on participants' demographics, wound dressing practices, knowledge, and attitudes toward wound dressing. After purposive sampling of three focused group discussions per each hospital made of nurses, medical doctors and patients were selected to discuss specific topics of interest identified in wound dressing principles: Reasons behind knowledge disparity among medical staff, buffering knowledge disparity among medical staff, locally made versus commercial gauzes, and Study on dressing versus no-dressing in clean and clean-contaminated wounds (annex 1).

### Data Analysis

Descriptive statistics were used, and an ANOVA test was used to determine the statistical difference between groups. Thematic analysis was used to analyze the qualitative data.

The study was approved by the Institutional review board (IRB) of the University of Rwanda (No 477/CMHS IRB/2019). Confidentiality was ensured and each participant was assigned a unique study identifier number. A password-protected linking study ID and personal identifier (name, hospital ID) were kept separately by the principal investigator (PI). Only the researcher and the research team had access to the study data and information.

There were no incentives offered to participants whose data were used in this study.

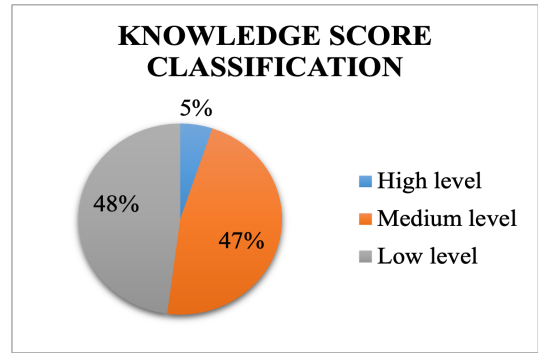
**RESULTS**

A total of 98 health professionals participated in the study: 38(38.78%) from CHUK, 30(30.61%) from Kibungo referral hospital, and 30(30.61%) from Kibogora district hospital. Nurse predominance 69(70.41%) was observed, and the median age of participants was 32.5 years with an interquartile range of 29 and 38 ((32.5(IQR:29-38))). The majority of participants (45.92%) had 1- 5 years of practice experience, while only 4.08% had a practice of more than 20 years (Table 1).

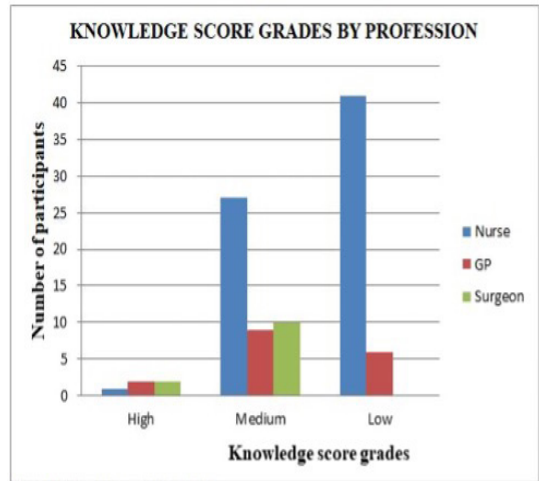
**Table 1: Socio-demographic characteristics of the study population**

Category		Frequency (%)
Gender	Male	53 (54.1)
	Female	45 (45.9%)
Age	Median age: 32.5years  (IQR 29-38 years)	
	Nurses	69 (70.41%)
Profession	GPs*	17 (17.35%)
	Surgeons	12 (12.24%)
	A1 (Diploma)	48 (48.98%)
Education level	A0 (bachelor's degree)	38 (38.78%)
	Masters	12 (12.24%)
	[1-5years]	45 (45.92%)
Experience	[6-10years]	32 (32.65%)
	[11-15years]	10 (10.20%)
	[16-20years]	7 (7.14%)
Geographic area of practice	>20years	4 (4.08%)
	Rural	29 (29.59%)
	City	69 (70.41%)
Health facility	CHUK*	38 (38.78%)
	KRH*	30 (30.61%)
	KDH*	30 (30.61%)

When asked about their general knowledge of wound dressing practices, 78.57% reported at least one of the three main indications for wound dressing as a) providing optimum conditions for a wound to heal b) protecting the wound from further trauma, and c) protection against infection.



**Figure 1: Knowledge score classification**



**Figure 2: Knowledge score grades by Participants' profession**

Others (14.29%) chose only (a), 4.08% chose only (c) and 2.04% chose only (b) as the main indication for wound dressing.

