Nurses' perception, barriers and associated factors towards hand hygiene practices for prevention of healthcare acquired infections in the intensive care units.

ABSTRACT

Introduction: Healthcare-Acquired Infections occur within 72 hours of hospitalization, surgical-related infections, and surgical site infections that develop 30 to 90 days after the procedure. They particularly impact critically ill patients due to their weakened immune systems, with hand washing being the most effective prevention method. **Objective of the study:** Assessing nurses' perceptions, barriers, and the impact of socio-demographic factors towards hand hygiene practices in ICUs. **Methods:** The study included 65 ICU nurses from three referral hospitals, using a quantitative descriptive cross-sectional design and whole population sampling. The data were collected from 05thNovember2021 to 11thFeb 2022. Data analysis was conducted with SPSS software version 21. **Results:** Seventy percent of participants viewed health-acquired infections (HAIs) as serious and susceptible, while 83.1% recognized the benefits of hand hygiene. The most commonly cited barrier to hand hygiene was allergies to products, reported by 32.3% of respondents. Positive perceptions of hand hygiene were significantly associated with the working institution and in-service training, with a P-value of less than 0.05. **Conclusion:** The study investigated nurses' perceptions, barriers, and factors influencing hand hygiene practices in ICUs. It revealed that allergies to hand hygiene products hinder the hand hygiene adherence, while institutional policies and in service training boost It.R**ecommendations :**There is a need for conducting research using an observational checklist to assess HH adherence among ICU nurses, enhancing nursing education on HH, and improving in-service training for managerial teams in three hospitals.

Keywords: assessment, perceptions, barriers, hand hygiene.

ABREVIATIONS

LIST OF SYMBOLS AND ACRONYMS

CHUB: Centre Hospitalière et Universitaire de Butare

CHUK: Centre Hospitalière et Universitaire de Kigali.

KFH: King Faisal Hospital.

HAIs: Health Acquired Infections

WHO: World Health Organization.

OR: Odds Ratio.

CI:Chi Square.

ICU: Intensive care Unit

USA: United States of America

IPC: Infection Prevention Control

HRH: Human Resource for Health

SPSS: Statistical Package for Social Sciences.

1. INTRODUCTION

Health Care-Acquired Infections are the infections that occur within 72 hours of being hospitalized, infections resulting from surgery, and infections at the surgical site that develop 30 to 90 days after the procedure(1).

Pooled data estimates that the burden of HAI in the African region is double that of developed settings(2), They are the leading cause of death and illness among hospitalized patients, making them a significant global health issue and a threat to healthcare safety (4).

Moreover, in the United States, one in every 25 hospital patients acquires an HAI daily, leading to an estimated 90,000 deaths annually among the two million Americans

affected by HAIs (2). Patients in intensive care units (ICUs) face a significant risk of healthcare-acquired infections (HAIs) because of the frequent use of invasive procedures and devices, induced immunosuppression, underlying health conditions, frailty, and advanced age (4).

The prevalence of at least one HAI was highest among intensive care patients (20.5%), compared to 6.4% for all other disciplines combined, in the study conducted in European countries(5).

A total of 112 surveillance studies on HAIs in intensive care units across 20 European countries showed that 86.3% of cases were identified. The main contributing factors were the use of central lines and ventilators, along with procedures such as colon surgeries and hip replacements. Among the risk factors for surgical site infections, caesarean sections were responsible for 95.5% of HAIs. (6).

A study in Turkey found that 15.8% of critically ill patients developed an health acquired infection,with the respiratory system being the main impacted area(7).

Healthcare-associated infections (HAIs) in Sub-Saharan Africa are more prevalent than other types of infections, with rates ranging from 1.6% to 28.7% (8).

A study at CHUK hospital in Rwanda revealed a healthcare-related infection rate of 15.1%, with half of these infections occurring in ICU wards (8). Effective hand hygiene is crucial for preventing HAIs(9). Rwandan government has partnered with the Human Resources for Health Program to establish an infection prevention and control system (8).

