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The Effect of Toolbox Trainings on Nursing Sensitive Quality Indicators: A Randomized Controlled Trial

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ABSTRACT

Introduction: Toolbox training or toolbox talks is short-term training to improve occupational health and safety practices in various sectors. These on-the-job trainings provide employees with opportunities to ask questions and share experiences, facilitating the enhancement of workplace safety practices. The aim of this study is to determine the impact of toolbox trainings provided to nurses on nursing-sensitive quality indicators (pain management, pressure ulcer, patient falls, peripheral venous catheter complications, and adverse event reporting) in the workplace.

Design: Randomized controlled, pre-test, post-test, and control group design.

Methods: Before the toolbox training, pretest measurement instruments were used for the nurses in both the experimental and control groups, and the nursing-sensitive quality indicators were monitored by two independent observers. Toolbox training was provided to nurses in the intervention group on their shift in the respective units. Both groups were followed up at the 8th and 12th weeks after the training. Descriptive tests, independent sample *t*-tests for intergroup comparisons, and repeated and mixed ANOVA for intragroup comparisons were utilized in data analysis.

Results: Significant differences were found between pre-test and post-test scores of the nurses in the group who received toolbox training in terms of falls, pressure ulcers, pain management, peripheral venous catheter, and adverse event reporting ($p < 0.01$). It was observed that the application scores significantly differed among all nurses who received toolbox training according to the findings of both observers, generally increasing in the second follow-up compared to the first, but decreasing in the third follow-up ($p < 0.05$). Evaluated according to unit quality indicators, it was determined that the number of patient falls (mean 4.04, 2.32, and 1.95 respectively), pressure ulcer occurrences (mean 4.48, 2.69, and 2.45 respectively), and the number of patients experiencing peripheral venous catheter complications decreased (mean 26.79, 16.46, and 15.42 respectively) in the units where nurses who received toolbox training worked. The average number of correctly managed pain patients (mean 37.82, 71.61, 69.07 respectively) and the number of reported adverse events (mean 2.79, 6.60, 6.42 respectively) were observed to increase in the second follow-up but decrease in the third follow-up.

Conclusions: As a result, it was determined that on-the-job trainings increased nurses' knowledge level regarding nursing-sensitive quality indicators, improved their practices, and enhanced unit quality indicators. According to the findings of this study, on-the-job trainings provided to nurses were found to be an effective method, and it is recommended to use them in addition to traditional training methods in nurses' in-service education.

Clinical Relevance: There is a growing demand for shorter and different training methods in nurses' education. In addition to classical in-service training methods, this training method, which was applied for the first time in the field of nursing, contributed

to the improvement of quality indicators sensitive to nursing. Our findings emphasize that it will be useful to use this training method in future studies on improving and developing nursing-sensitive quality indicators.
Trail Registration: The study has been registered with ClinicalTrials.gov (NCT05853588)

1 | Introduction

Nursing-sensitive quality indicators are defined by the American Nurses Association (ANA) as "indicators reflecting nursing care or outcomes most affected by nursing care" (Heslop, Lu, and Xu 2014). The concept of nursing-sensitive emphasizes that the nurse's practices contribute more to outcomes and visibly affect them, but it does not imply that nurses and nursing care are solely responsible for the observed patient outcomes (Sim et al. 2018). These indicators, as grouped within Donabedian's Quality Model, encompass structure, process, and outcome indicators in the Nursing Quality Indicators National Database created by the American Nurses Association (ANA). Nursing-sensitive indicators define both the care structures and care processes that influence care outcomes. According to Donabedian's Quality Model, structural elements encompass organizational characteristics of the institution where nursing services are provided, such as the number of nursing hours per patient day, nurses' level of education/certification, and skill level. Process elements include the interventions the nurse implements while providing care (e.g., patient assessment and nursing interventions). Outcome elements focus on the effects of nursing interventions on the patient (e.g., patient falls, pressure ulcers). Some indicators can be used to evaluate both process and outcome. For example, patient falls and fall-related injuries, pressure ulcers, and nurse satisfaction can be assessed as both process and outcome indicators (Montalvo 2007).

In studies related to nursing-sensitive indicators, it has been determined that supervisor support and training provided by supervisors (Driscoll et al. 2018), nurses' level of education and in-service training provided to nurses (Charalambous et al. 2016), care delivered by registered nurses (Chau et al. 2015; Myers, Pugh, and Twigg 2018), teamwork, and nurses' training in quality (Aiken et al. 2011) reduce patient falls and pressure ulcer rates. In a meta-analysis conducted by Dynan and Smith (2022), continuous in-service training was found to impact nursing-sensitive quality indicators related to patient safety. Türkmen et al. (2011) suggest the widespread implementation of in-service training for nurses on quality practices and the use of different training methods in addition to uniform group training methods. In the study by Kanber and Gürlek (2011), 62.5% of nurses stated that the in-service training they received did not meet their needs, 48% indicated that in-service training should be conducted in units rather than classrooms, and 73% reported that they did not regularly attend in-service trainings, only participating when they found time.

Toolbox trainings, also known as toolbox talks or toolbox meetings or safety meetings, are short educational sessions (typically 10–15 min long) conducted on-site to address essential practices without being lengthy or complex, focusing on the core of the topic (Babu and Devi 2020). These sessions are usually utilized in occupational health and safety training. This training method involves the trainer delivering face-to-face sessions to employees directly in the workplace without gathering them in a classroom, often by touring the site or visiting employees (Cavazza and Serpe 2010). It is noted that the use of on-the-job training in professions facing time constraints could be beneficial. Additionally, it is argued that delivering the training without gathering employees in a meeting room saves time (Schwatka et al. 2019).

The Occupational Health and Safety Unit at Harvard University expresses that this training method is an effective approach in preventing workplace accidents (Sparer and Dennerlein 2017). Furthermore, it is suggested that the knowledge levels of those receiving toolbox training will increase more compared to other classical training methods, and participants will be more willing to engage in the training (Grant 2016). In a randomized controlled study conducted by Eggerth et al. (2018) to determine the impact of toolbox trainings, it was found that workers' awareness of occupational health and safety improved, their knowledge increased, and more effective outcomes were achieved in practice. Sixty percent of participants in on-the-job trainings found this training method favorable (Olson et al. 2016), and it has been determined that these trainings are more effective than traditional group trainings (Burke et al. 2006).

