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Effect Of Evidence-Based Nursing Practices Training Programme on the Competency of Nurses Caring for Mechanically Ventilated Patients

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ABSTRACT

Background: Evidence-Based Practice (EBP) is globally recognized as a standard approach to improving healthcare quality and patient outcomes. Nurses, particularly those in Intensive Care Units (ICUs), play a crucial role in implementing EBP. Therefore, this study aims to assess the impact of an adapted evidence-based nursing practices training program on the competency of nurses caring for mechanically ventilated patients.

Methods: A prospective open-label parallel 1:1 controlled trial was conducted involving 80 nurses from the National Hepatology and Tropical Medicine Research Institute, , caring for ICU patients. The trial, registered under NCT05721664, took place between November 2022 and February 2023. Nurses were randomly assigned to either the intervention group, receiving the evidence-based nursing practice training program (EBNPTP) based on the Johns Hopkins EBP conceptual model, or the control group, receiving traditional in-service education. Four assessments (one pre- and three post-assessments) were conducted using the adapted evidence-based nursing competency assessment checklist to measure competency levels over time. The primary outcome was an increase in competency levels among nurses caring for mechanically ventilated patients.

Results: Statistically significant differences were observed between the intervention and control groups in terms of competency levels across the three post-assessments ($p < .001$). However, competency levels declined significantly over time ($p < .001$). A significant correlation was found between nurses' pre-assessment scores, educational level, and the third endpoint assessment ($p < .01$), as determined by multiple linear regression.

Conclusion: The EBP training program led to a significant increase in nurses' competency compared to traditional education. This emphasizes the importance of training nurses in EBP skills to enhance competency and improve patient care. However, sustaining EBP adoption in the long term requires further investigation into influencing factors.

BACKGROUND

Evidence-based practice (EBP) is a foundational approach in healthcare, aiming to deliver standardized care based on the latest scientific evidence to improve quality. It serves as a problem-solving method for making clinical decisions, enhancing patient outcomes, bridging theory to practice, promoting innovative care, reducing costs, and fostering lifelong learning. Nurses, especially those in Intensive Care Units (ICUs), play a vital role in optimizing healthcare efficiency and directly engaging with patients.

Consequently, healthcare institutions must facilitate frontline nurses' use of evidence in daily practice and address barriers to evidence implementation. Although EBP is not new, its evolution within nursing, dating back to Florence Nightingale in 1858, has significantly impacted healthcare practices. (Saunders et al., 2018)

Critical care demands high competency levels, particularly in managing mechanical ventilation (MV), a common treatment in ICUs. Despite its benefits, MV can lead to complications without proper nursing care, such as ventilator-associated pneumonia (VAP). Given EBP's focus on improving outcomes, we target VAP as a significant concern among MV patients , where VAP incidence ranges widely. This is notably higher than global rates, highlighting potential gaps in EBP implementation nursing. also reports lower VAP survival rates compared to global averages. These statistics underscore the need for enhanced nursing practices, especially in MV patient care, as recommended by previous studies. (Davies et al., 2019)

Hence, we hypothesize that nurses undergoing an evidence-based nursing practice training program (EBNPTP) will show a more sustainable increase in competency compared to those receiving traditional in-service education in caring for mechanically ventilated patients. This study aims to evaluate the impact of the EBNPTP on nurses' competency levels in selected ICUs . (Dang et al., 2021)

Conceptual Framework

The revised Johns Hopkins Evidence-Based Practice (JHEBP) Model was selected as a systematic and efficient approach to implementing an evidence-based program into practice in this study. The JHEBP model comprises four essential components: inquiry, practice, practice improvements, and learning. Nurse performance is considered the most typical determinant and predictor of the quality of care and patient outcomes. Due to a lack of nurses' competency levels regarding caring for MV patients, the quality of provided care and patients' outcomes are negatively impacted. As an independent variable, we designed the EBP training program for ICU nurses based on the JHEBP method. The EBP training program contains eight domains which meet the educational needs of nurses in terms of both knowledge and practices. The ultimate objective of the training is to provide a positive, sustainable change in nurses' competencies, thereby improving patient outcomes. The JHEBP Model defines learning as a sustainable change in candidates' behavior. Therefore, the post-assessment of nurses' competency as a dependent variable was measured three times at one-month intervals to evaluate the over-time change compared to the baseline pre-assessment and control group. (Elkolaly et al., 2019)

METHODS

Trial Design

The study employed a prospective open-label parallel 1:1 controlled trial design. The protocol adhered to the Standard Protocol Items Recommendations for Interventional Trials and was conducted

Participants Sampling and Study Setting

The study was conducted in adult ICUs . Inclusion criteria included willingness to participate, holding the current position for at least three months, and having at least two years of critical care experience. Exclusion criteria included intending to leave the job within the study period.