The rate of hand hygiene ranged between 19–74%, among nurses working in ICU, in an observational study conducted In Kigali University Teaching Hospital(CHUK)(10).

These results specifically pertain to nurses in CHUK ICU unit, and the impact of socio-demographic factors on ICU nurses' views of hand hygiene was not assessed(10).

Despite promising advancements, critical care nursing is still a growing specialty in Rwanda. Nevertheless,the scarcity of critical care nurses and the poor training provided to nurses working in ICUs still exist(11). In Rwanda,ICUsare only present in four referral hospitals, which restricts the opportunity for enough nurses to practice (11).

The research aimed to shed light on the conditions in other referral hospitals' ICUs across Rwanda, focusing on nurses' perceptions and the barriers they face, as well as how socio-demographic factors related to their views on hand hygiene.

1.1. Rational of the Study

The research recommendations can be implemented by IPC committees and management teams to improve hand hygiene protocols in ICUs. It will also provide baseline data for Rwanda's human resources for health and nursing education, identifying gaps in prevention of HAIs among nurses. The study will alert academics to infection control and nursing research needs. It will also inform the quality of care, enabling hospitals to improve and intervene accordingly.

2. METHODS

2.1 Study Setting and Data Collection A quantitative study approach was used, as it involves the quantification and analysis of numerical data by using the specific statistical techniques. The study was conducted in the ICUs

of the University Teaching Hospital of Butare (CHUB), Rwanda Military Hospital, and King Faisal Hospital.

Sixty-five nurses who worked in the ICUs of the aforementioned referral hospitals were the study's subjects, hence the total population sampling technique was used, and it is typically utilized when the number of the participants is fairly limited(12,13), which was the same case as the study.

A self-administered perception questionnaire designed with two main sections and based on the concepts of the Health Belief Model was used.The tool's reliability was confirmed through a pilot study using SPSS software version 21, with a Cronbach's Alpha of 0.73, and content validity confirmed by a panel of five University of Rwanda experts(14).

The first session is made of socio-demographic characteristics of the respondents which are made of 6 questions, whereas the second one consists of 43 perception-related questions that have been divided into four categories using a five-point Likert scale ranging between 4 to 1 : (strongly disagree =1), (disagree = 2), (agree =3) ; and (strongly agree= 4). A total population sampling technique was used. The pilot study was conducted to assess the reliability and validity of the tool.

2.2. Study Objectives

1. To assess the perception about hand hygiene among nurses working in the ICU of three referral hospitals in Rwanda
2. To assess theeffects of socio-demographic factors on perception of hand hygiene among nurses working in the ICU of three referral hospitals in Rwanda.
3. To assess the nurse's perceived barriers to hand hygiene in the prevention of HAIs.

2.3 Inclusion and Exclusion Criteria

All consented nurses working in the intensive care unit in the three selected referral hospitals above mentioned was enrolled, however, Nurses who was not working in ICU, those who did not give consent and those who was in their leaves, was not enrolled in the study.

3. RESULTS

Data were analyzed through the Statistical Package for Social Sciences (SPSS software version 21). Descriptive statistics was used to describe the nurses' perceptions of hand hygiene in the prevention of HAIs, whereas inferential statistics with a chi-square test were used to measure the association between socio-demographic characteristics with nurses' perceptions of hand hygiene.

3.1. Socio-demographic characteristics of the respondents

35.4% of the participants were from the University Teaching Hospital of Butare (CHUB), 33.8% were from Rwanda Military Hospital, and 30.8% were from King Faisal Hospital. 63.1% were female, while 36.9% were male. 49.2%, 40%, and 9.2% had advanced diplomas, bachelor's degrees, and master's degrees, respectively. 63.1% of the participants had received hand hygiene training within the last three years, whereas 36.9% had never received such training. 38.5% ranged in the age of 31 to 37 years old, while 7.70% ranged between 45 and 51 years old. 38.5% ranged between 6 and 11 years of working experience, versus 3.10%, whose years of experience ranged between 21 years and above.