In nursing, where there is a high workload, time constraints, and listeners' attention can easily be distracted, the implementation of different training methods such as on-the-job training, short training, and discussion training is recommended (Xu 2016). Safety briefings, which are conducted to enhance the safety culture in healthcare, are typically 15-min meetings aimed at sharing issues that occurred within the last 24 h, anticipating glitches or adverse events, and reviewing solutions to previously identified problems. In a systematic review on the outcomes of safety briefings practices (Ryan et al. 2019), it is noted that briefings indicate positive results in terms of identifying and reducing errors in patient falls, as well as in the length of hospital stays. Safety briefings are similar to toolbox trainings but focus on evaluating safety issues as informative and after-action review sessions, or communication-oriented practices. In this context, considering the lack of research on the application outcomes of toolbox trainings among nurses in the literature, this study examined the impact of this training method on nursing-sensitive quality indicators.

2 | Aim

The aim of this study is to determine the impact of toolbox trainings provided to nurses on nursing-sensitive quality indicators (pain management, pressure ulcer, patient falls, peripheral venous catheter (PVC) related complications, and adverse event reporting) in the workplace.

Research Hypotheses (H) were developed as follows:

Hypothesis 1. *Toolbox trainings provided to nurses affect nurses' knowledge levels on nursing-sensitive quality indicators ((a) pain management, (b) pressure ulcer, (c) patient falls, (d) peripheral venous catheter related complications, and (e) adverse event reporting).*

Hypothesis 2. *Toolbox trainings provided to nurses affect nurses' practices on nursing-sensitive quality indicators ((a) pain management, (b) pressure ulcer, (c) patient falls, (d) peripheral venous catheter related complications, and (e) adverse event reporting).*

Hypothesis 3. *Toolbox trainings provided to nurses affect unit quality indicators ((a) patient fall rates, (b) proportion of patients with correct pain management, (c) pressure ulcer rates, (d) peripheral venous catheter related complication rates, (d) adverse event reporting rates, and (e) average length of stay).*

3 | Methods

3.1 | Design

This study was planned with a randomized controlled, pre-test, post-test, and control group design. The Consolidated Standards of Reporting Trials (CONSORT) template was used in the research. The study was registered in the clinical trials registry www.clinicaltrials.gov (Registration No: NCT05853588). The research design is shown in Figure 1. The flow diagram of the study according to the CONSORT guidelines is also presented in Figure 1.

3.2 | Population, Randomization and Sample

The population of the study consisted of nurses working in the adult patient wards (excluding intensive care units) of a 608-bed (520 service beds) tertiary university hospital in Hatay. Eight of these wards were internal medicine wards, and nine were surgical wards. The total number of nurses working in surgical wards was 73, while the total number of nurses working in internal medicine wards was 78. A power analysis determined that a minimum of 72 nurses in total, with at least 36 nurses in each group, were required for the study with an effect size of $d=0.60$, $\alpha=0.05$, and $\beta=0.20$. Considering possible losses during the follow-up period, it was decided to include at least two reserves in each group. Accordingly, the sample of the study was determined as at least 36 nurses for both the intervention and control groups. The sample of the study was determined using simple random sampling method, one of the probability sampling methods. The inclusion criteria for the intervention and control groups were as follows: working in one of the internal medicine or surgical wards of the hospital; working in the current ward for at least 6 months besides past work experience; completing the orientation process at the hospital and being responsible for patient care; and voluntarily agreeing to participate in the study.

With the assistance of an external person, it was determined that all nurses working in adult services met the inclusion criteria for sampling. Nurses working in a total of four internal medicine and four surgical services were randomly assigned to the intervention and control groups through a lottery. The number of beds and nurses in the included services, as well as the services and number of nurses assigned to the intervention and control groups according to the lottery results, are specified in Table 1. As a result of the lottery, all nurses in the designated services (4 internal medicine and 4 surgical services) were included, thus forming a total of 77 nurses for the sample of the study, with 38 in the intervention group (2 internal medicine, 2 surgical services) and 39 in the control group (2 internal medicine, 2 surgical services) (Table 1).

GPower (v3.1.9) software (Faul et al. 2009) was used to conduct post hoc power analysis following the study. A partial η^2 value of 0.664 was found for the group time interaction effect, corresponding to an effect size of 1.405. In a 2×2 mixed design with independent group factor (2 levels) and repeated measures factor (2 levels), an effect size of $f=1.405$ was used for the group × time interaction effect. The analysis was conducted using the "ANOVA: Repeated Measures, within-between interaction" option from the F test family with a Type 1 error rate of 0.05 and a sample size of 77. As a result, the post hoc power (1-β) after the study was found to be 0.99.

3.3 | Research Process

The data for this study were collected in three phases between October 2021 and April 2022.

3.4 | Pre-Training Phase of the Research (T0)

In this phase of the study, demographic and work-related information was collected from nurses who met the inclusion criteria using the "Nurse Information Form". In addition, nurses in both the intervention and control groups were given the "Nursing-Sensitive Quality Indicators Knowledge Form" and asked to answer the multiple-choice questions contained in this form. In addition, two independent observers (the researcher and an experienced nurse) assessed the nurses' practices through observation using the "Nursing-Sensitive Quality Indicators Implementation Control Checklists". The nurse observer was not informed that the groups were experimental or control groups. Observations using checklists included real-time observation of nursing practice in relation to quality indicators during ward rounds and review of patient or unit records for past practice. The observers also obtained from patient records and unit and hospital reports were recorded in the "Unit Quality Indicators Monitoring Form."