Sample Size Calculation

The sample size of 80 nurses was determined using G power software with $\alpha = 0.05$, power = 0.80, and effect size = 0.56, based on a previous study's findings.

Randomization and Allocation

After eligibility verification, enrolled nurses were randomly allocated to intervention and control groups using a simple random sample generated by a lottery method, conducted by an unaffiliated third party.

Outcomes

The primary outcome was an increase in nurses' competency levels caring for MV patients, measured by the Evidence-Based Nursing Competency Assessment Checklist (EBNCAC) over three months after the EBNPT.

Measurement Tools

The EBNCAC, a structured observational checklist, assessed nurses' competency based on eight domains from the EBNPTP. The tool's validity and reliability were ensured through expert review and internal consistency analysis.

Evidence-Based Nursing Practices Training Programme (EBNPTP) for the Intervention Group

The EBNPTP was designed based on the JHEBP model and included theoretical and clinical components delivered over one week (30 hours). The program's content validity was established through expert review and pilot testing.

Control Group

The control group received traditional in-service education and periodic supplementary sessions as per standard practice.

Data Collection Procedure

Data collection involved pre-assessment using the EBNCAC in November 2022, followed by EBNPTP for the intervention group and subsequent post-assessments at one-month intervals until February 2023.

Data Analysis

Data were analyzed using SPSS V.23.0, with per-protocol analysis, descriptive statistics, repeated measures ANOVA, multiple linear regression, t-tests, and one-way ANOVA at a significance level of $p < .05$.

RESULTS

Out of 94 nurses initially considered, 14 were excluded due to not meeting eligibility criteria, resulting in 80 equally allocated nurses (intervention group, n = 40; control group, n = 40). Ultimately, data from 71 nurses (intervention, n = 37; control, n = 34) were included for the third post-assessment. Demographic characteristics of the enrolled participants at baseline are presented in Table 1, showing no significant differences between groups.

Both groups exhibited low competency levels initially, with no significant difference ($p = .81$). The intervention group showed the highest competency at the first post-assessment (mean score: 90.4 ± 11.55), declining by the third post-assessment (mean score: 65.6 ± 26.70). The control group maintained a consistently low competency across assessments. Significant differences were observed between groups in all post-assessments ($p < .001$).

Table 2 summarizes nurses' competency scores over the assessments, showing significant within-group differences ($p < .001$) and significant between-group differences ($p < .001$) with a substantial effect size ($\eta 2 = 0.699$). Two-way repeated measures ANOVA confirmed the EBNPTP's significant impact on competency improvement.

Multiple linear regression results in Table 3 indicate significant predictors of improvement at the third post-assessment: pre-assessment ($B = 0.53$, $p = .002$), educational level ($B = 14.12$, $p < .001$), and intervention group ($B = 35.69$, $p < .001$). The adjusted R square was 0.667, indicating 66.7% predictability.

Table 4 shows significant differences between nurses' education levels and third post-assessment scores ($F = 9.41$, $p < .01$), particularly higher scores for bachelor's degree nurses. No significant differences were found based on gender, age, or years of experience.

Overall, the study supports the hypothesis that the EBNPTP significantly increased nurses' competency levels, with education level and pre-assessment as significant predictors of improvement at the endpoint assessment.

