

# The Effect of Constructivist Training on the Rate of Catheter-Associated Urinary Tract Infections in the Intensive Care Unit

## Yoğun Bakım Ünitesinde Kateterle İlişkili İdrar Yolu Enfeksiyon Oranlarına Yapılandırmacı Eğitimin Etkisi

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### ABSTRACT

**Objective:** Catheter-associated urinary tract infections (CA-UTIs) are common healthcare-associated infections. Constructivist training is based on integrating new knowledge with previously learned knowledge. The aim of this study was to evaluate the effects of constructivist training on the rate of CA-UTIs in the Anesthesia and Reanimation Intensive Care Units (ARICU).

**Methods:** This study was a retrospective-prospective intervention study. Over the period of one month, a total of 62 healthcare staff (seven doctors, 38 nurses, and 17 cleaning staff) working in ARICUs were organized into groups of 4-5 people and received forty-five minutes of constructivist training on preventing CA-UTI. Personnel from each of three ICUs participated in the same number of training sessions. Comparisons were made of the rates of CA-UTI and catheter use in the six-month periods before and after the training. A 4-item questionnaire was administered to the study participants six months after completion of the training.

**Results:** The catheter-associated urinary tract infection rates before and after training were observed to be 8.3 and 8.7 per 1000 catheter days, respectively in ARICU-1, 7.0 and 8.1 per 1000 catheter days in ARICU-2, and 7.3 and 9.9 per 1000 catheter days in ARICU-3. No statistically significant difference was observed in the CA-UTI rate in each unit after constructivist training compared to the pre-training period. The intervention of constructivist training alone did not reduce the CA-UTI rates in the ICUs. According to the results of the survey conducted six months later, 92% of the nurses and 88% of the cleaning staff stated that constructivist training had positive effects.

**Conclusion:** The intervention of constructivist training alone did not reduce the rates of CA-UTIs in the ARICUs, but an increase was observed in the awareness of ICU nurses and cleaning staff.

**Keywords:** Constructivist training, intervention study, urinary tract infection, intensive care units, health personnel.

### ÖZ

**Amaç:** Kateter ilişkili üriner sistem enfeksiyonları (Kİ-ÜSE) sık görülen sağlık hizmetiyle ilişkili enfeksiyonlardır. Yapılandırmacı eğitim, yeni bilginin daha önce öğrenilen bilgiyle bütünleştirilmesi temeline dayanır. Bu çalışma, yapılandırmacı eğitimin Anestezi ve Reanimasyon Yoğun Bakım Üniteleri'nde (ARYBÜ) Kİ-ÜSE hızına olan etkisini değerlendirmeyi amaçlamaktadır.

**Yöntem:** Çalışmamız, retrospektif olarak tasarlanmış prospektif bir müdahale çalışmasıdır. Bir ay boyunca, ARYBÜ'lerde çalışan 62 sağlık personeli (yedisi doktor, 38'i hemşire ve 17'si temizlik personeli), 4-5 kişilik küçük gruplara ayrıldı ve bu gruplara Kİ-ÜSE'nin önlenmesi konusunda yaklaşık kırkbeş dakika süren yapılandırmacı eğitim verildi. Her üç yoğun bakımın personelleri aynı sayıda eğitim oturumuna katıldı. Çalışmada Kİ-ÜSE hızı ve kateter kullanım oranı eğitimden önceki altı ay ve eğitimden sonraki altı ay süresince karşılaştırıldı. Yapılandırmacı eğitim verildikten altı ay sonra katılımcılara dört sorudan oluşan bir anket uygulandı.

