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Knowledge and practices of intensive care unit nurses on the prevention of nosocomial pressure ulcers using a bundle protocol: an educational intervention study in Uganda

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Abstract

Introduction Nosocomial pressure ulcers are wounds acquired within the hospital setting, posing a burden to the patient families and the care teams due to patient discomfort and increased costs to treat and hospital resources. Globally, patients in intensive care units (ICUs) are most impacted, and the incidents go up to 33%, while a study done in Mbarara Regional Referral Hospital stated it at 19.3%. These incidents are preventable with the use of pressure ulcer prevention guidelines. This study aimed to investigate the effect of an educational intervention with a care bundle protocol on the knowledge and practices of intensive care unit nurses of Mulago National Referral Hospital in the prevention of nosocomial pressure ulcers.

Methods This was a single-group quasi-experimental pre-test and post-test study that purposively selected 26 ICU nurses of Mulago National Referral Hospital. Their baseline knowledge and practice were assessed with a knowledge assessment questionnaire and an observation checklist, respectively. The nurses were then trained on the pressure ulcer prevention bundle protocol, and the training lasted two weeks. ICU nurses' knowledge and practices were assessed two weeks after the training. Data was collected between May and July 2024 and was analyzed using STATA version 17. Independent sample t-test, Wilcoxon-rank sum test and ANOVA were used to compare variables.

Results The median (IQR) age of the study participants was 37.5 (32, 49). A biggest number of the participants were females [18] 69.2% and just above a third had attained a diploma [10] 38.5% or a Bachelor's degree [10] 38.5%. About two thirds of the participants [17] 65.4% had never received refresher training on prevention of pressure ulcers and just above a third of them had practiced for 3–5 years in critical care. The participants reported to care for about the median (IQR) of 3 [2, 4] pressure ulcers weekly. The critical care nurses' knowledge of pressure ulcer prevention increased to (SD) 63.2% (11.8) from (SD) 40.5 (10.6), yet practice increased to 62.6% from 37.6% with a P value of 0.001, which was statistically significant.

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Conclusion An educational intervention with a pressure ulcer prevention protocol brought about a significant change in participants' knowledge and practice. More in-service training sessions on pressure ulcer prevention protocols and their availability to staff are recommended.

Keywords Nosocomial pressure ulcers, Prevention, A care bundle protocol, Nurses' knowledge and practice

Introduction

Nosocomial pressure ulcers are wounds acquired with in the hospital setting. They result from tissue damage and necrosis due to decreased blood supply to the affected area [1]. These pressure ulcers commonly occur due to pressure, moisture, shearing and frictional forces [2]. Other risk factors may be intrinsic like age, chronic conditions like vascular diseases and diabetes, smoking, malnutrition, immunosuppression, or extrinsic like long stay in ICU, poorly fitting prosthetic devices, lying on hard surfaces, poor hygiene and patient restraints [2]. In high risk patients, nosocomial pressure ulcers have been witnessed to develop as quickly as within two hours after admission around the shoulder blades, knees, heels, on the occiput, sacrum etc [2, 3].

Even with the most up-to-date nursing interventions, nosocomial pressure ulcers are still an ongoing global issue among the critically ill [4, 5]. They have been noted to impose a huge burden to patients' families and the managing teams due to patient discomfort, increased costs and hospital resources [6, 7].

The incidence of nosocomial pressure ulcers varies greatly. One recent large study on the incidence of hospital acquired pressure ulcers (HAPU) globally demonstrated that they varied from 2.7 to 29%. In his research, Chou reported that the prevalence of hospital acquired ulcers in European hospitals ranged from 1 to 11% in medical wards and 4.7 to 66% in surgical wards [8, 9]. Importantly, patients in intensive care units (ICUs) were the most impacted by these incidents and the proportion of patients who experienced these outcomes went up to 33% in these settings [10]. The World Stop Pressure Ulcer Day report of 2014 stated that nearly 700,000 patients were affected by pressure ulcers each year and according to the Coloplast summit report of 2013, nearly 60,000 people die each year worldwide due to pressure ulcer related causes [9, 11].