Table 1. Demographic characteristics of the enrolled participants at baseline (*n* = 80)

Demographic characteristics	**Groups**		**Total (*n* = 80) *n* (%)**	***p***
	Control (*n* = 40) *n* (%)	**Interventional (*n* = 40) *n* (%)**		
Gender:				0.785 [a]
Male	8 (20.0)	9 (22.5)	17 (21.3)	
Female	32 (80.0)	31 (77.5)	63 (78.8)	

Years of experience in ICU:				0.463 [a]
1–10	23 (57.5)	21 (52.5)	44 (55)	
> 10–20	8 (20.0)	13 (32.5)	21 (26.3)	
> 20–30	8 (20.0)	6 (15.0)	14 (17.5)	
> 30–40	1 (2.5)	0 (0)	1 (1.3)	
Mean ± SD	10.4 ± 8.33	10.2 ± 7.80	10.3 ± 8.02	0.945 [b]
Educational level:				0.192 [a]
Diploma nurses	21 (52.5)	25 (62.5)	46 (57.5)	
Technical nurses	15 (37.5)	8 (20.0)	23 (28.8)	
Bachelor's nurses	4 (10.0)	7 (17.5)	11 (13.8)	
Age:				0.855 [a]
20–30	18 (45.0)	18 (45.0)	36 (45.0)	
> 30–40	11(27.5)	12 (30)	23 (28.8)	
> 40–50	7 (17.5)	8 (20.0)	15 (18.8)	
> 50–60	4 (10.0)	2 (5.0)	6 (7.5)	
Mean ± SD	33.4 ± 9.79	33 ± 9.15	33.2 ± 9.42	0.842 [b]

Table 2. Nurses' competency scores over four times of assessments between control and interventional groups

Measurements	**Groups**			**Two-way repeated measures ANOVA**						
	Control (*n* = 34) Mean ± SD	**Interventional (*n* = 37) Mean ± SD**			**Sum of squares**	**df**	**Mean Squares**	**F**	***p***	**η2**
Pre-assessment	31.55 ± 12.01	30.89 ± 11.56		Group (Between)	80404.23	1	80404.236	159.88	<.001	0.699
1st post-assessment	33.67 ± 13.51	90.40 ± 11.55		Time (within)	36882.69	1.660	22217.231	64.247	<.001	0.482
2nd post-assessment	32.58 ± 13.29	77.13 ± 21.31		Time × Group	32411.17	1.660	19523.696	56.458	<.001	0.450
3rd post-assessment	31.52 ± 13.51	65.64 ± 26.70								

Table 3. The predictors on 3rd post-assessment (Endpoint observation) by multi-linear regression

Model			**B**	**β**	**t**	**Sig.**	**R**	**R Square**	**Adjusted R Square**	**F**	***p***
Dependent	**Independent variables**										
3rd post-assessment (Endpoint)	Age	0.003	0.001	0.010	0.992	0.834	0.696	0.667	24.36	< 0.001	
	gender	5.592	0.084	1.193	0.237						
	years of experience in ICU	− 0.443	− 0.133	-1.083	0.283						
	Educational level	14.124	0.377	4.907	< 0.001						

	Pre-assessment (Baseline)	0.530	0.227	3.236	0.002						
	Control-Interventional groups	35.696	0.657	9.489	< 0.001						

Table 4. Influence of demographic characteristics on the pre-assessment and 3rd post-assessment

Demographic characteristics	***N***	**Pre-assessment as a baseline data**				**3rd post-assessment as an endpoint**				
		Mean ± SD	**t/F**	***p*-value**		**Mean ± SD**			**t/F**	***p*-value**
Gender										
male	15	31.53 ± 14.02	.11[a]	0.90		42.00 ± 17.80			-1.53[a]	0.13
female	56	31.12 ± 11.14				51.26 ± 29.19				
Age			1.18[b]	0.32					2.03[b]	0.11
20–30	31	32.77 ± 10.25				56.96 ± 29.85				
> 30–40	20	30.80 ± 12.09				47.85 ± 25.64				
> 40–50	14	26.57 ± 14.65				41.64 ± 25.08				
> 50–60	6	35.33 ± 8.71				32.50 ± 10.42				
Years of experience in ICU										
1–10	38	32.57 ± 12.62	.44[b]	0.72		55.13 ± 29.77			2.72[b]	0.051
> 10–20	19	30.31 ± 9.92				50.47 ± 25.87				
> 20–30	13	29.00 ± 11.98				32.84 ± 12.23				
> 30–40	1	25.00 ± 0				20.00 ± 0				
Level of education										
Diploma Nurses	40	30.15 ± 10.32	1.12[b]	0.33		41.15 ± 18.13	]*	]**	9.41[b]	< 0.001
Technical institute	21	30.80 ± 14.38				50.85 ± 32.46				
Bachelor's degree	10	36.30 ± 10.42				78.70 ± 28.03				