Overall, the knowledge score varied between 2.2 and 12 points. The median score was 6.65 points with IQR (4.5-8.3). Around 47(47.96%) subjectively considered their level of knowledge to be low, while only 5(5.10%) thought that they had an excellent level. However, 46 (46.94%) scored medium in knowledge about wound dressing (Figure1).

Two of the 12 surgeons who participated in the study (16.67%) scored high, whereas the remaining ten (83.33%) were in the medium-level group. Two of the 17 GPs who participated (11.76%) scored high, while nine (52.94%) scored medium, and six (35.29%) scored low. Only one of 69 nurses (1.45%) scored high, while 27 (39.13%) scored medium, and 41 (59.42%) scored low (Figure 2).

A one-way ANOVA was conducted to determine if

**Table 2: ANOVA Knowledge Score-Profession analysis**

Summary of knowledge score					
Profession	Mean	Standard deviation	Frequency		
<b>Nurse</b>	6.0971014	2.0196076	69		
<b>General Practitioner</b>	7.2294118	2.587413	17		
<b>Surgeon</b>	9.2166667	1.4788407	12		
<b>Total</b>	6.6755102	2.3026682	98		
Analysis of variance					
Source	SS	Df	MS	F	Prob>F
<b>Between groups</b>	105.789843	2	52.8949217	12.30	0.0000
<b>Within groups</b>	408.531381	95	4.30033033		
<b>Total</b>	514.321224	97	5.30228066		
Tukey post-hoc test Knowledge Score-Profession group					
Knowledge score	Contrast	Std. Err.	T	Tukey p> t	Tukey [95% Conf. Interval]
<b>Profession</b>					
GP vs Nurse	1.13231	.5615018	2.02	0.114	[-0.2046255-2.469246]
Surgeon vs Nurse	3.119565	.6486019	4.81	0.000	[1.575244-4.663887]
Surgeon vs GP	1.987255	.7818705	2.54	0.034	[0.1256211-3.848889]

the knowledge score was different for participants with different professions. Participants are into three groups: Nurse (n=69), GP (n=17), and Surgeon (n=12). There was a statistically significant difference between groups as determined by one-way ANOVA ( $F(2, 95) = 12.30, p < 0.001$ ) (Table 2).

A Tukey post hoc test revealed that knowledge score was statistically significantly higher in the surgeon group compared to the nurse group ( $3.12 \pm 0.65, p < 0.001$ ) as well as the surgeon and GP groups ( $1.98 \pm 0.78, p = 0.034$ ). However, there were no statistically significant differences between the GP and nurse groups ( $1.13 \pm 0.56, p = 0.114$ ) (Table 2).

When asked about how good the locally made dressing (gauze dressing) is at preventing SSI, 82(83.67%) participants reported that it is good, whereas 14(14.29%) were not sure. However, 82(83.67%) participants reported that it's not difficult to get a desired or indicated dressing (Table 3).

Most of the interviewed participants, 78.57%, reported using gauze dressing always, whereas

20.41% used gauze dressing often. On the other hand, only 4.08% reported using commercial (modern) dressing often, and 51.02% use them rarely, while 44.90% reported never using commercial/modern dressing.

Concerning clean or clean-contaminated wounds, 44.90% reported changing dressing every day, and 42.86% reported changing dressing every 2 days. When it comes to leaving a wound undressed, 48.98% responded to leaving clean wounds primarily sutured undressed after 48 hours, whereas 51.08% reported never leaving the wound undressed, fearing the risk of contamination and untrusted hygiene of patients is another hindrance (Table 4).

The FGDs highlighted several themes related to wound dressing practices in Rwanda. Knowledge disparities were found between healthcare providers, with surgeons having more knowledge due to their leadership role and education. Locally made gauzes are preferred for their availability, cost-effectiveness, and trustworthiness, while commercial gauzes are less trusted due to issues with their origin and cost. some of the participant's