Table1: Socio-demographic characteristics of the respondents (n=65)

Variables		**Frequency**	**Percentages**
Institution	CHUB	23	35.40%
	KFH	20	30.80%
	RMH	22	33.80%
Gender of the respondents	Male	24	36.90%
	Female	41	63.10%
Qualification of the respondents	Master's degree	6	9.20%
	Bachelor's degree (A0)	26	40.00%
	Advanced diploma (A1)	32	49.20%
	Secondary school diploma (A2)	1	1.50%
	Others specify	0	0.00%
In service training in hand hygiene in the last three years	Yes	41	63.10%
	No	24	36.90%
	In service training by institutions		
	KFH	16	80%
	CHUB	16	69.5%
	RMH	9	40.9%
Age of participants	24-30	18	27.70%
	31-37	25	38.50%
	38-44	17	26.20%
	45-51	5	7.70%
Working experience	1-5	24	36.90%
	6-10	25	38.50%
	11-15	12	18.50%
	16-20	2	3.10%
	21 and above	2	3.10%

Table 2: Association between socio-demographic characteristics and perception towards hand hygiene among nurses working in ICU (n=65).

Sociodemographic characteristics		Agree n(%)	Disagree n(%)	Chi- test/Fischer square	P-value
Institution				5.971	0.044
	CHUB	18(78.3)	5(21.7)		
	KFH	20(100	0(0)		
	RMH	17(77.3)	5(22.7)		
Gender of the respondents				1.572	0.201
	Male	22(91.7)	2(8.3)		
	Female	33(80.5)	8(19.5)		
Qualification of the respondents				1.469	0.665
	Master's degree	6(100)	0(0)		
	Bachelor's degree (A0)	21(80.8)	5(19.2)		
	Advanced diploma (A1)	27(84.4)	5(15.6)		
	Secondary school diploma A2)	1(100)	0(0)		
Any service training in hand hygiene in the last three years				5.552	0.031
	Yes	38(92.7)	3(7.3)		
	No	17(70.8)	7(29.2)		
Age of participants				0.703	1.000
	24-30	15(83.3)	3(16.7)		
	31-37	21(84)	4(16)		
	38-44	14(82.4)	3(17.7)		
	45-51	5(100)	0(0)		
Working experience				2.167	0.739
	1-5	21(87.5)	3(12.5)		
	6-10	19(76)	6(24)		
	11-15	11(91.7)	1(8.3)		
	16-20	2(100)	0(0)		
	21 and above	2(100)	0(0)		

The association between socio-demographic characteristics and perception of hand hygiene among nurses working in ICU was carried

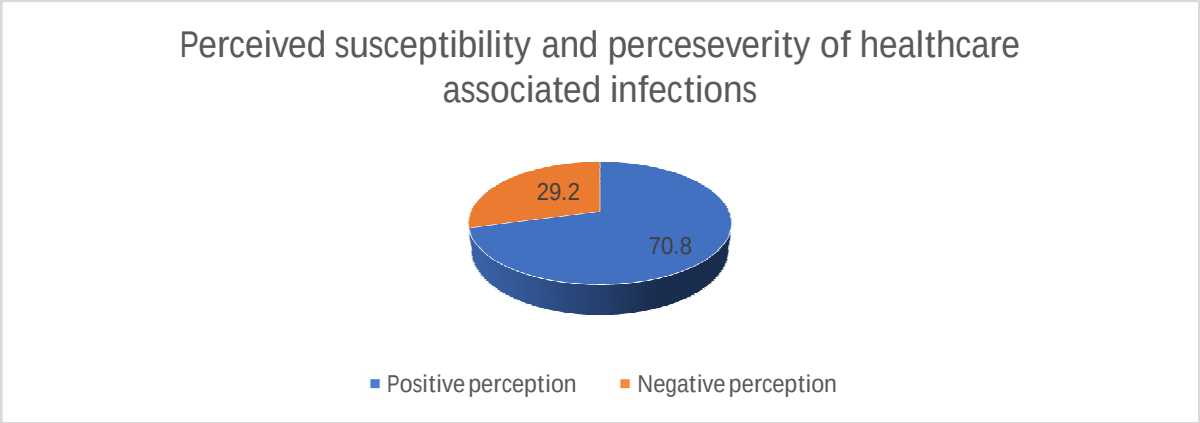
out, and the results showed that institution and training in hand hygiene were statistically associated with the perception of hand hygiene (P-value <0.05). Whereas among other socio-demographic characteristics such as age, gender, qualification, and working experience, statistically were not associated with nurses' perception of hand hygiene in the prevention of HAIs with P values of 1.00, 0.2, 0.665, and 0.739, respectively.

