

Nurses Application of the "TIME" Framework in the Wounds Assessment and Its Impact on the Wound Care Competences

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Abstract Introduction: The TIME framework is a practical tool for wound care assessment that includes tissue viability, infection/inflammation, moisture imbalance, and wound edges. However, it is not widely practiced in Sudanese health institutes, and literature on its use is limited. This study aimed to evaluate the impact of a TIME framework education program on the performance of nurses in wound care. **Methods:** This study used a prospective pretest-posttest one group design to evaluate the impact of a TIME framework education program on nurses' performance in wound care. Data were collected using questionnaires, observation checklists, and a 5-Likert scale for attitude evaluation, and analyzed using nonparametric tests. **Results:** The study found that the TIME framework education program had a significant positive impact on nurses' performance in wound care. The results showed a significant improvement in both knowledge (pretest score of mean=4.96, SD=0.20 versus posttest score of mean=3.33, SD=1.34) and practice (pretest score of mean=2.15, SD=0.90 versus posttest score

of mean=1.2083, SD=0.50). Nurses' attitudes towards using the TIME framework in wound care also improved significantly. **Conclusion:** This study concludes that the TIME framework education program is an effective intervention for improving nurses' performance in wound care. The program resulted in significant improvement not only in knowledge and practice but also in attitude. Continuous professional development programs on wound care practice with TIME assessment tool and wound care models are recommended.

Keywords TIME Framework, Nurses' Competence, Wound Care, Nurses' Attitude, Performance Improvement

1. Introduction

Wound care is especially challenging when provided by multiple caregivers with varied educational and

experiential backgrounds. In addition, wounds have a three-dimensional force which can impact under three domains: the individual, the health service, and the society. Subsequently, wounds have an effect on patient health and wellbeing, as well as considerable burden wound care. This in turn should provide an opportunity to seek improvement, prevention and management strategies of wound care which is held up on health care staff, organizations, and resources [1]. Therefore, delivery of competent wound care personnel may appear especially devastating for organizations that lack a wound care specialist and evidence-based training. Consequently, adequate education, which represents a mandatory issue in safe practicing wound care, cannot be guaranteed for all involved staff with priority focusing on nurses [2].

However, wound care had been updated by introducing the concept of four main components: Tissue non-viable, Infection/ Inflammation, Moisture imbalanced, and wound Edges non-advancing or undermining which collectively summarized as a TIME acronym for wound care. And then the TIME framework represents a useful, practical tool in the clinical setting which is based on identifying barriers to healing and implementing a plan of care to remove these barriers and promote wound healing. The concept of preparing the wound bed for healing and the TIME framework was developed as a systematic approach to the management of chronic wounds and has the potential to offer a solution in terms of addressing inequalities in care provision. Hence, it should be considered within the context of total patient care and should include a comprehensive assessment of the patient, treatment of the underlying condition and an appreciation of the patient's concerns and priorities along with local wound Care [3, 4].

TIME framework with its components has been described in the literature and case studies of its practical benefits [5]. TIME is a theoretical framework to structure education which was well evaluated on delivery, but the impact on practice needs to be addressed with adequate investigation of its outcome. A survey methodology was used to assess the perceived value of the TIME framework as an educational tool. The results had been reflected in an improvement in knowledge with automatic effects in practice [6]. In the context of chronic wound management, the dynamic and versatile nature of the TIME concept as a theoretical framework prove its flexibility to be used across different wound etiologies [7]. Preparing wounds for healing is an essential issue for nurses to achieve an optimum level of client's satisfaction using an applicable standardized tool that lead to effective and efficient wound assessment and management. Additionally, this tool focuses on; Tissue assessment (as viable or non-viable) and management, identify evidence of Infection and Inflammation then control or manage. Eventually, exploring the level of Moisture balance and helping the advancement of the epithelial edges of the wound (if assessed as static); that is the TIME tool for