3.5 | Initiative: Toolbox Trainings

After collecting the pre-training data, the training phase commenced. All nurses in the intervention group received face-to-face training by the researchers at least once during their shifts (08–16 and 16–08) while working in the ward where the research was conducted. In order to reach all nurses working both day and night shifts in a ward, the training was delivered at

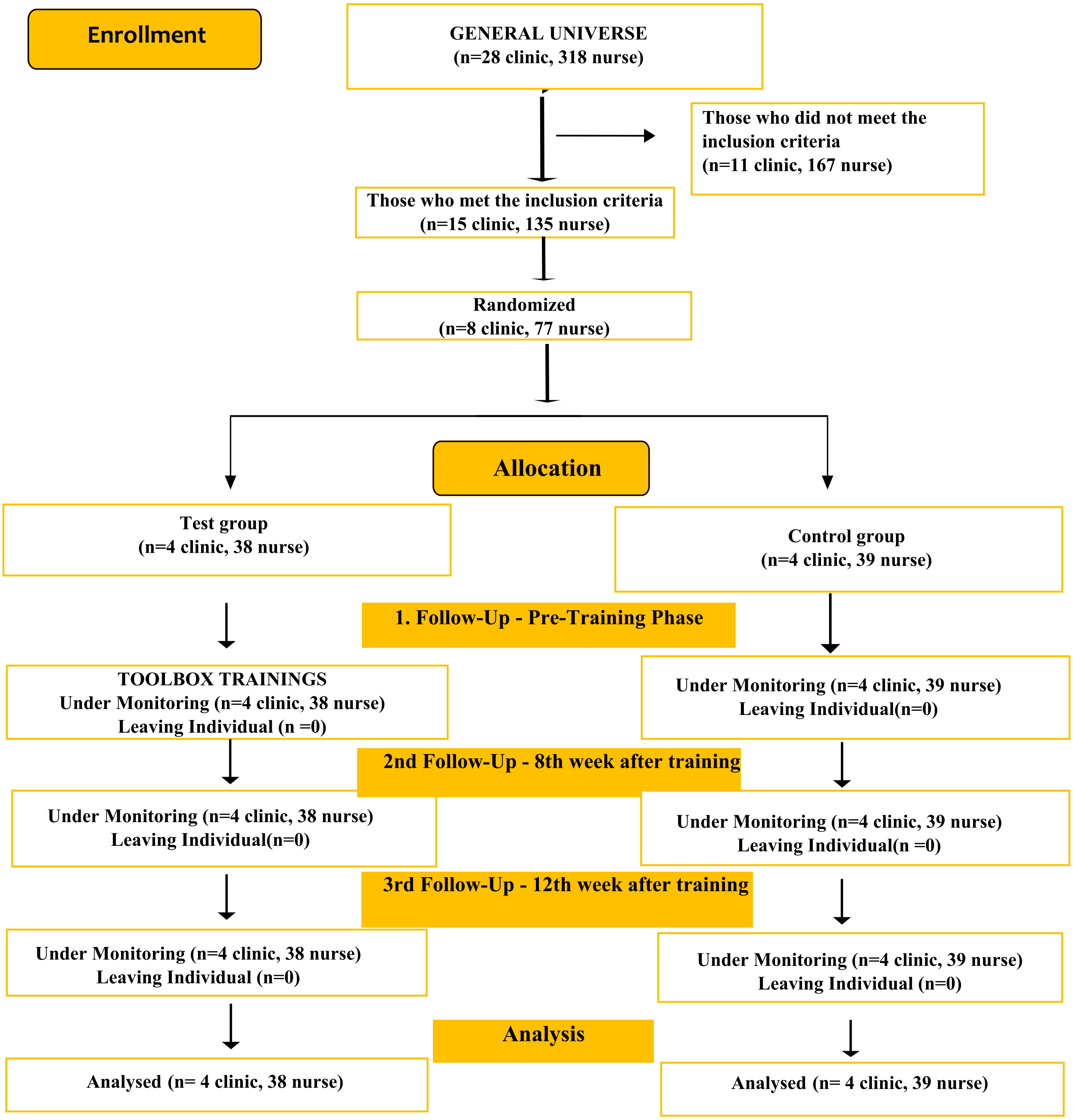

FIGURE 1 | CONSORT 2010 flow diagram.

least three times, up to four times. This ensured that all nurses working in the intervention group wards were reached. The duration of the on-the-job training was planned to be an average of 10–15 min as recommended in the literature, and it was implemented for a minimum of 9 min and a maximum of 13 min.

The titles of the provided trainings and the sequence of delivery were determined as follows: (1) Nursing practices for preventing falls and measures to be taken for falls, (2) nursing practices for preventing pressure ulcers and pressure ulcer prevention, (3) pain management, (4) nursing practices for PVC-related complications and prevention of complications, and (5) reporting of adverse events. During this training, brochures prepared according to the literature on nursing-sensitive quality indicators, containing brief information and illustrations/photos, single-sheet, were used and distributed to nurses after the training was completed.

3.6 | Monitoring Post-Training Results

Upon completion of all trainings (T1), the "Nursing-Sensitive Quality Indicators Practice Knowledge Form" was re-applied to determine the change in the knowledge levels of the nurses. To assess the impact of the provided trainings and to monitor changes in nursing-sensitive quality indicators, 8 weeks after the completion of all trainings (T2), the two observers revisited the units. During these visits, nursing practices and unit quality indicators were re-assessed using the "Nursing Sensitive Quality Indicators Implementation Checklists" and the "Unit

Quality Indicators Monitoring Form". Finally, 4 weeks after the 8-week post-training follow-up (T3), data collection phase was concluded by reassessing with the "Nursing-Sensitive Quality Indicators Practice Control Checklists" and the "Unit Quality Indicators Monitoring Form."

3.7 | Data Collection Tools

3.7.1 | Nurse Information Form

This form consisted of a total of 10 questions aimed at determining the demographic characteristics (5 questions; age, gender, marital status, educational background, postgraduate education) and work-related features (5 questions; weekly working hours, years of experience in the profession, type of employment, unit worked in, education received outside the institution) of the nurses participating in the study.

3.7.2 | Nursing-Sensitive Quality Indicators Application Knowledge Form (Pre-Test—Post-Test)

This form was developed by the researchers of this study to assess the level of knowledge of nurses in both the intervention and control groups regarding nursing-sensitive quality indicators. It was also designed to assess the effectiveness of the toolbox training for the intervention group. The form was created based on the relevant literature (Alcan et al. 2011) and the current quality guidelines (Ministry of Health, Public Hospitals Authority 2014; Healthcare Quality Standards-Hospital Version 6 2020). To establish the face validity of the developed form, it was sent to a sample group of 20 nurses working outside the hospital where the study was conducted. The nurses were asked to answer the questions to provide feedback on the clarity and relevance of the form. This form was administered to both groups before the toolbox training for the intervention group and again after all training sessions were completed.