Ideally, skin care for the critically ill is best done with the use of pressure ulcer prevention protocols [12]. A pressure ulcer prevention bundle protocol is a set of eight evidence-based interventions. These are believed to improve outcomes if performed collectively and implemented consistently [13]. These evidence based interventions include; education and training, risk assessment with a validated tool e.g. Braden scale, skin assessment (and those found to be at risk are given additional measures), Repositioning patients, skin care, managing incontinence of stool and urine, improving nutrition and

hydration, using pressure relieving devices to reduce friction and shear, and the outcomes to be documented and reviewed oftenly [14, 15].

A study at the University of Turkey, developed and validated a (Pressure ulcer) PU prevention bundle protocol following the European Pressure Ulcer Advisory Panel (EPUAP) guidelines. This protocol was developed mainly for critical care unit usage and results from its validation showed a content validity index of 0.99 rating it generally valid [16]. In terms of effectiveness, it decreased pressure ulcer incidences from 22.1 to 13.0 per 100 patient-day [17].

With these positive patient outcomes, nurses' knowledge and practice were also seen to have improved greatly basing on interventional studies conducted in different countries i.e. in Egypt, there was increment of knowledge and practice from 47 to 90% and 20–57% respectively [18], In Brazil knowledge increment was from 78.8 to 89.7% with satisfactory practice and in India nurses' knowledge increased from 54.6 to 86.2% [19] rating these protocols highly essential in clinical practice. Besides the educational interventions, other organizational strategies like enforcing policies, performance evaluation of critical care staff, patient and care taker participation with the provision of pressure ulcer prevention pamphlets and visual tools are some of the interventions used in the nosocomial pressure ulcer prevention [20, 21]. These have complimented the educational interventions, hence improving health care, patient-related outcomes, and staff growth in this regard [22].

Therefore, this study aimed to investigate the effect of an educational intervention on the knowledge of critical care nurses and their practices in the prevention of nosocomial pressure ulcers with the use of a prevention bundle protocol at Mulago National Referral Hospital.

Methods

Design

This study used a descriptive quantitative quasi-experimental design. It was a single-group study with a pre/post-test approach.

The research assistant observing the participants' practice filled out an observation practice checklist two weeks before the training intervention to assess the participants' baseline practice.

After baseline practice assessment, the nurses' baseline knowledge was assessed with a pressure ulcer knowledge assessment questionnaire. Later, participants underwent

a PU prevention training program using a bundle protocol. After two weeks, they were subjected to a post-test, and an observation checklist was completed.

Relationships between and among selected dependent and independent variables were then determined.

Setting

The study was conducted in the ICU of Mulago National Referral Hospital (MNRH). MNRH is located in the central region of Uganda, in the capital (Kampala), and has an 1800–2000 bed capacity. This is a specialized teaching hospital and Uganda's largest public hospital (referral). The ICU has 27 beds and about 35 nursing staff, making it the largest ICU in the country.

This study site was selected following evidence of increasing PUs in the critical care unit observed by Mwebaza in his study "Nurses' Knowledge, Practices and Barriers in the Care of Patients with Pressure Ulcers in a Ugandan Teaching Hospital." His emphasis was on training nurses on PU prevention guidelines [23].

Characteristics of participants

The target population was all nursing staff in direct care for the critically ill patients in Mulago National Referral Hospital ICU. This population was targeted because these nurses spend most of their time with ICU patients, and pressure ulcer prevention in these patients is part of their responsibility.

Data collection process

The data collection process was a three-phase process, i.e. pre-intervention, Intervention and Post-intervention. This lasted 12 weeks, and it took place within the intensive care unit of Mulago National Referral Hospital. The study's research assistants (RA) were critical care nurses who once volunteered in the ICU of MNRH. Research assistant 1(RA1) was in charge of observation for practice, while Research assistant 2 (RA2) was in charge of knowledge assessment. These underwent training on the study's objectives and data collection process. Research assistants and the principal investigator (PI) sought permission to volunteer in the ICU of MNRH for one month before the data collection process, to reduce the Hawthorne effect.