Table 3: Regression analysis of socio-demographic characteristics and perception of hand hygiene among nurses working in ICU (n=65).

Sociodemographic characteristics		**OR**	**95%CI**	**P-value**
Institution	CHUB	2.452	1.233-6.543	0.023
	KFH	4.321	2.433-9.876	0.043
	RMH	**Ref**		
Any service training in hand hygiene in the last three years	Yes	3.544	1.344-10.333	0.038
	No	**Ref**		

Variables that showed significant association in crosstabulation analysis were recruited into multiple logistic regression analyses to study their effect on hand hygiene perception, and the results showed that the participants from CHUB were more than two times more likely to have positive perception compared to those from RMH (OR = 2.452, 95% CI = 1.233-6.543, P-value = 0.023). Participants from KFH were more than four times more likely to have positive perceptions compared to those from RMH (OR=4.321, 95%CI=2.433-9.876, P-value=0.043). Those who were trained in hand hygiene were more than three times more likely to have positive perception compared to those who were not trained (OR = 3.544, 95% CI = 1.344-10.333, P-value = 0.038).

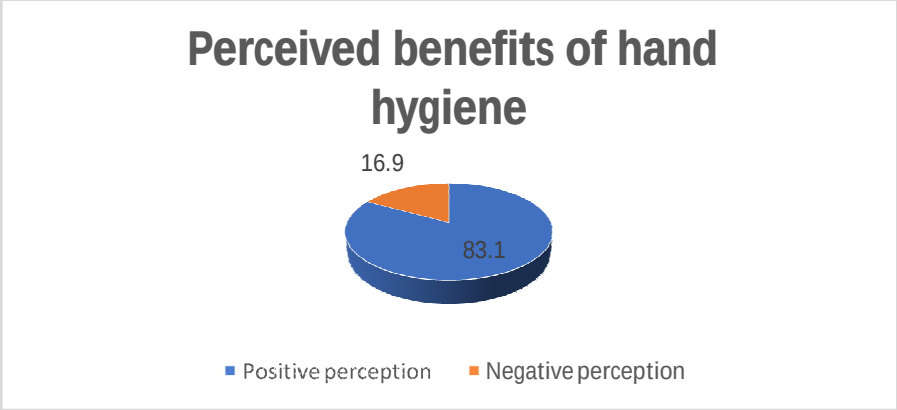
Figure 1: Perceptions about susceptibility and severity of healthcare-associated infections (n=65).



Of the participants, 29.2% held a negative perception, while 70.8% had a positive perception regarding the susceptibility and severity of healthcare-associated infections.

3.2. Perceived benefits of hand hygiene.

Figure 2: Perceived benefits of hand hygiene (n=65).



16.9% of the paticipants had negative perception vice 83.1 % who had positive perception toward the benefits of hand hygiene.

3.3. Cues to action (hand hygiene action)

Table 4: Cues to action (hand hygiene action) (n=65)

Statements		**Disagree**	**Agree**
Healthcare workers, patients and patient relatives are at risk of acquiring healthcare associated.	N	2	63
	%	3	97
Nurses are more vulnerable than other healthcareworkers to contamination with health care associated infections since they are in contact with patients.	N	5	60
	%	7.7	92.3
Contaminated health care worker's hands impose the greatest risk of transmitting healthcare associated infections to patientspatient relatives and to oneself.	N	3	62
	%	4.6	95.4
Health care associated infection is globally a major problem in Hospitals.	N	8	56
	%	13.8	86.2
Health care-associated infection is a major cause of preventable deaths and disability worldwide.	N	34	45
	%	30.8	69.2
Health care associated infection is associated with prolonged patient hospital stay.	N	5	60
	%	7.7	92.3
Health care associated infection causes high costs for the health systems	N	9	56
	%	13.9	86.1
Health care associated infection causes emotional stress for patients and their families.	N	11	54
	%	16.9	83.1
In general, the impact of health care-associated infection on a patient's clinical outcome is high.	N	9	56
	%	13.9	86.1

AGREE: Positive perception.