**Bulgular:** ARYBÜ'lerde Kİ-ÜSE hızı eğitim öncesi ve sonrası sırasıyla bin kateter gün başına ARYBÜ-1'de 8,3 ve 8,7, ARYBÜ-2'de 7,0 ve 8,1 ve ARYBÜ-3'te 7,3 ve 9,9 olarak gözlemlendi. Her bir üniteye yapılandırmacı eğitim sonrası, öncesi döneme göre Kİ-ÜSE hızında istatistiksel olarak anlamlı bir fark gözlemlenmedi. Yapılandırmacı eğitim müdahalesi, yoğun bakım ünitelerinde Kİ-ÜSE hızını tek başına azaltmadı. Çalışmaya katılanlara 6 ay sonra yapılan anket sonucuna göre; hemşirelerin %92'si ve temizlik personelinin %88'i yapılandırmacı eğitimin olumlu etkisi olduğunu belirtti.

**Sonuç:** Yapılandırmacı eğitim müdahalesinin tek başına ARYBÜ'lerdeki Kİ-ÜSE hızını azaltmadığı, ancak YBÜ yardımcı personelleri ve hemşireleri arasındaki farkındalığı artırdığı görüldü.

**Anahtar sözcükler:** Yapılandırmacı eğitim, müdahale çalışması, üriner sistem enfeksiyonu, yoğun bakım üniteleri, sağlık personeli.

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## INTRODUCTION

Infections related to healthcare typically involve the respiratory system, blood infections resulting from intravenous catheters, and catheter-associated urinary tract infections (CA-UTI) (1). Although they vary according to hospitals and departments, urinary tract infections are the most frequently seen healthcare-related infections worldwide. It has been shown that urinary tract infections account for 30-40% of all healthcare-associated infections and that 80-95% of urinary tract infections are associated with urinary catheters (2). It is estimated that an urinary catheter is applied at least once during hospitalization to 12-25% of patients, and an increase has been reported in the use of urinary catheters in recent years (3). Previous studies in Türkiye that have examined Intensive Care Unit (ICU) data in different cities have reported rates of 7.5-8.3 CA-UTIs per 1000 urinary catheter days (4, 5). One of those studies showed that the presence of CA-UTI could increase mortality by up to 10% (5). Other studies related to this subject have stated that in patients developing CA-UTI morbidity and mortality rates increased by 2.8-fold and the hospital stay was prolonged by 1-3 days (6). Reducing this common problem, the majority of cases of which can be prevented according to previous studies and infection control recommendations, is extremely important in respect of both patient outcomes and healthcare costs (7). Therefore, there is a need for a practice that can potentially reduce CA-UTI rates.

Learning in constructivist training is based on establishing a link between existing and new knowledge and integrating each piece of new information with existing knowledge (8). The role of the trainer in constructivist training is not to disseminate knowledge but to encourage and provide opportunities for the students to build their knowledge (9). Constructivist learning aims to provide learning opportunities for the mental understanding of the information learned (10,11). Constructivist training environments are those in which the individuals interact more with the learning environment and should, therefore, be organized to provide an enriched learning experience. This gives individuals the opportunity to test what they have previously learned, correct mistakes, and even abandon previous knowledge and replace it with new information (12,13).

Previous interventional studies aimed at reducing CA-UTI in ICUs have not applied constructivist training. The most frequently applied intervention to reduce the rate of CA-UTI is the application of a bundle program. Therefore, there is a lack of information in the literature on the use of constructivist training.

The aim of this study was to evaluate the effects of constructivist training applied to health care personnel working in the Anaesthesia and Reanimation Intensive Care Units (ARICUs) of our hospital on the rate of CA-UTIs.

## MATERIAL and METHODS

This study was designed as a prospective intervention and retrospective analysis. Approval for the study was received from the Ethics Committee of the Ankara Training and Research Hospital (decision no: 5576), and all procedures were applied in compliance with the Helsinki Declaration. Written informed consent was obtained from all the participants.