Pre-intervention phase

Objective one

Before filling out the baseline knowledge assessment questionnaires, it was necessary to first assess participants for the baseline practice. This was to ensure that the baseline knowledge assessment data collected wouldn't cause any changes in the participants' practice before the intervention.

Once the waiver of informed consent was obtained from REC, The RA1 observed the study participants on duty for their practice in pressure ulcer prevention following the duty Rota with the use of an observation checklist, one at a time without their knowledge. This process lasted about two weeks.

Objective two

Given that the study was conducted in the intensive care unit, it was important not to interrupt the staff's work schedules. Therefore, the research assistant (RA2) engaged the staff during their afternoon break sessions or those off duty to seek consent and administer the pressure ulcer knowledge assessment questionnaires to those cleared for baseline practice observation. This process lasted 45 min to 1 h and continued for two weeks.

Intervention phase

Immediately after completing the baseline data collection for all the study participants, the PI trained study participants on duty on the pressure ulcer prevention bundle protocol. The content was obtained from a study conducted in China about implementing a pressure injury care bundle in a Chinese ICU [24] and another study conducted in Turkey about the validating a pressure injury prevention care bundle [16].

The training sessions were theory, demonstrations and return demonstrations. These took place in the Mulago National Referral Hospital ICU. Given that the sample size was small (26 participants), each study participant got a chance to have their training session lasting about one and a half hours. A total of two training sessions were conducted per day. This also continued for two weeks. The training was best done in the afternoon to avoid interrupting the morning unit activities like ward rounds, patient reviews, nursing care plans and priority interventions.

Post intervention phase

Objective 3

After two weeks of training, RA2 administered the pressure ulcer knowledge assessment questionnaires to the study participants, i.e. those who were on the ward for their day duty and night shifts and those who could report from home while on their off duty. This activity lasted about 45 min and extended for two weeks until post-test knowledge assessment data was collected for all the study participants.

After two weeks of training, using observation checklists, the RA1 observed the critical care nurses for their practice in hospital-acquired pressure ulcer prevention. Participants were observed on both shifts, day and night, without their knowledge, and the process lasted for two weeks. The data collected in this phase fulfilled the third

objective of the research study. All the study participants were compensated for their time and transport.

Data analysis

Operational definitions

Knowledge The knowledge of pressure ulcers was assessed using a set of 30 multiple-choice questions, for which the correct answer was weighted “1” and all other wrong answers were weighted “0.” The percentage score was computed by summing all the weights, then divided by 30 (the highest possible score) and multiplied by 100. In reference to a study conducted from Egypt by Saad Soliman, > 74% was considered as adequate level of knowledge, 50–74% as moderate level of knowledge and < 50% as poor level of knowledge practice (Saad Soliman et al., 2022).

The practice Pressure ulcer prevention was assessed by observing all the participants for one moment while conducting procedures to prevent pressure ulcers. An observation checklist with 34 steps guided the RAs on the care given while preventing pressure ulcers among the critically ill with a care bundle protocol. Each step was assessed using a hierarchical Three-level scale where those who missed a step were given a score of “zero”, those who performed the step partially were given a score of “one”, and those who performed the procedure correctly were given a score of “two”. The weights were then summated,

and the total score was divided by 68 and multiplied by 100 to get each participant's percentage of practice score. A score $\geq 75\%$ was considered as satisfactory level of practice and < 75% was considered as unsatisfactory level of practice (Saad Soliman et al., 2022).

The data obtained was checked for completeness and correctness and cleaned before being exported into STATA.

The data was exported to STATA version 17.0. Descriptive statistics were used to summarize the data. Continuous variables were summarized using the mean and standard deviation (SD) or the median and interquartile range (IQR) depending on their normality tests. Categorical variables were summarized using frequencies and percentages.