wound care [8]. The first introduction to the adopted wound bed preparation (WBP) guideline training session was completed at the wounds international conference in 2011; the audiences included were health care workers, patients with their family members and nurses [9]. However, the current study focused on nurses as the backbone for effective care with considerable competency in the outcome using the TIME concept interrelated with preparing wounds for healing. Yet, little research has been completed to evaluate the efficacy of educational strategies hence promote appropriate selection and application of wound care products. Correspondingly, nurses as practitioners need to have an autonomy and independence in wound care using flexible tools for wound care. Hence, multiple decision alternatives, which are implicated in TIME concept, assist nurses in making complex clinical decisions, including the selection of appropriate wound dressings [10]. Contradictory, many clinical decisions continue to be influenced by tradition and the nurse's experience rather than scientific data. Furthermore, wound care as multi-professional issue needs collaborative thinking and cooperative decision-making with action plans generally for clinicians and specifically for nurses. Further, many difficulties are encountered on a daily basis in patient care; these include managing patient case load as well as teaching the colleagues as a continuous process [11].

Globally, the concept of wound bed preparation (WBP) is well accepted and appreciated as a framework that can provide a structured approach to wound management which is integrated basically with TIME framework. Wound bed preparation is 'the management of a wound in order to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures. Therefore, WBP concentrates on improving circumstances at the wound bed to encourage normal endogenous healing. Thus, this model will be recommended for all wounds that are not progressing to normal wound healing [12]. This study aimed to evaluate the impact of a TIME framework education program on the performance of nurses in wound care.

2. Methods

2.1. Study Design and Participants

We conducted a prospective pretest-posttest one group design study to assess the effectiveness of an educational program on wound care using the TIME framework in a sample of bachelor's degree holder nurses in the period between October 2022 to March 2023. Participants were selected randomly based on specific inclusion criteria and had at least five years of experience working in surgical units and encountering wound care. The study was conducted at the Continuous Professional Development

(CPD) Center, Ministry of Health in Khartoum state.

2.2. Sample Size and Sampling

To determine the sample size, we used a previous study's mean test scores and standard deviations of pretest and posttest results for knowledge and practice. Simple random sampling was used to enroll 48 nurses who met the study's inclusion criteria and attended all phases of the program.

2.3. Data Collection

We collected data using a structured pre-coded questionnaire consisting of three parts and a checklist to evaluate practical training outcomes. The questionnaire measured knowledge, attitude, and demographic variables using the TIME framework concept in wound care. Data were collected before and after the educational program and managed at regular intervals according to program phases. Descriptive statistics were used to summarize the data, and the Wilcoxon signed-rank test was used to compare mean scores of the pre- and post-intervention groups.

2.4. Education Program

The education program aimed to introduce nurses to the Tissue, Infection, Moisture, Edges of a wound (TIME) principles of wound assessment and management using a simulated wound model. The program was based on the Objectives Model and consisted of lecture-based sessions, case scenarios with discussion and problem-based learning, and communication techniques. The program also emphasized the importance of interpersonal relationships among learners and fostered accountability and commitment to lifelong learning. The training in wound care using the concept of TIME was planned according to specific steps, including exploring facilities and barriers, planning required facilities, and dividing participants into two groups. The program lasted for ten days, including five days for each group, with a total of 33 hours divided into theoretical and practical sessions.

2.5. Data Analysis

We used nonparametric tests to analyze the data collected before and after the educational program, including descriptive statistics to summarize the data and the Wilcoxon signed-rank test to compare mean scores of the pre- and post-intervention groups.

3. Results

Table 1 shows the number and percentage of participants in each category for the following characteristics: age groups, gender, educational level, departments, work

experience, and training course in wound care. A total of 48 participants were included in the study, with 21 participants falling into the age group of 25-30 years old. The majority of participants were female (93.75%) and held a bachelor's degree (89.58%). General surgery was the most represented department (50%), followed by ENT surgery (19%) and the bleeding center (6%). In terms of work experience, almost half of the participants had 2-7 years of experience (47.9%). None of the participants had received any training course in wound care.