The study was conducted in a tertiary-level hospital, in three separate tertiary ARICUs with a total bed capacity of 25 (ARICU-1: 11 beds, ARICU-2: 5 beds, and ARICU-3: 9 beds). All 62 healthcare staff in the three ICUs participated in the study (seven doctors, 38 nurses, and 17 cleaning staff). The healthcare staff working in each unit are 17 nurses and 7 cleaning staff in ARICU-1, 8 nurses and 4 cleaning staff in ARICU-2, and 13 nurses and 6 cleaning staff in ARICU-3. Seven doctors working in all three units were also included in the study. The constructivist training was also given to the doctors included in the study. The number of patients cared for by each nurse was examined and it was seen that each nurse was responsible for three patients on a shift. A record was made of the profession of the cleaning staff, education levels, duration of working, number of shifts, and how many patients they were responsible for on a shift.

A total of 62 ARICU staff participated in a month-long training course on CA-UTI prevention, led by two specialists in infectious diseases and clinical microbiology. These two doctors were only responsible for delivering training and were not involved in any other study phase. The training consisted of eight sessions for small groups of 4-5 nurses, each averaging 47 minutes. In addition, four sessions for small groups of cleaning staff were conducted, each lasting an average of 45 minutes. During these training sessions, the questions listed in Table I were discussed with the nurses and cleaning staff. The participants' knowledge was assessed based on their level of education. Each professional group received a short visual presentation tailored to their needs. Throughout the six-month follow-up period, new personnel joining the ICU team were monitored and this constructivist training program was given from the time they started working in the ICU.

Catheter-associated urinary tract infections, what can be done to prevent these, the bundle program applied, and the problems that can cause CA-UTI development were discussed in the groups and responses were noted. The cleaning staff, nurses, and doctors were interviewed again separately to discuss the problems identified during the constructivist training. Each issue was addressed individually, discussing potential solutions were discussed, and attempts were made to eliminate the problems.

Six months after the implementation of the constructivist training, the nurses and cleaning staff were asked four questions (Table II) to evaluate the contribution of the training and their conformity to the bundle program.

### Data Collection

Surveillance data for the six-month period before the constructivist training, including the ARICU, CA-UTI rates, and catheter use rates, were obtained from the National Hospital Infection Surveillance System (NHIS) through the Hospital Infection Control Committee (ICC). The six-month surveillance data were then obtained for the period following the one-month program of constructivist training, and the ICC evaluated the cases. A comprehensive assessment was made to compare the data gathered six months before and after the introduction of the constructivist training. The primary outcome of this study was to evaluate changes in the CA-UTI rate. The secondary outcome of the study was to assess changes in staff awareness of CA-UTI through a post-training survey.

### Statistical Analysis

Data obtained in the study were analyzed statistically using SPSS v 15.0 software (IBM Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL, USA). The conformity of continuous data to normal distribution was assessed with the Kolmogorov-Smirnov test and the Shapiro-Wilk test. Descriptive

statistical analysis results were stated as mean  $\pm$  standard deviation values for continuous variables and number (n) and percentage (%) for categorical variables. Cross tables were used in the statistical evaluations. The Independent Samples t-test and One-Way variance analysis were applied to data showing normal distribution, and the Mann-Whitney U-test and the Kruskal Wallis test were used for data not conforming to normal distribution. In order to identify differences between the groups in the cross-tables, the Chi-square test was utilized, and if the assumptions for the Chi-square test were not met, the Fisher test was applied. A value of  $p < 0.05$  was accepted as the level of statistical significance. In the power analysis conducted with an  $\alpha = 0.05$  error (95% confidence) using the pre- and post-education hospitalization times of patients and the study's sample size, the effect size was calculated as 0.25, and the power as 0.45. G\*Power software version 3.1.9.7 was used for the power analysis.