The above results generally show that the participantsperceive positively the risks and impact of healthcare-associated infections (HAIs), recognizing the serious threats, increased vulnerability of nurses, and the widespread nature of HAIs. However, there

DISAGREE: Negative perception.

are some of themwho have negative perception about the preventability of deaths, disabilities, and clinical outcomes. Improving infection prevention strategies, thus, the ongoing education is crucial.

Table 5: Perceived barriers to hand hygiene (n=65).

Statements		**Disagree**	**Agree**
Perceiving hand hygiene as not convenient	N	40	19
	%	61.5	29.3

Lack of material (soap, paper towel).	N	38	19
	%	58.4	29.3
Allergic reactions with hand hygiene product	N	39	21
	%	60	32.3
Being too busy	N	49	12
	%	75.4	18.4
Forgetfulness.	N	45	14
	%	69.3	21.6
Unsure of need	N	42	18
	%	64.6	27.7
Inadequate hand washing facilities	N	43	19
	%	66.1	29.3
Belief that when using gloves, no need for hand hygiene	N	49	13
	%	75.4	20
Hand hygiene interferes with Health care worker-patient Relationship.	N	51	11
	%	78.5	16.9
Lack of institutional priority for hand hygiene	N	47	14
	%	72.3	21.5
Lack of rewards/encouragement hygiene	N	46	14
	%	70.8	21.5

The study found that time constraints and convenience are the main barriers to hand hygiene behavior, with a significant percentage of respondents expressing concerns about materials and facilities. The lack of institutional priority and rewards/encouragement were not considered major barriers, suggesting areas for improvement in fostering a culture of hygiene.

4. Discussion

4.1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

The large percentage of respondents was females forty one . This is linked to the fact that females are still in good number in the nursing profession than males as 65% of nurses were female in African regions as reported by WHO (15). Thirty-two (49.2%) had an advanced diploma (AI) and it was reported that 80% of ICU nurses in Rwanda, had an advanced diploma(A1) (11).

The range of age from thirtyone to thirty seven was predominant with a greater proportion of twenty five (38.5%), and those with years of experience ranging between six to eleven years outnumbered others with 38.5%. This predominance of age range is linked to other study conducted at CHUK about Workplace Stressors and Coping Strategies of ICU nurses, where about 50% of participants had ages below 35 years (16), seemingly to the clinical experience in the same study, where 46.7% of participants ranged between 1 to 5 years of experience (16), which is not quite different from what was obtained in the current study where the percentage is 36.1 %.

Working institution and in-service hand hygiene training proved to be associated with the positive perception of hand hygiene in the current study, as the P value was statistically significant (P-value <0.05). However, age, gender, qualification and working experience did not correlate with nurses' perception of hand hygiene in the prevention of HAIs as P values were (P>0.05) respectively.

100 % of ICU nurses from KFH, had positive perception of hand hygiene than those from CHUB and RMH who rated 78.3% and 77.3 % respectively. This can be linked to the fact that 80% of ICU nurses at KFH had had in-service training, whereas ICU nurses trained at CHUB and RMH were 69.5% and 40.9% respectively, which is quite similar to the study conducted in Zambia among nursing students, whereby positive perception to hand hygiene was statistically proved to be associated with hand hygiene trainings with (p=0.018) (17).

Positive perception among ICU nurses in Iraq was linked to level of education and in service training for ICU nurses while administrative support and their encouragement was the factors which influenced their perception to hand hygiene practice in the prevention of HAIs (18).

Socio-demographic variables are modifying factors, which impact the perception of a health behaviors change as stated in the health belief model(19). In the current study, hand hygiene was a health behavior and, it revealed how much the study results, have been consistent with the conceptual framework.