3.7.3 | Nursing-Sensitive Quality Indicators Application Control Checklists

Draft checklists developed by the researchers of this study based on the literature (Alcan et al. 2011; Ministry of Health, Public Hospitals Authority 2014; Healthcare Quality Standards-Hospital Version 6 2020) consist of five sections aimed at monitoring pain management, pressure ulcer prevention, fall risk, PVC-related complications, and adverse event reporting in the unit. Each section contains items assessing the application of each indicator. For example, there are eight items related to pain management (e.g., follow-up assessment of pain after pain diagnosis was done at recommended intervals according to guidelines), nine items related to pressure ulcer prevention practices (e.g., planned position changes were made at appropriate intervals in immobile (semi or fully immobile) patients or these interventions were identified), seven items related to fall risk prevention (e.g., patients and their relatives received/receive necessary education to prevent falls, and the provided education was/is accurately

TABLE 1 | Number of services and nurses included in the draw and forming the intervention and control groups as a result of the draw.

Number of services and nurses included in the draw						Number of services and nurses determined as a result of the draw			
Internal services	Number of beds	Number of nurses	Surgical services	Number of beds	Number of nurses	Intervention groups (services)	Number of nurses	Control group (services)	Number of nurses
Internal 1	24	7	Surgical 1	24	8	Internal 1	7	Internal 3	16
Internal 2	24	7	Surgical 2	50	15	Internal 4	8	Internal 5	8
Internal 3	24	16	Surgical 3	22	7	Total of internal services	15	Total of internal services	24
Internal 4	21	8	Surgical 4	26	8	Surgical 2	15	Surgical 1	8
Internal 5	24	8	Surgical 5	19	8	Surgical 4	8	Surgical 3	7
Internal 6	21	8	Surgical 6	25	11	Total of Surgical services	23	Total of Surgical services	15
Internal 7	14	7	Surgical 7	24	7				
			Surgical 8	22	10				
Total	152	61	Total	212	74	Total	38	Total	39

and completely documented), seven items related to preventing PVC-related complications (e.g., planned interventions for PVC care were accurately and completely documented), and five items related to adverse event reporting practices (e.g., the system's structure, reporting process, and where to report are known). Checklists require real-time observation of nursing practices and a review of patient or unit records for past practices. Each item is assessed as performed (+) or not performed (−). A score of 1 is given for each item performed and 0 for each item not performed. The measurement tool can score a minimum of 0 and a maximum of 37 points (up to 8 for pain, 9 for pressure ulcers, 7 for fall risk, 7 for PVC-related complications and 5 for adverse events reporting). To establish content validity, the checklists were sent to seven experts, including four academic nurses and three experienced nurses. Content validity was assessed using the Davis Technique. Based on the experts' recommendations for the clarity of expressions, one item was removed from the Adverse Event Reporting Control Checklist. Content validity index was calculated as 0.98 for pain management, 0.95 for pressure ulcers, 0.98 for fall risk, 1.0 for adverse event reporting, and 1.0 for PVC-related complications monitoring list. The control checklists were administered by two independent observers—a researcher and an experienced nurse from outside of the study—at specific intervals: before the training, and at Weeks 8 and 12 after the training. These three follow-ups were conducted to determine the direction of change in practice.

The follow-up scores of nurses in the intervention and control groups were analyzed using a two-way mixed model. The two-way mixed Pearson analysis is used when measurements are taken by two different observers at three different times. No statistically significant difference was found between the observation values according to the observers ($p > 0.05$). Consistency values of intra-class correlation coefficients (ICCs) for the observers were examined. The ICC for all values was found to be 0.926 ($p < 0.001$). The ICC values for pain management, pressure ulcers, falls, adverse event reporting, and PVC-related complications were determined as 0.848, 0.804, 0.604, 0.779, and 0.756, respectively ($p < 0.001$). According to these results, consistency between the two observers was observed.

3.7.4 | Unit Quality Indicators Monitoring Form

The form was developed by the researchers of this study to record five nursing-sensitive quality indicators: Number of falls, percentage of patients receiving correct pain management, number of patients developing pressure ulcers, number of patients developing PVC-related complications, and number of adverse event reports. The average length of stay of patients on the unit before and after toolbox training was also recorded.

3.7.5 | Data Analysis

The data of the study were analyzed using IBM SPSS 25.0 software in a computer environment. Data were given to the statistician blinded to the groups. Post hoc power analysis of the study was conducted using ANOVA: Repeated Measures, within-between interaction in G*Power (v3.1.9) program (Faul et al. 2009). Normality of the data was assessed using Kolmogorov–Smirnov and graphical tests. Descriptive statistics including frequency, percentage, mean, standard deviation, median, minimum, and maximum values were used for the evaluation of descriptive data. Since continuous variables were found to follow a normal distribution, mean ± standard deviation values were used for descriptive statistics. Independent samples *t*-test was used to compare pre-test, post-test scores, and follow-up values between the intervention and control groups. Chi-square (χ^2) test was used to compare categorical variables between the intervention and control groups. Moreover, inter-rater agreement was examined using t-test and intraclass correlation test.

Group differences in post-test pain scores were compared using Analysis of Covariance (ANCOVA), with pre-test pain scores controlled as a covariate. Paired samples *t*-test was used to compare pre-test and post-test scores within each group. Repeated measures analysis of variance (ANOVA) results were used to compare follow-up values (1st follow-up, 2nd follow-up, 3rd follow-up) within each group. Two-way mixed analysis of variance (ANOVA) results were used to investigate whether there were differences in pain management, patient falls, adverse event reporting, pressure ulcer, PVC-related complications, and total scores between the two groups (intervention and control) at different measurement times (pre-test, post-test). Greenhouse–Geisser correction was provided for sphericity assumption in the relevant analyses. Similarly, two-way mixed analysis of variance (ANOVA) results were used to examine whether there were differences in follow-up values (1st follow-up, 2nd follow-up, 3rd follow-up) between the two groups (intervention and control) at different measurement times. Pearson correlation coefficient was used in correlation analysis between pre-test and post-test scores and follow-up values, and unit quality indicators.

3.7.6 | Ethical consideration

To conduct this study, ethical approval was obtained from the Hatay Mustafa Kemal University Non-Interventional Clinical Research Ethics Committee (Date: 06.05.2021, Number:14). Additionally, written permission was obtained from the hospital administration where the study was conducted. Nurses participating in the intervention and control groups were informed about the study and written consent was obtained from them. In the study, measures were taken to minimize bias according to the CONSORT guidelines. First, the experimental and control groups were randomly selected from different wards by a person not involved in the research. Since no nurse refused to participate, all nurses from the designated wards formed the experimental group. To avoid observer bias, an experienced nurse who was not involved in the study but worked at the hospital served as an observer. The observations were assessed by two independent observers and the results were compared. The researcher (also an observer) worked in a different department of the hospital, and there was no hierarchy between the researcher, the other observer, and the participating nurses. The unit's quality indicators were obtained from patient records and data reported to the hospital management.