**Table 3: Attitudes about Wound dressing attitude by professions**

Questions	Frequency (%)	Respondents' profession		
		Nurses n=69	GPs n=17	Surgeons n=12
A1. How well do you think is the locally made wound dressing to prevent surgical site infection?				
a. Not good	2 (2.04%)	1	1	0
b. Good	82 (83.67%)	56	14	12
c. Not sure	14 (14.29%)	12	2	0
A2. How difficult is it to get the desired/ indicated wound dressings in your hospital?				
a. Not difficult	82 (83.67%)	58	14	10
b. Difficult	8 (8.16%)	6	1	1
c. No idea	8 (8.16%)	5	2	1
A3. How difficult is it for you to leave a wound undressed after a clean/ clean-contaminated surgery?				
a. Not difficult	57 (58.16%)	40	8	9
b. Difficult	23 (23.47%)	14	7	2
c. No idea	18 (18.37%)	15	2	1
A4. Would you recommend a randomized controlled Trial aiming to compare dressing versus non-dressing in clean and clean-contaminated wounds?				
a. Yes	96 (97.96%)	67	17	12
b. No	2 (2.04%)	2	0	0

perspectives were medical informant one from CHUK said, "...the locally made gauzes are available, the staff knows sterilizing them...and the users are familiar with them..." Medical informant three from CHUK added, "...locally made gauzes are available, are low-cost, and give good results. "Patient informant two from KRH reported, "We usually see them [medical staff] using clean and well-packed materials..."

Patient factors, including financial capacity and preferences, as well as wound type, play a significant role in dressing choices. "... We need to consider what's effective for the hospital but also for the patient. They [commercial gauzes] might be available and of good quality but not affordable by the patient and will not be consequently used in the treatment procedure." (Medical informant 3, KRH). Additionally, improper wound dressing practices can arise from inadequate training, and there are concerns about leaving wounds undressed in certain circumstances. The study also emphasizes the importance of engagement

and teamwork among healthcare providers and the need for improved guidelines and training. Suggestions for active engagement include decentralization of knowledge, field trips, clear task allocations, and better access to materials and training. Lastly, there were concerns about the feasibility and ethical implications of conducting randomized controlled trials comparing dressing and non-dressing in clean wounds.

## DISCUSSION

This study revealed that the majority of surgical health professionals considered their general knowledge about wound dressing practice to be good and mentioned at least one of the indications of wound dressing (provision of optimum condition for a wound to heal, protection from further trauma, and protection against infection), held good attitude towards wound dressing practices as this was reflected in their practice of wound dressing using the locally made dressings

**Table 4: Dressing Practice and Participants' Profession**

Questions	Frequency (%) n=98	Respondents' Profession		
		Nurses n=69	GPs n=17	Surgeons n=12
P1. Did you change dressing yesterday?				
a. Yes	46 (46.94%)	35	4	7
b. No	52 (53.06%)	34	13	5
P2. If no, when did you change dressing for the last time?				
a. In this week	73 (74.49%)	53	9	11
a. Last week	17 (17.35%)	11	5	1
b. More than 2 weeks ago	8 (8.16%)	5	3	0
P3. The last time you changed a dressing, which dressing did you use?				
a. Gauze dressing, locally made	94 (95.92%)	67	16	11
b. Commercial dressing	4 (4.08%)	2	1	1
P4. How often do you use locally made gauze dressing?				
a. Always	77 (78.57%)	56	12	9
b. Often	20 (20.41%)	12	5	3
c. Rarely	1 (1.02%)	1	0	0
P5. How often do you use commercial wound dressings?				
a. Always	-	0	0	0
c. Often	4 (4.08%)	1	3	0
d. Rarely	50 (51.02%)	31	11	8
e. Never	44 (44.90%)	37	3	4
P6. When you are not there to change dressing yourself, who does it?				
a. Any available colleague (Nurse, GP, Surgeon)	54 (55.10%)	37	8	9
b. Any available nurse	44 (44.90%)	32	9	3
P7. If you have a clean or clean contaminated wound, on which frequency do you change the dressing?				
a. Every day	44 (44.90%)	38	3	3
b. Every 2 days	42 (42.86%)	20	14	8
c. Once a week	1 (1.02%)	1	0	0
d. On-demand	11 (11.22%)	10	0	1
P8. Do you ever leave a wound undressed?				
a. Yes	48 (48.98%)	31	9	8
b. No	50 (51.02%)	38	8	4
P9. When you are going to dress a wound, on which basis do you often choose a dressing to use?				
a. Availability of the dressing	53 (54.08%)	33	12	8
c. Affordability (Price)	5 (5.10%)	2	1	2
d. Comfort of the patient	29 (29.59%)	26	2	1
e. Don't know	4 (4.08%)	4	0	0
a, b & c	7 (7.14%)	4	2	1

to prevent SSI. However, there was variability among participants in knowledge scores, where the majority of surgeons and GPs scored medium, whereas nurses scored low.