## RESULTS

In the examination of the sociodemographic characteristics of the healthcare workers included in the study, it was seen that the nurses comprised 13% males and 87% females. The cleaning staff were 41% males and 59% females, with a mean age of 42 years, and the majority (59%) had an education level of primary school. After analyzing the cleaning staff's schedule in the ICU for a year during this study, it was observed that

**Table I.** Questions Asked to the Nurses and Other Healthcare Workers During the Constructivist Training

Questions asked to the nurses	Questions asked to the cleaning staff
What does hospital surveillance mean?	What is a healthcare-associated infections?
Do you think a urinary catheter should be placed in every patient?	How do you think a catheter-associated urinary tract infection can form?
How can a catheter-associated urinary tract infection form?	What can be done to prevent urinary catheter-associated urinary tract infections?
What can be done to prevent urinary catheter-associated urinary tract infections?	How is the catheter bag emptied?
Is the closed system protected?	

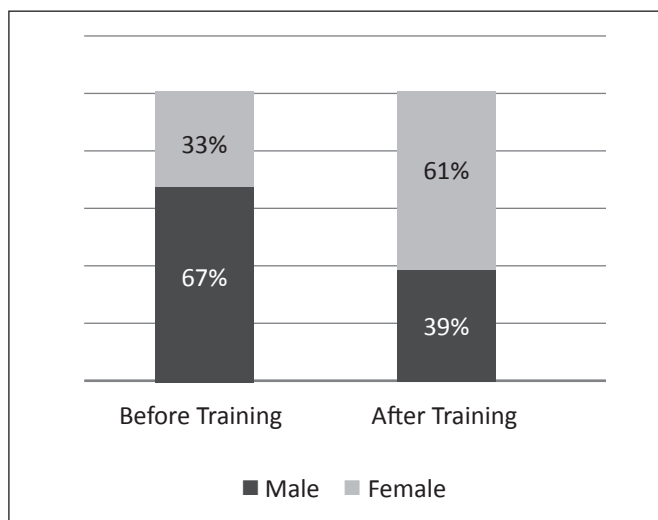
**Table II.** Questions Asked to the Nurses and Cleaning Staff After the Constructivist Training

- During the training, were you aware of subjects that you thought were important that you had not previously paid attention to?
  - Yes
  - No
- If you answered yes to the first question, has this made you change your behaviour at work?
  - Yes
  - No
  - Partially
- What kind of behavioural change has it caused?
- If it did not cause a change in behavior, what is the reason for this?

**Table III.** The CA-UTI Data of the Patients in the Aricus in the Six-Month Periods Before and After the Constructivist Training

	Before Constructivist Training		After Constructivist Training		p-value
	UC Use rate	CA-UTI rate	UC Use rate	CA-UTI rate	
ARICU-1	0.99	<b>8.34</b>	0.96	<b>8.7</b>	0.837
ARICU-2	0.99	<b>7.0</b>	0.99	<b>8.1</b>	0.745
ARICU-3	0.97	<b>7.32</b>	0.95	<b>9.9</b>	0.495

UC: Urinary catheter, CA-UTI rate: Catheter-associated urinary tract infection rate, ARICU: Anesthesiology and Reanimation Intensive Care Unit.

**Figure 1.** Distribution of patients diagnosed with catheter-associated urinary tract infection rate by gender.

they had two shifts daily in the first half of the year and three shifts in the latter half following training.

Following the implementation of the constructivist training and the interviews conducted with the healthcare workers, the problems were categorized as problems related to the application, healthcare staff, and materials. Interviews were conducted again with the nurses and doctors separately to discuss these problems that were determined during the constructivist training. Each problem was addressed individually, potential solutions were discussed and attempts were made to eliminate the problems.

The demographic data of the patients in ARICU diagnosed with CA-UTI were compared before and after the constructivist training. In the period before the training, 306 patients were followed up in ARICUs 1, 2, and 3, comprising 40% females and 60% males. After constructivist training, 279 patients, comprising 43% females and 57% males, were followed up in the three ARICUs. Before the constructivist training, 27 patients, 67% males and 33% females with a mean age of  $66 \pm 20.02$  years, were diagnosed with CA-UTI, and after the constructivist training, CA-UTI was diagnosed in 28 patients, 39% males and 61% females with a mean age of

$67.5 \pm 21.1$  years. No significant difference was determined in the mean age of the patients with CA-UTI before and after constructivist training ( $p=0.78$ ). The percentage of female patients in the period after the training (61%) was found to be statistically significantly greater than in the period before the training (33%) ( $p=0.042$ ).