4.2. Perceptions about susceptibility and severity of healthcare associated infections.

The results of the current study revealed that the large percentage of the participants had positive perceptions about perceptions of susceptibility and perceived severity of HAIs. These results are not far from what was obtained in the similar study at CHUK among nurses working in the different departments including ICU, where 86.9% of nurses, perceived positively that HAIs impact prominently patient clinical outcomes (20). This shows how much ICU nurses in RWANDA perceive the susceptibility of health acquired infections and how burden it is to modern medicine.

Intensive care units treat critically ill and immunocompromised patients which increases their susceptibility to HAIs (21). This, is associated with increased morbidity and mortality among ICUs patients(21). Nurses are the only ones who spend much more time with the patients in ICU than any other health worker, hence the positive perception to hand hygiene would be crucial in mitigating HAIs in ICUs (21). However, a significant portion of participants had a negative perception of this statement. This is concerning, particularly among ICU nurses who care for immunocompromised patients, making them more vulnerable to healthcare-associated infections (HAIs)(22). The lack of awareness regarding the susceptibility to and severity of HAIs has been associated with a

rise in HAI incidence, especially in clinical settings like ICUs(22).

This may be mitigated by creating awareness by providing proper hand hygiene education, and in service training in the prevention of health acquired infections (23). Furthermore, the positive perception found in the majority of ICU nurses about hand hygiene perception in preventing HAIs, could be taken as a path to enhance hand hygiene compliance among health care workers, especially ICU nurses.

4.3. Perceived benefits of hand hygiene

Sixtyone (93.8%) had positive perception about that hand hygiene is the primary measure for preventing and reducing health care-associated infections, versus four (6.1%) who had negative perception. The totality sixtyfive (100%) had positive perception about that hand hygiene is an economical method for reducing healthcare associated infections. Sixty (92.3%) had positive perception about that hand hygiene practices help control epidemics in health-care facilities, versus five (7.7%) who had negative perception. Fifty-eight (89.3%) had positive perception about that hand hygiene is cost-saving, versus seven (10.7%) who had negative perception. Fifty-nine (90.8%) who had positive perception about that hand hygiene practice before touching a patient interrupts microbial transmission to the patient, versus six (9.2%) who had negative perception. Sixty-two (95.4%) who had positive perception about that hand hygiene practice before a clean/aseptic procedure interrupts microbial transmission to the patient, versus three (4.6%) who had negative perception. Sixty-three (97%) had positive perception about that hand hygiene practice after touching a patient interrupts microbial transmission to the health care- worker, versus 2 (3%) who had negative perception. Sixty (92.3%) had perception about that hand hygiene practice after body fluid exposure risk interrupts microbial transmission to the health care- worker, versus 5(7.7%) who had negative perception. Sixty-four (99%) had positive perception about that hand hygiene practice after touching patient surroundings interrupts microbial transmission to the health care- worker and of them versus one (1.5%) who had negative perception, and fifty-nine (90.8) who had positive perception that in general, the effectiveness of hand hygiene in preventing health care-associated infection is high, versus 6 (9.2%) who had negative perception.

A large portion of the participants have shown the positive perception regarding the benefits of hand hygiene in the prevention of HAIs. These results are quite similar to what obtained in the similar study at CHUK among nurses working in different departments, including ICU nurses, whereby 96.4% had a positive perception of the importance of hand hygiene at the WHO five moments of hand hygiene while 100 % perceive hand hygiene as the primary mean for mitigating HAIs (20). Positive perception of the benefits of hand hygiene in the prevention of HAIs was linked with improved compliance to hand hygiene(9).

Nevertheless, the findings of the current study showed that a portion of participants held negative views about the role of hand hygiene in preventing healthcare-associated infections (HAIs) in the ICU. This is concerning, as it could contribute to an increase in HAIs within ICUs, especially since the WHO highlights hand hygiene as an effective and simple method to reduce these infections (24).