For objective 1, the mean and SD for practice scores were computed. The difference in the mean practice score between males and females was assessed using the independent sample t-test. The difference in median practice score between those who had ever received refresher training on the prevention of pressure ulcers and those who had never was evaluated using the Wilcoxon-rank sum test. The two-sided P values were presented, and the level of significance was less than 0.05. The difference in the mean practice score among the levels of education was assessed using one-way ANOVA.

For objective 2, the mean and SD for the knowledge scores were computed. The gender of participants and their previous training on pressure ulcer differences in median knowledge scores were assessed using the Wilcoxon-rank sum test. The difference in the mean knowledge score among the levels of education was evaluated using one-way ANOVA.

For objective 3, the mean difference in knowledge and practice scores before and after the educational intervention was assessed using a paired t-test.

Table 1 Demographic characteristics of 26 critical care nurses at MNRH who participated in the study

Variable	Categories	Frequencies and Percentages (%)
*Age (computed in years)	Median (IQR)	37.5 (32, 49)
Sex	Male	8 (30.8)
	Female	18 (69.2)
Education level	Certificate	2 (7.7)
	Diploma	10 (38.5)
	Bachelor's degree	10 (38.5)
	Post-graduate degree	4 (15.3)
Practice experience	Less than 2 years	3 (11.5)
	3–5 years	10 (38.5)
	6–10 years	8 (30.8)
	> 10 years	5 (19.2)
Ever received training in pressure ulcer prevention and care	Yes	9 (34.6)
	No	17 (65.4)
Number of pressure ulcer patients seen weekly	Median (IQR)	3 (2, 4)

*Computed in years.

Results

Demographic characteristics of the study participants

The median age for most of the study participants was 37.5 IQR [32]. Most of the participants were females 18 (69.2%). Nearly half of the participants had a Bachelor's degree 10 (38.5%). Most of the participants had practiced critical care for about three to five years 10 (38.5%), Yet only a few had ever received training on the prevention of pressure ulcers 9 (34.6%). The participants reported caring for about 2 to 4 pressure ulcers a week with a median of 3 pressure ulcers. (Table 1)

Objective 1

Baseline practice of critical care nurses in preventing nosocomial pressure ulcers with a bundle protocol

The mean (SD) baseline practice score was 37.6% (10.3). The difference in practice score between males and females was not statistically significant with a P value

of 0.222, considering less than 0.05 as the level of significance. Similarly, there was no statistical significance in the median (IQR) 36.8 (33.8, 38.2) practice score of those with previous training in the prevention of pressure ulcers and those without training with a *P* value of 0.608. There was no statistical significance among participants' practice in pressure ulcer prevention and their levels of education with a *P* value of 0.603. (Table 2).

Objective 2

Baseline knowledge of critical care nurses in preventing nosocomial pus with a bundle protocol

The overall mean (SD) knowledge score was 40.5% (10.6). The median (IQR) knowledge score was not statistically significant between males and females. There was no statistical significance in the median (IQR) knowledge score between those who had previous training in the prevention of pressure ulcers and those who didn't have any training. The level of education did not impact the baseline knowledge in preventing pressure ulcers (Table 3).

Objective 3

The mean knowledge and practice scores were statistically significant after the educational intervention (Table 4).

Discussion

The baseline knowledge and practice of pressure ulcer prevention were found significantly lacking, just like in the studies conducted by Mohammed in Iran and Salwa in Egypt [18, 25]. The lack of an active protocol on pressure ulcer prevention in the study ICU may have contributed to this finding. Also, there was no significant difference in the baseline knowledge and practice among participants who had prior training on pressure prevention versus those with no prior training. The participants' expression of the need for updated protocols on pressure ulcer prevention could support this finding. Some studies have shown that pressure ulcer prevention protocols are lacking in ICU environments and those with these protocols, nurses are found not to comply to them [26, 27]. The post-intervention knowledge and practice review revealed significant improvement in the study participants' knowledge and practices on pressure ulcer prevention [9, 28]. Staff training on the pressure ulcer prevention protocol as an intervention yielded these expected results like in some studies done in Finland by Marki and Saleh in Egypt which showed an improvement in knowledge, practices, attitudes and intentions, hence an education intervention being a powerful tool for nurses in the pressure ulcer prevention [29, 30].