The rates of CA-UTI in the ARICUs in the six-month periods before and after the constructivist training were compared separately. No statistically significant difference was determined for all three ARICUs regarding the mean CA-UTI rates before and after the training (Table III).

The rates of CA-UTI in the ARICUs in the six-month periods before and after the constructivist training were compared separately. The CA-UTI rate was determined before and after the training periods: 8.34 and 8.7 per 1000 catheter days, respectively, for ARICU-1, 7.0 and 8.1 per 1000 catheter days for ARICU-2, and 7.3 and 9.9 per 1000 catheter days for ARICU-3. No statistically significant difference was observed in the CA-UTI ratio in each unit after constructivist training compared to the pre-training period (Table III). Due to a small effect size observed at the end of the study, the actual power remained at 45%. This significant power limitation could impact the study's results. The inability to achieve sufficient sample power in this study may have contributed to the lack of significant differences found.

The rates of catheter use in the ICUs before and after constructivist training were determined as 0.99 and 0.96, respectively in ARICU-1, 0.99 and 0.99 in ARICU-2, and 0.97 and 0.95 in ARICU-3. A decrease in the rates of catheter use was observed in ARICU-1 and ARICU-3 (Table III).

A four-item questionnaire was administered to the healthcare workers to evaluate the effects of the constructivist training. From the responses of the 38 nurses and 17 cleaning staff, it was seen that in response to the question, "During the training, were you aware of subjects that you thought were important that you had not previously paid attention to?", 92% of the nurses answered "yes," and 8% answered "no," while 88% of the cleaning staff answered "yes," and 12% answered "no." The distribution of answers to the first question of the

survey, which evaluated the effects of constructivist training, was similar across occupational groups.

For the second question, “If you answered yes to the first question, has this made you change your behavior at work?”, 63% of the 35 nurses who answered “yes” to the first question responded “yes,” and 37% “partially.” In response to the same question, 33% of 15 cleaning staff answered “yes” and 67% “partially.” The distribution of responses to the second survey question was similar across occupational groups. In response to the question, “What kind of behavioral change has it caused?” most of the nurses (92%) stated that they had observed a decrease in irrigation frequency and now paid attention to emptying the urine bag sooner when full. The cleaning staff stated that they did not touch the urine bag and drainage container area unless necessary. Some nurses and cleaning staff mentioned that challenges such as fatigue, increased workload, understaffing, reduced days off, and lack of materials hindered the implementation of the behavioral changes they had learned during training.

## DISCUSSION

The results of this study demonstrated that the rate of CA-UTI did not change after constructivist training, although there was a decrease in the use of urinary catheters. It was also seen that the healthcare staff awareness of CA-UTI was increased and areas for improvement in prevention were identified.

Infection rates and urinary catheter use rates in ICUs in Turkey are collected in the NHISS through the ICC. According to NHISS data, the mean CA-UTI rate is 2.3 (50<sup>th</sup> percentile), and the mean urinary catheter use rate is 0.98 (50<sup>th</sup> percentile) in ARICUs of the Ministry of Health Training and Research Hospitals in Türkiye in general. Although the urinary catheter use rate in our ARICUs was lower than that reported for other ARICUs of training and research hospitals in the NHISS report, the CA-UTI rates were high. The high infection rate was attributed to the extended hospitalization of patients in the ARICUs and issues related to the application and materials mentioned above. There were also some problems related to the working conditions of the healthcare staff. These problems were determined to be the frequent turnover of cleaning staff, the assignment of inexperienced staff in the ARICU, an insufficient number of staff, and the significant workload. In a previous multicentre study, bundle programs were implemented to prevent CA-UTIs in ICUs and clinics, and no significant difference was reported in the CA-UTI rates in ICUs before and after implementing the bundle programs (7). In a study in Taiwan, two bundle programs were introduced in 13 ICUs, resulting in decreased CA-UTI rates in all units except for one, in which compliance with the urinary catheter care pro-

gram was lacking (14). In our study, some participants in the survey evaluating the impact of constructivist training reported that they could only partially apply what they had learned due to high workload, staff shortages, and shift changes.