Table 1. Demographic and professional characteristics of the study participants (N=48)

Characteristic	Category	Number	Percentage
Age groups	25-30	21	43.75
	31-36	17	35.42
	37-40	5	10.42
	above 40	5	10.42
	Total	48	100.00
Gender	Males	3	6.25
	Females	45	93.75
	Total	48	100.00
Educational level	Bachelor	43	89.58
	Master holder	4	8.33
	PhD student	1	2.08
	Total	48	100.00
Departments	General surgery	24	50.00
	ENT surgery	9	18.75
	Bleeding center	3	6.25
	GIT surgery	1	2.08
	Others	11	22.92
	Total	48	100.00
Work experience / year	2-7	23	47.92
	8-15	13	27.08
	16-25	4	8.33
	Others	8	16.67
	Total	48	100.00
Training course in wound care	Once	0	0.00
	Twice	0	0.00
	More than once	0	0.00
	Never	48	100.00
Total	48	100.00	

Table 2 displays the mean scores and dominant

responses for each item on the survey questionnaire. Overall, the respondents reported a moderate level of confidence in their ability to assess wounds using the TIME framework (Item 1, M=3.73, SD=0.75). However, they expressed uncertainty about the extent to which the TIME concept can be incorporated into wound management formulary in their hospital (Item 2, M=2.71, SD=0.94), and whether proper implementation of the TIME concept would improve patient outcomes (Item 3, M=2.75, SD=0.83).

Respondents reported a high level of agreement with the statement that they always give priority to the client's complaint of wound pain during dressing (Item 4, M=4.10, SD=0.78). However, they were uncertain about their responsibility to make recommendations to practitioners on appropriate wound management using the TIME concept for patients in their hospital (Item 5, M=2.90, SD=0.94). These findings suggest that while the respondents have a moderate level of confidence in their ability to assess wounds using the TIME framework, they may require further education and training on the benefits and practicalities of incorporating the TIME concept into wound management in their hospital setting.

Table 3 shows the post-test results which indicate a significant increase in participant confidence in their ability to assess wounds using the TIME framework, with a

mean score of 4.65 on a 5-point scale. Similarly, the participants expressed a high level of agreement (mean score of 3.60) towards learning how to incorporate the TIME framework into the wound management formulary in their hospital. Furthermore, the participants strongly agreed (mean score of 4.58) that proper implementation of the TIME concept in wound care would improve client health outcomes.

In addition, the participants strongly agreed (mean score of 4.43) that they always give priority to the client's complaint of wound pain during dressing. Furthermore, they expressed a high level of agreement (mean score of 4.15) that making recommendations to practitioners on appropriate wound management using the TIME concept for patients in their hospital is their responsibility. These findings suggest that the program was effective in increasing participant confidence and responsibility in using the TIME framework in wound management.

Figure 1 visually presents the effectiveness of an educational intervention on nurses' understanding of the TIME acronym, which stands for Time, Instructions, Monitoring, and Evaluation in the context of medication administration. The figure compares nurses' performance on a set of four categories poor, fair, good, and excellent knowledge related to the TIME acronym, both before and after the educational intervention.

Table 2. Mean scores and dominant scale of the questions related to the TIME framework in wound management

No.	Question Item	Mean	Dominant Scale
1	I am confident about my ability to assess wounds using the TIME framework.	3.73	Agree
2	You feel free learning about how to incorporate the TIME framework into wound management formulary in your hospital.	2.71	Uncertain
3	I am sure that proper implementation of the TIME concept in wound care will improve client's health outcome.	2.75	Uncertain
4	During dressing you always give priority to the client's complaint of wound pain.	4.10	Agree
5	Making recommendations to practitioners on the appropriate wound management using the TIME concept for patients in my hospital is my responsibility.	2.90	Uncertain

Table 3. Post-test Evaluation Results: Confidence and Perceived Responsibility of Healthcare Providers in Implementing the TIME Framework in Wound Care