Perceiving hand hygiene benefits encompasses both medical and psychosocial benefits of engaging in hand hygiene as health-promoting behaviour (25). Besides, Hand Hygiene trainings as part of a multimodal intervention, was linked with the positive perception of hand hygiene benefits, in the prevention of HAIs (25). Furthermore, the positive perception about the benefits of hand hygiene among other ICU nurses in

Rwanda, could be based on, in figuring out the poor hand hygiene perception and noncompliance practices among healthcare providers, especially nurses in the prevention of HAIs in ICU.

5. CONCLUSION.

The study shows 70% of participants are aware of health-acquired infections (HAIs) and the importance of hand hygiene. However, barriers persist, with allergies being the most common challenge. Factors like healthcare institution type and in-service training influence positive perceptions. Addressing practical and educational barriers is crucial for enhancing hand hygiene adherence in healthcare settings.

6. RECOMMENDATIONS

Different recommendations are addressed via different levels of nursing, such as nursing education; nursing research and nursing management.

6.1. Nursing education

The study results reveal that most of participants had positive perception toward hand hygiene in the prevention of HAIs. But there are still some who still have negative perception. I recommend Rwanda HRH and nursing education, to enhance hand hygiene in nursing education, be it in general nursing or nursing specialties especially in critical care and trauma nursing.

6.2. Nursing research

The current study was about assessing perception of hand hygiene and barriers only. I wish to recommend the next researchers to use observational checklist to assess the adherence to hand hygiene among ICU nurses in these study settings.

6.3. Nursing management

- HAIs is a limitation to patient safety. Effective hand hygiene is an efficient mean to mitigate HAIs. I recommend the hospitals administration and managerial team, to minimize the barriers revealed by the current study results, for the enhancement of hand hygiene perception and practices in ICU.
- I recommend managerial team to always emphasis on in service trainings about hand hygiene, while making policies and enhancing the mentality of ICU nurses, to let be reminded by the patients or their relatives to practice whenever forgotten, to improve hand hygiene perception and practice.

7. ACKNOWLEDGEMENTS

I thank all of the participants who helped make this study a success. I am alsograteful to Prof.Oluyinka Adejumo, Dr Sybyl Nelson,and Mrs RUMAGIHWALiberatha for giving valuable guidance throughout the publication process.

8. COMPETING INTERESTS

The authors declare that no competing interests exist.

9. CONSENT

According to international or Rwanda University standards, the author(s) gathered and retained the patient(s)' written consent.

10. ETHICAL APPROVAL

According to international Or Rwanda University standards, the author(s) have gathered and preserved written ethical approval.

Reference

1. CDC - Center for Disease Control and Prevention. Identifying Healthcare-associated Infections (HAI) for NHSN Surveillance. http://www.cdc.gov/nhsn/PDFs/pscManual/2PSC_IdentifyingHAIs_NHSNcurrent.pdf. 2015;2015(April):1–14.
2. Alrubaiee G, Baharom A, Shahar HK, Daud SM, Basaleem HO. Knowledge and practices of nurses regarding nosocomial infection control measures in private hospitals in Sana'a City, Yemen. Saf Heal. 2017;3(1):1–6.
3. Melariri H, Freercks R, van der Merwe E, Ham-Baloyi W Ten, Oyedele O, Murphy RA, et al. The burden of hospital-acquired infections (HAI) in sub-Saharan Africa: a systematic review and meta-analysis. eClinicalMedicine. 2024;71(April):1–16.
4. Al-Tawfiq JA, Tambyah PA. Healthcare associated infections (HAI) perspectives. J Infect Public Health [Internet]. 2014;7(4):339–44. Available from: http://dx.doi.org/10.1016/j.jiph.2014.04.003
5. Suetens C, Kärki T, Plachouras D. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals – 2022-2023. Ecdc. 2024. 183 p.
6. Cassini A, Plachouras D, Eckmanns T, Abu Sin M, Blank HP, Ducomble T, et al. Burden of Six Healthcare-Associated Infections on European Population Health: Estimating Incidence-Based Disability-Adjusted Life Years through a Population Prevalence-Based Modelling Study. PLoS Med. 2016;13(10):1–16.
7. Baykara N, Akalin H, Arslantas MK, Hanci V, Caglayan C, Kahveci F, et al. Epidemiology of sepsis in turkish intensive care units: A multicenter point-prevalance study. Crit Care. 2017;21(1 Supplement 1):1–14.
8. Mbim E, Mboto C, Agbo B. A Review of Nosocomial Infections in Sub-Saharan Africa. Br Microbiol Res J. 2016;15(1):1–11.
9. World Health Organization. Hand Hygiene: Why, How & When? World Heal Organ [Internet]. 2017;(August):1–7. Available from: https://www.who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf
10. Mvukiyehe JP, Tuyishime E, Ndindwanimana A, Rickard J, Manzi O, Madden GR, et al. in Rwanda. 2023;(150).
11. Munyiginya P, Brysiewicz P, Mill J. Critical care nursing practice and education in Rwanda. South African J Crit Care. 2016;32(2):55–7.
12. Etikan I. Comparison of Convenience Sampling and Purposive Sampling. Am J Theor Appl Stat. 2016;5(1):1.
13. Simarjeet K. Review Article Sample Size Determintation (For Descriptive Studies). Int J Curr Res. 2017;9(3):48365–7.
14. Maniriho F, Rajeswaran L, Collins A, Chironda G. Assessment of nurses' perceptions and adherence to five moments of hand hygiene in selected units at a University Teaching Hospital in Rwanda. Rwanda J Med Heal Sci. 2019;2(2):160.