Several studies in adult ICUs reported the following CA-UTI rates: 15.7/1000 catheter days in three International Nosocomial Infection Control Consortium (INICC) member hospitals, 8.3/1000 catheter days in 12 INICC member hospitals in Turkey, 15.7/1000 catheter days in a surgical ICU, and 21.9/1000 catheter days in Iran (4,15-17). In our study, the CA-UTI rates calculated after the constructivist training were 8.7/1000 catheter days in ARICU-1, 8.1/1000 catheter days in ARICU-2, and 9.9/1000 catheter days in ARICU-3. These rates observed after constructivist training were higher than those observed in the study of 12 ICUs from INICC member hospitals (4), but lower than those reported in the other studies cited above (15-17).

Following the application of a bundle program related to catheter use and care in a study in Sweden, catheter use decreased but no change was observed in the rate of CA-UTI (3). In an Indian study implementing a catheter care bundle program, decreases in CA-UTI incidence and catheter use rates were reported (18). The results of our study show that urinary catheter use decreased slightly in two of the three intensive care units included in the study after constructivist training, but the CA-UTI rate did not change, similar to the above-mentioned Swedish research.

Two significant risk factors for CA-UTIs are female gender and the length of time a catheter is used (19). A study to investigate CA-UTI risk factors determined that CA-UTIs were seen more often (78%) in females (20). Our study results showed that although the number and gender distribution of patients diagnosed with CA-UTI were similar before and after the constructivist training, the proportion of female patients diagnosed increased after the training (from 33% to 61%). The infection rates according to gender in our ARICUs after the application of the constructivist training program were seen to be compatible with the rates in the literature. The reduction in iatrogenic CA-UTI among males may be attributed to heightened awareness of the importance of limiting irrigation frequency, learned through constructivist training.

In a five-year study conducted in ICUs in Türkiye, the rate of urinary catheter use was 93-95%, and CA-UTI rates were 9.7-14.6 (21). In our study, after the application of constructivist training in the ARICUs, the rates of urinary catheter use were 96%, 99%, and 95%, and the CA-UTI rates were 8.7, 8.1, and 9.9 per 1000 catheter days, respectively. Although these urinary catheter use rates were higher than those reported in the five-year study, the CA-UTI rates were lower.



This study has some limitations. Firstly, the fact that it was not compared with an ARICU control group that did not receive constructivist training during the same period prevents a full evaluation of the effect of constructivist training. Another limitation was that the data for the period before the training was obtained retrospectively, so comparison of the frequency of urinary catheter irrigation before and after the training was relative. There remains a need for further studies to examine the effects of the material and personnel problems determined in this study on the efficacy of bundle applications.

## CONCLUSION

In conclusion, the results of this study, which utilized constructivist training to promote knowledge and awareness of preventing urinary tract infections in ICUs, showed that the Constructivist training intervention alone did not reduce CA-UTI rates in ARICUs. However, it raised the awareness of healthcare staff about CA-UTI and identified areas for improvement in preventing CA-UTI, which may require time to address.

### AUTHOR CONTRIBUTIONS

**Conception or design of the work:** SY, FSE

**Data collection:** SY, HB, CK

**Data analysis and interpretation:** SY, FSE, NT, GTE, SK

**Drafting the article:** SY, FSE, NT

**Critical revision of the article:** SY, FSE, CK, NT, HB, GTE, SK

**Other (study supervision, fundings, materials, etc):** SY

The author (SY, FSE, CK, NT, HB, GTE, SK) reviewed the results and approved the final version of the manuscript.

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