No	Question Item	Mean	Dominant Scale
1	I am confident about my ability to assess wounds using the TIME framework	4.65	Strongly agree
2	You feel free learning about how to incorporate the TIME framework into wound management formulary in your hospital.	3.60	Agree
3	I am sure that proper implementation of the TIME concept in wound care will improve client's health outcome.	4.58	Strongly agree
4	During dressing you always give priority to the client's complaint of wound pain.	4.43	Strongly agree
5	Making recommendations to practitioners on the appropriate wound management using the TIME concept for patients in my hospital is my responsibility.	4.15	Agree

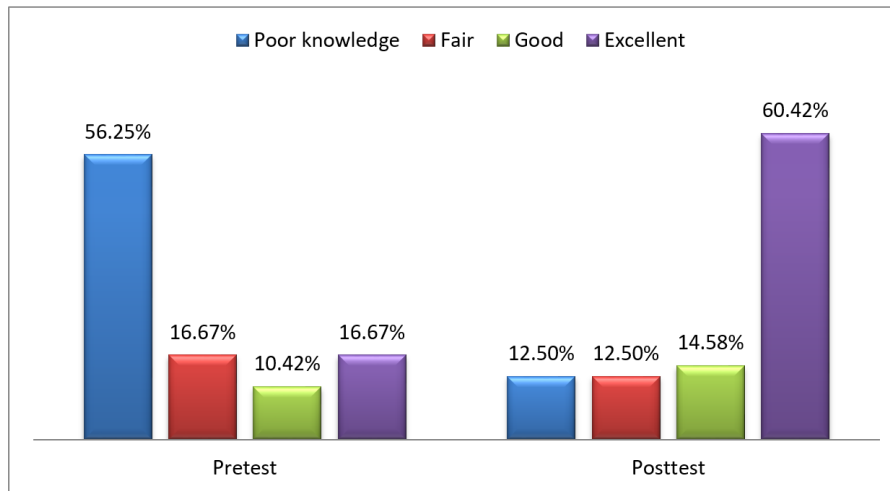


Figure 1. Nurses' knowledge about the TIME acronym

4. Discussion

This study was quasi experimental that focused on professional nurses (n=48) who were invited to participate in an educational training in wound assessment using the TIME tool and simulated wounds models. The study was based on pretest posttest design using the same instruments for evaluating knowledge, skills, and attitude.

All most all of participants were female nurses showed 93.75% among which the commonest ages, including male nurses, were between 25-36 years showed 79.17% (38 out of 48) nurses. The results revealed that there was no relation between work experience and test scores when comparing pretest with posttest scores (p-value= 1.00). This can be explained by the lack of such educational programs in the undergraduate nursing curriculum or the scarcity of continuing educational programs that address wound care. This last issue was enforced by the fact that all the participants in the selected sample had not attended such related educational training in wound care.

In this study, the interventional educational program has resulted in improvement of knowledge among the participants as well as practice. These outcomes corresponded with a previous report that showed improvement (p<0.001) in knowledge and practice. Most nurses' responses related to the TIME acronym abbreviation and meaning showed 14.6% (n= 7) as good in the post-test period as well as excellent equal 60.4% (n=29). Collectively, the total scores of nurses graded as good and as excellent equal 75% (n= 36), which indicated increasing knowledge in this respect. This was considered as the predictable outcome because of lecturing in details the four elements of TIME individually, with additional using cases scenario. Likewise, evidence from literature indicated that the TIME framework was poorly understood before the educational intervention, but this improved for each element of the TIME significantly after training. This was the second major part of the task to be performed to