4 | Results

4.1 | Characteristics of the intervention and control groups

The characteristics of the intervention and control groups are presented in Table 2. In the intervention group, the average age of nurses ($n=38$) was found to be 31.81 ± 6.33 (minimum 27, maximum 47), with 81.6% ($n=31$) being female, 73.7% ($n=28$) being graduates, 76.3% being married, 47.4% ($n=18$) having 6–10 years of professional experience, 65.8% ($n=25$) working in rotating shifts (night–day shifts), and the average weekly working hours being 41.97 ± 3.19 (minimum 40, maximum 50). It was determined that 50% of nurses in the intervention group ($n=19$) had previously received quality education (Table 1).

In the control group, the average age of nurses ($n=39$) was 30.77 ± 5.69 (minimum 23, maximum 46), with 76.9% being female ($n=30$), 87.2% ($n=34$) being graduates, 64.1% being married ($n=25$), 41% ($n=16$) having 1–5 years of professional experience, 61.5% ($n=24$) working in rotating shifts, and the average weekly working hours being 41.79 ± 3.01 (minimum 40, maximum 50). It was found that 46.2% of nurses in the control group ($n=18$) had previously received quality education (Table 2). There was no statistically significant difference between the intervention and control groups in terms of age, weekly working hours, gender, marital status, and previous quality education status ($p>0.05$). Comparison tests could not be performed for other characteristics (Table 2).

4.2 | Comparison of nurses' pre-test and post-test scores

The statistical analysis revealed a significant difference between the pre-test pain scores of the intervention (13.55 ± 4.01) and control (15.51 ± 3.59) groups ($t=2.261$, $p=0.027$, $p<0.05$). The mean pre-test pain score of nurses in the control group was found to be higher than that of the intervention group ($p<0.05$). However, no significant difference was found between the intervention and control groups in terms of pre-test scores for falls, pressure ulcers, PVC-related complications, adverse events, and total scores ($p>0.05$).

Similarly, a statistically significant difference was observed between the post-test scores of the intervention and control groups for patient falls, pressure ulcers, PVC-related complications, adverse events, and total scores ($p<0.05$). Covariance analysis (ANCOVA) was conducted to compare the post-test pain scores (intervention 19.34 ± 1.71; control 14.61 ± 2.89) between groups, with pre-test pain scores being controlled as a covariate. A significant difference was found between the groups ($F=91.612$, $p<0.001$).

When comparing the pre-test and post-test pain, falls, pressure ulcer, PVC-related complications, adverse event, and total scores of nurses in the intervention group, a significant difference was found ($p<0.001$). It was determined that the post-test scores of nurses in the intervention group significantly increased compared to their pre-test scores (Table 3).

TABLE 2 | Characteristics of nurses in the intervention and control groups ($N_{total}=77$).

	Intervention group ($n=38$)	Control group ($n=39$)	Test statistic	
	Mean ± SD	**Mean ± SD**	***t***	***p***
Age	31.81 ± 6.33 (27–47)	30.77 ± 5.69 (23–46)	0.763	0.448
Working hours per week	41.97 ± 3.19 (40–50)	41.79 ± 3.01 (40–50)	0.253	0.801
	***n* (%)**	***n* (%)**	χ^2	***p***
Gender				
Female	31 (81.6)	30 (76.9)	0.253	0.615
Male	7 (18.4)	9 (23.1)		
Education level				
Health vocational high school	9 (23.7)	3 (7.7)	*	*
Bachelor	28 (73.7)	34 (87.2)		
Postgraduate	1 (2.6)	2 (5.1)		
Marital status				
Married	29 (76.3)	25 (64.1)	1.370	0.242
Single	9 (23.7)	14 (35.9)		
Working time in the profession				
1–5 years	8 (21.1)	16 (41.0)	*	*
6–10 years	18 (47.4)	10 (25.6)		
11–15 years	6 (15.8)	11 (28.2)		
16–20 years	2 (5.3)	1 (2.6)		
21 years and above	4 (10.5)	1 (2.6)		
Shifts				
Continuous daytime	12 (31.6)	8 (20.5)	*	*
Continuous night	1 (2.6)	7 (17.9)		
Rotating shifts (day and night)	25 (65.8)	24 (61.5)		
Receiving quality training before				
Yes	19 (50.0)	18 (46.2)	0.114	0.736
No	19 (50.0)	21 (53.8)		

Abbreviations: χ^2, Chi-square test statistic; t, Independent sample t test;
* Analysis could not be performed due to insufficient number of subjects.

In contrast, when comparing the pre-test and post-test scores of nurses in the control group, only a significant difference was found in pressure ulcer scores ($t=2.903$, $p=0.006$). It

TABLE 3 | Comparison of pre-test and post-test scores of nurses in the intervention and control groups according to score types.

	Intervention group (n = 38)				Control group (n = 39)			
	Pretest	Posttest	Test statistics		Pretest	Posttest	Test statistics	
	Mean ± SD	Mean ± SD	t	p	Mean ± SD	Mean ± SD	t	p
Patient Falls Test Score	12.10 ± 3.61	17.50 ± 3.24	7.294	< 0.001**	12.43 ± 3.78	13.20 ± 3.14	1.062	0.295
Pressure Ulcer Test score	14.60 ± 3.92	19.74 ± 1.13	7.701	< 0.001**	15.26 ± 4.28	12.82 ± 4.56	2.903	0.006**
Pain Management Test Score	13.55 ± 4.01	19.34 ± 1.71	9.463	< 0.001**	15.51 ± 3.59	14.61 ± 2.89	1.482	0.147
PVC-Related Complications Test Score	12.24 ± 4.30	18.68 ± 2.23	9.168	< 0.001**	13.46 ± 4.46	13.33 ± 5.17	0.110	0.913
Adverse Event Reporting Test Score (AER)	10.66 ± 2.64	15.00 ± 2.59	8.055	< 0.001**	10.89 ± 3.60	10.51 ± 3.20	0.502	0.618
Total score	63.55 ± 9.15	90.26 ± 4.64	15.615	< 0.001**	67.69 ± 10.05	65.13 ± 6.83	1.515	0.138

Abbreviation: t, dependent sample t test.
**$p < 0.01$.

was observed that the mean post-test pressure ulcer score (12.82 ± 4.56) decreased compared to the mean pre-test score (15.26 ± 4.28). No significant difference was found in the pre-test and post-test scores of the control group for pain management, patient falls, PVC-related complications, adverse event reporting, and total scores ($p > 0.05$) (Table 3). Thus, the findings supported the H1.