Table 2 Distribution of baseline practice score of pressure ulcer prevention among critical care nurses at MNRH across independent variables

Variable	Categories	Median (IQR)	<i>P</i> value
Sex*	Male	33.8 (11.5)	0.222 [@]
	Female	39.2 (9.6)	
Ever received training in pressure ulcer prevention and care	Yes	36.8 (33.8, 38.2)	0.608
	No	35.3 (29.4, 45.6)	
Education level	Certificate	34.6 (25.0, 44.1)	0.603 [#]
	Diploma	38.2 (29.4, 45.6)	
	Bachelor's degree	36.8 (32.0, 48.5)	
	Post-graduate degree	34.6 (30.0, 36.1)	

*Mean (SD) presented [@]Independent sample t-test *P*-value [#]ANOVA *P* value

Table 3 Distribution of baseline knowledge score about pressure ulcer prevention among critical care nurses at MNRH across independent variables

Variable	Categories	Median (IQR)	<i>P</i> value
Sex	Male	43.3 (28.3, 53.4)	0.675
	Female	40.0 (33.3, 46.7)	
Ever received training in pressure ulcer prevention and care	Yes	43.3 (33.3, 50.0)	0.766
	No	40.0 (33.3, 43.3)	
Education level	Certificate	36.7 (4.7)	0.902 [#]
	Diploma	41.0 (12.3)	
	Bachelor's degree	39.7 (10.4)	
	Post-graduate degree	43.3 (11.9)	

[#]ANOVA *P* value

Table 4 Change in knowledge and practice of pressure ulcer prevention pre and post-intervention

	Mean (SD) before intervention	Mean (SD) after the intervention	<i>P</i> value (Paired t-test)
Knowledge	40.5 (10.6)	63.2 (11.8)	< 0.001
Practice	37.6 (10.3)	62.6 (7.3)	< 0.001

Baseline practice, knowledge and changes in practice and knowledge of critical care nurses in the prevention of nosocomial pressure ulcers post intervention

The mean baseline practice score among critical care nurses before the intervention was 37.6% with a SD 10.3. Given that the cutoff for satisfactory level of practice was 75% and above, this concluded as unsatisfactory level of practice as far as pressure ulcer prevention practice among the critical care nurses is concerned.

The level of practice was not affected by the participants' sex and level of education. Generally, the baseline participants' practice scores were not to the satisfactory

level and these findings are comparable to those in a study by Saad from Egypt, and that by Nuru from Ethiopia, as well as a study by Saleh where the practice scores were found to be 22%, 48.4% and 49% respectively [1, 30, 31]. This could have been due to a number of factors like poor nurse to patient ratios, absence of pressure ulcer prevention protocols in circulation and above all, the lack of knowledge on these prevention protocols.

The overall mean (SD) knowledge score of critical care nurses in the prevention of hospital acquired pressure ulcers before the intervention was 40.5% (10.6). This indicated a poor level of knowledge agreeing with most studies conducted on the nurses' knowledge and practice in the pressure ulcer prevention [25, 32, 33]. This finding was because most nurses had never had any prior training on pressure ulcer prevention, while those who had training, it was not on this specific pressure ulcer prevention guideline [34–36].

The knowledge of the critical care nurses in regards to the pressure ulcer prevention increased however on a moderate level i.e. mean (SD) 63.2% (11.8), yet practice increased from 37.6 to 62.6%, with a P value of <0.001 , hence a statistical significance. But since the study's cutoff on practice was 75% and above, this finding left us at unsatisfactory level of practice. This moderate level of knowledge and practice is attributed to the training sessions which were limited to only one session in participants who barely had any training in PU prevention on this specific bundle protocol. Studies showed that training nurses more than once with multiple intervention programs improved their knowledge to over 80% [18, 29, 37, 38]. Also, it was noted that the nurses had been working to prevent pressure ulcers however they were not following any guidelines. Most of their knowledge and practices were developed from experience over the years of practice. So compliance to this introduced guideline was not easy. Incompliance to new guidelines has been reported in most studies as a hindrance to quality care given to many patients within the critical care environment [31, 39, 40].