15. Boniol M, McIsaac M, Xu L, Wuliji T, Diallo K, Campbell J. WHO | Gender equity in the health workforce: Analysis of 104 countries. World Heal Organ [Internet]. 2019;(March):1–8. Available from: http://apps.who.int/bookorders.

16. Munyanziza T, Bhengu B, Umutoni Cishahayo E, Uwase A. Workplace Stressors and Coping Strategies of Intensive Care Unit Nurses at University Teaching Hospitals, in Rwanda. Rwanda J Med Heal Sci. 2021;4(1):53–71.

17. Mutanekelwa I, Molloy M. Demographics and training factors associated with hand hygiene among nursing students in Solwezi , Zambia : a cross-sectional study Demographics and training factors associated with hand hygiene among nursing students in Solwezi , Zambia : a cross-section. 2019;(July 2020).

18. Khodadadi E. Investigating the Factors Affecting the Hand Hygiene Compliance from the Viewpoints of Iranian Nurses Who Work in Intensive Care Units. Surg Infect - Some Facts. 2020;6(5):93–8.

19. Norman P, Conner M. Health behavior. In: The Curated Reference Collection in Neuroscience and Biobehavioral Psychology. Elsevier Science Ltd.; 2016. p. 1–37.

20. Maniriho F, Rajeswaran L, Collins A, Chironda G. Assessment of nurses' perceptions and adherence to five moments of hand hygiene in selected units at a University Teaching Hospital in Rwanda. Rwanda J Med Heal Sci. 2019;2(2):160.

21. Fox C, Wavra T, Drake DA, Mulligan D, Bennett YP, Nelson C, et al. Use of a patient hand hygiene protocol to reduce hospital-acquired infections and improve nurses' hand washing. Am J Crit Care. 2015;24(3):216–24.

22. Loftus MJ, Guitart C, Tartari E, Stewardson AJ, Amer F, Bellissimo-rodrigues F, et al. International Journal of Infectious Diseases Hand hygiene in low- and middle-income countries. Int J Infect Dis [Internet]. 2019;86:25–30. Available from: https://doi.org/10.1016/j.ijid.2019.06.002

23. Online FA, Knowledge T, Baderaldeen RM, Kheder SI, Pharmacy I. JOURNAL OF MEDICAL INFORMATICS AND DECISION MAKING. 2020;(2).

24. World Health Organisation (WHO). WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge Clean Care Is Safer Care. World Health [Internet]. 2009;30(1):270. Available from: http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

25. Abraham C, Sheeran P. The health belief model. Cambridge Handb Psychol Heal Med Second Ed. 2014;(June 2015):97–102.