accomplish this study, which addressed the four elements of the TIME tool in wound assessment with holistic patient care [13]. In this part the effect of the teaching program on nurses' practice indicated increased improvement in performance in the five questions using modified OSCE examination. Excellent performance was gained in all most all nurses concerning identification wound etiology, location, duration, and size showed significant improved skill 77.1% (n= 37, p-value equal 0.000). Similar significant results were obtained in the post scores in response to the other questions which were "Assessment of tissue type", "Assessment of the level of Infection and Inflammation", "Moisture level assessment and description" and "Assessment of wound edges and the healing process" with (p-value 0.000). Evidence from the literature supports these findings as comparisons were made between the assessment of patients by nurses before and after training which showed significant level of (p < 0.001). These highly significant results in practice compared with knowledge gained by theory may be attributed to the demonstration of each element of TIME separately in a simulated situation in a well-prepared environment which was more informative and practically accepted. Therefore, knowledge gained by theory may be delayed or need sufficient time for fixing the targeted sessions. But in general, knowledge gained was significantly improved (p-value 0.000). about "assertiveness of nurses regarding using the TIME to assess wounds" result showed that most nurses were eager to address wound assessment using TIME tool interestingly with replicating the concept to others in the field. However, in the next question about "assertiveness of nurses about integration TIME framework into wound management" the responses were less than 50%, which might reflect the difficult situation in their workplace in concern with adding something to the policy which can affect the general organization policy. Or in alternate meaning, there may be a lack of nurses' confidence to

implement this type of assessment. Yet really this program needs interdisciplinary work and cooperation with consistency and continuity of care to work successfully. Regarding the third question which was about “assertiveness of nurses regarding the consequences of proper implementation of the TIME concept in wound care”, the result showed strong agreement in the posttest period. In this issue, most nurses believed that after attending the educational program, they were interested in applying this concept in their clinical setting. Regarding the fourth question which was about “the opinion of nurses during dressing about their priority consideration when the client's complaint of wound pain”. An amazing outcome of a highly positive result was gained from the nurses’ responses, that the dominant scales still the same in the pretest period compared with the posttest periods nurses were strongly agreed. These findings reflected the nurses’ respect for the subjective feeling of the patient pertinent to satisfaction and comfort. This issue was particularly important when handling painful cases of wound dressing. The last concern was about “assertiveness of nurses regarding recommendation in applying the TIME concept in wound care to others”, the results indicated medium strong agreement in the post-test period. Generally, sometimes it appears difficult to advise someone to attend a similar program without applying the concept by self and following the outcome either rejected or accepted by organizations, and health care staff. Yet, this proved that nurses either have acquired positive beliefs about this new training area or nurses’ confident situation may be defective or hesitant [14]. Despite this, the number of responses showed that half of the sample population has faith in this program as an important issue to be implemented or reflected to others for efficient wound care [15]. Collectively, it was apparent that the education program added a positive attitude towards the TIME framework.

5. Limitations

The study provides insights into the use of the TIME assessment tool for wound care among Sudanese nurses but has several limitations. The majority of the participants were female nurses, potentially limiting the generalizability of the results across genders. The research's pretest-posttest single-group design, without a control group, introduces possible biases. The exclusive focus on nurses, combined with a modest sample size of 48 participants, might not capture the full spectrum of wound care professionals or offer broad representativeness.

6. Conclusions

This study demonstrated that nursing education utilizing the TIME assessment tool for wound care led to

improvements in knowledge, practice, and attitude. Retention of knowledge was highest for wound moisture description, eschar tissue identification, purulent exudate, and mechanical debridement. However, areas related to infection and inflammation terminology showed less improvement. Language barriers and limited attendance at the educational session were identified as potential barriers to achieving optimal outcomes. The findings emphasize the importance of using validated assessment tools such as TIME in nursing education for improved patient outcomes.

Ethical Consideration

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Ministry of Health in Khartoum state (Approval No. IRB-164-2022). Informed consent was obtained from all participants prior to their participation in the study. Confidentiality and anonymity were maintained throughout the study, and all data were collected and analyzed in accordance with ethical principles and guidelines.

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Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Authors' Contributions

Conceptualization, Amani Mahmoud Mokhtar.; Data curation, Eltayeb Abdelazeem Idress; Formal analysis, Murtada Mustafa Gabir Tia; Methodology, Mohammed F Alharbi and Hamza Hussain Balola; Resources, Ahmed Abdalla Jarelnpe; Software, Mohammed Hassan Moreljwab; Supervision and writing, Eltayeb Abdelazeem

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