This study revealed that an educational intervention with a power point material and return demonstration with a pressure ulcer prevention bundle protocol had a positive effect on the critical care nurses' knowledge and their practice in the prevention of hospital acquired pressure ulcers.

Therefore, more trainings on pressure ulcer prevention guidelines should be encouraged and scheduled within the intensive care units, the pressure ulcer prevention protocols should be availed to the staff and the nursing managers should supervise for their utilization.

Strengths and limitations of the study

The study required less resources hence it was less costly.

It also had a higher external validity because of the educational intervention used. This allowed the researchers to control for the confounding variables.

One of the limitations was a possibility of observation bias (hawthorn effect). This was overcome by using a research assistant who once worked within the ICU of MNRH to do both pre and post intervention observation for the participants' practice. This research assistant requested to volunteer again and was not disclosed to the study participants.

Secondly, the study was conducted in one center, hence this might not be generalized for all the critical care nurses elsewhere.

Last but not least, the number of intervention sessions were limited to one. Given that most participants had never had prior training on the prevention of pressure ulcers, this could have contributed to unsatisfactory results for most participants.

Implications and recommendations of the study

The study findings implied that critical care nurses' baseline knowledge and skills in pressure ulcer prevention with the use of the bundle protocols were lacking therefore, had been enhanced to moderate levels for knowledge and unsatisfactory levels for practice as per the cut off points, however with statistical significance.

The researchers therefore recommend the Nursing management to enforce trainings for critical care staff in regards to pressure ulcer prevention with the use of bundle protocols to continue enhancing their knowledge and practices with use of these bundle protocols.

To the ward in-charge, the researchers recommend that they organize continuous medical education sessions in relation to pressure ulcers, prevention and management with bundle protocols to boost the nurses' knowledge and practice.

Policy makers should ensure that Guidelines on pressure ulcer prevention are formulated and made easily accessible country-wide to increase awareness of these bundle protocols to the critical care staff and finally, the effect of the bundle protocols to be assessed by nursing staff as a multi-center study.

Conclusion

The intervention brought about an increase in knowledge of pressure ulcers and their prevention with the use of a bundle protocol as well as an improvement in nurses' practice to ensure these pressure ulcers are eradicated from the critical care unit.

Abbreviations

MNRH	Mulago National Referral Hospital
ICU	Intensive Care Unit

HAPU Hospital Acquired Pressure Ulcers
 AHRQ Acquired Health Research Quality
 RA1 Research assistant one
 RA2 Research assistant two
 PI Principal investigator
 EPUAP European Pressure Ulcer Advisory Panel

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-025-03731-4>.

Supplementary Material 1

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Author contributions

KPK conceived and designed the study. KPK, NE and IM implemented the study and conducted data analysis. AC supervised the study. KPK, SL, AC interpreted study results. KPK wrote the first draft of the manuscript. AC and SL reviewed and corrected the draft manuscript. All authors read and approved the final manuscript.

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Data availability

The data that supported the findings of this study is available from the first and corresponding author, Kalanzi Phiona Katasi but restrictions apply under license for the current study.

Declarations

Ethical approval and consent of participants

This study adhered to the ethical principles outlined in the Declaration of Helsinki. Ethical approval for the study was obtained from the relevant institutional ethical review boards that's to say, The Faculty Research Committee (FRC) and The Research Ethics Committee (MUST-REC, MUST-2023 – 1153) of Mbarara University of Sciences and Technology, A waiver of consent for observation of study participants for practice in pressure ulcer prevention and permission to conduct the study was also sought from the Research Ethics Committee (REC) of Mulago National referral hospital where the study was conducted.

Informed consent

Informed consent was obtained from all participants prior to their inclusion in the study. Participants were assured of their right to withdraw at any time without any repercussions, and confidentiality and anonymity of the data were strictly maintained. The study was conducted with the utmost respect for the dignity, rights, and well-being of the participants.

Competing interests

The authors declare no competing interests.

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