4.3 | Comparison of observations made by observers

The scores of the first and second observers for the three observations were compared between the intervention and control groups and presented in Table 4. A significant difference was found between the scores of the first and second observers for all observation points in both the intervention and control groups ($p < 0.05$). The mean scores of the intervention group nurses for pain management at the 2nd and 3rd observations, pressure ulcer at the 2nd and 3rd observations, falls at the 2nd and 3rd observations, adverse event reporting at the 2nd and 3rd observations, and PVC-related complications at the 2nd and 3rd observations were significantly higher compared to the control group. However, the mean scores of the intervention group nurses for falls at the 1st observation, pressure ulcer at the 1st observation, PVC-related complications at the 1st observation, and adverse event reporting at the 1st observation were significantly lower compared to the control group, as determined by the first observer. Similarly, the mean scores of the intervention group nurses for falls at the 1st observation, pressure ulcer at the 1st observation, pain management at the 1st observation, PVC-related complications at the 1st observation, and adverse event reporting at the 1st observation were significantly lower compared to the control group, as determined by the second observer ($p < 0.05$) (Table 4).

According to the mixed ANOVA results for repeated observations by the first and second observers, a significant difference was found between all observation scores of the intervention and control groups (F^1 values, $p < 0.001$). Additionally, all observation scores showed significant differences over time (F^2 values; $p < 0.001$). Furthermore, an interaction effect of group*-time was observed for all observation scores, indicating a significant difference (F^3 values, $p < 0.001$) (Table 4). Thus, the H2 was confirmed.

4.4 | Comparison of quality indicators of services

When comparing the averages of quality indicators in the intervention and control groups, including the number of falling patients, the rate of correct pain management, the number of developing pressure ulcers, the number of patients with PVC-related complications, the number of adverse event reports, and the average length of stay, a significant difference was found in all comparisons except for the 1st observation of pressure ulcers ($p = 0.075$, $p > 0.05$) (F^1 values, $p < 0.001$). In the intervention group, a decrease was observed in the average number of falling patients, the average number of developing pressure ulcers, the average number of patients with PVC-related complications, and the average length of stay (except for the average days of stay in the 2nd and 3rd observations). However, while the rate of correct pain management showed an increase in the 2nd observation compared to the 1st observation, a decrease was observed in the 3rd observation. The average number of adverse event reports showed an increase in the 2nd and 3rd observations compared to the 1st observation (e.g., Figure S1). Significant differences over time were observed in all indicators (F^2 values, $p < 0.001$). Additionally, when evaluating the group × time interaction for all indicators, a statistically significant difference was found (F^3 values, $p < 0.001$) (Table 5). Based on these findings, the H3 was confirmed.

5 | Discussion

This study encompasses the initial results of the first application of toolbox trainings in nursing, a method frequently utilized in occupational health and safety in the manufacturing sector. In this regard, it demonstrates the impact of a new and different method

TABLE 4 | Comparison of observers' application monitoring results in intervention and control groups.

	1st observer			2nd observer		
	Intervention group ($n = 38$)	Control group ($n = 39$)	Test statistics	Intervention group ($n = 38$)	Control group ($n = 39$)	Test statistics
	Mean ± SD	Mean ± SD	F/p	Mean ± SD	Mean ± SD	F/p
Patient falls						
1st follow-up	4.05 ± 0.84	4.79 ± 0.61	$F^1 = 65.335$	4.10 ± 1.03	5.00 ± 0.56	$F^1 = 43.640$
2nd follow-up	6.68 ± 0.47	4.87 ± 0.57	$F^2 = 110.198$	6.71 ± 0.51	4.97 ± 0.54	$F^2 = 82.736$
3rd follow-up	5.84 ± 0.55	4.38 ± 0.78	$F^3 = 115.063$	5.79 ± 0.58	4.54 ± 0.75	$F^3 = 97.399$
			$p^1 = 0.001$**			$p^1 = 0.001$**
			$p^2 < 0.001$**			$p^2 < 0.001$**
			$p^3 < 0.001$**			$p^3 < 0.001$**
Pressure ulcer						
1st follow-up	3.71 ± 1.14	5.13 ± 1.05	$F^1 = 71.004$	3.68 ± 1.16	4.97 ± 0.93	$F^1 = 88.459$
2nd follow-up	8.13 ± 0.41	5.10 ± 0.82	$F^2 = 267.693$	8.08 ± 0.49	5.00 ± 0.94	$F^2 = 222.521$
3rd follow-up	7.24 ± 0.71	4.56 ± 0.99	$F^3 = 325.258$	7.26 ± 0.64	4.56 ± 0.97	$F^3 = 251.098$
			$p^1 = 0.001$**			$p^1 = 0.001$**
			$p^2 < 0.001$**			$p^2 < 0.001$**
			$p^3 < 0.001$**			$p^3 < 0.001$**
Pain Management						
1st follow-up	3.84 ± 0.44	4.13 ± 0.77	$F^1 = 182.515$	3.79 ± 0.47	4.18 ± 0.79	$F^1 = 137.160$
2nd follow-up	6.95 ± 0.65	4.08 ± 0.66	$F^2 = 238.830$	6.95 ± 0.73	4.10 ± 0.72	$F^2 = 280.085$
3rd follow-up	6.10 ± 0.51	4.00 ± 0.65	$F^3 = 263.776$	6.05 ± 0.46	4.05 ± 0.65	$F^3 = 316.605$
			$p^1 = 0.001$**			$p^1 = 0.001$**
			$p^2 < 0.001$**			$p^2 < 0.001$**
			$p^3 < 0.001$**			$p^3 < 0.001$**
PVC-related Complications						
1st follow-up	3.53 ± 0.76	4.31 ± 0.79	$F^1 = 41.596$	3.39 ± 0.64	4.28 ± 1.14	$F^1 = 34,529$
2nd follow-up	6.08 ± 0.36	4.31 ± 0.79	$F^2 = 130.444$	6.10 ± 0.31	4.20 ± 0.92	$F^2 = 129,678$
3rd follow-up	5.55 ± 0.60	3.89 ± 0.88	$F^3 = 162.537$	5.63 ± 0.49	3.97 ± 0.90	$F^3 = 166,298$
			$p^1 = 0.001$**			$p^1 = 0.001$**
			$p^2 < 0.001$**			$p^2 < 0.001$**
			$p^3 < 0.001$**			$p^3 < 0.001$**
Adverse event reporting						
1st follow-up	1.81 ± 0.83	2.46 ± 0.72	$F^1 = 63.271$	1.74 ± 0.79	2.61 ± 0.78	$F^1 = 31,117$
2nd follow-up	4.58 ± 0.55	2.46 ± 0.68	$F^2 = 252.615$	4.60 ± 0.55	2.61 ± 0.81	$F^2 = 298,717$
3rd follow-up	3.92 ± 0.43	2.31 ± 0.61	$F^3 = 271.207$	3.87 ± 0.41	2.49 ± 0.85	$F^3 = 315,165$
			$p^1 = 0.001$**			$p^{1,2,3} < 0.001$
			$p^2 < 0.001$**			
			$p^3 < 0.001$**			