The variability of knowledge score was statistically significantly ( $p < 0.001$ ) higher in the surgeon group compared to the nurse group. This difference might be explained by the fact that surgeons spend many years specializing in subjects that involve principles and practice of wound management, which is similar to a published series in 2015: "Nurses obtain little provision in education and formation about assessment and management of the wounds though they are the ones to care on a large proportion of community patients seeking for wound care [6]." However, a survey done in France in 2011, where nursing schools have a dedicated training module on wound care management, revealed that nurses with a large practice in wound care work in accordance with the international and French guidelines in this field [7]. The participants' perspectives on wound dressing practices also varied: they argued that surgeons receive long education, have exposure to a variety of wound care techniques, and, more importantly, are chiefly responsible for wound dressing guidelines and procedures in the hospital. In contrast, patients didn't perceive any difference among medical staff except when including interns. Patient informant two from CHUK said, "As for me, they all use the same materials. I found no difference when they were dressing my wound." Patient informant five from Kibungo Referral Hospital (KRH) said, "There is no difference; they all provide me with decent service, and they all provide the same treatment." However, when informed that surgeons are more knowledgeable than other medical staff, patient FGDs associated this difference with their training program.

This study also revealed that locally made dressings are good for the prevention of SSI and not difficult to get as opposed to modern dressings due to the high cost in low-limited settings, similar to other published series [8,9].

The wound dressing principles take together into account the wound status before choosing the appropriate dressing, cost-effectiveness, easy applicability, and patient comfort [10-12]. However, this study revealed that more than half of the participants, 54.08%, chose the dressing to use based on the availability of the dressing only. Health professionals participating in this study

reported more than half (51.08%) never leave the wound undressed in clean or clean-contaminated wounds, fearing the risk of contamination and untrusted hygiene of patients, which may predispose the wound to surgical site infection. This is opposed to the standard practice of these wound classes in previous studies, which suggest not dressing in acute, primarily closed wounds except at the request of the patient [13,14]. However, there is still controversy on early removal of the dressing from clean or clean-contaminated surgical wounds as there are no negative effects on outcomes such as SSI, but still suggesting further randomized controlled trials to investigate whether dressings are necessary after 48 hours in different types of surgery [15].

Our study found substantial variation in the use of commercial (modern) wound dressings across facilities, with cost emerging as the primary barrier to their consistent use. In most cases, the financial burden of purchasing commercial gauze falls on patients, making it inaccessible for many. Despite these challenges, 97.96% of participants expressed support for conducting a randomized controlled trial (RCT) to compare outcomes between using wound dressings and leaving wounds uncovered in clean and clean-contaminated surgical cases. However, both medical and patient focus group discussions (FGDs) highlighted ethical concerns related to randomizing patients into a non-dressing arm. A patient informant from King Faisal Referral Hospital (KRH) noted, "...someone without dressing will not be protected from different infections," while a clinician from the University Teaching Hospital of Kigali (CHUK) cautioned that "patients will fear participating in that research." These findings underscore the need for careful ethical consideration and community engagement in the design of future RCTs evaluating dressing practices.

The study showed that 42.86% of participants were not aware of the SSI rate in LMICs in general and in their hospitals particularly; this gives a clear need for continuous training and education among health professionals [16].

Our study has some limitations to consider during the interpretation of the results: some healthcare workers may not strictly follow standardized dressing protocols, leading to inconsistencies, as well as differences in hospital level may introduce variability. Future studies should consider stratifying data by hospital type and patient risk

factors to improve generalizability.

## CONCLUSION

This study showed variability in knowledge, attitude, and practices among health professionals about wound dressing, especially the majority of nurses who scored low compared to surgeons. However, wound dressing practice considers the availability of locally made wound dressings due to resource limitations in accessing modern wound dressings. Additionally, some healthcare providers were hesitant to leave primarily closed wounds uncovered due to concerns about the risk of surgical site infections. An urgent change in the curriculum and training of the nursing programs is needed to focus more on details of wound management and more clinical trials to inform the clinicians on different practices of wound care.

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