DISCUSSION

This study represents the first controlled trial evaluate the impact and sustainability of an Evidence-Based Nursing Practice Training Programme (EBNPTP) on nurses caring for mechanically ventilated (MV) patients. The findings indicate a significant improvement in nurses' competency levels after receiving the EBNPTP, aligning with previous studies that also demonstrated the effectiveness of educational programmes in enhancing nurses' competencies. These results underscore the importance of adopting Evidence-Based Practice (EBP) methodologies to improve nurses' skills and knowledge. (Xie et al., 2018) The observed improvement in nurses' competency levels can be attributed to various factors, including increased job satisfaction, enhanced confidence, and expanded knowledge and skills acquired through the EBNPTP. These findings corroborate existing literature highlighting the positive impact of EBP training on nurses' performance. Additionally, the study sheds light on the inadequacies of traditional in-service education and emphasizes the need to replace it with more effective EBP training programmes across different nursing domains. (Karakuzu et al., 2018)

However, despite the initial improvement, the study also reveals a lack of sustainability in nurses' competency levels over time. This finding is consistent with previous research that suggests short-term gains from educational initiatives like EBNPTP may not always translate into long-term competency retention. Factors contributing to this lack of sustainability include nurses' attitudes, resistance to change, inadequate supervision, and a stressful work environment. Addressing these factors through ongoing support, supervision, and creating a conducive work environment is crucial for sustaining the benefits of EBP training. (Liu et al., 2021)

The study also highlights the influence of nurses' educational level on their competency levels, with bachelor's degree holders exhibiting higher competencies. This underscores the importance of higher education in nursing, as it equips nurses with advanced skills, knowledge, and confidence necessary for effective EBP implementation. Additionally, the study identifies baseline competency levels as predictive of future performance, emphasizing the need for continuous learning and skill development among nurses. (Gunawan et al., 2019)

Interestingly, demographic characteristics such as gender, age, and years of experience did not significantly impact nurses' competency levels before and after EBNPTP. This suggests that EBNPTP can be beneficial for all nurses, regardless of these demographic factors, highlighting its universal applicability in improving nursing practice. However, fostering positive attitudes, motivation, and professional values remains crucial for encouraging widespread adoption of EBP among nurses. (Gallagher-Ford et al., 2019)

CONCLUSION

This randomized controlled trial (RCT) represents a pioneering effort and the Middle East to evaluate the impact of an Evidence-Based Practice (EBP) training programme on nurses caring for mechanically ventilated (MV) patients and to assess the sustainability of this impact over time. The study confirmed the hypothesis by demonstrating a significant increase in nurses' competency levels compared to traditional in-service education. This highlights the potential benefits of widespread adoption of EBP across various nursing domains to enhance care quality. However, the study also identified challenges in sustaining the efficacy of the EBP training programme over time, indicating the need for ongoing support, monitoring, and evaluation of nurses' performance.

Addressing the sustainability challenge requires integrating the EBP training programme into nurses' job development and remuneration structures, ensuring continuous monitoring of their performance, and further investigating the factors influencing sustainability. The study underscored the significance of baseline competency levels and educational backgrounds in predicting nurses' performance, emphasizing the need for tailored training programmes and peer support mechanisms.

Limitations

The study had limitations including a small sample size and a dropout rate that wasn't initially considered in sample size estimation, potentially affecting the power of the study. Additionally, the duration of the sustainability assessment was limited to three months, and data collection was confined to a single hospital.

Recommendations

Based on the study findings, it is recommended to promote EBP awareness and provide comprehensive training for nurses across various healthcare settings. Assigning highly educated nurses to critical care settings can enhance advanced care delivery. Effective clinical supervision is crucial for sustaining EBP implementation. Larger-scale evaluations of EBP's impact across different nursing specializations and its effects on patient outcomes are recommended. Identifying obstacles to EBP implementation and strategies to bridge the education-practice gap through qualitative and quantitative research methods can further enhance EBP integration in nursing practice.

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