Abbreviations: F, Two-way mixed ANOVA test; $F1$, Between groups; $F2$, Between time-dependent measurements; $F3$, group × Time.
**$p < 0.01$.

for in-service training in nursing. Significant differences were observed between pre-test and post-test scores of falls, pressure ulcers, pain management, PVC-related complications, and incident reporting among nurses in the intervention group where toolbox training was provided. The post-test scores of nurses in the intervention group were significantly higher than those in the control group. Previous studies conducted outside the healthcare sector (Kaskutas et al. 2016; Mushayi, Deacon, and Smallwood 2018; Al-Shabbani 2019; Al-Shabbani, Sturgill, and Dadi 2020) also indicate that on-the-job training increases employees' knowledge levels. In a study with highway workers (Al-Shabbani, Sturgill, and Dadi 2020), it was found that toolbox training increased workers' post-training knowledge level by 45%, and in another study (Al-Shabbani 2019), by 28%. Similarly, studies providing occupational health and safety training to construction workers through toolbox training (Kaskutas et al. 2016; Mushayi, Deacon, and Smallwood 2018) have shown a significant increase in workers' knowledge levels in occupational health and safety practices. In a randomized controlled study evaluating the effectiveness of on-the-job training (Eggerth et al. 2018), a significant difference was

TABLE 5 | Mix ANOVA results in repeated measurements in the intervention and control groups according to unit quality indicators.

	Intervention group ($n=4$)	Control group ($n=4$)	Test statistics	
	Mean ± SD	Mean ± SD	F	p
Number of patient falls				
1st follow up	4.04 ± 2.08	3.91 ± 1.70	$F^1=7.864$ $F^2=109.972$ $F^3=78.827$	$p^1=0.006$** $p^2<0.001$** $p^3<0.001$**
2nd follow up	2.32 ± 1.97	3.78 ± 1.62		
3rd follow up	1.95 ± 0.87	3.72 ± 1.46		
Number of patients with pressure sores				
1st follow up	4.48 ± 1.04	3.66 ± 1.33	$F^1=3.263$ $F^2=289.187$ $F^3=267.817$	$p^1=0.075$ $p^2<0.001$** $p^3<0.001$**
2nd follow up	2.69 ± 0.66	3.65 ± 1.33		
3rd follow up	2.45 ± 0.65	3.60 ± 1.17		
Rate of patients with correct pain management				
1st follow up	37.82 ± 7.79	32.37 ± 3.34	$F^1=197.466$ $F^2=672.636$ $F^3=682.458$	$p^1<0.001$** $p^2<0.001$** $p^3<0.001$**
2nd follow up	71.61 ± 13.53	31.91 ± 2.71		
3rd follow up	69.07 ± 14.34	32.69 ± 3.08		
Number of patients with PVC-related complications				
1st follow up	26.79 ± 5.03	28.96 ± 12.09	$F^1=23.616$ $F^2=246.571$ $F^3=351.609$	$p^1<0.001$** $p^2<0.001$** $p^3<0.001$**
2nd follow up	16.46 ± 3.81	29.45 ± 12.33		
3rd follow up	15.42 ± 2.41	29.91 ± 12.43		
Number of adverse event reporting (AER)				
1st follow up	2.79 ± 1.19	3.20 ± 0.41	$F^1=150.938$ $F^2=111.845$ $F^3=329.245$	$p^1<0.001$** $p^2<0.001$** $p^3<0.001$**
2nd follow up	6.60 ± 1.19	2.41 ± 0.82		
3rd follow up	6.42 ± 1.48	1.97 ± 1.29		
Number of hospitalization days				
1st follow up	6.28 ± 0.82	6.22 ± 2.38	$F^1=7.601$ $F^2=174.352$ $F^3=256.494$	$p^1=0.007$** $p^2<0.001$** $p^3<0.001$**
2nd follow up	4.46 ± 0.48	6.32 ± 2.69		
3rd follow up	4.75 ± 0.62	6.49 ± 2.67		

Note: Number of patients with correct pain management/group average of the number of inpatients, F = Two-way mixed analysis of variance (two way mixed ANOVA test), $F1$ = Between groups, $F2$ = Between time-dependent measurements, $F3$ = Group × Time.
**$p<0.01$.

found between the post-test scores of those who received toolbox training and those who did not. However, no research could be accessed on the application of toolbox training in the healthcare sector and among nurses. The findings from this study support the literature indicating the effectiveness of toolbox training. It is believed that the effectiveness of toolbox training for nurses lies in providing information that employees will use in a concise, clear, and directly applicable manner. In fact, in a study demonstrating the performance of in-service training for nurses, the importance of more frequent and shorter-duration in-service trainings for the effectiveness of in-service training was emphasized (Dönmez 2020).

In the study, when the practices of nurses in the intervention group were evaluated for all indicators, significant differences were found between the mean scores of the three observations made by both observers. According to the findings of both observers, the mean scores of falls, pressure ulcers, pain management, PVC-related complications, and incident reporting in the intervention group were lower in the 1st observation compared to the 2nd observation. However, it was determined that the mean scores in the 2nd observation were higher than those in the 3rd observation. In adult professional in-service training, the primary goal is to increase the participants' knowledge level on the subject matter and achieve the desired behavior change (Terzioğlu et al. 2016). Elmas (2019) found high compliance scores in isolation measures in his study observing compliance with isolation measures after in-service training. In a study where practices such as medication administration, intravenous procedures, respiratory system aspiration, immobile patient care, specimen collection, patient admission, and discharge were observed following in-service training using lecture presentation method, it was determined that the mean observation scores increased for each practice, and there was a significant difference between the pre-training and post-training practice scores. In a study examining evidence-based practice attitudes resulting from in-service training (Baran, Atasoy, and Şahin 2020), nurses' evidence-based practice attitudes were observed before and after training, and it was found that practice scores increased immediately after the training. The results obtained in this study are parallel to the literature, indicating the effectiveness of toolbox trainings on nursing practices. It can be said that nurses encountering such a training method for the first time and the training being conducted in their work areas and within short periods positively reinforce nurses' learning motivation. It is emphasized that the COVID-19 pandemic has highlighted the importance of in-service training for nurses, but it is also emphasized that alternative methods should be applied in the training different from traditional training methods (Yalnız et al. 2020).

The practical nature of the training content may have motivated nurses to apply what they learned. When comparing the test scores of industrial workers who received on-the-job training and students on internships, it was found that the students' scores were lower than those of the workers. This result was interpreted as possibly stemming from workers directly applying the knowledge and finding a direct area to use the information (Hashem M. Mehany, Killingsworth, and Shah 2021). Additionally, the personalized nature of the training due to the relatively small number of nurses on shifts may have contributed to the effectiveness of the training. Indeed, it is stated that having as small groups as possible for the groups receiving on-the-job training increases the effectiveness of the training (Eggerth et al. 2018). On the other hand, according to the study results, the slight decrease in mean scores in the 3rd observation in the intervention group could be explained by the diminishing effect of the training over time, or it could be attributed to a flexibility caused by the difficulty of working conditions or inadequacies in the work environment. These study results suggest that follow-up research should evaluate the effectiveness of training provided to nurses over longer periods through observational studies.

In the study, when evaluating the impact of toolbox training on nursing-sensitive quality indicators in the units, significant improvements were observed in the indicators for units with the intervention group compared to those in the control group. Quality indicator results in the units where intervention group nurses worked were notably better than those obtained before the training. These findings indicate that the toolbox training positively influenced the quality indicator outcomes in these units. In the construction sector, toolbox training on occupational health and safety has led to a decrease in accident rates (Choudhry, Fang, and Rowlinson 2008; Rice et al. 2022).

However, there are limited studies examining the impact of different training methods on quality indicators. For instance, McVey et al. (2022) reported that nurses increased awareness of central venous catheter infections during the COVID-19 period by distributing brochures and infection prevention booklets. Before the training, the infection rate was 43%, which decreased to 19.4% in the 10th month post-training (McVey et al. 2022). Similarly, Reiter-Palmon et al. (2015) found that briefings about errors following patient falls reduced injury rates from 40% to 20%. Pannick et al. (2017) observed an increase in unwanted event reporting rates after briefings, with a significant difference noted between the number of reports before and after. Öncü (2017) also found a 15% increase in the reporting of patient falls following face-to-face evidence-based practice training for nurses. Additionally, the average length of hospital stay decreased from 8.56 days in the 3rd month after training to 7.33 days in the 6th month.

In this context, the study's finding that toolbox training generally improved quality indicators aligns with existing literature. Notably, the decrease in patients' length of stay is a significant finding. This reduction may be related to improvements in other quality indicators, such as reduced pressure ulcer rates, fewer complications related to peripheral venous catheters, and fewer patient falls.

5.1 | Limitations

Although the study was conducted in accordance with the CONSORT guidelines, there are some limitations. First of all, the fact that the study was conducted in only one hospital can be considered as a limitation. The nurses' previous education on the subject and their experiences with the practices may have affected the results. Since the sample was randomized according to the services, the differences between the intervention and control groups may have been affected by factors such as the work environment of the service, the leadership of the responsible nurse and the dynamics among the healthcare team. However, even though the observation before and after the training was conducted through a structured checklist and necessary precautions were taken to avoid observer bias (e.g., observation with two independent observers; the experienced nurse as observer does not know the groups), the possibility of observer bias should not be forgotten. This possibility can be investigated in future studies. The final follow-up, the 3rd follow-up, was conducted at the 12th week after the training. Results obtained with longer follow-ups in future studies may provide information about the duration of the training's effectiveness.

6 | Conclusion

To our knowledge, this study is the first to examine the use of toolbox training method in nursing. It was found that the final test scores of nurses in the intervention group were significantly higher than their pre-test scores in terms of patient falls, pressure ulcers, pain management, PVC-related complications, and adverse events reporting. Additionally, observations conducted by two observers in the workplace revealed positive developments in practices related to patient falls, pressure ulcers, pain management, PVC-related complications, and adverse events reporting. Finally, significant improvements were observed in the quality indicators of the services where nurses in the intervention group worked. This result indicates that providing nurses with on-the-job training using the toolbox trainings method is effective in enhancing nurses' knowledge and practices related to nursing-sensitive quality indicators. Furthermore, it demonstrated a positive impact on the quality indicators of the unit. Thus, all hypotheses were accepted. In healthcare services, the increasing demands each day have led to a rise in mandatory training for employees (McAuliffe and Gledhill 2022). With the pandemic, conducting these trainings online has become more prevalent. It is believed that innovative approaches with effective outcomes are needed for in-service nurse training. Our findings demonstrate the potential of toolbox training methods for application in nurse education and professional development for nurse educators and managers. Therefore, the toolbox training method is recommended to be used as an alternative or additional approach to traditional or standard training methods, especially in unit-level practical trainings in health care settings. Toolbox trainings can also be integrated into continuous professional development programs such as guidance nursing and mentoring, benefiting nurses' professional growth. Additionally, the ability of toolbox training to facilitate feedback from employees and supervision highlights the need for implementing strategies to expand its use. The results of this study also provide a basis for future research. Future studies could investigate the effectiveness of toolbox training in different subject areas and for different sample groups. The long-term effects of toolbox training on nursing practice and patient outcomes could be monitored and compared with other training methods.

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Ethics Statement

Hatay Mustafa Kemal University Non-Interventional Clinical Research Ethics Committee (Date: 06.05.2021, Number:14).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

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

Clinical Resources

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.